Implementation of Electronic Right-of-Way Management Systems Versus Paper Systems

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16. Abstract **The purpose of this report is to provide FHWA and state and local DOTs with a tool kit using tangible and easily understandable documentation with quantitative metrics. This toolkit will assist these professionals as they endeavor to get their leadership buy-in to support implementation of Integrated Electronic ROW Management Systems.**			
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Executive Summary

The acquisition of right-of-way for a transportation project is a critical path element to successfully letting the construction phase of a transportation project on-time. Public sector real estate professionals are continuously being challenged to manage this process more efficiently and effectively.   The development of an electronic right-of-way management system is one potential strategy for assisting state departments of transportation (state DOTs) with improving the overall efficiency and effectiveness of the right-of-way management process. While the implementation of a modern electronic data record-keeping system has the potential to provide a number of benefits for a state DOT, implementation of an electronic system can be costly and time consuming. In addition, it requires an ongoing investment to operate and maintain the new system.

Recognizing that implementing an electronic right-of-way management system can be potentially costly and complex, the Federal Highway Administration Office of Real Estate Services (FHWA HEPR) retained Parsons Brinckerhoff to develop tangible, easily understandable documentation for transportation professionals in public agencies to use in supporting the potential implementation of an electronic right-of-way information management system. The goal of this research project is to compare and contrast the relative strengths and challenges associated with using both an electronic system and a "paper" system and then to identify and document the business case associated with the implementation of an electronic system.

Definition of Right-of-Way Management System

For the purpose of this research project, an integrated right-of-way management system is assumed to include a system which supports the full lifecycle of the acquisition process including tracking right-of-way phase project information; identification of parcels which are candidates for acquisition; appraisal; negotiation; condemnation processes if required; business relocation services; and residential relocation services.   A right-of-way management system, as envisioned under this research project, also supports tracking of required utility relocation activities on a project and various property management activities that may be performed by an agency.

Likewise, a right-of-way management system will include integrated workflows which automatically route or move a task to be completed from one step or user to another within the system based on predefined business rules. The system also provides the capability to generate various required forms and letters within the system based on business rules. In addition, the right-of-way system is also integrated with an agency's financial management system to reduce the need for redundant data entry and potentially with other agency systems such as a document management system.

Research Project Approach

This report represents a synthesis of findings from the various tasks performed during the project. A brief summary of the major tasks/activities performed during the project is provided below:

- **Conduct Literature Search and Review**—The research team conducted a comprehensive literature search and review that summarizes existing information on right-of-way electronic data/record-keeping technologies and identifies information on measurable objectives for incorporation into subsequent tasks in the project.

- **Prepare Case Studies**—Building on the information gathered from the literature search, the research team conducted a web-based survey of various state DOTs and Local Public Agencies (LPA) to better understand which agencies are either using electronic right-of-way information management systems or paper-based systems on a daily basis. The results from this initial survey were used to identify nine agencies to conduct follow-up interviews with.

- **Determine Data Requirements**—The research team prepared an inventory of data requirements which documents the type of data elements that should be included in an electronic right-of-way information management system and potential sources for obtaining, collecting, or accessing this data.

- **Calculate Return on Investment**— Information obtained from both the literature search and various agencies during the case studies was utilized to document the potential business case for an agency implementing an electronic right-of-way information management system under two development alternatives.

- **Identify Barriers to Implementation**—The research team identified and documented potential barriers that may affect a state DOT's ability to implement an electronic right-of-way management system and proposed approaches for addressing and overcoming these barriers.

Key Findings

State of Practice

An initial literature review of various agencies' practices revealed that the level of automation and the use of systems varies widely from largely paper-based systems to systems in which both internal and external users can access and show information on a map. The technologies used for the systems also vary from in-house systems to commercially available systems. Agencies generally do not have a well-documented feasibility analysis and have not documented actual benefits. Costs for some of the implementations are easily available, but most were not available through the review of existing literature.

Agencies tend to move from paper-based systems to stand-alone tools or ad-hoc solutions, and then later to a web-based system. One of the focus areas is converting existing paper-based right-of-way plans to electronic plans and storing them in a robust document management system. Such systems allow for easy access to plans that can otherwise be difficult to catalog, maintain and retrieve. Another area of recent focus is integrating right-of-way information with an agency's GIS.

Initial Web-Based Survey Findings

The research team sent an initial survey to 114 individuals across 62 agencies, which included 50 state DOTs and 12 LPAs that was designed to identify agencies that are either using electronic right-of-way management systems or paper-based systems on a daily basis. The team received responses from a total of 29 individuals spanning across 24 agencies. Twenty-one of the responses were received from state DOTs while the other three were from LPAs.

- **Type of system used**—Based on the 29 individual responses of the survey, 3 individuals reported using an electronic system and 19 individuals reported using a hybrid system, while 7 individuals reported using a paper system.

- **Length of time current agency system has been implemented**—While 25 percent of agencies indicated that a new system has been implemented in the last 5 years, 38 percent of the agencies indicated that the system in use is over 10 years old.

- **System development approach**—Most agencies using an electronic or hybrid system responded that the system in use is custom-developed versus based on a commercial off-the-shelf software (COTS) solution

- **Implementation cost**—Only six agencies (five state DOTs and one LPA) reported concrete data related to the cost of implementation and only four agencies (all state DOTs) reported concrete data on the annual cost to maintain their electronic system. The implementation costs ranged from $26,000 to $6.5 million, while annual maintenance costs varied between $60,000 and $150,000.

  It is important to note that many agencies had difficulty reporting these types of numbers, as cost data either has not been documented or is not readily available.

- **Implementation approach**—Most agencies used a phased implementation approach, meaning the electronic system was implemented over a longer period of time and across several phases. Fifty percent of agencies used a combination of internal resources and external consultants to implement the new system.

Detailed Survey Findings

Nine agencies were selected to conduct follow-up interviews with; these agencies were asked to provide basic information about their system, including the business functions and processes

supported by the system, and details about the implementation process. Detailed case study write-ups for each agency are included in Appendix C.

Business Case Analysis

The information gathered from the literature search and case studies, combined with the research team's prior experience with implementing major information systems in state departments of transportation was used to develop a potential business case for establishing a case for implementing a new right-of-way management system for a prototypical medium-sized agency for two development alternatives:

1. **Commercial-off-the-shelf (COTS) solution**—There are currently several commercial off-the-shelf (COTS) software packages available in the marketplace that can provide some of the functionality required in an electronic right-of-way management system. Typically, many agencies find that no COTS solution completely meets all of their needs. Therefore, it is expected that some degree of customization of the COTS solution is usually required.

   The initial cost to implement the COTS solution defined as the project cost and the first year of operations is estimated to be $4.3 million. The seven-year total cost of ownership is estimated to be $6.78 million.

2. **Custom developed solution by systems integrator**—The second alternative is the custom development of a new right-of-way information management system by an external systems integrator.

   The initial cost to build and implement a custom solution is estimated to be $4.6 million. The seven-year total cost of ownership is $5.9 million. The total cost of ownership is very similar to the total cost of ownership of the COTS alternative since while it costs more to develop the custom solution there are no reoccurring software licensing costs.

Benefits Analysis

The research team identified potential tangible benefits of approximately $3 million per year from an electronic right-of-way-management system when fully implemented for the prototypical medium-sized transportation agency. Potential tangible benefits included reinvestment opportunities associated with the timely letting of transportation projects which allow projects to be let within the original planned construction budget; reduced parcel acquisition costs; reduced relocation program costs; reduced administrative costs to deliver the right-of-way program; and savings in the cost to perform property management activities.

Based on these anticipated benefit streams, the research team prepared a return on investment analysis which assumed the potential benefits from the new system were achieved in a staged manner, with full benefits achieved beginning in Year Six after implementation. For a system developed under the COTS alternative, there is a cumulative net benefit of $1.58

million with a payback early in Year 7 or four years after the initial system implementation is complete. For the custom development alternative, there is a total cumulative net benefit of $2.5 million with a payback in Year 7 or four years after the initial system implementation is complete.

In addition to the quantified business case, the research team also identified a number of intangible benefits of a new right-of-way management system. Examples of these intangible benefits include streamlining of business processes through automated workflows; reducing or eliminating redundant entry into data systems; providing improved access to information for management decision-making; implementation of a solution which utilizes current state of the practice technologies and as a result is easier to maintain and enhance; and facilitating knowledge transfer and training of new employees or consultants through a more intuitive and user-friendly system.

Risks and Barriers to Implementation

The Parsons Brinckerhoff research team established a list of potential barriers that could affect a state DOT's ability to implement or attempt to implement an electronic right-of-way management system and proposed approaches for addressing and overcoming these barriers. Examples of some of the potential risks/barriers related to the implementation of a new right of way management system include difficulty in achieving and maintaining executive sponsorship; changes in agency management or shifting agency priorities; organizational resistance to implementing a new system; limitations in the overall usability and adaptability of the new system; inability to control/manage project scope; and technical complexities related to interfacing with other agency systems or changes required to these other systems.

Conclusion

Implementation of an electronic right-of-way management system can clearly assist a state DOT or other public sector real estate organization to improve the overall efficiency and effectiveness of their operations.   A state DOT right-of-way business unit which is currently not utilizing an electronic right-of-way system should seriously consider investing in a modern electronic system.

Implementation of a new electronic right-of-way management system represents a significant investment for a public sector real estate organization.   However, in spite of the significant upfront investment required to implement a new system, the research team's analysis showed for a hypothetical medium sized state DOT that an electronic right-of-way management system has a positive return on investment.   In addition, implementation of an electronic right-of-way management system can provide numerous intangible benefits which contribute to improved efficiency and effectiveness of right-of-way operations, enhanced transparency and significantly improved access to information.

1 Introduction and Background

The acquisition of right-of-way for a transportation project faces many challenges:

- Public sector real estate professionals are continuously challenged to "do more with less," as staffing levels have been reduced in many states and outside consultants are being enlisted to perform more work

- Delays in letting and construction can lead to a substantial increase in the total cost of a project and creates accountability issues for the state DOT with policy makers and other stakeholders to whom commitments were made as to when construction would begin

- Since the right-of-way management business processes are highly structured and based on federal and state laws and regulations, states have limited flexibility in how they execute the right-of-way process

- The right-of-way process requires a significant amount of documentation to be developed and, in many cases, exchanged with property owners

- An extensive archive of paper right-of-way documents can make document retrieval cumbersome

The application of technology, including the development of an electronic right-of-way management system, is one potential strategy for assisting state departments of transportation (DOT) with improving the overall efficiency and effectiveness of the right-of-way management process. While the implementation of an electronic data recordkeeping system has the potential to provide a number of benefits for a state DOT, implementation of an electronic system can be costly and time consuming. In addition, it requires an ongoing investment to operate and maintain the new system.

Recognizing that implementing an electronic right-of-way management system can be potentially costly and complex, the Federal Highway Administration Office of Real Estate Services (FHWA HEPR) retained Parsons Brinckerhoff to develop tangible, easily understandable documentation for transportation professionals in public agencies, at the state and local levels, to use in supporting the implementation of electronic information management systems for right-of-way and related activities. The goal of this research project is to compare and contrast the relative strengths and challenges associated with using both an electronic system and a "paper" system and then to identify and document the business case associated with the implementation of an electronic system.

A number of states have automated their right-of-way management processes to some extent. In 2008, a survey administered to state agencies as part of *NCHRP 8-55A: Geographic Information Systems Applications for Transportation Right-of-way* found that 86 percent of states that responded (19 of 22) to the survey had an information system that supported

automation of the right-of-way function to some extent. Eighty-two percent of the states that responded (18) were planning to expand their right-of-way information system, 50 percent (11) were planning to replace their right-of-way information systems, and 59 percent (13) were planning to add a GIS component.

1.1 Definition of Right-of-Way Management System

For the purpose of this research project, an integrated right-of-way management system is assumed to include the following capabilities:

- Manage transportation project information relevant to the right-of-way acquisition process

- Manage information on individual parcels that are candidates for acquisition

- Support all aspects of the right-of-way acquisition lifecycle, including appraisal, negotiation, and relocation

- Support property management activities, including tracking of leases

- Capture the appraisal, the review appraisal, and the finding of just compensation within the system

- Support residential and business relocation services, including either calculations of relocation eligibility within the system or linkages to external tools/calculators

- Manage and track utility relocations, including managing the details of required agreements with utilities

- Provide integrated workflows which automatically route or move a task to be completed from one step or user to another within the system based on predefined business rules (Example: the assignment of a parcel to an appraiser, the entry of the appraisal into the system, the routing of the completed appraisal to the review appraiser (and return to the appraiser for revision if necessary), and then transmission of the completed appraisal to the individual responsible for approving the amount of just compensation for that parcel)

- Support the creation and management of various required forms and letters by the system based on business rules (for example, automatic creation of a 90-Day or 30-Day Letter or various relocation eligibility worksheets)

- Integrate with an agency's document management system to support scanning and storing of documents during the right-of-way acquisition process and linking to these documents for later viewing

- Integrate with an agency's financial management system to reduce or eliminate duplicate entry required to support various right-of-way payments (property acquisition, relocation, consultant services, etc.)

1.2 Report Contents

The remainder of this report documents Parsons Brinckerhoff's research approach and its findings and conclusions from the research study. This report is organized as follows:

- **Research Approach**—This section outlines the major tasks performed during the project and the approach utilized to complete these tasks.

- **Key Findings**—This section summarizes findings from the agency survey and case studies in terms of agency experience with the implementation of electronic right-of-way systems, the use of paper based systems, and lessons learned from the perspective of both electronic and paper-based data systems.

- **Business Case Analysis**—This section provides an example business case analysis that can be adapted by a state DOT and customized to that agency's particular business environment to help to establish the case for implementing a new right-of-way management system.

- **Risk and Barriers to Implementation**—The purpose of this section is to identify potential barriers that will affect a state DOT's ability to implement or attempt to implement electronic information management systems in their right-of-way offices and propose approaches for addressing and overcoming these barriers.

- **Appendices** – Appendices include the initial agency questionnaire, detail agency questionnaire used for follow-up discussions, and detailed summaries of each of the agency case studies.

2   Research Approach

This report represents a synthesis of findings from the various tasks performed during the project. A brief summary of the major tasks and activities performed during the project is provided below.

2.1 Conduct Literature Search and Review

The research team conducted a comprehensive literature search and review that summarizes all existing information on right-of-way electronic data/recordkeeping technologies and identifies information on measurable objectives (e.g., implementation and maintenance costs, potential resources for system development, and comparison of the effectiveness of a paper-based system versus an electronic system) for incorporation into subsequent tasks in the project. Findings from the literature search, along with a detailed bibliography of all reference materials and sources consulted, were compiled into a summary report.

2.2 Prepare Case Studies

Building on the information gathered from the literature search, the research team analyzed the electronic data/record-keeping systems of nine state/local highway agencies. The first step of this task consisted of conducting a web-based survey of various state DOTs and Local Public Agencies (LPA) to better understand which agencies are either using electronic right-of-way information management systems or paper-based systems on a daily basis and identify implementation costs and ongoing operational costs, anticipated and actual business benefits, implementation challenges, and other relevant information. In order to select the agencies for in-depth telephone interviews, we used the results from this initial survey to identify nine agencies that either use electronic systems, paper systems, or a combination of the two (hybrid). The research team interviewed representatives from each of the nine agencies, using a detailed questionnaire as a discussion guide. The findings from both the initial survey and detailed interviews were compiled into a summary report which outlines findings, conclusions, and recommendations.

2.3 Determine Data Requirements

The research team prepared an inventory of data requirements which documents the type of data elements that should be included in an electronic right-of-way information management system and potential sources for obtaining, collecting, or accessing these data. The inventory includes process flows provided by the FHWA Contracting Officer's Representative (COR) and leverages the prior experience and knowledge of the research team. The final inventory is organized by major business process and sub-process and identifies potential sources for accessing or collecting the relevant data.

2.4 Calculate Return on Investment

Information obtained from both the literature search and various agencies during the case studies was utilized to document the potential business case or return on investment for an agency implementing an electronic right-of-way information management system. The final report outlines the estimated implementation cost under two development alternatives: (1) commercial off-the-shelf (COTS) solution and (2) custom developed solution with development performed by an external systems integrator for the agency. It also presents anticipated tangible and intangible benefits associated with the implementation of a new right-of-way management system and includes a return on investment calculation for each development alternative.

2.5 Identify Barriers to Implementation

The research team identified and documented potential barriers that may affect a state DOT's ability to implement or attempt to implement electronic information management systems in its right-of-way offices and proposed approaches for addressing and overcoming these barriers.

The research team prepared an initial inventory of potential barriers/risks in the form of a sample project risk log for implementing an electronic right-of-way information management system. Risk is defined as "an uncertain event or condition that, if it occurs, will have a negative or positive effect on one or more project objectives," which is consistent with the Project Management Institute's PMBOK® Guide definition of risk.

3 Key Findings

3.1 State of Practice

An initial literature review of various agencies' practices revealed that the level of automation and the use of systems varies widely from largely paper-based systems to systems in which both internal and external users can access and show information on a map. The age of systems also varies significantly between agencies. In most cases, agencies with older systems are considering upgrading their systems. The technologies used for the systems also vary from in-house systems to commercially available systems. Agencies generally do not have a well-documented feasibility analysis and have not documented actual benefits. Costs for some of the implementations are easily available, but most were not available through the review of existing literature.

Agencies tend to move from paper-based systems to stand-alone tools or ad-hoc solutions and then later to a web-based system. One of the focus areas is converting existing paper-based right-of-way plans to electronic plans and storing them in a robust document management system. Such systems allow for easy access to plans that can otherwise be difficult to catalog, maintain, and retrieve—while occupying a lot of space. Another area of recent focus is integrating available data with GIS information, thus providing the capabilities to view information on a map. This allows agencies to view surrounding properties and make more informed right-of-way decisions.

3.2 Initial Web-based Survey Findings

The research team sent an initial survey to 114 individuals across 62 agencies—which included 50 state DOTs and 12 LPAs—that was designed to identify agencies that are either using electronic right-of-way management systems or paper-based systems on a daily basis. The team received responses from a total of 29 individuals spanning across 24 agencies. Twenty one of the responses were received from state DOTs while the other three were from LPAs. These agencies were as follows:

- Alaska DOT&PF
- Alabama DOT
- Arkansas State Highway and Transportation Department
- Arizona DOT
- Colorado DOT
- Dallas County (TX) Public Works
- Idaho Transportation Department
- Kentucky Transportation Cabinet
- Maricopa County (AZ) Public Works
- Maryland SHA

- Minnesota DOT
- Mississippi DOT
- Nevada DOT
- New Jersey DOT
- North Dakota DOT
- Ohio DOT
- Oklahoma DOT
- Oregon DOT
- Pennsylvania DOT
- Polk County (FL)
- South Dakota DOT
- South Carolina DOT
- Tennessee DOT
- West Virginia DOT

A copy of the initial agency questionnaire is included in Appendix A.

Type of System Used

Exhibit 1 summarizes the 29 individual survey responses on the types of systems used by agencies. As indicated by the responses, a majority of the agencies use a hybrid – a combination of electronic and paper-based system.

Exhibit 1: Type of System

Type of System	# of Respondents[1]
Paper-Based	7
Electronic	3
Hybrid	19

Length of Time Current Agency System Has Been Implemented

Exhibit 2 presents how long the systems have been in place at the 24 various agencies. As indicated in the responses, a quarter of the agencies indicated that a new system has been implemented in the last 5 years. On the other hand, 38 percent of the agencies indicated that the system in use is over 10 years old.

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[1] Based on number of respondents as responses from some agencies were inconsistent

Exhibit 2: Length of Time Current Agency System Has Been Implemented (in Years)
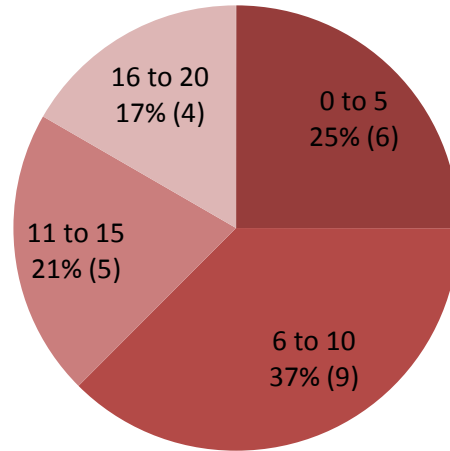
Pie chart:
- 0 to 5: 25% (6)
- 6 to 10: 37% (9)
- 11 to 15: 21% (5)
- 16 to 20: 17% (4)

System Development Approach

Most agencies using an electronic or hybrid system responded that the system in use is custom-developed versus based on a COTS solution as shown in Exhibit 3.

Exhibit 3: System Development Approach for Electronic Systems, Custom vs. COTS[2]

Pie chart:
- Off-the-Shelf 9%
- Both 10%
- Custom-Developed 81%

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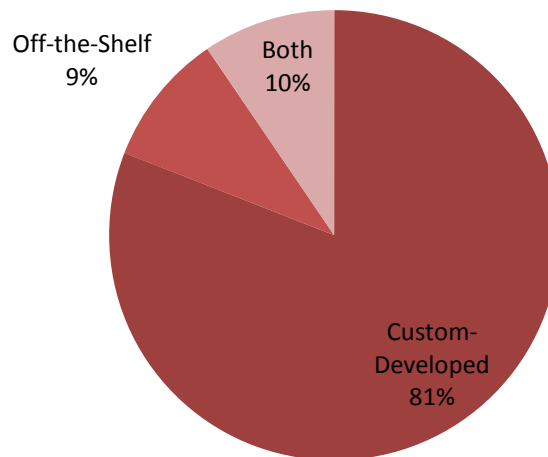
[2] Based on percent of respondents who responded using electronic or hybrid systems

Business Functions

A key portion of the survey focused on the business functions supported by the right-of-way information management system. Exhibit 4 identifies the top five business functions supported by an integrated right-of-way information management system.

Exhibit 4: Business Functions Supported by Electronic/Hybrid Right-of-way Management System

Response	Percent[3]
Appraisal	73%
Negotiation	68%
Acquisition	64%
Relocation	64%
Property Management	64%

In addition to the five business functions identified above, survey respondents also indicated that the following business functions were supported by the electronic systems in use at one or more agencies:

- Comparable sales
- Contract management
- Demolition
- Eminent domain
- Environmental services
- Excess land and demolition
- Aspects of financial management
- Permitting
- Rail
- Right-of-way mapping/surveying
- Title abstracts
- Utility relocation

In addition, two-thirds of respondents reported that their right-of-way information management system was integrated with at least one other system, including geographic information system (44 percent), document management system (63 percent), and financial management system (63 percent).

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[3] Based on percent of respondents who responded using electronic or hybrid systems

Implementation Cost

Only six agencies (five state DOTs and one LPA) reported concrete data related to the cost of implementation and only four agencies (all state DOTs) reported concrete data on the annual cost to maintain their electronic system. The implementation costs ranged from $26,000 to $6.5 million, while annual maintenance costs varied between $60,000 and $150,000.

It is important to note that many agencies had difficulty reporting these types of numbers, as cost data either has not been documented or is not readily available.

Implementation Approach

Most agencies used a phased implementation approach, meaning the electronic system was implemented over a longer period of time and across several phases. This allowed for easier integration of the new system into the current workflow and resulted in better adoption by the end-user. Fifty percent of agencies used a combination of internal resources and external consultants to implement the new system, as illustrated in Exhibit 5.

**Exhibit 5: Implementation Approach for Electronic Right-of-way Systems
Phased vs. All at Once and Internal vs. External**
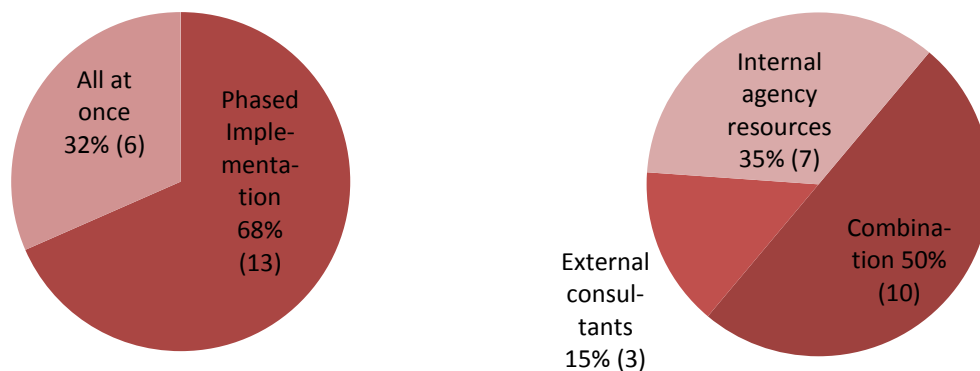
Implementation Challenges and Benefits

The survey also looked at two important components related to implementation—both the challenges faced and benefits realized by the agencies. Exhibit 6 outlines typical implementation challenges. Exhibit 7 summarizes the expected benefits of the system implementation identified by the survey respondents. A comprehensive list of implementation challenges and key benefits can be found in the *Key Benefits, Challenges, and Lessons Learned* section below.

Exhibit 6: Implementation Challenges When Implementing a Right-of-way System

Response	Percent[4]
Difficulties with data conversion from the existing automated or manual systems	76%
Obtaining a sufficient level of end-user involvement	59%
Change management and overcoming resistance throughout the agency	47%
Balancing resources (i.e., time, money, and IT support) to be able to improve system	41%
Ensuring adequate technical and end-user support	24%
Ensuring appropriate executive sponsorship and support	12%

Exhibit 7: Anticipated Benefits from Implementation of a Right-of-way System

Response	Percent[5]
Decrease in data entry and access redundancy	89%
Improved documentation and consistent/standardized reporting	78%
Decrease in time it takes to perform tasks	78%
More efficient utilization of current staff or reduction in staffing	78%
Improved oversight	67%
Increased access to information both internally within agency and by the public	56%
Improved customer service and public relations	33%

Use of Paper-based Systems

The seven agencies that do not use an electronic or hybrid system were asked to provide information on why they are using a paper system instead of some form of an electronic system. Some of the key responses included:

- One agency has been working on acquiring a new system since at least 2005, but funding constraints have limited implementation

- Current system meets the agency's needs

- Agency is slow to adapt to new technologies

- Limited resources available from agency information technology department

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[4] Based on percent of respondents who responded using electronic or hybrid systems
[5] Based on percent of respondents who responded using electronic or hybrid systems

- Requirement for original signature on documents

- Cost to acquire and implement software versus demonstrated business needs

3.3 Detailed Survey Findings

Based on the web-based survey responses, the research team used the following selection criteria to select nine agencies to conduct follow-up interviews with, which included:

- At least one local public agency using electronic and one local public agency using a paper system

- Agencies who recently implemented or upgraded their system

- Agencies who conducted a cost/benefit analysis

A copy of the detailed questionnaire is included in Appendix A.

Exhibit 8 identifies the agencies selected for detailed follow-up and the rationale for the selection.

Exhibit 8: Agencies Selected for Detailed Follow-up and Rationale for Selection

Agency	Key Agency Properties/Criteria
Idaho Transportation Department	Undergoing new system implementation
Kentucky Transportation Cabinet	Prepared business case analysis
Maricopa County (AZ)	LPA using an electronic system
Maryland SHA	Prepared business case analysis
Minnesota DOT	Uses electronic system that was customized for use
Polk County (FL)	LPA using a paper system
South Dakota DOT	Uses paper system
Tennessee DOT	Prepared business case analysis
West Virginia DOT	Recently developed new automated system Developed business case as a part of overall statewide ERP business case

Agencies were asked to provide basic information about their system, including the business functions and processes supported by the system, and details about the implementation process. Exhibit 9 provides an overview of agency responses. More detailed case study write-ups for each agency are included in Appendix C.

Exhibit 9: Systems Overview

Agency	System In Use	System Type	Custom or Off the Shelf?	Size of Program	Number of Users	Implementation Cost	Annual Maintenance Cost	Integrations
Idaho Department of Transportation	PAECETrak – implementation in progress	Electronic	Off the shelf	200 parcels per year, with acquisitions valued at over $20 million in FY 2011 and 2012; 21 relocations in FY 2012 and 20 relocations in FY 2011, with relocation costs of $1.2 million and $580,000 respectively per fiscal year.	9+	$560,000	$75,000	ProjectWise
Kentucky Transportation Cabinet	Right-of-way and Utilities Management System (RWMS)	Hybrid	Custom-developed	1,800-2,000 parcels per year, $20-25 million in acquisition costs per year	<200 users	$300,000-400,000	0.5 FTE	None
Maricopa County	Real Estate Acquisition Application	Electronic	Custom-developed	300-600 parcels per year, $9-21 million in acquisition costs per year	8+	$26,000	~$1,000 during six month period	None
Maryland State Highway Department	Office of Real Estate Management System (OREMS)	Electronic	Custom-developed	Acquired average of 360 parcels; $15.6 million average annual acquisition and relocation cost	N/A	$2.6 million	$150,000	GIS
Minnesota Department of Transportation	Right-of-way Electronic Acquisition Land Management System (REALMS)	Electronic	Framework purchased from Virginia DOT	400-600 acquisitions per year	50-75 users	$2.8 million	5-6 staff members	GIS and SWIFT

Agency	System In Use	System Type	Custom or Off the Shelf?	Size of Program	Number of Users	Implementation Cost	Annual Maintenance Cost	Integrations
Polk County	--	Paper	Custom-developed	60 parcels per year	N/A	N/A	6 FTEs	None
South Dakota Department of Transportation	Landowner Database Inventory System; Property Management System	Hybrid	Custom-developed in-house	600-1100 parcels a year, $8-12 million in acquisition costs per year	N/A	$198,000	N/A	GIS
Tennessee Department of Transportation	Integrated ROW Information System (IRIS) – implementation in progress	Electronic	Custom-developed	1,002 acquisitions in 2012; $43.9 million in compensation costs and $2.3 million in residential and non-residential costs	150 users	$1 million	Includes costs of department overhead, server overhead, disaster recovery	PeopleSoft PPRM, FileNet, Edison, GIS
West Virginia Department of Transportation	Agile Assets RWUR Module	Electronic	Custom-developed	$20 million in acquisition costs per year	125 users	$3 million	$250,000	GIS, EMC Documentum, WV's geocoding system

3.4 Key Benefits, Challenges, and Lessons Learned

There were several key benefits, challenges, and lessons learned that emerged from the literature search and surveys of state agencies that are outlined below.

Key Benefits

Key benefits that agencies have reported obtaining from the implementation of a right-of-way management information system include the following:

- Elimination of duplicate data entry into multiple applications/systems

- Faster generation and improved accuracy of required forms

- Improved access to management information for analysis and decision-making

- Increased access to information by internal staff, external stakeholders, and the general public

- Reduction in time required by end users to document information in the system

- Increased utilization of current staff resources and increased efficiency with limited staff resources since information does not have to be "chased" down

- Enhanced management and tracking of encroachment permits

- Improved management and tracking of the negotiation and acquisition processes including ensuring that these processes are properly documented to meet all federal and state requirements

- Increased efficiency in determining relocation eligibility and in the management of relocation payments

- Enhanced property management capabilities including improved collection rates for rent and lease payments

- Increased consistency and standardization of documentation among all District offices

- Improved tracking of utility relocation activities including better visibility to the status of relocation activities and earlier identification of potential issues

- Improved customer service and public relations

- Improved program oversight

- Reduction in risk and increased efficiency in completing right-of-way and utility relocation functions to meet planned letting dates

For agencies with a paper-based system, a primary benefit cited was the cost savings realized from gaining some business process efficiencies and improved access to information, while not

purchasing an electronic system. A paper-based system may work well for agencies that have a small right-of-way program, but there are also significant benefits to having an electronic system, especially from the perspective of document storage.

Implementation Challenges

Implementation challenges encountered during implementation of new right-of-way management systems include the following:

- Difficulties with data conversion from the existing automated or manual system

- Obtaining a sufficient level of end-user involvement

- Change management and overcoming resistance throughout the agency

- Balancing resources (i.e., time, money, and IT support) to be able to improve system

- Ensuring adequate technical and end-user support

- Ensuring appropriate executive sponsorship and support

- Overcoming silos during system development to ensure a cross section of people from lower level to higher management are involved in the process

- Lack of budget set aside for future maintenance and improvements to the system

- Need for significant amount of knowledge transfer to the vendor team on right-of-way processes and requirements

These challenges are further explored in the *Risks and Barriers to Implementation* section of the Report. Also see Exhibit 6.

Lessons Learned

The key lessons identified during the implementation of new right-of-way management systems include the following:

- Ensure business processes are clearly documented and reflect the most current practices before beginning implementation

- Evaluate in-house versus off-the-shelf products as part of selecting an implementation approach, as there are clear advantages and disadvantages inherent in both possible approaches

- Ensure appropriate executive sponsorship and support for the new system

- A strong implementation team (including both consultants and internal staff) is critical to a successful implementation process

- Obtain a sufficient level of end user involvement throughout the entire project lifecycle

- Ensure both headquarters and regional/district staff are involved in system development

- Ensure there is adequate planning for and time and resources devoted to data conversion from the existing automated or manual systems

- Provide adequate levels of end user training that is delivered on a "just in time" basis prior to system implementation

- Ensure adequate technical and end-user support for the new system

- Develop and implement a plan to continue to modify, enhance, and grow the new system versus assuming the initial system go-live is the end of the implementation process

- Plan a program that will meet not only present needs, but which is scalable to meet future needs as well

- Use automated systems to increase client service relationships by creating a transparent acquisition reporting method—schedule and costs can be tracked more easily and clients are better able to see what the cost and schedule drivers within an acquisition process are

- Involve all of the district offices during the implementation process to help them develop a degree of ownership of the implementation effort—input from the district staff was critical in creating a robust system that met everyone's needs

- Prepare a detailed contract with a clearly defined scope to ensure the system implementation vendor fully understands what it is delivering and avoid any misinterpretations

4 Business Case Analysis

The information gathered from the literature search and case studies, combined with the research team's prior experience with implementing major information systems in state DOTs was used to develop a potential business case for establishing a case for implementing a new right-of-way management system for two development alternatives:

- Commercial-off-the-shelf solution

- Custom-developed solution performed by an external systems integrator for the agency

The intent of the business case analysis performed during this project is to provide an example business case analysis that can be adapted by a state DOT and customized to that agency's particular business environment to help establish the case for implementing a new right-of-way management system. The research team prepared the business case analysis in this report for a hypothetical mid-size state DOT. However, the methodology and templates utilized to perform the analysis are transferrable and adaptable for use by an agency contemplating investing in a new right-of-way management system.

A more detailed description of the two alternatives included in the analysis and the estimated cost of these alternatives are provided in the sections below.

> *Three of the agencies interviewed (Idaho Department of Transportation, Tennessee Department of Transportation, and the West Virginia Department of Transportation) were in the process of or had recently implemented COTS solutions.*

4.1 Summary of Potential Development Alternatives

Alternative 1: COTS Solution

There are currently several COTS packages available in the marketplace that can provide some or most of the functionality required in an electronic right-of-way management system. Typically, many agencies find that no COTS solution completely meets all of their needs. Therefore, it is expected that some degree of customization of the COTS solution is usually required.

The potential advantage of a COTS solution with a limited number of custom extensions is that the initial cost to implement the COTS solution (the commercial software plus some customized add-ons) may be less expensive than developing a custom solution from scratch. However, this assumption is highly dependent on the cost of acquiring the COTS licenses. In addition, the COTS solution still requires design and development of any required interfaces with other agency systems and any custom programs needed to support conversion of data from existing systems. Another advantage of the COTS solution is that the agency, as long as it pays the

annual software maintenance fees, will continue to receive product upgrades; whereas in a custom solution, the agency's IT staff or a contractor hired by the agency would be responsible for any upgrades or enhancements to the system.

Project Scope/Approach

Project activities for the implementation of a COTS solution can generally be divided into four phases: (1) Pre-implementation Planning phase, (2) System Implementation phase, (3) Project Management phase, and (4) Organizational Change Management phase. The Project Management and Organizational Change Management phases span the full lifecycle of the project. The suggested task/activities in each phase are described below.

Pre-implementation Planning Phase

The suggested task/activities in the Pre-implementation Planning phase are as follows:

- Initiate the project, including developing a project charter, a project management plan to outline management processes to be followed during the project, and the initial project work plan. A project kick-off meeting with all key stakeholders should also be conducted.

- Review and document the agency's current or "As-Is" business processes. Typically, this is done by developing a series of process flows and brief narratives for each major business process or sub-process and identifying issues or bottlenecks with each process.

- Conduct several business process re-engineering sessions to prepare "To-Be" business process flows which address key issues or bottlenecks defined during the As-Is documentation efforts.

- Define system requirements to reflect the proposed To-Be processes. Requirements typically consist of the following:
  - Functional requirements include the required capabilities within the new right-of-way management solution to support the needs of the business. The functional requirements will be organized logically by major business process and sub-process.
  - An initial list of data that should be included in an electronic right-of-way information management system, as developed by the research team in Task 5, can be found in Appendix D. This list is organized by major business process and sub-process and identifies potential sources for accessing or collecting the relevant data.

- General requirements include capabilities that cut across functional areas, such as ease of use, common look and feel, security, work flow, audit trails, archiving, document management (if desired in the right-of-way solution itself), online help, and user documentation among others.

- Management analysis and reporting requirements include user requirements for a robust, easy-to-use reporting environment within the right-of-way system itself and for the

capability of the new right-of-way software to integrate with other business intelligence and reporting environments utilized by the agency. These requirements will include both standard reports available within the software solution and ad-hoc reporting capabilities.

- Interface requirements include requirements to integrate with existing or planned agency systems such as the agency's financial management system, project management system, document management system, or geographic information system (GIS) environment.

- Conversion requirements include requirements to migrate data from one or more existing agency systems to the new system.

- Prepare a request for proposal (RFP) to select the COTS solution and the systems integrator. We have assumed that the agency will select the COTS solution and the systems integrator in a single RFP process as currently in the right-of-way COTS market most software vendors do their own product implementations versus some other types of application systems where multiple systems integrators may implement a COTS product and the agency may obtain a better price by first selecting the COTS software solution and then bidding out the implementation services separately.

- Review proposals, conduct software demonstrations for all or a short list of proposers, and select the COTS solution and the systems integrator to implement the COTS solution.

- Complete required contract negotiations.

System Implementation Phase

The suggested task/activities in the System Implementation phase are as follows:

- Initiate implementation phase, including preparing the updated work plan for implementation reflecting the selected systems integrator's proposed approach and timeline for conducting the implementation and holding an implementation phase kick-off meeting.

- Confirm system requirements, which are designed to have the systems integrator/software vendor review and confirm its understanding of the requirements with the agency staff.

- Provide training on the selected COTS solution for agency staff on working on the project team.

- Configure the selected COTS solution.

- Conduct an initial testing session often called a conference room pilot or CRP to validate the fit of the software against the requirements.

- Identify gaps between the COTS solution and the agency's requirements and propose solutions to address the gaps.

- Design and develop required customizations to address any gaps; design and develop custom reports and design and develop interface and conversion programs.

- Conduct system test to verify individual system functions (for example appraisal, acquisition, and negotiation).

- Conduct integration test to test the inter-relationships between major business functions (for example managing a parcel across the appraisal, acquisition, and negotiation processes) and interfaces with other systems.

- Execute Mock Conversion 1, which usually occurs just prior to the integration test.

- Prepare for and conduct user acceptance test—it is recommended that this be an agency-led activity and that the testing involves additional staff who have not been involved in the day-to-day project development activities.

- Execute Mock Conversion 2, which usually occurs just prior to the user acceptance test.

- Prepare training materials and user procedures—typically, this material will be developed by customizing and enhancing the software vendor's base materials to meet the needs of the specific agency.

- Conduct end-user training—typically, it is recommended that the systems integrator teach one or two classes as a pilot and then the remaining end-user training is conducted by agency personnel who have been a part of the research team. Training may also be offered before user acceptance test as a way of validating the effectiveness of the training with any user acceptance testers who are new to the system.

- Execute the final data conversion and cutover the system to a production status.

- Provide post production support for a period of time, such as 60 days, in which the research team stays together as a unit prior to turning the system over to the ongoing post production support team. This period typically constitutes the system acceptance period and proceeds final payment for the implementation services to the systems integrator.

Project Management Phase

The Project Management phase tasks are performed throughout the project, and the tasks include:

- Manage performance of all project activities
- Maintain the project work plan
- Prepare project status reports
- Manage potential project scope changes that may arise
- Conduct Project Steering Committee meetings

- Manage the project budget and financial plan

Organizational Change Management Phase

Organizational Change Management phase tasks are performed throughout the project, and the tasks include:

- Identify impacts of the new system on the organization

- Plan for and proactively manage the implementation of these changes throughout the project lifecycle including a structured stakeholder engagement and communications plan for central office and field staff

- Manage and implement user training program on both the new system and new business procedures

Exhibit 10 provides a representative timeline for the implementation of a COTS solution. The total project duration is 29 months from project initiation through post production support. This includes all the time required for procurement of the COTS solution and systems integration services.

For purposes of this analysis, we are showing functionality being deployed in a single implementation step. Alternatively, an agency could stage deployment of functionality by business function or major process—for example, implement the appraisal, negotiation, and acquisition functions first and other functions at a later point.

Exhibit 10: Potential Timeline for COTS Implementation

Phase/Task	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29
Pre-Implementation Planning Phase																													
Initiate Project	1																												
Document As-Is Processes		1	1																										
Define To-Be Process				1	1																								
Define System Requirements					1	1	1																						
Prepare RFP					1	1	1																						
Select Software/Systems Integrator								1	1	1	1																		
Negotiate Contract												1																	
Systems Implementation Phase																													
Initiate Implementation Phase													2																
Confirm System Requirements													2																
Train Core Agency Project Team													2																
Configure Software														2															
Conduct Conference Room Pilot															2	2													
Identify Gaps and Confirm Solutions																	2												
Design and Develop Required Customizations																		2	2	2									
Conduct System Test																					2	2							
Conduct Integration Test																						2	2						
Execute Mock Conversion 1																						2							
Conduct User Acceptance Test																								2					
Execute Mock Conversion 2																								2					
Prepare Training Materials and Procedures																					2	2							
Conduct User Training																								2	2				
Perform Data Conversion and System Cut-over																										2			
Provide Production Support																												2	2
Project Management	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Organizational Change Management	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Legend:

1	Anticipated duration of Pre-implementation Planning, Project Management, and Organizational Change tasks
2	Anticipated duration of Systems Implementation tasks
3	Anticipated duration of Project Management tasks
4	Anticipated duration of Organizational Change Management

Cost Estimate

The cost estimate for a COTS solution hosted by the agency itself on-site or in a state-managed data center includes the following components:

- External consultant (if utilized) to support the Pre-implementation Planning phase—A cost of $250,000 has been assumed in Year 1.

- Initial cost of acquiring software licenses—Licensing cost was assumed to be $500,000 with the license acquired at the start of the System Implementation phase in Year 2.

- Software maintenance cost, which is typically 20 to 22 percent of the cost of the initial software licenses for the entire seven-year period being modeled. Model was developed at 20 percent of original software license cost escalated 2 percent per year for Year 2 through Year 7.

- Systems integration services to configure and test the COTS solution; develop required custom extensions; develop interface and conversion programs; deploy the new system and support the system for the 60 day post production/system acceptance period. For this analysis, we are assuming an 80-percent fit between the selected software and the agency's requirements with customizations needed to address the identified gaps between the COTS solution and the agency's requirements. Based on recent experience of the research team, systems integration cost has been assumed to be $1.8 million, with this expenditure across two fiscal years. Sixty percent of the cost is allocated to Year 2 and 40 percent of the cost is allocated to Year 3.

- Managed services support for one year following implementation by a scaled down vendor team working closely to transition the system to the agency's IT staff. Cost is estimated at $365,000 based on one FTE staff member from the systems integrator. This cost is split between Year 3 (60 percent) and Year 4 (40 percent). We would typically recommend that this support period include an upgrade to the most current release of the software vendor's solution prior to the end of the managed services period.

- Incremental hardware (additional servers or other components) or other technical infrastructure (operating system software, database management system software, etc.) specifically required to support the new right-of-way system. For purposes of this analysis, incremental cost of additional technical infrastructure is assumed to be $100,000.

- Maintenance on the hardware and other technical infrastructure components, which is assumed to be 15 percent of the acquisition cost for the incremental hardware and software. This cost is also escalated 2 percent per year through the technology refresh in Year 5 and then again for Year 6 and Year 7 using the cost of the technology refresh as the new base cost for escalation purposes.

- One complete refresh of the hardware and technical infrastructure in Year 5 of the seven-year planning period. For purposes of this analysis, the cost of the technical refresh is assumed to be $100,000 in Year 5.

- Agency staff cost during the project—Typically, we would allocate to the project the cost of any agency staff assigned to the project full-time or near full-time where it is necessary to backfill their current regular assignment. In some situations where the backfill is going to be performed by an external resource, we would include the additional cost associated with backfilling for the person with a consultant in the project budget. The cost of staff participating in project workshops, reviewing project deliverables, and participating in testing and other activities on a part-time basis is usually not included in the project budget. For purposes of this analysis, we have assumed one agency business staff member and one agency IT staff member at a fully loaded rate of $75/hour during Pre-implementation Planning and two business staff members and two IT staff members at the same fully loaded rates during the System Implementation phase for a cost of $1,248,000. This cost assumes two FTE staff members during Year 1 for the Pre-implementation Planning phase at a cost of $312,000 and three FTE staff members during Year 2 and Year 3 for the System Implementation phase at a cost of $468,000 per year.

- Agency staff cost to support the system during production operations—This includes both the business side lead or system power user and the agency IT staff supporting the solution. We have included a 50-percent FTE business staff person at $75/hour and a 50-percent FTE IT staff member for the balance of the seven-year planning period with a cost of $936,000. This represents a cost of $156,000 per year in Year 4 and Year 5 for ongoing support; a cost of $468,000 in Year 6 to support an increased staffing level of two business staff and two IT staff during a planned upgrade of the system to the next version of the COTS software; and a cost of $156,000 in Year 7 for a continuation of routine ongoing support.

- Systems integration support for one major upgrade at approximately Year 6 of the seven-year planning window—This cost is assumed to be approximately 40 percent of the original implementation cost or $750,000.

- Agency staff cost during the major upgrade—This staffing is modeled at the same levels and cost factors as during the initial system implementation.

Exhibit 11 outlines the proposed cost for the COTS alternative. The initial cost to implement the solution defined as the project cost and the first year of operations (Year 1 through Year 3) is $4.3 million. The seven-year total cost of ownership is $6.78 million.

Exhibit 11: Cost Estimate for COTS Implementation

Cost Element	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Pre-implementation planning consultant	$250,000	$250,000						
COTS software licenses	$500,000		$500,000					
COTS software maintenance	$630,812		$100,000	$102,000	$104,040	$106,121	$108,243	$110,408
Systems integration services	$1,800,000		$1,080,000	$720,000				
Managed services support	$365,000			$219,000	$146,000			
Hardware and other technical infrastructure	$100,000		$100,000					
Hardware and infrastructure maintenance	$92,730		$15,000	$15,300	$15,606	$15,918	$15,300	$15,606
Hardware refresh	$100,000					$100,000		
Agency staff cost during project	$1,248,000	$312,000	$468,000	$468,000				
Agency staff cost to support system ongoing	$936,000				$156,000	$156,000	$468,000	$156,000
Systems integration services for upgrade	$750,000						$750,000	
Total Cost	$6,772,542	$562,000	$2,263,000	$1,524,300	$421,646	$378,039	$1,341,543	$282,014

Alternative 2: Custom Solution Developed by Systems Integrator

The second alternative is the custom development of a new right-of-way information management system by an external systems integrator on behalf of the agency. The most obvious benefit of this alternative is the ability to custom build a solution that can specifically meet all of the agency's defined requirements. While this may seem desirable from an operational point of view, this approach typically takes longer given the time required to design, develop and implement the solution. The cost to build may also be higher depending on the difference between the development cost and the cost to purchase licenses for the COTS product. In addition, typically, we would consider a custom developed solution to be more risky from an information technology project delivery perspective. However, if an extensive amount of customization of the COTS solution is going to be required to meet an agency's requirements, it may become more practical and potentially even less costly and less risky to custom develop a solution rather than to purchase a COTS solution and then extensively customize the COTS solution.

Several of the agencies interviewed had implemented custom solutions, some developed internally and some developed with the assistance of a third party systems integrator. Agencies with custom solutions included the Kentucky Transportation Cabinet, Maricopa County, Maryland State Highway Administration, and the Minnesota Department of Transportation.

Project Scope/Approach

Project activities for the development of a custom solution can generally be divided into two phases: Pre-implementation Planning and System Implementation. The activities under Pre-implementation Planning phase are similar to those under the COTS alternative, while the System Implementation phase involves much more custom development and system build out. There is also a Project Management phase and a Change Management phase which span the full lifecycle of the project. The suggested tasks/activities in each phase are outlined below.

Pre-implementation Planning Phase

Tasks during Pre-implementation Planning include:

- Initiate the project, including developing a project charter, a project management plan to outline management processes to be followed during the project, and the initial project work plan. A project kick-off meeting with all key stakeholders should also be conducted.

- Review and document the agency's current or "As-Is" business processes.

- Conduct several business process re-engineering sessions to prepare "To-Be" business process flows which address key issues or bottlenecks defined during the As-Is documentation efforts.

- Define system requirements (as described for the COTS alternative above) to reflect the proposed To-Be processes.[6]

- Prepare an RFP to select the systems integrator to develop and implement the custom solution.

- Review proposals, conduct interviews of all proposers or a short list and the select systems integrator to build the custom solution.

- Complete required contract negotiations.

System Implementation Phase

Tasks during System Implementation include:

- Initiate implementation phase.

- Confirm system requirements to validate that the systems integrator fully understands the agency's requirements.

- Prepare a system design which documents the screens, reports, and data structures within the proposed system.

- Detail design, code and unit test the custom programs required for the system, as well as any interface and data conversion programs.

- Conduct system test.

- Execute Mock Conversion 1.

- Conduct integration test.

- Execute Mock Conversion 2.

- Prepare for and conduct user acceptance test.

- Prepare training materials, user procedures, and detailed technical documentation for the new system. These materials will need to be developed from scratch as the system is being developed.

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[6] An initial list of data elements that should be included in an electronic right-of-way information management system, as developed by the research team in Task 5, can be found in Appendix D. This list is organized by major business process and sub-process and identified potential sources for accessing or collecting the relevant data.

- Conduct end-user training; as with the COTS solution, typically it is recommended that the systems integrator teach one or two classes as a pilot and then the remaining training is conducted by agency personnel who have been a part of the research team.

- Execute the final data conversion and cut-over the system.

- Provide post-production support for a period of time, such as 60 days, in which the research team stays together as a unit prior to turning the system over to the post-production support team. As with the COTS alternative, this 60-day window serves as the system acceptance period for the agency

Project Management Phase

The Project Management phase tasks are performed throughout the project and the tasks include:

- Manage performance of all project activities

- Maintain the project work plan

- Prepare project status reports

- Manage potential project scope changes that may arise

- Conduct Project Steering Committee meetings

- Manage the project budget and financial plan

Organizational Change Management Phase

Organizational Change Management phase tasks are performed throughout the project, and the tasks include:

- Identify impacts of the new system on the organization

- Plan for and proactively manage the implementation of these changes throughout the project lifecycle, including a structured stakeholder engagement and communications plan for central office and field staff

- Manage and implement user training program on both the new system and new business procedures

Please note that an agency could elect to phase its implementation, in which case the System Implementation phase activities could be repeated for various functional areas—for example, Appraisal, Negotiation, and Acquisition are implemented in one phase, Relocation in a second phase, and then Property Management in a third phase at a later time.

In addition, these implementation tasks/activities are outlined following what is known as a "waterfall" methodology. An alternative approach would be to use an "Agile" methodology in

which sections of a system are designed, developed, and unit tested in a series of short two- to three-week "sprints" and then sets of functionality developed across several sprints are tested and deployed into production in a series of software releases. Increasingly, more systems are being developed following an Agile methodology.

Exhibit 12 provides a representative timeline for the implementation of a COTS solution. The anticipated duration is slightly longer than the COTS alternative at 31 months from project initiation through post-production support.

Exhibit 12: Potential Timeline for Custom Implementation

Phase/Task	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31
Pre-Implementation Planning Phase																															
Initiate Project	1																														
Document As-Is Processes		1	1																												
Define To-Be Process				1	1																										
Define System Requirements					1	1	1																								
Prepare RFP					1	1	1																								
Select Software Systems Integrator								1	1	1	1																				
Negotiate Contract												1																			
Systems Implementation Phase																															
Initiate Implementation Phase													2																		
Confirm Requirements													2																		
Prepare System Design														2	2	2	2														
Code/Unit Test Software																	2	2	2	2	2	2									
Conduct System Test																							2	2							
Execute Mock Conversion 1																									2						
Conduct Integration Test																									2	2					
Execute Mock Conversion 2																											2				
Conduct User Acceptance Test																											2				
Prepare Training Materials and Procedures																					2	2	2	2							
Conduct User Training																											2	2			
Perform Data Conversion and System Cut-over																													2		
Provide Production Support																														2	2
Project Management	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Organizational Change Management	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Legend:

1	Anticipated duration of Pre-implementation Planning, Project Management, and Organizational Change tasks
2	Anticipated duration of Systems Implementation tasks
3	Anticipated duration of Project Management tasks
4	Anticipated duration of Organizational Change Management

Cost Estimate

The cost estimate for a custom solution developed by a systems integrator and hosted by the agency includes the following components:

- External consultant (if utilized) to support the Pre-implementation Planning phase—A cost of $250,000 has been assumed in Year 1.

- Systems integration services to configure test and deploy the new system and support the system for the 60-day acceptance period—This is estimated based on the research team's prior experience as 16,000 hours of effort at $175/hour. The cost is divided evenly between Year 2 and Year 3.

- Managed services support for one year following implementation by a scaled-down vendor team working closely to transition the system to the agency's IT staff—Cost is estimated at $365,000 based on one FTE staff member from the systems integrator. This cost is split between Year 3 (40 percent) and Year 4 (60 percent). The relative allocation of the cost of this item by year is based on the target go-live date for the custom alternative in Year 3. This go-live date occurs later in the year for the custom alternative than it does for the COTS alternative meaning that more of the managed services support for the custom alternative will continue into Year 4 than was the case for the COTS alternative.

- Incremental hardware (additional servers or other components) or other technical infrastructure (operating system software, database management system software, etc.) specifically required to support the new right-of-way system—For purposes of this analysis, incremental cost of additional technical infrastructure is assumed to be $100,000 in Year 2.

- Maintenance on the hardware and other technical infrastructure components, which is assumed to be 15 percent of the acquisition cost of the incremental hardware and other technical infrastructure—This cost is also escalated 2 percent per year through the technology refresh in Year 5 and then again for Year 6 and Year 7 using the cost of the technology refresh as the new base cost for escalation purposes.

- One complete refresh of the hardware and technical infrastructure in Year 5 of the seven-year planning period—For purposes of this analysis, the cost of the technical refresh is assumed to be $100,000 in Year 5.

- Agency staff cost—The methodology is similar to the COTS alternative. For purposes of this analysis, we have one agency business staff member and one IT staff member at $75/hour during Pre-implementation Planning and two business staff members and two IT staff members during the System Implementation phase with a cost of $1,248,000. This cost assumes two FTE staff members during Year 1 for the Pre-implementation Planning phase

at a cost of $312,000 and three FTE staff members during Year 2 and Year 3 for the System Implementation phase at a cost of $468,000 per year.

- Agency staff cost to support the system during production operations—This includes both the business side system champion or power user and the agency IT staff supporting the solution. We have included a 50-percent FTE business staff person at $75/hour and one FTE IT staff member for the balance of the seven-year planning period. The IT support is assumed to be higher in the custom alternative than the COTS alternative as there will be a need for the agency to add to or enhance the system versus applying new software releases from the COTS vendor. The total cost of agency staff to operate and maintain the system is $936,000. This represents a cost of $234,000 per year in Year 4 through Year 7.

Exhibit 13 outlines the proposed cost for the custom development alternative. The initial cost to implement the solution defined as the project cost and the first year of operations (Year 1 through Year 3) is $4.6 million. The seven-year total cost of ownership is $5.9 million. The total cost of ownership is very similar to the total cost of ownership of the COTS alternative since while it costs more to develop the custom solution there are no reoccurring software licensing costs.

Exhibit 13: Cost Estimate for Custom Implementation

Cost Element	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Pre-implementation planning consultant	$250,000	$250,000						
Systems integration services	$2,800,000		$1,400,000	$1,400,000				
Managed services support	$365,000			$146,000	$219,000			
Hardware and other technical infrastructure	$100,000		$100,000					
Hardware and infrastructure maintenance	$92,730		$15,000	$15,300	$15,606	$15,918	$15,300	$15,606
Hardware refresh	$100,000					$100,000		
Agency staff cost during project	$1,248,000	$312,000	$468,000	$468,000				
Agency staff cost to support system ongoing	$936,000				$234,000	$234,000	$234,000	$234,000
Total Cost	$5,891,730	$562,000	$1,983,000	$2,029,300	$468,606	$349,918	$249,300	$249,606

4.2 Benefits Analysis

This section analyzes the benefits to be realized from implementing a new electronic right-of-way management system. All the tangible and intangible benefits addressed in this section are based on implementing functionality to support core right-of-way business processes, including Appraisal, Acquisition, Negotiation, Relocation, and Property Management.

There are two key benefit terms that are used in this analysis:

- **Tangible benefits**—Any benefits that can be quantified and expressed in monetary terms are considered to be tangible benefits. The result of tangible benefits may be, for example, increased revenue, streamlined production (improved efficiency), and reinvestment opportunities in terms of an agency's overall capital program (more projects or output with the same capital budget) or its right-of-way program budget.

- **Intangible benefits**—Any benefits that cannot be assigned a specific dollar value or otherwise quantified are considered to be intangible benefits. These benefits are expressed in terms of improved mission performance, improved decision making, more reliable or usable information, and improved "good will" (e.g., perceptions of agency performance by the governor, the Legislature, and the general public). Many public goods and services are difficult to reliably and precisely quantify in dollar units. However, intangible benefits are vital to understanding the total outcome of implementing a new right-of-way information system.

Tangible Benefits

This subsection identifies anticipated tangible benefit streams. These tangible benefit streams have been established based on the experience of the research team and information obtained through the agency surveys and interviews.

Given the limited (almost non-existent) available research data on the actual benefits achieved from the implementation of a right-of-way management system in a transportation agency, we would recommend that the agency achieve a consensus on a set of benefit assumptions within their agency through the use of the "Delphi" method—that is consulting with a series of subject matter experts within their agency and potentially in other peer agencies on their opinion on what is a reasonable and conservative benefit stream and then use these agreed to benefit stream assumptions as the basis for constructing a business case. An agency can use the potential benefit streams documented in this report as a starting point for these collaborative discussions, adding or removing benefit streams or making adjustments in savings assumption based on their specific agency environments.

The research team suggests for agency consideration the following potential quantifiable benefit streams:

- An increase in the overall efficiency and effectiveness of the delivery of the agencies capital program as measured by a reinvestment opportunity of 1/2 percent of the annual capital program resulting from a reduction in delays in meeting project letting dates due to delays in acquiring right-of-way; this reinvestment opportunity allows an agency to deliver more projects or more value within projects (outputs/outcomes) from the same level of capital budget dollars

- Enhanced ability to monitor, control, and report on the performance of the delivery of the agency's right-of-way program as measured by a reinvestment opportunity in the form of a 2-percent annual savings in the cost of parcel acquisitions

- Improved efficiency and effectiveness in the delivery of the right-of-way program as a result of standardization and automation as measured by a reinvestment opportunity in the form of a 3-percent savings in total staff cost (both internal staff and external appraisers and consultants) to deliver the agency's right-of-way program

- Improved management of the relocation program as measured by a reinvestment opportunity in the form of a 2-percent savings in the total relocation benefits paid out per year by the program

- More timely and effective property management as measured by a reinvestment opportunity of a 2-percent savings in the total annual cost (internal and external) to perform property management activities

Exhibit 14 outlines these potential benefit streams on an annualized basis for a hypothetical transportation agency with a $400 million capital program, annual property acquisition cost of $40 million, and annual relocation costs of $4 million.

Exhibit 14: Potential Tangible Benefit Streams

Anticipated Benefit Stream	Estimated Benefit
Reinvestment opportunity based on a 1/2 % annual savings in capital program based on annual program size of $400 million	$2,000,000
Reinvestment opportunity resulting from a 2 % annual savings in the cost of parcel acquisitions based on annual parcel acquisition costs of $40 million	$800,000
Reinvestment opportunity resulting from a 3% annual savings in staff cost to deliver the right-of-way program (exclusive of property management) based on a total internal and external cost of $5 million	$150,000
Reinvestment opportunity resulting from a 2% annual savings in relocation program costs based on an annual relocation program size of $4 million	$80,000
Reinvestment opportunity resulting from a 2% annual savings in staff cost to perform property management activities based on a total internal and external cost of $400,000	$8,000
Total Estimated Annual Benefits	$3,038,000

Intangible Benefits

This sub-section outlines potential intangible benefits from the implementation of a new right-of-way management system. Potential intangible benefits include:

- Re-engineering and standardizing work processes through the application of new technology

- Consolidating potentially duplicate systems

- More effectively meeting current agency business requirements and providing a platform for more easily addressing changes in agency business needs in the future

- Reducing business risk in terms of complying with changes to regulatory requirements

- Strengthening internal controls within the agency's right-of-way function

- Improving customer service to agency partners and employees

- Implementing standardized reporting capabilities with timely and accurate data

- Implementing electronic workflow and approval capabilities for many right-of-way business functions

- Eliminating or significantly reducing the number of silo or off-line systems within the agency's right-of-way function

- Accurately capturing and securely storing agency data

- Incorporating mobile technologies to allow employees or consultants to interact with the new system in the field

- Incorporating self-service functionality for partners and suppliers, resulting in reduced manual entry being required into the new system by agency employees

- Providing solid performance measurement capabilities

- Providing the ability to interface with various existing and future agency financial management, project management, document management, and GIS systems/applications

- Implementing a solution which is easy to learn, use, and maintain

- Implementing a solution which utilizes a current state of the practice technologies and, as a result, is easier to maintain and enhance to address changing business needs

4.3 Return on Investment Analysis

This section documents the proposed return on investment analysis from the implementation of a new right-of-way management system for a transportation agency. For purposes of this analysis, the realization of the anticipated benefit stream has been staged as follows:

- No benefits during the implementation period or in the first year after implementation

- 25 percent of the potential benefit stream achieved in the next full year following implementation (Year 4 based on the project timelines)

- 50 percent of the potential benefit stream achieved in the second full year following implementation (Year 5 based on the project timelines)

- 100 percent of the potential benefit stream achieved in the third full year following implementation and all remaining years (Year 6 and Year 7 based on the project timelines)

Exhibit 15 presents the return on investment analysis for the COTS alternative. It shows a cumulative net benefit of $1.58 million with a payback early in Year 7 or 4 years after the initial system implementation is complete. Exhibit 16 presents the return on investment analysis for the custom development alternative. It shows a total cumulative net benefit of $2.5 million with a payback in Year 7 or 4 years after the initial system implementation is complete.

Exhibit 15: Return on Investment Analysis and Payback for COTS Alternative

Cost Element	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Reinvestment opportunity based on a 1/2 % annual savings for a capital program size of $400 million per year	$5,500,000				$500,000	$1,000,000	$2,000,000	$2,000,000
Reinvestment opportunity resulting from a 2% annual savings in the cost of parcel acquisitions for a $40 million per year acquisition program	$2,200,000				$200,000	$400,000	$800,000	$800,000
Reinvestment opportunity resulting from a 3% annual savings in internal and external staff cost to deliver the right-of-way program (exclusive of property management) based on an estimated staff cost of $5 million per year	$412,500				$37,500	$75,000	$150,000	$150,000
Reinvestment opportunity resulting from a 2% annual savings in relocation program cost based on an estimated program cost of $4 million	$220,000				$20,000	$40,000	$80,000	$80,000
Reinvestment opportunity resulting from a 2% annual savings in staff cost to perform property management activities based on an estimate staff cost of $400,000	$22,000				$2,000	$4,000	$8,000	$8,000
Total Estimated Benefits	$8,354,500	$0	$0	$0	$759,500	$1,519,000	$3,038,000	$3,038,000
Total Estimated Costs*	$6,772,542	$562,000	$2,263,000	$1,524,300	$421,646	$378,039	$1,341,543	$282,014
Estimated Net Benefit	$1,581,958	-$562,000	-$2,263,000	-$1,524,300	$337,854	$1,140,961	$1,696,457	$2,755,986
Cumulative Net Benefit		-$562,000	-$2,825,000	-$4,349,300	-$4,011,446	-$2,870,485	-$1,174,028	$1,581,958

*See Exhibit 11 for Total Estimated Costs

Exhibit 16: Return on Investment Analysis and Payback for Custom Alternative

	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Reinvestment opportunity based on a 1/2 % annual savings for a capital program size of $400 million per year	$5,500,000				$500,000	$1,000,000	$2,000,000	$2,000,000
Reinvestment opportunity resulting from a 2 % annual savings in the cost of parcel acquisitions for a $40 million per year acquisition program	$2,200,000				$200,000	$400,000	$800,000	$800,000
Reinvestment opportunity resulting from a 3% annual savings in internal and external staff cost to deliver the right-of-way program (exclusive of property management) based on an estimated staff cost of $5 million	$412,500				$37,500	$75,000	$150,000	$150,000
Reinvestment opportunity resulting from a 2% annual savings in relocation program cost based on an estimated program cost of $4 million	$220,000				$20,000	$40,000	$80,000	$80,000
Reinvestment opportunity resulting from a 2% annual savings in staff cost to perform property management activities based on an estimated staff cost of $400,000	$22,000				$2,000	$4,000	$8,000	$8,000
Total Estimated Benefits	$8,354,500	$0	$0	$0	$759,500	$1,519,000	$3,038,000	$3,038,000
Total Estimated Costs*	$5,891,730	$562,000	$1,983,000	$2,029,300	$468,606	$349,918	$249,300	$249,606
Estimated Net Benefit	$2,462,770	-$562,000	-$1,983,000	-$2,029,300	$290,894	$1,169,082	$2,788,700	$2,788,394
Cumulative Net Benefit		-$562,000	-$2,545,000	-$4,574,300	-$4,283,406	-$3,114,324	-$325,624	$2,462,770

*See Exhibit 13 for Total Estimated Costs

5 Risks and Barriers to Implementation

This section identifies potential barriers that will affect a state DOT's ability to implement or attempt to implement electronic information management systems in their right-of-way offices and proposes approaches for addressing and overcoming these barriers.

The Parsons Brinckerhoff research team established this list of potential barriers by applying a formal risk management methodology that it has utilized previously to manage large-scale business and technology change projects. For the purposes of this document, a risk is defined as "An uncertain event or condition that, if it occurs, will have a negative or positive effect on one or more project objectives." This definition is consistent with the Project Management Institute's PMBOK® Guide definition of risk.

The objectives of project risk management are to increase the probability and impact of positive events and to decrease the probability and impact of events adverse to the project. Risk management begins during project planning, continues during the initiation phase of the project, and then is more fully expanded during the system design and implementation phases of the project.

The end product of the risk management process is a risk management plan (RMP). The RMP is considered a living document and it should be maintained throughout the life of the project by research team members, with the project manager as the RMP owner.

The purpose of the RMP is to identify possible risks to the project and the manner in which they can be managed. The RMP is a tool that helps ensure that risk levels and uncertainty are properly managed so that the project is successfully completed. The RMP documents how to approach, plan, and execute risk management activities for the project. The RMP helps determine which risks might affect the project. The RMP aids in developing options and actions to enhance opportunities and to reduce threats to project objectives. The RMP systematically identifies threats and opportunities to the project, scores each risk based on probability and severity, and documents a response strategy. Strategies for negative risks include avoid, transfer, mitigate, and accept. Strategies for positive risks include exploit, share, enhance, and accept.

Exhibit 17 provides an overview of the risk management methodology/approach utilized to prepare the initial inventory of risks/barriers. It is highly recommended that this type of risk management process be integrated into an agency's project approach for implementing a proposed electronic right-of-way management information system.

Exhibit 17: Components of the Risk Management Process

The risk management process includes four key elements:

- **Risk Identification**—This is the process of identifying risks that could affect the project and their characteristics. The research team utilized information in the surveys and detailed interviews and our own research team's prior experience in establishing an initial list of barriers/risks. It is recommended that each agency utilize this list as a starting point and then conduct risk planning workshops with their key stakeholder groups as part of project planning activities. Each risk is then documented in a Risk Log.

- **Risk Analysis and Prioritization**—For each risk that is identified, assess the probability of occurrence using the standard probability scale and the level of impact using a standard impact assessment matrix in the event that the risk does occur. The product of probability and the impact will yield the Risk Score that will help determine Risk Planning.

- **Risk Planning**—This step involves devising a risk response plan for handling each of the high-priority risks identified in Risk Analysis and Prioritization. We developed risk response plans based on information gathered during the survey and detailed interviews and the experience of our team. Typically, this activity is the result of iterative discussions between the project manager and a range of project stakeholders.

- **Risk Control and Monitoring**—This step includes executing the appropriate risk response plan to reduce the probability of a risk occurring or to mitigate its impact, should it occur. This includes monitoring the progress in handling all risks that have occurred and continuing

to identify and assess new risks that may emerge. This step should be carried out continuously during an implementation project.

5.1 Components of Inventory of Potential Barriers/Risks

Utilizing the methodology described above, the research team prepared an initial inventory of potential barriers/risks in the form of a sample project risk log for implementing an electronic right-of-way information management system. This section describes each of the elements or components in the project risk log.

Risk Identifier

This is a unique sequence number assigned to each risk identified for ease of communication and reference. For this example, we have assigned the identifier "RW" + a unique sequence number.

Critical Success Factors

Critical success factors (CSF) are categories utilized to group a set of related project barriers/risk for risk analysis and response planning by typical elements that need to be in place to ensure project success. Exhibit 18 provides an example of these project critical success factors.

Exhibit 18: Examples of Critical Success Factors Applied to Risk Planning

Critical Success Factor (CSF)	How CSF can influence risk
Executive Support	Influence, support, adherence to agency Strategic Plan
User Involvement	Inclusion of users in determining requirements
Project Management	Clearly and concisely communicate needs of the project without sacrificing performance
Business Objectives	Correct identification and prioritization of objectives
Appropriate Scope	Clear project objectives for each phase
Infrastructure	Adherence to the agency's or the state's technology standards and leveraging of current components
Firm Requirements	Clear and obtainable goals are defined
Formal Methodology	Consistency in management of project
Reliable Estimates	Realistic estimates based on collective knowledge of all stakeholders
Interdependencies	Reliable and knowledgeable staff, knowledge of interdependent relationships across various agency offices and divisions involved in the project
Funding	Adequate funding to implement approved scope
Implementation	Maintain development to assigned phases
Organizational Culture	Ability of the organization to successfully transition to the new system
Supportability	Ability of the agency business and technical staff to support the new system
Flexibility	Ability to react to changes in project requirements to ensure successful completion

Risk Description

The risk description is a short narrative describing the nature of the potential risk/barrier.

Risk Classification

Risks are typically classified as internal or external. Internal risks are defined as the ones that the research team has control or influence over. Examples include project scope, staffing, project assumptions that may be incorrect and organizational risks. External risks are those risks that are beyond the control of the research team. Examples include any government regulations and supplier performance.

Probability

This attribute provides the probability of the risk occurrence. The higher the probability, the more likely it is that the risk will occur. A 10-point scale ranging from 0.1 to 1.0 has been used to indicate the risk probability, where 0.1 indicates a very low probability and 1.0 indicates a very high probability of risk occurrence. Exhibit 19 shows the probability distribution based by likeliness of occurrence.

Exhibit 19: Risk Probability Scale

Probability	Definition
0.1-0.2	It is very unlikely that this risk will occur
0.3-0.4	It is unlikely that this risk will occur
0.5-0.6	It is equally likely whether this risk will occur or not
0.7-0.8	It is likely that this risk will occur
0.9-1.0	It is very likely that this risk will occur

For purposes of preparing this initial list of barriers/risks, the research team has assigned probability scores based on information obtained in the survey and detailed interviews and our prior experience in implementing major information system projects.

Impact

This attribute provides a measure of the potential severity of the impact of a risk on the project. A scale of 1 to 10 has been used to indicate the risk impact, where 1 indicates a very low impact and 10 indicates a very high impact of risk.

Exhibit 20 below shows the risk impact table utilized for the project. This risk impact scale has been adapted from the Project Management Institute's PMBOK® Guide (Third Edition).

Exhibit 20: Risk Impact Scale

Project Objective	Very Low	Low	Moderate	High	Very High
	1-2	3-4	5-6	7-8	9-10
Cost	Insignificant cost increase	< 5% cost increase	5-10% cost increase	10.01-25% cost increase	> 25% cost increase
Schedule	Insignificant schedule slippage	< 5% schedule slippage	5-10% schedule slippage	10.01-25% schedule slippage	> 25% schedule slippage
Scope	Scope decrease barely noticeable	Minor areas of scope are affected	Major areas of scope are affected	Scope reduction unacceptable to the client	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires client approval	Quality reduction unacceptable to the client	Project end item is effectively unusable

For purposes of preparing the initial inventory of barriers/risks, the research team has assigned impact scores based on information obtained in the survey and detailed interviews and our prior experience in implementing major information system projects.

Risk Score

This attribute indicates the combination of probability and impact. The risk score is obtained by multiplying the probability and the impact numbers.

Exhibit 21 below shows the risk score matrix utilized for the initial risk planning conducted by the research team. This matrix has been adapted from the PMBOK® Guide (Third Edition). The project risks are divided into low risks ("green condition"), moderate risk ("yellow condition"), and high risk ("red condition") based on their risk scores here.

Exhibit 21: Calculation of Risk Score
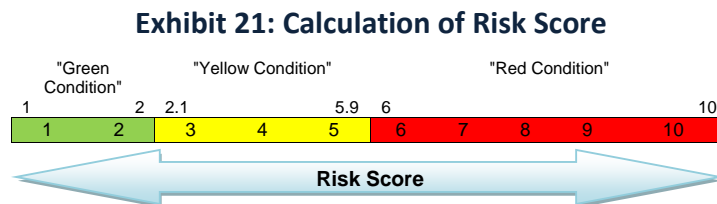
Risks with the highest risk scores are focused on first in the risk response plan, followed by moderate risks, and then by low risks.

Identified By

This attribute indicates the source that identified the risk. This can either be an individual, a group, or a meeting or process used to identify the risk. For the purposes of the initial inventory of barriers/risks, we have put "research team" in as a placeholder.

Risk Owner

This attribute indicates the individual who owns the risk. Typically, this ownership should be assigned to a specific individual (for example, the Project Sponsor or the agency's Chief of Information Technology, etc.). For purposes of the initial inventory of barriers/risks, we have assigned a placeholder role based on our team's prior experience.

Risk Response

The risk response indicates the response to risk as one of the following: avoid, transfer, mitigate, exploit, share, enhance, or accept.

Strategies for Negative Risks or Threats

The strategies to deal with risks that may have a negative impact on project objectives if they occur are avoid, transfer, and mitigate:

- **Avoid**—Risk avoidance involves changing the project management plan to eliminate the threat posed by an adverse risk, to isolate the project objectives from the risk's impact, or to relax the objective that is in jeopardy, such as expanding the schedule or reducing scope. Some risks that arise early in the project can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise.

- **Transfer**—Risk transference requires shifting the negative impact of a threat, along with ownership of the response, to a third party. Transferring the risk simply gives another party responsibility for its management; it does not eliminate it. Transferring liability for risk is the most effective approach in dealing with financial risk exposure. Risk transference nearly always involves payment of a risk premium to the party taking on the risk. Transference tools can be quite diverse and include, but are not limited to, the use of insurance, performance bonds, warranties, guarantees. Contracts may be used to transfer liability for specified risks to another party. In many cases, use of a cost-type contract may transfer the cost risk to the buyer, while a fixed-price contract may transfer risk to the seller, if the project's design is stable.

- **Mitigate**—Risk mitigation implies a reduction in the probability or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred. Adopting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions. Mitigation may require prototype

development to reduce the risk of scaling up from a bench-scale model of a process or product. Where it is not possible to reduce probability, a mitigation response might address the risk impact by targeting linkages that determine the severity. For example, designing redundancy into a subsystem may reduce the impact from a failure of the original component.

Strategies for Positive Risks or Opportunities

Strategies to address positive risks or opportunities include exploit, share and enhance:

- **Exploit**—This strategy may be selected for risks with positive impacts where the organization wishes to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen. Examples of directly exploiting responses include assigning more talented resources to the project to reduce the time to completion or to provide better quality than originally planned.

- **Share**—Sharing a positive risk involves allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project. Examples of sharing actions include forming risk-sharing partnerships, teams, special-purpose companies, or joint ventures, which can be established with the express purpose of managing opportunities.

- **Enhance**—This strategy modifies the "size" of an opportunity by increasing probability or positive impacts and by identifying and maximizing key drivers of these positive-impact risks. Seeking to facilitate or strengthen the cause of the opportunity, and proactively targeting and reinforcing its trigger conditions, might increase probability. Impact drivers can also be targeted, seeking to increase the project's susceptibility to the opportunity.

Strategies for both Threats and Opportunities

Acceptance—This strategy may apply to both threats and opportunities. Acceptance is adopted as a strategy because it is seldom possible to eliminate all risk from a project. This strategy indicates that the research team has decided not to change the project management plan to deal with a risk or is unable to identify any other suitable response strategy. It may be adopted for either threats or opportunities. This strategy can be either passive or active. Passive acceptance requires no action, leaving the research team to deal with the threats or opportunities as they occur. The most common active acceptance strategy is to establish a contingency reserve, including amounts of time, money, or resources to handle known or even sometimes potential, unknown-threats or opportunities.

Risk Strategy and Notes

The response strategy and notes builds from the selected risk response and provides the details for the risk response. The sample risk response plan below was prepared based on both

information gained during the survey and interviews earlier in the project and our team's experience on prior projects.

5.2 Initial Inventory of Potential Barriers/Risks

An initial inventory of potential barriers/risks documented by the research team is included in Exhibit 22 below.

Exhibit 22: Initial Inventory of Barriers/Risk

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW01	Executive Support	Project executive sponsor(s) clearly identified	External	0.3	9	2.7	Research Team	ROW Unit Business Champion	Avoid	• Prepare and present project business case to executive management • Obtain clear project sponsorship • Continue to proactively and regularly brief project sponsors throughout the project
RW02	Executive Support	Changes in management or shifting agency priorities can impact the project	External	0.7	10	7.0	Research Team	Project Sponsor	Mitigate	• Closer engagement and involvement of all Steering Committee members to minimize impact of departure of any particular key management staff member
RW03	Executive Support	Dedicated resources are reduced or not continued due to shifting agency priorities.	External	0.7	10	7.0	Research Team	Project Sponsor	Mitigate	• Define financial support at all levels of management involved in the project through the Project Steering Committee and agency executive management governance structures
RW04	Executive Support	Lack of resources for implementation	Internal	0.5	9	4.5	Research Team	Project Sponsor	Share	• Gain IT and other stakeholder agreement early in the planning and requirements phases of the project to provide resources to implement project • Monitor any resource issues throughout the project and raise issues to the Steering Committee for resolution
RW05	Executive Support	Lack of support staff after implementation	Internal	0.5	8	4	Research Team	Project Sponsor	Mitigate	• Conduct early communication with agency IT staff and address plans for ongoing support regularly with the Steering Committee

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW06	User Involvement	Business processes are not clearly understood by stakeholders; stakeholders have divergent expectations; difficulties in the ability for users to understand need for the new system	Internal	0.5	9	4.5	Research Team	Project Business Lead	Mitigate	• Identify project stakeholders • Develop a sound communications plan that is 360 degrees in scope • Identify data owners, users, and persons of interest and utilize mailing lists to maintain communication
RW07	User Involvement	Failure to coordinate across all districts or regions in the agency	Internal	0.5	9	4.5	Research Team	Project Business Lead	Mitigate	• Include steps in the Communications Plan to communicate with stakeholders across the districts. The Steering Committee will help drive that communications process
RW08	User Involvement	Knowledge transfer from phase to phase is not complete	Internal	0.5	8	4	Research Team	Project Manager and Business Lead	Avoid	• Ensure that stakeholders from each phase are involved through transfer of the phase
RW09	Project Management	Effect on the organization of implementing a new system; resistance to change; inability to consider using a new system	Internal	0.8	9	7.2	Research Team	Project Sponsor and Business Lead	Mitigate	• Establish Project Steering Committee to drive changes in business processes and the organizational culture • Identify expectations at each step, ensure concurrent systems are maintained throughout development, and conduct orientation sessions • Develop structured change management plan and incorporate experience change management resources on an as needed basis into project work plan

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW10	Project Management	Lack of ongoing coordination with Steering Committee	Internal	0.3	5	1.5	Research Team	Project Manager and Business Lead	Avoid	• Continue communication with Steering Committee and provide them with timely and straight forward updates on project progress
RW11	Project Management	Availability of external resources to augment agency staff.	Internal	0.5	6	3	Research Team	Agency CIO	Mitigate	• Utilize industry standard technologies in which a larger number of external resources are trained and available in the market place
RW12	Project Management	Lack of prioritization on individual work tasks	Internal	0.3	8	2.4	Research Team	Project Manager and Business Lead	Mitigate	• Create a detailed work plan for each project phase which considers the need to balance multiple priorities • Clear communication of tasks and due dates from Project Managers
RW13	Business Objectives	Desired benefits not achieved	Internal	0.4	10	4	Research Team	Project Manager and Business Lead	Avoid	• Adhere to requirements, involve stakeholders and tie scope decisions to performance measures to ensure success
RW14	Business Objectives	Failure to reduce volume of paper-based processes used today	Internal	0.5	9	4.5	Research Team	Project Business Lead	Mitigate	• Include business process analysis as a formal part of the requirements definition phase to identify opportunities to streamline and reduce paper-based processes
RW15	Minimized Scope	Project scope too large and complex to implement	Internal	0.6	8	4.8	Research Team	Project Sponsor	Avoid	• Develop detailed multi-phase project plan which clearly defines scope of each phase • Link scope of each phase to anticipated business benefits

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW16	Appropriate Scope	Changes in requirements; lack of definition of scope	Internal	0.5	10	5	Research Team	Project Sponsor	Mitigate	• Agree on requirements. • Implement and enforce clear scope change control processes to mitigate
RW17	Appropriate Scope	The system is not designed to be flexible for changing business needs	Internal	0.5	10	5	Research Team	Business Lead	Avoid	• Engineer system in such a way that is flexible and can adapt to changing business needs
RW18	Infrastructure	Assumptions of high-speed access where none exists – new right of way system requires high speed network connectivity outside central offices and outside agency network (VPN access), which can be problematic	Internal	0.7	8	5.6	Research Team	Project Manager	Mitigate	• Identify all physical locations requiring system access and map current communications infrastructures (high-speed, phone) • Plan and conduct load testing and other performance test prior to initial system cut-over • Proactively coordinate with Information Technology or other units responsible for technology infrastructure (State network team, etc.)
RW19	Infrastructure	Loss of data; disaster recovery plan not complete	Internal	0.2	8	1.6	Research Team	Project Manager and IT Infrastructure Lead	Avoid	• Design data model/process to require periodic data backups and an effective and robust disaster recovery plan to cover power outages and system failures
RW20	Infrastructure	Lack of/or loss of data integrity through unauthorized use	Internal	0.2	10	2	Research Team	Project Manager and IT Security Lead	Avoid	• Provide security and access control to only allow asset owners to modify data

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW21	Infrastructure	Lack of adherence to statewide, agency or other technical standards	Internal	0.3	8	2.4	Research Team	Project Manager and Agency CIO	Avoid	• Identify compatibility of proposed solution with agency and statewide technical standards as a requirement in any solution design or systems integrator/software RFP
RW22	Firm Requirements	Requirement to interface with a number of different agency systems.	Internal	0.8	8	6.4	Research Team	Project Manager and Business Lead	Mitigate	• Develop data synchronization / integration processes to facilitate seamless interfaces between systems • Continue reporting of issues and requirements through the Steering Committee and alert all stakeholders of interface requirements and potential issues related to implementation and support of these interfaces
RW23	Firm Requirements	Inability to interface with other evolving systems	Internal	0.3	10	3	Research Team	Business Lead and Project Manager	Avoid	• Identify all systems requiring interface with new right-of-way system and Initiate meetings early in the lifecycle to develop interface requirements • Conduct appropriate levels of testing of each interface and include interface as part of system testing and user acceptance testing • Perform thorough application testing by a team of right-of-way subject matter experts prior to rollout in order to correct issues before application is introduced to new users, This will allow for smooth transition and user buy-in.
RW24	Firm Requirements	The ability to access data is difficult; interface is not user-friendly	Internal	0.4	8	3.2	Research Team	Project Manager	Avoid	• High level user interface requirements developed during the requirements phase should specify a user friendly web-based interface. Further define these requirements during the requirements definition phase

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW25	Firm Requirements	Scope and responsibility for end-user training not clear	Internal	0.6	9	5.4	Research Team	Project Manager	Avoid	• Include training in the systems integrator RFP and communicate with agency training staff to coordinate training delivery and on-going training post go-live • Engage users in process to maximize on the job training
RW26	Firm Requirements	Lack of necessary reports and ease of accessing and retrieving reports	Internal	0.4	6	2.4	Research Team	Business Lead and Project Manager	Avoid	• Include clear requirements for reports (types, frequency, ad hoc vs. standard) and the desired report retrieval process in the RFP • Perform thorough application testing by a team of right-of-way subject matter experts prior to rollout in order to correct issues before application is introduced to new users, This will allow for smooth transition and user buy-in.
RW27	Firm Requirements	Lack of a strategy to integrate GIS	Internal	0.6	7	4.2	Research Team	Business Lead and Project Manager	Avoid	• Define the process of integrating with the agency GIS as part of development of requirements
RW28	Firm Requirements	Security processes not clearly identified	Internal	0.2	8	1.6	Research Team	Project Manager	Avoid	• Prepare a data warehouse security process document and communicate it to owners, users and administrators
RW29	Reliable Estimates	Increase in project cost through unforeseen economic factors	External	0.3	9	2.7	Research Team	Project Manager	Avoid	• Revisit budgets at each steering committee meeting; economic factors should be on agenda for discussion where appropriate • Include contingency in the project budget estimates

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW30	Reliable Estimates	Projected completed late or over budget	Internal	0.6	9	5.4	Research Team	Project Manager	Avoid	• Manage costs against needs; cost overruns will threaten continuation of project if economic pressures due to downturns occur • Include certain cost objectives in vendor contract • Include late penalties in vendor contract • Monitor project budget should be monitored on a monthly basis • Transfer risk by requiring performance bonds
RW31	Reliable Estimates	Excessive cost through shifting of staff	Internal	0.3	8	2.4	Research Team	Project Manager	Mitigate	• Include assessment of the effects of staff reassignments on budget for this project
RW32	Reliable Estimates	Lack of coordination with budget owners	External	0.3	7	2.1	Research Team	Project Manager	Mitigate	• Establish single point of contact for all budget issues (Steering Committee) and include in the Communication Plan
RW33	Interdependencies	Impact of implementation of new right-of-way system on development and use of other systems in development by an agency.	Internal	0.8	8	6.4	Research Team	Agency CIO	Mitigate	• Close coordination and work planning with other ongoing project efforts
RW34	Funding	Dedicated funding is reduced or not continued.	External	0.6	9	5.4	Research Team	Project Sponsor	Mitigate	• Implement-operational "chunks"; this allows early successes to be shown and shared with decision makers
RW35	Implementation	Implementation strategy attempts to implement too much at one time	Internal	0.5	8	4	Research Team	Project Sponsor	Avoid	• Utilize a phased approach to the implementation of the system within the agency

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW36	Implementation	Implementation timeline not realistic	Internal	0.3	5	1.5	Research Team	Project Sponsor and Project Manager	Mitigate	• Develop detailed multi-phase implementation plan • Establish priorities for data warehouse and focus on priority items • Verify implementation plan and effort estimates through benchmarking, discussions with other states, etc.
RW37	Implementation	Unwillingness of appraisers, right of way consultant or right of way contractors to utilize the new system or change the processes or data they currently provide to the agency	Internal	0.5	7	3.5	Research Team	Business Unit Champion and Business Lead	Avoid	• Early identification and communication with any project stakeholders to identify and understand any issues Early incorporation of data exchange requirements in future contracts with suppliers and contractors
RW38	Implementation	New system is not promoted as the primary source of data and other existing systems are continued to be used as a primary source of information.	Internal	0.7	7	4.9	Research Team	Project Sponsor and Business Unit Champion	Mitigate	• Communicate vision of project and conduct meetings with current data base owners and other stakeholders • In some cases, there will be a period of transition for various data in terms of migrating to the new system as the system of record
RW39	Implementation	Vendors/suppliers are not providing services as promised and on schedule.	Internal	0.4	9	3.6	Research Team	Project Manager	Mitigate	• Clear performance specifications in any RFP • Proactive project management and monitoring by the assigned IT Project Manager and the agency CIO

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response *(Accept / Avoid / Mitigate / etc.)*	Risk Response Strategy and Notes
RW40	Implementation	Balancing production vs. development in a multi-phase operation	Internal	0.5	9	4.5	Research Team	Project Manager	Avoid	• Develop detailed project plans which specify resource needs • Ensure that future phase implementation plans consider requirements of resources to support previous implementation phases already in production
RW41	Implementation	Lack of proper balance between "rush to complete" and "usefulness of result"; project successes and failures are not reviewed	Internal	0.3	7	2.1	Research Team	Project Sponsor	Mitigate	• This will be addressed by a planned "modular" implementation approach as part of the project implementation plan
RW42	Implementation	Lack of owner for overall system implementation, operation and maintenance	Internal	0.3	8	2.4	Research Team	Project Sponsor	Avoid	• Establish clear owner and accountability for system development and operation • Specify vendor responsibilities in this regard in any RFP issued by an agency
RW43	Organizational Culture	Possible job losses and/or reassignments affect development and/or implementation	External	0.5	9	4.5	Research Team	Project Sponsor	Mitigate	• Early identification of any organizational changes and development of transition plans

Risk ID	Critical Success Factor	Risk Description	Risk Classification Internal External	Probability 0.1 – 0.99	Impact 1 – 10	Risk Score (PxI)	Identified By	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
RW44	Supportability	The technical needs of the new system surpass the current capabilities of business and technology staff to support the new system.	Internal	0.4	8	3.2	Research Team	Project Manager	Avoid	• Selected solution for the system should be consistent with existing agency technology standards to the extent possible • Develop data synchronization / integration processes to facilitate seamless interfaces between systems • Continue reporting of issues and requirements through the Steering Committee and alert all stakeholders of support issues
RW45	Flexibility	Difficulty adapting solution to special requirements or needs	Internal	0.7	6	4.2	Research Team	Business Lead	Avoid	• Define system to be flexible to the extent possible to changes in agency business requirements

6 Conclusion and Recommendations

Public sector real estate professionals are continuously challenged to "do more with less," as staffing levels have been reduced in many states and outside consultants are being enlisted to perform more work. In addition, the right-of-way process is very structured based on federal and state laws and highly document intensive. Utilizing only a paper-based system can make document retrieval cumbersome and time consuming.

Implementation of an electronic right-of-way management system can clearly assist a state DOT or other public sector real estate organization to improve the overall efficiency and effectiveness of their operations. A state DOT right-of-way business unit not currently utilizing an electronic right-of-way system should seriously consider investing in an electronic right-of-way management system.

At the same time, implementation of a new electronic right-of-way management represents a significant investment for a public sector real estate organization. Depending on the implementation approach taken (commercial off-the-shelf or custom development), the research team estimated the cost of implementing a new system for a medium sized agency to be approximately $4.5 million with a seven-year total cost of ownership between $6 million to $7 million.

In spite of the significant upfront investment required to implement a new electronic right-of-way management system, the research team's analysis showed for a hypothetical medium sized state DOT that an electronic right-of-way management system does have a positive return on investment over a seven year period of between $1.6 million and $2.5 million depending on the implementation approach. In addition, implementation of an electronic right-of-way management system can provide numerous intangible benefits which contribute to improved efficiency and effectiveness of right-of-way operations, enhanced transparency and significantly improved access to information.

As with any technology or business change project, however, there are also numerous challenges that must be addressed to successfully implement a new system. Based on discussions with agencies who have recently implemented new right-of-way management systems, some of these implementation challenges include:

- Difficulty in achieving and maintaining executive sponsorship for the proposed project through any changes in executive leadership

- Changes in agency management or shifting agency priorities impacting the project including reductions in the project budget and/or changes in project staff

- Organizational resistance to implementing a new system; this may include resistance to change or an unwillingness on the part of some staff to consider using a new system

- Limitations in the overall usability and adaptability of the new system which complicates the ability of agency users to quickly become productive with the new system

- Inability to control/manage project scope leading to an unanticipated increase in the project budget and potential schedule delays

- Technical complexities related to requirements to interface with a number of different agency systems

- Impact of required changes to other agency management systems in order to interface with the new right of way management system

To ensure a successful implementation, these challenges must be proactively addressed through a structured and on-going risk management process and by applying various best project management practices including:

- Establish and maintain strong executive management support including proactive engagement of any new executive management team members if there are changes in agency leadership

- Establish a clear project governance structure involving representation from all impacted agency stakeholder groups

- Assign both a business and IT project manager, with the IT project manager preferably having prior implementation experience with the selected commercial off the shelf software solution or technology suite being utilized to implement the system

- Ensure a consistent level of participation from agency subject matter experts from project initiation through testing and deployment, even if this requires some backfilling of staff during the project period

- Provide just-in-time end user training using agency business processes and agency data and case examples and not canned materials from the systems integrator or software vendor

- Identify any organizational change management impacts (process changes, organizational changes, etc.) that may result from the new system and putting strategies/ plans in place to address these impacts as early as possible and then monitoring the implementation of these strategies throughout the project

Appendix A – Initial Agency Questionnaire

Instructions: Please complete the interviewee questions, then all of the questions that pertain to the current system in place at your agency.

Interviewee

1. Provide your name, agency, title, and role.
2. How long have you been with the agency? In your current role?
3. Provide a brief description of your responsibilities.

System Overview

4. Does the agency currently use a paper-based or electronic right-of-way system?
5. What is the name of the system?
6. Please provide a brief overview of system capabilities. For hybrid systems, briefly indicate what elements are automated and what elements are paper-based.
7. How long has the system been in place (in years)?
8. Is the system custom-developed or an off-the shelf solution? If other, please specify.
9. If off-the-shelf, what is the name of the software application?
10. Please indicate the business functions that are supported by the system (select all that apply and/or provide additional details:
    a. Appraisal
    b. Negotiation
    c. Acquisition
    d. Relocation
    e. Property Management
    f. Others and/or additional details
11. Please indicate which of the following general capabilities are provided by your system (select all that apply and/or provide additional details:
    a. Integrated workflows
    b. Creation and management of required forms (30 day letter, etc.)
    c. Others and/or additional details
12. Is the system integrated with any other systems within the agency? (Select all that apply and/or add additional details)
    a. Geographic information system
    b. Document management system
    c. Financial management system
    d. Others and/or additional details

Implementation Parameters

13. How did you implement your system? Please provide supporting details. Why did you use this approach? If phases, what were the phases? What additional details can you provide?
14. What was the total estimated cost of initially implementing the system (in dollars), including software, hardware, implementation services and other project costs?
15. How was the system implemented by the agency? Please provide supporting details.

Post-Installation

16. What is the annual cost (in dollars) for operating/maintaining the system?
17. Has this system gone through any upgrades in the last 5 years?
18. If the system has not gone through any upgrades in the last five years, are there plans to upgrade the system in the near future? Please provide supporting details.
19. What were some of your primary challenges during implementation? (Select all that apply)
    a. Difficulties with data conversion from the existing automated or manual systems
    b. Change management and overcoming resistance throughout the agency
    c. Balancing resources (i.e., time, money, and IT support) to be able to improve system
    d. Ensuring appropriate executive sponsorship and support
    e. Obtaining a sufficient level of end-user involvement
    f. Ensuring adequate technical and ender-user support
    g. Other (please specify)
20. How did you overcome some of the challenges identified in the previous question?
21. Did your agency conduct a benefit-cost analysis to determine if the proposed electronic system would be cost-effective? Please provide supporting details
22. What are some of the benefits to implementing an electronic system? (Select all that apply)
    a. More efficient utilization of current staff or reduction in staffing
    b. Increased access to information both internally within agency and by the public
    c. Improved customer service and public relations
    d. Improved documentation and consistent/standardized reporting
    e. Decrease in time it takes to perform tasks
    f. Decrease in data entry and access redundancy
    g. Improved oversight
    h. Other (please specify)
23. To what extent are you achieving the benefits identified in the previous question?
24. What are some of the major lessons learned that you would want to share with other agencies?

25. If your agency is utilizing primarily a paper system, what are the reasons the agency has not transitioned to an electronic system?

26. If you have any other comments, please share them here.

Appendix B – Detailed Agency Questionnaire

Note: The first set of questions pertains to electronic systems while the second set of questions pertains to paper-based systems. All or parts of both question sets may pertain to agencies with "hybrid" systems

Interviewee

1. Please provide your name, agency unit and title.
2. How long have you been with the agency? In your current role?
3. How long have you been in the public sector real estate profession? What other roles did you have with your agency or within public sector real estate prior to your current position?
4. Please provide a brief description of your responsibilities.
5. Please briefly describe any prior experience you may have had with the implementation and use of automated systems in prior roles or with a prior agency?

Electronic System

System Information

6. Is your system a custom-developed solution, a commercial off the shelf application or some combination? If a commercial off the shelf application, what is the vendor solution?
7. Please briefly describe how each of the following business processes are supported by the system:

    a. Identification and inventory of potential parcels and other property interests within a proposed project

    b. Assignment of appraisers including potential selection of contract appraisers

    c. Completion of appraisal, appraisal review and determination of just compensation

    d. Selection and management of consultant negotiation agents

    e. Managing and tracking negotiations with property owners

    f. Managing and tracking condemnation proceedings

    g. Closing and obtaining access to the property

    h. Demolition or other activities assigned to the right-of-way unit

    i. Residential relocation

    j. Business relocation

     k.   Property management

     l.   Disposition (lease/sale) of excess right-of-way

     m. Other business functions (utility relocation, outdoor advertising, etc.)

8. Does the system automate the generation of required documents? Please describe briefly how this functionality works.

9. Please describe briefly the work flow capabilities available within the system?

10. Is the system integrated with any other systems within the agency (e.g., document management system, financial management system, geographic information system, etc.)? For each major integration point, please describe the types of information exchanged between systems.

11. Does the agency use other methods to support its right-of-way processes in addition to the installed system?

12. How does the agency handle documents that require signatures for Federal and State compliance?

13. How many and what types of users have access to the system?

     a.   Do consultants have access to the system and if so for what functions?

     b.   Do any funding partners (FHWA Division Office, State DOTs for a local public agency, etc.) have system access and if so for what functions?

     c.   For state DOTs – is the system available for use by any local public agencies for Federal or State funded projects?

     d.   How is access controlled for internal and external users?

     e.   What job aids (user documentation, online help, etc.) are available for users to facilitate system use? How helpful do you feel these various job aids are in assisting users?

Implementation Parameters

14. Did the agency conduct a feasibility analysis prior to implementing the system? If yes, what did the analysis consist of?

15. How did the agency come to a decision on whether to use a custom-development or an off-the-shelf solution (e.g., cost, meeting data requirements)?

     a.   What were the key decision-making factors and considerations?

     b.   How, if at all, were agency staff and input involved during the decision-making process?

16. If the agency conducted a benefit-cost analysis, how was this factored into the final decision?

    a. What were the expected benefits from the new system?

    b. Would you be willing to share a copy of the benefit-cost analysis with the research team?

17. How long (years/months) did the implementation process take place?

18. Was the system implemented in phases or at one time?

19. Did the implementation effort include any of the following activities:

    a. Business process re-engineering either before or during implementation

    b. Development of formal requirements prior to system selection, design and implementation

20. Was a consultant used to facilitate the implementation process?

    a. If so, how were responsibilities divided between the consultant and agency staff?

21. What was the total cost of implementation (hardware, software, custom development, data conversion, etc.)?

22. What were the primary challenges during implementation and what steps did you take to address these challenges?

23. What was the training strategy utilized to prepare users for transitioning to the new system?

    a. What was the training method (classroom, online, etc.)?

    b. How were courses divided (by functional area, etc.)?

    c. Who developed the training materials (in-house, provided by the vendor, etc.)?

Post-Installation

12. What is the estimated annual cost to maintain the electronic system (software licenses/maintenance, hardware maintenance, consultant or in-house staff, etc.)?

13. Has your system gone through any upgrades within the last 5 years? If yes, what was the approximate cost of these upgrades (software, hardware, professional services, etc.)?

14. What upgrades, if any, are planned for the future (e.g., adding additional functions)?

15. Please describe your assessment of user acceptance of the system? (i.e., satisfied, not satisfied)?

16. Does the system meet the agency's key needs in managing the right-of-way process? If no, what are some of the major gaps in system functionality?

17. What are the key strengths and weaknesses/limitations of the system?

18. To what extent are the expected benefits that were established prior to implementation being achieved (see Q.10a)?

19. After having gone through the implementation process, is there anything you would have done differently?

20. What are some of the major lessons learned and key takeaways you would want to share with another state planning an electronic system?

Paper-Based System

1. How long has the system been in place?

2. Please describe how the paper-based system supports the following business process areas:

    a. Identification and inventory of potential parcels and other property interests within a proposed project

    b. Assignment of appraisers including potential selection of contract appraisers

    c. Completion of appraisal, appraisal review and determination of just compensation

    d. Selection and management of consultant negotiation agents

    e. Managing and tracking negotiations with property owners

    f. Managing and tracking condemnation proceedings

    g. Closing and obtaining access to the property

    h. Demolition or other activities assigned to the right-of-way unit

    i. Residential relocation

    j. Business relocation

    k. Property management

    l. Disposition (lease/sale) of excess right-of-way

    m. Other business functions (utility relocation, outdoor advertising, etc.)

3. How are required documents prepared? For example are their standard templates available in office automation software, etc.?

4. How does the agency handle any required approval/sign-off processes where multiple people need to review a document? Is any automation such as email used in conjunction with the paper system?

5. How is any required information that is needed by other systems within the agency provided (e.g., financial management system, etc.)?

6. How is information for which other agency systems may be the system of record (for example project information and project status) obtained, documented and kept up to date in your paper system?

7. How do external users request access to right-of-way information?

8. What procedures are in place for the internal staff to access and update right-of-way information?

9. Please provide an estimate of the annual ongoing maintenance and labor costs of the paper system?

10. What features of your system work best?

11. What challenges and limitations do you see with your current manual/paper process? How could technology help you address these challenges?

12. What is the general user acceptance to your paper-based system (i.e., satisfied, not satisfied)?

13. To what extent have you evaluated implementing a more automated system? If yes, what are some of the reasons you have not yet moved forward with a new system?

Appendix C – Agency Case Studies

The following appendix contains detailed survey findings for each of the nine (9) agencies for which the team conducted follow-up telephone surveys.

Idaho Transportation Department (ITD)

Agency Information

The Right of Way Section of the Idaho Transportation Department (ITD) is responsible for the acquisition of property required for highway construction, material sources, and maintenance shed sites and provides oversight for LPAs in Idaho that acquire property for highway purposes using Federal funding. The Right of Way Section is currently centralized with a headquarters office, six district Property Managers, and a scenic enhancement representative, but the division is moving towards becoming a centralized group. During fiscal years 2011 and 2012, ITD acquired an average of over 200 parcels per year, with acquisitions valued at over $20 million per fiscal year. ITD did 21 relocations in FY 2012 and 20 relocations in FY 2011, with relocation costs of $1.2 million and $580,000 respectively per fiscal year.

System Overview

- System Type: Electronic
- System Name: PAECETrak
  - Commercial off the shelf system provided by BEM Systems
- Implemented in: In-progress, targeted for completion during 2014
- Total Implementation Cost: $560,000+
- Primary Benefits: Improved access to data and reduced time required to perform various activities

Business Functions Supported By System

The business functions supported by the ITD PAECETrak system are identified in Exhibit 9

Exhibit 9: Business Functions Supported by ITD Right of Way System

Business Function	System PAECETrak
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	✓
Property Management	✓
GIS	

System Background

The original right of way system that the division used was developed internally using a Microsoft Access Database. The program became fairly complex in the 1990s and it worked well while the developer of the system was still around to maintain and make required modifications to the system. However, since the developer's departure from the Right of Way Section, the system has not been updated. The system is still able to collect data but it has otherwise become obsolete. Although the system initially had all the components that were needed, including outdoor advertising, relocation, property management, and others, the system is now out of date and has evolved into three independent databases that do not talk to each other.

The section recently decided to purchase a commercial off-the-shelf right of system, PAECETrak by BEM Systems, to track all of its right of way activities. Implementation is currently underway with initial go-live of the new system expected during 2014.

System Capabilities

The ITD PAECETrak system will support the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.** Identification of parcels will be done by the Design section, but once right of way plans are designed and approved, parcel data will be entered into the new system using a parcel ID number for each parcel.

- **Assignment of appraisers including potential selection of contract appraisers.** The Appraisal Coordinator will assign appraisers once parcels have been identified.

- **Selection and management of consultant negotiation agents.** Negotiations are done-in house, but for larger projects, the Right of Way Section may hire outside firms to handle the negotiations.

- **Manages and tracks negotiations with property owners.** The system will contain contact information of property owners.

- **Manages and tracks condemnation proceedings.** The previous system was not able to manage and track condemnation proceedings; although the previous system could identify a condemnation, information would then need to be manually generated. However, the new system has the capability to manage and track condemnation proceedings.

- **Closing and obtaining access to the property.** Most closing is done with the title company, which is identified along with escrow officers.

- **Demolition or other activities assigned to the right of way unit**. The new system will keep track of the agent responsible for demolition activities, time tables, and so forth. This will be an enhancement from the previous system.

- **Business and residential relocation.** The relocation capabilities were not purchased; the new system will keep track of relocations, but not the detailed work of the relocation agent.

- **Property management.** The system will keep track of property management, including when a parcel may be needed for a construction project, surplus parcels, rent, etc. Since property management was separate from the previous system, this will be an enhancement.

- **Disposition (lease/sale) of excess right of way.** The system will keep track of leases and sales associated with the disposition of excess right of way.

- **Other business functions.** Utilities relocation was previously a process that was done manually by an individual who has since retired, but PAECETrak has a utility module that the Right of Way Section may purchase to automate the process. The Right of Way Section also uses Cartegraph, a commercial off-the-shelf product with customizations used exclusively for outdoor advertising. Cartegraph is able to generate billing reports for each sign owner; the overall cost is calculated based on the number of signs owned. However, there are no plans for Cartegraph to integrate with PAECETrak.

The system will be able to generate all documents for acquisition and generate reminders about certain events. Although the previous system had some reminder capability, over time, the functionality became obsolete because it was not maintained, and staff had to keep track of milestone dates on their own.

The system will include workflows and as appraisals are assigned, the system will keep track of milestones as the acquisition process is completed for each parcel. In order to move the acquisition process forward and track progress, the person responsible for the current workflow item has to indicate it is completed before the next workflow item can proceed.

Signatures will be documented electronically in the database and hard/paper signatures will not be required.

System Integration

PAECETrak is integrated with the following systems:

- Document Storage System - PAECETrak will integrate with ProjectWise, ITD's document storage system, enabling staff to store and access documents related to right of way, including plan sheets and deeds.
- Other - Although PAECETrak has a GIS module, ITD has not yet purchased it.

User Access

There are currently 9 staff members, but the Section is expected to grow to 11 members during the upcoming fiscal year. Appraisers will be able to upload documents and the design team for ITD will have limited system access. Local Public Agencies may have read only access, but the details are being worked out since implementation is still underway. Although the Right of Way Section has the ability to assign access to any user, it wants to make sure that appropriate security measures are in place.

Implementation Details

Pre-Implementation

Since the previous system could no longer be supported, the agency made the decision to procure a new system. The agency went through the bid process and it took approximately 1.5 years to get to the implementation stage.

The RFP was developed with heavy involvement from internal staff and the Department of Purchasing. Internal staff worked together with the Department of Purchasing to identify specific business requirements that would meet the Right of Way Section's needs.

Implementation Process

Implementation of the new system is currently underway. The process was scheduled for six months, but implementation is now expected to take nine months because of some issues related to data conversion that were encountered along the way. The go-live date was initially scheduled for the end of July 2014, but it has been pushed back to an estimated date of late September 2014 due to ITD internal system security compatibility issues with the new system, which has delayed staff from becoming familiar with the new system and has prevented the use of historic data in the new system.

The ITD Right of Way Section went through an extensive business re-engineering process. Each person in the ITD Right of Way Section identified current business processes and improvements, and the group then worked together to define how these processes would be incorporated into the new system. In some instances, this required changing business process to match the new system.

Cost

The original budget for implementation was $560,000, including the first year's maintenance fee, but the project has since exceeded this budget by approximately $14,500.

Training

Representatives from the vendor will be sent out for a week to conduct training. The ITD Right of Way Section has already gone through the process of looking at the system screen by screen, but before and after the system is scheduled to go-live, the Section will spend a week on how each person's role fits into the system. There will also be online support.

Post-Implementation

General

Since the system is still being implemented, user acceptance has yet to be determined.

The ongoing cost to maintain the agency's system is estimated to cost approximately $75,000 per year.

Benefits

The new system is expected to reduce the time to complete various activities and to improve access to data. The anticipated system benefits are as follows:

- More efficient utilization of current staff or reduction in staffing
- Increased access to information both internally within agency and by the public
- Improved customer service and public relations
- Improved documentation and consistent standardization
- Decrease in time it takes to perform tasks
- Decrease in data entry and access redundancy
- Improved oversight

Challenges

Because data conversion was not initially included within the scope of the RFP for implementation, ITD had to come up with additional funds for data conversion.

Organizational change management was also identified by ITD as an implementation challenge because staff members are accustomed to using the old system but the new system will require users to adapt to a new way of doing things.

Lessons Learned

ITD identified several key lessons learned from its implementation process:

- There is resistance to making changes since everyone is used to doing things the old way. However, the new system will require everyone to confront and adapt to these new changes in order to use the new system and reap the maximum amount of benefits.
- Since data conversion was not initially accounted for, this drove the cost of implementation up.

Kentucky Transportation Cabinet (KYTC)

Agency Information

The Kentucky Transportation Cabinet (KYTC) Division of Right of Way and Utilities is responsible for the acquisition of right of way, relocation of affected families, businesses, and utilities, and safety improvements to highway railroad crossings. KYTC accomplishes these objectives through the Right of Way and Utilities Division in the central office which establishes policy and procedures and a Right of Way function and Utilities function in each of the 12 KYTC districts which have primary responsibility for project related work.

The KYTC Division of Right of Way and Utilities acquires 1,800 to 2,000 parcels each year, which translates into approximately $20-25 million in annual acquisition costs. The relocation program consists of approximately 200 to 300 parcels, which amounts to approximately $10 million annually. There are a total of 70 staff members, and about 60 percent of the work is currently done in-house, with the remainder done by consultants. In the next few years, this breakdown is expected to shift; 60 percent of the work is expected to be done by consultants and 40 percent of the work is expected to be completed in-house.

System Overview

- System Type: Hybrid
- System Name: Right of Way and Utilities Management System (RWUMS)
  - Custom system
- Implemented in: 2011
- Last Update: No updates since implementation
- Total Implementation Cost: $300,000-$400,000
- Primary Benefits: More efficient utilization of current staff/reduction in staffing, decrease in time it takes to perform tasks, decrease in data entry and access redundancy

Business Functions Supported By System

The business functions supported by the KYTC RWUMS application or the paper/hybrid system are outlined in Exhibit 10.

Exhibit 10: Business Functions Supported by KYTC RWUMS Right of Way System or the Paper/Manual System

Business Function	System	
	RWUMS	Paper/Manual
Appraisal	✓	
Negotiation/Acquisition	✓	
Relocation		✓
Property Management		✓
GIS		

System Background

The KYTC Division of Right of Way and Utilities uses the Right of Way and Utilities Management System (RWUMS) for right of way, but has switched over to the Kentucky Utilities and Rail Tracking System (KURTS) to manage utility and railroad relocation. RWUMS is custom-developed and supports tracking of the appraisal and acquisition processes. The relocation program is not part of the system yet.

System Capabilities

RWUMS supports the following business processes:

- **Assignment of appraisers including potential selection of contract appraisers.** When a project is sent down from Design, staff members upload information from the summary sheet and then assign an appraiser. Once the appraisal is completed, then the assigned negotiator makes an offer.
- **Manages and tracks condemnation proceedings.** Once a property goes into condemnation, the Division of Right of Way takes on a secondary role and the general counsel takes charge of the process. The general counsel office has its own tracking database and the Division of Right of Way does not have access to this database. KYTC legal staff is assigned to each district and the Right of Way district supervisor communicates with the assigned attorney to monitor progress for each parcel.
- **Demolition or other activities assigned to the right of way unit**. Each district is responsible for demolition. If there are time constraints, then the responsibility goes to the highway contractor. The system does not have a tracking mechanism for monitoring these activities or timeframes.
- **Disposition (lease/sale) of excess right of way.** There is a database of excess land, but it is not project-related.
- **Other business functions.** KURTS is the system used by KYTC for utility and railroad relocation. The KYTC Right of Way and Utilities Division handles outdoor advertising as it relates to acquisition and relocation, but does not handle permitting.

Property management is done using Microsoft Word forms and not with the database system.

An IT staff member has been assigned to generate status reports for each project, but the generation of documents is not otherwise automated.

The KYTC Division of Right of Way and Utilities was originally planning to include work flow capabilities within RWUMS, but this functionality has not been implemented. When a certain stage in the process is completed, there are no trigger emails and the staff has to rely on individual person to person communications instead. For example, once an appraiser has completed an appraisal, the appraiser notifies the Right of Way Supervisor and the completed appraisal is logged into a separate status report. The appraisal is then forwarded to the review appraiser and the review appraiser then notifies the supervisor when the review appraisal has been completed. The appraisal is then routed to the central office for review. Once the central office approves the appraisal, the central office then notifies the district. KYTC reported these manual hand-offs can delay the flow of work through the acquisition process and it is hoped that additional work-flow type automation can be implemented in the future.

System Integration

RWUMS is stand-alone and does not integrate with any other KYTC systems. The system does not have GIS capability.

User Access

The system has less than 200 users, including fee appraiser and acquisition consultants that have access to the system. The central office handles uploading of the project number and other project information and then the project manager or supervisor has access to upload parcel data. When assignments are made, certain roles have restricted access to the system; for example, appraisers will only have access to appraisal forms for the parcels they are assigned to.

Although there is a user guide that goes through the steps of using the system, generally training is on the job. A new agent will shadow another agent to learn the process.

Implementation Details

Pre-Implementation

KYTC reviewed the right of way systems in place in a few different states to assess the capabilities of these systems, including Virginia and Pennsylvania, but found that these systems would not really work for Kentucky. The KYTC Right of Way and Utilities Division also evaluated purchasing an off-the-shelf system but determined this approach to be cost prohibitive. KYTC then made the decision to implement its own system.

Implementation Process

KYTC retained an outside consultant to assist with planning and designing the new system. The consultant served as the project manager for system development and implementation. The project manager worked with internal staff, and internal staff provided him with a list of needs for the new system. The project manager had access to internal IT staff and worked with the KYTC Right of Way and Utilities Division for over a year to design the specific forms that KYTC required. KYTC then completed the system development internally after the departure of the project manager.

Although business process re-engineering was considered, this was not a primary objective during the systems development process.

Implementation began in the summer of 2010 and took approximately 1.5 years. Implementation began with a couple of districts first as a pilot before the system was rolled out statewide.

Cost

KYTC estimated the implementation cost at $300,000 to $400,000.

Training

There was a person in the central office who was assigned to go to the pilot districts and give a brief overview of how the system would work and show the district staff how to enter and track information. This presentation was then eventually given to the rest of the districts as each district began to use the system.

Post-Implementation

General

The ongoing maintenance of the KYTC RWUMS application requires staff time equivalent to 0.5 FTE. One individual takes care of role assignment and another person takes care of any information technology issues.

The system has not undergone any upgrades since implementation, but KYTC has discussed potential upgrades, including incorporating the ability to print appraisals and status reports with one click. Internal IT staff members are reviewing this request to determine feasibility. Users agree that there are opportunities to improve the system.

Benefits

The benefits resulting from implementation of RWUMS are as follows:

- More efficient utilization of current staff or reduction in staffing
- Decrease in time it takes to perform tasks
- Decrease in data entry and access redundancy

Challenges

The biggest challenge during implementation was getting people to try the system. Once certain information is entered into the system, the system is supposed to be able to take that same information and populate certain fields on different forms. However, KYTC initially encountered a problem because the system was not reading the information correctly and it was not possible to override the mistakes.

KYTC also identified several opportunities for further improvement with the system:

- Getting information out of the system is a limitation.
- Parcel assignments are made on a parcel by parcel basis and cannot be assigned all at once, which is tedious and time consuming. After each assignment, the user needs to back all the way out and then reenter to enter the next parcel. This is not very user friendly, especially if an agent is attempting to set-up a project with 30 plus parcels.

KYTC reported the system to be a work in progress and the agency is continuing to work towards implementing its full vision of the system.

Lessons Learned

KYTC identified the following key lessons learned from its implementation process:

- Agencies should make several considerations when planning for an electronic system, including:
    - Whether or not the system serves all agency needs
    - How much time it will take to develop and prepare the system for use
    - Whether the system will be able to integrate with other systems

Maricopa County (AZ)

Agency Information

The Public Works Real Estate Division of Maricopa County is responsible for the acquisition of the necessary land rights for Maricopa County public works projects and the disposal of excess land. The Division consists of three functional units: Property Management, Acquisition, and Property Engineering. The Acquisition branch includes seven agents that liaise with the County Attorney's office or outside counsel for property condemnation. The branch acquires between 300 and 600 parcels a year for the Maricopa Department of Transportation (MCDOT) and the Flood Control District of Maricopa County, which amount to approximately $9 million to $21 million in acquisition and relocation costs.

System Overview

- System Type: Electronic
- System Name: Real Estate Acquisition Application (REAA)
  - Custom system
- Implemented in: November 2011
- Last Update: Currently ongoing
- Total Implementation Cost: $26,000
- Primary Benefits: Increased accessibility to data

Business Functions Supported By System

The business functions supported by the Maricopa County REAA application and other agency paper/manual processes are outlined in Exhibit 11.

Exhibit 11: Business Functions Supported by Maricopa County Real Estate Acquisition Application and Associated Paper/Manual Processes

Business Function	System	
	Real Estate Acquisition Application	**Paper/Manual**
Appraisal	✓	
Negotiation	✓	
Acquisition	✓	
Relocation		✓
Property Management		✓
GIS	✓*	

GIS is a separate system

System Background

Each functional unit of the Maricopa County Public Works Real Estate Division has its own database that has been custom-developed over time and acts as a record of action. The Acquisition branch worked with the Maricopa County IT Department to develop the Real Estate Acquisition Application. Since the system was built in-house, the branch has been able to add additional components on an as-needed basis.

System Capabilities

The Real Estate Acquisition Application supports the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.** Once the branch identifies the types of property rights it will acquire, the system is able to track the number of parcels, costs, what is being acquired, and how it will be acquired. The branch does not typically handle timber rights but it does run into mineral rights if it is dealing with property managed by the Bureau of Land Management (BLM).

- **Assignment of appraisers including potential selection of contract appraisers.** The system contains a list of projects and has a work breakdown structure for each project. The appraisal screen has a request form for ordering an appraisal that can populate itself by extracting information from the database. The system is also able to track the appraiser, appraisal cost, and when the appraisal was ordered, delivered, reviewed, and turned over to the acquisition agent.

- **Manages and tracks negotiations with property owners.** The branch had been using Microsoft Word to manage and track its negotiations for over 20 years, but eventually switched over to using a database so that other people would have access to the information too. The computer system is set up so that some things are on shared drives, while other things are saved on individual drives. Previously, most people saved documents onto their individual drives, which then limited anyone else from being able to access those documents.

- **Manages and tracks condemnation proceedings.** Condemnation proceedings are part of the subset of parcel information under land rights. Condemnation tracking also has a tab for settlement information that tracks who the judge is, whether or not appraisers were changed, major milestones, and scheduling orders and dates that allow staff to create reports. There is a separate tab for appraisal information so staff can track the internal appraisal versus the property owner's appraisal, and what the final outcome of the case was. The attorney has a status sheet in order to be able to communicate with the Land Acquisition Branch Manager about the case. User access for condemnation proceedings is very limited because of the sensitive nature of the information.

- **Closing and obtaining access to the property.** On the negotiation tab, a user can enter in closing requirements and put in dates that have been reached. The system also keeps track of the status of the escrow—whether it is open, closed, or canceled.
- **Property management.** Property management is linked to the GIS function, and the branch is able to see which parcels it has obtained and which parcels it has transferred.

The system currently does not handle demolition or relocation. The Property Management branch handles demolition activities for MCDOT and the Flood Control District of Maricopa County. The Acquisition branch is looking into building a relocation element into the acquisition database at some point, but there is currently not enough relocation activity to justify the staff time it will take to develop the module. MCDOT has internally developed its own database for utility relocations.

Maricopa County has been slowly adding templates to the system. Since documents change over time, the county wanted to ensure templates that were being added were not outdated. Although the system does not have workflow capabilities, the main page of a project contains a work breakdown structure that gives a quick visual of the status of each parcel.

System Integration

The Real Estate Acquisition Application is integrated with several of Maricopa County's other systems. These include:

Financial Management System

The Real Estate Acquisition Application is integrated with the County's financial management system which is responsible for generating all required payments for acquisition related activities.

Other

The Real Estate Acquisition Application also integrates with Maricopa County's GIS. GIS enables staff to see which parcels it has obtained and which parcels it has transferred. In addition, the Maricopa County GIS is also linked to the Property Management function.

User Access

The Acquisition Branch has eight staff members that use the system, in addition to appraisers and project managers at MCDOT and the Flood Control District of Maricopa County. Since Maricopa County has a tight firewall in place, consultants are not yet able to access the system. There were also challenges with sharing the system with the County Attorney's office since they also have their own firewall. IT staff is exploring FTP and SharePoint as alternatives for user access to information in the system.

IT staff wrote a user manual to go along with the system. Since the Acquisition team treats this procedural manual as a live document, it was easier to match up processes when developing the system. Whenever there is an issue with the system, the system sends an alert to the person who developed the program and that person will work on troubleshooting the issue. The product appears to have strong end-user ownership.

Implementation Details

Pre-Implementation

The Acquisition branch previously used a mainframe-based Data General database management system to track milestones for projects. When everything was transitioned from this Data General system into Microsoft Excel, access to the information became more difficult. This is especially change for the Acquisition branch since the branch works with multiple other Maricopa County agencies.

The Acquisition branch looked at a couple of different off-the-shelf programs but the cost was too high and could not be justified given the small number of users that would use the product. In addition, an off-the-shelf program would likely have required a great deal of customization to meet the specific needs of the organization, which would have resulted in a fairly expensive project effort. Each of the software vendors with whom Maricopa County met was willing to customize programs and make them integrate with other systems within the Public Works Real Estate Division, but the solution was cost prohibitive since funding would have had to be pulled from the budgets of all three branches of the Public Works Real Estate Division (Acquisition, Property Management, and Property Engineering). Thus, Maricopa County ultimately decided to develop the program in-house using County IT staff.

Implementation Process

When the IT Department came in to begin development of the system, they were initially amazed at the amount of information that had to be tracked. The IT staff attempted when designing the system to prevent the screens in the system from being too busy with a lot of information on a single screen. It took the IT Department some time to understand why something was important, which pointed to a need for everyone to use the same language for consistency. Since everyone understood things visually, IT staff and branch staff used visual aids to communicate with each other.

The branch began its initial search in 2010 and the last few months of 2010 was when the IT Department began reviewing the procedural manual. From the end of 2010 to June 2011, there were monthly meetings that took place where IT showed screenshots of the system and went through the logic of how they coded things. It was six months before a working product was

developed. After three months of beta testing and some tweaking, the system was launched in November 2011. By 2012, everything was in the system and the branch no longer used Excel to track projects.

The Real Estate Acquisition Application has received the 2014 National Association of Counties (NACo) Award for its development and implementation.

Cost

The total cost of implementation was under $30,000.

Training

There are two levels of users, users that only view information and users that enter data into the system. When the system was first rolled out, both types of users were given a half day training session. As new people come onboard, they will receive training on how the system operates.

Post-Implementation

General

The Real Estate Acquisition Application is widely accepted by the branch; agents have really embraced the system and see a lot of value in it. All the information is in one place, which makes it easy for staff to obtain what they need, even if other staff members are out of the office or on temporary leave. However, there are limitations to what information can fit into a field, which is especially problematic for project coordination reports.

The system is currently undergoing an upgrade to incorporate reporting. There are seven reports that can be generated out of the database using report writer capabilities within the system but the Acquisition branch is looking to incorporate other types of reports as well.

Maintenance costs are minimal compared to the labor cost of development. Maintenance costs for the first six months were estimated to be under $1,000.

Benefits

The primary benefit of the Real Estate Acquisition Application is improved access to information. The previous Excel-based database was very isolated, which was challenging especially since the Acquisition branch works with several other agencies. Ensuring everyone had access to data was a challenge with Excel spreadsheets, which was especially problematic when staff members were absent. The primary benefits of the new system are as follows:

- More efficient utilization of current staff given staff members do not have to "chase" information
- Increased access to information within the Acquisition Branch and by various external stakeholders
- Improved customer service and public relations
- Improved documentation and consistent standardization
- Decrease in the overall time it takes to perform acquisition tasks

Challenges

The Acquisition branch faced some difficulties with data conversion, but the branch was able to overcome this challenge because the in-house business solutions team was willing to put in the time to understand the acquisition process.

Lessons Learned

Maricopa County identified several key lessons learned from its implementation process:

- Before beginning implementation of a new system, business processes need to be clearly documented and reflect the most current practices
- Having an in-house team that was willing to understand the acquisition process made the system development process easier
- Evaluate in-house versus off-the-shelf products as part of selecting an implementation approach, as there are clear advantages and disadvantages inherent in both possible approaches
- Automated systems increase client service relationships by creating a transparent acquisition reporting method; schedule and costs can be tracked more easily and clients are better able to see what the cost and schedule drivers within an acquisition process are.

Maryland State Highway Administration (MDSHA)

Agency Information

The Office of Real Estate of the Maryland State Highway Administration (MDSHA) is responsible for all right of way activities on the Maryland State highway system including acquisitions, relocation assistance, outdoor advertising, appraising, appraisal review, property management, dispositions, and records and research. The MDSHA Office of Real Estate also supports right of way acquisition activities required by other modal administrations within the Maryland Department of Transportation (MDOT). Over the last 3 years, the Office of Real Estate has acquired an average of 360 parcels and the average annual acquisition and relocation cost was $15.6 million. Since the Office is also acquiring parcels for the Maryland Transit Administration (MTA) and has had a significant increase in work due to a State Revenue Increase (SRI), the acquisitions for this year and the next several years will probably increase by 75 to 100 percent.

System Overview

- System Type: Hybrid
- System Name: Office of Real Estate Management System (OREMS)
    - Custom system
- Implemented in: 2001
- Last Update: 2014 (in-progress)
- Total Implementation Cost: $2.6 million
- Primary Benefits: Increased access to information both internally within agency and by the public, improved documentation and consistent standardization, decrease in data entry and access redundancy.

Business Functions Supported By System

The business functions supported by the OREMS application are outlined in Exhibit 12.

Exhibit 12: Business Functions Supported by Maryland State Highway Administration OREMS Application

Business Function	System
	OREMS
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	✓
Property Management	✓
GIS	

System Background

The MDSHA Office of Real Estate utilizes two main systems to manage its right of way activities. The Office of Real Estate Management System (OREMS) handles tracking of most functions, excluding outdoor advertising and junkyard management. OREMS is Oracle-based and has been in use for approximately 10 years. The Outdoor Advertising and Junkyard Management System is a Salesforce.com system that is hosted in-house, and is less than a year old.

System Capabilities

The OREMS application supports the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.** Every parcel on every project is put into the system; if a parcel does not end up getting acquired, it still remains in the system.
- **Assignment of appraisers including potential selection of contract appraisers.** The system is able to track when an appraisal is ordered, received, reviewed, when the reviewer received and approved it, and whether the reviewer approved the appraisal. The system can handle as many appraisals as necessary on each parcel.
- **Completion of appraisal, appraisal review, and determination of just compensation.** Each division and function has different permissions, so the reviewer only has certain permissions before the appraisal goes back to the negotiator and district office staff. The reviewer can input certain information, and then the appraisal goes to the District Chief who reviews the paperwork. If the appraisal is rejected, it goes to Compliance and Review. Although OREMS has the capability to prepare a warrant for property acquisition, the responsibilities are handled outside of the Office of Real Estate within MDOT's financial management system. However, once an expenditure occurs, OREMS is able to track cost to date on a particular project.
- **Manages and tracks negotiations with property owners.** The system is able to manage and track the various steps in the negotiations process.
- **Manages and tracks condemnation proceedings.** The system tracks when the district office sends packets to start preparation of agenda items for approval to condemn properties. Once an agenda items is approved, check requests are created in OREMS to cover the necessary filing fees with the court. Key dates related to court hearings and other condemnation activities can be tracked in the system.
- **Closing and obtaining access to the property.** The assigned agent is responsible for managing and tracking closing activities in OREMS. There is also a Settlement Coordinator who also tracks various closing activities in OREMS.
- **Business and residential relocation**. There is a function for relocation within OREMS, but it is not the easiest to use and is still a work in progress. The relocation function is

currently utilized for recordkeeping and forms, but it does not give any alerts. OREMS does not handle property asset management or relocation assistance.

Property disposition is managed by the Office of Real Estate, based on direction from other business units within the Maryland State Highway Administration (MSHA). There is a database for disposals that various stakeholders have access to, but it is not a true management system. Disposals are currently mostly done through a paper process.

OREMS has the capability to generate certain documents used in the acquisition process, but the documents are more drafts than final documents ready for distribution. The Outdoor Advertising system is able to generate some letters and correspondences.

Both OREMS and the Outdoor Advertising system also have workflow capabilities. There are also required fields in OREMS that must be completed before moving to the next step or function.

Documents that require signatures are printed, signed, then scanned. The only exception is for cost estimates, which can be approved through the system. OREMS has the capability to approve many things, but this is duplicated with written signatures because when the system was originally designed ten years ago the agency was unsure whether FHWA would accept electronic signatures.

System Integration

OREMS is integrated with several other MDSHA systems. These include:

Document Management System

OREMS interfaces with MDSHA's document management system, which gives users access to right of way documents.

Financial Management System

OREMS also interfaces with the MDOT financial management system to share data related to project cost and budget.

Other

The MDSHA GIS is integrated with the Outdoor Advertising System. Integration between GIS and OREMS is planned as an upcoming enhancement to OREMS.

User Access

In addition to staff of the Office of Real Estate, consultants and the Office of Attorney General also have access to the system.

There is a user manual for the system and each screen in the system also has a help button. There is also a small IT group that supports the system.

Implementation Details

Pre-Implementation

The Office of Real Estate did not conduct a benefit-cost analysis for developing a new system; instead, the Office was given direction from the IT group that a system would be developed in-house. OREMS is a product of a few smaller programs that were eventually combined. IT had questioned the benefits of enhancements and improvements versus purchasing an off-the-shelf system, but ultimately decided to retain the current program.

Implementation Process

Original development of the system took two to three years, but the system continues to undergo development. The system was developed with consultants that worked for MDSHA and two internal IT staff members. The system was initially deployed to districts with lighter workloads and then deployed to all districts.

Cost

The total cost of the implementation was $2.6 million.

Training

Training was fairly comprehensive, although it took a while for users to get used to the system. Users did not initially understand what they could get out of the system until they became more familiar with the system and saw that it had more functionality than the previous system. OREMS training was provided by in-house staff and the consultants assisting with the implementation of the system.

Post-Implementation

General

There are several key priorities for upgrades to OREMS that have been identified, including GIS integration and the ability to be able to produce certain reports from the system. The requirements enhanced reporting in OREMS was part of recommendations from a recent audit. The Office of Real Estate has compiled a list of improvements for future upgrades; this list is revisited periodically and used to inform the next phase of improvements.

The system was not widely accepted when it was first rolled out, but it is now a part of the daily routine.

Maintenance costs are approximately $150,000 per year.

Benefits

The Office of Real Estate staff is achieving several benefits from the system including:

- Increased access to information both internally within the agency and by the public
- Improved documentation and consistent standardization
- Decrease in the total amount of data entry required, as well as the amount of redundant data entry required

Challenges

The consultant met with staff for over a year to go through what everyone's job entailed. However, each functional area dealt with their specific part of the new system without necessarily integrating with others, which resulted in silos. The mangers had decided which individuals would meet with the consultants, but the people selected were not always the ones that would be doing the work. There needed to be a better cross section of people, from the lower level to higher management, involved with system development. At the time, the program was set up by divisions rather than work functions, and not all divisions were included in the process; certain divisions and functions were emphasized over others, such as acquisitions.

Although MDSHA set aside money for the system, it did not set aside a budget for ongoing maintenance and enhancement needs, especially since work processes can change. To address this, the MDSHA Office of Information technology had to establish a budget for enhancements and continued support following implementation.

Lessons Learned

The MDSHA Office of Real Estate identified several key lessons learned from its implementation process:

- Ensure that the people involved in the development of the system represent a good representative cross section of the people that will be using the system. The program should be based on business function and not on any one particular office or division.
- Identify system upgrades and future maintenance needs and allocate an appropriate budget.

- Plan a program that will meet not only present needs, but which is scalable to be able to meet future needs as well.

Minnesota Department of Transportation (MnDOT)

Agency Information

The Minnesota Department of Transportation (MnDOT) Office of Land Management is responsible for managing right of way acquisition, utility relocation, and property management. Policy and procedures for right of way acquisition are established by the central office, with projects delivered by staff in each of MnDOT's eight (8) decentralized districts. MnDOT handles approximately 400 to 600 acquisitions statewide annually. Over the last four fiscal years (FY 2010-FY 2014), average annual acquisition costs were $36.2 million per fiscal year and average annual relocation costs were $1.7 million per fiscal year.

System Overview

- System Type: Electronic right of way system
- System Name: Right of Way Electronic Acquisitions Land Management System (REALMS)
  - Custom system
- Implemented in: 2006
- Last Update: The system is updated on a regular basis
- Total Cost: $2.8 million
- Primary Benefits: Consistency of data throughout the state

Business Functions Supported By System

The business functions supported by the OREMS application are outlined in Exhibit 13.

Exhibit 13: Business Functions Supported by MnDOT REALMS Application

Business Function	System
	REALMS
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	✓
Property Management	✓
GIS	✓

System Background

MnDOT uses Right of Way Electronic Acquisitions Land Management System (REALMS), a custom electronic system for managing its right of way activities. REALMS is based on the Virginia Department of Transportation's (VDOT) Right of Way and Utilities Management System (RUMS), with customizations to address MnDOT specific needs and business processes. The agency estimates that 95 percent of RUMS was modified because of differences between the way MnDOT does business and the way VDOT does business. A major difference is how each

agency goes about the condemnation process. While MNDOT groups parcels during the condemnation process by counties, VDOT treats each parcel as its own eminent domain case.

System Capabilities

REALMS supports the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.** The system has indicators to denote different types of rights, such as mineral or timber rights.
- **Assignment of appraisers including potential selection of contract appraisers.** The system is able to assign appraisers and reviewers to specific parcels. The actual appraisal document is created by the appraiser in a separate system and then uploaded and stored in REALMS.
- **Selection and management of consultant negotiation agents.** The system is able to assign negotiation agents to parcels.
- **Manages and tracks condemnation proceedings.** All condemnation proceedings are documented in a log file in the system.
- **Closing and obtaining access to the property.** The system assigns closing agents to each parcel.
- **Demolition or other activities assigned to the right of way unit**. The system tracks all demolition activities applicable to a parcel. Demolition activities are treated as improvements and MnDOT either leverages an existing contract or establishes a contract for activities such as abatement, demolition, sales, and leases.
- **Residential relocation.** The system supports residential relocation services very well; all relocation activities are done directly in the system.
- **Property management.** After a property is acquired, the system fully supports its management. REALMS is able to track leases, demolishment, turnbacks, and conveyances for surplus properties. The system also has extensive reporting capabilities that allow the agency to easily report on what properties it owns.
- **Other business functions.** At the time the software was purchased, the Utility, Agreements, and Permits unit was not part of the Office of Land Management. However, the unit has since become incorporated into the Office of Land Management. As a result, MnDOT is looking into potentially incorporating the application the Utility, Agreements, and Permits unit uses currently use into the REALMS application. Outdoor advertising is also tracked in a separate system.

REALMS tracks various documents across the entire acquisition process and is able to populate somewhere in the magnitude of 150 forms. The system also has extensive work flow and notifications capabilities (through a work list). REALMS can also send emails to an external

email system, but this notification function is turned off to prevent users from receiving an excessive amount of notifications from the system. The one exception is that external notifications are used when work is required by another department. For example, since there are some work activities performed by the Environmental unit that are tracked within REALMS, the system will send a notification to Environmental when their involvement is needed to complete an activity.

System Integration

REALMS is integrated with several other MnDOT systems. These include:

Document Management System

REALMS is integrated with Hummingbird, MnDOT's document management system. Hummingbird stores all documents on which signatures are required. Documents requiring a signature are printed, signed, and then scanned to store in Hummingbird. REALMS stores a link to the documents which users can click on to access the signed documents within Hummingbird.

Project Management System

Although REALMS is not integrated with Primavera P6, the project management system that is used as the department standard for tracking and scheduling projects, MnDOT uses information from REALMS to input information into the P6 application. Project status, milestones, schedule progress, budget, and other project-related information are shared between the two systems.

Financial Management System

REALMS integrates with the PeopleSoft-based Statewide Integrated Financial Tools (SWIFT), the State of Minnesota's financial management system. Project cost, budget, and other financial data are shared between REALMS and SWIFT.

Other

REALMS is integrated with MnDOT's GIS application to allow some spatial display of project and parcel information.

User Access

There are approximately 75 MnDOT users of REALMS. In addition, contract consultants also have access to the system. External users are able to access the system through a Citrix client

REALMS is generally regarded as a fairly intuitive and user-friendly application. End-user help is provided through RoboHelp, which supports development and display of context specific help screens.

Implementation Details

Pre-Implementation

MnDOT had two applications prior to REALMS. The agency initially developed an application based on Oracle Forms. This application was then migrated to a .NET application. MnDOT determined that implementing a full life cycle electronic system including workflow capabilities was the next logical step in the evolution of technology to support right of way.

When MnDOT began the process for procuring a new system, the agency solicited information from a number of other state DOTs about their right of way management systems. MnDOT liked the look and feel of Virginia's electronic system. MnDOT acquired the rights to the Virginia system from VDOT and then contracted with the consultant who had implemented RUMS to come on-board to facilitate the implementation of REALMS.

MnDOT did not go through business process re-engineering prior to implementation because the agency felt that right of way processes are based for the most part on law or regulation and have remained, for the most part, the same through the years. Initially, some districts thought they did things differently than other districts, but upon closer inspection, there really was not much of a difference across the business processes of all the districts.

Implementation Process

The system was implemented in phases and took approximately two years. The initial implementation phase was focused on program delivery activities. There were then several additional follow-up phases to deploy property management, environmental, and other areas. The internal project management team worked with several consultant staff and also involved other individuals from within MnDOT (e.g., Crystal Reports programmer, the database administrator, the GIS administrator) to develop the application. Once the consultant taught internal staff how to use the application, staff began to take on more responsibilities. Overall, the implementation process was fairly smooth.

Cost

The cost to buy RUMS from VDOT was $800,000 and another $2 million was spent on customization and implementation. MnDOT owns the system and makes all updates and add-ons internally.

Training

Classroom training was utilized to deliver training to all system users (central office, district staff and consultants). Training materials were developed as a collaborative effort between the consultant and MnDOT.

Post-Implementation

General

REALMS is well accepted by its users and meets the agency's key needs. One gap that was identified was that if certain fields are not populated, the system will not work as well as it should. The agency also cited that the system is not always used to its full potential because of user preferences to continue using existing business processes.

REALMS is maintained by five (5) to six (6) internal staff members. MnDOT continues to enhance the system as necessary to support business requirements (for example the incorporation of environmental due diligence). The next major upgrade will involve integrating the utilities application into the system. In addition, MnDOT would also like to expand the integration between REALMS and Primavera P6.

Benefits

REALMS has helped to ensure data consistency throughout the state. Other benefits from REALMS identified by MnDOT include:

- More efficient utilization of current staff
- Increased access to information both internally within MnDOT and by the public
- Improved customer service and public relations
- Improved documentation
- Greater consistency and standardization
- Decrease in time it takes to perform tasks
- Decrease in redundant data entry
- Improved program oversight

Challenges

A primary challenge that was encountered during implementation was difficulties with data conversion from the existing automated or manual systems. This challenge was overcome by working directly with the IT groups. Having a business IT group within the office that understands the acquisition and property management processes was helpful in working towards resolution of issues during implementation.

Lessons Learned

MnDOT identified several key lessons learned from its implementation process:

- Committing to a scope and then following through with it was necessary to move the implementation process forward, with the understanding that there may be a need to make changes later.
- A strong implementation team (including both consultants and internal staff) is critical to a successful implementation process.
- Involving all of the district offices during the implementation process helped them to develop a degree of ownership of the implementation effort. Input from the district staff was critical in creating a robust system that met everyone's needs.

Polk County (Florida)

Agency Information

The Right of Way and Real Estate Section of Polk County is responsible for managing the right of way acquisition for all Polk County projects. This includes managing land inventory and all activities associated with real property needs, including vacation of right of way and easements. The Right of Way and Real Estate Section was previously a part of Polk County's transportation division but is now its own separate division.

The Polk County Right of Way and Real Estate Section acquires on average approximately 60 parcels a year and maintains an inventory of over 2,900 parcels. Approximately 85 percent of the parcels are used in buildings and conservation, while the rest of the parcels are surplus candidates. The program is much smaller than what it was a few years ago. Previously, Polk County was acquiring upwards of 600 parcels a year, but during the economic downturn, the workload reduced significantly and staff was reduced by 40 percent.

System Overview

- System Type: Paper-based right of way system with Excel spreadsheets
- System Name: N/A
- Implemented in: 2002
- Last Update: N/A
- Total Implementation Cost: N/A
- Primary Benefits: Cost savings realized from not purchasing an electronic system

Business Functions Supported By System

The business functions supported by Polk County's paper-based system are outlined in Exhibit 14.

Exhibit 14: Business Functions Supported by Polk County's Paper-Based System

Business Function	Paper-Based
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	
Property Management	
GIS	

System Background

When the current Right of Way Manager came onboard, there was no system in place, but the Polk County Right of Way and Real Estate section had a need to track and readily report cost information for its right of way activities. The Right of Way Manager worked with internal staff

to develop a series of Microsoft Excel spreadsheets to track project schedule, status, and cost. This system has been in place for approximately 12 years.

System Capabilities

The system supports the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.** The Surveying and Mapping section produces right of way maps, unless the effort is consultant-driven (for larger projects). Since electronic data can get lost or become inaccessible if the system is down, the Right of Way and Real Estate section keeps redundant paper maps in addition to electronic copies that are kept on file. Legal descriptions and sketches are saved by the Survey and Mapping section.
- **Assignment of appraisers including potential selection of contract appraisers. Selection and management of consultant negotiation agents.** The Right of Way and Real Estate section has several master contracts that it can leverage for additional staff support for appraisals and acquisitions. Polk County typically rotates appraiser assignments. For larger projects, Polk County tries to split up the assignment so that one appraiser handles commercial and another appraiser handles residential. The Right of Way and Real Estate section prepares the scope of the contract and provides it to the Procurement Department to release electronically.
- **Completion of appraisal, appraisal review, and determination of just compensation.** Appraisals are typically done through the master contract and a separate appraiser is assigned to conduct the review. For eminent domain, only a paper copy of the appraisal is allowed; all other appraisals can come through by email.
- **Other business functions.** The Right of Way and Real Estate section deals with signage only if it purchases a piece of property that includes a sign, but it does not otherwise handle permitting. There are a few instances in which the Right of Way and Real Estate section drives income from outdoor advertising on an annual lease.

The paper-based system contains standard templates; however since these templates are not fill-in forms, they must be modified when preparing various required documents.

Approvals and sign-offs are handled by the Polk County Board. The Board meets twice a month and the right of way staff handles putting together the agenda packets to send to the Board. Prior to approval, the check request is forwarded to the accounting section of the Clerk of Court's office. The office will manually cut the check once the Board approves the agenda item.

System Integration

The system is not integrated with any other systems.

User Access

External users may request right of way information by submitting the request through the Information Technology section. Information Technology can fulfill the request if it is a standard request. If the request is more specific, then it is forwarded to the Right of Way section to handle.

Implementation Details

Pre-Implementation

Before the current Right of Way and Real Estate Section Manager came on-board, the section did not have a system in place, but there was a need identified to be able to track and report right of way activities at any given time, including costs of projects or parcels and whether or not a project is on-time, on-schedule, and within budget.

Since the size of the program is so small, the right of way staff could not justify the costs associated with purchasing an electronic system.

Implementation Process

The Polk County Right of Way and Real Estate section utilized the tools it had available to it (i.e., Microsoft Office Suite) to develop a system that would help track its right of way activities from cradle to grave.

Cost

Not applicable

Training

New staff members and consultants are provided one-to-one training on the various forms and templates.

Post-Implementation

General

The paper-based system is maintained by the Right of Way and Real Estate section's six staff members.

Polk County is implementing an enterprise document management system, but it has not been deployed to the Right of Way and Real Estate section yet. Historical documents are stored in a file room and capturing all of these documents electronically will be a large level of effort.

Benefits

The primary benefit of a paper-based system that was developed in-house was the cost savings realized from providing gaining some business process efficiencies and improved access to information, while not purchasing an electronic system.

Challenges

Budget and resource constraints are preventing the agency from transitioning to a new system. There is currently a lot of duplication in regards to how right of way activities are tracked. As a result, the Right of Way and Real Estate section would like to revisit the potential conversion to an electronic system in the next few years. The current paper-based system is compatible with the present size of the right of way program and its operations; an electronic system may make more sense once the program begins to grow and handle more acquisitions and larger projects. Until then, the Right of Way and Real Estate section will operate with its current paper-based system as it goes through what amounts to a recovery period.

Lessons Learned

The Polk County Right of Way and Real Estate section identified the following key lesson learned:

- A paper-based system works for Polk County at this time because the right of way program is small. However, there are definitely benefits to having an electronic system, especially from the perspective of document storage.

South Dakota Department of Transportation (SDDOT)

Agency Information

The Right of Way Program of the South Dakota Department of Transportation (SDDOT) is responsible for the acquisition of property necessary for highway purposes, which includes providing relocation assistance. The office is responsible for acquiring between 600 and 1,100 parcels a year. These parcels range from just a few square feet for a curb corner or urban gutter section to several acres for residential and commercial acquisitions. While most of the work is done in-house, consultants are occasionally used. The annual program budget is between $8 and 12 million.

System Overview

- System Type: Hybrid
- System Name: Landowner Database Inventory System; Property Management System
  - Custom system
- Implemented in: 1994
- Last Update: 2012
- Total Implementation Cost: $198,000
- Primary Benefits: Staff cost savings and improved response time to public inquiries

Business Functions Supported By System

The business functions supported by the SDDOT Landowner Database Inventory System and the Property Management System applications are outlined in Exhibit 15.

Exhibit 15: Business Functions Supported by SDDOT Landowner Database Inventory System and the Property Management System Applications

Business Function	Landowner Database Inventory System	Property Management System
Appraisal	✓	
Negotiation	✓	
Acquisition	✓	
Relocation	✓	
Property Management		✓
GIS	✓	

System Background

The SDDOT Right of Way Program uses the Landowner Database Inventory system and the Property Management system to track its right of way activities. Both systems have been in use for approximately 10 years and utilize Citrix on the frontend and a SQL Server database on the

backend (note the Landowner Database Inventory system used to be a mainframe system and was converted to SQL Server). The Landowner Database Inventory System tracks acquisitions and relocations. The Property Management System contains an inventory of parcels and provides a range of reporting capabilities on SDDOT's property inventory.

System Capabilities

The Landowner Database Inventory system keeps track of the status of projects and properties. Users from Right of Way and other offices enter data into the system at various steps in the acquisition process. The system uses manual workflows through emails, which are separate from the system.

Reports on the status of different aspects of a project can be printed out or reviewed electronically. All documents are stored in manual folders that are turned in, reviewed, and then signed off by the Program Manager. The documents are then scanned and stored for recordkeeping in File Director. When an acquisition and any associated relocation assistance is complete, the PDF of the deed and any associated documents (i.e., plat, temporary easement) are stored in the Landowner Database system. Forms are currently separate from the system, but forms are scheduled to be integrated into the system in the next phase of system enhancements. Electronic signatures are another planned improvement for the near future.

The Property Management System contains an inventory of parcels. The system has been enhanced periodically over the years, including the ability to generate a variety of management reports.

System Integration

The Landowner Database Inventory system integrates with SDDOT's GIS. GIS integration is accomplished by bringing shape files into the GIS environment as polygons, and then adding attributes to those polygons. When a user clicks on a polygon, the deed and plat for that particular property will appear.

The Property Management system integrates with SDDOT's financial management system.

User Access

User access is restricted to South Dakota DOT employees and depends on the role of the user; different users have different editing capabilities for particular areas within the system. Most people have viewing capabilities.

The Right of Way Program gets inquiries on a regular basis regarding what the agency owns so a mapping system will eventually be available for mass public viewing on the web. There are currently four employees (equivalent to 1-2 FTEs) that handle inquiries, but the web mapping system will significantly eliminate the level of staff time required.

Implementation Details

Pre-Implementation

The decision to develop systems to manage right of way activities came from a need for asset management and the amount of time that was being spent on research for requests on property interests that the Department has in the state of South Dakota. Since both systems were created internally with out-of-the-box GIS type software and applications that are part of the software inventory within the Department, a benefit cost analysis was not performed.

Implementation Process

During the last revision of the Landowner Database (over the course of six to eight months), the SDDOT Right of Way Program tried to incorporate a lot of ideas from other offices to make the system more user friendly. The Program Manager sent around a questionnaire to identify what was working well with the system and what improvements should be made to the system. The feedback from the questionnaire is currently being worked through and addressed. The system was last upgraded 1.5 years ago, although there have been some minor enhancements since then.

During a major upgrade, the Right of Way Program forms a task group, which is comprised of IT staff, users, and upper management, to identify improvements that will save time and resources and provide business benefits. The task group then must develop a formal document that outlines proposed enhancements to the system and submit this request to an IT governance board for review and approval.

Cost

The cost to develop both systems was $198,000. Adjustments for upgrades or user-friendly programming changes add minor amounts annually.

Training

Once modifications are made, there are typically four to six users involved in the testing process. After alpha testing, a user guide is developed and provided to several users to review and recommend modifications. The user manual is then modified based on the input of the test users before it is more widely disseminated. There is also informal, in-house training that can be administered upon request.

Post-Implementation

General

The mapping system is widely accepted and people look forward to updates. The Landowner system has gained acceptance over the past several years as a result of the effort to make it more user friendly and intuitive for entering and extracting data. Users appreciate the system for its utility.

The Landowner and Property Management systems are supported by the South Dakota Bureau of Information and Telecommunications (BIT) staff. There is an additional staff person that is working on the GIS components.

The next planned system improvement that is scheduled to occur within the next year is to integrate all forms and make them available electronically. This enhancement would enable field agents to access important documents electronically. There are also plans to implement an electronic signature system, although this request has not yet been approved.

In addition, the SDDOT Right of Way Program is working to establish a contract to mass populate the Property Management system with several hundred thousand parcels that it owns.

Benefits

When the mapping system becomes available to the public, the SDDOT Right of Way Program will be able to re-direct the time of staff members that are currently handling inquiries from the public to other activities. The mapping system will also enable SDDOT to provide improved customer service and transparency by readily allowing the public to access information about property owned by SDDOT.

Challenges

Challenges faced during the implementation process included resource availability, time and gaining upper management buy-in regarding return on investment.

Lessons Learned

The SDDOT Right of Way Program identified the following lesson learned from its implementation process:

- Ensure that users of the system understand the broad scope of system functionality and all the different groups that are affected by the system to prevent silos from developing.

Tennessee Department of Transportation (TDOT)

Agency Information

The Right of Way Division of the Tennessee Department of Transportation (TDOT) is responsible for the appraisal and acquisition of land needed for state highway construction and the relocation of families and businesses affected by TDOT construction projects. The Division consists of a headquarters office and four regional offices. The Division handled 1,002 acquisitions in 2012, incurring $43.9 million in compensation costs and $2.3 million in residential and non-residential costs.

System Overview

- System Type: Electronic system
- System Name: Integrated Right of Way Information Systems (IRIS)
  - Commercial off-the-shelf solution with customization
- Implemented in: 2014 (in-progress)
- Last Update: N/A
- Total Implementation Cost: $1 million
- Primary Benefits: Cost avoidance, reduction in paper

Business Functions Supported By System

The business functions supported by the TDOT IRIS application are outlined in Exhibit 16.

Exhibit 16: Business Functions Supported by TDOT IRIS Application

Business Function	System
	IRIS
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	✓
Property Management	✓
GIS	✓

System Background

The TDOT Right of Way Division's legacy right of way system, known as the Tennessee Right of Way Information System (TRIS), tracks the various steps in the right of way acquisition process and generates standard forms and letters. The system has a Microsoft Access front-end and an Oracle Spatial back-end. The TDOT Right of Way Division decided to acquire a new system to help reduce the cost of hiring additional staff to take on an increasing work load.

TDOT recently entered into a contract with BEM Systems to develop a new right of way management system to be known as the Integrated ROW Information System (IRIS). Implementation is currently underway. The system will be based on BEM's PAECETrak application. The basic premise and process flow of the system will be off-the-shelf (approximately 60 percent of system functionality) with additional customizations driven by specific requirements TDOT has requested (approximately 40 percent of system capability).

System Capabilities

IRIS will support the following business processes:

- **Inventory of potential parcels and other property interests within a proposed project.** The system will include an inventory of right of way properties that the Division is acquiring. TDOT also has an interest in tracking excess land; this functionality will be accommodated in the proposed system. The basis of "excess land" is defined in TDOT as two categories. Existing excess land are tracts acquired with resulting loss of access, or those acquired as uneconomic remnants. All other excess land transactions are resulting from a public request for ROW and an assessment is made if the ROW is necessary for the current highway for future needs of the highway. For that purpose, excess land inventory for inclusion in the system is limited to acquired loss of access or uneconomic acquisitions moving forward.

- **Assignment of appraisers including potential selection of contract appraisers.** The Department uses predominantly consultants to provide appraisals while reviews have been performed by staff. The Division is moving toward consultant reviews as a result of many staff members retiring. The new system will contain appraisal information and facilitate consulting appraisals, but it does not currently go as far as containing the full appraisal reports electronically. The Department is expected to add the capability after delivery of the application.

- **Manages and tracks negotiations with property owners.** The current system logs information and tracks steps in the negotiation process, but the new system will log key events and process and provide electronic approvals. Each system user will have a work list and will receive a notification that they need to submit an approval before the process can continue. The approval process will be automated as much as possible.

- **Manages and tracks condemnation proceedings.** The system will track key condemnation related information since PAECETrak has a module for this. The Attorney General's office is interested in getting information in the system, but attorney client privilege may prevent or limit this.

- **Closing and obtaining access to the property.** Consulting services are typically used for closing due to staff shortages. The system will provide functionality for tracking the required closing steps.

- **Demolition or other activities assigned to the right of way unit**. Functionality for tracking any required steps in this regard will be included in the new system.
- **Residential relocation.** Full relocation and calculation capability was included in the RFP. However, TDOT is also exploring the possibility of integrating Turbo Relocation with the new system.
- **Disposition (lease/sale) of excess right of way.** The system supports managing both short-term leases prior to or during highway projects and long-term leases for excess land.
- **Other business functions.** Utility relocation functionality is incorporated in the new system.

TDOT's IRIS application will incorporate approximately 280 documents and will have work flow processes. Electronic signatures for federal and state compliance will be controlled through user security. Signatures needed by external individuals, such as attorneys or property owners, will be printed, signed, then scanned back in the system and archived in FileNet.

In order to facilitate system use, a "hover over" function will be implemented; when a user places their cursor over an item, a box will pop up to explain what the function of that item is. A user manual is to be developed.

System Integration

IRIS will be integrated with several other TDOT agency systems. These include:

Document Storage System

As is the case with TDOT's current right of way system, IRIS will be highly integrated with FileNet, which is TDOT's document storage system, to store, archive and support retrieval of documents.

Enterprise Resource Planning System

IRIS will create coding sheets for manual input into Edison, the State of Tennessee's PeopleSoft-based Enterprise Resource Planning (ERP) system. A direct interface between IRIS and Edison is currently planned by the Department after delivery of the application.

Project Management System

IRIS will be integrated with TDOT's Program, Project and Resource Management (PPRM) system. PPRM is TDOT's project management system that tracks all phases of project development, including state and Federal project numbers, local project participation, staff assignments, and schedule dates.

Other

The Tennessee Roadway Information Management System (TRIMS) is currently being used for capturing, maintaining, and viewing roadway data. It is anticipated that this system will integrate with IRIS. The Right of Way Division will also get parcel information from the Design division for import into IRIS through GeoPAK and DGN files (a CAD file format).

User Access

TDOT has identified approximately 150 users for IRIS. Consultants will have the capability to access to the system since it will be web-based. In the past, the Division had issues with giving access to people that did not utilize the system on a regular basis as this infrequent use often led to misinterpretation of the information. The enhanced new system is expected to provide interactive data more reliably with a dashboard and more intuitive data portrayals. If Local Public Agencies (LPAs) choose to contract with the Division to acquire right of way, key steps of the process are captured for auditing purposes. Access to the system is controlled through user security.

Implementation Details

Pre-Implementation

Implementation of the new system was driven in part by the desire to avoid the cost of hiring additional staff to manage an increasing work load, reduction in paper usage, and the ability to retrieve information quickly. Although TDOT conducted a benefit cost analysis to support the purchase, there was a clear justification even without this analysis to purchase a new system.

TDOT initially looked at the Virginia Department of Transportation's (VDOT) Right of Way and Utilities Management System (RUMS), but found that the system would not meet Tennessee's unique state requirements. Although TDOT had considered an off-the-shelf solution, it was initially thought that an off-the-shelf solution would not be able to integrate with its other systems. TDOT initially prepared its RFP document for a custom solution, but the eight proposals that were received all proposed using commercial off-the-shelf applications as the core of a new system so TDOT had to re-advertise its solicitation to allow for an off-the-shelf solution with customizations.

Implementation Process

The timeframe for the entire implementation process including RFP development and vendor selection was targeted to be three years, with the RFP outlining an 18 month timeline for the implementation vendor to install the new system. However, it is expected that the actual implementation phase of work where the software is installed and deployed will be

approximately two years. Implementation of IRIS began in October 2012. Training is scheduled for the end of September and the go-live date is scheduled for October/November of 2014.

The implementation vendor is performing the required conversion data mapping but TDOT will be responsible for actually converting data from the existing TRIS application to IRIS so that TDOT will not be running parallel systems. While the new system is being implemented all at once, there are some system capabilities that were not included in the initial implementation phase. Since TDOT owns the code for the new system, it is looking at addressing final modifications in-house that were not addressed by the vendor. There is also some GIS capability that will have to be finished in-house.

The selected vendor contracted with a consultant, DTS, to implement the GIS component. The IT department also had a project manager for IT development and the Right of Way Division Assistant Director acted as the lead subject matter expert.

Cost

The total cost of implementation was approximately $1 million, which consisted of the vendor contract to develop the system. The hardware was already in place and Turbo Relocation was obtained through an AASHTO license.

Training

TDOT will utilize instructor led training. The RFP includes two weeks of training. TDOT decided not to use a "Train the Trainer" program to ensure consistency of the training provided and make sure staff receive training on how to most effectively use the new system in hopes of making it more difficult for users to be able to continue to do business "the old way" in the new system. Training will be provided to groups of users in seven specific functional areas.

Post-Implementation

General

The ongoing cost to maintain the new TDOT system will include department overhead costs (for the project manager and database manager), server support cost, and cost associated with the disaster recovery site.

Benefits

The primary benefits of the new system include cost avoidance to hire additional staff to manage an increasing work load and a reduction in paper handling cost. Additional benefits of the system include:

- Increased access to information both internally within the agency and by the public

- Improved customer service and public relations
- Improved documentation and increased standardization
- Decrease in time it takes to perform tasks
- Decrease in the amount data entry required
- Improved program oversight

Challenges

TDOT did not report many of the typical challenges during a new system implementation such as user acceptance, buy-in, and change management to be issues during the implementation of IRIS because users were looking for a replacement for the legacy system.

Lessons Learned

The TDOT Right of Way Division identified the following key lesson learned from its implementation process:

- A detailed contract with a clearly defined scope will ensure the vendor fully understands what it is delivering and avoid any misinterpretations.

West Virginia Department of Transportation (WVDOT)

Agency Information

The Right of Way Division of the West Virginia Department of Transportation (WVDOT) acquires all the real estate that is necessary for the construction and maintenance of public roads and highways under its jurisdiction. The WVDOT Right of Way Division has approximately 80 staff members, which includes central office staff and 10 districts. Between July 2013 and May 2014, the Division purchased $20 million worth of property. Relocation costs for that same period was $650,000.

System Overview

- System Type: Electronic right of way system
- System Name: Agile Assets Right of Way and Utility/Railway (RWUR) Module
  - Commercial off-the-shelf solution with extensive customizations
- Implemented in: 2014
- Last Update: N/A
- Total Implementation Cost: $3 million
- Primary Benefits: Streamlined process and making employees more accountable for performing their responsibilities

Business Functions Supported By System

The business functions supported by WVDOT's RWUR application are outlined in Exhibit 17.

Exhibit 17: Business Functions Supported WVDOT RWUR Application

Business Function	System
	RWUR
Appraisal	✓
Negotiation	✓
Acquisition	✓
Relocation	✓
Property Management	✓
GIS	✓

System Background

The WVDOT Right of Way Division recently implemented a commercial off-the-shelf solution with extensive customizations to manage its right of way processes. The system known as the Right of Way, Utilities and Railroad (RWUR) application was developed as part of the State of West Virginia's larger enterprise resource planning project to integrate WVDOT's right of way management business processes with the state's Enterprise Resource Planning (ERP) system known as wvOASIS. The module was built from the ground up using the AgileAssets product

and moves most of the business processes from paper to electronic documents. This includes most acquisition activities from the setup of acquisition parcels from CAD plans through the abstraction, appraisal, negotiation, condemnation, relocation, payment, and closing processes. Much of the system is built around electronic workflows.

WVDOT has also used ApplicationXtender for its document management system since 1995 to electronically file and retrieve right of way documents.

System Capabilities

The WVDOT RWUR module will support the following business processes:

- **Identification and inventory of potential parcels and other property interests within a proposed project.**
- **Assignment of appraisers including potential selection of contract appraisers.** The system keeps track of who has ordered appraisal forms.
- **Completion of appraisal, appraisal review and determination of just compensation.**
- **Selection and management of consultant negotiation agents.** The system does not manage selection of agents but it does manage assignment of work.
- **Manages and tracks negotiations with property owners.**
- **Manages and tracks condemnation proceedings.**
- **Demolition or other activities assigned to the right of way unit**. The system is able to track the request for asbestos removal and keys, and notify the Construction or Engineering Divisions that a property is ready to be demolished.
- **Residential and business relocation.**
- **Property management.** Property Management will be included with the Real Estate module to be deployed in a later phase of the wvOASIS project.
- **Disposition (lease/sale) of excess right of way.**
- **Other business functions.** Utility relocation is in the system, but is part of a different division within the WVDOT Division of Highways. Outdoor advertising is part of the Traffic Engineering Division, but it will be integrated into the Transportation Module during a later phase of the wvOASIS project.

The WVDOT Right of Way Division previously had over 170 forms, but it has now reduced that number to 70 forms that the system is able to generate and either fully or partially complete. The system can also generate a number of different reports and summaries.

The WVDOT Right of Way Division can assign a parcel interest before the system workflow begins. This workflow allows WVDOT to assign personnel, which typically begins with the Chief Acquisition Manager or the District Right of Way Managers. Once each step is completed, an email message is sent with the work flow and the job assigned. Managers can go in and review

workflows and see which parcel is at which stage of the workflow. All functionality in the system is workflow based, including security.

System Integration

RWUR is integrated with several other WVDOT systems. These include:

Document Management System

RWUR integrates with ApplicationXTender to store all right of way related documents.

Financial Management System

There is a manual interaction between RWUR and the State of West Virginia's new CGI Advantage financial system. Information is collected within RWUR that is needed for entry into the financial system for property acquisition and relocation payments

Other

The system is integrated with GIS and West Virginia's geocoding system. Plans from plan sheets can be converted to CAD- or GIS-type layers and then imported as a layer into the RWUR module, which will provide a parcel index, parcel number, and a polygon of the property.

User Access

The RWUR application has approximately 125 users, including consultant appraisers, FHWA West Virginia Division office staff, and WVDOT central office Finance staff, and WVDOT District Comptroller staff.

Consultant review appraisers have access to the system, but they are only able to view, obtain, and enter information for the parcels they are assigned to. The FHWA Division Office staff members also have access. FHWA staff can review a range of information in the system. FHWA is also able to provide electronic approvals and attach written letters. Attorneys or other service contractors were not given approval for system access.

Implementation Details

Pre-Implementation

Several years ago WVDOT received an audit finding that recommended that WVDOT implement an electronic system that could track how much property was purchased and sold each fiscal year and be able to break this information into greater detail without having to rely on paper files.

Based on this audit finding, the WVDOT Right of Way Division initiated some preliminary investigation of potential systems. Before this process moved forward, the State of West Virginia started its wvOASIS ERP project and a decision was made to include a new right of way management system as part of this larger project.

Implementation Process

Requirements definition began in May 2010 and the wvOASIS ERP implementation vendor team including the RWUR solution was selected in the fall of 2011. Implementation began in December 2011. The RWUR application went live in January 2014. There was a significant amount of system development that had to take place because, while the core of the system was built on AgileAssets' existing application framework for other state DOT functions such as maintenance management, most of the right of way specific elements of the system was built from scratch.

There was some business process re-engineering as part of the implementation process, but WVDOT indicated that these were minor changes that did not significantly affect or materially change WVDOT's right of way management business processes.

Cost

The implementation cost for the RWUR part of the wvOASIS project is estimated at $3 million.

Training

Training was delivered through classroom instruction. The first two classes were taught by the vendor, with the remaining classes taught by WVDOT staff. Districts were brought to Charleston one at a time as an integrated district team for training on the new system. Training sessions were also provided for central office staff and contract appraisers and an overview class was presented to WVDOT management. Training materials and the user guide were developed as collaboration between the vendor and in-house staff. The user manual for the system is completed, but when WDOT goes live on the new wvOASIS financial system, the manual will need to be updated.

The vendor worked with in-house staff to ensure that the business documentation would be user friendly. The partnership was very successful since internal staff was able to translate the vendor's technical language into a language that could be easily understood by DOT staff.

Post-Implementation

General

The ongoing cost to maintain the agency's system is estimated to be approximately $250,000 per year.

Benefits

The expected benefits for the new RWUR system includes a more streamlined acquisition process and making employees more accountable for performing their responsibilities. The system will also help WVDOT to more effectively keep track of different parcel interests (land, mineral, timber, etc.)

Challenges

The primary challenge with the implementation was that the WVDOT Right of Way Division staff assigned to the project as subject matter experts had to do a significant amount of knowledge transfer to the vendor team on right of way business processes. Once the vendor team became more familiar with the WVDOT Right of Way Division processes and requirements, the implementation went smoothly.

Lessons Learned

The WVDOT Right of Way Division identified several key lessons learned from its implementation process:

- Having more team members involved in implementation will ensure the system will meet the needs of everyone.
- It is important to ensure upper management buys into the system and agrees with decisions being made by the implementation team.

Appendix D – Inventory of Data Elements by Right-of-Way Business Process

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
Project Set-up		
Project Information	• Project number • Project name • Project description • Project location (text) • Project location (geospatial) • Planned project start date • Planned project end date • Actual project start date • Actual project end date • Agency project manager • Phases of work to date (multiple) • Actual start/stop date for each phase of work (multiple)	• Interface with agency financial management or project management system to obtain project information • Manual entry into system of information not available through a system interface based on information provided by Project Planning or Engineering staff
Right-of-Way Phase of Work General Information	• Original planned phase start date • Actual phase start date • Planned phase end date • Adjusted baseline phase end date • Actual phase end date • Original phase budget • Current approved phase budget • Total phase expenditures to date • Total phase encumbrances or commitments • Phase funding balance available • Federal participation %	• Interface with agency Financial or project management system • Manual entry into system based on information provided by Project Planning, Engineering staff and Finance staff for information not available via interface from a financial or project management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	- Federal funding types (multiple) - Other partner participation % (multiple)	

Right-of-way Phase of Work Cost Estimate Information	- Initial estimate of right-of-way cost including:
	  - Date of initial estimate
	  - Basis for initial estimate
	  - Adjustments to right-of-way cost estimate (multiple)
	- History of revisions to cost estimate (multiple) including:
	  - Date of revised cost estimate
	  - Staff member preparing estimate
	  - Reason for revision
	- Current estimate of acquisition costs
	- Date current estimate was last updated by the system
		- Initial estimate may be able to be populated from an agency project management system or estimating system or entered manually into the system
		- Subsequent revisions to estimates would be recorded in the right-of-way system
		- Current estimate of acquisition costs could be calculated by the system from the actual acquisition cost of parcels closed to date and the latest appraisal information entered into the system for parcels not yet acquired or alternatively this data could be manually entered by an authorized user

Current Project Status		
Right-of-way Phase Financial Status	- Actual right-of-way phase cost to date - Right-of-way phase commitments	- Actual cost to date calculated by system based on acquisition cost

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	to date • Right-of-way phase forecasted cost at complete	and other actual right-of-way phase costs (may require data integration with financial system) • Actual commitments to date calculated by system based on any commitments made in right-of-way system and/or financial system (acquisitions approved but not closed, relocation payments pending, etc.) • Forecasted cost at complete calculated by system – current estimate of acquisition cost, relocation cost, consultant cost, etc. May require integration with financial system to obtain all commitments. Calculated field should be adjustable by an authorized user with justification/explanation if there are other anticipated costs known to Right-of-way staff but not yet identified or documented in system
Parcel Acquisition Status	• Number of parcels acquired to date	• Calculated by system based on current status of

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	• Number of parcels pending acquisition • Percentage (%) of parcels acquired to date	parcel acquisition for project
Right-of-way Certification Date	• Projected date for Right-of-way Certification • Actual date for Right-of-way Certification	• Pre-populated by system based on latest estimated date for acquisition of an individual parcel. Also, should be able to be entered or adjusted by an authorized user based on Right-of-way staff knowledge/estimate of likely date for obtaining right-of-way certification • Enterable by authorized user subject to system edit checks (acquisition of all parcels complete, etc.)
Interested Parties		

Individual name and contact information (if individual)	• Name of individual
	• Address/contact Information (multiple) including:
	  - Street
	  - City
	  - State
	  - Zip Code
	  - Country
	• Phone numbers (multiple) and type of phone number
		• Entered manually or interfaced and populated from Right-of-way Plan sheets
		
		• Information is entered one time in a database of interested parties during the acquisition phase and re-used at various points in the right-of-way process (relocation, property

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	• Email address • Demographic information required for any statistical reporting including: - Gender and ethnicity - Low income qualification - Any disabilities	management, etc.)
Business name and contact information (if business)	• Business name • Type of business • Address/contact information (multiple) including: - Contact Name - Street - City - State - Zip Code • Phone numbers (multiple) and type • Email address • Demographic information on business owner(s) needed for any statistical reporting: - Gender and ethnicity - Low income qualification - Any disabilities	• Information is entered one time in a database of interested parties during the acquisition phase and re-used at various points in the right-of-way process (relocation, property management, etc.)
Appraisers, Attorneys , Consultants and Contractors		

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

Company Information	• Company Name
	• Company identification number
	• Agency unique vendor identification number
	• Taxpayer information number (or potentially obtained if needed from agency financial or procurement system)
	• Address/contact information (multiple) including:
	  - Contact Name
	  - Street
	  - City
	  - State
	  - Zip Code
	• Phone numbers (multiple) and type
	• Email address
	• Specializations (multiple)
	• Agency prequalification (multiple) including type of prequalification and effective dates (start/end)
	• Contract history (multiple) including contract number, service types, contract start date and contract end date
		• Information manually entered into system or potentially partially interfaced from an agency procurement or financial system
		
		• Company identification number assigned by system or utilize vendor identification number in another agency system

Individual Appraiser and Consultant Information	• Name • Company identification number • User identification number • Address/contact information	• Information manually entered into system or potentially uploaded from file provided by appraisal or consultant firm

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	(multiple) including: - Street - City - State - Zip Code • Phone numbers (multiple) and type • Email address • Appraiser license: - License number - Expiration date • Skills/certifications/specializations (multiple) as defined by agency • Agency training history (multiple) including classes attended and date attended	• System user-id assigned by system
Agency Employees		
Agency Employee Information	• Name • Employee identification number • Business Unit • Address/contact information including: - Street - City - State - Zip Code • Phone numbers (multiple) and type • Email address	• Information manually entered into system or potentially interfaced in part from agency human resource management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	• Appraiser license:
	  - License number
	  - Expiration date
	• Skills/certifications/specializations (multiple) as defined by agency
	• Agency training history (multiple) including classes attended and date attended	

System Administration		
Roles	• Role identifier for each specific system role • Role description • System functions/windows to which this role has access (multiple) and the types of access allowed (Inquire, Update, etc.)	• Manually entered into system by authorized system administrator
Responsibility	• User id • Authorized Role	• Manually entered into system by authorized system administrator
Parcel Set-up		

Parcel Information	• Parcel number
	• Parcel description
	• Parcel location including:
	  - Lot number
	  - Physical address
	  - Geospatial location
	  - Other descriptive location information
	  - Jurisdiction
		• Interfaced electronically from Right-of-way Plan Sheets or entered directly into system from information on plan sheets or information provided on other documentation prepared by Engineering staff

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	- Zoning • Parcel characteristics including: elevation, monuments, etc. • Parcel area • Parcel attributes or descriptors (multiple) • Underground storage tank flag (Yes/No) • Uneconomic remnant flag (Yes/No) • Utility relocation required (Yes/No)	
Parcel Interests	• Parcel number • Unique parcel interest identifier • Parcel interest type (property, building, mineral, timber, water, air or other interests as defined by an agency)	• Interfaced electronically from Right-of-way Plan Sheets or entered directly into system from information on plan sheets or information provided on other documentation prepared by Engineering staff
Parcel Owners	• Parcel number • Parcel interest identified • Owner names and contact information from interested parties database • % of ownership for each owner	• Interfaced electronically from Right-of-way Plan Sheets and Title Abstract Information or entered directly into system from information on plan sheets or information provided

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	• Nature of ownership (descriptive text)
	• Other notes related to ownership
	• Source of ownership information (Multiple)
	• Results of title abstract search including:
	  - Date of deed
	  - Deed book and page
	  - Declaration of value
	  - Magisterial district
	  - Tax map and parcel if property was obtained by current owner of deed
	  - Whom property was inherited from
	  - Will book and page
	  - Executor of estate and contact information
	  - Previous deed, including deed book and page and date the deed was transferred for property which was inherited and for which there was a valid will
	• Property liens including deeds of trust, vendor liens, judgment liens, etc.:
		on other documentation prepared by Engineering staff
		
		• Owner information linked from Interested Parties database
		
		• Title Abstract Search and other information manually entered into the right-of-way system
		
		• Supporting documentation attached in right-of-way system or link captured to agency document management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	- Lien type - Lien holder - Date recorded • Mortgages including: - Mortgage holder - Date recorded - Outstanding balance • Other supporting documentation	
Appraisal		
Appraisal Waiver	• Appraisal waiver established (Yes or No) • Date of appraisal waiver • Agency staff authorizing waiver	• Manual entry into system
Appraisal Information	• Assigned appraiser linked to appraiser information or employee database • Date appraisal performed • Valuation • Valuation basis • Pictures • Worksheets • Other notes • Other supporting documentation	• Manual entry into system or uploaded from system utilized by Appraisers to prepare Appraisal • Pictures, worksheets and other supporting documentation attached in right-of-way system or link captured to agency document management system
Review Appraisal Information	• Assigned review appraiser linked to appraiser information database or employee database • Date review appraisal performed • Acceptance of appraisal (Yes or No)	• Manual entry into system • Supporting documentation attached in right-of-way system or link captured to agency document management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	• Basis for review assessment • Other notes • Any worksheets and supporting documentation attached	• Potential for use of workflow
Parcel Owner or Other Independent Appraisal	• Appraisal firm performing appraisal • Appraiser name • Appraiser contact information (address, city, state, phone, email) if not already in appraiser database in right-of-way system • Date appraisal performed • Valuation • Valuation basis • Other notes • Worksheets and supporting documentation attached	• Manual entry into system • Appraiser information can be linked to appraisal database if appraiser is already in agency system • Supporting documentation attached in right-of-way system or link captured to agency document management system
Establishment of Just Compensation	• Just compensation amount • Date established • Authorized agency representative approving just compensation • Narrative justification or other notes	• Manual entry into system • Potential for use of workflow to obtain approvals based on established agency business rules
Acquisition		
Negotiation Log	• Negotiator linked from consultant or employee information • Date of contact with property owner	• Manual entry directly into system or from paper form and written notes produced by negotiator • Opportunity for use of

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	• Method of contact • Location of contact • Nature and description of conversation	mobile technology to capture information in the field immediately following meeting with property owner

Offer History	• Offer history (multiple) including:
	  - Offer approved by
	  - Negotiator presenting offer
	  - Date of offer
	  - Offer amount
	  - Other notes
	  - Offer accepted (Yes or No)
	  - Copy of written offer sheet
		• Manual entry into system
		• Supporting documentation attached in right-of-way system or link captured to agency document management system
		• Potential for use of workflow to obtaining any required approvals of offer within the agency

Counter Offer History	Property owner counter offers (multiple) including: • Date of offer • Offer amount • Other notes • Copy of any written information or correspondence presented to the agency	• Manual entry into system • Supporting documentation attached in right-of-way system or link captured to agency document management system
Correspondence Log	• Log of each correspondence with parcel owner including: - Date of correspondence/letter	• Documentation generated by system based on established business rules

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	- Type of correspondence (90-Day Letter, 30-Day Letter, Other) - Copy of correspondence	and/or manual entry into system • Supporting documentation attached in right-of-way system or link captured to agency document management system

Administrative Settlement	• Amount of administrative settlement (if any)
	
	• Date approved
	
	• Authorized agency manager approving settlement
	
	• Other approvals if required by business rules (multiple) including
	
	  - Agency executives, State DOTs for an LPA, FHWA Division Office, etc.
	
	  - Date of approval if granted
	
	  - Comments/notes
		• Manual entry into system
		
		• Potential for use of workflow for various approvals based on business rules

Closing	• Scheduled closing date/time • Closing attorney linked to attorney database • Closing location (Address, City, State) • Date warrant/check Requested • Date warrant/check generated	• Manual entry into system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	• Warrant/check number • Any amounts not reportable on 1099 • Actual closing date/time • Other closing documentation stored in system	

Condemnation Request	• Date recommended for condemnation
	
	• Reasons for initiating condemnation (multiple)
	
	• Narrative justification for initiating condemnation
	
	• Approvals (multiple) based on agency business rules including:
	  - Approved by
	  - Date
	  - Notes/comments
		• Manual entry into system

Initiation of Condemnation	• Assigned attorney • Court of jurisdiction • Date warrant/check requested for filing fee • Date warrant/check generated for filing fee • Warrant/check number for filing fee • Date warrant/check requested for escrow amount • Date warrant/check generated for escrow amount • Warrant/check number for	• Manual entry into system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	escrow amount	

Condemnation Proceedings	• History of court proceedings (multiple) including:
	  - Scheduled court date
	  - Actual hearing date
	  - Hearing purpose
	  - Narrative summary of hearing/trial outcomes
	  - Date of the judge's final order
		• Manual entry into system

Condemnation Resolution	• Date of resolution • Date warrant/check requested to cover any additional amounts due • Date warrant/check generated for any additional amounts due • Warrant/check number for any additional amounts due	• Manual entry into system
Parcel Turn-over to Property Management	• Date title filed with appropriate authority • Date keys received • Other turnover activities and date performed (Multiple activities definable by an agency)	• Manual entry into system
Relocation		
Residential Relocation Information	• Potential residential relocation recipient information linked from interested parties database • Eligible for relocation services (Yes/No) • Date notice of relocation	• Information on individuals linked from interested parties database • Certification information entered into right-of-way system with self-

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	eligibility issued
	 • Date notice of comparable dwelling issued
	 • Date of self-certification of eligibility
	 • Copy of self-certification affidavit stored in the system
	 • Relocation questionnaire information for individuals being displaced including:
	   - Length of time at address
	   - Current lease terms/monthly rent
	   - Utility costs
	   - Plans for relocating
	   - Desired relocation location
	 • Documentation of available replacement housing including:
	   - Location
	   - Date available
	   - Asking price/rent
	   - Property description
	   - Other property attributes
	   - Property inspection (whether or not inspection has been conducted and by whom)
	 • Replacement housing appraisal
		certification scanned and uploaded into right-of-way system or scanned and linked to in an agency document management system
		 • Eligibility information logged manually into system with supporting worksheets attached and uploaded into the system or an agency document management system
		 • Relocation questionnaire information entered manually into the right-of-way system
		 • Replacement housing survey and appraisal information entered manually into right-of-way system
		 • Relocation payment information entered into right-of-way and/or obtained through an interface with the agency financial system
		 • Supporting documentation uploaded and stored in system or linked to in an

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	including:
	
	- Location and type of comparable dwelling
	
	- Description of comparable dwelling (i.e., size, condition, utility and cost including utilities)
	
	- Price used to set upper limit of replacement housing payment
	
	- Rent used to set upper limit of replacement housing payment
	
	• Types of eligible relocation services (Multiple)
	• For each eligible relocation service:
	  - Amount of eligible relocation payment
	  - Relocation accepted (Yes or No)
	  - Date warrant/check for relocation payment requested
	  - Date warrant/check for relocation payment generated
	  - Warrant/check number
	• Relocation worksheets stored In system including:
	  - Moving
	  - Replacement Housing
	• Documentation supporting
		agency document management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	relocation payments stored in system (receipts, etc.)	

Business Relocation Information	• Information on potential recipient of business relocation services linked from Interested Parties database
	
	• Eligible for relocation services (Yes/No)
	
	• Date of Notice of Relocation Eligibility Issued
	
	• Date of self-certification of eligibility
	
	• Copy of self-certification affidavit stored in the system
	
	• Current lease terms including:
	  - Lease amount per month
	  - Date of lease expiration
	
	• Other relocation questionnaire information including:
	  - Length of time at address
	  - Nature/type of business
	  - Current lease terms/monthly rent
	  - Utility costs
	  - Plans for relocating or discontinuing operations
	  - Desired relocation location and other business specific attributes
	
	• Types of Eligible Relocation Services (Multiple)
	
	• For Each Eligible Relocation
		• Information on businesses linked from interested parties database
		
		• Certification information entered and self-certification uploaded into system or linked to in an agency document management system
		
		• Lease and relocation questionnaire information entered manually into the right-of-way system
		
		• Eligibility logged manually into system with supporting worksheets attached and uploaded into the system
		
		• Supporting documentation uploaded and stored in right-of-way system or linked to in an agency document management system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	Service: - Amount of Eligible Relocation Payment - Relocation Accepted (Yes or No) - Date Warrant/Check for Relocation Payment Requested - Date Warrant/Check for Relocation Payment Generated - Warrant/Check Number • Relocation Worksheets Stored In System including: - Moving expenses - Business re-establishment expenses • Documentation Supporting Relocation Payment (Receipts, etc.) Stored in System	
Relocation Log/Diary	• Log of each contact with potential relocation recipient including: - Date of contact - Location - Individuals present linked from interested parties database where possible - Narrative summary of discussion	• Manually entered into system with link to information in interested parties database • Potential to scan and upload notes and/or link to an agency document management system
Relocation	• Log of each correspondence with	• Documentation generated

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
Correspondence Log	eligible party including: - Date of correspondence/letter - Type of correspondence - Copy of Correspondence	by system based on established business rules where possible and/or manual entry into system • Supporting documentation scanned into the right-of-way system or link captured to agency document management system
Property Management		
Asbestos Inspection	• Required (Yes/No) • Scheduled date of asbestos inspection • Actual date of asbestos inspection • Inspection performed by • Cost of inspection • Contract number or purchase order number reference	• Manual entry to the system
Building Demolition	• Demolition of building required (Yes/No) • Scheduled date of demolition (if Yes) • Actual date of demolition (if Yes) • Contractor performing building demolition • Contract number for demolition work • Estimated cost of demolition	• Manual entry into the system with linkage to contractor information and employee information • Potential to interface some information from agency financial or procurement system • Potential for multiple records per building

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	work • Actual cost of demolition work • Agency staff member inspecting work completion • Date of agency inspection	scheduled for demolition
Underground Storage Tank Removal	• Required (Yes/No) • Scheduled date of removal • Actual date of removal • Work performed by • Estimated cost of removal • Actual cost of removal • Contract number or purchase order number reference • Agency staff member inspecting completion of work • Date of inspection	• Manual entry into the system with linkage to contractor information and employee information • Potential to interface some information from agency financial or procurement system • Potential for multiple records per tank requiring removal
Other Required Work or Regularly Scheduled Maintenance Activities (for example Grave Relocation, etc.)	• Type of work • Date scheduled • Date performed • Contractor or internal staff performing work • Estimated cost of work activity • Actual cost of work activity • Contract number or purchase order number reference • Agency staff member inspecting work completion • Date of inspection	• Manual entry to the system with linkage to contractor information and employee information • Potential to interface some information from agency financial or procurement system • Work types definable by authorized user
Lease Management	• Parcel number or other unique	• Parcel and/or parcel

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	identifiers for parcel being leased Parcel interest being leased (fee, air rights, mineral rights, etc.)
	
	• Source of acquisition of property or property rights (i.e. from whom did the agency acquire this property or property right being leased)
	   - Name
	   - Deed book
	   - Page number
	   - Instrument number
	
	• Parcel or parcel Interest was acquired with Federal funds (Yes/No)
	
	• Required approvals to lease property:
	   - Agency staff approvals and date approved (multiple)
	   - FHWA or other external approvals if required and date approved (multiple)
	   - Agency Board and/or other required Board approvals and date
	
	• Lessee information linked from interested parties database
	
	• Date Lease Executed
	
	• Lease Begin Date
	
	• Lease End Date
	
	• Fair market rent determination:
		interest information including whether Federal funds utilized linked from Acquisition function if available; otherwise information about the parcel or parcel interest being leased will need to be manually entered based on available agency records
		
		• Customer information linked from interested parties database
		
		• Required approvals obtained through electronic sign-offs in the system
		
		• Lease terms and deposit information will be manually entered into the system
		
		• Potential to interface from/to accounts receivable function of agency financial system to generate customer invoices and obtain payment history information back from agency financial system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	- Valuation: - Performed by: - Date of valuation: - Date valuation approved • Deposit information: - Deposit paid (Yes/No): - Date of deposit: - Amount paid • Lease financial terms including: - Lease payment - Payment period (Monthly or other) - Date payment due - Interest or other applicable late fee • Payment history (multiple) including: - Payment received date - Check number - Amount received - Balance due (if any) - Late fee (if any) • Current customer account balance/balance due (if any)	
Sale/Disposition	• Parcel number or other identifier • Parcel interest being sold (fee, air rights, mineral rights, etc.) • Source of acquisition of property or property rights (i.e. from whom did the agency acquire this	• Parcel and/or parcel interest information including whether Federal funds utilized linked from Acquisition function if available; otherwise information about the

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection
	property or property right being sold) - Name - Deed book - Page number - Instrument number • Parcel or parcel interest was acquired with Federal funds (Yes/No) • Documentation that parcel or parcel interest was offered to government agencies (if initial purchase was Federally funded): - Agency - Date offered - Date notified of decision by Agency - Copies of supporting documentation • Required approvals to sell property: - Agency approvals and date approved (multiple) - FHWA or other external approvals if required and date approved (multiple) - Agency Board or other required Board approvals and date • Buyer information linked from interested parties database	parcel or parcel interest being proposed for sale will need to be manually entered based on available agency records • Buyer information linked from interested parties database • Record of property purchased with Federal funds being offered to Federal agencies first is manually entered into the system • Tracking of required sign—offs by internal staff of a property sale will be based on workflows within the system or manual data entry • External partner and board approvals of a property sale will be based on either partner approvals within the system or data entry into the system • Fair market value information entered into the system • Deposit information entered into the system • Manual entry into system

Business Function or Sub-function and Associated Data Type	Data Elements	Method of Collection

	• Fair market value determination:
	  - Valuation
	  - Performed by
	  - Date of valuation
	  - Date valuation approved
	• Deposit information:
	  - Deposit paid (Yes/No)
	  - Date of deposit
	  - Amount paid
	• Sale price
	• Closing date
	• Amount due/paid at closing
	• Closing attorney (if utilized)
	• Date title transferred/recorded
	• Copy of deed of sale
		or interfaced from auction web site or other third party system
		• Supporting documentation attached in right-of-way system or link captured to agency document management system
		
		• Sale information potentially interfaced to asset accounting module of agency financial system

Exhibit E - Acknowledgments

The research team would like to thank the staff members of the 24 agencies who responded to the initial questionnaire. We would especially like to thank the staff from the nine (9) agencies who then participated in the follow-up detailed questionnaire. The information obtained through these two survey instruments was a critical element in the conduct of this research project.   The agencies completing the detailed questionnaire were:

- Idaho Transportation Department, Right of Way Section

- Kentucky Transportation Cabinet, Division of Right of Way and Utilities

- Maricopa County, Public Works Real Estate Division

- Maryland State Highway Administration, Office of Real Estate

- Minnesota Department of Transportation, Office of Land Management

- Polk County Florida, Right of Way and Real Estate Section

- South Dakota Department of Transportation, Right of Way Program

- Tennessee Department of Transportation, Right of Way Division

- West Virginia Department of Transportation, Right of Way Division