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Final Report

NCHRP 8-55A

Developing a Logical Model for a Geo-Spatial Right-of-Way Land Management System

Prepared for:

Transportation Research Board of The National Academies

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
CADD	Computer-Aided Design and Drafting
Caltrans	California Department of Transportation
CASE	Computer Aided Software Engineering
CD	Compact Disk
DOT	Department of Transportation
EA	Enterprise Architecture
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
IT	Information Technology
MPO	Metropolitan Planning Organization
NCHRP	National Cooperative Highway Research Program
PennDOT	Pennsylvania Department of Transportation
ROW	Right-of-way
TRB	Transportation Research Board
UML	Uniform Modeling Language
WSDOT	Washington Department of Transportation
XML	Extensible Markup Language

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ABSTRACT

Effectively managing information in a state transportation agency is critical to its ability to perform its mission of delivering safe, accessible, and sustainable transportation for people and goods while meeting performance goals under increasing resource constraints. Delivering projects on time and in budget is a high priority performance goal that is both readily measured and highly visible. Fundamental to delivering projects is the ability to acquire real property within the required timeframe. Acquiring property and relocating the affected people and businesses relies on knowing precisely and quickly the status of the different aspects of the acquisition and relocation process. Effectively managing the information required to perform these functions is at the heart of an enterprise-wide information management system for right-of-way offices. Geospatially enabling the system provides a visual component to managing this information and substantially enhances an agency's ability to carry out its business effectively. This project developed a logical model for an enterprise-level geospatially-enabled information management system providing the building blocks for states to develop a system that best meets their individual needs. An implementation guide and two executive summaries that provide (1) an overview of the usefulness and benefits of incorporating an information management system and (2) the necessary requirements to implement such a model are also included. The logical model was developed in Enterprise Architect by Sparx Systems and is provided on an accompanying CD.

SUMMARY

The National Cooperative Highway Research Program (NCHRP) 8-55 and 8-55A research projects were designed to identify how geographic information systems could be used to support the acquisition of real property and relocation of those affected and to provide the basis for an enterprise-wide geospatially-enabled information management system for the offices that are responsible for these issues in state transportation agencies. This report details the work performed for 8-55A. The objectives of this project were to develop a logical model for a prototypical enterprise-wide geospatially-enabled right-of-way management system and deliver two presentation-ready executive summaries that demonstrate the benefits and usefulness of such a system. Linkage between the logical model and other state transportation agency enterprise systems was included in the model to assist with implementation within an enterprise environment.

The logical model developed for this project, using uniform modeling language (UML) and computer aided software engineering (CASE) tools, provides a backbone for transportation agencies to modify as necessary for building an information management system to meet their specific needs in acquiring and managing real property.

The initial step to developing the model was to update the literature review from the first project (Hancock, 2006) and perform a survey of information system and geographic information system (GIS) usage in real estate or right-of-way (ROW) offices in state transportation agencies. Results indicated that many states employ stand-alone applications while a much smaller number have larger enterprise systems covering the major right-of-way business processes. In addition,

GIS emerged as an important tool for achieving standardization and coordination for data analysis and sharing across transportation agencies. However, this geospatial capability is only available in individual applications and small systems covering one or two areas of right-of-way. With one exception, Minnesota, large information management systems which cover multiple right-of-way areas are not currently integrated with an enterprise GIS.

To assist states with designing and implementing a right-of-way information management system, this project developed the logical model based on requirements from Public Law 91-646 as amended (The Uniform Act) and the recommended processes defined in the Federal Highway Administration (FHWA) Project Development Guide (PDG) (FHWA, 2000). The model encompasses the business areas of appraisal and acquisition of real property and the relocation of individuals and businesses that are affected by that acquisition, as well as the management of property owned by the agency.

Because the logical model provides a framework and not an operable system, it could not be tested in the traditional sense. Instead, it was evaluated through interviews with personnel in right-of-way offices at three transportation agencies: California (Caltrans), Pennsylvania (PennDOT), and Washington (WSDOT). Three scenarios were considered including:

- An office that does not have an information management system, or wants to replace an existing system, and wants to include geospatial capabilities,
- An office that wants to geospatially enable an existing information management system,
- An office that does not have an information management system but has access to an agency enterprise GIS.

The evaluation consisted of detailed discussions with members from each functional area, and recommendations and modifications were integrated into the final model.

An implementation guide, “A Guide to Where’s my Stuff”, was developed to provide guidance to state agencies in implementing an information management system including directions on how to customize and use the logical model to support that implementation.

Because information management systems require substantial resources and time to implement, two executive summaries were also created for use by right-of-way offices in pursuing the necessary commitment to support the development of a system. The first summary focuses on the current state of the practice in ROW enterprise-level geospatially-enabled information management systems with a discussion of the benefits associated with those systems. The second summary focuses on what information is important for an executive to evaluate as part of a request to fund an information management system.

CHAPTER 1 INTRODUCTION

1.1 PROBLEM STATEMENT

Right-of-way (ROW) requirements are significant components of project scheduling and cost. ROW information that has traditionally been manually recorded includes agency ownership, appraisal information acquisition status, and property–management functions that are important for addressing real estate issues, utilities, environmental permitting and mitigation, access management, outdoor advertising control, and programming. Electronic management of this information improves coordination and consistency of data, leading to reduced project delivery delays caused by ROW acquisition. In addition, the ability to retrieve these data electronically provides fast, convenient, and consistent access to all users, reducing the time and expense needed to ship documents; eliminating repetitive entries; minimizing data-entry errors caused by multiple formats; and ultimately saving money for state transportation agencies. Electronic management of real estate information could improve coordination with local jurisdictions and provide appropriate data to the public on agency ownership of property.

While many state transportation agencies use technologies such as Computer-Aided Drafting and Design (CADD) to generate ROW plans, final approved plans are often manually recorded and filed on paper or Mylar. Posting and storing such data by hand is obsolete, inefficient, and unresponsive to the demands of modern project management, hindering multiple users from conveniently accessing real-time ROW information and resulting in undue delay and costs. Moreover, paper and Mylar records are vulnerable to damage or destruction in the event of fire, flooding, or other catastrophic event.

The automation of ROW functions and development of data-integration models using currently available technology, including geospatial applications, are needed to enable multiple users to access ROW information quickly and easily and to improve the ability of agencies to deliver projects on time and in budget.

Project 8-55 identified the data elements needed to support the automation of ROW functions as the first step in the development of fully operational systems that integrate geo-spatial technologies into the ROW process (Hancock, 2006). Project 8-55A used this information to develop and evaluate a logical model for a geospatially-enabled ROW information management system which can be used as the basis for developing a fully functional information management system that meets the individual needs of each state transportation agency.

1.2 OBJECTIVES AND SCOPE

The objectives of this research were to develop an enterprise-level logical model for a prototypical geospatially-enabled, right-of-way management system and deliver two presentation-ready executive summaries in print and electronic formats that demonstrate the benefits and usefulness of a geospatially-enabled, information management system and what would be required to implement such as system. Linkage between the logical model and other state transportation agency enterprise systems is included in the design to ensure interoperability between a right-of-way system and other existing systems in an enterprise environment.

An implementation guide, “A Guide to Where’s my Stuff”, was developed as part of the logical model and is published as a separate document (Hancock, 2011). The logical model, developed using Sparx Systems Enterprise Architect, is included with the guide on a compact

disk (CD). The executive summaries are included in Appendix A of this document as well as the guide.

1.3 RESEARCH OVERVIEW

This research consisted of six tasks. The first task was an extension and update of the literature review performed for 8-55 and included a search of key features and attributes that could be associated with a logical model for a prototypical geospatially-enabled, ROW management system for state transportation agencies. This task also included a survey of state ROW offices for current use of information systems and GIS.

The second and third tasks were to develop the outline for the logical model and then to develop the model itself. The objective was to prepare an outline of the logical model for the right-of-way business areas of *appraisal*, *acquisition*, *relocation*, and *property management*. The resulting overall model consists primarily of process flow diagrams, business process models, and use case models as mapped to the business process models.

The fourth and fifth tasks were to establish an evaluation plan and then to evaluate the logical model to determine (1) how features of the models integrate with existing geospatial systems and (2) how such a system might be implemented in states that do not presently use either geospatially enabled or ROW information management systems.

Once the model was completed and evaluated, the sixth task was to develop an implementation plan that would assist state agencies with implementing an enterprise-wide geospatially-enabled information management system, specifically for three scenarios: in a state with (1) no enterprise-level, geospatially-enabled ROW information management system, (2) an

enterprise-level ROW information management system that is not geospatially enabled, and (3) a geospatially enabled system that has no or limited ROW components.

The final task was to prepare two executive summaries. The first summary focused on the current state of the practice in ROW enterprise-level geospatially-enabled information management systems and includes a discussion of the benefits and costs associated with those systems in the context of designing and implementing such a system for state transportation agency ROW offices. The second summary presented what is necessary for an executive to understand to implement an enterprise-level geospatially-enabled information management system.

1.4 REPORT ORGANIZATION

This report is organized into five chapters. The first chapter provides an overview of the problem statement, objectives and a brief overview of the research performed in this project. The second chapter describes the results of the literature review and survey. Chapter 3 discusses the logical model and implementation guide, while Chapter 4 summarizes the evaluation of the model and Chapter 5 presents conclusions and recommendations for suggested future research.

Appendix A consists of the two executive summaries while Appendix B includes the survey and survey results. Additional deliverables for this project are available under separate cover and include the implementation guide "A Guide to Where's My Stuff" and, on the accompanying CD, the supporting appendices to the Guide, the logical model and documentation, a slideshow presentation to support the executive summaries, and the Visio files for the process diagrams shown in Figures 1 through 6.

CHAPTER 2 LITERATURE REVIEW

A review was performed, updating the results from Project 8-55 (Hancock, 2006), and provided an understanding of the state of the practice in geospatially-enabled enterprise information management systems for both right-of-way activities and for more comprehensive transportation agency systems that include the acquisition of real property as one of the components. The resulting literature review built on the annotated bibliography compiled in Project 8-55 and included literature that covered:

- all types of enterprise level information systems
- technologies used for information systems
- geospatial systems and layers
- linkages between systems

The updated bibliography is available in the appendices to the implementation guide.

Through the AASHTO Subcommittee on Right-of-Way and Utilities, an updated survey of states was performed to determine the state of the practice of state transportation agency ROW offices in their use of information management systems, interaction with broader systems in other areas of the agency, and in use of GIS. The survey and results are included in Appendix B.

Based on the literature review and survey, several states have implemented information management systems at different levels in their right-of-way or real estate offices. These systems vary from individual applications for a specific activity to more comprehensive systems that operate across several activities. A brief overview of some existing right-of-way systems is summarized in Table 1 while a detailed discussion is provided in the following sections.

Table 1. Examples of right-of-way systems currently in use by transportation agencies

	System	Agency / State	Primary Functional Areas of Application
Individual Systems	ODAIMS: Outdoor Advertising Inventory Management System [a]	Florida	Outdoor advertising signs regulation
	OREMS: Office of Real Estate Management System [b, c]	Maryland	Acquisition
	TUMS: Transportation Utility and Management System [d]	Wisconsin	Correspondences between offices
Small Enterprise Systems	ROWMIS: Right of Way Management Information System [d]	California	Highway projects; Parcel acquisitions
	IRMS: Image Records Management System [b]	Connecticut	Document Management for right-of-way documents and maps
	RAI: Realty Asset Inventory Management System [d]	Missouri	Realty assets, sales, leases and excess properties
	IRWIN: Integrated Right-of-Way Information Network [e, f]	Nevada	Property acquisition and property management
	ARMS: Automated Right-of-Way Management System [g]	Nebraska	Appraisal; Negotiation (partial)
	ROWIS: Right-of-Way Information System [g]	Texas	Project setup, mapping, funding, appraisal, negotiations, eminent domain
	HAMS: Highway Access Management System [d]	Wisconsin	Driveway permits and land division reviews.
Large Enterprise Systems	CPMS: Comprehensive Project Management System [h]	Alabama	Project status, right-of-way mapping, appraisal status, acquisition, relocation, leased property
	RWMS: Right-of-Way Management System [i]	Florida	Most functional areas of right-of-way
	LRS: Land Record System [j]	Indiana	Land records; Status of each parcel
	AARS: Appraisal, Acquisition, and Relocation System [k]	Louisiana	Appraisal, Acquisition and Relocation
	REMIS: Real Estate Management Information System [l]	Michigan	Most functional areas of right-of-way
	REALMS: Right-of-Way Electronic Acquisition Land Management System [d]	Minnesota	Right-of-way acquisition, land management
	PTS: Right-of-Way Parcel Tracking System [m]	Mississippi	Full range of right-of-way activities
	RWDMS: Right-of-Way Data Management System [n, o]	Oregon	Enterprise content management for right-of-way processes
	ROWIS: Right-of-Way Office Information System [p, q]	Pennsylvania	Appraisal, Acquisition, Relocation, Property Management
	RUMS: Right-of-Way Utilities Management System [p, r]	Virginia	Most functional areas of right-of-way
	READS: Real Estate Automated Data System [s]	Wisconsin	Most functional areas of right-of-way

a. Office of Real Estate Services. (2004a). "Outdoor Advertising-State Study, State of Florida Outdoor Advertising – Automated Data Gathering System, A Case Study." United States, Federal Highway Administration, Florida. <http://www.fhwa.dot.gov/REALESTATE/oacases/casefl.htm>

b. Oregon Department of Transportation (ODOT), (2008), "Enterprise Content Management Systems (Right of Way)", United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Washington, DC. <http://cms.transportation.org/sites/rightofway/docs/RWorEnterpriseContentMgmtSys3408.do>
c. Federal Highway Administration. (2004). "Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards". FHWA-HEP-04-010, Washington, DC.
d. Ordway, D., Whaley, J. (2008). "Geographical Information Systems Applications For Transportation Right-of-Way", Summary Report on a Follow-Up Peer Exchange, Lee's Summit, Missouri, July 22-24, 2008, <http://www.gis.fhwa.dot.gov/documents/rightOfWay.asp#missouri> [Retrieved on 03/27/09];
e. "Office of Real Estate Services – Newsletter", Federal Highway Administration, Issue 2009. <http://www.fhwa.dot.gov/realestate/newsletter/second2009.pdf> [Retrieved on 08/06/09]
f. "NDOT Integrated Right of Way Information Network (IRWIN) Phases 1 and 2", ITIS, Inc. <http://itis-corp1.com/index.php?page=irwin-phase-2> [Retrieved on 08/06/09]
g. New Jersey Department of Transportation, (2004), "Survey - Right-of-Way information system", United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Washington, DC. <http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf>
h. Gravley R., "ALDOT's Comprehensive Project Management System (CPMS)", Southern States and Federal Transportation Finance Conference, Alabama, 2008.
i. Federal Highway Administration "GIS in Right of Way Scan, Tallahassee, Florida," (2004), Washington, DC. <http://www.fhwa.dot.gov/realestate/scans/talafreport.htm>
j. Indiana Department of Transportation, Office of Real Estate (2006) "Property Management Manual." Indianapolis. <http://www.in.gov/indot/files/05.PropertyManagementManual12-05.pdf>
k. Xriver Technologies LLC (2008). "Appraisal, Acquisition, & Relocation System (AARS)", United States. <http://www.xrivertech.com/Common/CaseStudies/CaseStudy_AARS.PDF>
l. Michigan Department of Transportation. (2003). "Real Estate Management Information System." Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit F, Michigan.
m. Peyton, L., Mississippi Department of Transportation. (2002). "ROW Parcel Tracking System Detailed requirements/Functional design document." United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit H, Mississippi.
n. Oregon Department of Transportation (2006) "Right of Way Data Management System (RWDMS)" ODOT Surveyors Conference. <http://oregonwatertrails.org/ODOT/HWY/GEOMETRONICS/docs/RWDMS.pdf>
o. Federal Highway Administration. (2009). "Congratulations to the Winners of the 2008 Excellence in Right-of-Way Awards". Washington, DC. <http://www.fhwa.dot.gov/REALESTATE/rowea.htm>
p. Hancock, K. (2006). "Integrating Geo-Spatial Technologies into Right-of-Way Data Management Process." Contractor's Final Report, National Cooperative Highway Research Program Project 8-55, Transportation Research Board, Washington DC. <http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_310.pdf>
q. Bentley Systems Inc. "Bentley Right Of Way Office For The Web", <ftp://ftp2.bentley.com/dist/collateral/Bentley_20Right_20of_20Way_20for_20the_20Web_20Spec_20Sheet_2C_20Low_20Respdflo.pdf> [Retrieved on 08/06/09]
r. Virginia Department of Transportation. (2008) "Right of Way Utilities Management System (RUMS)" Virginia, <http://virginiadot.org/business/row-rums.asp> [Retrieved on 08/06/09]
s. MSI Data Systems Inc. (2008). "READS - Automated Software for State Government Highways/Real Estate Operation". Mequon, WI <http://www.msidata.com/products/reads> [Retrieved on 07/16/2009]

Individual systems typically support a single activity. They include applications developed to manage limited data using personal scale computer databases, or assist in specific computations with the help of excel spreadsheets, or in generating pay packages or specific documents using pre-defined templates. Some systems manage information for more than one principal area in a right-of-way office or focus on a single activity, such as document management, across all areas in a right-of-way office. These systems are classified as small enterprise systems. More comprehensive systems that include the majority of right-of-way functional areas are classified

as large enterprise systems and range from customized enterprise database management systems to complex information management systems such as Alabama's Comprehensive Project Management System (CPMS). CPMS is a broad system that integrates its right-of-way system with a larger project management system and several other systems like Disadvantaged Business Enterprises program (DBE), Right-of-Way, Storm Water, Consultant Management, State-wide Transportation Improvement Program (STIP) and Transportation Economic Land Use System (TELUS) (Gravley, 2008). The right-of-way management system that forms a sub-system to the CPMS includes six major processes; Project Status, right-of-way mapping, appraisal status, acquisition, relocation, and leased property management.

From the literature, information systems with varying levels of complexity and breadth are currently in use. Only a small percentage are as comprehensive as CPMS and even fewer are geospatially enabled and integrated into the overall business of a state transportation agency. The following sections present more detailed information from the literature review.

2.1 RIGHT-OF-WAY INFORMATION MANAGEMENT SYSTEMS

Several states have implemented different types of information management systems at different levels in their right-of-way or real estate offices. These systems vary from those that perform a specific activity to comprehensive systems that operate at an enterprise-wide level. This section provides an overview of existing systems for right-of-way in use at the time of this research.

2.1.1 Stand-alone Systems

Several standalone systems are currently in use by state transportation agencies. Typically these systems were developed for a specific activity within the right-of-way project process like asset management, acquisition, outdoor advertising, etc.

Examples of these standalone systems include the Indiana DOT and Maryland DOT. Indiana has a Land Record System (LRS) that maintains a database of land records (IDOT, 2006). It is used to track project and parcel activities for the Property Management function. Maryland has a standalone application for acquisition activities called the Office of Real Estate Management System (OREMS) which uses a database to store and manage acquisition information (ODOT, 2008) (FHWA, 2004). South Carolina also has a system for their acquisition activities, using a centralized computer database. It further has an integrated document repository to manage right-of-way acquisition activities (ODOT, 2008) (NJDOT, 2004). New York has an in-house application used to track payments and generate pay packages (ODOT, 2008). This system is considered a stand-alone system but may have the capability to link to other processes in design, planning and right-of-way mapping.

A different type of stand-alone system is Wisconsin's Transportation Utility and Management System (TUMS), which is used for highway projects to identify, track and manage correspondence between offices in accordance with the WisDOT guide to utility coordination.(Ordway, 2008).

An information system under development for determining relocation assistance benefits for displaced residents and businesses is AASHTO's Turbo Relocation. This system is being developed by Balanced Environmental Management Systems (BEM), in cooperation with

AASHTO and the Turbo Relocation Task Force to provide an interactive software product to assist states in consistently calculating relocation benefits (AASHTO).

2.1.2 Small Enterprise Systems

Small enterprise systems either manage information for more than one principal area of the right-of-way management processes or focus on a single activity, such as document management across the right-of-way office or agency.

Right of Way Management Information System (ROWMIS), developed by Caltrans, is an example of one such small enterprise system (Ordway, 2008). This system helps to facilitate the planning and management of highway projects and parcel acquisition across the state of California. It is a web-based application with a secure centralized database containing project, parcel, and acquisition information. The system currently does not include appraisal and relocation assistance apart from the capability to generate forms. Right-of-way Information System (ROWIS) of Texas, built on SQL Server, is another such system that captures data related to project setup, mapping, funding, appraisal, negotiations, and eminent domain (NJDOT, 2004). This system also does not include relocation and property management of the right-of-way project process.

Missouri's inventory management system called the Realty Asset Inventory (RAI) is a small enterprise system that is used statewide to manage Missouri's realty assets and to identify properties that are no longer needed for highway purposes (Ordway, 2008) (FHWA, 2007). RAI is a computerized relational database system that documents all sales, leases and excess properties with additional reference to other realty of interest, such as environmental, cultural, historical, and wetland mitigation sites. However, the system does not consider other aspects of

right-of-way like appraisal and relocation. It does include an embedded right-of-way parcel acquisition database that documents acquisition information. Similarly, Nebraska has an application that uses a Lotus based system that interacts with DB2 and MicroStation called the Automated Right-of-way Management System (ARMS) (NJDOT, 2004). This includes project tracking data and a document generation capability. This system focuses on appraisal with some of the negotiation modules but does not include relocation and property management aspects of the right-of-way management.

Image Records Management System (IRMS) is another example of a small enterprise system for Connecticut which creates and tracks the right-of-way documents using an Oracle database (John, 2009). Although, this system only manages documents, it is categorized as a small enterprise system for its enterprise-wide usage. North Dakota uses a small-scale enterprise-level application called the Records Information Management System (RIM) consisting of multiple databases which are integrated with File-Net to manage right-of-way records and files (ODOT, 2008).

2.1.3 Large Enterprise Systems

Several states have more comprehensive enterprise systems that include most major right of way activities. Virginia's Right-of-Way Utilities Management System (RUMS) is a web-based system that runs on an Oracle database to track the real estate acquisition process on a project-by-project basis and includes a powerful document management feature (Hancock, 2006). It supports right of way and utilities business from the estimate stage through condemnation by tracking evaluations, negotiations, legal functions, relocation of families and businesses, disposition of improvements and the relocation of utility facilities. Real Estate

Management Information System (REMIS) of Michigan is also a fully integrated enterprise level information management system for right-of-way activities featuring immediate updating of reports and schedules (MichDOT, 2003). REMIS provides easy access to data through organized folders within the system such as job folder, parcel folder, relocation folder, condemnation folder etc. Both, RUMS and REMIS capture most of the functional areas in right-of-way.

Real Estate Automated Data System (READS) of Wisconsin (WisDOT) and Appraisal, Acquisition, and Relocation System (AARS) of the Louisiana Department of Transportation and Development (LA DOTD) also have large enterprise systems. READS allows users to obtain status updates on any parcel through streamlining and simplifying the daily highway/real estate operations (MSI 2008). This automated system includes extensive data tracking, report generation and analysis for acquisition, land inventory, cost estimation, litigation, accounting, property management, appraisals and relocation. AARS is a web based intranet/internet application using Oracle database and includes detailed appraisal, acquisition and relocation workflow processing needs as defined by the LA DOTD Real Estate Section (ODOT, 2008) (Xriver, 2008).

Other states that have automated Right of Way processes at an enterprise-wide level include Oregon and Pennsylvania. Oregon's Right of Way Data Management System (RWDMS) is an enterprise content management initiative for right of way project processes (ODOT, 2006) (FHWA, 2009). The system assists in the effective management of the state's database of assets through ODOT's Intranet and FileNet programs. Pennsylvania Department of Transportation's (PennDOT) system called the Right of Way Office Information System is a state-wide system that standardized the property information into a single electronic case folder for each land parcel. PennDOTs comprehensive management tool incorporates innovative data-integration

capabilities and supports Right-of-Way appraisal, negotiation, relocation, and property management (Hancock, 2006) (Bentley). It also includes administration of the project, appraisers and district activities, and tracking of legal information, along with the management of contracts, task orders, and subcontractors.

Nevada DOTs Right of Way Information Network (IRWIN) is another example of an integrated system for the management of their right of way information to facilitate streamlined workflow and common interface solutions (FHWA, 2009) (NDOT). The system supports inventory, access, retrieval, management and reporting of all DOT right-of-way properties and allows users to track work processes and access stored documents from a centralized information center. The system integrates with NDOT's GIS, Public Lands Survey System data and video logging system, electronic document management system and NDOT's Integrated Financial System.

Washington State Department of Transportation is another example for an integrated system. Its web-based Right-of-Way Management System, known as the Integrated Realty Information System (IRIS), has helped in structuring their land acquisition processes (Ordway, 2008). The system provides advanced reporting and management workflow that helps WSDOT with the efficient management of the property acquisitions, financial data, and project/property costs. WSDOT plans to expand the system to integrate with GIS to further advance its capabilities by locating the properties affected by an acquisition and displaying them geospatially.

In general these, larger enterprise systems enable data sharing across divisions of right-of-way but do not necessarily communicate with other major information systems transportation agencies. Alabama is one exception that integrates its right of way system with its

Comprehensive Project Management System (CPMS), along with several other systems including Disadvantaged Business Enterprises program (DBE), Right-of-Way, Storm Water, Consultant Management, State-wide Transportation Improvement Program (STIP) and Transportation Economic Land Use System (TELUS) (Gravley, 2008). The right-of-way management sub system includes six major processes; project status, right-of-way mapping, appraisal status, acquisition, relocation, and leased property as well as a comprehensive reporting module.

2.2 GEOGRAPHICAL INFORMATION MANAGEMENT SYSTEMS IN RIGHT-OF-WAY

The use of GIS as an analysis and decision making tool in state transportation agencies has been increasing steadily since the early 1990's. A number of agencies use GIS to manage, analyze and disseminate geospatial information, making data more accessible to the decision maker and enhancing the data interpretation capability. When location is brought to bear on any fundamentally spatial activity, such as transportation, managing and analyzing information is more effective and powerful.

Thus, geospatial enablement of an information management system adds value to the system by enabling new methods of integration and ways of visual interpretation of data. Several stand-alone and some enterprise level applications of GIS are currently in use by transportation right-of-way offices. Similar to section 2.1, this section groups systems according to their complexity from stand-alone system to geospatially-enabled information management systems. In addition, a section on vendor software designed for right-of-way applications is provided.

2.2.1 Stand-alone Systems

Most stand-alone systems use GIS to enhance data viewing and extraction capabilities and not as an analysis tool. Maryland's MdProperty View is an individual system that includes scanned images of property maps and digitized parcel centroids which link each property to the State Department of Assessments and Taxation's parcel database (Hancock, 2006). The Office of Real Estate uses this system to obtain parcel information for obtaining property information for the acquisition of right of way for transportation projects. In Texas, San Antonio's Right of Way Application is an Internet-based tool which provides users with access to scanned images of all past and current right-of-way maps by interactively selecting a location in the district from pointing and clicking on a GIS interface. San Antonio District right of way professionals, as well as other DOT employees, use this system to view project information from any computer connected to the internet/intranet (Hancock, 2006).

Geographical Information System based Management Information System (GISMIS) used by New Jersey integrates its digitized document database with geospatial highway database of digital roadway plans and right-of-way maps (Kaan, 2003). This is a standalone system used for the effective management and retrieval of requested documents from a very large scanned digital document database.

New Mexico's Non-Right of Way (NRW) Parcel & Improvement Inventory system is a standalone GIS application that enables automated generation of NRW Parcel and Improvement Inventory summary sheets which include geospatial view of parcel locations (Hancock, 2006).

Florida has integrated GIS into several departments in its right-of-way office (FHWA, 2004). As an example, Outdoor Advertising Inventory Management System (ODAMIS) is a

client/server application created specifically for the regulation of outdoor advertising signs. GIS enables users to view sign locations on a map.

2.2.2 Small Enterprise Systems

As discussed in Section 2.1.2, small enterprise systems either manage information for more than one principal area of the right-of-way management processes or focus on a single activity across right-of-way office or agency. Highway Access Management System (HAMS) of Wisconsin can be categorized as a small enterprise-level information management system that brings together diverse information for managing driveway permits and land division reviews (Hancock, 2006) (Ordway, 2008). HAMS has combined the capabilities of several components into one geospatially driven web interface, enabling straightforward interaction between end-users and the system.

2.2.3 Large Enterprise Systems

Large scale enterprise systems using GIS have only been implemented in Minnesota at the time of this research, although several states have plans to add GIS capabilities. Right-of-way Electronic Acquisition Land Management System (REALMS) is a larger enterprise-wide system that is used by the Minnesota Department of Transportation to support right-of-way acquisition and land management functions (Ordway, 2008). This web-based, online system allows users to quickly access and search right-of-way information, visualize and track parcel geometry, and customize and generate reports. Users are able to search for a record in REALMS and view it in the map view as well as search for REALMS data in the map and view

information from the REALMS database, thus providing an enhanced integrated geospatial capability to the system.

The following systems have specific plans to incorporate GIS but are not currently enabled. Right of Way Management System (RWMS) of Florida is a large web-based enterprise system used to record and track all right-of-way activities including acquisition, eminent domain, relocation, property management, business damages, contracting, appraisal, cost estimating and funds management using Hummingbird DM product (ODOT, 2008) (FHWA, 2004). Although the system currently has no integrated GIS, it has the capability to integrate geospatial technologies and Florida is working on a building an enterprise GIS. Mississippi's Right of Way Parcel Tracking System (PTS), which has the capability to interface with a GIS in the future, currently manages information flow of the full range of right-of-way activities that include title, parcel deed, development, appraisal, negotiation/acquisition, relocation, eminent domain, hazardous material sites and improvements (Petyon, 2002).

Oregon's FileNet Enterprise Content Management (ECM) application enables access to the right-of-way data (township, range, file number, record number, deed date, history of deed sales etc) of each parcel to its users (FHWA, 2007). The data was captured and indexed by the placement of centroids. Oregon is expecting that the legal description creation process and the appraisal description process will be automated, after which, relocation, condemnation, acquisition activities are anticipated to be moved into the system. Eventually, ODOT plans to expand the application to make mass acquisition cost estimates based on historical data and prices and to access all documents through a GIS interface that displays the parcel polygon instead of the current centroids.

2.3 VENDOR SYSTEMS

Off-the-shelf systems developed by vendors include Land and Right-of-Way Acquisition Management & Record Keeping by the Diversified Energy Software Solutions (DESS) (Diversified). It is advertised as a secure systematic application that streamlines the entire life-cycle of the land and right of way acquisition process, and rapidly provides acquisition and property information. It covers several right-of-way areas like, Agent Daily Report Logs, Documents and Digital Content, Agent-Owner Contact Diaries, Court Orders, Tract Financials, Project Financials, On-Demand Reporting, GIS Map Integration, Special Provisions, Owner Contact Records, Condemnation, Tie Plats, Title Opinions, Negotiations, On-Demand Searching and Personnel Task Tracking. Similarly, Balanced Environmental Management (BEM) Systems has developed a system called Paecetrak which is a web-based, GIS-enabled application advertised to manage the acquisition of properties for transportation system right-of-way (BEM). This system is currently being used for NJTransit capital programs.

DREAMaps is yet another off-the-shelf application developed by Smart Data Strategies Inc (SDS). It is a web-based, GIS-enabled commercial application for right-of-way Management that has a modular architecture allowing seamless integration by wrapping around existing workflows with web and desktop platform compatibility, web browser support, and product security. Illinois's Aeronautical Land Acquisition System (ALAS) that has been developed to analyze and aid in the decision-making process of the property in those areas that are being considered for the airport and related facilities, is built on Dream Maps (Hancock, 2006). This system also has an electronic file cabinet module that allows users to scan and link documents to related parcels.

2.4 SUMMARY

This review shows that GIS has emerged as an important tool for achieving standardization and coordination for data analysis and sharing across transportation agencies and can potentially improve management of right-of-way information. Individual applications have limited but measurable benefits for right-of-way. Small enterprise systems enhance capabilities across one or two areas of right-of-way offices. Large systems cover multiple right-of-way areas but are not currently integrated with an enterprise GIS. This identifies the need to provide states with a template for developing an enterprise wide geospatially enabled information management system to help enhance the overall right-of-way project process.

With data centrally accessible and efficiently organized, the possibilities for extraction and analysis are greatly expanded. Geospatial integration helps streamline projects from the initial planning stages through construction and maintenance phases. Further, some transportation agencies are migrating to maintaining geospatial data warehouses where layers of information are maintained and served out to agency stakeholders. Integrating information management systems with these geospatial warehouses is necessary to the effective implementation of a geospatially enabled system.

CHAPTER 3 LOGICAL MODEL

The logical model developed for this project was designed to provide the basis and underlying structure for state transportation agencies to develop an operational enterprise-level, geospatially-enabled information management system for the right-of-way business areas of *appraisal, acquisition, relocation,* and *property management*. Geospatial enablement and interoperability with other information systems are also included in the logical model framework. In addition, an implementation guide, "A Guide for Managing Stuff", for the model was developed which includes (1) enterprise-wide standardization guidelines for data elements that cross multiple activities to ensure interoperability with other agency systems, (2) guidelines for use by state transportation agencies to adapt the model to their specific requirements, (3) guidance on how such a system would integrate and interact with other agency systems, (4) information about how this system integrates into the project delivery process, and (5) guidance on how this system supports state transportation agency performance measures and goals. This guide is available under separate cover.

Development of the model consisted of establishing the structure of the logical model, ensuring that the enterprise was correctly defined and capturing the various business processes to be included. Although actual coding was not part of the model, input and output data models were defined and interactions between the business processes, inputs, outputs, and user resources were included. Business process flow diagrams, shown in Figures 1 through 6, and the data elements from Project 8-55 (Hancock, 2006) provided the basis for developing the model.

The logical model was developed using the Computer Aided Software Engineering (CASE) tool Enterprise Architect by Sparx Systems (Sparx Systems). This is a desktop CASE software package that fully supports UML 2.0, a uniform modeling language that is flexible, extendable, and comprehensive, but generic enough to serve as a foundation for all system modeling. It uses a visual graphic interface which allows the user to map elements and models into graphic diagrams. One of the reasons for selecting this package was that it provides a read-only executable program that allows anyone to view the model in the CASE environment thus allowing anyone to view the model. This program is included with the model on the CD provided with the implementation guide.

In the terminology of software and information systems, the design and implementation of this information system primarily consisted of Conceptual, Logical and Physical Data Modeling, prior to system development (Nicewarner, 2004) (Bryce). Conceptual and Logical Modeling captured the data, processes, activities and functions of the right-of-way business, while the Physical Modeling described how the system is implemented in terms of computer hardware/software, database files, information system screens etc. Conceptual and logical model designs were developed prior to the Physical Model design which, in combination, are used for eventual software development.

UML is an accepted set of notation techniques for visually defining, documenting and representing software intensive systems. This uniform design supports the portability of framework development for the model and provides an appropriate platform for modeling the rigorous and traceable information system for complex right-of-way activities. The UML model views are divided into two sets; Behavioral Model Views and Structural Model Views, as shown in Figure 7. The Behavioral Model Views capture the dynamic behavior of the system over time.

This dynamic view for the system is demonstrated by four UML models or diagrams: Business Process Model or Analysis model, Use Case Model, Communication Diagrams, and Sequence Diagrams. The Business Process Model captures the broad outline of procedures and the sequence of activities that drive the business. The Use Case Model defines the features, or requirements, expected to be provided by the system, and captures the interactions within the system and with entities that are external to the system. Sequence Diagrams and Communication Diagrams are a form of Interaction Model Views and are encompassed in the individual use cases, illustrating the communication between objects and messages that trigger those communications.

The Structural Modeling View defines the static architecture of a model. It models the elements that constitute the system and the relationships and dependencies between the elements. The Structural Modeling View consists of three models: Class Model Diagrams, Component Model Diagrams, and Package Model Diagrams. Class Model Diagrams reflect the logical structure of the system by capturing the attributes and behavior of the model in its static view and illustrating the relationships between the classes and interfaces. Component Model Diagrams depict how a system is decomposed into various components that can illustrate the structure of arbitrarily complex systems. Package Model Diagrams demonstrate the organization of packages and their elements, and thus help in organizing use case diagrams, class diagrams, or other UML diagrams.

The proposed overall right-of-way model supports the abstraction of right-of-way information and activities that facilitate the design of a comprehensive right-of-way information management system, with the help of the above described UML Model Views. These individual models depict explicit yet complimentary perspectives of the overall model. The complete

description and the application of these UML modeling views for designing the right-of-way system logical model are described in detail in the appendices to the implementation guide.

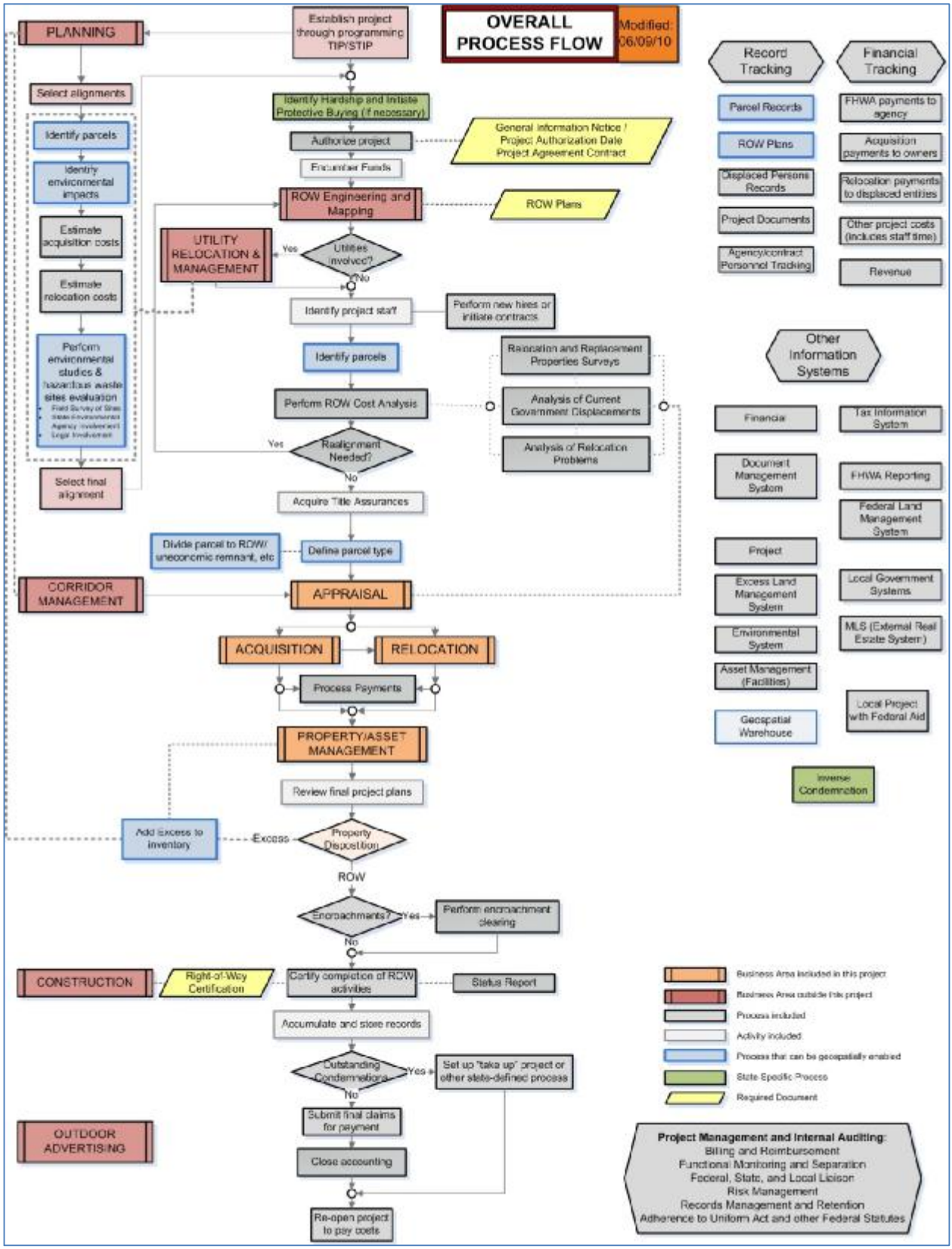

Figure 1. Overall right-of-way business process flow

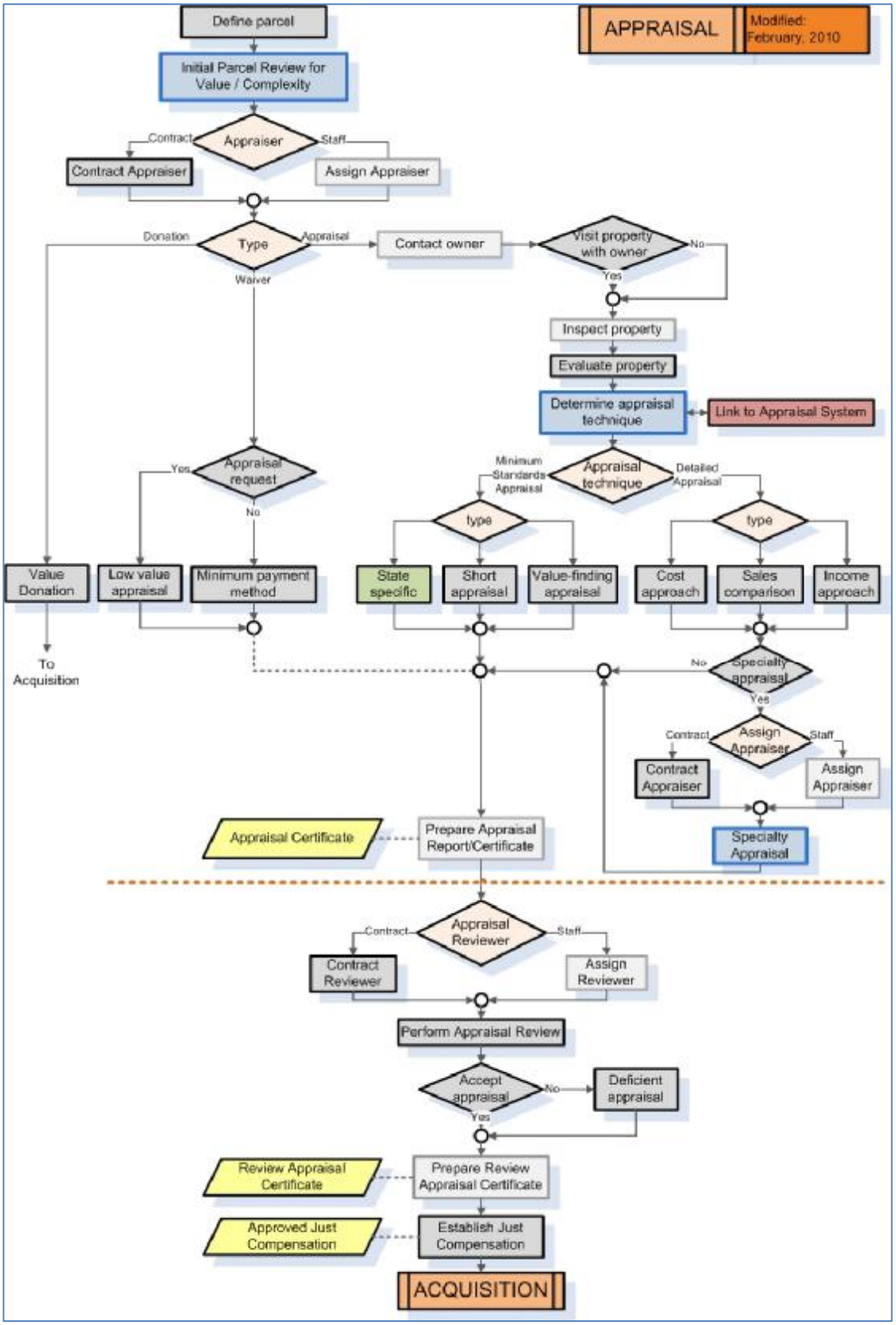

Figure 2. Process flow diagram for Appraisal

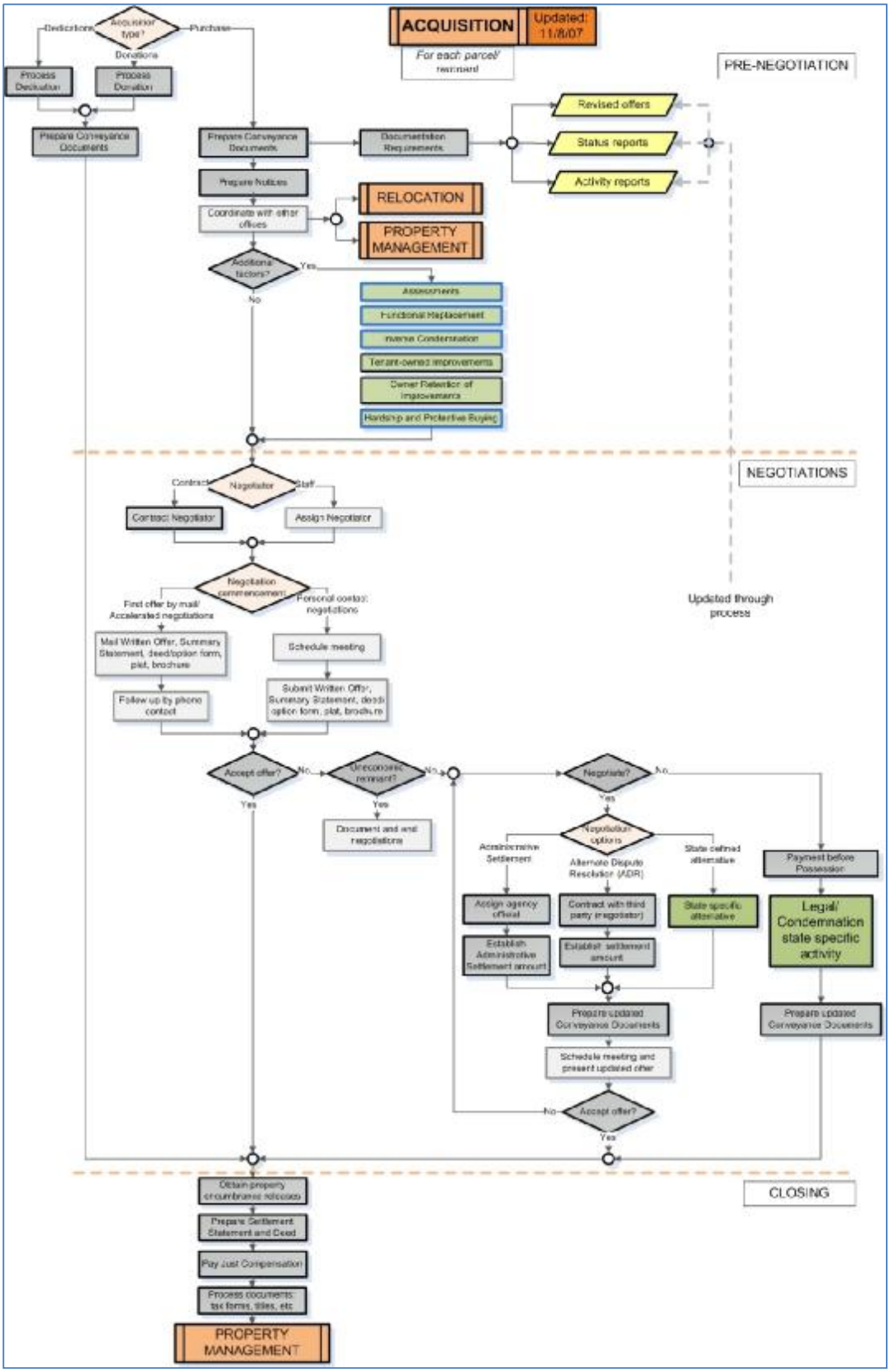

Figure 3. Process flow diagram for Acquisition

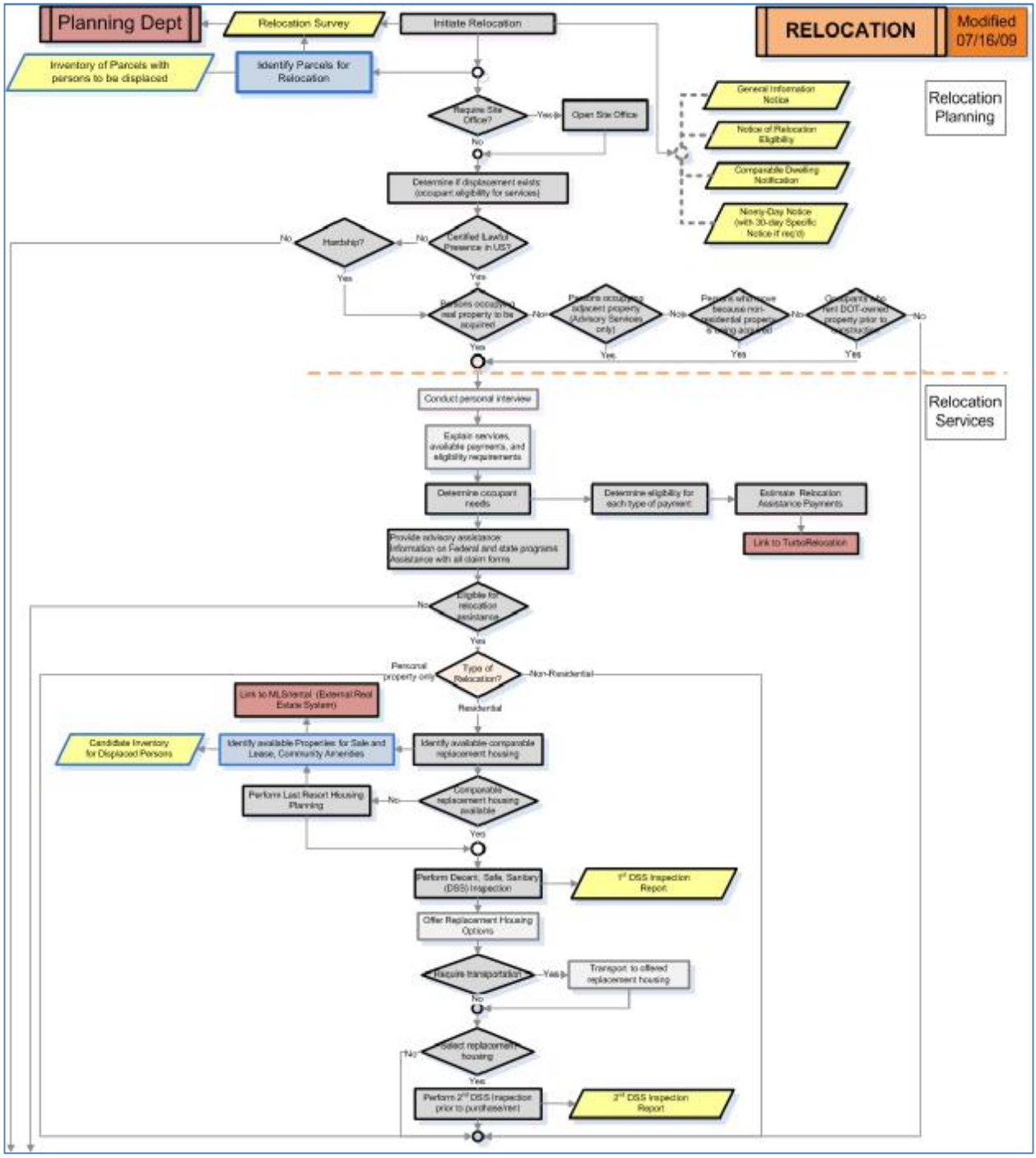

Figure 4. Process flow diagram for Relocation, Part 1

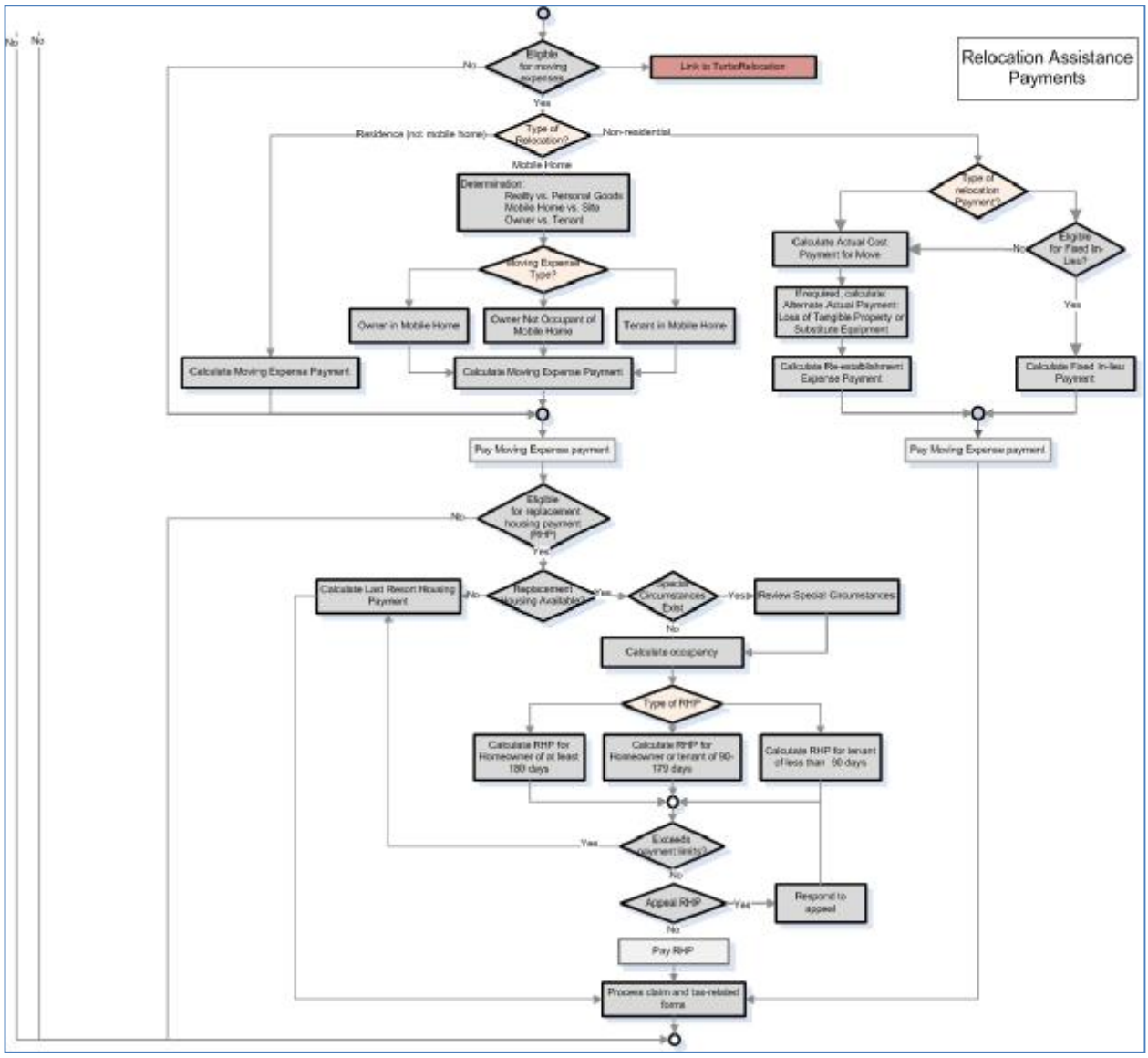

Figure 5. Process flow diagram for Relocation, Part 2

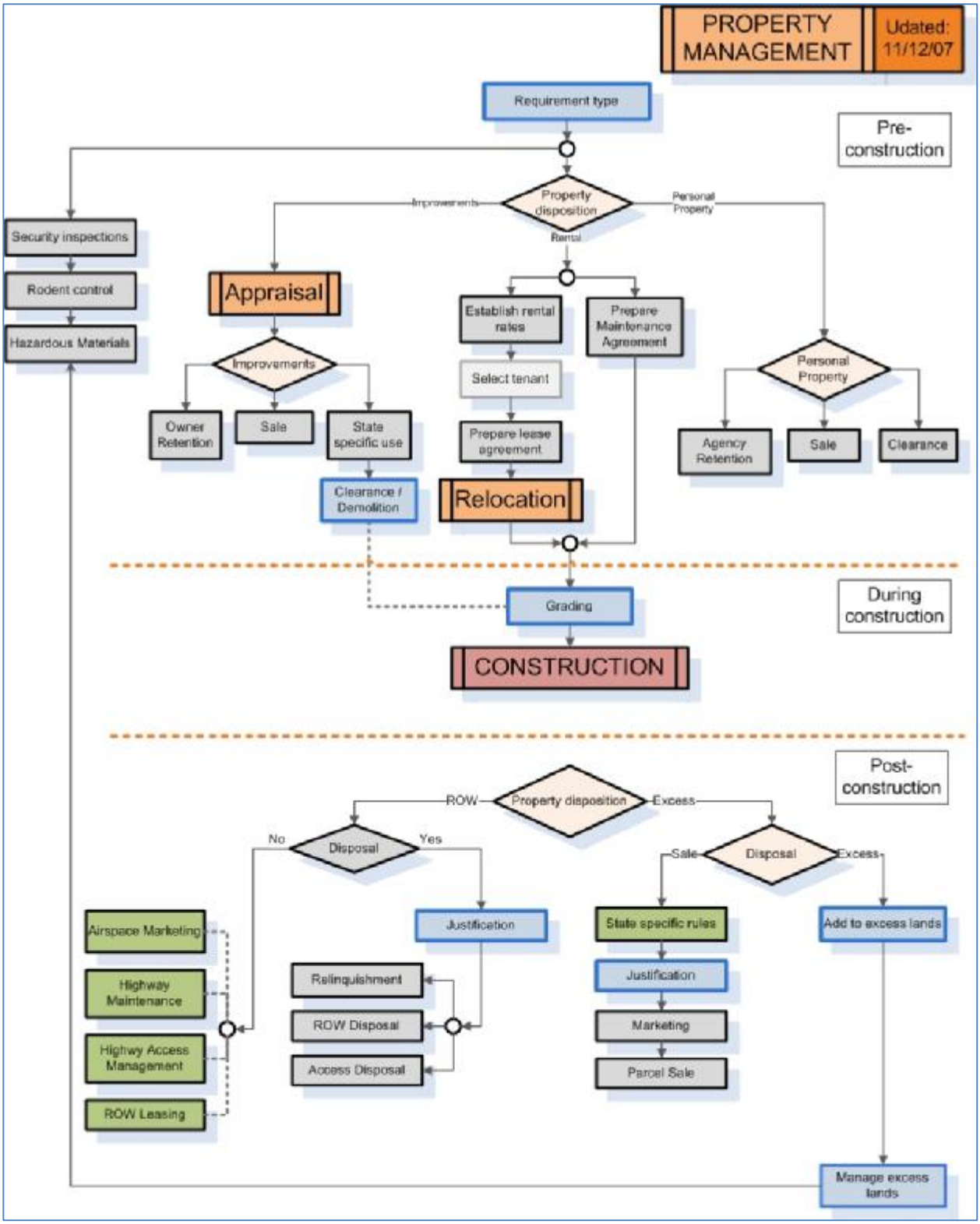

Figure 6. Process flow diagram for Property Management

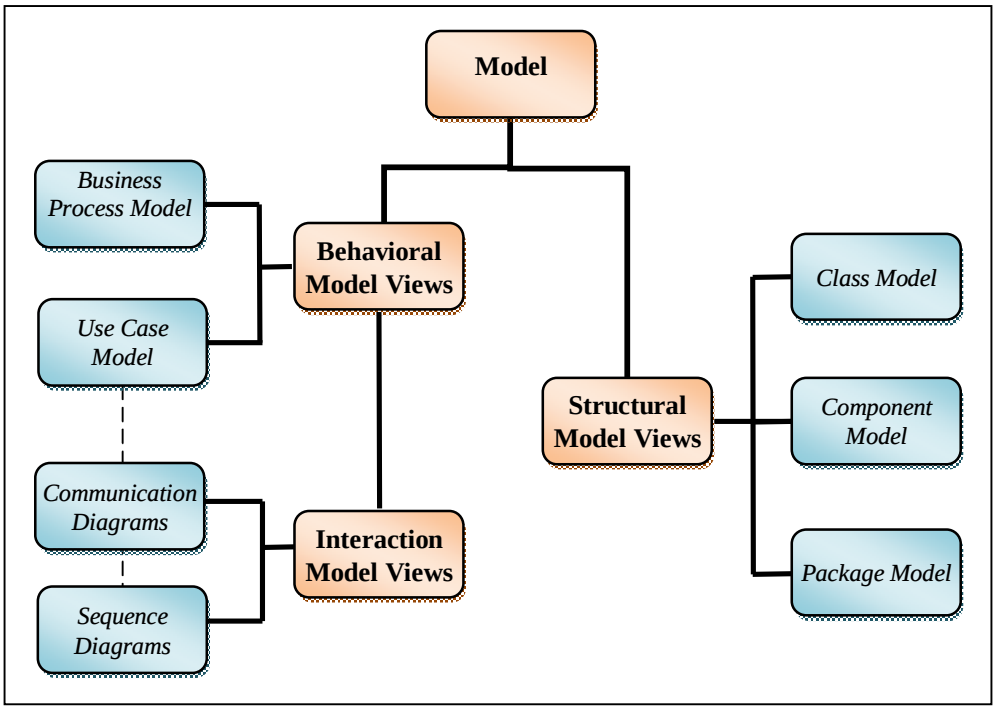

Figure 7. UML diagrams included in the model and their classification

CHAPTER 4 TESTING

During development, the logical model was evaluated with unit tests, used for testing units that are being built such as classes and components; and integration tests, used for testing how units work together. Performing other system-based testing was not an option given that no code was developed for this project.

Once the model was complete, case study testing was performed through visits with three states to evaluate the validity and usefulness of the model. The intension was to evaluate (1) implementing a comprehensive geospatially-enabled enterprise-wide information management system, (2) geospatially enabling an existing right-of-way information management system or (3) integrating an information management system with an existing transportation agency GIS warehouse. With the evolution of enterprise GIS systems and the fact that most transportation agencies have implemented one or more enterprise database systems, the second two cases were merged together in the logical model and thus in the testing.

While the logical model was being developed, six states were identified as candidates for testing the model, primarily using information from the survey results. The primary criteria consisted of (1) existence of an information infrastructure, including use of information management systems and interoperability of information, both in the right of way office and across the agency, (2) existence and use of GIS and availability of transportation GIS base layers, and (3) the extent of the enterprise within the state right-of-way office. Originally, states that were not part of the study were identified but based on the complex UML structure of the logical model and the fact that a working prototype was not part of this project, the states that

were involved in the project were better able to evaluate the work that was performed and provide feedback base on their own experience in developing information management systems.

The final three states selected for evaluating the system were Pennsylvania, Washington, and California. How they relate to the defined case studies and their contribution to the process are summarized in Table 2.

Table 2. States participating in case study evaluation

State	Case Study Criteria	Status at Time of Visit	Comments
Pennsylvania	Geospatially enable an existing system	Mature system	Well established system with internal development expertise "work environment" system
Washington	Geospatially enable an existing system	Newly launched system	New system with staff that had just gone through implementation "electronic ledger" system
California	Implement new enterprise system	In development	New system under development. Still in the design phase by internal staff

The models were evaluated through detailed discussions with members of the right-of-way office both in group settings and one-on-one with members of each of the four primary areas of appraisal, acquisition, relocation, and property management. Interactions with other systems in the agency were identified, both those existing and those planned, with specific data elements being checked against the model where possible. The following sections encapsulate the hours of discussions that were held with right-of-way personnel.

Pennsylvania. With PennDOT, the focus was to determine if the model accurately represented how a right-of-way office would track and visualize parcel status and whether the model had identified the appropriate activities that could benefit from geospatial enablement. The Parcel Tracking and Geospatial Enablement components of the model were presented and evaluated for practicality and accuracy, and to ensure that the information captured in the model is compliant with their business practices. The discussion included an overview of the

framework, the parcel tracking logical flow chart and the list and description of attributes of the parcel tracking model, and the list of identified geospatial enablement activities. Discrepancies or variations with the model were documented, and the model updated as summarized in Table 3.

Table 3. Summary of changes to the geospatial model based on PennDOT visit

	Object Affected	Functional Area	Description of Change
Parcel Tracking	State - Parcel type of take	Project Development	Renamed Parcel Type to Parcel type of take
	State - Appraisal Type	Appraisal	Noted under the state description that it can be otherwise defined as 'format required'
	State - Appraisal Technique	Appraisal	Noted under the state description that it can be otherwise defined as 'valuation technique'
	State - Status : Appraiser Assignment	Appraisal	Noted under the state description that verifying appraiser certification acts as a checkmark or requirement for determining appraiser assignmt
	State - Appraisal Complexity	Appraisal	Added to capture the complexity of parcel appraisal
	State - Utilities	Appraisal	Added to identify the utilities (if any) present on the right-of-way parcel
	State - Secondary Relocation Indicator	Relocation	Modified the categories under the state description to address billboards and commercial signs on parcel.
	State - Notice to Proceed	Project Closing	Added to identify the type of notice issued for proceeding with roadway construction
	State - Status : Federal Voucher Letter	Project Closing	Added to identify the submission of federal voucher letter
	States - Milestones	Parcel Tracking	Identified milestones from the existing flags and values, are added to Appraisal, Acquisition, Relocation and Property Management
Geospatial Enablement	Layer -VideoLog	Appraisal	Added for identifying the parcels during alignment selection, locating properties during initial appraisal review, and for determining the complexity of appraisal.
	Layer : Utilities	Appraisal	Added to facilitate the identification of parcels with utilities and locating the possible areas for adjusting the utilities.
	External Resource- Historical Parcel Sales Records	Appraisal	Added to facilitate the geospatial activity associated with sales comparison.
	Geospatial Activity- Sales Comparison (Data Analysis)	Appraisal	Added to incorporate paired sales comparison with historical data.
	Geospatial Activity- Spatial Analysis : 3D Analyst	Appraisal	Added to analyze the effect of elevation changes on adjoining property
	Geospatial Activity- Data Query/ Extraction / Overlay	Appraisal	Added to identify parcels with utilities
	Geospatial Activity- Spatial Analysis: Overlay / Spatial Query	Relocation	Added to locate suitable parcels for adjusting or relocating the affected utilities.
	External Resource : Historical Parcel Sales Records	Appraisal	Added to facilitate the geospatial activity associated with sales comparison.

One important aspect of the feedback for the Parcel Tracking model consisted of specifically identifying milestones separately from general status for parcels as they move through each of the business functional areas since milestones are typically tracked as part of performance measures within the office.

Washington. With WSDOT, the goal was to take advantage of their experience in recently having implemented an enterprise-wide information management system and to identify activities or functions that were missed or could be improved. Although it did not include GIS, they had designed the system to include that capability in a follow-on phase. Table 4 provides a summary of changes to the logical model that resulted from the evaluation discussions.

Some critical lessons learned that could be beneficial to transportation agencies as they pursue implementing an information system include:

- Take the necessary time to plan for the system including possible re-engineering of activities. Be careful of the "want it now" desire.
- Do not underestimate the challenge of legacy data.
- Communicate! Communicate! Communicate! This goes in both directions.
- Include the necessary time investment of staff in implementation activities.

California. Caltrans is in the process of designing and implementing a new right-of-way information management system. They desire to geospatially enable it but may have to add that capability at a later date. The majority of discussions centered around differences in terminology and several state-specific activities that were not added to the logical model because they are unique to how Caltrans does certain activities. The primary change that was incorporated into the model was a more accurate representation of time-specific requirements associated with notices and possession. Sequence diagrams throughout the model were updated as necessary. Because Caltrans had process diagrams and a data model for the new system, they provided the

researchers with this information and the team was able to compare these against the project model. Although the changes were not itemized, several small adjustments were made.

Table 4. Summary of changes resulting from WSDOT evaluation

Functional Area	Activity Affected	Description of Change
Appraisal	Scoping	Improve Links to early planning activities: Project planning systems
Appraisal	Market data sheet	Add activity
Acquisition	Clearing title	Expand activity, add associated milestone
Acquisition & Relocation	External information	Add links to external information (beyond other systems): County assessor's office HUD Codes
Acquisition	Easements	Define type
Acquisition	Encumbrances	Expand activity and define type
Appraisal and Acquisition	Geospatial enablement	Add septic and well relocation for geospatial enablement
Relocation	Flags	Add flag for who is entering information (additional attributes beyond just agent)
Relocation	Appeals diary	Add activity and document
Property Management	External link	Add link to real-time permitting/licensing system
Property Management	Communication	Add link to "broadcast" capability to ensure appropriate actors made aware of information
Property Management	Geospatial enablement	Add attribute to tie lease to parcel and alignment
Overall	History of plans	Add activity to track changes to ROW plans
Overall	Terminology	Identify different terminology used by different states
Project Management	Certification of completion	Expand certification of completion definitions

CHAPTER 5 CONCLUSIONS AND SUGGESTED RESEARCH

5.1 CONCLUSIONS

This project accomplished three objectives. The first was an expanded comprehensive annotated bibliography of literature about use of geospatial and innovative information systems to include enterprise level systems used in state transportation agencies. The second was a logical model for a geospatially-enabled enterprise-wide information management system for right-of-way offices and an accompanying implementation guide. The third was two executive summaries: the first of which focused on the current state of the practice designed to answer "what's in it for me (my agency)?" while the second focused on implementing an information system and answered "what does the ROW office need to ensure the implementation is successful?"

The bibliography and survey supported the need for a comprehensive enterprise-level geospatially-enabled information management system for right-of-way activities and provided important information for the necessary linkages to existing information systems within transportation agencies. It also provides a valuable resource for states who are interested in specific literature related to information systems and right-of-way activities.

Exploiting the significant role an integrated and interoperable enterprise-wide information management system can play in supporting the right-of-way business processes can improve efficiency and on-time project delivery for transportation agencies. Development of an effective right-of-way information management system requires precisely modeling the activities

and information that make up the business. The UML-based logical model provides the basis for such a system and is expected to:

- Provide a template for state transportation agencies to support the development of an enterprise-wide right-of-way information management system that has the flexibility to meet the unique needs of the individual agencies.
- Establish a standard structure and vocabulary for effectively processing and sharing right-of-way information to improve enterprise-wide business activities.
- Assist transportation agencies in planning for implementing a system that would integrate and interact with other existing enterprise-level information systems in the agency, prior to the investment of funds.
- Enhance the integration of the right-of-way business processes into the state agency's overall project delivery process.

Although the model provides the necessary structure for building a right-of-way system, it does not include software development. Business processes identified in the model are consistent with current federal guidelines for right-of-way offices (FHWA, 2006), and are designed to achieve interoperability in right-of-way activities, and to facilitate data integration across the organization. The design is expected to act as a flexible blueprint for state transportation agencies to implement an enterprise-wide information management system, accommodating the unique needs of individual agencies.

The implementation guide is designed to assist transportation agencies in implementing a system to meet the goals established in this project. It includes specific guidelines on building the system using the logical model as developed or modifying it to meet their unique requirements. Three specific scenarios are included:

- Implement a comprehensive geospatially-enabled enterprise-wide information management system
- Geospatially enable an existing right-of-way information management system
- Integrate an information management system with an existing transportation agency GIS warehouse

The executive summaries are intended to provide short, easily understood documents that can be used to market the need for and implementation of an information management system to upper management within the organization.

Specifically, the results of this research were designed to provide right-of-way offices with the necessary information to pursue support and funding to implement or expand a right-of-way information management system. The logical model provides a backbone for building the system, reducing the time and effort required by the agency during implementation.

5.2 SUGGESTED RESEARCH

This research developed a logical model for a geospatially-enabled enterprise-wide information management system for right-of-way activities. The next step is to build the system, itself. Because of the unique nature of each state transportation agency, it is unrealistic to attempt to build a single system that could be adapted to each agency. Therefore, the focus should be on communicating these results and supporting state initiatives to implement systems.

One of the challenges identified during the research performed for both this project and NCHRP 8-55 was keeping pace with rapidly evolving technology while working within a more restrictive information technology (IT) process for implementing this technology. Research into how transportation agency IT policies can be more flexible and agile while maintaining necessary standards to meet the larger agency requirements could provide substantial benefits to the implementation of these types of systems.

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APPENDIX A. EXECUTIVE SUMMARIES

The executive summaries presented in this appendix were developed for members of upper management within transportation agencies. The first summary focuses on the current state of the practice in ROW enterprise-level geospatially-enabled information management systems with a discussion of the benefits and costs associated with those systems in the context of designing and implementing such a system for right-of-way offices. The second summary focuses on what information is important for an executive to have for evaluation as part of a request to fund an enterprise-level geospatially-enabled information management system to improve its successful implementation.

Executive Summary 1: *Improving Resource management and Operations in Right-of-Way Offices with Right-of-Way Information Management Systems*

Executive Summary 2: *Implementing an Information Management System in Right-of-Way Offices, An Overview for Executives*

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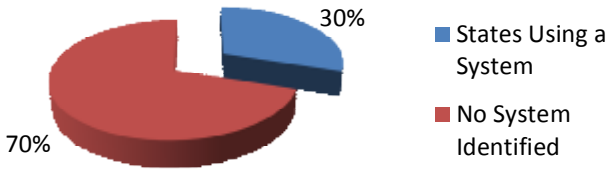
Improving Resource Management and Operations in Right of Way Offices

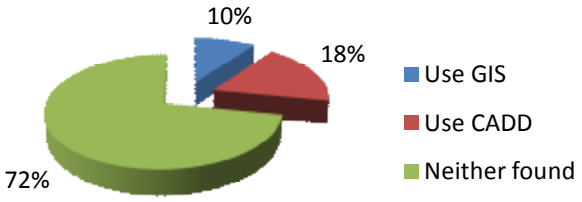
With Right-of-Way Information Management Systems

A well designed and implemented information management system can substantially improve management of resources – **personnel**, **money**, **information**, and **time** – which is critically important to successfully meeting state performance goals and budgets. Adding geospatial capabilities (GIS) to the system to replace hardcopy maps and tabular information and to give additional management and analysis functions can significantly increase its usefulness.

State Use of ROW Information Management Systems



State ROW Office Use of GIS/CADD



In the Right-of-Way office, this is particularly important because of the resources required to deliver real property for transportation improvements and manage state-owned land.

BENEFITS

- **Improved on-time delivery of project real property**
- **Expedited project award**
- **Reduced staffing and/or improved staff efficiency**
- **Improved scheduling**
- **Improved access to information both internally and by the public**
- **Improved customer service and public relations**
- **Improved documentation and reporting uniformity**
- **Reduced time to perform tasks**
- **Reduced redundancy, primarily in data entry**
- **Increased management flexibility**
- **Improved oversight capabilities**
- **Improved integration, use, and sharing of information**

DOCUMENTED SAVINGS

- ***A return on investment of more than 21%***

  Pennsylvania invested $829,000 on a ROW information system that ***reduced annual operating*** costs by nearly $680,000 while providing ***greater convenience*** to users. Because the system integrates with their financial system, the time to process payments ***reduced from several days to several minutes.***

- ***Staffing reductions and improved on-time performance***

In Virginia, the ROW information system provides over 500 staff and contractors all information on ROW projects, providing ***exceptional customer service***. Information is entered only once, ***eliminating duplication of effort***. ***Clear project tracking*** provides staff with a comprehensive understanding of the status of each project including resource allocation.

In Maryland, ***research staff has been reduced by half*** because parcel and other geospatial information is available through the intranet. ***In-person courthouse research and travel time have been eliminated***.

New Mexico uses GIS to generate summaries on excess property for sale to the public, ***reducing the time required*** to provide this information from several hours to several minutes. The information includes a map with an aerial photograph image background resulting in dramatically **reduced questions from the public**.

Using GIS, the San Antonio district of Texas provides its staff with electronic access to project drawings, thus **eliminating the manual locating and reviewing of large drawing sets**. Drawings are accessed by simply clicking on a desired section of road.

- ***One-person project oversight and management of real estate activities***

In Illinois, a multi-million dollar airport project is managed by a single person who has desktop **access to near real-time information** about the project.

RISKS OF NOT IMPLEMENTING A SYSTEM

A primary purpose of this type of information management system is to facilitate standard business operations and support information and decision making by providing easy access to both internal and external information relevant to meeting the goals and operational needs of the transportation agency and the real estate office.

Without such a system, decision makers are limited in their ability to monitor performance and identify opportunities quickly and make strategic adjustments to resource allocation as needed. The real estate office will be limited in its ability to respond to the rapidly increasing reliance on digital information exchange to perform its functions.

Expectations in the current technological environment are for faster, more accurate information with fingertip access to on-line maps. Without a geospatially enabled system, these expectations cannot be met for staff or the public.

FOR MORE INFORMATION

This document is part of the National Cooperative Highway Research Project 8-55A "Developing a Logical Model for a Geo-Spatial Right-of-Way Land Management System". The project is managed by Ed Harrigan EHARRIGA@nas.edu and is being performed under Kathleen Hancock hancockk@vt.edu at Virginia Tech and was completed in 2/11.

Results of the first phase, 8-55 "Integrating Geo-Spatial Technologies into the ROW Data-Management Process", including the documented savings reported here, are available at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_310.pdf and http://www.trb.org/news/blurb_detail.asp?id=7308

Implementing an Information Management System in Right-of-Way Offices

An Overview for Executives

Increasing responsiveness and maximizing resources are important factors in how transportation agencies improve their business in today's data-driven, performance-based environment. The ability to deliver projects on time and within budget is one measure of a transportation agency's performance. The effective delivery of real property by the right-of-way office is fundamental to achieving this agency objective. A well designed and implemented information management system can substantially improve this capability. Adding geospatial capabilities (GIS) to the system to replace reliance on hardcopy maps and tabular information and to give additional management and analysis functions can significantly increase its usefulness.

Understanding the critical factors necessary to successfully implement an information management system can ensure the best value for the necessary outlay in resources and can substantially improve the realization of the system's full potential. Obtaining strategic buy-in from agency executive-level decision makers to pursue implementation will provide the necessary foundation for system.

Implementing a System

The process to implement an information management system is well documented and follows standard procedures:

- Formalize support
- Assess requirements
- Assess capabilities
- Define the system
- Develop an implementation plan
- Implement the system
- Maintain the system

Implementation is typically considered complete at the point when the system being implemented has transitioned to "business as usual" for its users.

Implementation Responsibilities

- ***Project champion:*** This person is typically known and trusted by agency management and is responsible for marketing and promoting the system both inside and outside the agency.
  Without an identified champion, history has shown that projects flounder at the first major challenge.
- ***Steering group:*** The steering group is responsible for ensuring that there is active and appropriate input and feedback to the system during the implementation process.
  Transportation agencies consist of multiple departments and offices responsible for different aspects of doing business. Without representation from each group that will be impacted by the system, the system will face numerous challenges including: a) meeting agency information technology (IT) requirements, b) obtaining buy-in from stakeholders, and c) coordinating data sharing between data owners and users, as well as performing the tasks necessary to support right-of-way activities.
- ***Project manager:*** The project manager is responsible for the day-to-day management of the process.
  This person must have the necessary skills, authority and resources to coordinate sometimes conflicting input from the groups and individuals involved in the process. The project manager must also have the organizational skills to ensure that the process stays on track and within design boundaries and sufficient technical understanding of the right-of-way process and individual functions to reasonably evaluate input during the development process.
- ***Development team:*** The development team consists of the people who will actually be developing the system.
  They can be wholly from within the agency or wholly contracted from outside or a combination of both. The importance, at the proposal stage, is that the skills necessary to the project be clearly identified and articulated.

Implementation Factors

- ***Assessing requirements***: Any proposal for a new information system should include a clearly stated understanding of the scope and goals of that system. As these requirements are refined, consideration should include the business areas to be included (often referred to as the *enterprise*), the functions that should be performed, the data needed to support these functions, other systems that should interact with the proposed system, security issues, and any legal and regulatory requirements.
- ***Assessing capabilities***: An understanding of the capabilities in the right-of-way office and across the agency is critical to successfully implementing a system. Considerations include available or required hardware and software, existing applications including database management systems and GIS, datasets along with who is responsible for them, and agency policies and procedures related to IT including application development, data and data standards, and hardware and software acquisition. Knowing who will be responsible for maintaining the system and any corresponding data and output is also necessary. Availability of funding for development and continued maintenance is critical to the project's success.
- ***Defining the system***: This is the core of the system and will be the basis for the tool that manages the information associated with right-of-way offices. The technical considerations will be included in the detailed implementation plan. An important aspect of this definition is knowing the starting point for system development. Three common starting points include:
  - The system is being developed from scratch with no existing information management system or GIS.
  - The system is expanding on an existing information management system to include GIS.
  - The system is being developed to take advantage of existing GIS capabilities.

  Knowing this information will ensure that appropriate coordination is considered in the design.

Additional Considerations

The current evolution and expansion of technology is extremely rapid and most transportation agency policies and procedures are not designed to operate at the same rate of change. Innovative and flexible approaches to supporting improved information management tools could save money and time both in their implementation and use.

From concept to operation, a comprehensive information management system can take 12 to 24 months or longer, and, during that time, technology will become more powerful, faster, and more flexible at the same time that the general public will become more technologically sophisticated with fingertip access to information through smart phones and other similar devices. A flexible design can readily take advantage of this changing technology without requiring major modifications. However, waiting for the next advancement before initiating the process can, and often does, result in never starting.

Many transportation agencies are in the process of either designing or building an agency-wide infrastructure for sharing data and/or integrating computer systems. Although, the desire to fold individual systems into this larger initiative is compelling, the reality may be more problematic given the scale, complexity, and cost of the larger effort. With current technologies, consideration should be given to supporting individual systems if they provide the necessary connections to and support for integrating with the larger initiative.

For More Information

This document is part of the National Cooperative Highway Research Project 8-55A "Developing a Logical Model for a Geo-Spatial Right-of-Way Land Management System". The project was managed by Ed Harrigan EHARRIGA@nas.edu and was performed under Kathleen Hancock hancockk@vt.edu at Virginia Tech and was completed in 2/11. A detailed implementation guide was developed as part of this project and will be available through TRB.

Results of the first phase, 8-55 "Integrating Geo-Spatial Technologies into the ROW Data-Management Process", including the documented savings reported here, are available at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_310.pdf and http://www.trb.org/news/blurb_detail.asp?id=7308

APPENDIX B. SURVEY AND RESULTS

A written survey was completed during this project and was distributed to attendees of the 2006 AASHTO/FHWA Right of Way and Utilities Subcommittee Conference in Baltimore Maryland. The purpose of this survey was to update the survey results from NCHRP 8-55 to states that were actively using geospatial technologies in their day-to-day activities as well as to identify what other systems were in use by the transportation agency. This survey, along with the corresponding cover letter is presented followed by a summary of the results and a scan of agency web pages to identify other possible states using an information system along with that system.

Figure B-1. NCHRP 8-55A survey

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right-of-Way Land Management System"

Name of state:_____ Name of person completing survey:

Contact information:_____

Status: Your ROW office is currently | | USING | | TESTING | | IMPLEMENTING | | DEVELOPING | | PLANNING FOR | | NONE (check one)
a comprehensive information management system | | with | | without GIS (check one)

Current Information management systems in your ROW office							USE OF GIS ☐ Check if ROW uses GIS separate from the information management system				
Functional Area	Name of System How you refer to system. (If more than one, list all)	Is system a stand-alone desktop program?	Is system on the Internet or Intranet?	Is system considered a client/server based program?	Do people outside ROW have access to system?	Is system part of a more comprehensive system in DOT? Does system have a GIS component?	To manage data	To see parcel status	To view ROW info To perform analyses	To create maps	Other
		Place a check mark in the boxes below for all that apply.									
A. All Right-of-Way functions											
B. Most ROW functions											
If individual systems:											
1. Property Appraisal											
2. Property Acquisition											
3. Property Condemnation											
4. Relocation Assistance											
5. Property/Asset Mgmt											
6. Other_____											
COMMENTS:											

Figure B-1. NCHRP 8-55A survey (cont)

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right-of-Way Land Management System"

Links to other systems. If your system(s) can pass information to or from other information systems (without manually re-entering this information) please check all that apply and enter the name of the system. If not, skip this question.

Within DOT
- ☐ Project Management (name_____)
- ☐ Environmental (name_____)
- ☐ Document Management (name_____)
- ☐ Financial (name_____)
- ☐ Planning (name_____)
- ☐ CAD/CADD (name_____)
- ☐ Human Resources (name_____)
- ☐ GIS (name_____)
- ☐ Other_____

Outside DOT:
- ☐ Local government
- ☐ Tax records
- ☐ Other state agency _____
- ☐ MLS (Multiple Listing Service)
- ☐ State Treasurer
- ☐ Other Federal Agency_____
- ☐ US DOT
- ☐ AASHTO
- ☐ Other_____

GIS Information.

Yes / No Do personnel in your ROW office use GIS software? What package_____

Yes / No Does your ROW office have personnel trained in GIS?

Yes / No Do personnel in your ROW office work with GIS personnel in a different office? What office_____

Future Plans:

Yes / No Is the ROW office planning to *EXPAND* an existing information management system?

Yes / No Is the ROW office planning to *REPLACE* an existing information management system?

Yes / No Is the ROW office planning to *IMPLEMENT* a new information management system?

Yes / No Is the ROW office planning to *ADD* GIS capabilities to an existing information management system?

Yes / No Is the ROW office participating in a larger planning activity for information management across the agency?

THANK YOU FOR COMPLETING THE SURVEY

Please return survey to: Virginia Tech's CGIT, 1101 King St, Suite 610, Alexandria, VA 22314 or email to hancockk@vt.edu

For further information please contact:
Dr. Kathleen Hancock, 703-518-2718, hancockk@vt.edu

SURVEY RESPONSES

23 responses to the survey that was sent out to the AASHTO ROW subcommittee listserve were received. Table B1 lists the states that responded and Figure B1 shows the geospatial representation of the same information.

Table B-1. States responding to survey

State	Abbr	State	Abbr
Alabama	AL	North Dakota	ND
Arkansas	AR	Oklahoma	OK
California	CA	Oregon	OR
Kentucky	KY	Pennsylvania	PA
Louisiana	LA	South Carolina	SC
Maine	ME	South Dakota	SD
Maryland	MD	Tennessee	TN
Michigan	MI	Texas	TX
Minnesota	MN	Vermont	VT
Missouri	MO	Washington	WA
New York	NY	Wisconsin	WI

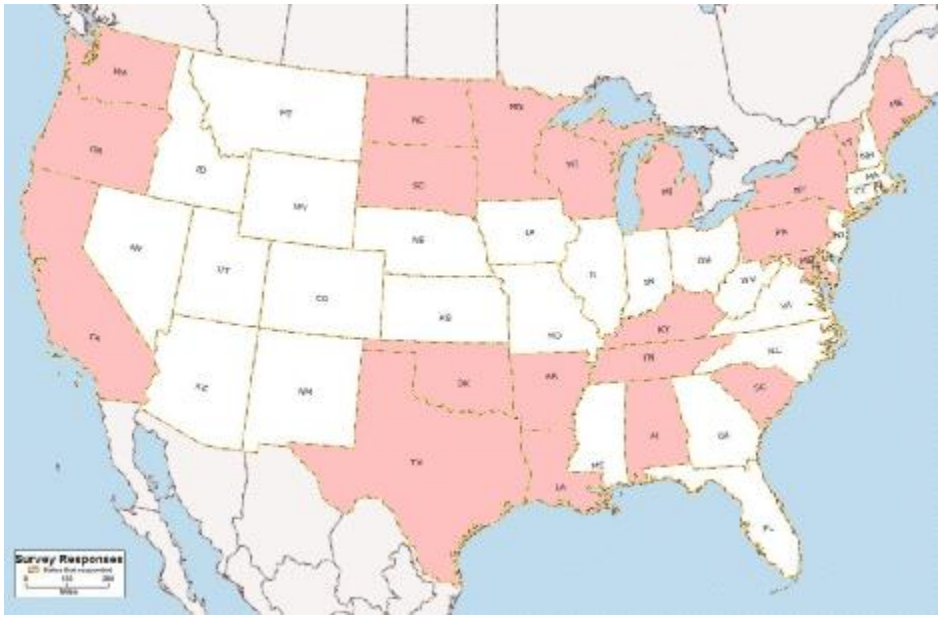


Figure B-2. States that responded to survey

Table B-2. Survey responses

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right-of-Way Land Management System"

Status: Your ROW office is currently: 12 USING 3 TESTING 1 IMPLEMENTING 10 DEVELOPING 5 PLANNING FOR 1 NONE (check one)
a comprehensive information management system 6 with 9 without GIS (check one).

Current information management systems in your ROW office								USE OF GIS 11 Check if ROW uses GIS separate from the information management system					
Functional Area	No. States that marked this option Name of System How you refer to system. (If more than one, list all)	Is system a stand-alone desktop program?	Is system on the Internet or Intranet?	Is system considered a client/server based program?	Do people outside ROW have access to system?	Is system part of a more comprehensive system in DOT?	Does system have a GIS component?	To manage data	To see parcel status	To view ROW info	To perform analyses	To create maps	Other
		Place a check mark in the boxes below for all that apply.											
A. All Right-of-Way functions	15	6	8	10	8	6	3	2	2	3	2	2	Doc access (1)
(GIS separate from System)	2							3	2	4	2	1	Hwy data (1) Utility (1)
B. Most ROW functions	4		3	4	4								
If individual systems:													
1. Property Appraisal	2	1											
2. Property Acquisition	4	1	2	1	1								
3. Property Condemnation	3		1	1									
4. Relocation Assistance	2												
5. Property/Asset Mgmt	4	3	3	3	3	1	2						
6. Other **Engineering (2)**	1			1	1	1	1	1			1		
ROW Plats			1				1						
Utilities/Excess	1												
Outdoor Adv (2)			1	1									

Table B-2. Survey responses (cont)

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right-of-Way Land Management System"

Links to other systems. If your system(s) can pass information to or from other information systems (without manually re-entering this information) please check all that apply and enter the name of the system. If not, skip this question.

Within DOT:
- 10 Project Management (*name*_____)
- 2 Environmental (*name*_____)
- 6 Document Management (*name*_____)
- 12 Financial (*name*_____)
- 2 Planning (*name*_____)
- 3 CAD/CADD (*name*_____)
- 0 Human Resources (*name*_____)
- 5 GIS (*name*_____)
- 1 Other_Outdoor adv__ 1 Utility_ _1 Fac/prog mgmt/asset rep____

Outside DOT:
- 0 Local government
- 1 Tax records
- 1 Other state agency __GIS_____
- 0 MLS (Multiple Listing Service)
- 0 State Treasurer
- 0 Other Federal Agency_____
- 0 US DOT
- 0 AASHTO
- 0 Other_____

GIS Information.

- 14 Yes 8 No Do personnel in your ROW office use GIS software? What package_____
- 10 Yes 12 No Does your ROW office have personnel trained in GIS?
- 18 Yes 4 No Do personnel in your ROW office work with GIS personnel in a different office? What office_____

Future Plans:

- 18 Yes 4 No Is the ROW office planning to *EXPAND* an existing information management system?
- 11 Yes 10 No Is the ROW office planning to *REPLACE* an existing information management system?
- 14 Yes 7 No Is the ROW office planning to *IMPLEMENT* a new information management system?
- 13 Yes 8 No Is the ROW office planning to *ADD* GIS capabilities to an existing information management system?
- 15 Yes 6 No Is the ROW office participating in a larger planning activity for information management across the agency?

One state did not reply to future plans

Table B-3. Survey response details

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right of Way Land Management System"

State	System Name(s)	GIS Software	GIS collaboration	Comments
Alabama	Comprehensive Project Management System			Interested in GIS, however do not currently have necessary data
Arkansas	Land Acquisition	GeoMedia	Environmental Div, GIS Sec	Currently testing Engineering, Title & Payment components of Land Acquisition System. Plans are to extend to include Appraisal, Acquisition & Relocation
California	ROWMIS RAP Tracker RWPM (legacy)/AMI-HM RUMS/FLMS	ArcGIS		Future development of GIS capabilities anticipated
Kentucky	RWMS (has GIS) RWU (legacy)	ArcGIS		RWMS in development
Louisiana	AARS (App, Acq, Rel Sys)			
Maine	RMS (Realty Mgmt System)	ArcMap	Planning/IT	
Maryland	OREMS (Office of Real Estate Mgmt System) Sales Track,	ArcView 3.2 ArcGIS 9.2 DataViewer	Off of Plan. & Prel Eng. Off of Hwy Dvlp	Evaluating ways to integrate GIS into OREMS
Michigan Minnesota	R-Tracks REALMS	TransCad ArcGIS	Cent for Geog Info Off of Dec Sup Enterp GIS unit	In planning Planning links to systems outside DOT
Missouri	acquisition system realty inventory system	ArcGIS	Trans Planning	Developing comp web-based acq system with GIS capab to be integ with inventory system and TMS (DOT Trans Mgmt Sys)
New York	Q & A (windows & DOS)		Info Tech Div	
N Dakota Oklahoma	Access database Database & GIS Lotus Approach Outdoor adv		Surveys & Photogrammetry Planning & Research	Info entered in Access by one person. Prop Mgmt separate database . Right of Way plats stored in GIS
Oregon Penn	RWDMS Right of way Office CAD Application	Trans/GIS (homegrown)	Trans Data Div (TDD) Bur of Plan & Research	RWDMS enterprise content mgmt system. Phased implementation and eventual link to DOT and access outside
S Carolina S Dakota	Entire Connection MS Sharepoint AgWare Property Assets	ArcGIS	Data Inv & Road Design	
Tennessee	TRIS (Tn ROW Info Sys)	TRIMS		TRIS built on Oracle Spatial but not exploited yet
Texas	ROWIS	ArcGIS	Tech Serv Div	Using GIS functionality under development for Utility, working on GIS for ROW assets

Table B-3. Survey response details (cont)

SURVEY of Transportation Agency ROW Offices

for NCHRP 8-55A "Developing a Logical Model for a Geospatial Right-of-Way Land Management System"

Vermont		ArcMap		
Washington	IRIS		OIT	System is GIS capable but not yet used
Wisconsin	RELADS (Real Estate Automated Data System) HAMS (hwy access mgmt) TUMS (utility)	ESRI	Planning, Design, Plats	 ESRI based ESRI based

Table B-4. Review of State ROW Web Pages

State	ROW info?	ROW Home Page?	ROW Information System?	Information System name (from survey)	GIS? [from 8-55A survey]	GIS? from 8-55 survey	Information on Web Page
Alabama*	Yes	Yes	Yes	CPMS	CADD		Contacts, overview, flowchart, FAQs, rights, plans, procedural manuals and events
Alaska	Yes	Yes	None found		None found		ROW Plans available, applications for leases, sign and driveway permits, employee directory, appraisal forms and guidelines
Arizona +	Yes	Yes	None found		CADD	Yes	Property Sales, Acquisitions, and CADD
Arkansas *	Some	Yes	Yes	Land Acquisition	None found [GeoMedia*]		ROW Director with brief ROW description. ROW manual
California *+	Yes	Yes	Yes	ROWMIS RAP Tracker	Yes [ArcGIS*]		PDF publications, online ROW manual, excess land sales, appraisal forms, sign permits, and contact information
Colorado	Yes	No	None found		None found		ROW manual. Purchase of excess land
Connecticut	Some	No	None found		None found		Property Sales coming up. Permits
DC	No	No					Department of Public Works
Delaware +	Some	No	None found		None found	Yes	Site map: Basic ROW information.
Florida +	Yes	Yes	Yes		None found	Yes	FAQs on functional areas, online database of pre-qualified consultants, Outdoor Advertising Inventory Mgmt System - Online Database, rules and regs
Georgia +	No	Yes	None found		None found	Yes	Consultant ROW information
Hawaii	Some	Yes	None found		None found		General information
Idaho	Yes	Yes	None found		None found		Description of functional areas and land sales. Public Auction site highlighted.
Illinois	Some	No	None found		None found		Land sales and some forms. Advertising Control page. Land acquisition manual
Indiana	No	No	Yes		None found		Contact information. Permits
Iowa +	Yes	Yes	None found		CADD		Sales site, some manuals, brochures, national right of way links page
Kansas +	Yes	Yes	None found		None found	X	Links to good ROW information
Kentucky *	Yes	Yes	Yes	RWMS	None found [ArcGIS*]		General information. ROW Manual
Louisiana *	Yes	Yes	None found	AARS	None found		Manuals, training, newsletters, forms and a directory of personnel
Maine*	Some	No	Yes	RMS	CADD [ArcMap*]		ROW Manual. General ROW information
Maryland *+	Some	Yes	None found	OREMS	None found [ArcGIS*]	Yes	ROW functional areas described. Maps & Brochures
Massachusetts +	Yes	Yes	None found		None found	Yes	General information on ROW process & Departments. ROW Manual
Michigan*	Yes	Yes	Yes	R-Tracks	CADD [TransCad*]		Public information on ROW process and relocation. Property sale information
Minnesota *+	Yes	Yes	Yes	REALMS	Yes [ArcGIS*]	Yes	Links to lots of different information including manuals

Mississippi +	Some	No	None found		None found	Yes	Brief description of office. LPA Manual
Missouri*	No	No	None found		None found [ArcGIS*]		Primarily project related. LPA Manual
Montana	Some	Yes	None found		CADD		ROW manual
Nebraska	Yes	Yes	None found		None found		Manuals, land sales, applications and general right of way information
Nevada*	No	No	None found	IRWIN	None found		ROW forms. State DOT clickable map
N Hampshire	Some	No	None found		CADD		General information. CADD information
New Jersey	Some	Yes	Yes		None found		Some basic ROW information and links. Has link to ROW manual under Publications
New Mexico +	Some	Yes	None found		Yes	Yes	Basic information
New York *+	Some	Yes	None found	Q & A	None found	unclear	General right of way and outdoor advertising
North Carolina	Yes	Yes	None found		None found		Information on sections and who to contact
North Dakota*	Some	Yes	None found		None found		Interactive site for Right of Way plats
Ohio +	Some	Yes	None found		None found	unclear	ROW manuals, training resources, Acquisition and Appraisal pre-qualified individuals, and FAQ.
Oklahoma *+	No	Yes	None found		None found	Yes	Contacts only
Oregon *	Yes	Yes	Yes	RWDMS	None found [TransGIS*]		Extensive site with information on each work unit, forms, manuals, etc
Pennsylvania *	Some	Yes	Yes	ROW Office	No		General information and contacts. ROW section falls within the Design Services Division
Puerto Rico	No	No					Spanish
Rhode Island	No	Yes	None found		None found		ROW acquired under Real Estate Section. Minimal ROW information available.
South Carolina *+	Some	No	None found	Entire Connection	None found	Yes	ROW Acquisition, Appraisal and Relocation manuals
South Dakota *	Some	Yes	None found	AgWare	None found [ArcGIS*]		General information and contact page. Relocation Brochure
Tennessee *	Yes	Yes	None found	TRIMS	None found [TRIMS*]		Information on sections, who to contact and some forms
Texas *+	Some	Yes	None found	ROWIS	None found [ArcGIS*]	Yes	Information on acquisition contracts, forms & other resources. ROW manual
Utah	Yes	Yes	Yes		CADD		ROW information including manuals, forms, information, property sales and much more
Vermont *	Some	Yes	None found		None found [ArcGIS*]		Basic information and contacts
Virginia +	Some	Yes	Yes		No		Contact and general information. Land sales site. Information on RUMS
Washington *+	Some	Yes	Yes	IRIS	None found		Property Sales and ROW Plans
West Virginia	Some	Yes	None found		None found		General information
Wisconsin *	No	No	None found	READS	None found [ArcGIS*]		Contact page listing
Wyoming	No	No	None found		None found		Land sales

* Responded to 8-55A Survey
\+ Responded to original 8-55 Survey