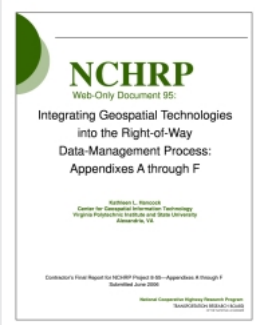


Integrating Geospatial Technologies into the Right-of-Way Data-Management Process: Appendixes A through F

DETAILS

0 pages | null | PAPERBACK

ISBN 978-0-309-43654-0 | DOI 10.17226/23203

AUTHORS

NCHRP

Web-Only Document 95:

Integrating Geospatial Technologies into the Right-of-Way Data-Management Process: Appendixes A through F

Kathleen L. Hancock
Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
Alexandria, VA

Contractor's Final Report for NCHRP Project 8-55—Appendixes A through F
Submitted June 2006

National Cooperative Highway Research Program
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

ACKNOWLEDGMENT

This work was sponsored by the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program (NCHRP), which is administered by the Transportation Research Board (TRB) of the National Academies.

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished schol-ars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and techni-cal matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Acad-emy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achieve-ments of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Acad-emy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. William A. Wulf are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, the Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation. The Board's varied activities annually engage more than 5,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

CONTENTS

APPENDIX A

ANNOTATED BIBLIOGRAPHY

A list of references that use GIS and other technologies for Right-of-Way and related activities is provided in section A-1 in alphabetical order by author. This is followed by an annotated bibliography of these documents in alphabetical order by title in section A-2. A series of crosswalks of documents by annotated categories is then provided in section A-3. The annotated categories include:

- Category of ROW functions: Listed
- Type of article/paper/study: Listed
- Type of system: Listed
- Survey results included: Yes/No
- Benefit/Cost information included: Yes/No
- Lessons learned provided: Yes/No
- Data elements included: Yes/No
- Contact information provided: Yes/No

A-1 LIST OF REFERENCES

AASTHO, (2004), VDOT becomes model for Right-of-Way computer streamlining, United States, Virginia Department of Transportation, Virginia.
Web page: http://www.virginiadot.org/business/row-default.asp

Ader, B., (2003). Cadastral Data Content Standard for the National Spatial Data Infrastructure, United States, Subcommittee on Cadastral Data, Federal Geographic Data Committee, Version 1.3., Reston, Virginia.
Web page: http://www.fgdc.gov/fgdc.html

Amadori, J., (2006), Collier County Right-of-Way Application, United States, Data Transfer Solutions, LLC, Florida.

Bacon, M., Smith, R., et.al, (1993), Management Guide for Implementation of Geographic Information System (GIS) in State DOTs, United States, University of Wisconsin-Madison, Transportation Research Board, HRD191,Washington, DC.

Balakrishnan, S., (2002), Data Specification for Utility GIS and Corresponding Cost Benefits in the year 2002, India, Consultants India, Chennai.
Web page: www.gisdevelopment.net/application/utility/power/

Cadastral Subcommittee, (2005), Cadastral Core Data, United States, Federal Geographic Data Committee Subcommittee for Cadastral Data, Eastern Cadastral Steering Committee, Western Cadastral Steering Committee, Core Data Standard Development Team, Version 7, Washington, DC.
Web page:
http://www.nationalcad.org/data/documents/Cadastral Core Data Verison 7.pdf

Clup, M., and Bills, T., (1998), Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project, United States, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.
Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/scag/

Clup, M., and Parrott, B., (1998), Transportation Case Studies in GIS, Case Study 5: SANDAG's Multiple Species/Habitat Conservation Programs and Transportation Planning,United States, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.
Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/sandag/

Clup, M., Foster, D., Stills, W., (1998), Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning, United States, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.
Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/ncdot/

Davey GIS services, (2002), GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas, United States, Cincinnati Parks Board, Ohio.

Web page:
http://www.davey.com/cgi-bin/serveFile.pl/ROWMgt.pdf?type=adventure&fieldname=pdf&id=89

Davey GIS services, (2002), Vegetation Management System—Interstate Right of Way, United States, Cincinnati Parks Board, Ohio.
Web page:
http://www.davey.com/cgi-bin/serveFile.pl/CinciTurf.pdf?type=adventure&fieldname=pdf&id=92

Davis, D., and Judd, C., (2003), The challenges of building an enterprise-quality web mapping solution for state Government, United States, Florida Department of Environmental protection, Florida.

Davis, S., (2004), State Model for Coordination of Geographic Information Technology, United States, National States Geographic Information Council, Lexington, Kentucky.
Web page: http://www.nsgic.org/states/statemodel_git.pdf

Elfick, M., Hodson, T., Wilkinson, C., Managing a Cadastral SDI Framework built from boundary dimensions, United States, TS39.1, Cairo, Egypt.

ESRI, (2005), GIS for Cadastre Management, United States, ESRI, California.
Web page: http://www.esri.com/library/brochures/pdfs/gis-for-cad-mgmt.pdf

Facilities Geodetic Control Subcommittee, Federal Geographic Data Committee, (1998), Geospatial Positioning Accuracy Standards, United States, Federal Geographic Data Committee, FGDC-STD-007-1998, Virginia.
Web page: http://www.fgdc.gov/standards/documents/standards/accuracy

Facilities Working Group, Federal Geographic Data Committee, (2000), Appraisal Utilities Data Content Standard, United States, Federal Geographic Data Committee, FGDC-STD-010-2000,Virginia.
Web page: http://www.fgdc.gov/standards/documents/standards/utilities/utilities.pdf

Faucett, J., (2003), Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report, United States, Federal Highway Administration, DTFH61-01-T-08008, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/finalsynthtoc.pdf

Federal Highway Administration, (2000), Design / Build Contracts and Right-of-Way Activities, United States, Federal Highway Administration, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/dbcrwa.htm

Federal Highway Administration, (2003), Excellence in Right-of-Way Awards, United States, Federal Highway Administration, FHWA-EP-03-03, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/rowea04/

Federal Highway Administration, (2004), Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards, United States, Federal Highway Administration, FHWA-HEP-04-010, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/rowea04/

Federal Highway Administration, (2004), GIS in Right of Way scan, Federal Highway Administration, United States, FHWA Office of Real Estate Services, Tallahassee, Florida.

Federal Highway Administration, (2005), State Environmental Streamlining and Stewardship Practices Database, United States, Federal Highway Administration, Washington, DC.
Web page: http://environment.fhwa.dot.gov/strmlng/index.asp

Fraser, R., (2000), Analysis of Transmission Line Routing Alternatives with Multiple Scenarios, United States, ESRI Users Conference, Palm Springs, California.
Web page: http://gis.esri.com/library/userconf/proc00/professional/papers/PAP704/p704.htm

GIS/Trans Limited, (1999), Transportation Case Studies in GIS, United States, Travel Model Improvement Program, U.S. Department of Transportation, Federal Highway Administration, Washington, DC.
Web page: http://www.bts.gov/tmip/gis.htm

Gunning, A., (2001), GIS Applications Using Digital Orthophoto Data, United States, Pima Association of Governments, 8th TRB Conference on Application of Transportation Planning Methods, Session 12,Texas.

Hanson Professional Services Inc., (2005), Electronic Project Management for Land Acquisition, United States, The division of Aeronautics, Illinois Department of Transportation, Illinois.

Heiner, JD., Kockelman, KM., (2005), Costs of Right-of-Way Acquisition: Methods and Models for Estimation, United States, Journal of Transportation Engineering, Volume: 131, Issue: 3.

Highway Subcommittee on Right of Way and Utilities, (2004), Right of Way and Utilities Guidelines and Best Practices, Strategic Plan Strategy 4-4, United States, American Association of State and Highway Transportation Officials Standing Committee on Highways, Washington, DC.
Web page: http://www.international.fhwa.dot.gov/eurorightofway/index.htm

Khunke, C., (2001), Pipeline R-O-W management at light speed, Canada, GIS for Oil & Gas Proceedings, Terra Remote Sensing Inc., Sidney.
Web page: www.terraremote.com

Kim, E., Jha, MK., Schonfled, P., (2004), Intersection Construction Cost Functions for Alignment Optimization, United States, American Society of Civil Engineers-Journal of Transportation Engineering, Volume:130, Issue:2, Virginia.

Krugman, R., McLawhorn, N., and Orvis, C., (2004), 2004 Wisconsin Real Estate Peer Exchange, United States, Research, Development & Technology Transfer program, Wisconsin Department of Transportation, Madison, Wisconsin.
Web page: http://www.fhwa.dot.gov/realestate/bhrerpt.htm

Marose, R., Gooch, C., (2004), Digital Land Record Information, United States, California Mapping Coordinating Committee, CMAS 3-01-70-1451A, California.
Web page: http://gis.ca.gov/council/docs/DLRI_Report_Final.pdf

Mehta, A., (2006), Highway Access Controls: Decision Support Utilizing Spatial Coordination, United States, Bureau of Information Technology Services, Wisconsin Department of Transportation, Wisconsin.

Michigan Department of Transportation, (2003), Real Estate Management Information System, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit F, Michigan.
Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Mississippi Department of Transportation, (2002), ROW Parcel Tracking System Detailed requirements/ Functional design document, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit I, Mississippi.
Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Nagy, Z., (2004), Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data, United States, Federal Geographic Data Committee Subcommittee for Cadastral Data, Eastern Cadastral Steering Committee, Western Cadastral Steering Committee, Core Data Standard Development Team, Version 5, Washington, DC.
Web page:
http://www.nationalcad.org/data/documents/NC Guideline Content Elements for Parcel Publishing-v5.pdf

National Alliance of Highway Beautification Agencies, (2001), Transportation Case Studies in GIS, United States, U.S. Department of Transportation, Federal Highway Administration, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/oanatl/index.htm

National Cooperative Highway Research Program, (2000), Innovative practices to reduce delivery time for Right-of-Way in project development, NCHRP SYNTHESIS 292, United States, Transportation Research Board-National Research Council, Washington, DC.

National Telecommunications and Information Administration, (2002), State and Local Right-Of-Way Success Stories, United States, U.S Department of commerce, Washington, DC.
Web page: http://www.ntia.doc.gov/ntiahome/staterow/ROWstatestories.htm

New Jersey Department of Transportation, (2004), Right-of-Way information system, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Washington, DC.
Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Office of Program Administration, (2003), Utility Relocation and Accommodation on Federal-Aid Highway Projects: Program Guide, United States, Federal Highway Administration, Sixth edition, Washington, DC.
Web page: http://www.fhwa.dot.gov/reports/utilguid/

Office of Real Estate Services, (2002), Challenges and Opportunities, United States, Federal Highway Administration, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/2002rowr.htm

Office of Real Estate Services, (2003), Challenges and Opportunities, United States, Federal Highway Administration, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/2003rowr.htm

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of Florida Outdoor Advertising – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Florida.
Web page: http://www.fhwa.dot.gov/realestate/oacases/casefl.htm

Office of Real Estate Service, (2004),Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Kansas.
Web page: http://www.fhwa.dot.gov/realestate/oacases/caseks.htm

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Missouri.
Web page: http://www.fhwa.dot.gov/realestate/oacases/casemo.htm

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Montana.
Web page: http://www.fhwa.dot.gov/realestate/oacases/casemt.htm

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, New Jersey.
Web page: http://www.fhwa.dot.gov/realestate/oacases/casenj.htm

Office of Real Estate Services, (2005), Right-Of-Way Domestic Scan, United States, Federal Highway Administration, Austin, Texas.

Web page: http://www.fhwa.dot.gov/realestate/scans/ausfreport.htm

Office of Real Estate Services, (2005), Right-of-Way Outreach and Program Research, United States, Federal Highway Administration, Washington, DC.
Web page: http://www.fhwa.dot.gov/realestate/research.htm

Overturf, Bradly J., (2002), Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System, United States, Connecticut Department of Transportation, Report No. 1136-F-02-8, Connecticut.
Web page: http://docs.trb.org/00938448.pdf

Ozbay, Kaan, (2004), Development and Evaluation of Management Information Systems, United States, New Jersey Department of Transportation, 60-32RU848, New Jersey. **Web page:** http://www.cait.rutgers.edu/project-briefs/1999-2000/60-32Ru848.html

Peters, D., (1999), Right of Way Quality Management System-The Journey of five states, United States, Federal Highway Administration, United States Department of Transportation, Washington, DC.
Web page: www.fhwa.dot.gov/realestate /rowmgt/

Petyon, L., Mississippi Department of Transportation, (2002), ROW Parcel Tracking System Detailed requirements/Functional design document, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit H, Mississippi.
Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Quiroga, C., (2003), Research improves right-of-way management, United States, Texas Transportation Researcher, Volume 39, No.1, Washington, DC.
Web page: http://tti.tamu.edu/researcher/newsletter.asp?vol=39&issue=1&article=11

Quiroga, C., Pina, R., (2002), Development of a GIS platform for inventory of utilities located within TxDOT Right-of-Way, United States, Texas Department of Transportation (TxDOT), Project No. 0-2110, Texas.
Web page: http://imr.tamu.edu/projects/0-2110/Summary.htm

Quiroga, C., Pina, R., (2003), Utilities in Highway Right-of-Way: Data Needs and Modeling, United States, Transportation Research Board, Issue: 1851, Paper: 03-3362, Washington, DC.

Sydelko, P.J., (1997), ROW planning: Saving Pipeline Industry Time and Money, United States, Argonne National Laboratory, Illinois.
Web page: http://www.es.anl.gov/htmls/row.planning.html

Thorne, J., Turner, D., Lindly, J., (1993), Highway/Utility Guide, United States, Federal Highway Administration, United States Department of Transportation, FHWA-SA-93-049, Washington, DC.

Web page: http://www.fhwa.dot.gov/programadmin/utility.html

Xybernaut Solutions, Inc., Louisiana Department of Transportation and Development, Appraisal, Acquisition, and Relocation System (AARS), United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit J, Washington, DC.
Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Zhang, Z., Caldas, C., (2005), Electronic appraisal development study update, United States, AASTHO/FHWA ROW & Utilities Subcommittee Conference, Project 9-1523, Texas.
Web page: http://www.dot.state.tx.us/row/aashto.htm

A-2 ANNOTATED BIBLIOGRAPHY

2004 Wisconsin Real Estate Peer Exchange

Krugman, R., McLawhorn, N., Orvis, C., (2004), 2004 Wisconsin Real Estate Peer Exchange, United States, Research, Development & Technology Transfer program, Wisconsin Department of Transportation, Madison, Wisconsin.

Web page: http://www.fhwa.dot.gov/realestate/bhrerpt.htm

Category of ROW functions:	Property appraisal
	Other
Type of article/study:	Report
Type of system:	Not identified
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

The report contains the best practices and experiences of DOTs in improving the ROW processes.

Summary:

The Wisconsin Department of Transportation (WisDOT) Bureau of Highway Real Estate (BHRE) is working to streamline and optimize many of its program areas in the face of budget cuts, restructuring, and inefficiencies. In an effort to be as successful as possible in these efforts, WisDOT hosted a peer exchange. The goal of the meeting was to provide an opportunity for Wisconsin and all other participating states to learn from the successes and experiences of others.

Under the best practices that were discussed in this program, developing and using electronic appraisals and databases was mentioned as a good valuation methodology. Among the best practices in the area of consultants and in-house staffing, pre-qualification of consultants via online was suggested. The survey results are presented in Appendix-C of the report.

Analysis of Transmission Line Routing Alternatives with Multiple Scenarios

Fraser, R., (2000), Analysis of Transmission Line Routing Alternatives with Multiple Scenarios, United States, ESRI Users Conference, Palm Springs, California.

Web page: http://gis.esri.com/library/userconf/proc00/professional/papers/PAP704/p704.htm

Category of ROW functions:	Utility relocation management
Type of article/study:	Paper
Type of system:	ARC/INFO, ArcView GIS, Microsoft Access
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This paper describes the series of steps involved in identifying the best parcels for acquisition in a ROW project.

Summary:

A 345-kV transmission line is proposed by Wisconsin Public Services and Minnesota Power between Weston, Wisconsin and Duluth, Minnesota with a 115-kV line extending form Rhinelander, Wisconsin to Tripoli, Wisconsin. Public meetings were held in each county with in the study area to identify issues and concerns. Over 1000 miles of alternative route segments were analyzed in ARC/INFO and in ArcView GIS software's GeoProcessing Wizard in an economical manner. Each line segment had one or more possible scenarios – parallel to an existing transmission line; double-circuit an existing line; relocate an existing line to new ROW; adjacent to road, railroad, or pipeline ROWs; or use new ROW – that required different ROW widths on each side of the line segment. Region buffers were created based on the scenarios, which were then intersected with the land cover and wetland data and analyzed for the number of acres of new or existing ROW. The data was taken into Microsoft Access in order to create summary tables for reach route.

Appraisal, Acquisition, and Relocation System

Xybernaut Solutions, Inc., Louisiana Department of Transportation and Development, Appraisal, Acquisition, and Relocation System (AARS), United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit J, Washington, DC.

Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Category of ROW functions:	Property acquisition Property appraisal Relocation assistance
Type of article/study:	Report
Type of system:	Oracle, Microsoft Visual Studio, HTML, Java, SQL Navigator, RoboHelp, Windows NT2000 (OS), Internet Information Server, Microsoft Transaction Server, Microsoft Data Access Components.
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The document is a brief overview of AARS developed as a part of the Program and Project Management System (PPMS) project developed for Louisiana Department of Transportation and Development (LA DOTD).

Summary:

LA DOTD has developed additional capability to plan and manage parcels of land in their Right-of-Way (ROW) through automation. They have incorporated a two database approach due to two different modules, Internet and Intranet. The internet modules are used by internal LA FOTD resources, while the internet modules will be used by the external consultants. The objectives targeted by LA DOTD for AARS are briefly specified in the document. Internet, Intranet and common modules in AARS and their functionality and user domain is mentioned clearly. The future visions of the LA DOTD in are also discussed at the end.

Cadastral Core Data

Cadastral Subcommittee, (2005), Cadastral Core Data, United States, Federal Geographic Data Committee Subcommittee for Cadastral Data, Eastern Cadastral Steering Committee, Western Cadastral Steering Committee, Core Data Standard Development Team, Version 7, Washington, DC.

Web page: http://www.nationalcad.org/data/documents/Cadastral Core Data Verison 7.pdf

Category of ROW functions:	Others
Type of article/study:	Report
Type of system:	Not identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	No

Applicability:

The document contains the standards that are to be used for publication and distribution of cadastral information.

Summary:

Cadastral core data is a minimum set of attributes about land parcels that is used for publication and distribution of cadastral information by cadastral data producers. The Cadastral Core Data defines the minimum content for the Cadastral National Spatial Data Infrastructure (NSDI).
The Cadastral Core Data will be extracted from parcel data producers at all levels of government, but primarily local governments from real tax systems and federal agencies for federally held lands. Cadastral Core Data will be standardized so it can be integrated across jurisdictional boundaries, from county-to-county and from state-to-state.

The Cadastral Core Data definition does not define the form, format, structure or content of the more detailed information. Likewise, it is not intended to replace or supersede existing data provisioning polices.

The history and current status of core data, characteristics and categories of information, cadastral core data elements and data elements from business cases are discussed in the report in a rather exhaustive manner.

Cadastral Data Content Standard for the National Spatial Data Infrastructure

Ader, B., (2003), Cadastral Data Content Standard for the National Spatial Data Infrastructure, United States, Subcommittee on Cadastral Data, Federal Geographic Data Committee, Version 1.3., Reston, Virginia.

Web page: http://www.fgdc.gov/fgdc.html

Category of ROW functions:	Property appraisal
	Property/Asset Management
Type of article/study:	FGDC Report
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The FGDC Cadastral Data Content Standard provides semantic definitions of objects related to land surveying, land records, and land ownership information.

Summary:

The subcommittee on cadastral data aimed to provide a standard for the definition and structure of cadastral data which will facilitate data sharing at all levels of government and the private sector and will protect and enhance the investments in cadastral data at all levels of government and the private sector. The goals for cadastral data content standard are to provide common definitions for cadastral information found in public records, which will facilitate the effective use, understanding and automation of land records; to provide suggested attribute values which will enhance data sharing, to resolve discrepancies related to the use of homonyms and synonyms in federal land record systems which will minimize the duplication within and among those systems, to provide guidance and direction for land records and land surveying professionals on standardized definitions which will improve land records, automation, management, and to use participatory involvement in the standard development to reach out to non-federal organizations that will encourage broadly based application of the standard.

Challenges and Opportunities

Office of Real Estate Services, (2002), Challenges and Opportunities, United States, Federal Highway Administration, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/2002rowr.htm

Category of ROW functions:	Planning & Management
	Property appraisal
	Other
Type of article/study:	Report
Type of system:	Not identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

In this report contains the initiatives taken by FHWA on the occasion of earth day to serve the communities which are affected by their projects.

Summary:

FHWA right of way staff supported Earth Day through enhancement projects, acquisition of scenic easements, outdoor advertising control, junkyard screening, and a respect for visual quality when developing projects. They are evaluating the modification to traditional appraisal review requirements in 49 CFR 24.104. They are supporting the use of electronic appraisal methods by States. This initiative is evaluating methods and techniques. It might include the use of artificial intelligence to perform quality checks on valuation documentation.

The research areas of FHWA with automation include a small business innovative research project examining the use of photogrammetric stereo images to assist access control managers with driveway and land use change permits. A preliminary test is underway in one district in Florida. The second research area is the impact of highway on property values in Baltimore, Maryland. A limited study is underway to determine the effect of highways on property values. This study is being done by Morgan State University. The plan is to develop a software model for this analysis.

Challenges and Opportunities

Office of Real Estate Services, (2003), Challenges and Opportunities, United States, Federal Highway Administration, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/2003rowr.htm

Category of ROW functions:	Planning & Management
	Property acquisition
	Property appraisal
Type of article/study:	FHWA Report
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

In this report, the innovative practices in Right-of-Way were briefly discussed.

Summary:

The report consists of vital issues, innovative practices in various fields, scans, ROW training and administration in which Right-of-Way Innovative Practices Domestic Scans was also discussed. The topics investigated during the scan include context sensitive design and right-of-way involvement, access management with emphasis on interchange optimization, relocation innovation on the Woodrow Wilson Bridge project, right of way contractor management practices or design build projects and right-of-way, right-of-Way Aspects of Design Build, electronic Appraisals Pooled Fund Research and Individual State Research, LPA Stewardship for Right-of-Way and the Future of Right-of-Way in Innovative Financing**.**

Right-of-Way Electronic Appraisals Pooled Fund Research:

State Department of Transportation pooled fund research project on the electronic transmission and storage of appraisals and appraisal related documents. The goal of the research is to develop a "How To" manual of instruction for the electronic transmittal, storage, and retrieval of appraisal documents. Potential follow on research and implementation activities and the current state of electronic appraisal transmission and appraisal software creation and implementation. The 9 states participating in this research currently are Alabama, Alaska, Florida, Louisiana, New York, North Carolina, Tennessee, Texas and Wisconsin.

The Challenges Of Building An Enterprise-Quality Web Mapping Solution For State Government

Davis, D., and Judd, C., (2003), The challenges of building an enterprise-quality web mapping solution for state Government, United States, Florida Department of Environmental protection, Florida.

Category of ROW functions:	Other
Type of article/study:	Paper
Type of system:	GIS
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This paper discusses various steps taken to enhance ArcIMS systems for security, reliability and performance.

Summary:

Florida Department of Environmental Protection (FDEP) has taken up the challenge to build a commercial-grade, centrally-managed, web mapping system that would replace an existing handful of independent, internet and intranet map servers. The goals identified for the project are security, redundancy (reliability) and performance. To improve the security, a reverse proxy server for ArcIMS configuration was implemented. Tools like IIS Lockdown and URL Scan were used to secure the servers and apply an additional layer for their two web/application servers. Along with security, the reverse proxy server has benefited by easing access for administrative and maintenance tasks for the ArcIMS servers, improving the file transfer and ArcIMS administrative tasks during trouble-shooting and error resolution and allowing the spatial servers to maintain faster network connections to the vector and raster data servers. Secondly, redundancy would help reduce single points of failure by having duplicated machines in the case of hardware malfunction, while also providing load balancing to distribute sever processing. But, limitations like deadlines, sparse funding, and stretched staff resources make this infeasible. The goal has been partly reached by an ArcIMS design that features a three tier, distributed system with separate platforms for web/application server, spatial server and data server components. Using another reverse proxy server, IP load balancing, ArcIMS Fail-over and ArcIMS load balancing are the future plans to achieve better reliability. The performance of the system was slightly boosted by using distributed system design, ArcIMS spatial server load balancing efforts, and by specifying more RAM for spatial server hardware and efficient developmental practices.

The paper discusses the lessons learned in designing, building and implementing a highly available, fault-tolerant and distributed ArcIMS system.

Collier County Right-of-Way Application

Amadori, J., (2006), Collier County Right-of-Way Application, United States, Data Transfer Solutions, LLC, Florida.

Category of ROW functions:	Property appraisal Property acquisition Property/Asset Management
Type of article/study:	Other
Type of system:	CarteGraph, ArcGIS, SQL
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This application helps to make informed decision related to the Right-of-Way acquisition process.

Summary:

Collier County Right-of-Way Application combines GIS functionality with data management and asset management which helps in decision making and management of Right-of-Way acquisition process. The application helps track all relevant information of the parcels that would have to be acquired due to the Right-of-Way project like dates and required documents. Detailed reports allow for review of current costs for litigation, costs for acquisition, historical trends of hard and soft costs and. Other uses with GIS Parcel data directly linked to Property Appraiser's database would be to have up-to-date parcel data, up-to-date area and property values and accurate owner information.

Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards

Federal Highway Administration, (2004), Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards, United States, Federal Highway Administration, FHWA-HEP-04-010, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/rowea04/

Category of ROW functions:	Planning & Management Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	FHWA News Release
Type of system:	GIS, Internet services
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This news release contains a brief overview of Right-of-Way projects that include outstanding innovations.

Summary:

The projects that enhanced the right-of-way professional's ability to meet the challenges associated with acquiring real property for a Federal-aid project in United States were identified and presented 2004 Excellence in Right-of-Way Awards. Some of the DOTs that developed systems that are integrated with GIS or any other software tool are described briefly. Alabama DOT received innovation award for making electronic copies of all the documents and then make them accessible through any user over internet. This system helped to improve the service to the customers and the efficiency of the ROW department due to lesser informational retrieval times, and reduce the costs of maintenance of documents. The New Mexico DOT implemented GIS applications for managing Indian land acquisitions, government land acquisitions, property management and monitoring water rights. The Right-of-Way Bureau's Railroads and Utilities Section is currently in the final stage of implementing an internet-based GIS rail/highway grade crossing system. This Honorable Mention Award recognizes the Office of Real Estate Management System (OREMS) created by the Maryland State Highway Administration (MSHA) to streamline the paperwork involved in the right-of-way process. The system allows many acquisition tasks and processes to be automated, and integrates scanned acquisition plats enabling real property specialists to log into the system and print copies of the latest plats from a computer.

Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data

Nagy, Z., (2004), Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data, United States, Federal Geographic Data Committee Subcommittee for Cadastral Data, Eastern Cadastral Steering Committee, Western Cadastral Steering Committee, Core Data Standard Development Team, Version 5, Washington, DC.

Web page:
http://www.nationalcad.org/data/documents/NC Guideline Content Elements for Parcel Publishing-v5.pdf

Category of ROW functions:	Others
Type of article/study:	Report
Type of system:	Other
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	No

Applicability:

The document contains the standards that are to be used for publication and distribution of cadastral information about land parcels.

Summary:

Cadastral core data is a minimum set of attributes about land parcels that is used for publication and distribution of cadastral information by cadastral data producers and maintainers. The core data is intended to provide sufficient information to support integrating basic land parcel information across jurisdictional boundaries and answering fundamental questions for business processes that need cadastral information. This document contains descriptions of the elements for parcels that may be provided by local data producers to integrate parcel information across the region. More detailed information will always be gathered from the data producer.

In order to integrate information across the state and build a seamless parcel map for North Carolina the parcel was tied to a common coordinate system and meet all of the national specifications, which include the National Spatial Reference System (NSRS), Orthophotography and a reference system. In North Carolina, the NC State Plane Coordinate system is used as a grid reference for the creation of map sheets. A metadata reference should describe the parcel dataset for any given jurisdiction and should meet Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata. It should contain information about the entire data set such as county name, county parcel contact, a description of the basis for the assessment system (cost, use, market value etc), and the date of the file.

Costs of Right-of-Way Acquisition: Methods and Models for Estimation

Heiner, JD., Kockelman, KM., (2005), Costs of Right-of-Way Acquisition: Methods and Models for Estimation, United States, Journal of Transportation Engineering, Volume: 131, Issue: 3.

Category of ROW functions:	Planning & Management
	Property acquisition
	Property appraisal
Type of article/study:	Other
Type of system:	Other
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The paper presents various hedonic price models for cost estimation associated with property acquisition in ROW.

Summary:

Accurate cost estimation procedures are needed to facilitate budgeting and timely completion of the Transportation projects. The costs of partial takings, commercial properties, remainder damages, court costs, utility relocations, and other ROW- related items are difficult to anticipate.

This paper describes some hedonic price models and large sample data analysis that might help agencies track and predict ROW costs and the likelihood of damages. The models in the paper present the cost associated with taking property using recent acquisition data form several Texas corridors and commercial sales transactions in Texas. Each model is based on some criteria that differ from model to model. Results indicate that damages depend heavily on parking, access, and location. Value of improvements was observed to be more influential then the size of the taking, and the utility costs are highly variable. In case of the commercial property value models, improvement square footage and the condition of the property were very significant predictors.

Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002

Balakrishnan, S., (2002), Data Specification for Utility GIS and Corresponding Cost Benefits in the year 2002, India, Consultants India, Chennai.

Web page: www.gisdevelopment.net/application/utility/power/

Category of ROW functions:	Property/Asset management
	Utility relocation management
	Other
Type of article/study:	Paper
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This paper discusses the aspects to be considered by utility ROW firms to develop appropriate technical specifications.

Summary:

Utility companies must consider certain factors to decide upon the specification for their GIS data. Impact of technology on the cost of data acquisition, impact of maturity of GIS data vending industry, impact of better and cheaper GIS software, cost of upgrading the landbase at a future date are some of the key areas that are to be researched on to make a rational decision. This analysis is more specific to the developing counties like India. Two kinds of data acquisition methods are identified namely fine mapping and coarse mapping based on the quality of data. An optimal data model is chosen by considering various factors like cost of Geometric data, as varying over time, cost of GIS software and hardware of different capabilities, benefits derived from different systems and cost of future upgrade if applicable. Some facts and proactive analyses of the GIS industry are presented in the paper that is immensely helpful in optimization.

Design / Build Contracts and Right-of-Way Activities

Federal Highway Administration, (2000), Design / Build Contracts and Right-of-Way Activities, United States, Federal Highway Administration, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/dbcrwa.htm

Category of ROW functions:	Planning & Management Property acquisition Property appraisal Relocation assistance
Type of article/study:	FHWA Report
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This report has guidelines and recommendations that have to be followed to include (RoW) acquisition in design/build projects.

Summary:

The article has brief description of the background of design/build projects which includes their advantages over traditional ways as well as limitations in various aspects. Recently, design/build projects have been authorized to include (R/W) acquisition in addition to design and construction, creating a "turnkey" project for the State. The unique characteristics of design/build projects, recommendations and best practices for design/build contracting and right-of-way best practices to consider in design/build projects were mentioned in a very detailed manner. One of the points in recommendations for design/build contracting is establishment of a project tracking system and quality control system where the contractor shall provide a project tracking system acceptable to the State DOT which shall show the appraisal, acquisition and relocation status of all parcels or submit regularly scheduled reports.

Development and Evaluation of Management Information Systems

Kaan Ozbay, (2004), Development and Evaluation of Management Information Systems, United States, New Jersey Department of Transportation, 60-32RU848, New Jersey.

Web page: http://www.cait.rutgers.edu/project-briefs/1999-2000/60-32Ru848.html

Category of ROW functions:	Planning & Management Property/Asset management
Type of article/study:	Report
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This document discusses a project in which GIS is used for electronic data storage and retrieval.

Summary:

The main goal of this Management Information Systems (MIS) application, used in conjunction with geographical information system, is to facilitate the access to ROW maps by electronically storing them in a database linked to a GIS map. This allows NJDOT personnel to find and access all of the ROW information available pertaining to any particular road contained on the GIS mapping system. The task descriptions, budget, project schedule and technology transfer activities are mentioned in the document.

Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System (OASIS)

Bradly J. Overturf, (2002), Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System, United States, Connecticut Department of Transportation, Report No. 1136-F-02-8, Connecticut.

Web page: http://docs.trb.org/00938448.pdf

Category of ROW functions:	Outdoor Advertising
Type of article/study:	Report
Type of system:	GPS, GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

A summary report of the GIS-based right-of-way outdoor advertising sign information system implemented by ConnDOT .

Summary:

The project focused on providing automated data acquisition and storage systems to enhance the advertising sign-inventory process. Specifically, in the areas of data collection, storage, and dissemination of information and integration with related information systems in ROW were addressed. The project objective was to develop and implement an automated image- and data acquisition and retrieval system for ROW. The system is integrated with current field photolog activities and data processing operations.

In the report, aspects like image and data needs in the office of rights-of-way, project objective, project activities, implementation stages and benefit cost analysis of OASIS are presented in detail.

Development Of A GIS Platform For Inventory Of Utilities Located Within Txdot Right-Of-Way

Quiroga, C., Pina, R., (2002), Development of a GIS platform for inventory of utilities located within TxDOT Right-of-Way, United States, Texas Department of Transportation (TxDOT), Project No. 0-2110, Texas.

Web page: http://imr.tamu.edu/projects/0-2110/Summary.htm

Category of ROW functions:	Utility relocation management
Type of article/study:	Research Report
Type of system:	GIS, Web-enabled data entry
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This research report reviews existing sources of utility data, summarizes the GIS model, and describes a GIS/Internet-based prototype system.

Summary:

Each year, thousands of new utilities are installed within the TxDOT right-of-way (ROW). With the proliferation of utilities within its ROW, it is becoming increasingly difficult for TxDOT not only to allow more utilities but also to deliver and manage its own transportation system in a timely and efficient manner. TTI researchers developed a geographic information system (GIS)-based model that associates positional data with details of utility facility ownership, service or commodity type, infrastructure size, material, and other pertinent characteristics. The main objects of their project were to compile and review existing sources of utility data at TxDOT, developing a GIS model to represent the location of utility facilities located within the TxDOT ROW and associated attribute data such as ownership, purpose, size, type, and other pertinent characteristics, developing a Internet-based prototype that automates the utility permitting data entry and review process, provide recommendations for implementing and expanding the prototype GIS platform and provide recommendations for standards and minimum requirements for quality and content.

Digital Land Record Information (DLRI)

Marose, R., Gooch, C., (2004), Digital Land Record Information, United States, California Mapping Coordinating Committee, CMAS 3-01-70-1451A, California.

Web page: http://gis.ca.gov/council/docs/DLRI_Report_Final.pdf

Category of ROW functions:	Other
Type of article/study:	Report
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This report provides a summary of land information needs and four options for fulfilling needs with different investment levels for the state of California.

Summary:

Land information is vital to the operation of all segments of our society fueling economic development, land planning and management, infrastructure management, public safety, and homeland security. Government and private businesses require and use land information daily to conduct their business activities but often must rely on inadequate information because public agencies are not coordinating strategies. Street addresses and land parcels are used as a means of referencing public and private assets, services, and managing business transactions. So, implementing a statewide land information program will result in better information access supporting the State's business operations. Modern information technology known as geographic information systems (GIS) combines computer mapping and databases to provide effective access and use of land information.

This report has a brief description of the present land information needs and various options available to fulfill these needs in California. Each implementation option presented within this report will improve accessibility for the State, thus enhancing the effectiveness of State programs. With the more comprehensive options, beneficiaries of a coordinated statewide Land Information system would include all levels of government, private enterprise, and property owners. Public and private business activities that will be enhanced are very broad including property tax administration, real estate transactions, property management, environmental management, public safety operations, land use planning, infrastructure planning and management, disaster response and recovery, and resource planning and management.

The report mainly consists of existing land record environment in California, state agency DLRI needs, DLRI status of California, other states and federal government, statewide DLRI vision, data profiles and standards, implementation options, costs and benefits.

Electronic Appraisal Development Study Update

Zhang, Z., Caldas, C., (2005), Electronic appraisal development study update, United States, AASTHO/FHWA ROW & Utilities Subcommittee Conference, Project 9-1523, Texas.

Web page: http://www.dot.state.tx.us/row/aashto.htm

Category of ROW functions:	Planning & Management
	Property appraisal
	Property/Asset management
Type of article/study:	Presentation
Type of system:	Web-based data entry
	Decision support system
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This presentation provides ideas for a project on Electronic Appraisal System (EAS) in the ROW.

Summary:

The Right-of-Way appraisal process utilizing manual data entry and manual appraisal report generation might result in inconsistent appraisal data as individuals with varying degrees of experience, knowledge and background are employed to perform land appraisals for Right-of-Way acquisition which may result in variations in the value placed on land between two different appraisers evaluating the same or similar piece of property. So, a statistical procedure is proposed to reduce such inconsistencies. So it was decided to develop a conceptual framework, user functional needs, data and technical requirements for an electronic appraisal system (EAS) that can be used to capture, transmit, store, manage, analyze, and report appraisal data to improve the appraisal process and therefore reduce inconsistencies in land appraisal values. As the study has begun recently information for developing and implementing an Electronic Appraisal System will be available at the end of this study. The details of work schedule of the project, conceptual framework, key features of EAS, future work and anticipated products are available in the presentation.

Electronic Project Management for Land Acquisition

Hanson Professional Services Inc., (2005), Electronic Project Management for Land Acquisition, United States, The division of Aeronautics, Illinois Department of Transportation, Illinois.

Category of ROW functions:	Planning & Management
	Property acquisition
	Relocation assistance
	Property/Asset management
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The article is a brief overview of a GIS-internet based application used for land acquisition management.

Summary:

The application was developed to manage the land acquisition in an airport project. Using myriad of paper reports and charts to provide information on the progress of the project does not always provide up to date information or sometimes cannot be found in time for a meeting. Another pitfall is that they normally are not georeferenced.

GIS is more than mapping software. It is a technology that manages, analyzes, and disseminates geographic knowledge. Most computer technology is designed to increase a decision- maker's access to relevant data. But, GIS goes beyond sifting data to give you the tools to interpret that data, allowing you to see relationships, patterns, or trends intuitively that are not possible to see with traditional charts, graphs, and spreadsheets.

This article has a brief description of all the layers used, design criteria, the benefits of the application when compared to the traditional acquisition process, the data elements, and snap shots of various reports showing the summaries of property management functions, expenses and income.

State Environmental Streamlining and Stewardship Practices Database

Federal Highway Administration, (2005), State Environmental Streamlining and Stewardship Practices Database, United States, Federal Highway Administration, Washington, DC.

Web page: http://environment.fhwa.dot.gov/strmlng/index.asp

Category of ROW functions:	Other
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This database contains examples of streamlining and stewardship practices used by states to efficiently and effectively fulfill their National Environmental Policy Act (NEPA) obligations.

Summary:

Environmental Streamlining and Stewardship requires transportation agencies to work together with natural, cultural, and historic resource agencies to establish realistic timeframes for transportation project development and environmental review. These agencies need to work cooperatively to adhere to those timeframes, while they are protecting and enhancing the environment. The efficient and effective coordination of multiple environmental reviews, analyses, and permitting actions is essential to meeting the Environmental Streamlining and Stewardship mandates for highway and transit projects under SAFETEA-LU.

This site is designed to provide guidance and information on FHWA Environmental Streamlining and Stewardship initiatives and practices found across the country. The map can be clicked to retrieve all practices for a state or the database can be searched using the search engine to find specific practices with keywords like 'GIS'.

Excellence in Right-of-Way Awards

Federal Highway Administration, (2003), Excellence in Right-of-Way Awards, United States, Federal Highway Administration, FHWA-EP-03-03, Washington.

Web page: http://www.fhwa.dot.gov/realestate/rowea04/

Category of ROW functions:	Planning & Management Property appraisal & review Outdoor advertising Property/Asset management
Type of article/study:	FHWA News Release
Type of system:	Internet services, ORACLE, GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This News Release contains a brief overview of the Right-of-Way projects that incorporate outstanding innovations.

Summary:

The projects by DOTs across the country that improved existing processes, created new processes to improve the project development and delivery process, assumed leading roles in project right of way activities, delivered cost savings, and improved production time are chose to be the winners of Excellence in Right-of-Way Awards. Some of the applications that incorporated automation are as follows.

Illinois

The Illinois Department of Transportation's (IDOT) created an Internet subscription service for IDOT property disposal. The new subscription service provided customers e-mail notifications of excess property sales and disposals tailored to their interests. The service also allowed IDOT to maintain one centralized list instead of nine district lists and provided existing customers with the opportunity to update their own record to indicate address changes or changes in notification preferences. New customers were able to subscribe to future notices by simply entering information. The new catalog is dynamic and updated as properties are sold and new properties are made available. Each listing in the catalog provides the user with text information on property location, photographs, and a user-friendly map of sites and contact information for district office personnel. The new catalog provides the public with a searchable record of previous IDOT property disposals that contains sales prices and related information and can also be used to research IDOT demolition contracts. This automation has cut IDOT's costs for disposing of excess property, reduced IDOT man-hours and paperwork, created a centralized listing of property disposal information and provided customers with a database of sales and historical sales information and also helped move excess properties back to local tax rolls as quickly and efficiently as possible.
South Dakota Department of Transportation improved their efficiency by implementing an updated electronic appraisal and appraisal review software program.

Missouri

Missouri Department of Transportation (MoDot) developed a new and improved computerized system for outdoor advertising control that implores the management of all outdoor advertising and junkyard control. Benefits of the new system are an inventory of signs and junkyards with physical information and digital photos, provides sign and junkyard location information precisely on the state road system, allows signs and junkyards to be displayed on GIS system map applications, provides individual sign and junkyard information storage and retrieval capabilities, tracks new sign and vegetation permit applications and automatically generates letters, permits and other necessary documents, controls the billing process and interface with State Financial Management Systems, and tracks invoice delinquencies, enforces collections and makes reporting data available through Oracle software. The new system also allows the MoDOT to generate a monthly inventory of permits due for renewal in the counties with the route and location sequence, along with physical characteristics information, checked during inspection, provide detailed summary reporting on all aspects of outdoor advertising and junkyard control, produce reports on business activity revealing such details as the distribution of renewals across the biennial renewal cycle, which allows MoDOT to balance and direct personnel resources, and control outdoor advertising and junkyards on regulated routes more effectively and efficiently.

Geospatial Positioning Accuracy Standards

Facilities Geodetic Control Subcommittee, Federal Geographic Data Committee., (1998), Geospatial Positioning Accuracy Standards, United States, Federal Geographic Data Committee, FGDC-STD-007-1998, Virginia.

Web page: http://www.fgdc.gov/standards/documents/standards/accuracy

Category of ROW functions:	Other
Type of article/study:	Report
Type of system:	Not identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The report is an elaborate description of the standards that needs to be followed in for utilities data.

Summary:

This document provides a common methodology for reporting the accuracy of horizontal coordinate values and vertical coordinate values for clearly defined features where the location is represented by a single point coordinate. It provides a means to directly compare the accuracy of coordinate values obtained by one method with that obtained by another method for the same point. It is increasingly important for users to not only know the coordinate values, but also the accuracy of those coordinate values, so users can decide which coordinate values represent the best estimate of the true value for their applications. These standards can be used in geospatial data applications in areas such as transportation, community development, agriculture, emergency response, environmental management, and information technology.

Part1 of the report consists of geospatial positioning accuracy standards. Part2 has standards for geodetic networks. Geodetic control surveys are usually performed to establish a basic control network (framework) from which supplemental surveying and mapping work are performed. The third part of the report is about the spatial data accuracy standards. The National Standard for Spatial Data Accuracy (NSSDA) implements a testing and statistical methodology for positional accuracy of fully georeferenced maps and digital geospatial data, in either raster or vector format.

GIS Applications Using Digital Orthophoto Data

Gunning, A., (2001), GIS Applications Using Digital Orthophoto Data, United States, Pima Association of Governments, 8th TRB Conference on Application of Transportation Planning Methods, Session 12,Texas.

Category of ROW functions:	Others
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

The article is about possible application of digital orthophotos data for public agencies, private sector, and common people.

Summary:

The Pima Association of Governments has acquired a digital orthophotos flight covering over 1200 square miles. This provides the detail of a high resolution aerial photograph with the spatial accuracy of a geo-referenced map which allows for measurement of distance and area. The article describes the benefits and costs, future steps and possible applications of the data developed in the project.

The ultimate product of this effort will be a comprehensive and accurate set of geo-referenced data on a common base for use in modeling, analysis and a multitude of project applications, offering greater precision and regional consistency.

GIS for Cadastre Management

ESRI, (2005), GIS for Cadastre Management, United States, ESRI, California.

Web page: http://www.esri.com/library/brochures/pdfs/gis-for-cad-mgmt.pdf

Category of ROW functions:	Other
Type of article/study:	Case studies
Type of system:	GIS, GPS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The document is compiled by ESRI (major GIS software developer), to illustrate the benefits of GIS in cadastre management.

Summary:

Geographic information system (GIS) technology offers cadastres a method of quickly accessing and producing maps, leveraging database information, and automating enterprise work processes. The vocation of the cadastre for all countries has become multipurpose: serving administrative mandates, maintaining an up-to-date database, assigning values for taxation, calculating subsidies, addressing rural development and agrarian management, and providing products and services to citizens and companies. GIS helps land information agencies fulfill a variety of these services, from producing specialized maps to providing complex schemes for integrating and delivering spatial data services under the modern mode of e-government.

In this document case studies of the applications developed by European countries using GIS were discussed elaborately. The countries and the field in which GIS was used by them are as follows: Sweden has achieved automated workflow, Italy's application enables data interchange between land record office and local agencies, Lithuania and North Ireland used GIS for land valuation, Cyprus has multipurpose cadastres, Belgium has unified the cadastre and land registration agencies (National cadastre GIS extends to National spatial data infrastructure) and the Republic of Slovakia has the parcel identification system that is tied up to the agricultural information.

Along with the case studies, ESRI has documented the various advanced tools (internet portals, data interoperability extension, etc), direct (automated workflow, data options, incorporating survey results, data accuracy, etc) and indirect (economic health, multiuse cadastre, etc) advantages of GIS in maintaining the cadastre data. The document also consists of ESRI business partners who would be providing GIS solutions

GIS in Right of Way Scan

Federal Highway Administration, (2004), GIS in Right of Way Scan, Federal Highway Administration, United States, FHWA Office of Real Estate Services, Tallahassee, Florida.

Category of ROW functions:	Planning and Management Outdoor advertising Property/Asset Management Property acquisition
Type of article/study:	FWHA Scan
Type of system:	GIS Web mapping systems, Oracle, VB6, Web-enabled data entry
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This scan provides relatively new GIS uses in ROW.

Summary:

Through this scan, participants explored the development of new GIS tools that allow earlier input of ROW data to aid in project decision making. New technology that allows web-based systems to be developed while incorporating state-of-the-art aerial and 3D stereo imagery was demonstrated. Various applications are presented to explain the usage of GIS in ROW. In the Florida DOT spatial, a-spatial databases and the actual map are linked using GIS, VB6 and Oracle for outdoor advertising and inventory management. The system was designed to track all the aspects of ROW down to individual interests in the real estate. The Department of Environmental programs uses a web point application that allows GIS points to be verified and updated using aerial imagery and other layers. This lessens the time and cost associated with traveling to the field to verify data. GIS is used in the ROW acquisition which has enabled to them to have reduced research and response time with fewer resources. They had accurate information at the time of negotiation. The New Mexican DOT has used GIS in property/asset management, excess land disposition, etc. This resulted in easy access to both visual and text data of NMDOT owned properties, resulting in minimum use of hardcopy data and operating costs. In another application GIS is used in ROW decision making in which information can be added to a form via online GIS interface. GIS proximity analyses can be used to locate additional features on the map that are useful for completing or analyzing an application.

GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas

Davey GIS services, (2002), GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas, United States, Cincinnati Parks Board, Ohio.

Web page:
http://www.davey.com/cgi-bin/serveFile.pl/ROWMgt.pdf?type=adventure&fieldname= pdf&id=89

Category of ROW functions:	Others
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The article published by Davey GIS services regarding the GIS use in vegetation management along Right of Ways.

Summary:

Vegetation along rights of way (ROW) is managed for various reasons including outage prevention (electrical transmission), maintenance access (pipelines), and safety (highways).Unfortunately, certain management techniques such as herbicide use or heavy equipment are incompatible with various ROW landscapes. Enhanced management can be facilitated by deriving a map of environmentally sensitive areas using existing GIS data. These areas can be identified using specific attributes of hydrology, slope, and soils data. The result is in-office analysis before any herbicide or heavy equipment is sent into the field. Incorporating advance knowledge of environmentally sensitive areas into ROW management plans helps bolster public sentiment, reduce costs, foster environmental stewardship, contribute to regulatory compliance, and provide legal defense assistance.

Highway Access Controls: Decision Support Utilizing Spatial Coordination

Mehta, A., (2006), Highway Access Controls: Decision Support Utilizing Spatial Coordination, United States, Bureau of Information Technology Services, Wisconsin Department of Transportation, Wisconsin.

Category of ROW functions:	Property/Asset Management
Type of article/study:	Paper
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The abstract below describes phase I of an applications framework, who's data, and other layers are used in a corollary project to plan on emerging development pressures.

Summary:

Wisconsin Department of Transportation's Highway Access Management System (HAMS) is a one-stop Web portal designed to simultaneously answer all questions related to DOT reviews and to provide end-to-end automation for the business process and workflow of driveway permits and land division reviews. These reviews require the simultaneous addressing of temporal, legal, spatial, and automation aspects given the multifaceted nature of the access management process. Conceived as a decision support system, HAMS is a data warehouse with several components including a document management system; roadway data repository; engineering, GIS, and USGS 24K quads server; as well as a core relational database that holds data on land divisions, keywords, the State Access Management Plan, statutory access controls, and data from a workflow tracking system. HAMS combines the capabilities of all these components into one spatially driven Web interface so that the interaction of the user with the system is simple and straightforward.

Highway/Utility Guide

Thorne, J., Turner, D., Lindly, J., (1993), Highway/Utility Guide, United States, Federal Highway Administration, United States Department of Transportation, FHWA-SA-93-049, Washington, DC.

Web page: http://www.fhwa.dot.gov/programadmin/utility.html

Category of ROW functions:	Utility relocation management
Type of article/study:	Research Report
Type of system:	GIS, GPS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This report provides guidance on better practices to be employed to address the issues of highway and utility facilities sharing common right-of-way.

Summary:

Better practices that were thought to address the full array of issues which can arise from highway and utility facilities sharing common right-of-way are presented in this Highway/Utility guide. The guide states that some of the good practices in the area of information management and mapping are to use single common base map by all the users of the public ROW, to use central repository to record all of the facilities within the ROW which should simplify and economize the planning and design of construction repairs, minimize construction delays and reduces construction damage. The central repository would provide a consolidation of mapping that would avoid duplication of map. The map programs can be combined with an inventory in a computerized system with a separate layer for each utility.

The benefits of Computer-Aided Design and Drafting, automated mapping and facility management merged capabilities were briefly stated. The term GIS-T has been coined to denote the application and capabilities of a GIS in the transportation field. A GIS-T permits the assimilation, integration, and presentation of data collected and stored by each of the divisions within a highway agency.

Innovative Practices To Reduce Delivery Time For Right-Of-Way In Project Development

National Cooperative Highway Research Program, (2000), Innovative practices to reduce delivery time for Right-of-Way in project development, United States, Transportation research board-National research council, NCHRP SYNTHESIS 292, Washington, DC.

Category of ROW functions:	Planning & Management Property Appraisal
Type of article/study:	NCHRP Synthesis
Type of system:	Electronic document transfers, electronic signatures, Intranet databases, Information technology tools, computer based project scheduling tools.
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This report contains an analysis done of transportation agencies in the United States to reduce the delivery time for ROW in project development.

Summary:

The Right-of-Way function is an important element in project development. This synthesis examines the delivery of ROW and property interests for project construction and mitigation activities and reports on successful strategies employed by agencies to accelerate this process. After a thorough research it was identified that sufficiently trained and experienced staff, administrative settlements, effective use of contract service providers, use of information technology tools like electronic document transfers, intranet databases, electronic signatures and other information technology tools; development of effective computer-based project scheduling tools, delegating authority to project development teams, better coordination with design function, etc. can accelerate the right-of-way delivery.

Intersection Construction Cost Functions for Alignment Optimization

Kim, E., Jha, MK., Schonfled, P., (2004), Intersection Construction Cost Functions for Alignment Optimization, United States, American Society of Civil Engineers-Journal of Transportation Engineering, Volume:130, Issue:2, Virginia.

Category of ROW functions:	Planning & Management
	Engineering & Mapping
	Property acquisition
	Property appraisal
Type of article/study:	Paper
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

The paper presents a method for precisely formulating intersection construction costs including earthwork, right-of-way, and pavement costs.

Summary:

Intersection design characteristics are reviewed and intersection cost components are formulated in the paper. Coordinates of intersections and other points of interest are found. Because estimating right-of-way costs requires identifying affected properties and structures in the vicinity of an intersection, two examples based on geographic information system (GIS) databases from Maryland and an artificial study area are presented to show how the developed cost functions can be used in real applications. The costs incurred are categorized according to the extent and type of damage to the property. This method is based on the state of Maryland's GIS databases and its method of estimating right-of-way costs. The cost is affected by the size, shape, and relative isolation of properties. The estimation procedures largely automate and computerize the existing appraisal process of the Maryland State Highway Administration's Office of Real Estate.

The developed intersection construction cost functions can be incorporated in previously developed highway alignment optimization models that neglected the characteristics and costs of intersections.

Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report

Faucett, J., (2003), Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report, United States, Federal Highway Administration, DTFH61-01-T-08008, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/finalsynthtoc.pdf

Category of ROW functions:	Planning & Management Engineering & Mapping Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	FHWA Report
Type of system:	None identified
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This report discusses an integrated approach for all the disciplines in ROW activities.

Summary:

This report is developed for the United States Department of Transportation's Federal Highway Administration (FHWA) project. Findings in this report were developed based on a review of available literature, an analysis of results from the FHWA Integration Solutions Survey, and through input and suggestions from a Sounding Board of nationwide transportation professionals. The project focuses on the integration of the disciplines of planning, environment, engineering and real estate in the development of transportation solutions. The role of each discipline within the framework of the transportation development process, as well as in relationship to each other is discussed. Analysis of key success factors and challenges associated with the implementation of an integrated approach is also made. The report contains suggestions provided by survey respondents for improving coordination between disciplines and enhancing the smooth transition from a linear process to a more integrated approach. An annotated bibliography was complied from relevant studies and information which includes internet searches, discussions with involved FHWA parties, and discussions with relevant American Association of State Highway and Transportation Officials (AASHTO), Transportation Research Board (TRB) and other transportation-related entity committee members.

Management Guide for Implementation of Geographic Information System (GIS) in State DOTs

Bacon, M., Smith, R., et.al, (1993), Management Guide for Implementation of Geographic Information System (GIS) in State DOTs, United States, University of Wisconsin-Madison, Transportation Research Board, HRD191,Washington, DC.

Category of ROW functions:	Other
Type of article/study:	Report
Type of system:	GIS-T
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This is a guide to the DOTs for implementation of Geographic Information System in managing ROW activities

Summary:

The purpose of the management document is to provide a basic understanding of GIS and GIS-Transportation (GIS-T), to describe the factors involved in successful planning and implementation of GIS-T, to provide a basic understanding of how GIS-T can benefit transportation agencies and to describe benefit-cost considerations and methods for evaluating the success of GIS-T implementation. The work reported herein is intended to provide a basis on which individual transportation agencies can develop or revitalize and then process with plans to exploit GIS technology to the fullest in both the near-term and long-term futures.

Managing A Cadastral SDI Framework Built From Boundary Dimensions

Elfick, M., Hodson, T., Wilkinson, C., Managing a Cadastral SDI Framework built from boundary dimensions, United States, TS39.1, Cairo, Egypt.

Category of ROW functions:	Property appraisal Property/Asset Management
Type of article/study:	Paper
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This paper introduces an approach to improve and maintain the accuracy of cadastral boundary geometry which is a key layer in geographic information systems used for ROW applications.

Summary:

As the cadastral information is the most important layer in property related geographic information systems, the accuracy of this layer is a major aspect for any applications using GIS. This paper emphasizes that improvement of this layer, and thus concurrent improvement of geometry of other layers constructed with reference to the cadastral boundaries. In countries where cadastral boundaries are defined by dimensional data, the only way to generate a reliable and accurate cadastral boundary is by direct use of this dimensional data. This requires extending standard GIS systems for the management and storage of dimensional data, including special software tools for data entry, analysis and processing. This includes a method for updating GIS feature layers from the changes in the boundary geometry of the cadastral fabric.

Outdoor Advertising – National Study

National Alliance of Highway Beautification Agencies, (2001), Transportation Case Studies in GIS, United States, U.S. Department of Transportation, Federal Highway Administration, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/oanatl/index.htm

Category of ROW functions:	Outdoor Advertising
Type of article/study:	Survey
Type of system:	Not identified
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	No

Applicability:

The document has the results of a national survey to determine the functioning of the Department of Outdoor Advertising in each DOT's.

Summary:

The FHWA's Office of Real Estate Services (ORES) sponsored, in coordination with the National Alliance of Highway Beautification Agencies (NAHBA), a national survey of all states in an effort to determine the types of outdoor advertising (ODA) data each state collects, modes of collection, maintenance and usage of data. The survey showed that many states are now using automated data collection systems for the administration of their outdoor advertising programs. The majority of those states find these systems sufficient for managing the day-to-day needs and requirements of their ODA program. On the other hand, the majority of states using non-automated data collection systems find them inadequate for managing their ODA program.

An attempt was made in the survey to determine the level of consistency in the definition of certain outdoor advertising terms amongst the states. The terms investigated include "normal maintenance", "urban area" and "unzoned commercial and industrial area". The survey results are presented in the form of pie-charts and bar graphs and explained lucidly. Recommendations for further research and the issues that can be investigated in future were also discussed at the end of the document.

Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of Florida Outdoor Advertising – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Florida.

Web page: http://www.fhwa.dot.gov/realestate/oacases/casefl.htm

Category of ROW functions:	Outdoor advertising
Type of article/study:	Case study
Type of system:	GIS, GPS, Oracle
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This research study examines outdoor advertising (ODA) methods of data collection, sources of information, and database maintenance in Florida using electronic data management capabilities.

Summary:

In the case study, aspects like need for the electronic data management system, system requirements, process of system selection, system design and development process, software and hardware requirements, type of the system developed, data collection procedures and mechanics, existing data transfer to the new system, strengths, weaknesses and keys to over come weaknesses were elaborated upon. The cost of the system including design, implementation, training, hardware and software equipment and maintenance were provided. The appendix of the case study has the business rules devised by State of Florida Outdoor Advertising Department, snapshots of the application and data elements in the system database.

The ODA-Inventory Management System (IMS) system is a client-server application using an Oracle relational data base. It supports all the activities undertaken by the Central and District ODA offices, as well as supporting the use of the District field computers for purposes of data collection and maintenance. The data base is menu driven with object oriented, Windows-type screens. The system also includes an Internet component that allows access to data via the Internet and web browsers such as Microsoft Explorer and Netscape. The web server accesses data in a replicated data base (which might be a subset of the original one) so as not to compromise the security of the ODA-IMS system. The system contains various error-checking mechanisms and security elements. A history log which includes the date of the change, the type of change, and identification of the system user is kept for all changes/updates made to the data base. Additionally, when field data is uploaded, any data elements that have been changed are displayed along with their previous value to protect the consistency of data. The system generates reports based on common needs identified by ODA staff and also accommodates generating other non-standardized reports based on data queries made by the user.

Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System

Office of Real Estate Services, (2004), Outdoor Advertising-State Study State of Montana – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Montana.

Web page: http://www.fhwa.dot.gov/realestate/oacases/casemt.htm

Category of ROW functions:	Outdoor advertising
Type of article/study:	Case study
Type of system:	GPS, Oracle
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This research study examines outdoor advertising methods of data collection, sources of information, and database maintenance in Montana using electronic data management capabilities.

Summary:

In the case study, aspects like need for the electronic data management system, system requirements, process of system selection, system design and development process, software and hardware requirements, type of the system developed, data collection procedures and mechanics, existing data transfer to the new system, strengths, weaknesses and keys to over come weaknesses were elaborated upon. The cost of the system including design, implementation, training, hardware and software equipment and maintenance were provided. The appendix of the case study has snapshots of the application and data elements in the system database.

The Outdoor Advertising Control (OAC) is a client-server application using an Oracle relational database. OAC is housed on the Central office server where the entire database is stored and District offices are networked to HQ for use of the database. Forms or entry screens are each separate files that are stored locally on the District office computers to facilitate faster display of screens. Digital cameras can be connected directly to laptops available in the District Offices and images are stored at one location in the file system. That location is maintained within the database and can be changed at any point of time without disturbing the software. The system locates signs by route number and milepost, but was designed with fields to accommodate GPS coordinates. Screens are object-oriented, Windows-type screens with radio buttons or pull-down menus associated with as many fields as possible. Users must log on using a user-ID. All users have access to all data in the data base. An entry log is maintained that records the date, time and user-ID for the last change made to any data element in the database. Data inspected and manually changed in the field is entered into the system in the District offices. Several frequently used queries and resulting reports are embedded in the system. Customized queries and reports can also be generated easily by the system.

Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Missouri.

Web page: http://www.fhwa.dot.gov/realestate/oacases/casemo.htm

Category of ROW functions:	Outdoor advertising
Type of article/study:	Case study
Type of system:	ArcView (GIS), GPS, Oracle
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This research study examines outdoor advertising methods of data collection, sources of information, and database maintenance in Missouri using electronic data management capabilities.

Summary:

In the case study, aspects like need for the electronic data management system, system requirements, process of system selection, system design and development process, software and hardware requirements, type of the system developed, data collection procedures and mechanics, existing data transfer to the new system, strengths, weaknesses and keys to over come weaknesses were elaborated upon. The cost of the system including design, implementation, training, hardware and software equipment and maintenance were provided. The appendix of the case study has snapshots of the application and data elements in the system database.

The Transportation Management System (TMS) is a client-server PC based system using Oracle database software. The ODA module is one aspect of the Travelway Features Management system within the MoDOT Transportation Management System. The screens are menu-driven, object-oriented, windows type screens. Several commonly used queries and reports are included in the design of the system. Customized queries and reports can also be generated.

The system includes various error checking features including a user-ID and password log-on requirement, and drop-down menus associated with most data fields. The user's ID defines the level of access he or she has to certain data in the system. Various internal data checks are also built into the system that check the validity of the data entered.

Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System

Office of Real Estate Services, (2004), Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, New Jersey.

Web page: http://www.fhwa.dot.gov/realestate/oacases/casenj.htm

Category of ROW functions:	Outdoor advertising
Type of article/study:	Case study
Type of system:	GPS, Microsoft Access
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This research study examines outdoor advertising methods of data collection, sources of information, and database maintenance in New Jersey using electronic data management capabilities.

Summary:

In the case study, aspects like need for the electronic data management system, system requirements, process of system selection, system design and development process, software and hardware requirements, type of the system developed, data collection procedures and mechanics, existing data transfer to the new system, strengths, weaknesses and keys to over come weaknesses were elaborated upon. The cost of the system including design, implementation, training, hardware and software equipment and maintenance were provided. The appendix of the case study has snapshots of the application and data elements in the system database.

The New Jersey Outdoor Advertising (NJODA) is a client-server application using a menu-driven Microsoft Access relational database. The database is designed with four levels of information storage. Each level of information is password protected so that information at that level is only accessible to those approved to operate at that level. The system accommodates digital storage, displaying up to three photographs for each sign in the system. The system server has room for storage of as many photographs as desired for each sign, but only three are displayed on the screen. The system also stores and retrieves upon command scanned documents associated with a particular permit number. The screens are object-oriented, Windows type screens. As many fields as possible have pull-down menus to help eliminate data entry errors. Other error checking features include the password protected segmentation of the data mention above, and imported data control. Imported data controls are implemented by the system when data from the field is uploaded for permanent updating of the system data base. Any new or changed data is displayed along with the corresponding previous value for that data item. The user can selectively opt to accept or deny any of the changes/additions. The system can be queried quickly on a frequently used subset of fields. Other custom queries can also be created easily.

Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System

Office of Real Estate Services, (2004),Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System, United States, Federal Highway Administration, U.S. Department of Transportation, Kansas.

Web page: http://www.fhwa.dot.gov/realestate/oacases/caseks.htm

Category of ROW functions:	Outdoor advertising
Type of article/study:	Case study
Type of system:	Object View software, DB2/2 database (on an OS2 platform), ClearAccess
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This research study examines outdoor advertising methods of data collection, sources of information, and database maintenance in Kansas using electronic data management capabilities.

Summary:

In the case study, aspects like need for the electronic data management system, system requirements, process of system selection, system design and development process, software and hardware requirements, type of the system developed, data collection procedures and mechanics, existing data transfer to the new system, strengths, weaknesses and keys to over come weaknesses were elaborated upon. The cost of the system including design, implementation, training, hardware and software equipment and maintenance were provided. The appendix of the case study has snapshots of the existing application and data elements in the system database.

The existing ROW system is a client/server application using a DB2/2 relational database. The screens are Windows type screens with drop-down menus associated with many of the fields, limiting the possible entries for those fields. Some fields are also color coded which illustrates the ability to edit that field. Users of the system must sign on using a unique user-ID and password that provides access to the entire system. Reports automatically generated by the system include: work assignment report, permit report, sign certificates, single sign report, sign renewal letter, mailing labels, detail sign inventory, prepaid license fee, control audit report, and voucher report (deposits). At this point, the outdoor advertising program had been using the ROW system for about 3 years. The new system is currently being developed.

The new system will be a client/server system function on a Windows NT 4.0 operating system and will use an Oracle RDMS database. The sign portion of the system (as opposed to the portion of the system dealing with salvage yards) is scheduled to be implemented by the end of the first quarter of 2001. Enhancements such as database replication, web-enablement digital image storage and use of GPS technology will become follow-on projects which have not yet been explored.

Pipeline R-O-W Management At Light Speed

Khunke, C., (2001), Pipeline R-O-W management at light speed, Canada, GIS for Oil & Gas Proceedings, Terra Remote Sensing Inc., Sidney.

Web page: www.terraremote.com

Category of ROW functions:	Utility relocation management
Type of article/study:	Paper
Type of system:	GIS, LIDAR
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This paper provides a case study that examines the advantages of using LIDAR bathymeter and GIS in the industry of oil and gas transmission—pipeline ROW management.

Summary:

The paper examines how the application of a new air remote sensing technology, LIDAR and GIS, can cost-effectively provide simple and transparent management tools needed to design, build, manage and value the billions of dollars in pipeline infrastructure. Sophisticated airborne scanning LIDAR devices integrated with digital imagery and GPS/IMU systems can provide rapid and precise x, y and z positioning and detailing, with considerable cost savings. Its ease of integration into any existing GIS brings both strategic and financial benefits. LIDAR bathymeter with georeferenced imagery flown simultaneously results in the end product that is a powerful tool for coastal management around the world. Some of the most striking differences with this new approach are data processing can begin immediately, often before the data acquisition is complete. Secondly, a helicopter platform can vary its speed to provide denser data (permits the data collection of up to one million data points per minute) at some sensitive or crucial locations and finally, the outputs of the process are readily sleevable into any off-the-shelf or custom GIS. Williams Gas Pipeline which serves a substantial amount of population in United States in the sector of natural gas was built with help of this technology integration. The terrain scanning laser produced the bare earth ground DEM and vegetation profiles for corridor management. High resolution digital imagery provided precise capture of the entire right-of-way, and a half-mile buffer zone for alternate routings.

It has been thus identified that LIDAR systems are fast, precise and cost-effective means to acquire, process and deliver critical geospatial data for energy supply.

Real Estate Management Information System

Michigan Department of Transportation, (2003), Real Estate Management Information System, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit F, Michigan.

Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Category of ROW functions:	Planning & Management Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	Report
Type of system:	PowerBuilder 7.0.3, Padlock2.0 security system, Novell GroupWise Message Software, Windows 3.11, Windows NT, Windows XP, ER/Win for data modeling, Net Services, Novell LAN Workgroup TCP/IP PL/SQL, PRO*C, SQL*PLUS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This document provides an overview of the application that is used by Michigan DOT to automate ROW activities.

Summary:

The Michigan DOT has prepared an orientation document that briefs up the details like features, main functions and the hardware and software and database statistics of the new web based system. The document mainly consists of the step by step procedure to navigate through the application with corresponding snapshots of each link.

The functions of the applications are to maintain project/job data, maintain parcel data, carry out condemnation activities, track payments/all costs for parcel acquisition and generate reports.

Research Improves Right-Of-Way Management

Quiroga, C., (2003), Research improves right-of-way management, United States, Texas Transportation Researcher, Volume 39, No.1, Washington.

Web page: http://tti.tamu.edu/researcher/newsletter.asp?vol=39&issue=1&article=11

Category of ROW functions:	Planning & Management
	Engineering & Mapping
Type of article/study:	Paper
Type of system:	GIS
	Web-based data entry
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article summarizes the research performed on effective utility management in Texas.

Summary:

Researchers at the Texas Transportation Institute (TTI) recently completed a research project that provides a major advancement for the management of utilities located within TxDOT right-of-way. The two main products of the research are a geographic information system (GIS)-based model for the inventory of utilities located within TxDOT ROW and a GIS/Internet-based prototype system for automating the utility permitting process at TxDOT. The new Internet-based procedure is expected to improve the management of installation notices at TxDOT by enhancing the current process with automated steps, managing and consolidating all data associated with the process, allowing map and data distribution through online data and file uploading, and online access to all documentation.

Right-Of-Way Domestic Scan

Office of Real Estate Services, (2005), Right-Of-Way Domestic Scan, United States, Federal Highway Administration, Austin, Texas.

Web page: http://www.fhwa.dot.gov/realestate/scans/ausfreport.htm

Category of ROW functions:	Property appraisal
Type of article/study:	Scan
Type of system:	Not Identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This right of way domestic scan examines some innovative and non-traditional ways of project development and delivery process.

Summary:

The office of Real estate services sponsored this scan to foster peer-to-peer knowledge exchange and share best practices and experiences. The scan includes presentations on Right of Way aspects of design-build, Right of Way electronic appraisals pooled fund research and individual state research.

The tasks with the scope of automation and usage of GIS are briefed up in this summary. The design-build presentation focused on the new design-build regulatory requirements like clear zones must be maintained around unacquired properties, the contractor must establish a project tracking system and quality control system, a hold off zone may be established around occupied properties, open burning should not occur within 1,000 feet of an occupied dwelling etc.

Under Right of Way electronic appraisals pooled fund research and individual state research, Texas Department of Transportation and seven other DOTs pooled fund research effort to develop a "How To" manual of instruction for the electronic transmittal, storage and retrieval of appraisal documents. FDOT's appraisal and appraisal review office described the current system for the electronic transmission and storage of appraisals and appraisal related documents. VDOT's Chief Appraiser described VDOT's efforts to create a software package to perform electronic appraisals. The VDOT vision is to customize a currently available commercial off the shelf appraisal software system. Several common potential benefits of electronic transmission, electronic standardized appraisals and forms, and an artificial intelligence system were described as the three DOTs presented their ideas.

Right-Of-Way Information System

New Jersey Department of Transportation, (2004), Right-of-Way information system, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Washington.

Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Category of ROW functions:	Planning & Management
	Engineering & Mapping
	Property acquisition
	Property appraisal
	Relocation assistance
	Property/Asset management
	Utility relocation management
	Other
Type of article/study:	Survey
Type of system:	Automated data entry and management
	GIS
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This survey was done by New Jersey DOT to identify the DOTs across the country that have implemented any kind of automated system in ROW.

Summary:

The New Jersey DOT wanted to replace the traditional and laborious manual ROW procedures with a comprehensive web based right-of-way information system. Their goal was to have a system which is Oracle/Sql server based and capable to capture images and data related to appraisal, title searches, acquisition and automatic generation of letters and documents from the available data. They even wanted to have a system designed to interface with a GIS database. The list of survey questions New Jersey DOT compiled and the responses of various DOTs all over the country to this survey, describing their present status in the aspect of automation of ROW activities can be found in this document. Some DOTs have even provided the list of firms that could develop a system meeting the requirements of New Jersey DOT. The states that participated in the survey are California, Illinois, Michigan, Minnesota, Mississippi, Nebraska, Ohio, South Carolina, Texas, Vermont, Virginia and Washington.

Right-of-Way Outreach and Program Research

Office of Real Estate Services, (2005), Right-of-Way Outreach and Program Research, United States, Federal Highway Administration, Washington, DC.

Web page: http://www.fhwa.dot.gov/realestate/research.htm

Category of ROW functions:	Property Acquisition
	Relocation Assistance
	Other
Type of article/study:	FHWA Report
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article is about the current research areas in Right-of-Way carried out by small business contractors, universities, and researchers.

Summary:

Office of Real Estate Services (HEPR) is fulfilling the right-of-way missions through outreach workshops, technical assistance, and program research by utilizing small business contractors, Universities and innovation researchers to develop management and technology tools. GIS is becoming an important field for right-of-way and has unlimited potential for right-of-way decision analysis. HEPR is currently supporting three GIS studies.

Automated Driveway Access Management with GIS 3-D Imagery:

An access management system, or ADAM for Automated Driveway Access Management, has been developed to accept, evaluate, and approve driveway permits. This web-based process incorporates historical information, automated letters and forms, and on-line information sharing and also provides effective use of digital photo-imagery with high accuracy levels. Visualization functions, including on-line 3-D capability, link to databases holding standard highway characteristics information. ADAM provides cost savings by eliminating paper review one office at a time and eliminating the need for costly field visits.

Innovative GIS Corridor Assessment and Land Acquisition Management Tools:

A prototype tool was studied to visualize a GIS-based linkage between environmental hazard analysis and land acquisition estimates for transportation projects. The tool is compatible with existing geospatial, imagery, and analysis tools. The initial phase of the research explored development of a system to assist transportation decision-making by incorporating comparative right-of-way land values and natural hazard risk assessment data. This phase of the research explored four technology areas like determining the most appropriate natural hazards to be included in the analysis process as well as defining potential geospatial data sources for information related to these hazards, determining the most

appropriate methods for acquiring and archiving cadastral data and determining the methods for analyzing the data to minimize the cost of right-of-way land acquisition, determining the best methods for analyzing the impacts of natural hazards on right-of-way alignment decisions and for assessing cost alternatives and determining the best methods for using visualization in the decision processes. The next phase of the research is being considered to produce effective analytical tools and processes that are tied to right-of-way decision-making needs.

Geographic Information Systems (GIS) implementation in Right-of-Way programs:

A literature review effort is examining materials relevant to the application of geographic information systems in right-of-way programs. This effort will provide specific information to guide development of an attitudinal survey on GIS implementation. The questionnaire devised as a part of this study would capture the various functional areas of right-of-way programs that have potential for application of GIS and would examine the prevailing perception in right-of-way offices about the pros and cons of GIS-based implementation systems, viable alternatives to GIS systems, including automated mapping and facility management systems. The results of the survey and nay subsequent meetings will be used as a guide in preparing the best practices of GIS implementation in right-of-way programs.

Web-Based Annual Acquisition and Relocation Statistics:

This investigation will bring together an annual statistics database plus an on-line report form. The database and the report form will support an annual statistics web page, replacing the current paper delivery and manual compilation of State right-of-way and Federal Agency real property expenditures. The database will house all electronic historical statistics and accept all future data inputs. The web pages will allow seamless interface with the data, and provide summary data tables.

An assessment of the effects of public project acquisitions on adjacent business:

The purpose of this report was to investigate the secondary impacts of highway activities on adjacent properties. "Secondary impacts" refers to a variety of ways a highway, the physical structure, the construction activity, and its use may affect the value of a piece of property. Among the secondary impacts discussed in this report are: noise; loss of access; loss of parking; diversion of traffic; odors and emissions; loss of business profits/goodwill; interim construction loss; loss of view; and loss of visibility. Today, there is no substantial data to support these claims, and attempts to quantify these impacts are difficult. Some methods used to inform the public about a project and to address concerns about secondary impact are by using maps to show temporary access to properties whose access will be affected during construction and use of computer-aided visuals which show "before" and "after" images of specific property (effective for public meetings, negotiations, litigation).

Right of Way and Utilities Guidelines and Best Practices

Highway Subcommittee on Right of Way and Utilities, (2004), Right of Way and Utilities Guidelines and Best Practices, United States, American Association of State and Highway Transportation Officials Standing Committee on Highways, Strategic Plan Strategy 4-4, Washington, DC.

Web page: http://www.international.fhwa.dot.gov/eurorightofway/index.htm

Category of ROW functions:	Planning and Management Property acquisition Property appraisal & review Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	AASHTO Report
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This document contains recommended guidelines and best practices for major functional work areas in the Right of Way and Utilities process.

Summary:

It contains the guidelines and best practices prepared by Highway Subcommittee on Right of Way and Utilities that are to be incorporated in Right of Way and Utilities process. Project development, appraisal and appraisal review, acquisition, relocation, property management, utilities, management practices, training areas have been addressed in the document. Guidelines that are recommended to be followed by the above work areas were specified. The best practices that have to be emulated by the states to run according to these guidelines were vividly explained for each work area.

Right Of Way Quality Management System-The Journey Of Five States

Peters, D., (1999), Right of Way Quality Management System-The Journey of five states, United States, Federal Highway Administration, United States Department of Transportation, Washington, DC.

Web page: www.fhwa.dot.gov/realestate /rowmgt/

Category of ROW functions:	Other
Type of article/study:	FHWA Report
Type of system:	None identified
Survey results:	Yes
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This research report reviews existing sources of utility data, summarizes the GIS model, and describes a GIS/Internet-based prototype system.

Summary:

This paper describes the types of management systems and best management practices present within State Transportation Department (STD) right-of-way (ROW) divisions. Additionally, it presents how to plan, implement, and measure a management system. Finally, this paper profiles 5 State ROW divisions in various phases of implementing their management systems. The states included are Wisconsin, Pennsylvania, Florida, Louisiana, and Oregon. First some terms and concepts associated with an integrated management system are discussed to familiarize the readers. The critical steps in management system are planning, implementation, monitoring and measurement, and revision. Public Relations, Training, Project Management, Production Tools, Internal and External Controls, Performance Indices and Planning Model of all the five states are mentioned. In summarizing each State's key elements and practices with regard to their management systems, certain benefits and costs have been realized. The benefits realized from incorporating a quality management system are a motivational work environment for employees, a quality project delivered on time and within budget, and highly satisfied clients. The opportunities for improvement in the quality planning process are additional strategic planning initiatives, organizational goal setting, evaluation of correct performance indicators, development of additional internal and external performance measures for the organization, the opportunity for continuous employee training and empowerment, the opportunity for improved communication skills, and the need for sharing processes and databases throughout the entire organization. Improved communication in a technical setting can help smooth workload requirements, prevent misunderstanding, and build common bonds between personnel. Finally, there is an opportunity for STD organizations in general to develop processes and databases that are used across functional and geographic boundaries.

ROW Parcel Tracking System Business Requirements document

Mississippi Department of Transportation, (2002), ROW Parcel Tracking System Business Requirements document, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit I, Mississippi.

Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Category of ROW functions:	Planning & Management Engineering & Mapping Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	Document
Type of system:	Not Identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	No

Applicability:

The document has business requirements for the new ROW Parcel Tracking System.

Summary:

The objectives that have to be defined by the MDOT for the new Parcel Tracking System (PTS) have been specified in the document. Some of them are, providing the management with the latest updated details of any parcel and the associated project, improved data sharing, better data retrieval, easier and more flexible reporting, capability to produce notifications and alerts automatically, etc. The current problem areas of MDOT that are to be improved upon through the new design are also mentioned. Most importantly, there is a list of requirements defined to describe the specific business or functional needs for each business area of ROW. Specific information to be captured through a new parcel tracking application has been listed for each requirement in a table format. Engineering maps and deeds, title, appraisal, acquisition, relocation, property management, eminent domain, upper management, ROW district coordinators, and interfaces are the business areas have been addressed in the document.

ROW Parcel Tracking System Detailed requirements/Functional design document

Petyon, L., Mississippi Department of Transportation, (2002), ROW Parcel Tracking System Detailed requirements/Functional design document, United States, Subcommittee on Right-of-Way and Utilities (AASTHO), Exhibit H, Mississippi.

Web page:
http://cms.transportation.org/sites/rightofway/docs/Survey_Right_of_Way_Information_System.pdf

Category of ROW functions:	Planning & Management Engineering & Mapping Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	Document
Type of system:	Not Identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	No

Applicability:

The document has detailed requirements (Functional design) for a new ROW Parcel Tracking System.

Summary:

This document exhaustively specifies the standards and formats that have to be followed by the ROW agents who include appraisers, review appraisers, acquisition agents, relocation agents, title agents and property management agents. The objectives that have to be defined by the Mississippi Department of Transportation for the new Parcel Tracking System (PTS) have been specified. Some of them are, providing the management with the latest updated details of any parcel and the associated project, improved data sharing, better data retrieval, easier and more flexible reporting, capability to produce notifications and alerts automatically, etc. The document contains explanation of business workflow of ROW parcel tracking system. Global project and parcel data, funding, project scheduling, agents, parcel file location, engineering maps and deeds, title, appraisal, acquisition, relocation, property management-improvements, eminent domain, property management- contaminated sites, property management-utilities, project status, upper management-closing a project, invoices and payments, project certification, notifications, reports, FHWA annual statistics, word templates and document creating, security areas are the ROW activities that have been addressed in the document.

ROW Planning: Saving Pipeline Industry Time and Money

Sydelko, P.J., (1997), ROW planning: Saving Pipeline Industry Time and Money, United States, Argonne National Laboratory, Illinois.

Web page: http://www.es.anl.gov/htmls/row.planning.html

Category of ROW functions:	Other
Type of article/study:	Paper
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article is about increasing the efficiency of pipeline ROW planning by using computerized geographic information systems (GISs).

Summary:

Using traditional methods of siting a gas pipeline route and obtaining the required permits generally takes a couple of years. Scientists of Argonne National Laboratory reduced the time and effort required for gathering and assessing the data needed by using geographic information systems and thus, obtaining a permit has also become faster. Factors like population centers, land cover, endangered species habitats, wetlands, hydrography, soils, and transportation routes can be considered simultaneously which provide information about siting, permitting, construction, maintenance, and monitoring of pipeline ROWs. By using this technology, alternative routes can be identified under given constraints and least-cost analysis can also be performed such that environmentally sensitive areas or areas with severe engineering constraints are avoided. This approach to planning pipeline routes saves both time and money of the industry.

State and Local Right-Of-Way Success Stories

National Telecommunications and Information Administration, (2002), State and Local Right-Of-Way Success Stories, United States, U.S Department of Commerce, Washington, DC.

Web page: http://www.ntia.doc.gov/ntiahome/staterow/ROWstatestories.htm

Category of ROW functions:	Other
Type of article/study:	Paper
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article describes new procedures followed by ROW management that have benefited telecommunication firms.

Summary:

Rights-of-way management has arisen as a key issue in broadband deployment at the federal, state, and local levels. The steps required for a telephone company to lay new lines on a public street, a cable company to start providing Internet service, or a cell phone company to place antennas on public poles, can have real consequences in the decision to deploy broadband service to a community. These issues generally fell into four categories like timeliness of processes, fees, information collection and remediation and maintenance. A number of providers noted that deployment was often slowed by overly burdensome requests for information, lengthy processes for obtaining permits, unreasonable charges for use of the rights-of-way, and undue remediation and maintenance requests. Additionally, several providers noted that the complex patchwork of procedures among localities made installation of facilities across municipal boundaries costly and time-consuming. But, there are some occasions when the providers were benefited by the novel approaches of ROW management both at state and local level. This article contains examples shared by industry and/or governments of policies and procedures they believe have succeeded in improving access to rights-of-way. The examples illustrate different mechanisms that can improve the involvement of the stakeholders, streamline the collection of information, improve the timeliness of the application process, ensure that fees are reasonable, and/or improve remediation or maintenance procedures.

State Model for Coordination of Geographic Information Technology

Davis, S., (2004), State Model for Coordination of Geographic Information Technology, United States, National States Geographic Information Council, Lexington, Kentucky.

Web page: http://www.nsgic.org/states/statemodel_git.pdf

Category of ROW functions:	Other
Type of article/study:	Report
Type of system:	GIS
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The report has the critical factors that were identified for better data sharing and coordination in the sector of Geographic Information Technology.

Summary:

It was identified that significant cost savings can be realized through coordinated efforts using the "Collect Data Once and Use It Many Times" approach employed by many states and endorsed by NSGIC. To better support interaction and coordination between all levels of government, NSGIC began to identify fundamental characteristics of effective statewide coordination of GIT. The end result was a listing of critical factors for measuring performance objectives and the criteria needed for an effective statewide GIT coordination program.

The critical factors that are identified in the state model and a survey of nine questions providing a reliable snapshot of coordination characteristics across the nation were presented elaborately in the report. An appendix containing the charted survey results can be found at the end.

Transportation Case Studies in GIS

GIS/Trans Limited, (1999), Transportation Case Studies in GIS, United States, Travel Model Improvement Program, U.S. Department of Transportation, Federal Highway Administration, Washington.

Web page: http://www.bts.gov/tmip/gis.htm

Category of ROW functions:	Planning & Management Engineering & Mapping Other
Type of article/study:	Case Study
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The document has brief summaries of five case studies in which GIS was used to in an innovative manner.

Summary:

Geographic information system has great capability to improve the efficiency and quality of transportation planning and program development. The case studies are collected and complied together to assist in formulating data management programs and inter-agency partnerships for data collection and maintenance.

Southern California Association of Governments ACCESS Project, North Carolina DOT (NCDOT) - Use of GIS to support Environmental Analysis during system planning, and SANDAG's Multiple Species/Habitat conservation programs and transportation planning have been summarized earlier.

Portland Metro, Oregon – GIS Database for Urban Transportation Planning: GIS is used in a wide range of activities like collection of data inputs to travel forecasting model, perform spatial analyses such as measure jobs-housing balance, and display model outputs on Metro's base map. This geo-centric approach was used in many applications that support modeling including activity based modeling and the TransSims Travel Model Improvement.

Maine Department of Transportation Statewide Travel Demand Model: The travel demand model provides a standard forecast of statewide traffic growth that can be used to evaluate capital improvement projects and as inputs for air quality analysis. This project addresses even the recreational travel patterns that lead to peak traffic and congestion during summer tourist season.

Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project

Clup, M., and Bills, T., (1998), Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project,United States, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.

Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/scag/

Category of ROW functions:	Planning & Management Engineering & Mapping
Type of article/study:	Case Study
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This article documents a case study that uses GIS in developing various applications of different fields and different end users in California.

Summary:

"ACCESS" is an ambitious project initiated by Southern California Association of Governments (SCAG) with the goal to make Southern California the "most information accessible region in the world". ACCESS project provides local jurisdictions uninhibited access to many different data sources and thus encourages their participation in the regional planning processes. SCAG is responsible for the preparation of the long range Regional Transportation Plan (RTP), for the transportation control strategies in the Regional Air Quality Management Plan (AQMP), for the creation of the Regional Comprehensive Plan (RCP), and for developing the regional long-range growth forecasts for population, housing and employment which is possible only with the participation of the local jurisdictions. The project was envisioned to reach goals like facilitate decision making, enhance coordination among jurisdictions and within sub-regions, encourage and simplify information/data sharing, increase communication between SCAG and local jurisdictions, and among jurisdictions themselves, set regional standards in terms of tools, data bases, and software and strategically leverage GIS technology to meet these goals. The article has a detailed description of the policy background, problem definition, goals and design criteria, existing application of GIS and their usage, nature of data and layers that were incorporated, the project organization and cost/benefit analysis.

Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning

Clup, M., Foster, D., Stills, W., (1998), Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning, United States, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.

Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/ncdot/

Category of ROW functions:	Planning & Management Engineering & Mapping
Type of article/study:	Case Study
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This article documents a case study using GIS to make critical decisions about ideal locations that can be used to expand transportation facilities considering environmental factors in North Carolina.

Summary:

"The Phased Environmental Approach," initiated by Northern Carolina (NCDOT) as a pilot to improve its process for integrating environmental issues into the transportation System Planning Process. This project establishes the ability of GIS to support a major change in NCDOTs systems planning process. The article states that the benefits of the project are earlier consideration of environmental issues in the planning process, faster and more effective environmental analysis process, enhanced participation of regulatory/ resource agencies, improved data credibility, better decisions at the system planning level, greater commitment to decisions and savings of time and cost. These benefits are briefly explained at the end of the article. The article has a detailed description of role of GIS in the project, differences between the traditional and improved planning processes, phased environmental approach in highway project development, case studies in Northern Carolina area and benefit and cost estimates of the case study projects.

Transportation Case Studies in GIS, Case Study 5: SANDAG's Multiple Species/Habitat Conservation Programs and Transportation Planning

Clup, M., Parrott, B., (1998), Transportation Case Studies in GIS, Case Study 5: SANDAG's Multiple Species/Habitat Conservation Programs and Transportation Planning, United States, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.

Web page: http://tmip.fhwa.dot.gov/clearinghouse/docs/gis/sandag/

Category of ROW functions:	Planning & Management Property acquisition Engineering & Mapping
Type of article/study:	Case Study
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article documents a case study using GIS to make critical decisions about ideal locations that can be used to expand transportation facilities considering environmental factors in California.

Summary:

Planning for transportation facilities in a region that has nearly 200 endangered species is a major challenge for San Diego Association of Governments (SANDAG). These programs are responsible for the development and management of extensive biological and land management databases. Geographic information systems were chosen as the best method for maintaining and analyzing these data. GIS has become an invaluable tool as the following benefits are identified. Habitat and species data are maintained in a GIS format and are always accessible to transportation planners, allows better decision making in the early planning stages of a transportation project, saves time and money in managing quality environmental data, allows transportation planners to conduct various types of analyses which they could not do before, a more coordinated and comprehensive approach to environmental impact analyses, quicker resolution of conflicts between transportation projects and preservation of the natural environment, early recognition of design alternatives to avoid or mitigate the impact to the natural environment. The article has a detailed description of transportation issues and habitat conservation programs of San Diego, pictures of the old and modified transportation systems, layers used in biological and land management databases, phases of the GIS-based habitat planning process, role of GIS in supporting the Transportation Planning process, other transportation planning applications in San Diego area using these databases, GIS infrastructure costs for the project and benefits of the habitat conservation programs.

Utilities Data Content Standard

Facilities Working Group, Federal Geographic Data Committee, (2000), Appraisal Utilities Data Content Standard, United States, Federal Geographic Data Committee, FGDC-STD-010-2000, Virginia.

Web page: http://www.fgdc.gov/standards/documents/standards/utilities/utilities.pdf

Category of ROW functions:	Other
Type of article/study:	Report
Type of system:	Not identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The report is an elaborate description of the standards that needs to be followed in for utilities data.

Summary:

Utilities Standards developed through the FGDC, addresses the problem of lack of national geospatial data content standard through broad participation including national, state, and local governments, municipalities, professional associations, and private industry. This Utilities Standard will benefit Federal, state, and local governments, municipalities and utility companies that require a utilities data content standard. This Utilities Standard can also be used to support the FGDC's integrated standard database project. This standard will also provide new data sharing opportunities for the National Spatial Data Infrastructure (NSDI).

The purpose of this Utilities Geospatial Data Content Standard is to standardize geospatial information for utility systems. This standard specifies the names, definitions and domains for utility system components that can be geospatially depicted as feature types and their non-graphical attributes. This Utilities Standard supports large-scale, intra-city applications such as engineering and life cycle maintenance of utility systems. It is applicable for any system that captures or uses spatial data about utility systems and can be utilized in support of life-cycle management applications like planning, design, construction, and facilities management.

Utilities in Highway Right-of-Way: Data Needs and Modeling

Quiroga, C., Pina, R., (2003), Utilities in Highway Right-of-Way: Data Needs and Modeling, United States, Transportation Research Board, Issue: 1851, Paper: 03-3362, Washington, DC.

Category of ROW functions:	Other
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The article is about effective management of utilities in highway right-of-way using GIS.

Summary:

With the proliferation of utilities within the right-of-ways of highway facilities, it is becoming increasingly difficult for transportation agencies not only to allow more utilities but also deliver and manage their own transportation systems in a timely and efficient manner.

In this paper a geographically referenced prototype model that ties the locations of utility facilities to a state highway network and that associates the positional data with details of utility facility ownership, service or commodity type, infrastructure size, material, and other pertinent characteristics is described. The inventory model can accommodate a variety of utility-related processes within a transportation agency, including utility permits, joint use agreements, and deliverables from subsurface utility engineering contracts. Common sources of utility facility data at a transportation agency are reviewed, and a geographic information system model that represents the location of utility facilities within the highway ROW is described.

Utility Relocation and Accommodation on Federal-Aid Highway Projects: Program Guide

Office of Program Administration, (2003), Utility Relocation and Accommodation on Federal-Aid Highway Projects: Program Guide, United States, Federal Highway Administration, Sixth edition, Washington, DC.

Web page: http://www.fhwa.dot.gov/reports/utilguid/

Category of ROW functions:	Utility relocation management
Type of article/study:	FHWA Report
Type of system:	None identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This document is a guide to assist individuals administering Federal-aid highway programs.

Summary:

The utility program guide has been developed by the Federal Highway Administration (FHWA) to assist individuals administering Federal-aid highway programs that involve the use of Federal-aid highway funds for the relocation, adjustment and accommodation of utility facilities, and private lines on Federal-aid highway right-of-way. Laws and regulations dealing with utility relocation and accommodation matters in United States code and code of Federal Regulations respectively are explained. A historic perspective is included for several items to explain why certain policy requirements were established. Examples are included to show how certain provisions have been applied. This guide also incorporates information from several FHWA Headquarters' responses to filed inquires that have served as interpretations of various policy provisions. The Laws and regulations can be obtained from the appendix of the guide.

VDOT Becomes Model For Right-Of-Way Computer Streamlining

AASTHO, (2004), VDOT becomes model for Right-of-Way computer streamlining, United States, Virginia Department of Transportation, Virginia.

Web page: http://www.virginiadot.org/business/row-default.asp

Category of ROW functions:	Planning & Management Property acquisition Property appraisal Relocation assistance Property/Asset management Utility relocation management
Type of article/study:	Report
Type of system:	Web-enabled data entry, Electronic document transfers, Web applications for users, Intranet databases.
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	No

Applicability:

This article is about the Right of Way and Utilities Management System (RUMS) developed by Virginia DOT.

Summary:

VDOT has developed RUMS that gives right of way managers at-a-glace status of a highway project, including key deadlines to ensure right of way and utilities activities are completed on schedule. RUMS also helps right of way and utilities agents generate, customize, store and retrieve forms, letters and other documents. It automates the assignment and reassignment of work to division agents and tracks legal processes and maintenance and disposal of surplus properties. It also has an intuitive user interface easy enough for the new user to learn and powerful enough for the advanced user to quickly navigate to specific information. RUMS is available as a protected web-based system on the internet so that VDOT right-of-way agents can access it from anywhere.

This computerized system has garnered attention from around the country because of its extensive capabilities.

Vegetation Management System—Interstate Right of Way

Davey GIS services, (2002), Vegetation Management System—Interstate Right of Way, United States, Cincinnati Parks Board, Ohio.

Web page:
http://www.davey.com/cgi-bin/serveFile.pl/CinciTurf.pdf?type=adventure&fieldname =pdf&id=92

Category of ROW functions:	Others
Type of article/study:	Other
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

The article published by Davey GIS services briefs up their project that eased the maintenance of turf areas along the Interstate Right of Ways.

Summary:

In order to manage the maintenance of turf areas adjacent to all interstates leading in and out of Cincinnati, Davey GIS Services developed a GIS solution. The approach used was to create turf polygons along interstate highways within the city limits which were soft copy digitized from digital orthophotos and a map and table-driven interface to allow quick retrieval of the turf polygon attributes, and easy entry of work records which are linked to the individual turf polygons. The turf polygons had generic attributes such as area and perimeter and in addition to numerous blank data fields that were constructed so that the client could fill them in at a later date. The regular ArcView interface was customized and streamlined to suit the client's needs using Avenue scripting language.

The scripts automate several of the complicated Geographic Information System (GIS) tasks normally performed by the user. For example, editing operations performed on the work management data table were reduced to a user-friendly data entry screen, rather than a multi-step edit procedure. Several hundred orthophotos and several layers of base maps were also made available to the user through a one-click menu interface, as opposed to a lengthy file search process. The data table windows and the map window are programmed to resize themselves appropriately, based on how many of the windows are open at one time.

A-3 CROSSWALKS

A-3.1 ROW Category

Planning and Management

Challenges and Opportunities (2002)
Challenges and Opportunities (2003)
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Design / Build Contracts and Right-of-Way Activities
Development and Evaluation of Management Information Systems
Electronic Appraisal Development Study Update
Electronic Project Management for Land Acquisition
Excellence in Right-of-Way Awards
GIS in Right of Way Scan
Innovative Practices to Reduce Delivery Time for Right-Of-Way In Project Development
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Intersection Construction Cost Functions for Alignment Optimization
Real Estate Management Information System
Research Improves Right-Of-Way Management
Right-Of-Way Information System
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
Transportation Case Studies in GIS
Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Transportation Case Studies in GIS, Case Study 5: SANDAG's Multiple Species/Habitat Conservation Programs & Transportation Planning
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Engineering and Mapping

Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Intersection Construction Cost Functions for Alignment Optimization
Research Improves Right-Of-Way Management
Right-Of-Way Information System
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
Transportation Case Studies in GIS
Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project

Transportation Case Studies in GIS, Case Study 3:
NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Transportation Case Studies in GIS, Case Study 5:
SANDAG's Multiple Species/Habitat Conservation Programs & Transportation Planning

Property Appraisal

2004 Wisconsin Real Estate Peer Exchange
Cadastral Data Content Standard for the National Spatial Data Infrastructure
Challenges and Opportunities (2002)
Challenges and Opportunities (2003)
Collier County Right-of-Way Application
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Design / Build Contracts and Right-of-Way Activities
Electronic Appraisal Development Study Update
Excellence in Right-of-Way Awards
Innovative Practices to Reduce Delivery Time for Right-Of-Way in Project Development
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Intersection Construction Cost Functions for Alignment Optimization
Managing a Cadastral SDI Framework Built From Boundary Dimensions
Real Estate Management Information System
Right-Of-Way Domestic Scan
Right-Of-Way Information System
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Appraisal Review

Excellence in Right-of-Way Awards
Right of Way and Utilities Guidelines and Best Practices

Property Acquisition

Challenges and Opportunities
Collier County Right-of-Way Application
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Design / Build Contracts and Right-of-Way Activities
Electronic Project Management for Land Acquisition
GIS in Right of Way Scan
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Intersection Construction Cost Functions for Alignment Optimization

Real Estate Management Information System
Right-Of-Way Information System
Right-of-Way Outreach and Program Research
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Property/Asset Management

Cadastral Data Content Standard for the National Spatial Data Infrastructure
Collier County Right-of-Way Application
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Development and Evaluation of Management Information Systems
Electronic Appraisal Development Study Update
Electronic Project Management for Land Acquisition
Excellence in Right-of-Way Awards
GIS in Right of Way Scan
Highway Access Controls: Decision Support Utilizing Spatial Coordination
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Managing a Cadastral SDI Framework Built From Boundary Dimensions
Real Estate Management Information System
Right-Of-Way Information System
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Relocation Assistance

Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Design / Build Contracts and Right-of-Way Activities
Electronic Project Management for Land Acquisition
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Real Estate Management Information System
Right-Of-Way Information System
Right-of-Way Outreach and Program Research
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Utility Relocation

Analysis of Transmission Line Routing Alternatives with Multiple Scenarios
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards

Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Development of a GIS Platform for Inventory of Utilities Located Within Txdot Right-Of-Way
Highway/Utility Guide
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Pipeline R-O-W Management At Light Speed
Real Estate Management Information System
Right-Of-Way Information System
Right of Way and Utilities Guidelines and Best Practices
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
Utilities in Highway Right-of-Way: Data Needs and Modeling
Utility Relocation and Accommodation on Federal-Aid Highway Projects: Program Guide
VDOT Becomes Model for Right-Of-Way Computer Streamlining

Outdoor Advertising

Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System
Excellence in Right-of-Way Awards
GIS in Right of Way Scan
Outdoor Advertising – National Study
Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System
Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System
Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System
Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System
Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System

Other

2004 Wisconsin Real Estate Peer Exchange
The Challenges of Building an Enterprise -Quality Web Mapping Solution for State Government
Cadastral Core Data
Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data
Challenges and Opportunities (2002)
Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Digital Land Record Information
Geospatial Positioning Accuracy Standards
GIS Applications Using Digital Orthophoto Data
GIS for Cadastre Management
GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas
Management Guide for Implementation of Geographic Information System (GIS) in

State DOTs
Right-Of-Way Information System
Right-of-Way Outreach and Program Research
Right Of Way Quality Management System-The Journey of Five States
ROW Planning: Saving Pipeline Industry Time and Money
State and Local Right-Of-Way Success Stories
State Environmental Streamlining and Stewardship Practices Database
State Model for Coordination of Geographic Information Technology
Transportation Case Studies in GIS
Utilities Data Content Standard
Vegetation Management System—Interstate Right of Way

A-3.2 Type of System

GIS

Analysis of Transmission Line Routing Alternatives with Multiple Scenarios
The Challenges of Building an Enterprise-
Quality Web Mapping Solution for State Government
Collier County Right-of-Way Application
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Development and Evaluation of Management Information Systems
Development of a GIS-Based Rights of Way Outdoor Advertising Sign
Information System
Development of a GIS Platform for Inventory of Utilities Located Within TxDOT
Right-Of-Way
Digital Land Record Information
Electronic Project Management for Land Acquisition
GIS Applications Using Digital Orthophoto Data
GIS for Cadastre Management
GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas
Highway Access Controls: Decision Support Utilizing Spatial Coordination
Highway/Utility Guide
Intersection Construction Cost Functions for Alignment Optimization
Management Guide for Implementation of Geographic Information System (GIS) in
State DOTs
Managing a Cadastral SDI Framework Built From Boundary Dimensions
Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System
Outdoor Advertising-State Study, State of Montana – Automated Data
Gathering System
Outdoor Advertising-State Study, State of Missouri – Automated Data
Gathering System
Outdoor Advertising-State Study, State of New Jersey – Automated Data
Gathering System
Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System
Pipeline R-O-W Management At Light Speed
Right-Of-Way Information System

Right-of-Way Outreach and Program Research
ROW Planning: Saving Pipeline Industry Time and Money
State Environmental Streamlining and Stewardship Practices Database
State Model for Coordination of Geographic Information Technology
Transportation Case Studies in GIS
Transportation Case Studies in GIS, Case Study 1:
Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3:
NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Transportation Case Studies in GIS, Case Study 5:
SANDAG's Multiple Species/Habitat Conservation Programs & Transportation Planning
Utilities in Highway Right-of-Way: Data Needs and Modeling
Vegetation Management System—Interstate Right of Way

Other

2004 Wisconsin Real Estate Peer Exchange
Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Challenges and Opportunities (2002)
Electronic Appraisal Development Study Update
Excellence in Right-of-Way Awards
GIS in Right of Way Scan
Innovative Practices to Reduce Delivery Time for Right-Of-Way in Project Development
Outdoor Advertising – National Study
Real Estate Management Information System
Research Improves Right-Of-Way Management
Utilities Data Content Standard
VDOT Becomes Model for Right-Of-Way Computer Streamlining

A-3.3 Survey Results

2004 Wisconsin Real Estate Peer Exchange
The Challenges of Building an Enterprise-Quality Web Mapping Solution for State Government
Innovative Practices to Reduce Delivery Time for Right-Of-Way In Project Development
Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report
Outdoor Advertising – National Study
Right-Of-Way Information System
Right Of Way Quality Management System-The Journey of Five States
State Model for Coordination of Geographic Information Technology

A-3.4 Benefit/Cost Information

Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System

Digital Land Record Information
GIS Applications Using Digital Orthophoto Data
GIS in Right of Way Scan
Management Guide for Implementation of Geographic Information System (GIS) in State DOTs
Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System
Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System
Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System
Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System
Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System
Right Of Way Quality Management System-The Journey of Five States
Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Transportation Case Studies in GIS, Case Study 5: SANDAG's Multiple Species/Habitat Conservation Programs & Transportation Planning

A-3.5 Lessons Learned

The Challenges of Building an Enterprise-Quality Web Mapping Solution for State Government
Development of a GIS Platform for Inventory of Utilities Located Within TxDOT Right-Of-Way
GIS in Right of Way Scan
Innovative Practices to Reduce Delivery Time for Right-Of-Way in Project Development
Outdoor Advertising – National Study
Right Of Way Quality Management System-The Journey of Five States
Transportation Case Studies in GIS, Case Study 1: Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3: NCDOT: Use of GIS to Support Environmental Analysis During System Planning

A-3.6 Data Elements Listed

Analysis of Transmission Line Routing Alternatives with Multiple Scenarios
Cadastral Core Data
Cadastral Data Content Standard for the National Spatial Data Infrastructure
Content Elements for Regional/Statewide Publication of Core Geospatial Parcel Data
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Digital Land Record Information
Geospatial Positioning Accuracy Standards
GIS in Right of Way Scan
Managing a Cadastral SDI Framework Built From Boundary Dimensions
Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System
Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System
Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System

Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System
Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System
ROW Parcel Tracking System Business Requirements document
ROW Parcel Tracking System Detailed Requirements/Functional Design Document
Transportation Case Studies in GIS, Case Study 1:
Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3:
NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Utilities Data Content Standard
Utilities in Highway Right-of-Way: Data Needs and Modeling

A-3.7 Contact Information

Analysis of Transmission Line Routing Alternatives with Multiple Scenarios
Cadastral Data Content Standard for the National Spatial Data Infrastructure
Challenges and Opportunities (2002)
Challenges and Opportunities (2003)
The Challenges of Building an Enterprise-Quality Web Mapping Solution for
State Government
Congratulations to the Winners of the 2004 Excellence in Right-of-Way Awards
Costs of Right-of-Way Acquisition: Methods and Models for Estimation
Data Specification for Utility GIS and Corresponding Cost Benefits in the Year 2002
Design / Build Contracts and Right-of-Way Activities
Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System
Development of a GIS Platform for Inventory of Utilities Located Within TxDOT
Right-Of-Way
Digital Land Record Information
Electronic Appraisal Development Study Update
Electronic Project Management for Land Acquisition
Geospatial Positioning Accuracy Standards
GIS for Cadastre Management
GIS in Right of Way Scan
GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas
Highway Access Controls: Decision Support Utilizing Spatial Coordination
Highway/Utility Guide
Innovative Practices to Reduce Delivery Time for Right-Of-Way In Project Development
Integration and Streamlining Transportation Development and Decision Making:
State of the Practice Synthesis Report
GIS Right-of-Way Management- Identifying Environmentally Sensitive Areas
Managing a Cadastral SDI Framework Built From Boundary Dimensions
Outdoor Advertising-State Study, State of Florida – Automated Data Gathering System
Outdoor Advertising-State Study, State of Montana – Automated Data Gathering System
Outdoor Advertising-State Study, State of Missouri – Automated Data Gathering System
Outdoor Advertising-State Study, State of New Jersey – Automated Data Gathering System
Outdoor Advertising-State Study, State of Kansas – Automated Data Gathering System
Pipeline R-O-W Management at Light Speed
Research Improves Right-Of-Way Management

Right-Of-Way Domestic Scan
Right-of-Way Outreach and Program Research
Right Of Way Quality Management System-The Journey of Five States
ROW Planning: Saving Pipeline Industry Time and Money
State and Local Right-Of-Way Success Stories
State Environmental Streamlining and Stewardship Practices Database
State Model for Coordination of Geographic Information Technology
Transportation Case Studies in GIS
Transportation Case Studies in GIS, Case Study 1:
    Southern California Association of Governments Access Project
Transportation Case Studies in GIS, Case Study 3:
    NCDOT: Use of GIS to Support Environmental Analysis During System Planning
Transportation Case Studies in GIS, Case Study 5:
    SANDAG's Multiple Species/Habitat Conservation Programs &
    Transportation Planning
Utilities Data Content Standard
Utilities in Highway Right-of-Way: Data Needs and Modeling
Vegetation Management System—Interstate Right of Way

APPENDIX B

CASE STUDIES

Six case studies were prepared. These were designed as stand-alone documents and are included in this appendix as they were prepared.

Illinois Department of Transportation

Division of Aeronautics

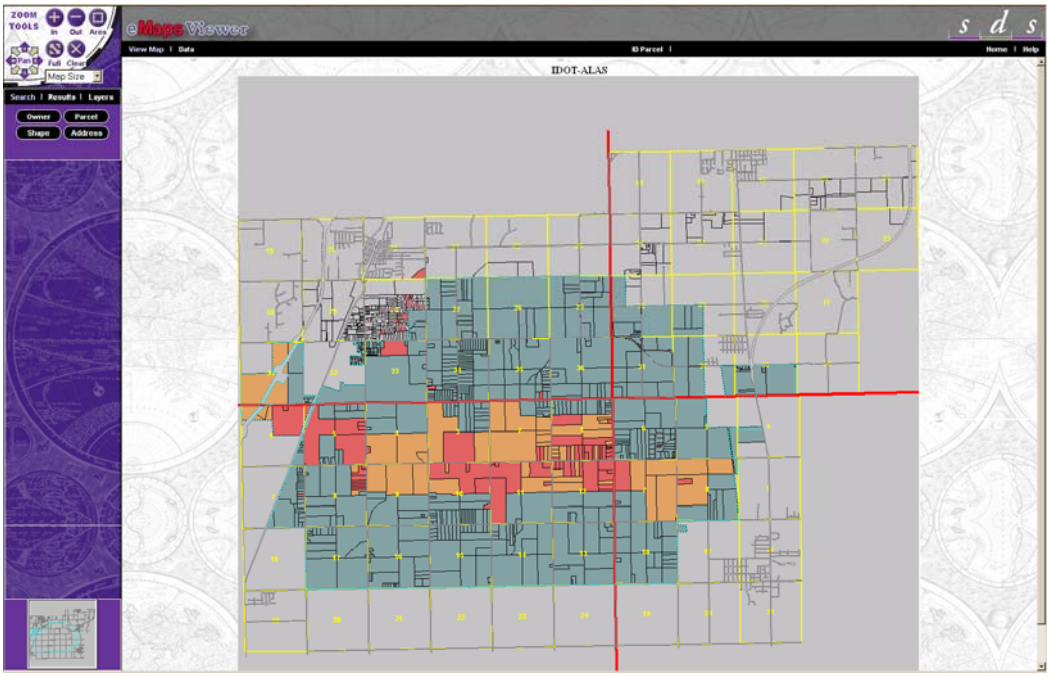
The Aeronautical Land Acquisition System (ALAS) Used for the South Suburban Airport Project

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Illinois Department of Transportation, Division of Aeronautics Springfield, Illinois

The Aeronautical Land Acquisition System (ALAS) Used for the South Suburban Airport Project



Summary

Real estate acquisition and property management are the responsibility of the Division of Aeronautics for the South Suburban Airport Project in Illinois. To effectively oversee the consultant providing professional services for this activity, the Division required that the consultant use a comprehensive internet-based geospatially enabled information management system. In response, the Aeronautical Land Acquisition System (ALAS) was incorporated into the business process.

The consultant enters acquisition and property management information into ALAS and IDOT views the information and generates summary reports for project oversight.

System Benefits to Project

The Aeronautical Land Acquisition System allows a single person within the Division of Aeronautics to provide oversight to the real estate acquisition for a large complex airport project. Specific benefits include:

- Quick desk-top access to all project information in near real-time
- Generation of project summary reports as needed.
- Ability to respond quickly to requests for information.

Return on investment has been measured in the ability of a single person to effectively oversee the land acquisition and property management for a large public project.

Case Studies in Innovative Systems in Transportation Right of Way

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information about an agency's use of a comprehensive data management system that includes geographic information systems to deliver a large public project.

Project Overview

Planning for the South Suburban Airport began in 1984 as a cooperative venture between the states of Illinois, Indiana, Wisconsin, the city of Chicago and the Federal Aviation Administration (FAA). After many studies, the airport location alternatives were narrowed to five sites in 1990.

The state of Illinois submitted an Environmental Assessment to FAA in March 1998 for the approval of development of an airport at a site in eastern Will County, Illinois. In 2002, the site was approved as a technically and environmentally feasible location for the development of a potential future air carrier airport in the south suburban area of the greater Chicago region.

Currently the proposed airport is owned by the state and, as such, the Illinois Department of Transportation (IDOT) is responsible for overseeing the project including land acquisition and property management. Because this is the only state-owned airport, the Department contracted out for professional services to perform these and related activities.

In 2000, IDOT issued a Request for Proposals (RFP) for professional services for this task and in 2001 contracted with Hanson Professional Services, Inc. One criterion in the RFP was that the consultant use a geospatially enabled web-based information management system to manage and track information associated with the project. Hanson partnered with Smart Data Strategies (SDS) modifying components of the SDS DREAMaps software to develop the Aeronautical Land Acquisition System (ALAS). In 2002, after the professional services team and software were in place, the state began purchasing land surrounding the Will County airport site with funding of $75 million earmarked by the Illinois FIRST program.

The project currently remains early in the land acquisition phase with the consultant working primarily with owners who are willing to sell their properties and managing properties that have been acquired to date.

System Overview

The Aeronautical Land Acquisition System (ALAS) is a comprehensive web-based land acquisition information management system with a geospatial component.

The consultant uses ALAS to input and manage information associated with land acquisition and property management for the SSA Project. IDOT uses it to access this information and prepare summary reports about the project. The public also has access to a limited amount of information through ALAS on the SSA Project web page.

This system has allowed IDOT staff to effectively oversee land acquisition and project management for the SSA project without having to hire additional personnel.

Case Studies in Innovative Systems in Transportation Right of Way

Agency Overview

Organization

The Division of Aeronautics is the aviation branch of the Illinois Department of Transportation (IDOT). Presently, the Division oversees approximately 1,125 landing facilities in Illinois that range from O'Hare International Airport as the largest and most complex to a small grass strip located in a farmer's back yard. In addition to airports, the Division provides oversight to balloon and glider ports, ultralight landing facilities, seaplane bases, and heliports.

The Airport Land Acquisition Section, within the Bureau of Airport Engineering, plans and administers all airport land purchase functions for the Division. Land Acquisition ensures that all airport land purchases using federal and state funds conform to established laws, policies and procedures. The section reviews all appraisals, negotiations, acquisitions and relocation assistance requirements for all land required to maintain the Illinois Airport System Plan. As part of the SSA Project, the IDOT hired a consultant to provide professional services for acquisition of right of way.

Information Technology Support

The Information Systems Bureau supports the business operations of IDOT with information resource planning. The Bureau provides guidance in preparation of requests for qualifications and requests for proposals when information systems are a component of these requests. They ensure that the system is compatible with the current information infrastructure and that the system meets the information needs for the business application.

For the SSA Project, the Information Systems Bureau participated in the preparation of the request for proposals. Since the electronic information within ALAS resides with Hanson and not at IDOT, no additional interaction was required.

System Description

Background

The request for proposals for professional services for the SSA Project land acquisition included a requirement for an information management system. The consultant partnered with SDS to provide this capability through SDS's DREAMaps suite of software tools, specifically:

- *eMapsPlus* which provides Ecommerce web data distribution capabilities
- *Analyst* which allows users to locate and identify parcels, view related data, gather statistics, and perform calculations on parcel data using ESRI's GIS toolset. Parcel Editor, an Analyst extension, allows users to edit parcel shapes and information.

Using the eMapsPlus and Analyst components, the consultant and SDS developed the Aeronautical Land Acquisition System for the Illinois DOT.

System Requirements

The primary requirements established in the request for proposal consisted of:

- The system must be compatible with IDOT's current information systems infrastructure, and
- The system must provide the necessary information for the business application.
- The system must provide for public access through a web application.

The latter requirement included the stipulation that the consultant modify and/or update the system as needed to meet this criterion.

Information managed in ALAS

The primary users of ALAS are the consultant, who enters information into the system, and IDOT Airport Land Acquisition Section who oversees the activities performed by the consultant. A public web application is also included for general access to preset information.

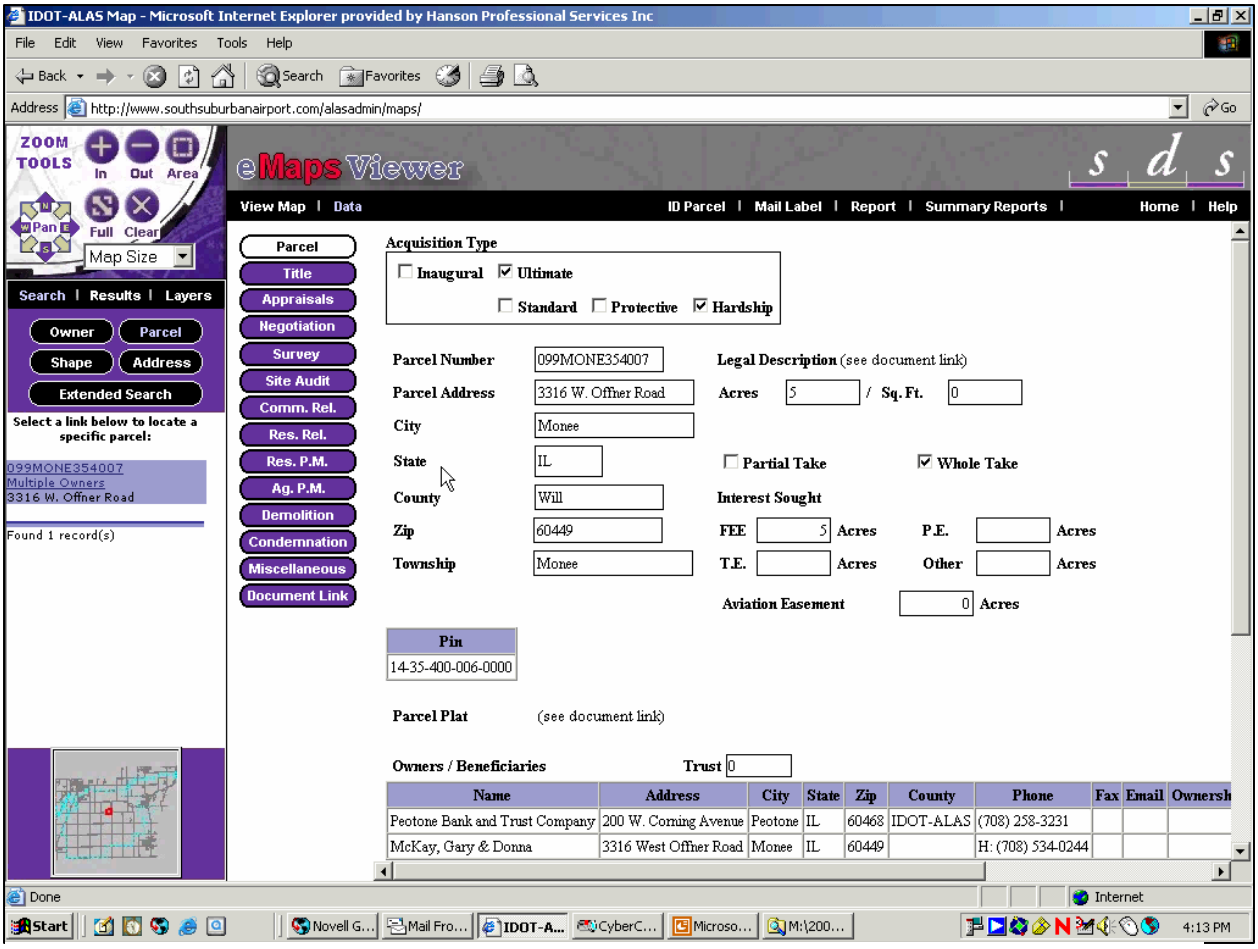


Figure 1 Example of ALAS with data review form for Parcel

ALAS currently includes approximately 800 fields of information. However, this is expected to increase as the project moves beyond the voluntary sale phase. The information that is managed in the system is divided into the following categories:

- Parcel
- Title
- Appraisal
- Negotiation
- Survey
- Site Audit (environmental)
- Residential Relocation
- Residential Property Management
- *Commercial Relocation*
- *Commercial Property Management*
- Agricultural Relocation
- Agricultural Property Management
- Demolition
- *Condemnation*
- Miscellaneous
- *Excess land*
- Financial
- Document Link

Bulleted items that are shown in italics are currently inactive since these activities have not yet begun.

User Interface

ALAS uses the standard windows interface with a frame around the work space that includes zoom tools, search tools, and selected parcel information on the left and options to switch between the map and data view with buttons for reporting capabilities across the top as shown in Figure 1. The work space presents a map of the project, data about the project, or the data input and review forms for the different activities. Figure 1 shows the form view with the category buttons down the left side of the workspace. The form shown in the workspace is associated with Parcel

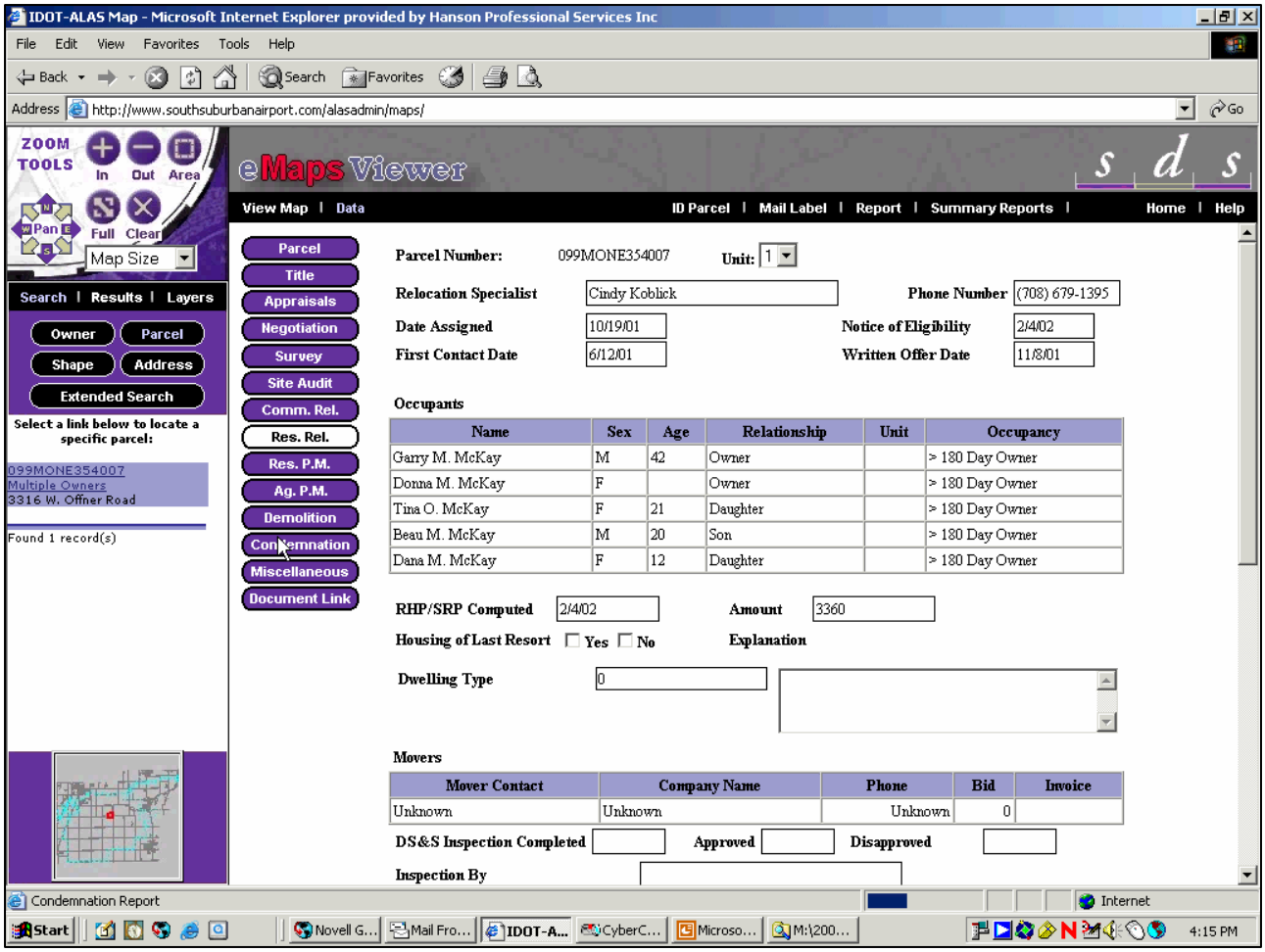


Figure 2 Example of data review form for Residential Relocation

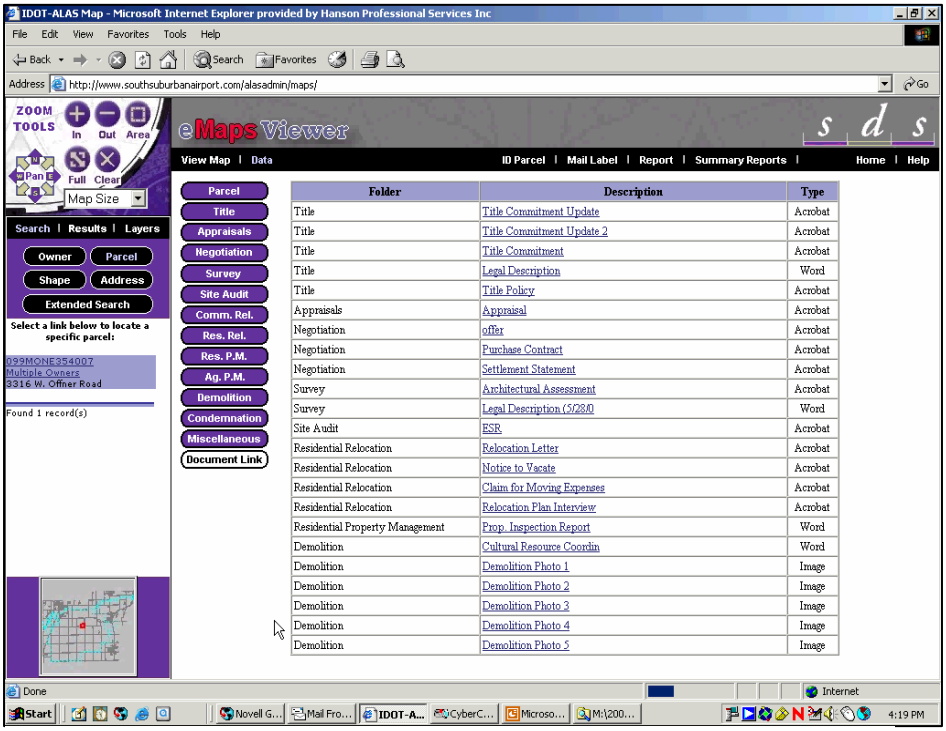
information. Similarly, Figure 2 shows the form associated with Relocation. Figure 3 shows the Document Link which provides access to all scanned documents associated with a parcel including surveys, letters, appraisals, audits, and contracts. Clicking on the Description field for that document opens it in the application associated with the document type. ALAS does not generate any of these documents, only providing project summaries and tables of data values. Figure 4 gives an example of the geospatial interface in ALAS that is available to IDOT.

To increase public participation and improve public relations, a version of ALAS was developed for the South Suburban Airport Project web page to allow anyone to view project parcels along with a limited amount of information about a parcel.

If the user selects *View Your Parcel* from the web page, the ALAS map viewer is launched. The user can search for a parcel by name, parcel ID number, address, or by drawing a shape on the currently displayed map. Figure 5 shows the last option, highlighting all parcels within a square section and listing the owners on the left. By selecting a specific parcel and pressing the *Data* button at the top, the user sees the information in Figure 6.

A summary table, also generated by ALAS, of parcels that have been purchased is available to the public on the *Property Owner Information* page by selecting *Parcels purchased by IDOT*. This provides a table of parcel ID, owner, address, purchase price, and acreage. At the bottom is a summation of purchase price and acreage.

Case Studies in Innovative Systems in Transportation Right of Way



The system includes a logon requirement. Users are assigned a logon class that determines their ability to access, add, or modify information. IDOT staff has access privileges to view information and print reports. The consultant has the most comprehensive level of access.

Figure 3 Example of Document Link form

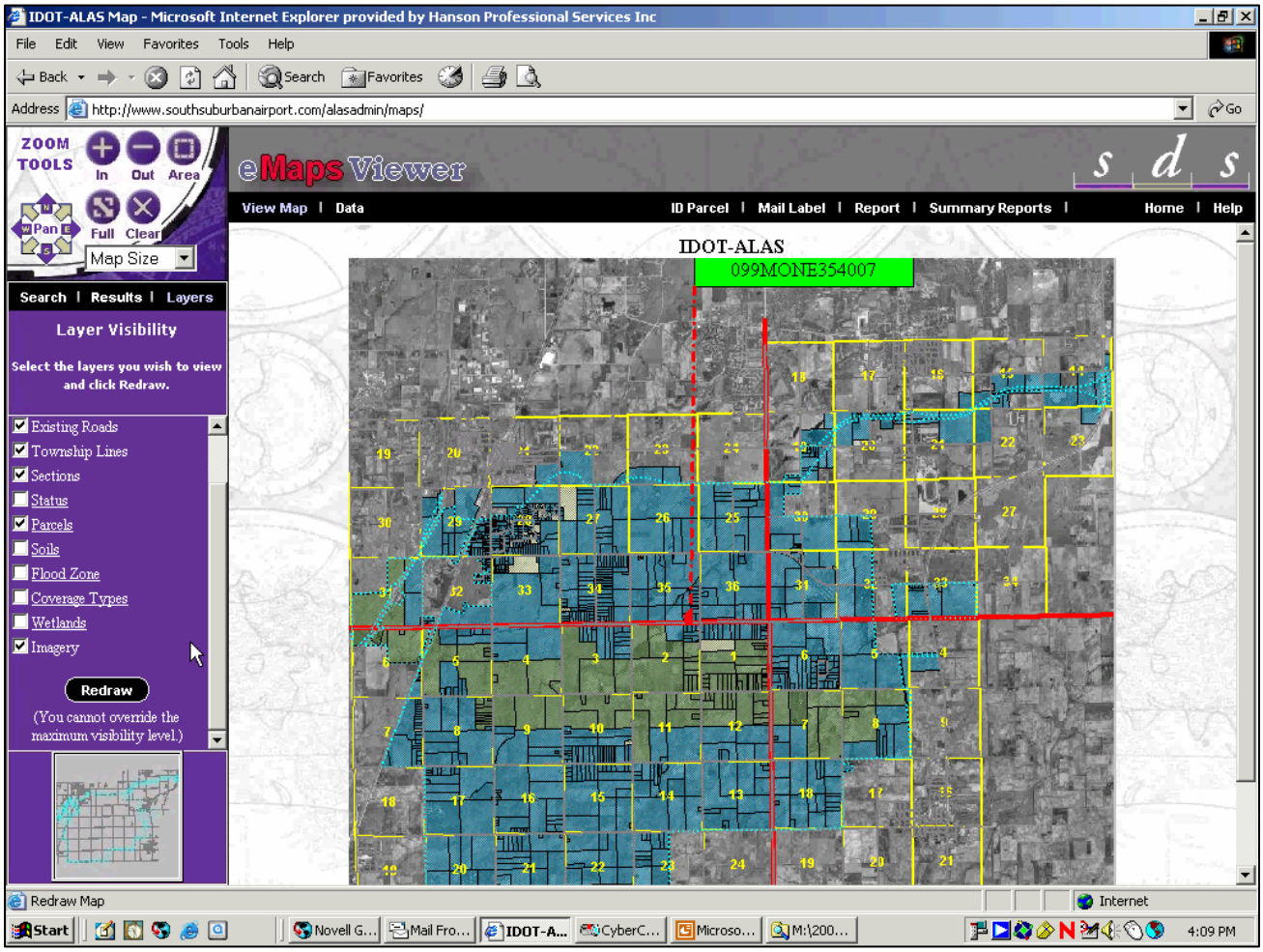


Figure 4 Example of ALAS geospatial interface used by IDOT

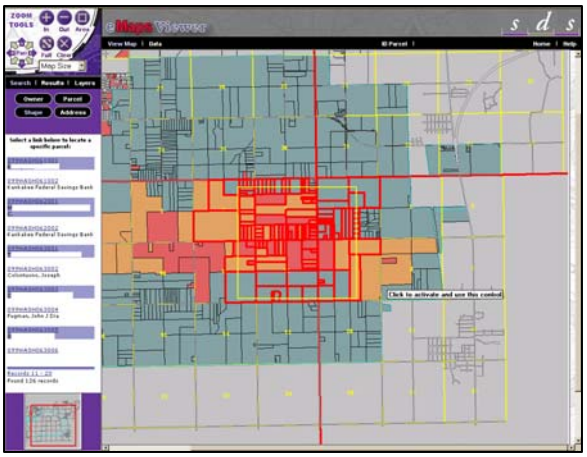


Figure 5 Example of the public map view

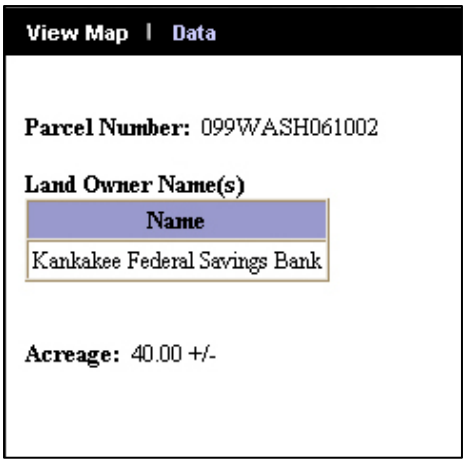


Figure 6 Example of publicly available data

Technologies Used

ALAS is a web application hosted on the consultant's web server. The data are also maintained by the consultant. Access to the system is through the internet and only requires a browser.

The technology used to develop ALAS includes:

- DREAMaps software
  -eMapsPlus
  -Analyst
- ArcGIS 9 (mapping for DREAMaps)
- Database manager

ALAS does not interface or exchange information with any other IDOT information management systems.

Geospatial Data

ALAS includes the following geospatial data:

- Parcel boundaries in the project area
- Road centerlines in the project area
- Project area boundaries
- Township lines
- Section boundaries
- Soil types
- Wetland boundaries
- Conceptual Airport Layout Plan
- Orthophotos in the project area

These data were acquired and/or created by the consultant as part of their services for this project and are not maintained by IDOT.

Extension and Future Plans

Because of the nature of the contract with the consultant, ALAS will continue to be modified as necessary to meet IDOT's business needs through the life of the project.

Estimated Cost of System

The cost of the system was part of the professional services contract and included purchase of the DREAMaps components used to develop ALAS, system development and modification, and system updates as needed. As a proportion of the overall contract amount, ALAS represents a very small fraction of one percent.

System Benefits

From IDOT's perspective, the benefits include the ease of managing the project with quick and easy access to near real time information. ALAS acts as a finger-tip file cabinet. The ability to generate summary reports as needed has also been invaluable to IDOT staff. Providing effective management for a complex project without increasing staff has provided IDOT its most quantifiable benefit.

Lessons Learned

IDOT staff knew from the beginning that ALAS would require changes and modifications throughout the project. Because of this expectation, working with the system has been relatively painless.

One consideration for the development phase of ALAS that staff would change would be to spend more time and effort on identifying and designing reports.

Although the interface to accessing information in ALAS is relatively intuitive, staff would have preferred additional training to more fully understand the capabilities of the system.

In selecting and implementing ALAS, IDOT did not consider the potential changes in information technology and capabilities over the life of the project. Although this has not created any issues, opportunities for taking advantage of new technologies are limited.

References

The Official South Suburban Airport Project web site, http://www.southsuburbanairport.com/ accessed May 31, 2006.
Public ALAS web site, http://www.southsuburbanairport.com/alaspublic/maps/ accessed May 31, 2006

Hanson Professional Services Inc.
Consultant to IDOT
1525 S. Sixth St.
Springfield, IL 62703
(217) 788-2450
http://www.hanson-inc.com/

Smart Data Strategies
DREAMaps provider
357 Riverside Drive, Suite 100
Franklin, TN 37064
(615) 794-5280
http://www.sds-inc.com/

Contacts

For more information about the use of the ALAS in the South Suburban Airport Project, please contact:

Division of Aeronautics, Illinois Department of Transportation
Terry Tappenbeck
1 Langhorne Bond Drive
Springfield, Illinois 62707
(217) 785-0066

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

Maryland State Highway Administration

Office of Real Estate

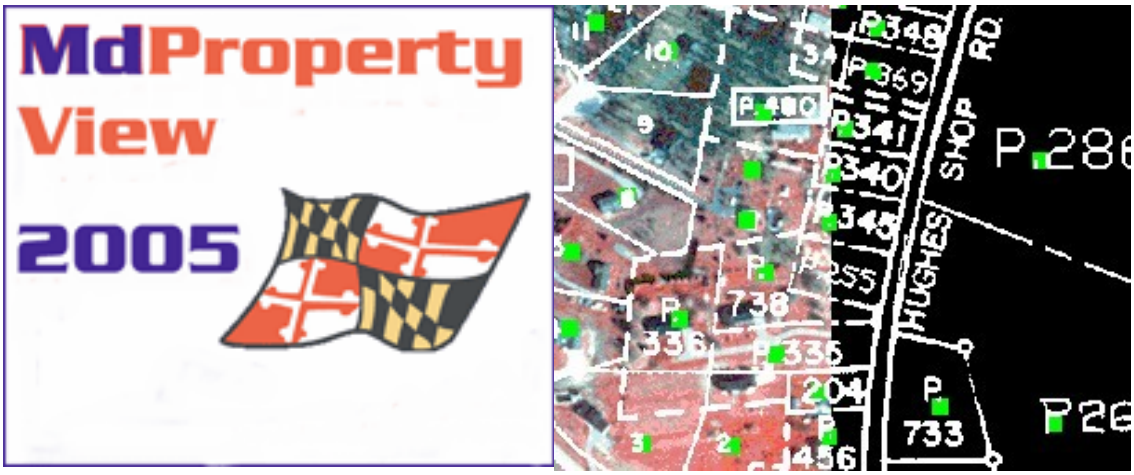
Maryland Department of Planning's MdProperty View

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Maryland State Highway Administration, Office of Real Estate, Baltimore, Maryland

Maryland Department of Planning's MdProperty View



Summary

MdProperty View is a tool which simplifies the way in which property information for Maryland is gathered, presented, and used. The system includes scanned images of property maps and digitized parcel centroids which link each property to the State Department of Assessments and Taxation's parcel database. The Office of Real Estate uses this system to obtain parcel information for the acquisition of right of way for transportation projects.

System Benefits

Originally, Office of Real Estate property researchers had to travel to the courthouse and search for tax assessment information for each piece of property. Through MdProperty View, this information is now available at their finger tips on their personal computers. The geospatial format gives the researchers an intuitive interface to quickly visualize these properties as they move to the next step of the acquisition process.

Return on investment has been measured in the reduction in research staff by half because of the reduced time to access property information.

Case Studies in Innovative Systems in Transportation Right of Way

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information about a system developed and managed by a sister state agency and licensed and used by the State Highway Administration for a single purpose.

System Overview

MdProperty View is a stand-alone geospatial application built on ArcView 3.x or ArcGIS 8.x that allows users to see and access Maryland property information for Maryland's 23 counties and Baltimore city. Supporting data include 2,200 scanned and geo-referenced parcel maps and 2 million property centroids which are linked to the State Department of Assessments and Taxation's parcel database. The Office of Real Estate (ORE) in the Maryland State Highway Administration uses MdProperty View to electronically obtain parcel information instead of physically going to the Courthouse. Used for a single activity within the right-of-way acquisition process, this system has allowed ORE to reduce the number of employees in the Records and Research section by 50%.

Agency Overview

Organization

The Maryland State Highway Administration (SHA) is responsible for more than 16,000 lane miles of interstate, primary and secondary roads, approximately 17% of Maryland highway mileage. SHA is divided into seven districts and 28 maintenance shops which handle daily responsibilities in Maryland's 23 counties. The Baltimore headquarters includes planning, engineering, policy and administrative offices.

The Office of Real Estate, under the Office of Planning & Engineering at headquarters, is composed of the following divisions: Appraisal Review, Property Review, Special Acquisition, and Real Estate Administration and oversees activities for the state including obtaining parcel information. District offices are responsible for field activities associated with the acquisition of right-of-way.

Information Technology Support

The Highway Information Services Division (HISD), which is in the Office of Planning and Preliminary Engineering, maintains a database of highway information in both electronic and graphic form. The division is responsible for the development and support of SHA's Geographic Information System. Integraph MicroStation is SHA's standard CAD platform. The original GIS platform at SHA was Intergraph's MGE but they later invested heavily in ESRI GIS products. Maps are drawn in MicroStation and then imported and modified in ArcGIS to allow linear referencing and attributing.

Several asset management databases are stored on SHA's enterprise GIS server using Oracle RDBMS. These include the data for MdProperty View which is licensed from the Maryland Department of Planning as well as the Highway Performance Monitoring System (HPMS), Pavement Inventory and Condition Data, Bridge Inventory, Accident Data, and Extra Lands Data. A custom ArcView application, called the SHA GIS Data Viewer, was created to provide users a front-end to access these asset management databases.

The Office of Real Estate has been improving their business practices by strategically and incrementally implementing innovative systems. Their approach has been to identify available solutions to specific needs and then to work with HISD to develop new systems. To support their property research activities, the Office of Real Estate has a license agreement for MdProperty View with the Maryland Department of Planning.

System Description

Background

MdProperty View was developed in 1996 by the Maryland Department of Planning (MDP) and is currently in its' ninth edition. Originally the software was an ArcView extension but now includes desktop or client-server modes compatible with ArcView 3.2 or ArcGIS 8.x. SHA helped finance the original system through a one-time fee and continues to provide road centerline and stream layers to MDP.

Activities performed using MdProperty View

The primary users of MdProperty View are county and state agencies for assessments and planning. In SHA, the Office of Real Estate is the primary user where the application is used for property assessments in developing project cost estimates and for obtaining relevant parcel information for acquisition. The software is also used to obtain geographic coordinates for property centroids for the ExtraLand Application. Before MdProperty View, ORE staff had to physically go to the courthouse to research tax files to obtain the same information.

Now, the SHA Office of Planning & Preliminary Engineering provides the Office of Real Estate with a list of parcels, parcel details, and mapping keys in a Microsoft Excel spreadsheet which is joined with the parcel centroid layer in MdProperty View to view parcels for a specific project.

User Interface

MdProperty View software is located on each desktop and accesses data from the HISD server over the agency's intranet. It is a web-enabled system built on ESRI's ArcView or ArcGIS and uses that general interface. Figure 1 shows the ArcView-based system when initiated.

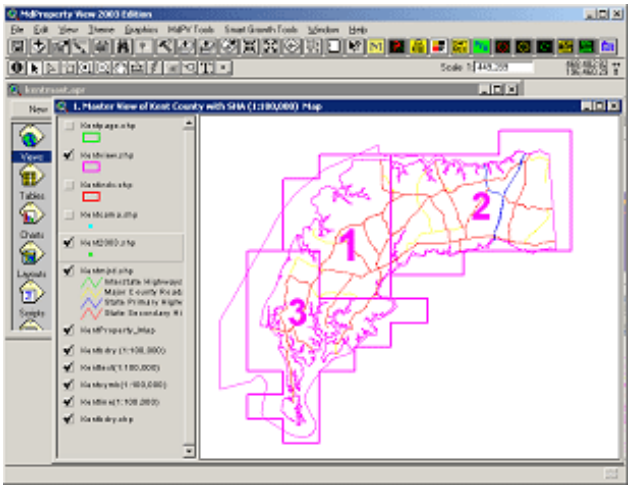


Figure 1 MDProperty View system

The Enhanced User Interface is a custom suite of button-driven tools which makes MdProperty View extremely easy to use. This interface is a valuable part of both the ArcGIS and ArcView versions of the product. Each of these tools is accessed through icon buttons on the MdProperty View interface toolbar shown in Figure 2.

On-line documentation and technical support are provided by MDP.

Figure 2 MDProperty View user tool bar

Technology Used

MdProperty View uses the following software and technology:

- ArcView 3.x or ArcGIS 8.x (must be purchased separately)
- Internet access
- Crystal Reports (to generate standard reports)
- Oracle

Geospatial Data

MdProperty View includes several layers of geospatial information which are maintained and/or updated at different intervals, depending on the layer, by MDP. SHA obtains this information annually from MDP through a license arrangement.

Geospatial layers in MdProperty View used by ORE include:

- Scanned tax maps
- Parcel centroids linked to data from the Maryland State Department of Assessments and Taxation
- County boundaries

Other layers are available from MDP including imagery and various boundaries.

Estimated Cost of System

SHA provided a one-time cost share amount for the initial development of MdProperty View. Although MdProperty View data are on a SHA server, the Office of Real Estate is not responsible for upkeep and maintenance of the information. Cost recovery to MDP is through annual license fees based on number of installations. Current cost for statewide coverage for a single installation is approximately $10,000 per year.

System Benefits

Increased employee efficiency, faster access to information, and better quality of parcel data are some of the qualitative benefits of the use of MdProperty View by the Office of Real Estate. Because the system was developed and is maintained outside of SHA, they do not quantitatively measure specific system benefits.

Lessons Learned

Easily understood and usable user interface design is critical for quick acceptance of software tools.

Expect and plan for a potentially tough transition when initiating new technology and related systems.

References

Maryland Department of Planning, "MdProperty View", http://www.mdp.state.md.us/data/index.htm accessed December 27, 2005.

Maryland State Geographic Information Committee, "Technology Toolbox Data Sample, MdProperty View", http://www.msgic.state.md.us/techtool/samples/propview.htm accessed December 27, 2005.

Contacts

For further information about the Office of Real Estate's use of MdProperty View, please contact:

State Highway Administration, Maryland Department of Transportation
Joseph Miklochik
Director
Office of Real Estate
707 North Calvert Street, M-301
Baltimore, Maryland 21202
(410) 545-2828

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

New Mexico Department of Transportation

Right of Way Section, Property Management Unit

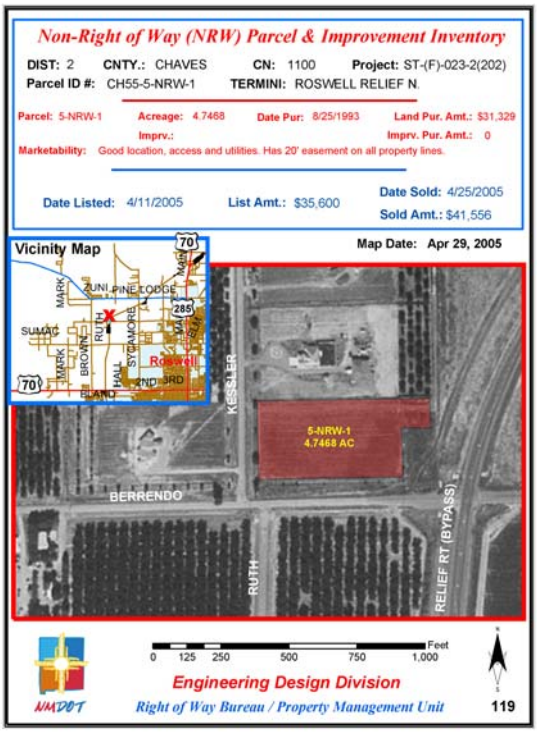
Non-Right of Way (NRW) Parcel & Improvement Inventory

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

New Mexico Department of Transportation, Right of Way Bureau, Property Management Unit, Santa Fe, New Mexico

Non-Right of Way (NRW) Parcel & Improvement Inventory



Summary

The Non-Right of Way (NRW) Parcel & Improvement Inventory system is a template-based automated process within ESRI's ArcGIS which generates a one-page summary of information about parcels that are available for sale to the public. This summary is posted on the Internet in .pdf format for public access.

All staff in the Property Management Unit are trained to use ArcGIS for every day management of information associated with their business processes including the generation of these NRW Parcel summaries.

System Benefits

- Centralized information on DOT-owned parcels that is accessible to all employees.
- Automated generation of NRW Parcel and Improvement Inventory summary sheets.
- Geospatial view of parcel locations with associated information.

The biggest benefit has been in the ease of retrieving data from a single source and eliminating the search for and manual compilation of information.

Although unmeasured in dollars, the return on investment has been recognized through improved staff efficiency and the ability to provide information to the public about excess property in a more timely manner.

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information on a simple, straight-forward application of a geospatial template which generates information on parcels that are for sale by a transportation agency.

System Overview

Although not truly an information system, the Non-Right of Way (NRW) Parcel & Improvement Inventory activity uses geospatial technologies and computer-based templates to generate uniform forms of information about parcels that are for sale to the public. This straight forward activity has improved organizational efficiency and customer satisfaction.

Agency Overview

Organization

The New Mexico Department of Transportation (NMDOT) is responsible for building, maintaining, and operating approximately 30% of the state's roads, bridges, and tunnels.

NMDOT is divided into six districts. The central office in Santa Fe is headquarters for approximately twenty-five operational and administrative units.

The Right of Way Bureau, located at headquarters, is responsible for acquiring and managing all property for the Department for the construction and maintenance of projects. It identifies property owners, provides title reports, appraises effected properties, reviews the appraisals, and negotiates and acquires these properties. The Bureau also manages NMDOT-owned properties, including sales, leases, encroachments and various other property management responsibilities. Right of Way activities are primarily performed in the central office by NMDOT employees.

Information Technology Support

NMDOT has a centralized Geographic Information Systems (GIS) Office which manages the geospatial information infrastructure for the department. This office is responsible for maintaining core geospatial databases including county, city, and town boundaries; road centerlines; mile markers; and interchanges. Digital orthophotos are provided for the entire state through Intergraph's TerraShare. The GIS office manages the centralized server for this core geospatial data, including the parcel layer developed and used by the Property Management Unit.

System Description

Background

Through its close working relationship with the local Federal Highway Administration (FHWA) office, the Property Management Unit within the Right of Way Bureau became aware of the benefits of using GIS technologies for their business practices in about 2001 and began using ESRI's ArcGIS products as one of their suite of software tools.

Prior to the introduction of ArcGIS, project information was managed in spreadsheets and hardcopy files. Once GIS was introduced, staff members used ArcGIS to develop project-based parcel layers that included the necessary project information as part of tables associated with the geospatial features.

In general, all staff members, currently four, are provided training in how to use ArcGIS when they join the Unit and are responsible for managing the information necessary to their activities within that software.

Development
Through a visit from the GIS Office, staff members of the Property Management Unit were introduced to the Map Book tool and the benefit of using a template approach to performing repetitive activities such as creating fact sheets about available real estate inventory. The GIS office assisted with downloading the Map Book extension and demonstrating its use.

As a result, members of the Unit created the Non-Right of Way (NRW) Parcel & Improvement Inventory template as part of their normal activities.

System Goals
Because the NRW template evolved from a specific need within the Unit, no formal goals were established. The primary reason for its development was to save time in responding to requests from the public for information about parcels for sale.

The functional goals of the NRW Parcel & Improvement Inventory were to provide uniform information about real estate for sale by the Department in a consistent format and to publish that information to the Internet for quick and easy access by the public.

System Requirements
The ArcGIS software, currently version 9.0 and including the Map Book tool, is required on each desktop computer. The geospatial layers used in the software are provided on the centralized data server through the Department's intranet. The resulting .pdf files generated by the NRW Parcel & Improvement Inventory are served to the Internet through the Department's Web server.

User Interface
The user interface is the ArcGIS software interface which does require training with that software. Map Books provides an added toolbar to the interface but otherwise operates as an extension of ArcGIS.

When the Unit receives information from a project, they heads-up digitize the parcels that they are responsible for from that project in ArcGIS and add the parcel information to the database. If and when parcels become excess inventory, they become part of the NRW Parcel & Improvement Inventory system.

The NRW template, through Map Books, automatically generates the Inventory form for posting on the Internet. Prior to sale of the Inventory, the form includes an orthophoto-based image with the parcel highlighted and a vicinity map. The following information is automatically extracted from the database to populate the form which is shown in Figure 1.

- District number
- County
- Control number
- Project Number
- Parcel Identification number
- Termini
- Acreage
- Date of purchase by state
- Amount of land purchase by state
- Improvements, if any
- Amount of improvement purchase
- Marketability assessment
- Date listed
- List amount

Once the inventory has been sold, the form is updated to include:

- Date Sold
- Sold Amount

Technologies Used
The property management unit uses the following software and technology:

- ESRI's ArcGIS 9 with Map Book tool
- Adobe Acrobat Writer

Extension and Future Plans
The Unit does not have specific plans to expand the existing system although they would like to see other units within the Right of Way Bureau adopt GIS as a software tool.

Estimated Cost of System

In addition to the purchase of the ESRI software, costs consisted of time to train staff to use the software and staff time to design and develop the template.

System Benefits

Dollar benefits were not measured for using GIS for day-to-day activities or in determining how many resources were saved once the template was employed. However, customer satisfaction, increased employee efficiency, and better quality of data are some of the unquantified benefits identified by the Property Management Unit.

Lessons Learned

The primary lessons learned from the incorporation of GIS are:

- Send employees to formal classes or workshops as opposed to training them on the job.
- Use geodatabases for managing geospatial information as opposed to shapefiles.
- Work with the IT office to improve remote server access and performance.

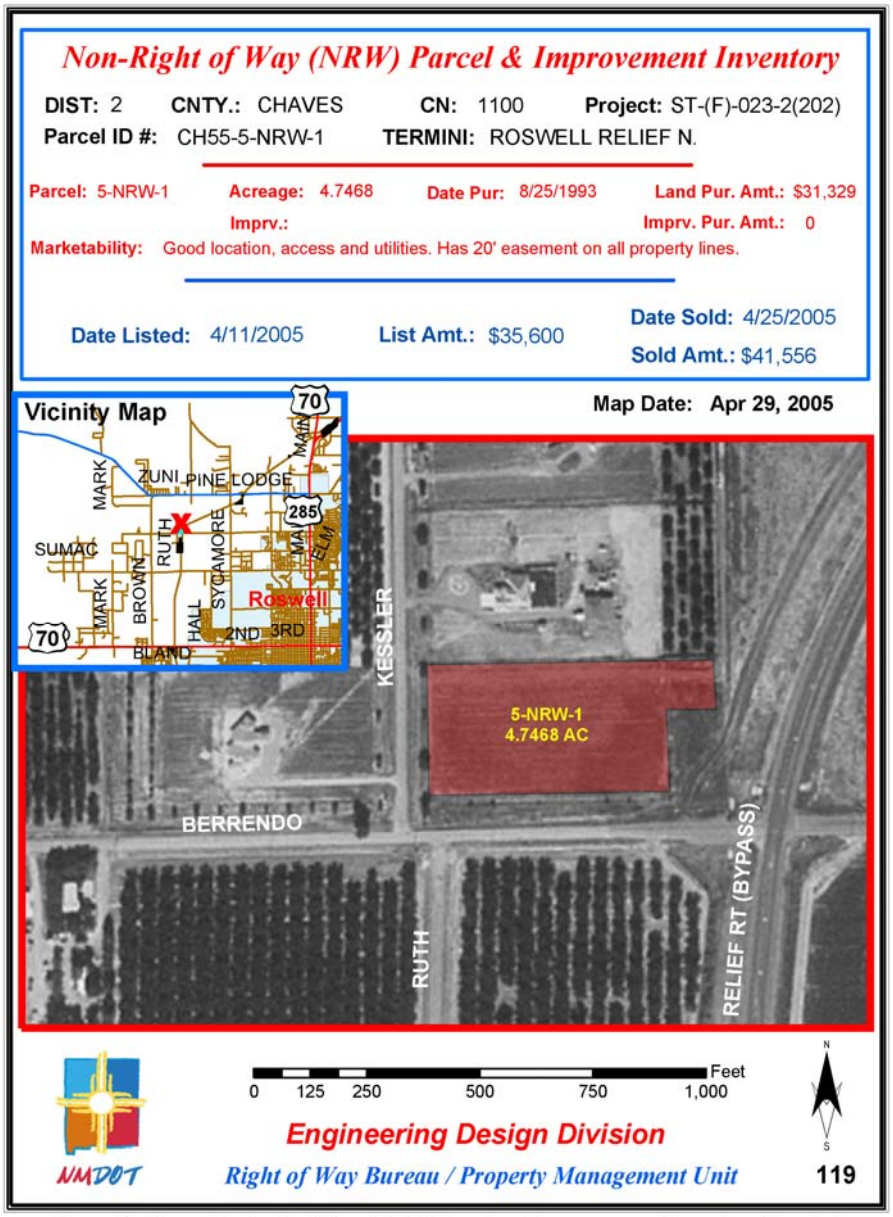


Figure 1. Example of output from NRW Parcel and Improvement Inventory Template.

References

http://nmshtd.state.nm.us/main.asp?secid=13802 NMDOT, accessed March 2006.

Contacts

For further information about the Non-Right of Way (NRW) Parcel & Improvement Inventory, please contact:

New Mexico Department of Transportation
Robert Lopez
Information Technology Section Manager
Right of Way Bureau/Property Management Unit
1120 Cerrillos Road
Santa Fe, NM,
87504-1149
(505) 827-5349

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

Pennsylvania Department of Transportation

Utility and Right of Way Section

PennDOT Right of Way (ROW) Application

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Pennsylvania Department of Transportation, Design Services Division, Utility and Right of Way Section Harrisburg Pennsylvania

PennDOT Right of Way (ROW) Application

Summary

The PennDOT ROW Application is a comprehensive management tool that incorporates innovative data-integration capabilities and supports:

- Right-of-Way appraisal, negotiation, relocation, and property management
- Administration of the project, appraisers, and district activities
- Management of contracts, task orders, subcontractors
- Tracking of legal information

This application provides decision makers with finger-tip access to Right of Way highway project information.

System Benefits

- Improves information flow through the business process
- Manages user permissions to the system more effectively
- Provides desktop access to information for all users
- Maintains a library of forms and letters used statewide

The biggest benefit has been through the electronic link to the statewide accounting system with improved timeliness of payment approvals reducing the time from overnight to minutes.

A quantifiable 21% return on investment has been recognized through improved management of the large number of external consultants used by PennDOT just through effective management of permissions.

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information on a comprehensive and integrated data management system that was modified from an existing vendor software application.

System Overview

The PennDOT Right of Way (ROW) Application is an enterprise system which manages the right-of-way process from start to finish. The ROW Application is designed to provide a single, comprehensive management tool for tracking project and land parcel status. The system incorporates a web-based structure, graphical user interface, and comprehensive data integration through XML interface technology linking to multiple department databases. The system includes document management features that generate and store over 300 forms.

Agency Overview

Organization

The Pennsylvania Department of Transportation (PennDOT) is responsible for more than 41,000 miles of roadway, approximately 35% of the total.

PennDOT is divided into eleven districts including 67 counties. The central office is located in Harrisburg.

The Utility and Right of Way Section (URWS), part of the Bureau of Design, is responsible for developing and ensuring compliance with policies and procedures that comply with applicable laws and regulations for the acquisition of right-of-way, relocation of utilities and alterations to railroad facilities as required by highway and bridge projects. The central office is responsible for quality assurance over the highly decentralized districts who are responsible for quality control.

Information Technology Support

PennDOT has a Bureau of Information Systems (BIS) which provides information technology solutions, integrated information systems, tools for the efficient use of data, and communication services to the Department. The Bureau is actively involved in all aspects of bringing information technology to the various areas in the Department and was part of the design and implementation team for the ROW Application.

System Description

Background

PennDOT has a recognized history of performing continuous quality management of its business processes. URWS was part of the reengineering initiative in 1995 which redesigned and streamlined right of way activities within the department. In 2001, the section decided to replace the main-frame REMIS system which had become obsolete and costly to maintain. BIS and URWS started the replacement process in 2003. At the beginning of 2004, the Information Technology Request was approved and the formal process of defining the new application was started. In 2004, PennDOT contracted with Bentley Systems to implement their Right of Way Office software over a 10-month period.

Development

PennDOT uses joint application development (JAD) teams as part of a steering committee to provide guidance to any new enterprise systems. For the ROW Application, seven JADs were established, one for each of the functional areas, administration, and system testing. These groups, with BIS and Bentley provided the steering committee. Several JAD meetings

were held from mid 2004 through mid 2005. Their responsibilities included:

- Defining JAD responsibilities
- Submitting existing forms for review and comparison
- Drafting, reviewing, and signing off on Use Case documents
- Identifying desired data fields
- Defining forms and reports
- Reviewing End User Procedures and Guide

Working with the JADs, Bentley modified its Right of Way Office to meet the criteria established by the steering committee and the ROW Application was implemented in May 2005.

PennDOT has a one year maintenance agreement with Bentley to support the implementation and transition period.

System Goals

Goals for the system were established early in the process and included:

- Provide an internet-based desktop environment for right of way professionals
- Provide extensive reporting capabilities
- Provide electronic forms
- Have a user-friendly interface
- Only entering information once
- Provide convenient internal and external access to the system
- Provide electronic communication between the ROW Application and other department applications.

System Requirements

The original physical requirements for the system included that it have a single server (with back up servers), be able to access other department information systems, have an internet-based interface for internal and external access, and provide security management for all users.

Activities managed in ROW Application

Activities managed by the ROW Application include entering information for appraisals, negotiations, acquisitions, and property management; managing excess property; processing forms for payments; and providing a clearance process.

User Interface

Several hundred right of way and utility employees and field consultants currently use the ROW Application. Users are given access only to the functions that they need. The basic interface is similar to typical Web applications with "folders" and links down the left side and a workspace to the right. The initial page is shown in Figure 1.

Each activity is represented by a folder. Under each folder is a series of forms for entering or viewing information in the system. Figure 2 provides an example of the Project Maintenance form. Project funding information is entered

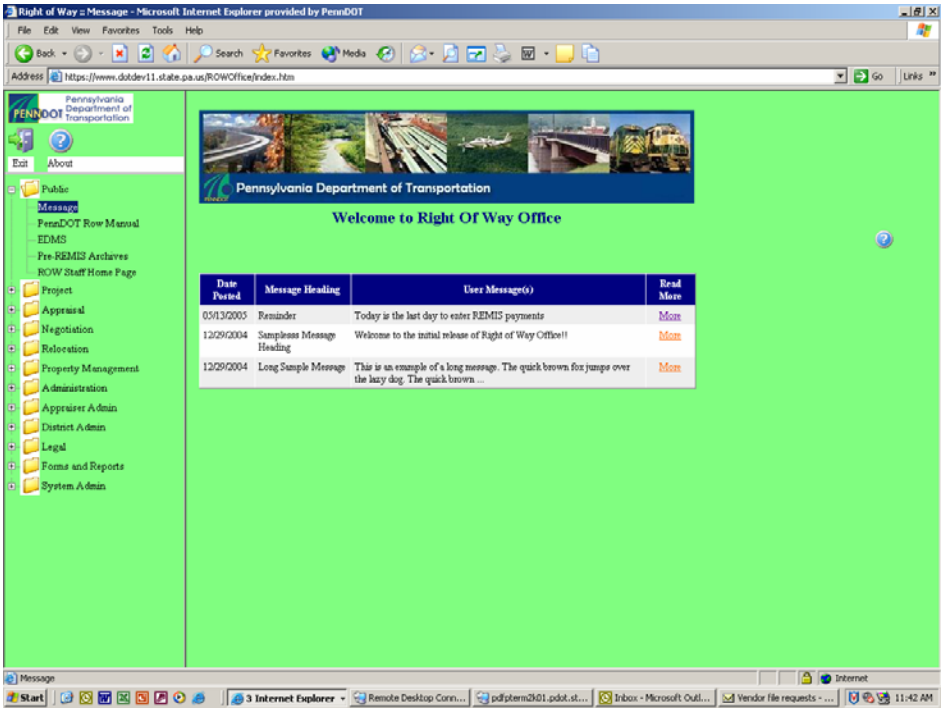


Figure 1 Entry page for PennDOT ROW Application

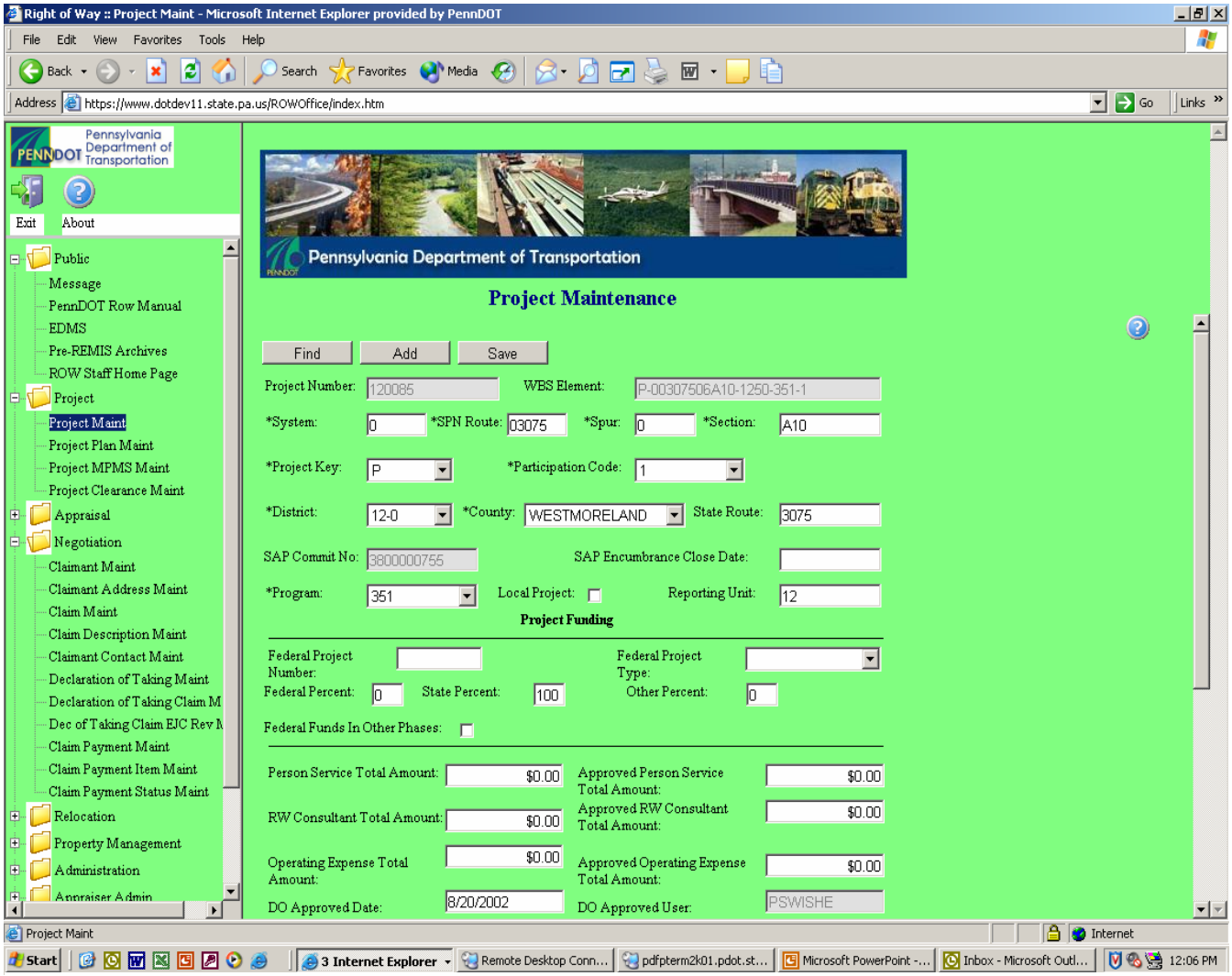


Figure 2 Example of Project Maintenance form

here and electronically matches funding previously established in the department's statewide accounting system. ROW Application automatically populates the Commitment Number, dedicating encumbered funds to a specific project.

An example of the standard search screen is given in Figure 3. Figure 4 provides a summary of payments on a project. Each payment can be selected to view more information about that transaction.

Technologies used

ROW Application uses or has used the following software and technology:

- XML
- Crystal Report Writer
- Bentley's Right of Way Office

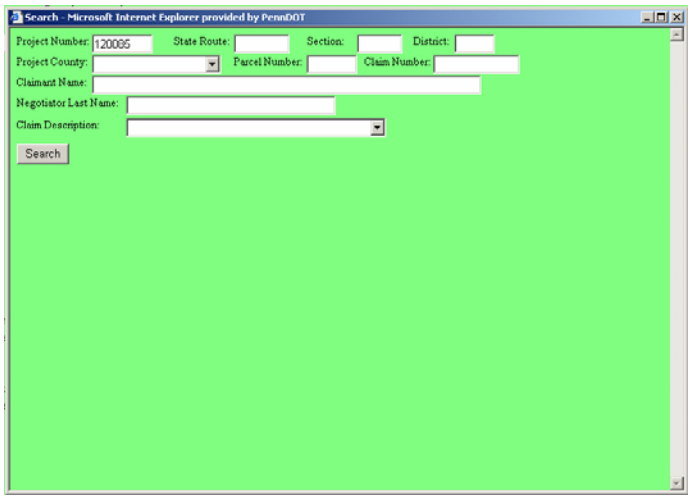


Figure 3 Example of standard search screen

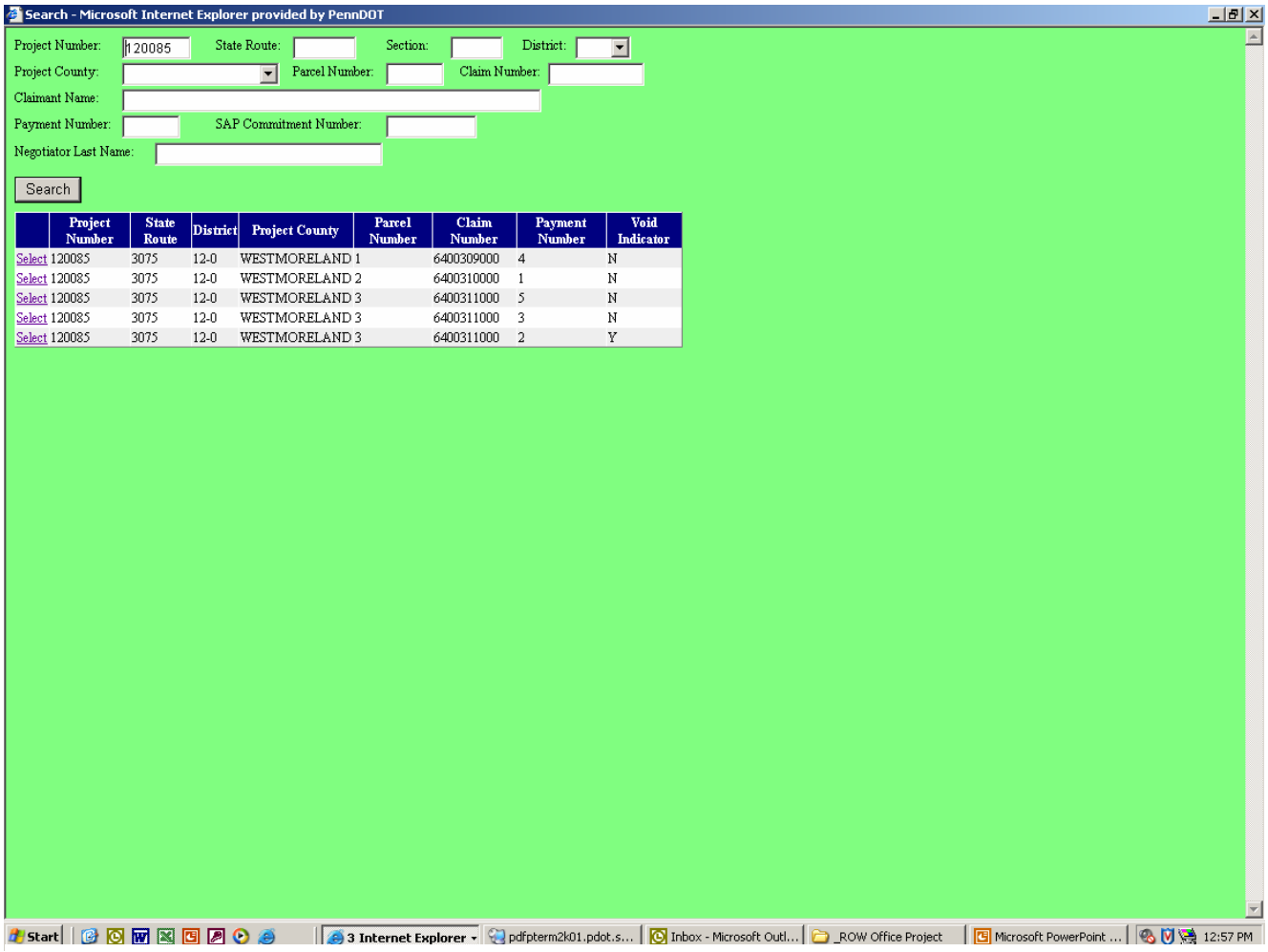


Figure 4 Example of payment summary page

Extension and Future Plans

Additional reports and entry forms will be added to ROW Application over the year following implementation. In the future, the URWS also intends to link the system to the Multimodal Planning Management System (MPMS) and the Electronic Document Management System (EDMS) to allow electronic communication between systems. The section also would like to link parcels to location and provide a geospatial interface for viewing information.

Estimated Cost of System

The cost for purchasing and modifying ROW Application was $829,000. The URWS is currently under a one-year maintenance agreement with Bentley.

System Benefits

Improved product delivery, reduced payment processing time, reduced data entry, reduced security access management, and uniform report generation are some of the benefits identified by URWS personnel.

Based on internal tracking of costs associated with right of way activities, the section has determined that they have reduced annual operating costs by $679,000 resulting in a return on investment of over 21 percent.

Lessons Learned

In terms of the URWS, “No good deed goes unpunished.”

References

HEEP Area1 2005 Conference Presentations, Gettysburg, PA, http://www.geodecisions.com/2005heeparea1/attendees-conference.htm accessed April 5, 2006.

FHWA, "Right of Way quality Mangement System – The Journey of Five States, Chapter 5", FHWA, Washington DC, http://www.fhwa.dot.gov/REALESTATE/rowmgt/chap5.htm accessed April 5, 2006.

Bentley Systems, Inc.
Exton, PA
1-800-BENTLEY
http://www.bentley.com/en-US/Products/Right-of-Way+Office/Overview.htm?market=Civil, accessed April 2006.

Contacts

For further information about the Pennsylvania ROW Application, please contact:

Pennsylvania Department of Transportation
Dale Perry
Right of Way Administrator
Utility and Right of Way Section
400 North Street, 7th Floor
Harrisburg, PA 17120
(717) 787-2827

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

Texas Department of Transportation

Right of Way Map, Survey, and Utilities Section

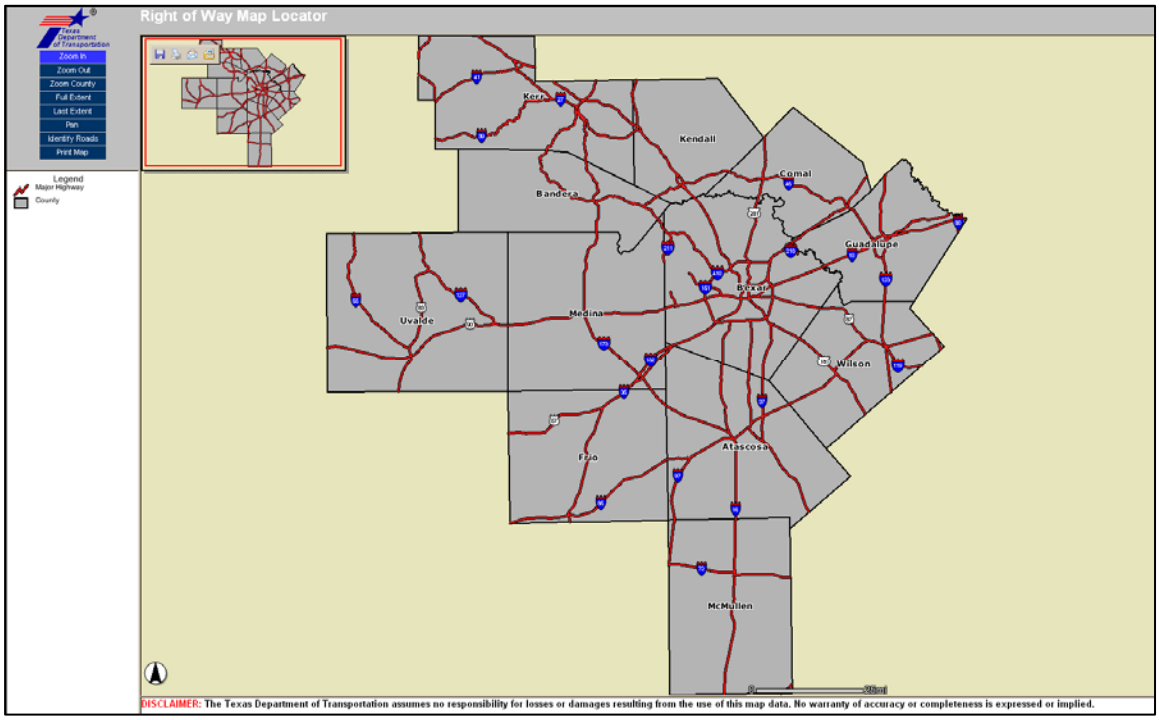
San Antonio Right of Way Application

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Texas Department of Transportation, Right of Way Division, Right of Way Map, Survey. & Utilities Section, Austin, Texas

San Antonio Right of Way Application



Summary

The San Antonio Right of Way Application is an Internet-based tool which provides users with access to scanned images of finalized right-of-way maps by interactively selecting a location in the district. The system includes images of every district ROW map, both historic and current. The San Antonio District right of way professionals, as well as other DOT employees, use this system to view project information from any computer connected to the internet/intranet.

System Benefits

Location-based access to electronic copies of final right-of-way maps has improved staff efficiency through:

- reducing the effort needed to physically obtain and review map sets
- being able to point and click at a location on an interactive map instead of looking up the information using textural information.

Having fingertip access to <u>all</u> final right-of-way maps has reduced research time for obtaining historical project information.

Return on investment has been measured in reduced time and effort to access project information.

Case Studies in Innovative Systems in Transportation Right of Way

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information on an internet-based map document access system that uses location to identify maps.

System Overview

The San Antonio Right of Way Application is currently a stand-alone web-based geospatial application built with ArcIMS that allows users to access control section information and scans of all finalized right-of-way project drawings for the San Antonio District by selecting a location on the roads and highways shown in the map application. The scanned images can be viewed on-line as pdf files or downloaded to local computers as tif images.

The Right of Way professionals in the San Antonio District use the system to review project information from digital maps on line instead of physically retrieving large map sets from storage. This system has reduced the amount of staff time necessary to obtain critical project information.

The San Antonio Right of Way Application was developed in the San Antonio District as a prototype and covers the counties of Atascosa, Bandera, Bexar, Comal, Frio, Guadalupe, Kendall, Kerr, McMullen, Medina, Uvalde and Wilson. TxDOT intends to extend the system to cover the entire state.

Agency Overview

Organization

The Texas Department of Transportation (TxDOT) is responsible for more than 79,000 centerline miles of interstate and primary and secondary roads, approximately 26% of Texas highway and road mileage.

TxDOT is divided into 25 districts which plan, design, build, operate and maintain the state transportation system in the 254 counties. Headquartered in Austin are the 22 operating divisions, including the Right of Way Division which provides statewide coordination and oversight.

The districts are highly federated with most operations occurring at the district level. This system is primarily used by right-of-way professionals at the district level.

Information Technology Support

The Information Services Division (ISD), supports the business operations of TxDOT with innovative information technology and strategic information resource planning. The Division supports the Department's activities in photogrammetry, global positioning systems, geographic information systems, engineering software, and Geopak Data Files. Unlike many DOTs, the GIS unit is part of the GPS and Photogrammetric Units, not in the Planning Division. The Unit coordinates and participates in partnership with operating divisions and research teams in the development of new information systems and initiatives.

GIS at TxDOT was established after 1998 when the ISD-wide Information Systems Retooling Initiative was completed. At the beginning of this decade, the ISD performed a business process and information technology (IT) needs assessment in support of the GIS Architecture and Infrastructure Project (GAIP) reported in 2003. As a result of this initiative, TxDOT is now creating a flexible, spatially-enabled interface to be a

single information portal to TxDOT data sets and applications called Main Street Texas, or MST. The San Antonio Right of Way Application is one of the applications that has been incorporated into the portal.

System Description

Background

The San Antonio Right of Way Application was developed as a prototype for accessing digitally scanned project plans.

Activities performed using San Antonio Right of Way Application

The primary users of the San Antonio Right of Way Application are district office professionals who require information from project plans. However, anyone with an Internet connection and Adobe Acrobat Reader can access the system. Before the Application, staff had to locate the project drawings in storage and extract the large format drawings to obtain the necessary information.

The application is designed to serve images for all of the "Finalized" ROW maps the San Antonio District has in their collection. It displays images for roadways broken into 17 inch sections for roll maps and whole pages for flat maps. The images consist of the earliest maps which acquired the original parcels to the latest maps which acquired parcels for widening projects.

User Interface

When the San Antonio Right of Way Application is selected from the San Antonio District's web page, two buttons are provided:

Instructions for Using Application
San Antonio Right of Way Application

Limited but adequate on-line documentation is provided under the first button. A disclaimer is included under the second button which then leads to the application when the user selects *Continue*. Figure 1 shows the initial interactive map view. The buttons in the upper left corner provide the functionality including standard zoom and pan capabilities and *Identify Roads* which accesses the database and scanned images.

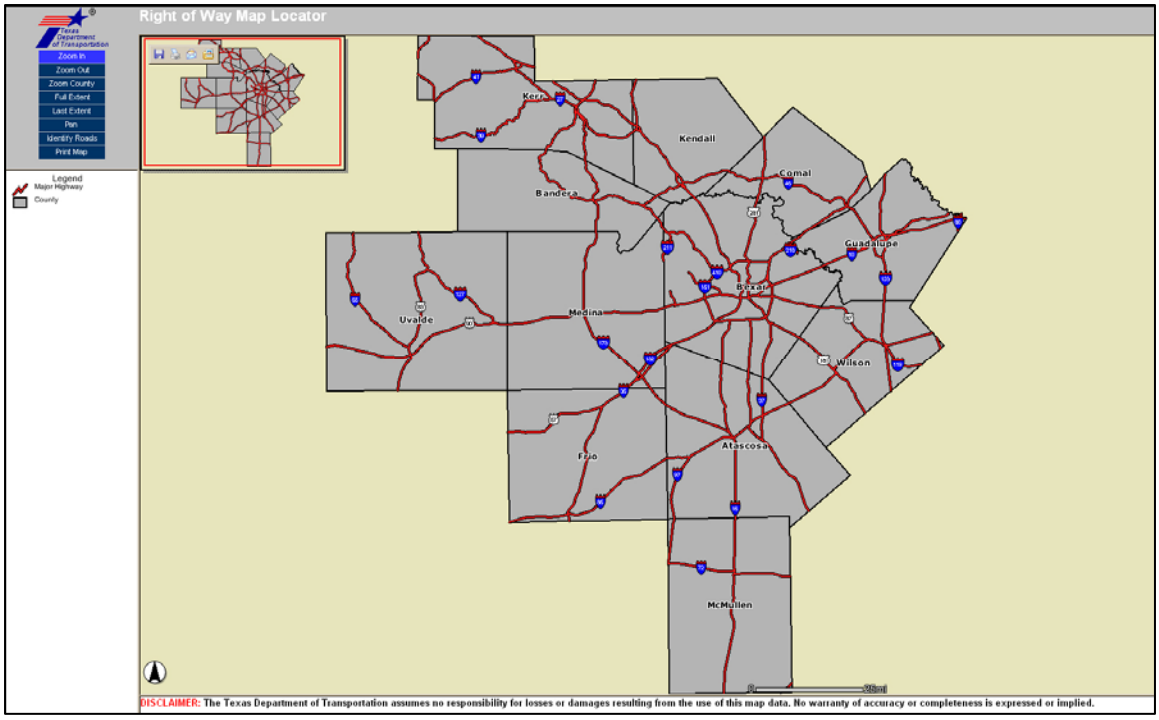


Figure 1 Initial view of application

Case Studies in Innovative Systems in Transportation Right of Way

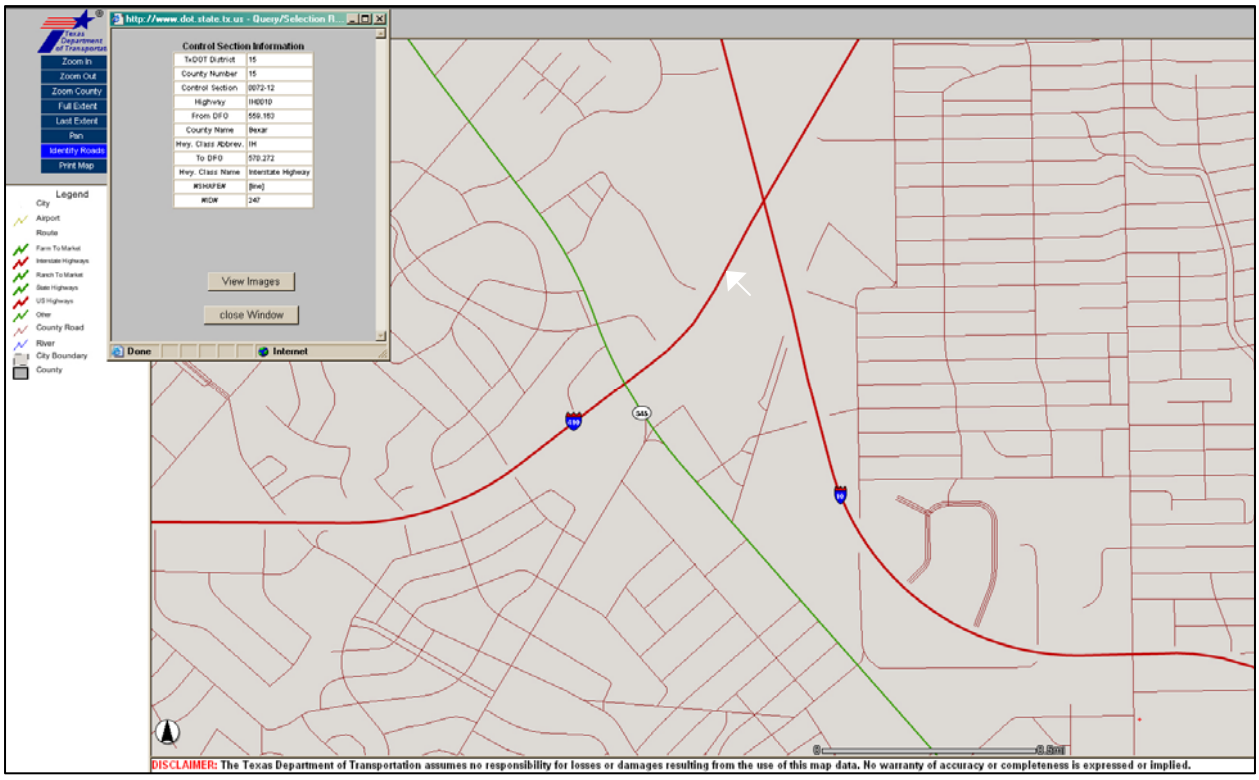


Figure 2 Control Section table

The user zooms in to a scale that allows sections of roads to be uniquely identified by clicking on their location with the mouse. A separate window opens showing a table of information associated with the highway control section as shown in figure 2. Control Section Information includes:

- TxDOT District
- County Number
- Control Section
- Highway
- From DFO
- County name
- Hwy Class Abbrev.
- #SHAPE#
- #ID#

The last two items are associated with the geospatial data. When the *View Images* button is selected, a separate window is opened with a list of all available images that match the County number and control section number as shown in Figure 3. Initially, the top half of the window is grey with a note that the user must have Adobe Acrobat installed to view pdf documents.

The lower section contains a list of scanned images by map set title and date as shown in Figure 3a.

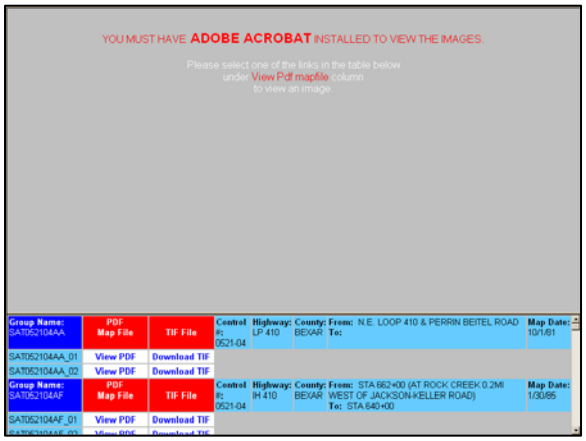


Figure 3 List of control section maps

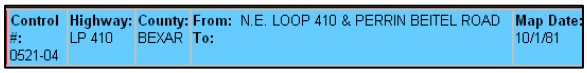


Figure 3a Map information

The user has the option to either view the pdf image or download the tif file for any scanned image.

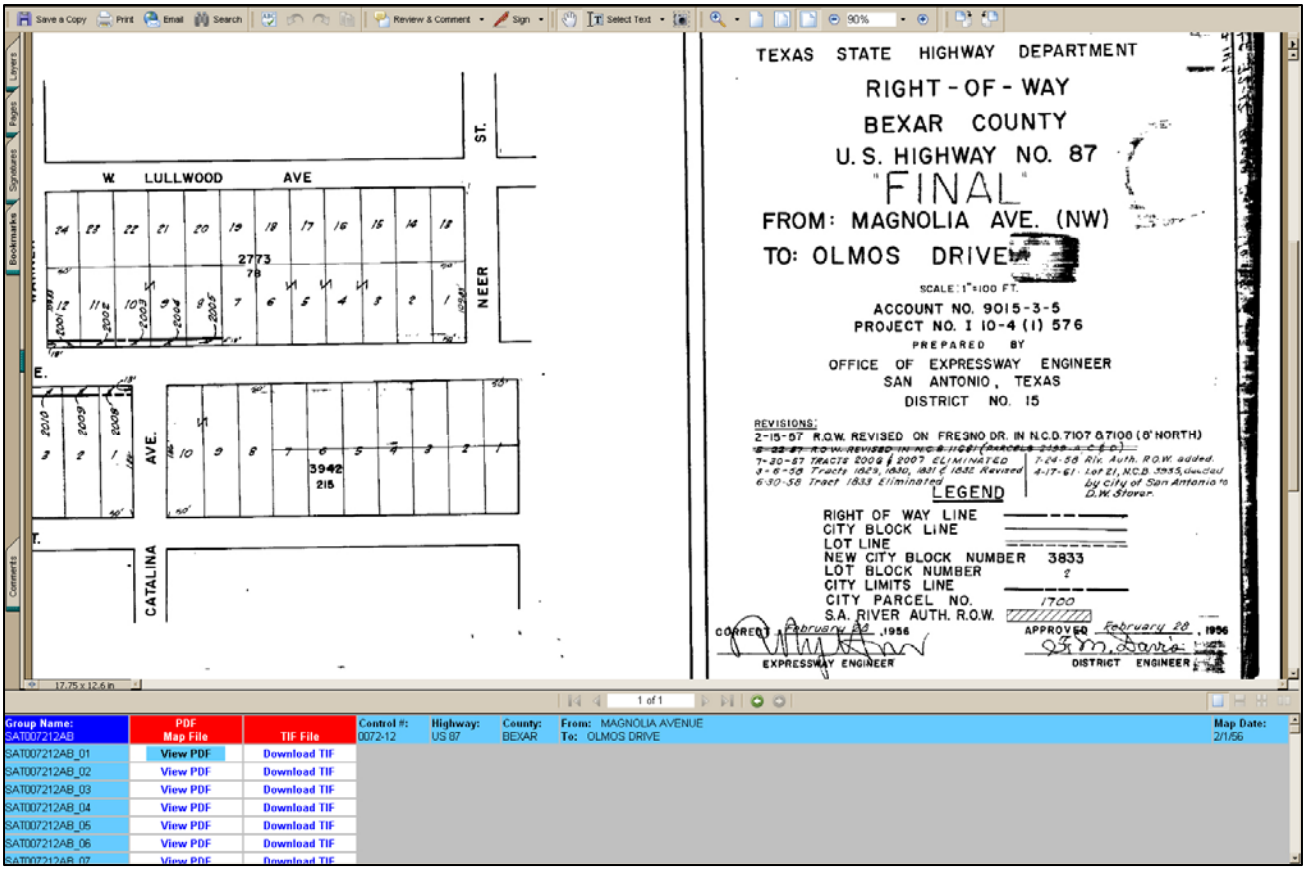


Figure 4 View PDF image

When the user selects *View PDF*, Adobe Acrobat opens in the top section of the window including its native functionality, as shown in Figure 4. When the user selects *Download TIF*, the window shown in figure 4a appears.

Figure 4a Download TIF image

Technologies Used

To access and use The San Antonio Right of Way Application, internet users are only required to have Explorer and Adobe Acrobat. The development of the Application required the following software and technology:

- ArcGIS 8.x (must be purchased separately)
- ArcIMS/Web Application
- Adobe Acrobat Professional (to create PDF files)
- Oracle
- Large-scale high-resolution scanner and associated software to generate TIF images
- Disk storage for images

Geospatial Data

The San Antonio Right of Way Application includes the following layers of geospatial information:

- County boundaries
- City boundaries
- Rivers
- Interstate highways
- US highways
- State highways
- County roads
- Farm to market roads
- Ranch to market roads
- Airport roads

Extension and Future Plans

TxDOT is in the process of implementing their Main Street Texas, a web-distributed, spatiotemporal, integrated information system which will act as portal for applications and data across the department. Currently, the San Antonio Right of Way Application is one of the initial applications included in the early development phase. As MST is developed, the data and images from this application will be integrated into the overall enterprise.

Estimated Cost of System

The cost of the system is not available. The geospatial layers were available through other activities in the Department. The web application was developed as a research project and included creating the geospatial reference to control sections. The scanning of map documents has occurred over several years.

System Benefits

Increased employee efficiency and faster access to information are the primary qualitative benefits of the use of the San Antonio Right of Way Application by the San Antonio District office.

Lessons Learned

The document imaging system server and related technology, including the acquisition of additional disk storage capacity to store electronic versions of final right of way maps is important to success of this system.

References

Texas Department of Transportation, TexDOT *Expressway*, http://www.dot.state.tx.us/sat/rowmap/sarow.htm accessed May 7, 2006.

Terra-Genesis, Inc., TxDOT Business Needs Assessment and GAIP Business Solutions Document, Version 2.2, Texas Department of Transportation Information Systems Division, April 2003.

Contacts

For more information about the San Antonio Right of Way Application, please contact:

Texas Department of Transportation
Jesse Cooper
Section Director
Right of Way Map, Survey, & Utilities Section
125 E. 11th St
Austin, Texas 78701
(512) 416-2874

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

Virginia Department of Transportation

Right of Way and Utility Division

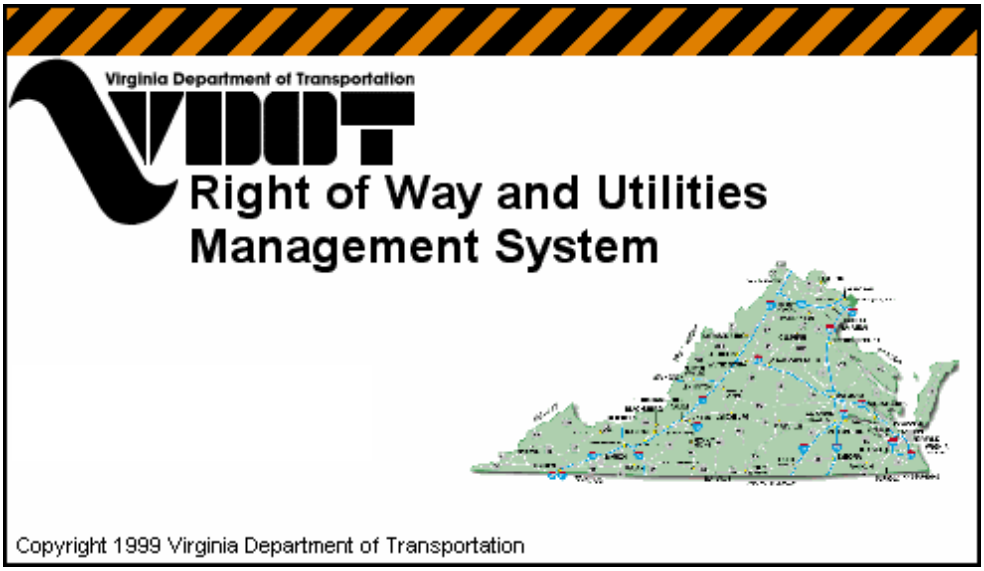
Right of Way and Utility Management System (RUMS)

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Virginia Department of Transportation, Right of Way and Utility Division, Richmond, Virginia

Right of Way and Utilities Management System (RUMS)



Summary

RUMS is a comprehensive management tool that incorporates innovative data-integration capabilities and supports:

- Right-of-Way appraisal, acquisition, improvement removal, relocation, legal, donation, grave relocation
- Utility design, easements, facility adjustments
- Assignment tracking
- Management of contracts, task orders, subcontractors
- Property management for sale, lease, property grouping, historical tracking

This unique software application provides decision makers with up-to-the-minute Right of Way highway project information and status.

In addition, RUMS allows management to easily and quickly assign and reassign work to appropriate field agents.

System Benefits

- Organizes all important Right of Way & Utility information
- Eliminates redundant data entry in completing forms used internally and externally to communicate with citizens
- Addresses needs at all levels - from data entry through management
- Emphasizes management focus on advertisement date and project status
- Enables improved access of information
- Produces reports at the click of a button that once took hours
- Maintains one centralized library of forms and letters used statewide

The biggest benefit has been in how easily data can be retrieved eliminating painstaking manual compilation.

Although unmeasured in dollars, the return on investment has been recognized through reduced staffing costs, improved scheduling commitments, and increased productivity.

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information on a comprehensive and integrated data management system that was developed within the Department.

System Overview

Implemented in early September of 1999, the Right of Way and Utilities Management System, **RUMS,** is an enterprise system which manages the complicated and often lengthy right-of-way process from start to finish. RUMS is designed to provide a single, comprehensive view of project and land parcel status, allowing for more efficient tracking of key dates. The system incorporates a web-services structure, easily navigable graphical user interface, and comprehensive data integration through a centralized data base. The system includes document management features that generate and store forms and letters.

Agency Overview

Organization

The Virginia Department of Transportation (VDOT) is responsible for building, maintaining, and operating nearly all of the state's roads, bridges, and tunnels making Virginia the third-largest state-maintained highway system in the country.

VDOT is divided into nine districts. The VDOT central office in Richmond is headquarters for approximately thirty operational and administrative units.

The Right of Way and Utilities Division is responsible for the appraisal and acquisition of property rights necessary for the construction and improvement of state roads. In conjunction with these duties, the Division also coordinates the movement of utilities and the relocation of businesses and families displaced by highway projects. It also tracks the management and disposition of residual parcels and surplus right of way. Right of Way activities are primarily performed in the nine districts by both VDOT employees and contractors. The central office is responsible for policies and procedures, approvals, and quality assurance and oversight.

Information Technology Support

VDOT has an Information Technology Operations Division which manages the information infrastructure for the department. IT participates in development of new systems as a partner with the business group that will be implementing the system.

The process that was used for RUMS was to identify the need; review alternatives, particularly off-the-shelf packages and systems used by other states; and based on the results of these activities, prepare a needs statement and preliminary specification to the IT division for the new system. The steering committee that oversaw the preliminary functionality consisted of IT and right-of-way staff. Based on input from the committee, IT approved the scope and then reviewed the project as established goals were achieved.

System Description

Background

In the mid-1990's, VDOT identified a need for an improved system to track increasingly complicated ROW activities, replacing a legacy main-frame system that had been in place for several years. The legacy system had numerous limitations including:

- Lack of consistent tracking of critical dates, allowing milestones to be missed without warning

- Inaccessibility of right-of-way data for management analysis
- Difficulty in searching and updating information
- Lack of capturing and tracking important information forcing users to enter such information in comments or not at all
- Lack of standardization of correspondence and forms used throughout the state
- Laborious completion of correspondence and internal documentation slowing the RW acquisition process.

After reviewing what other states were doing at the time, VDOT determined that building an in-house system was the appropriate approach.

VDOT issued a request for proposals for a new system in August 1997, awarding the contract to KPMG Consulting (now BearingPoint, Inc. of McLean, Va). Work commenced in December and RUMS went live in September 1999.

Development

Initially, a steering committee was created to determine the preliminary functionality and to set the workflow for the system. Subsequently, a working group was established, consisting of in-house experts across the Right of Way and Utilities Division from the central office and the nine districts. Extensive work was done by the committee in close partnership with the consultant to clearly identify specifications of the system. Regular meetings were mandated to ensure that the project met the goals and objectives of the Division and stayed on track.

Steps in the development included:

- As-is / to-be analysis
- Early prototype
- Design and initial data model
- Full prototype (Functional Version 0.5)
- Program specifications and final data model
- Development and testing
- Rollout training
- Pilot (single district - 3 weeks)
- Training (on-demand and repeatable)
- State-wide implementation
- Maintenance
- Improvements and modifications.

The original system was migrated to the VDOT Intranet using the browser-based .NET in 2003 (iRUMS). This capability has allowed staff onsite to view and update information immediately, making the system more efficient and consistent. An Internet version is currently under development.

RUMS is upgraded continuously rather than at intervals. The consultant remains on contract to perform maintenance and approved modifications.

System Goals

Goals for the system were established early in the process and included:

- Provide management with *at-a-glance* status of a highway project
- Allow management to focus on key highway project dates and shift resources to ensure the completion of right of way and utility activities prior to those dates
- Help Right of Way and Utilities agents generate, customize, store, and retrieve appraisal forms, letters of correspondence, and other documentation
- Have an intuitive user interface simple enough for a new user to easily learn and powerful enough for the advanced user to quickly navigate to any information in the system
- Automate the assignment and reassignment of work to division agents
- Interface with the Department of Transportation's mission critical Project/Program Management System (VDOT's programming and scheduling system)

System Requirements

The original physical requirements for the system included that it have a single server (with back up servers), use ORACLE as the database, and use Visual Basic for the user

interface. Later requirements included that the system be intranet based and the user interface be changed to .NET.

Output requirements for the system included the following forms:

- Standardized forms (i.e., internal memoranda, external correspondence, etc.) for all RUMS users
- Only applicable forms provided to a User based on the screen currently being viewed in RUMS - eliminating the need to search through a myriad of unrelated forms
- Forms populated with information from the RUMS database - eliminating redundant data entry
- Modifiable forms using Microsoft Word
- Forms can be updated remotely - user does not have to be in the RUMS application
- Completed forms stored in RUMS for viewing
- "Sandbox" concept allows new forms to be created without updates to RUMS software

Web based reporting:

- Reports defined with Crystal Report Writer
- Reports executed on "Cizer" (third-party product) Web Server and viewable by users via the Web Browser
- Web server with appropriate power and fast connection to database, allowing efficient execution of Crystal Reports
- Client not locked while report is executing
- Ability to satisfy 500 users via Web

Activities managed in RUMS

The purpose of RUMS is to track the "acquisition process." This includes appraisals, negotiations, relocation of displaced families and businesses, relocation of utilities, legal processes needed to acquire properties, and maintenance and disposal of surplus/residue properties. With RUMS, Right of Way managers can quickly see the status of highway projects, along with key deadlines for right of way and utilities transactions. When necessary, managers can use the system to reassign agents to meet these deadlines.

Specifically, RUMS supports the following Right-of-Way functions:

- Right-of-Way Management – appraisal, acquisition, relocation, grave relocation, legal (title examinations, deeds/rights of entry, condemnation, post-condemnation agreements, court awards), disposition of any improvements not part of the highway contract
- Utility Management – design, easements, facility adjustments
- Assignment Tracking – productivity reporting, personalized worklists
- Contract Management – contracts, subcontracts, task orders, contract based security
- Property Management – management, leasing, and disposition of surplus/residue properties

As more VDOT users become aware of RUMS, new uses are being identified. The Environmental Division now uses RUMS to track asbestos abatement. The Environmental Division also uses RUMS to track wetland mitigation sites ensuring that they are not inadvertently used on another project or sold.

User Interface

Because RUMS is a complex system with over 50 different user forms, a detailed discussion of the interface is not provided. Instead, examples of the various components are presented along with screen captures from the actual system.

Over 800 right of way and utility employees, field consultants, and other VDOT employees currently use RUMS. Users are given access only to the functions that they need. The basic interface is similar to typical Web sites with tabs at the top of the page. The left side of the screen provides a "TreeView" with a series of folders and subfolders for each function. The

right side is the work space where user forms appear as shown in Figure 1.

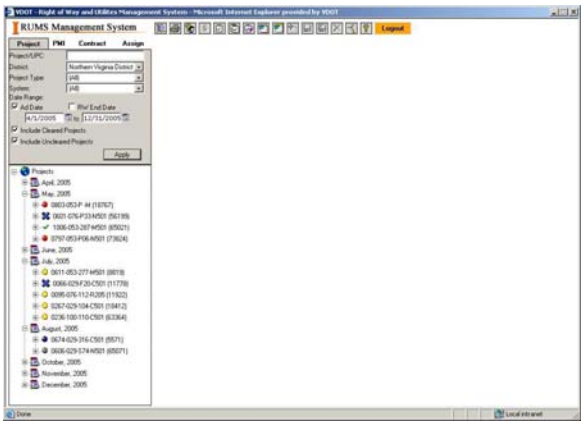


Figure 1 Basic RUMS user interface

Different icons are used in the TreeView to represent different functions while colors are used to represent status of those functions.

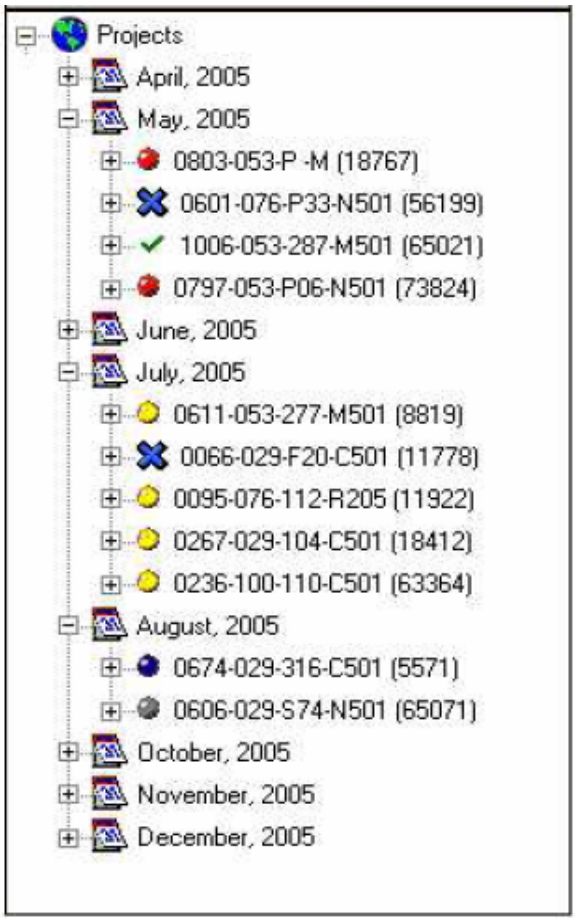


Figure 2 Example of project tracking

A green checkmark indicates the function is complete. A red icon means the function is within 90 days of the scheduled advertisement date, yellow is within 120 days, and blue indicates more than 120 days. An example is provided in Figure 2.

Projects are tracked by a unique project identification number (generated at by the Project Management Division) and the advertisement date. Parcels are tracked by an assigned parcel number and owner's name under the project. The square icon next to the parcel is divided into four triangles which are "filled" as the different activities associated with its acquisition as shown in Figure 3.

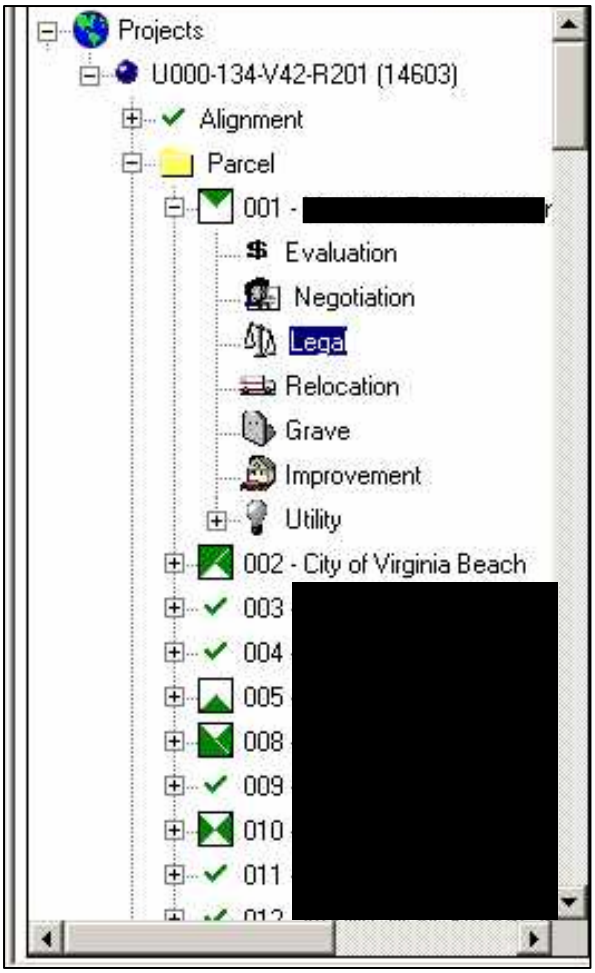


Figure 3 Example of parcel tracking
(names of individuals blacked out)

An example of a page providing information to the user, in this case, general information about a given parcel, is given in Figure 4. Figure 5 shows an example of a page with fields that have been populated from outside the system which are highlighted in yellow.

Figure 6 shows the Forms template screen which allows users to select a standard form. Once selected, the form is automatically filled with information from the system. The user can then modify the form as necessary.

Technologies Used

RUMS uses or has used the following software and technology:

- Oracle 9i
- MS Word 2000 / VBA (with Word 97 compatibility)
- Mercury Testing Tools: TestDirector / LoadRunner / WinRunner
- Crystal Report Writer
- Cizer (Web Enabled Report Execution)
- ADABAS SQL Gateway (interface to other VDOT systems)
- Visual Basic 6.0 replaced by .NET and 10G
- Sheridan VB Extensions: Data Widgets, Active TreeView, Designer Widgets

Extension and Future Plans

Currently RUMS is deployed in a Web environment through the VDOT IntraNet (iRUMS). Future plans include making the system Internet accessible during the next year.

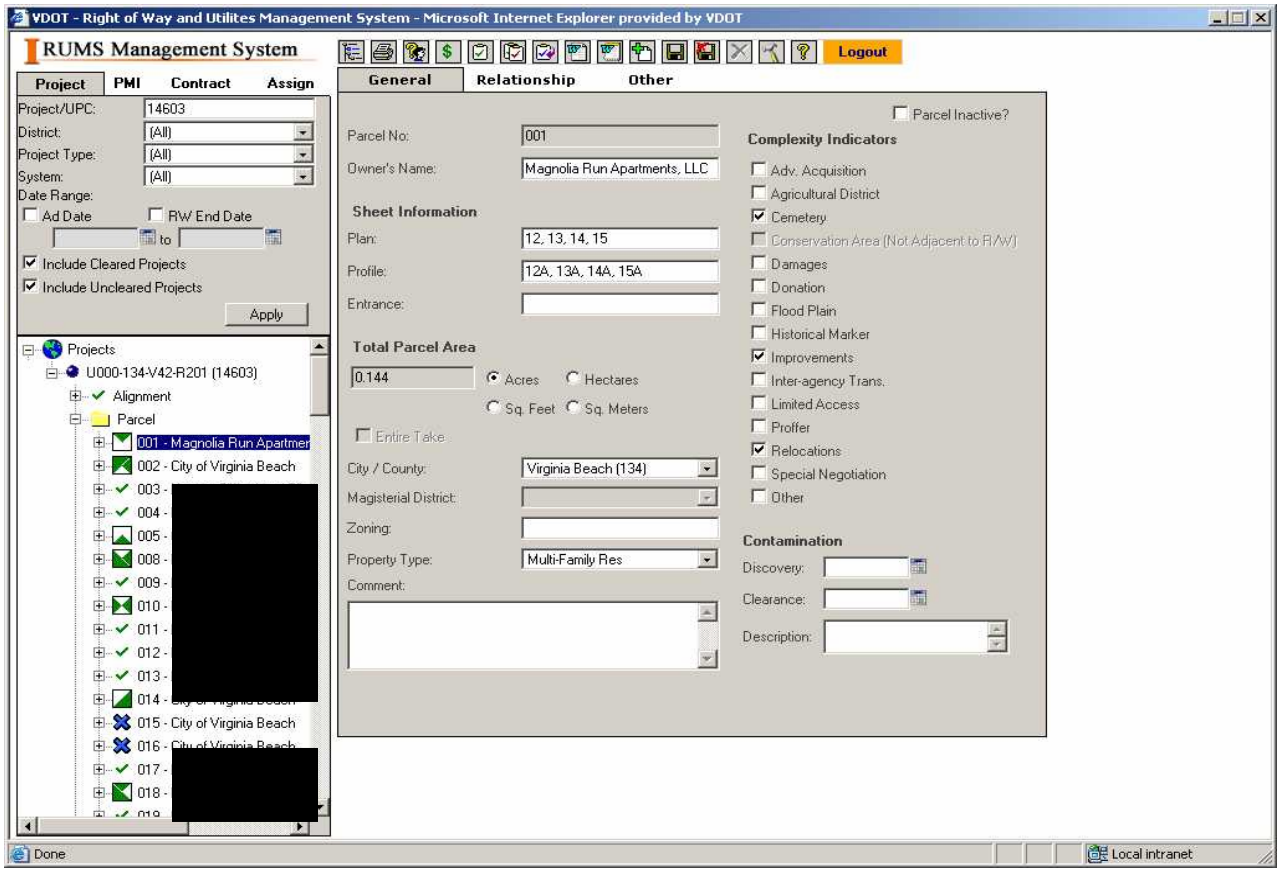


Figure 4 Example of a data input page (names of individuals blacked out)

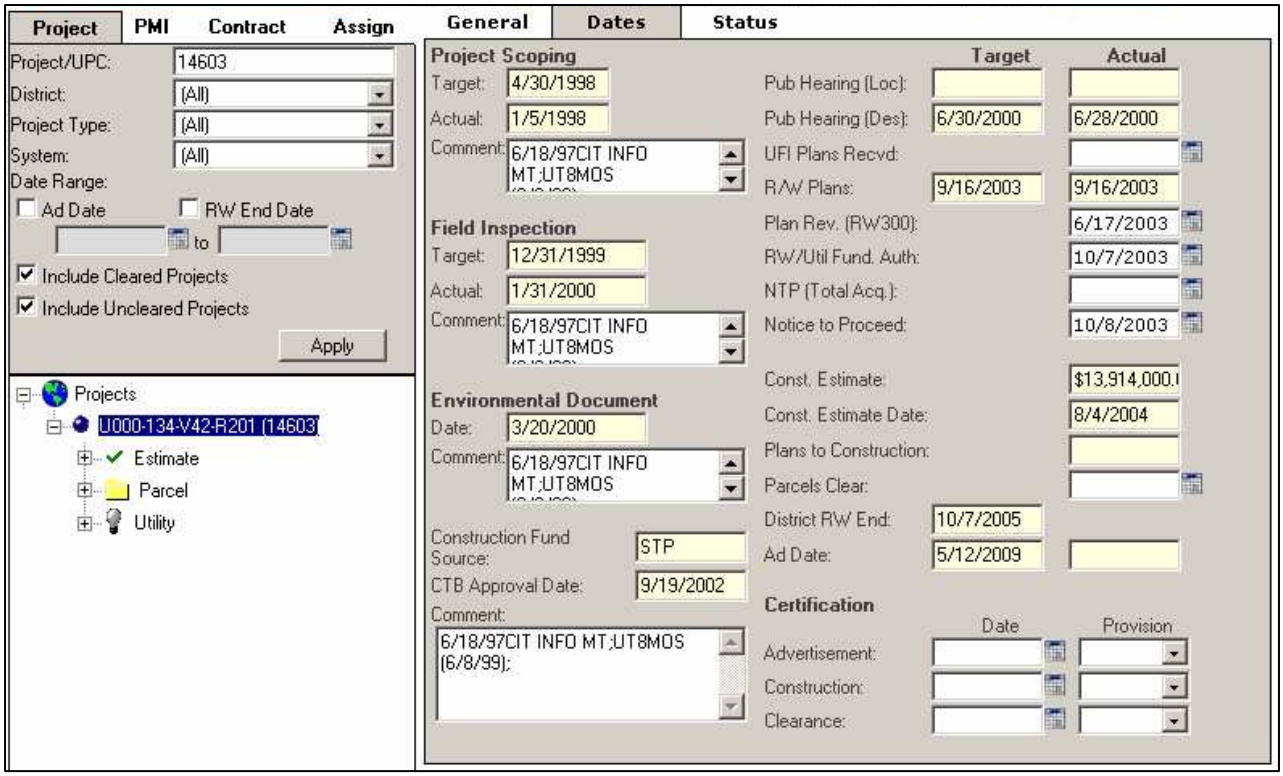


Figure 5 Example of page populated from the project management system

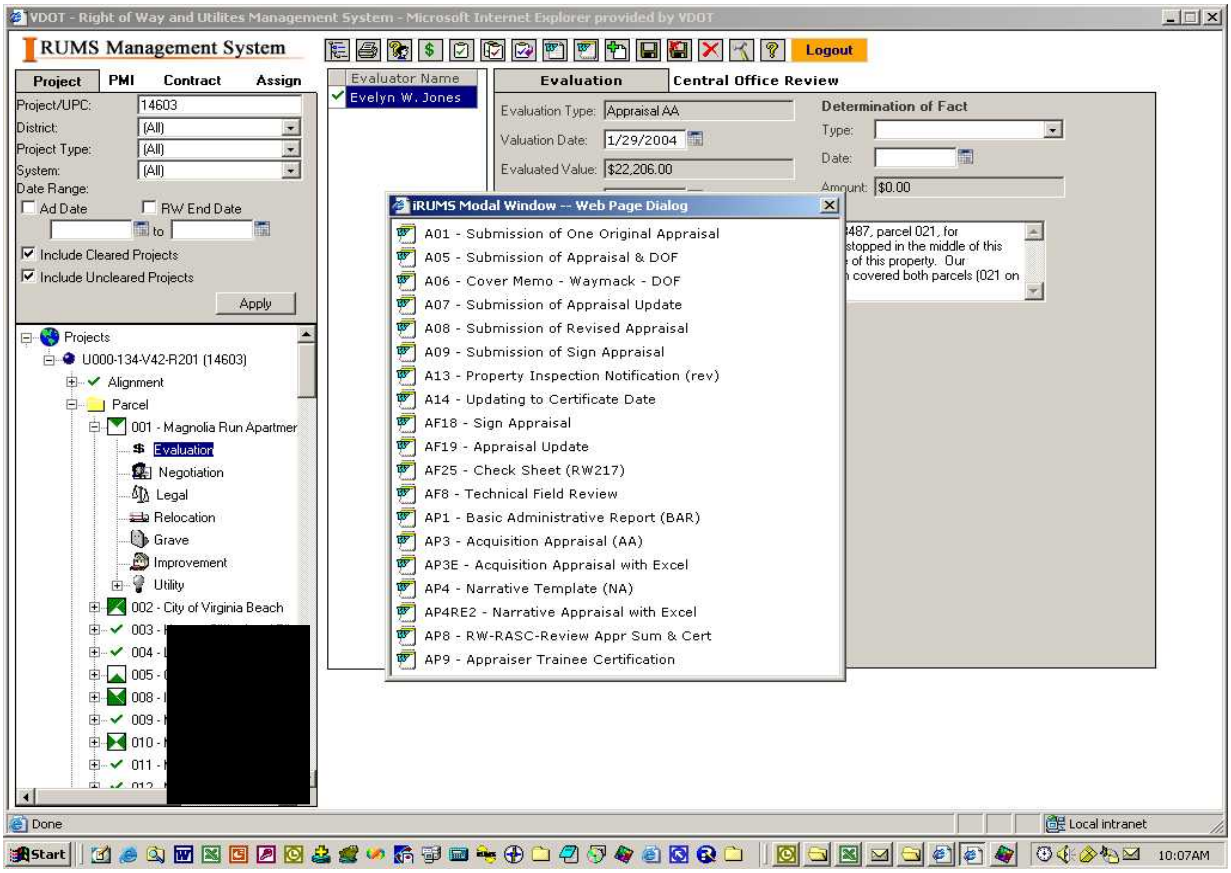


Figure 6 The Forms template page

Estimated Cost of System

The cost for developing RUMS was $2.5 million. Combined hardware and software costs were estimated to be $3.5 million. The right of way and utilities division continues to contract for maintenance and support.

System Benefits

Customer satisfaction, increased employee efficiency, and better quality of data are some of the benefits that cannot be quantified. In terms of monetary benefits, the source code of RUMS was purchased by two other DOTS generating income to help offset development costs. The following are the benefits involved in each task of Right-of-Way:

- RUMS emphasizes management focus on advertisement date and project status. It compiles information for advertisements for surplus properties to be published on the Internet.
- RUMS manages the business process rather than simply storing data. It addresses needs at all levels—from data entry through management. Users view RUMS as a tool for actively performing their work, rather than an "after the fact" data entry burden.
- RUMS includes a customizable and extensible ad hoc query feature, with Excel export, to address management analysis needs.
- RUMS organizes important RW&U information (structured data and forms), and can integrate with document management systems. The system's automated population of certain data within forms and letters has reduced redundancy and errors.
- RUMS provides intuitive navigation for novice and advanced users
- RUMS standardizes formats for generating correspondence and documents
- RUMS eliminates redundant data entry
- Workload is reduced as data entered into RUMS is now available to a myriad of letters and other documents
- RUMS allows each operational group to access their pertinent data while allowing management a high-level view of statuses across all RW&U sections. The "project story" is told through at-a-glance status analysis tools.
- RUMS helps enforce compliance with federal and departmental policies and procedures.

Lessons Learned

Good communication and understanding between the ROW division and contractors at every stage is essential to develop a good system.

A good leader is important to smooth the transition by personnel to the new system.

Flexible training sessions should be provided to "experts" in each district.

A very reachable and reliable help desk should be provided to users to minimize frustrations.

References

Sande Snead, "RUMS—Right-of-Way Tracking", Public Roads, Vol. 68, No. 4, January/February 2005. http://www.virginiadot.org/business/row-rums.asp VDOT, accessed December 20, 2005.

BearingPoint
Software Development Consultant
1976 International Drive
McLean, VA 22102
http://www.bearingpoint.com

Contacts

For more information about RUMS, please contact:

Virginia Department of Transportation
C. L. (Les) Griggs, Jr.
Information Technology Section Manager
Right of Way and Utilities Division
1401 East Broad Street
Richmond, VA 23219
(804) 786-2917

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

Minnesota Department of Transportation

Office of Land Management

Right of Way Electronic Acquisition Land Management System (REALMS)

Supplement to RUMS Case Study

National Cooperative Highway Research Program

Case Studies in Innovative Systems in Transportation Right of Way

Minnesota Department of Transportation, Office of Land Management, St. Paul, Minnesota

Right of Way Electronic Acquisition Land Management System (REALMS)

Supplemental Case Study to Virginia's RUMS System

REALMS
Right of Way Electronic Acquisition Land Management System

Summary

REALMS is a comprehensive management tool that incorporates innovative data-integration capabilities. It was modified from the Virginia Right of Way and Utilities System (RUMS) and supports:

- Right-of-Way pre-acquisition, appraisal, acquisition, relocation, condemnation, and post acquisition,
- Assignment tracking
- Management of contracts, task orders, subcontractors
- Expanded property management
- Expanded parcel creation and management and updating plats.

Experience

Minnesota DOT purchased RUMS from Virginia DOT and modified it for their purposes, expanding the property management activities and adjusting the operation of the system to meet their specific needs. Many subtle differences in business processes and state requirements resulted in more modifications than originally anticipated.

Approximately twenty months after RUMS was purchased and the modifications and testing were complete, the system was implemented over a two-day period when the previous databases were closed and the new system brought on line.

Case Study Objective

The automation of Right of Way functions and development of data-integration models using existing technology, including geospatial applications, improves coordination and consistency of data leading to reduced project delivery delays and improved customer service. Many Right of Way agencies across the United States have incorporated various types and levels of systems to improve their business processes. The objective of this case study is to present information about the adoption of a comprehensive information management system that was originally developed for one state and then modified to meet the needs of another state.

System Overview

Operational in August of 2005, the Right of Way Electronic Acquisition Land Management System, REALMS**,** is an enterprise system which manages the complex right-of-way process from pre to post acquisition. REALMS, built on Virginia's RUMS system is designed to provide a single, comprehensive view of project and land parcel status, allowing for efficient tracking of key dates. As with RUMS, the system incorporates a web-services structure, easily navigable graphical user interface, and comprehensive data integration through a centralized data base. The system includes document management features that generate and store forms and letters.

Agency Overview

Organization

The Minnesota Department of Transportation (Mn/DOT) maintains the fifth largest highway system in the United States and is directly responsible for building, maintaining, and operating approximately 12,000 miles of the nearly 135,500 miles of highways in the state.

Mn/DOT is divided into eight districts. The central office is located in Saint Paul and is headquarters for approximately thirty operational and administrative units.

Right of way oversight and coordination activities occur within the Office of Land Management (OLM) while the eight District Offices are responsible for the appraisal and acquisition of property rights necessary for the construction and improvement of state roads. The OLM also tracks the management and disposition of residual parcels and surplus right of way.

Information Technology Support

Mn/DOT has both a centralized Office of Information Technology which coordinates agency-wide IT activities and support and an Information Technology Unit within the Office of Land Management which provides or organizes research, development, training and support for all of OLM field and office information systems. The IT Unit also manages the Central Office Land Management data processing budget and the office's three web servers: a database application server, the interface to internal and external customers, and a reports server.

System Description

Implementation

Based on a detailed needs assessment and review of existing systems, Minnesota DOT selected and purchased Virginia's RUMS software in February 2004 and contracted with Bearing Point, the contractor that worked with Virginia, to modify the software. Their system, Right of Way Electronic Acquisition Land Management System (REALMS), was in use by August 2005.

After initial implementation, Minnesota estimated that REALMS required modification of approximately 80% of the original code to account for differences in the way they do business and implementation of additional functions. Although this was higher than anticipated, the modifications and implementation went smoothly and the system

meets the goals that were established at the beginning of the process.

System Goals

The goals for REALMS included that the central office could easily track right of way activities, data entry would be minimized and redundancy eliminated, forms would be standardized, year-end report generation would be automated, and that the source code be flexible and modifiable.

Activities Managed in REALMS

The purpose of REALMS is to track the pre, during, and post acquisition activities of the Department. This includes:

- creating the attorney's condition of title
- recording commissioner's orders, legal descriptions, and valuations
- recording purchases
- managing relocations
- managing condemnations
- recording final mapping
- managing and disposing of improvements
- managing leases, limited use permits, and turnbacks
- reconveying land.

In addition, the system supports several administrative functions including:

- generating forms and reports
- managing users and contracts
- recording authorizations, improvements, permits, project agreements and right of way package transmittals
- tracking all expenditures for right of way acquisitions
- creating and updating parcels
- updating plats.

User Interface

Because REALMS is a complex system with multiple windows related to each activity, a detailed discussion of the interface is not provided. Instead, examples of different components are provided.

Both OLM employees and consultants are provided with access to the system based on the functions each user performs. The basic interface is similar to typical Web sites with

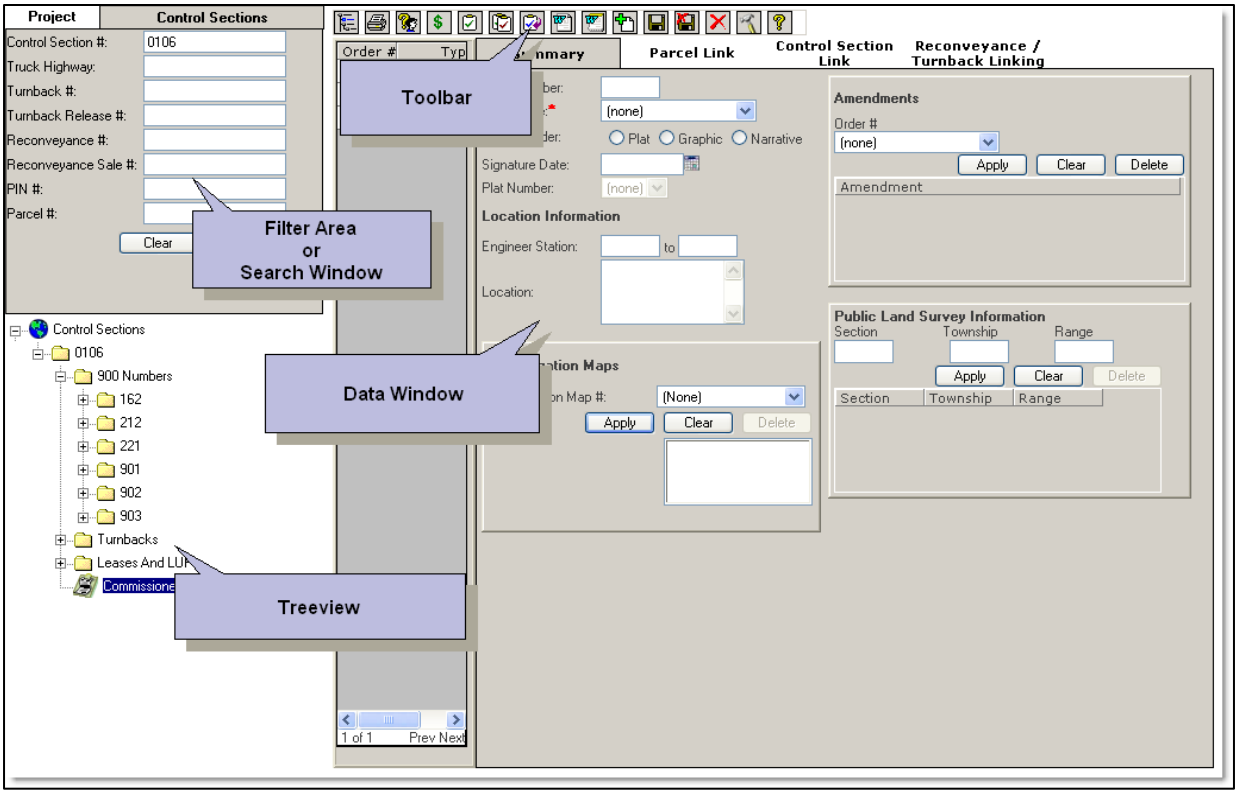


Figure 1. Control Section screen view

tabs and buttons across the top of the page and a "TreeView" on the left side as shown in figure 1. The upper left section is the filter area or search window, while the work space fills the right side of the view.

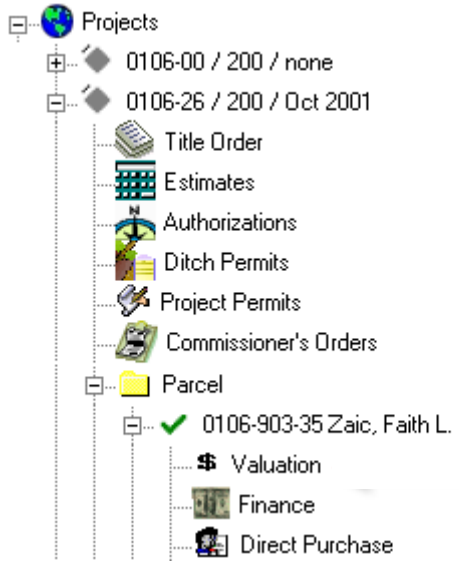


Figure 2 Example project and parcel icons

Different icons are used in the TreeView to represent different functions. Both color and shape are used to reflect activities and status. Figure 2 provides an example of some of the *project* and *parcel* icons.

An example of an information screen about condemnation is shown in Figure 3. White space is editable, while grey space is not.

Figure 4 shows the interface to available reports using Crystal Enterprise a Mn/DOT standard reporting tool that has been linked to REALMS.

Technologies Used

REALMS uses the following software and technology:

- Oracle 9i
- MS Word 2000
- Mercury Testing Tools: TestDirector / LoadRunner / WinRunner
- Crystal Report Writer
- Cizer (Web Enabled Report Execution)
- .NET and 10G
- Sheridan VB Extensions: Data Widgets, Active TreeView, Designer Widgets

Extension and Future Plans

Phase II of REALMS development will provide interfaces with the project management system PPMS, the electronic document management system EDMS, and other agency databases. Another priority is to

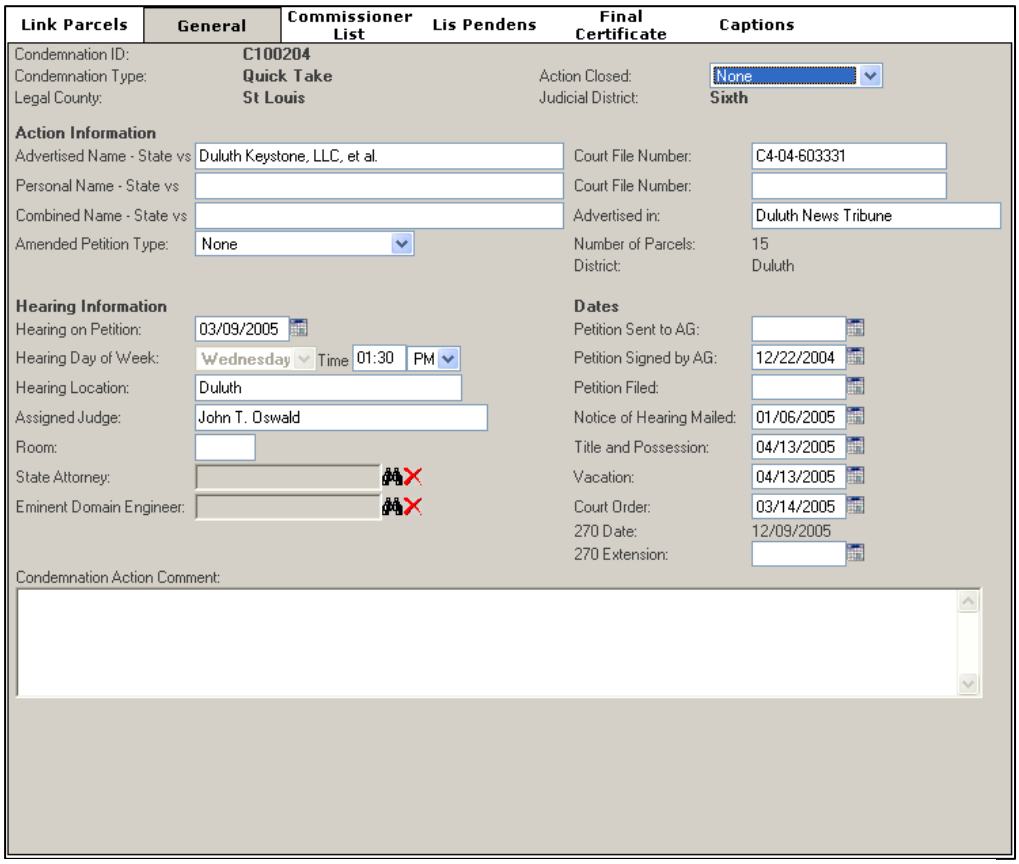


Figure 3 Example of information screen

Figure 4 Report creation interface

enhance the system according to user identified improvements. Linking to the statewide parcel mapping initiative will incorporate a geospatial capability within REALMS.

Estimated Cost of System

For the first phase of REALMS, Mn/DOT estimates that the cost to modify the RUMS source code was approximately three times the cost to purchase the original code.

System Benefits

Consistency, better quality of data, and improved access to information are the primary benefits identified by OLM staff and contractors. Improved quality assurance and quality control have also resulted from implementation of REALMS. From the perspective of the users in the field, using the system before REALMS was considered to be an onerous task. Now, REALMS is an appreciated tool to help with their work.

Lessons Learned

Understanding different priorities between stakeholders is essential and these understandings should be rearticulated throughout the development and implementation process. For REALMS, the four primary groups that were involved in the development were the right of way staff within the Office of Land Management, Mn/DOT's centralized Office of Information Technology, the Information Technology unit within OLM, and the contractor, Bearing Point.

Comparing the "original" purchased system with what is actually needed by the agency is important and may result in the determination that starting from scratch better meets its needs and is more cost effective.

Committed buy-in from the joint application development (JAD) team insures a relatively smooth implementation.

References

Minnesota Department of Transportation State wide Right of Way Surveys Fiscal Year 2006 Annual Report, November 2005, http://www.olmweb.dot.state.mn.us/Forms__Publications/Publications/Annualreport/AnnualReportFY2005.pdf, accessed July 10, 2006.

BearingPoint
Software Development Consultant
1976 International Drive
McLean, VA 22102
http://www.bearingpoint.com

Contacts

For more information about RUMS, please contact:

Minnesota Department of Transportation
Kevin Leonard.
Transportation Program Supervisor
Office of Land Management
395 John Ireland Blvd, MS 630
St. Paul, MN 55155
(651) 296-2204

Case study development was performed under contract for:

Sponsor
The National Cooperative Highway Research Program
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

The work was performed by:

Contractor
Kathleen Hancock, PE, PhD
The Center for Geospatial Information Technology
Virginia Polytechnic Institute and State University
1101 King St, Suite 610
Alexandria, VA 22314

APPENDIX C

DATA ELEMENTS

Key to Process Flow Diagrams

Function generally considered outside of Right-of-Way Programs

Function within Right-of-Way Programs as identified in “From the Ground Up: Real Property and Transportation Needs”
Referenced by Roman Numerals (I, II, III)

Function that may or may not be within Right-of-Way, determined by States
Referenced by capital letter (A, B, C)

Activity within a Function
Referenced by Function and numbers (I.0.1, I.0.2, I.0.3,)

Activity that would be divided into sub activities
Referenced by Function and number (II.1, II.2, II.3)

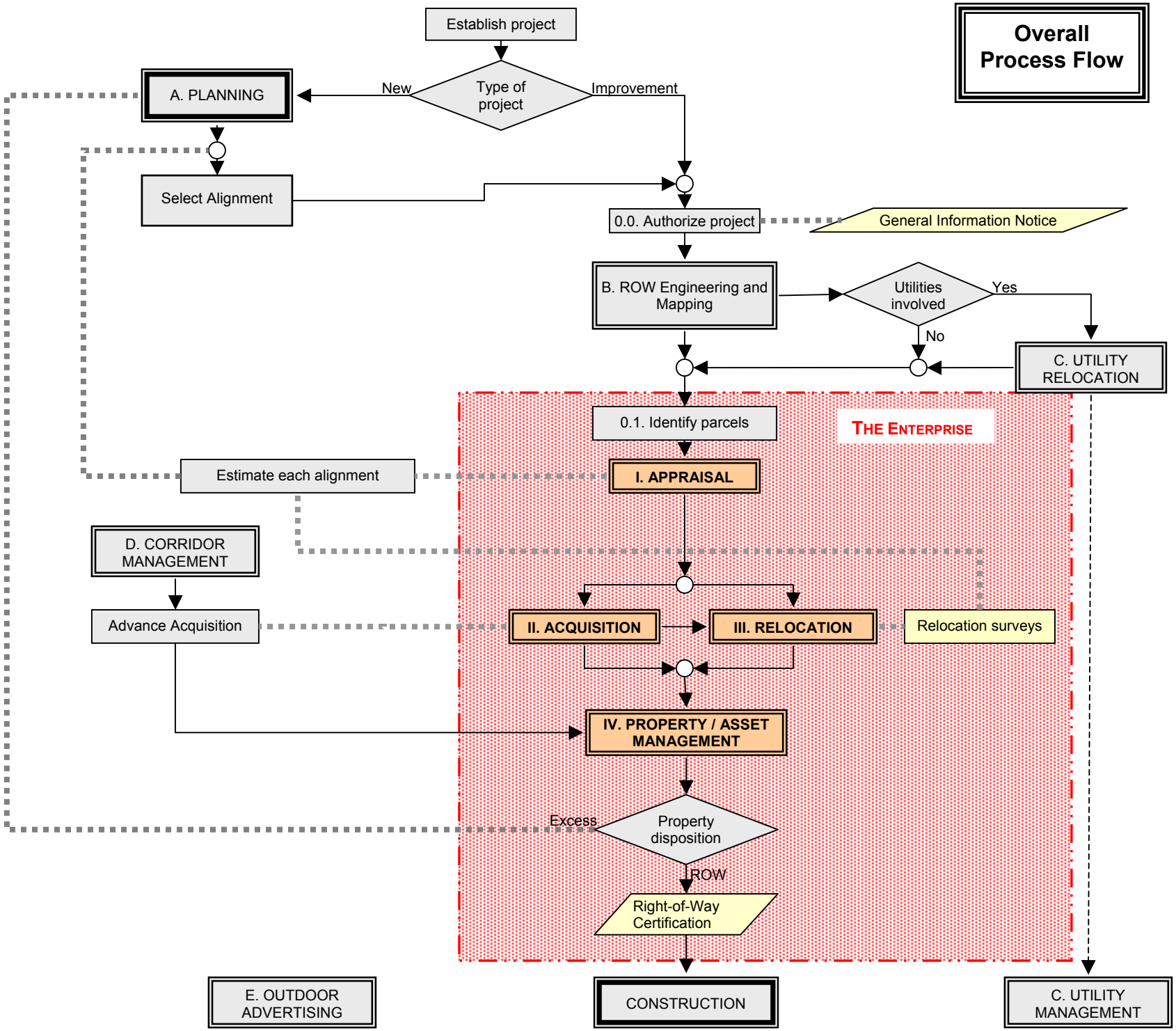
Decision point

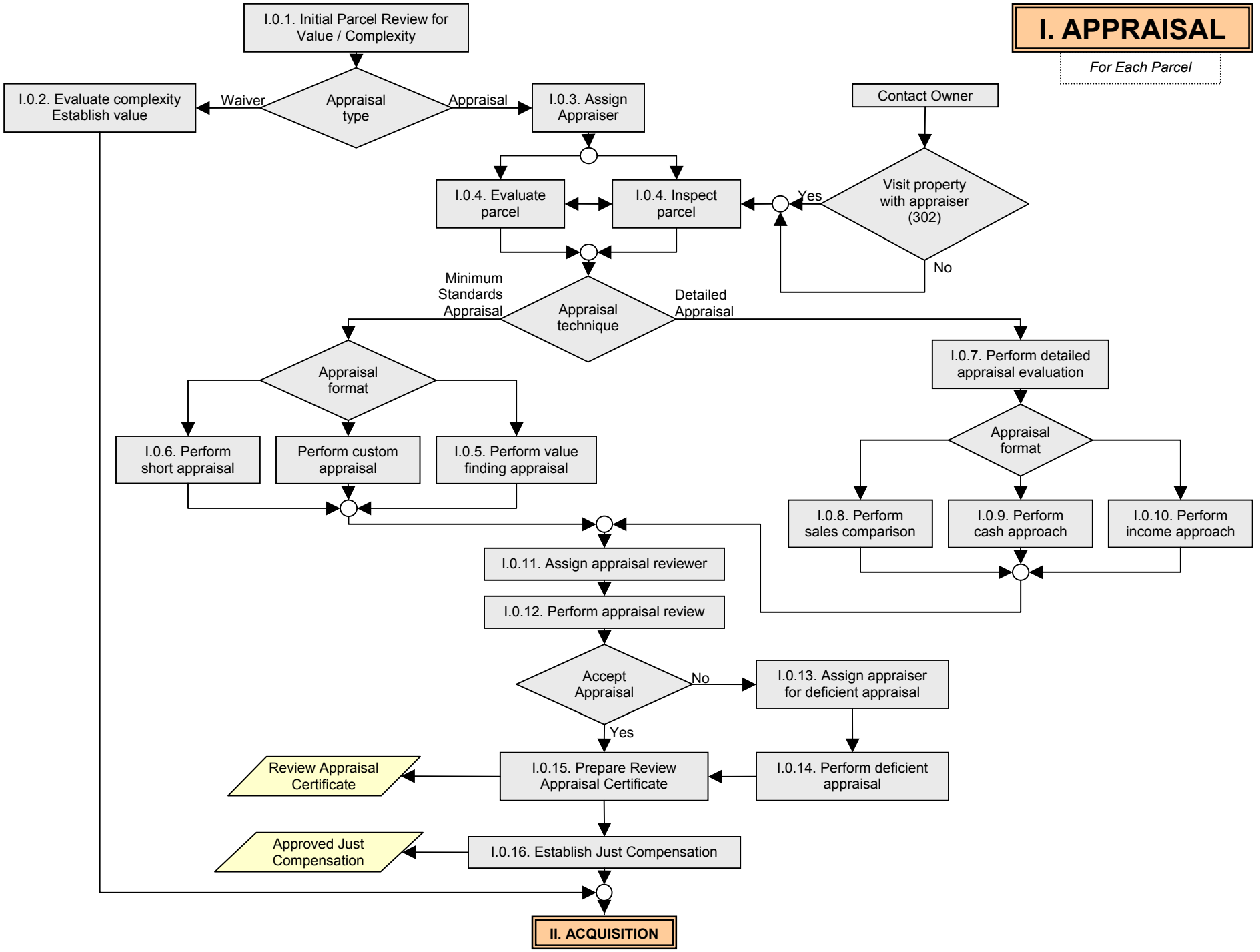
Signed document (ie certificate or just compensation)

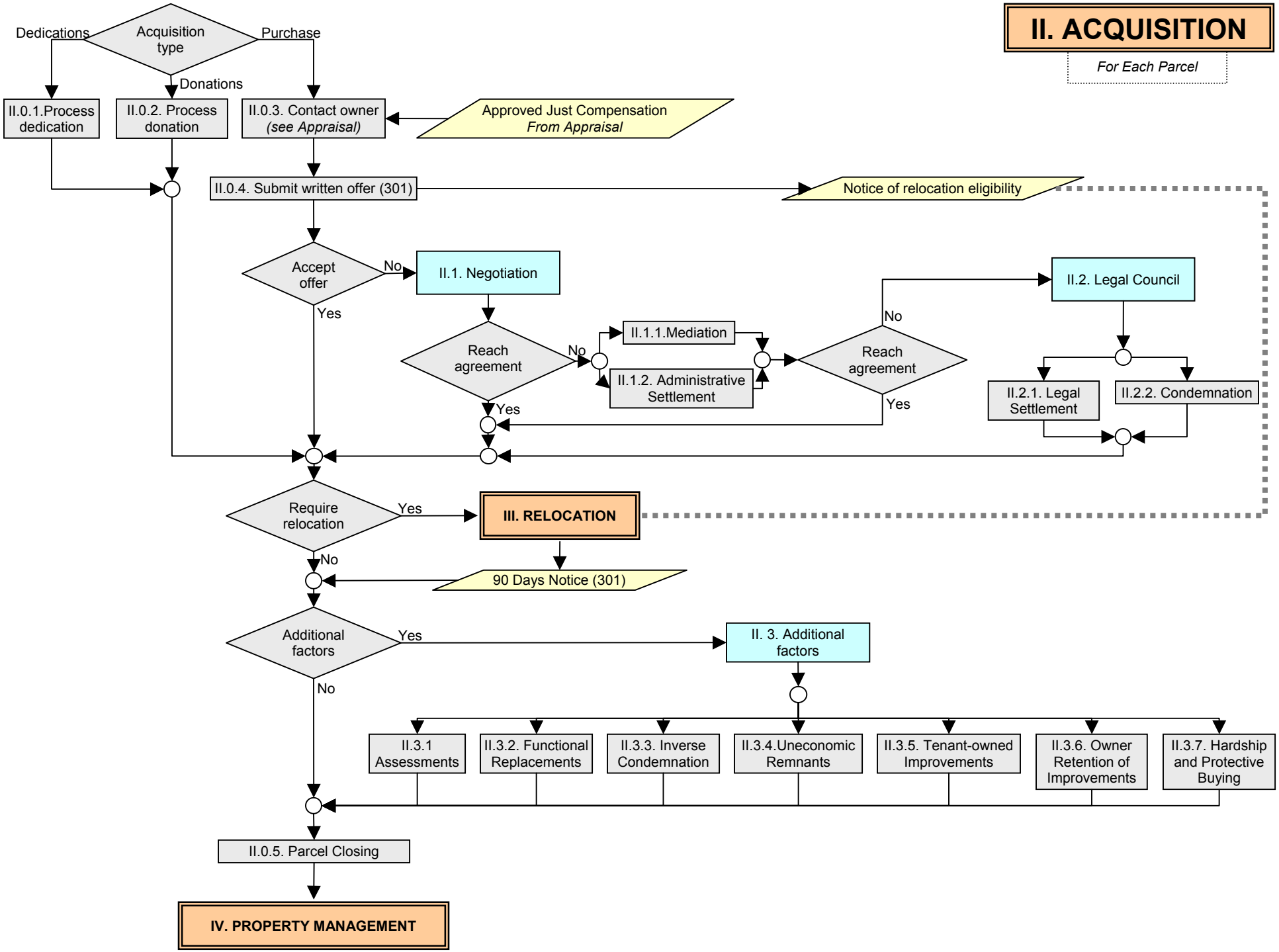
Link between activities and/or process decisions—does not necessarily indicate sequence or order of performance

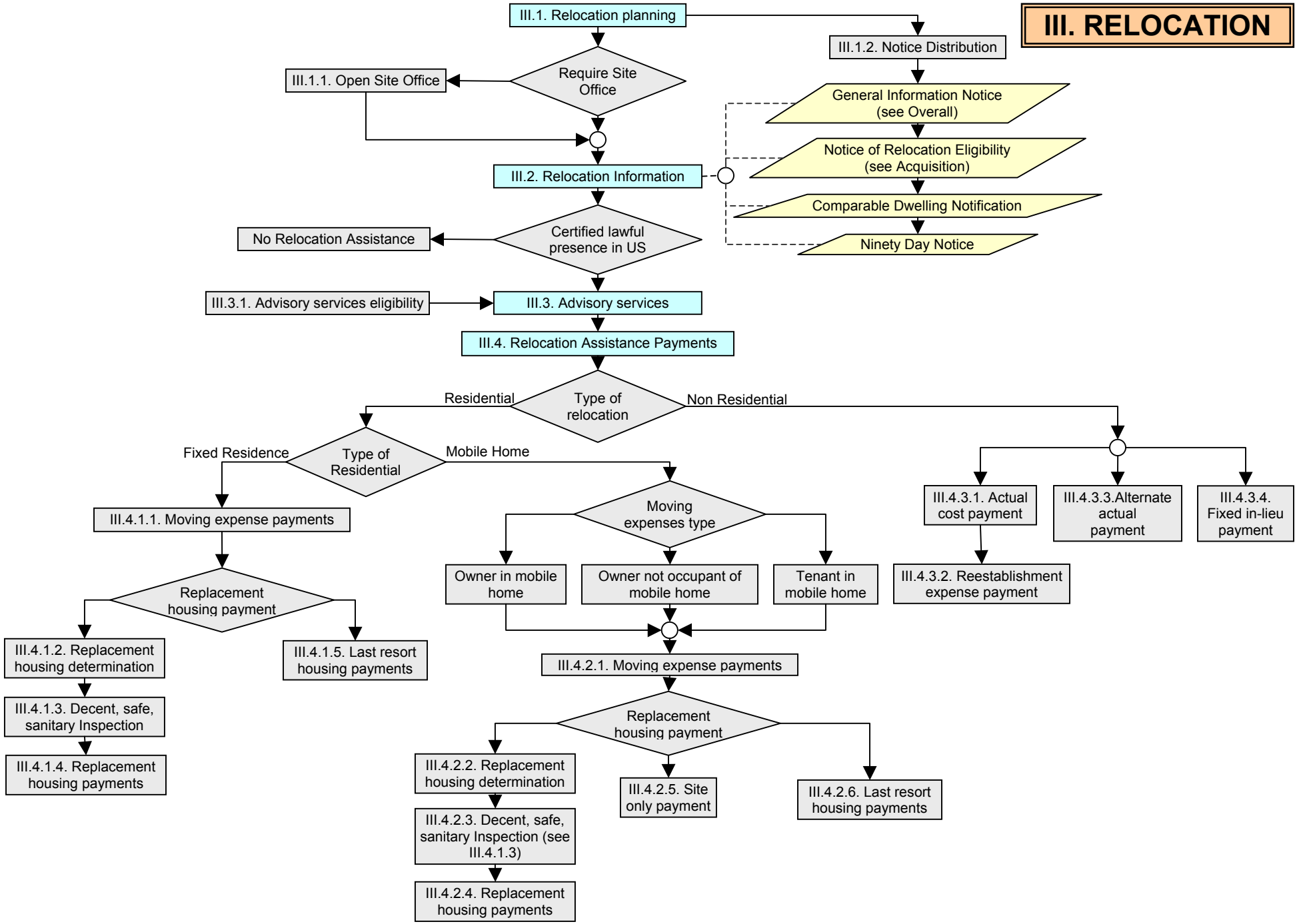
Link between functions/activities prior to project authorization

Link between activities

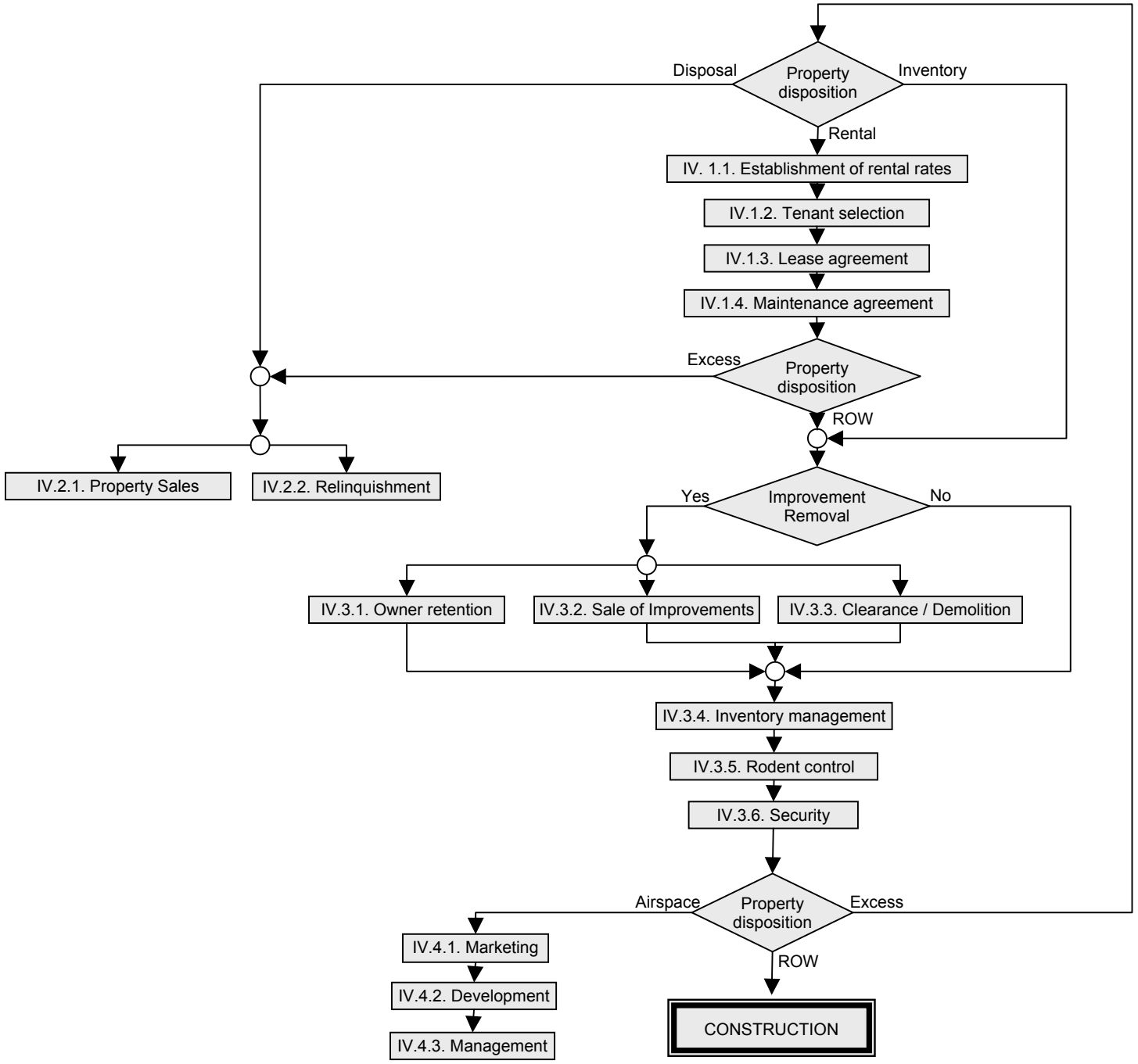








IV. PROPERTY MANAGEMENT



C-1 Geospatial data element tables

Categoty	Feature class	C/C+	Data Type	Data Element Description	Data Source	Source of Data Element
Cadastral elements	Geospatial Reference	C	Metadata	NGRS coordinate system	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Datums	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Monumneted points	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Jurisdiction	Department of Transportation/Equiv	Cadastral core data - Report
		C	Geospatial	Orthography	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Date of Orthophotos	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Terrain information (breaklines etc**)	Department of Transportation/Equiv	Cadastral core data - Report
	Cadastral Reference	C+	Metadata	Jurisdiction name	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Metadata	Jurisdiction contact	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Metadata	Coordinate system desciption	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Metadata	Units of measure	Department of Transportation/Equiv	Cadastral core data - Report
		C	Metadata	Horizontal and vertical datum	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Metadata	Date of file	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Metadata	Another metadata file if datum is not unique for the entire jurisdiction	Department of Transportation/Equiv	Cadastral core data - Report
		C	Primary Key	Control ID	Department of Transportation/Equiv	Cadastral core data - Report
		C	Geospatial	East X	Department of Transportation/Equiv	Cadastral core data - Report
		C	Geospatial	North Y	Department of Transportation/Equiv	Cadastral core data - Report
		C	Geospatial	Elevation Z	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Monument Type	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Monument Surveyor	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Monument Date	Department of Transportation/Equiv	Cadastral core data - Report
		C+	Attribute	Coordinate Date	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Coordinate System	Department of Transportation/Equiv	Cadastral core data - Report
		C	Geospatial	Elevation Units	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Horizontal Datum	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Elevation Datum	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Horizontal Accuracy	Department of Transportation/Equiv	Cadastral core data - Report
		C	Attribute	Elevation Accuracy	Department of Transportation/Equiv	Cadastral core data - Report
	Parcels	C	Geospatial	Parcel Outline	Tax Assessors/Equiv	Cadastral core data - Report
		C	Geospatial	Parcel Centroid	Tax Assessors/Equiv	Cadastral core data - Report
		C	Attribute	Parcel ID	Tax Assessors/Equiv	Cadastral core data - Report
		C	Transactional	Source Reference	Tax Assessors/Equiv	Cadastral core data - Report
		C	Attribute	Source Reference Date	Tax Assessors/Equiv	Cadastral core data - Report
		C	Attribute	Owner Type	Tax Assessors/Equiv	Cadastral core data - Report
		C	Attribute	Improved	Tax Assessors/Equiv	Cadastral core data - Report
		C	Attribute	Parcel Area	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Metadata	Jurisdiction name,	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Metadata	Jurisdiction parcel contact	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Metadata	Basis of assessment	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Metadata	Interpretation of assessment classification	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Metadata	Date of file	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Owner Name	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Value of Land	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Value of Improvements	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Total Value	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Primary Value Classification	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Secondary Value Classification	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Tax Bill Mailing Address	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Parcel Street Address	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Parcel Zoning	Tax Assessors/Equiv	Cadastral core data - Report
		C+	Attribute	Public Parcel Name	Tax Assessors/Equiv	Cadastral core data - Report

Categoty	Feature class	C/C+	Data Type	Data Element Description	Data Source	Source of Data Element
Transportation elements	Transportation Project	C	Attribute	Project ID	Department of Transportation/Equiv	Case study visits
		C	Geospatial	Alignment From end point	Department of Transportation/Equiv	Case study visits
		C	Geospatial	Alignment To end point	Department of Transportation/Equiv	Case study visits
		C	Geospatial	Alignment	Department of Transportation/Equiv	Case study visits
		C	Geospatial	Right of way limits	Department of Transportation/Equiv	Case study visits
	Framework Transportation Centerlines Transportation Segment Reference Point(FTRP) table	C	*Primary Key*	*Authority ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Transportation Segment reference point ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Location description	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	FTRP-Feature type	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Latitude	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Logitude	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Horizontal accuracy measurement method	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Horizontal accuracy	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Elevation	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Vertical accuracy measurement method	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Vertical accuracy	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	Status	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
	Framework Transportation Centerlines Transportation Segment table	C	*Primary Key*	*Authority ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Transportation-Segment-ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	From-End-Point	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	To-End-Point	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	Path-Description	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Intermediate-Point(Required when Applicable)	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	FTSeg-Feature-Type (Optional)	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	State	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Length (Optional and Recommended)	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C	Geospatial	Length-Accuracy-Measurement-Method	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	Status	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
	Transportation Centerlines Connectivity table	C	*Primary Key*	*Authority ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Transportation Segment reference point ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Transportation-Segment-ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	FTSeg-Offset-%	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	Offset-%-Accuracy-Description	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard
		C+	Attribute	Status	Department of Transportation/Equiv	NSDI Framework Transportation Identification Standard

Categoty	Feature class	C/C+	Data Type	Data Element Description	Data Source	Source of Data Element
Transportation elements	Transportation Centerlines Relating Attributes of FTRP & FTSeg	C	*Primary Key*	*Authority ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Transportation reference point ID or Segment ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	Start offset	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	End offset	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Attribute-Name	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Attribute	Attribute-Value	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
	Transportation Centerlines Equivalency table	C	*Primary Key*	*Reference-FTRP-ID or Reference-FTSeg-ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C	*Primary Key*	*Equivalent_FTRP_ID or Equivalent_FTSeg_ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	Start offset	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C	Geospatial	End offset	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Status	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
	Transportation Centerlines Authority description	C+	*Primary Key*	*Authority ID*	*Department of Transportation/Equiv*	*NSDI Framework Transportation Identification Standard*
		C+	Attribute	Authority Name	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Date	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-Person-Primary	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-Voice-Telephone	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-Facsimile-Telephone (optional)	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-Electronic-Mail - Address (optional)	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-URL (optional)	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Contact-Instructions	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-Address	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-City	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-State-or-Province	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-Postal-Code	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-Country	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-Index-Access- Information	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Authority-Information (optional)	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard
		C+	Attribute	Status	*Department of Transportation/Equiv*	NSDI Framework Transportation Identification Standard

C-2 Attribute data element tables

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
OVERALL PROCESS	0.0. Authorize Project	*Primary Key*	***Project ID***	*Number/String*	*New Mexico, PenDOT, RUMS*	*State/Local agency*	*Unique ID*
		Geospatial	Transportation Project: If geospatial not incorporated then attributes from Transportation included here		*New Mexico, PenDOT, RUMS*	*State/Local agency*	
	0.1. Identify Parcels	*Primary Key*	***Project ID***	*Number/String*	*New Mexico, PenDOT, RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*New Mexico, PenDOT, RUMS*	*State/Local agency*	*Unique ID*
		Geospatial	Cadaster (Parcel): If Geospatial not incorporated then attributes from Cadaster included here.				
		Attribute	Source Reference	String	RUMS, PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Source Reference Date	Date	RUMS, PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Parcel Photographs	BLOB		State/Local agency	FHWA (Appraisal Guide)
I. APPRAISAL	I.0.1. Initial Parcel Review	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Estimated Value	Number	RUMS, PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Complexity	String	RUMS, PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Appraisal Requirement	String	PenDOT	State/Local agency	FHWA (Appraisal Guide)
	I.0.2. Waiver - Establish Value	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Established Value	Number	RUMS	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Just Compensation	Number	RUMS	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Type (Donation, Donation in Exchange, Dedication, Waiver)	String	RUMS	State/Local agency	FHWA (PGD)
	I.0.3. Assign Appraiser	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Appraiser Name	String	PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Attribute	Date Assigned	Date	PenDOT	State/Local agency	FHWA (Appraisal Guide)
		Document	Appraiser Certificate	**	PenDOT	State/Local agency	FHWA (Appraisal Guide)
	I.0.4. Inspect and Evaluate Parcel	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Complexity	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Appraisal Type (Value Finding, Short Form, Detailed)	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Communication	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Parcel Plan	BLOB	PenDOT	Appraiser	FHWA (PGD)
		Attribute	Parcel Topography	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Parcel Shape	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Parcel Access	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Parcel Landscaping	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Utilities Affected	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute(s)	Improvements Description (Building type, # of stories, construction type, condition, effective age, gross floor area, total # of rooms, baths, bedrooms, heating/ cooling, amenities, etc)	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	5-Year Sales History	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Present Use	String		Appraiser	FHWA (PGD)
		Attribute	Highest and Best Use	String	RUMS	Appraiser	FHWA (PGD)
		Attribute	Photographs	BLOB		Appraiser	FHWA (Appraisal Guide)
	I.0.5. Value Finding Appraisal	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Date of Valuation	Date	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Interest Acquired	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value Appraised	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Basis for Value	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Brief Analysis	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Market Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Land	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Improvement	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Takings	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Damages	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Remarks	String	RUMS	Appraiser	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
I. APPRAISAL	I.0.6. Short Form Appraisal	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Property Value Justification	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Appraisal Purpose	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Rights to be Appraised	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	***Date of Valuation	Date	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Interest to be Acquired	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Problem to be Solved	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Title Information	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Value Appraised	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	***Date of Valuation	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Interest being Acquired	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Market Data Approach	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Land	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Improvement	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Takings	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Value-Damages	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Land Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Improvements Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Statement of Value - Property	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Statement of Value - Damages	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Tenant Names	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Tenant Owned Buildings Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Tenant Owned Structures Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Tenant Owned Improvements Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Lease Terms	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Sale Price	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Time Adjustment	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Sale Price adjusted for Time	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Price per Unit of Comparison	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	All other Adjustments (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Net Adjustment	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Indicated Value	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Total Adjustments Explanation	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Total Damage Explanation	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Remarks	String		Appraiser	FHWA (PGD)
	I.0.7. Detailed Appraisal Evaluation	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Estate Definition	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Appraisal Purpose	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Statement of assumptions and limiting conditions	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Statement of known and observed encumbrances	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Title Information	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Consideration of Easements	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Consideration of Leases	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Basis for Highest use being different from Present use (Legally and Economically)	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Statement of Value - Real Property	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Statement of Value - Property	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Statement of Value - Damages to the remaining property	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Partial acquisition Statement of Value - Benefits to the remaining property	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Approach used (sales comparison, cash approach, income approach)	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Strengths and Weaknesses of each approach	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Remarks	String		Appraiser	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
I. APPRAISAL	I.0.8. Sales Comparison Approach	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Description of Comparable sales	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Geospatial	Cadaster (Parcel)		PenDOT	Appraiser	
		Attribute	Date of sale or offering	Date	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Parties to the transaction	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Source of financing	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Method of financing	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Verification by party involved in transaction (Buyer, seller, broker, or specialist)	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Consideration paid	Number	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Price per Unit of area	Number	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Conditions of sale (Motivation)	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Person(s) with whom data was verified	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of data verification	Date	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Location of comparable	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Access to the comparable	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Total area	Number	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Type of improvements	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Size of the Improvements	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Improvements Description (Building type, # of stories, construction type, condition, effective age, gross floor area, total # of rooms, baths, bedrooms, heating/ cooling, amenities, etc)	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Type of easements	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Mineral, water, and other rights	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Highest and best use at date of sale-Analysis	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Zoning (at the date of sale)	String	RUMS, PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of Appraiser's Inspection	Date	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Photographs of principal improvements	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Comparable data map.	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Time	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Time (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Location	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Location (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Physical characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Physical characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Economic characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Economic characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Motivation for the transactions	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Motivation for the transactions (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Listings Available	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Offerings Available	String	PenDOT	Appraiser	FHWA (Appraisal Guide)
		Attribute	Rental Data Available	String	PenDOT	Appraiser	FHWA (Appraisal Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
I. APPRAISAL	I.0.9. Cost Approach	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Explanation for lack of Sales comparison approach	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Reproduction or Replacement cost	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Detailed analysis including calculation	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Description of Physical Deterioration	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Description of functional and economical obsolescence	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Land value (based on sales data)	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of sale or offering	Date	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Parties to the transaction	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Source of financing	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Method of financing	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Verification by party involved in transaction (Buyer, seller, broker, or specialist)	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Consideration paid	Number	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Price per Unit of area	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Conditions of sale (Motivation)	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Person(s) with whom data was verified	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of data verification	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Location of comparable	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Access to the comparable	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Total area	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Type of easements	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Mineral, water, and other rights	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Highest and best use at date of sale-Analysis	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Zoning (at the date of sale)	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of Appraiser's Inspection	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Photographs of principal improvements	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Comparable data map.	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Time	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Time (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Location	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Location (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Physical characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Physical characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Economic characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Economic characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Motivation for the transactions	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Motivation for the transactions (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
I. APPRAISAL	I.0.10. Income Approach	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Explanation for lack of Sales comparison approach	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Rental Data of the comparable	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Capitalization rate of the comparable	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Verification by the owner	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Person(s) with whom data was verified	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of data verification	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Location of comparable	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Type of improvements	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Size of the Improvements	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Improvements Description (Building type, # of stories, construction type, condition, effective age, gross floor area, total # of rooms, baths, bedrooms, heating/ cooling, amenities, etc)	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Zoning	String	RUMS	Appraiser	FHWA (Appraisal Guide)
		Attribute	Date of Appraiser's Inspection	Date		Appraiser	FHWA (Appraisal Guide)
		Attribute	Photographs of the comparable improvements	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Comparable data map.	BLOB		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Time	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Time (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Location	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Location (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Physical characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Physical characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Similarities or dissimilarities - Economic characteristics	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Adjustment - Economic characteristics (Dollars or %)	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Estimated gross Market rent or income	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Allowance for vacancy and Credit loss	Number		Appraiser	FHWA (Appraisal Guide)
		Attribute	Remaining economic life	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Capitalization rate estimated	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Method used for Capitalization rate	String		Appraiser	FHWA (Appraisal Guide)
		Attribute	Source of rates and factors by appraiser	String		Appraiser	FHWA (Appraisal Guide)
	I.0.11. Assign Appraisal Reviewer	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*	RUMS, PenDOT	*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Appraisal Reviewer Name	String		State/Local agency	FHWA (Appraisal Guide)
		Attribute	Date Assigned for reviewing	Date	RUMS, PenDOT	State/Local agency	FHWA (Appraisal Guide)
	I.0.12. Perform Appraisal Review	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Appraiser ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*	RUMS, PenDOT	*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Appraisal Acceptance	String		Appraisal Reviewer	FHWA (Appraisal Guide)
		Attribute	Follows appraisal principles and techniques (state and federal)	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	In accordance with agency's appraisal specifications	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Sufficient information to support conclusions and market value estimate	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Buildings, structures, improvements and fixtures listed	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Consideration of compensable items, damages and benefits	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Inclusion of non-compensable items under State law	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Contains fair market value estimate / in case of partial acquisition, fair market value for real property and damages value for remaining property	Boolean		Appraisal Reviewer	FHWA (PGD)
		Attribute	Reason(s) for Deficiency	String	RUMS	Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
I. APPRAISAL	I.0.13. Assign Appraiser for Deficient Appraisal	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Deficient Appraiser ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Date Assigned for Correction	Date		State/Local agency	FHWA (Appraisal Guide)
	I.0.14. Perform Deficient Appraisal	*Primary Key*	***Project ID***	*Number/String*		*FHWA*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Deficient Appraiser ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Modified Just Compensation Estimate	Number		Deficient Appraiser	FHWA (PGD)
		Attribute	Modified Real Property Compensation	Number		Deficient Appraiser	FHWA (PGD)
		Attribute	Modified Damages - Partial acquisition	Number		Deficient Appraiser	FHWA (PGD)
		Attribute	Modified List of Buildings, structures, improvements and fixtures being acquired	String		Deficient Appraiser	FHWA (PGD)
		Attribute	Field inspection of parcel	Boolean		Deficient Appraiser	FHWA (PGD)
		Attribute	Reason for no field inspection	String		Deficient Appraiser	FHWA (PGD)
		Attribute	Field inspection of comparable sales	Boolean		Deficient Appraiser	FHWA (PGD)
		Attribute	Reason for no field inspection	String		Deficient Appraiser	FHWA (PGD)
		Attribute	Value of items - Compensable under State law but not Federal law	String		Deficient Appraiser	FHWA (PGD)
		Attribute	Description of the corrections made to the original appraisal	String		Deficient Appraiser	FHWA (PGD)
	I.0.15. Review Appraisal Certificate	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Deficient Appraiser ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Appraisal reports reviewed	String		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	The appraisal reviewer has no direct or indirect present or future personal interest or monetary benefit from the acquisition	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Just Compensation Estimate	Number		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Date of Value	Date		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Real Property Compensation	Number		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Damages - Partial acquisition	Number		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	List of Buildings, structures, improvements and fixtures being acquired	String		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Field inspection to the parcel	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Reason for no field inspection	String		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Field inspection to the comparable sales	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Reason for no field inspection	String		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Attribute	Estimate reached without collaboration or direction	Boolean		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
		Document	Signed Review Appraisal Certificate	**		Appraisal Reviewer	FHWA (Real Estate Acquisition Guide)
	I.0.16. Just Compensation	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraiser ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Appraisal Reviewer ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Primary Key	*Deficient Appraiser ID*	*Number/String*		*State/Local agency*	*FHWA (Appraisal Guide)*
		Attribute	Just Compensation value	Number		State/Local agency	FHWA
		Document	Approved Just Compensation document	**		State/Local agency	FHWA

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
II. ACQUISITION	II.0.1. Dedication	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Subdivision or zoning approval reference	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Land use concession to owner	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
	II.0.2. Donation	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Document	Waiver of just compensation	**		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Waiver of appraisal	Boolean		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Construction feature exchange	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
	II.0.3. Contact Owner	*Primary Key*	***Project ID***	*Number/String*	PenDOT, RUMS	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	PenDOT, RUMS	*State/Local agency*	*Unique ID*
		Attribute	Acquisition agent ID	Number/String	PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Acquisition agent Name	String	PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Acquisition Agent address	String	PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Acquisition Agent Phone #	Number	PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Date of initial contact	Date	RUMS	Acquisition agent	FHWA (PGD)
		Attribute	Contact Mode	String	RUMS	Acquisition agent	FHWA (PGD)
		Attribute	Activity Records	String	RUMS	Acquisition agent	FHWA (PGD)
	II.0.4. Submit Written Offer	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Acquisition agent ID	Number/String		State/Local agency	FHWA (PGD)
		Document	Written offer	**		Acquisition agent	FHWA (PGD)
		Attribute	Date of written offer	Date		Acquisition agent	FHWA (PGD)
		Attribute	Offer letter salutation	String		Acquisition agent	FHWA (PGD)
		Attribute	Just Compensation value	Number		Acquisition agent	FHWA (PGD)
		Attribute	Damages compensation	Number		Acquisition agent	FHWA (PGD)
		Attribute	Uneconomic remainder valuation	Number		Acquisition agent	FHWA (PGD)
		Attribute	Improvement retention cost	Number		Acquisition agent	FHWA (PGD)
		Attribute	Highway # (to be constructed)	Number/String		Acquisition agent	FHWA (PGD)
		Attribute	Description of land, improvements, fixtures	String		Acquisition agent	FHWA (PGD)
		Attribute	Description of damage compensation (remaining property)	String		Acquisition agent	FHWA (PGD)
		Document	Document (description of the area + interest in real estate to be acquired)	**		Acquisition agent	FHWA (PGD)
		Document	Document (ROW plans, properties affected and names of owners being compensated)	**		Acquisition agent	FHWA (PGD)
		Attribute	List of structures, buildings equipment and fixtures considered (Total)	String		Acquisition agent	FHWA (PGD)
		Attribute	List of structures, buildings equipment and fixtures owned by lessees or sublessees	String		Acquisition agent	FHWA (PGD)
		Attribute	List of structures, buildings equipment and fixtures not included in acquisition	String		Acquisition agent	FHWA (PGD)
		Attribute	Summary Statement Agent ID	Number/String		Acquisition agent	FHWA (PGD)
		Attribute	Summary Statement Agent Name	String		Acquisition agent	FHWA (PGD)
		Attribute	Summary Statement Agent address	String		Acquisition agent	FHWA (PGD)
		Attribute	Summary Statement Agent Phone #	String		Acquisition agent	FHWA (PGD)
		Document	90-Day notice to Vacate (see Relocation)	**		Acquisition agent	FHWA (PGD)
	II.0.5. Parcel Closing	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Property encumbrance release-Title	Boolean		Acquisition agent	FHWA (PGD)
		Document	Settlement Statement and Deed	**		Acquisition agent	FHWA (PGD)
		Attribute	Payment release	Boolean		Acquisition agent	FHWA (PGD)
	II.1. Negotiation	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Negotiation Agent ID	Number/String	PenDOT	State/Local agency	FHWA
		Attribute	Negotiation Agent Name	String	PenDOT	State/Local agency	FHWA
		Attribute	Date of agreement	Date		Negotiation Agent	FHWA
		Attribute	Compensation after Negotiation	Number		Negotiation Agent	FHWA
	II.1.1. Mediation	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Reason for choosing Mediation	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Mediator(s) Name	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Mediator(s) Qualification	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Cost of Mediation	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Compensation after Mediation	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
II. ACQUISITION		*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
	II.1.2. Administrative Settlement	Attribute	Compensation through Appraisal process	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Official's Name	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Official's Qualification	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Reason for choosing Administrative Settlement	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Document	Supporting documents (appraisals, owner's appraisal)	**		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Recent court awards	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Compensation after Administrative Settlement	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Estimated project delay cost	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Estimated trail costs	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
	II.2.1. Legal Settlement	*Primary Key*	***Project ID***	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS*	*State/Local agency*	*Unique ID*
		Attribute	Compensation through Appraisal process	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Legal Counsel Official's ID (*should be among the Acquisition personnel IDs)	String		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Rationale for Legal Settlement	String	RUMS	Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Document	Supporting documents	**		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
		Attribute	Compensation after Legal Settlement	Number		Negotiation Agent	FHWA (Real Estate Acquisition Guide)
	II.2.2. Condemnation	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Compensation through Appraisal process	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
		Primary Key	*Condemner ID*	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Necessity for Acquisition	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Document	Document (Engineering and/or design ROW plans, properties affected)	**		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Compensation after Condemnation	Number		Condemner	FHWA (Real Estate Acquisition Guide)
	II.3.1. Assessments	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Necessity for additional tax or fee (Benefits of the public construction)	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Document	Document (Engineering and/or design ROW plans, properties affected)	**		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Assessment levied	Number		State/Local agency	FHWA (Real Estate Acquisition Guide)
	II.3.2. Functional Replacement	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Compensation through Appraisal process	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Description of present facility	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Reason for Functional Replacement	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Agreement - Terms and Conditions	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Respective Responsibilities	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Cost of New Facility	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
	II.3.3. Inverse Condemnation	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Damage or Difficulty caused	String		Property owner	*FHWA (Real Estate Acquisition Guide)*
		Document	Document (Engineering and/or design ROW plans, Properties affected)	**		Property owner	FHWA (PGD)
		Attribute	Compensation after Inverse Condemnation	Number		Property owner	FHWA (Real Estate Acquisition Guide)
	II.3.4. Uneconomic Remnants	*Primary Key*	***Project ID***	*Number/String*		State/Local agency	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		State/Local agency	*Unique ID*
		Attribute	Compensation through Appraisal process	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	% Fraction of the Remnant	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Usage of the Remnant	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Fair market value of the Remnant	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Compensation after considering Remnants	Number		Appraiser	FHWA (Real Estate Acquisition Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
II. ACQUISITION	II.3.5. Tenant Owned Improvements	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Description of Tenant-owned Improvements being acquired	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Acquisition cost of Tenant-owned improvements	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Removal cost of Tenant-owned improvements	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Final Tenant Compensation (Greater of the two costs)	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
	II.3.6. Owner Retention of Improvements	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Compensation through Appraisal process	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
		Elements in Sales Comparision Approach					FHWA (Real Estate Acquisition Guide)
		Attribute	Retention Value of the Improvements	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Final Compensation	Number		Appraiser	FHWA (Real Estate Acquisition Guide)
	II.3.7. Hardship & Protective Buying	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	Unique ID
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	Unique ID
		Attribute	Specific hardship to proterty owner	String		Appraiser	FHWA (Real Estate Acquisition Guide)
		Attribute	Agency decision	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Agency provided official public notice	String		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Project currently in approved STIP	Boolean		State/Local agency	FHWA (Real Estate Acquisition Guide)
		Attribute	Agency documented acquisition in public interest and necessary	String		State/Local agency	FHWA (Real Estate Acquisition Guide)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
III. RELOCATION	III.1. Relocation Planning	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Large families present	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Low-income elderly people present	Boolean		State/Local agency	FHWA (PGD)
		Attribute	People with disabilities present	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Possible shortage of dwellings for the above people	Boolean		State/Local agency	FHWA (PGD)
	III.1.1. Site Office	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*FHWA (PGD)*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*FHWA (PGD)*
		Primary Key	*Agent ID*	*Number/String*		State/Local agency	*FHWA (PGD)*
		Attribute	Hours of operation	Number		State/Local agency	FHWA (PGD)
		Geospatial	Location (point)	X,Y coordinates		State/Local agency	FHWA (PGD)
	III.1.2. General Notice Distribution	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Language of notices	String		State/Local agency	FHWA (PGD)
		Document	General Information Notice	**		State/Local agency	FHWA (PGD)
		Attribute	Date of issuing notice	Date		State/Local agency	FHWA (PGD)
		Document	Notice of Relocation Eligibility	**		State/Local agency	FHWA (PGD)
		Attribute	Date of initiation of negotiations	Date	RUMS, PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Date of issuing notice	Date	RUMS	State/Local agency	FHWA (PGD)
		Document	Comparable Dwelling Notification	**		State/Local agency	FHWA (PGD)
		Attribute	Date of issuing notice	Date		State/Local agency	FHWA (PGD)
		Document	Ninety Day Notice	**	RUMS, PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Date of locating at least one replacement dwelling	Date	PenDOT	State/Local agency	FHWA (PGD)
		Attribute	Date of issuing notice	Date		State/Local agency	FHWA (PGD)
		Attribute	Instructions about moving	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Information about advisory services	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Relocation payments description	Boolean		State/Local agency	FHWA (PGD)
	III.2. Additional Relocation information	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Description of the comparable dwelling	String		Appraiser	FHWA (PGD)
		Attribute	Location	String		Appraiser	FHWA (PGD)
		Attribute	Price used to set upper limit of replacement housing payment	Number		Appraiser	FHWA (PGD)
		Attribute	Rent used to set upper limit of replacement housing payment	Number		Appraiser	FHWA (PGD)
		Attribute	Basis for determination	String		Appraiser	FHWA (PGD)
		Document	Required certification	**	PenDOT	Appraiser	FHWA (PGD)
		Attribute	Individual, either citizen or national of the US or legal alien in the US	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Each family member, either citizen or national of the US or legal alien in the US	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Owner of unincorporated business, farm, or nonprofit organization, either citizen or national of the US or legal alien in the US	Boolean		State/Local agency	FHWA (PGD)
		Attribute	In case of incorporated business, farm, or nonprofit organization, corporation is authorized	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Denial of relocation benefits impacts adversely the health or safety of spouse, parent, or child who is either citizen or national of the US or legal alien in the US	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Denial of relocation benefits impacts adversely the continued existence of family unit of which a spouse, parent, or child who is either citizen or national of the US or legal alien in the US is a member	Boolean		State/Local agency	FHWA (PGD)
		Attribute	Denial of relocation benefits impacts adversely his\her spouse, parent, or child who is either citizen or national of the US or legal alien in the US in any other way	Boolean		State/Local agency	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
III. RELOCATION	III.3.1. Advisory Services Eligibility	*Primary Key*	***Project ID***	*Number/String*	RUMS	*FHWA*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	RUMS	*State/Local agency*	*Unique ID*
		Attribute	Eligibility category	String	RUMS	State/Local agency	FHWA (PGD)
		Attribute	Eligibility Description	String	RUMS	State/Local agency	FHWA (PGD)
	III.3. Advisory Services	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Relocation agent ID*	*Number/String*		State/Local agency	*FHWA (PGD)*
		Attribute	Advisory service(s) provided	String		Relocation Agent	FHWA (PGD)
		Attribute	Current listings	String		Relocation Agent	FHWA (PGD)
		Attribute	Federal & state housing programs	String		Relocation Agent	FHWA (PGD)
		Document	Application or claim forms	**		Relocation Agent	FHWA (PGD)
		Attribute	Transportation services	String		Relocation Agent	FHWA (PGD)
		Attribute	Other social services	String		Relocation Agent	FHWA (PGD)
		Attribute	Agencies providing services	String		Relocation Agent	FHWA (PGD)
	III.4.1.1. Fixed Residential Moving Expense Payments	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Payment type (Method)	String	RUMS	Relocation Agent	FHWA (PGD)
		Attribute	Commercial mover bids*	String	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Chosen bid amount *	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Self-documented move-activities *	String		Property owner/tenant	FHWA (PGD)
		Attribute	Self-documented move-time spent *	String		Property owner/tenant	FHWA (PGD)
		Attribute	Self-documented move-purchases of supplies and services *	String		Property owner/tenant	FHWA (PGD)
		Attribute	Self-documented move-persons performing the move *	String		Property owner/tenant	FHWA (PGD)
		Attribute	Self-documented move-hourly rate paid*	Number		Property owner/tenant	FHWA (PGD)
		Attribute	Total moving expenses paid	Number		Relocation Agent	FHWA (PGD)
	III.4.1.2. Residential Replacement Housing Determination	*Primary Key*	***Project ID***	*Number/String*	PenDOT	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	PenDOT	*State/Local agency*	*Unique ID*
		Primary Key	*Replacement dwelling ID*	*Number/String*	PenDOT	State/Local agency	*Unique ID*
		Attribute	Number of comperable dwellings offered	Number		Relocation Agent	FHWA (PGD)
		Geospatial	Location of replacement dwelling	polygon/point		Relocation Agent	
		Attribute	Size of replacement dwelling	String		Relocation Agent	FHWA (PGD)
		Attribute	Physical condition of replacement dwelling	String		Relocation Agent	FHWA (PGD)
		Attribute	Utility and cost of replacement dwelling	String	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Access to employment	String		Relocation Agent	FHWA (PGD)
		Attribute	Access to public & commercial faciltiies	String		Relocation Agent	FHWA (PGD)
		Attribute	Typical residential site	Boolean		Relocation Agent	FHWA (PGD)
		Attribute	Currently available	Boolean		Relocation Agent	FHWA (PGD)
		Attribute	Adverse environmental conditions	Boolean		Relocation Agent	FHWA (PGD)
		Attribute	Other needs	String		Relocation Agent	FHWA (PGD)
		Document	Comperable Dwelling Notification	**		Relocation Agent	FHWA (PGD)
	III.4.1.3. Decent, Safe, Sanitary (DSS) Inspection	*Primary Key*	***Project ID***	*Number/String*	PenDOT	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	PenDOT	*State/Local agency*	*Unique ID*
		Primary Key	*Replacement dwelling ID*	*Number/String*	PenDOT	State/Local agency	*Unique ID*
		Attribute	Local housing/occupancy code compliance	Boolean/string		Relocation Agent	FHWA (PGD)
		Attribute	Potable Water	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Kitchen	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Heating System	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Bathroom	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Electrical System	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Structurally sound	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Adequate in size	Boolean/string	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	ADA Accessible	Boolean/string		Relocation Agent	FHWA (PGD)
		Document	DSS Inspection	**		Relocation Agent	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
III. RELOCATION	III.4.1.4. Residential Replacement Housing Payment Determination	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Replacement dwelling ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Resident type (Time of stay, ownership)	String	RUMS, PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Replacement housing category(s)	String	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Date of purchase or rent and occupancy of replacement dwelling	Date	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Price differential *	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Replacement dwelling cost(s)	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Incidental expenses	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Incidental expenses description	String	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Mortgage interest differential	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Rental Assistance payment (<$5250)	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Rent-Replacement dwelling	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Actual rent-Displacement dwelling	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Market rent-Displacement dwelling	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Income of displaced person	Number		Relocation Agent	FHWA (PGD)
		Attribute	Difference	Number	PenDOT	Relocation Agent	FHWA (PGD)
		Attribute	Down payment assistance *	Number	PenDOT	Relocation Agent	FHWA (PGD)
			In case of 90-179 days owner-occupants, Down payment assistance = Rental Assistance for 180 days owner-occupants				
		Attribute	Special circumstances description	String		Relocation Agent	FHWA (PGD)
		Attribute	Insurance received	Number		Relocation Agent	FHWA (PGD)
		Attribute	Price differential *	Number		Relocation Agent	FHWA (PGD)
		Attribute	TOTAL PAYMENT	Number		Relocation Agent	FHWA (PGD)
	III.4.1.5 Housing of Last Resort	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Reason for Housing of Last Resort	String		Relocation Agent	FHWA (PGD)
		Document	Written agreement	**		Relocation Agent	FHWA (PGD)
		Attribute	Method for providing housing of last resort	String		Relocation Agent	FHWA (PGD)
		Attribute	Cost of Housing of Last Resort	Number	PenDOT	Relocation Agent	FHWA (PGD)
	III.4.2. Mobile Home	*Primary Key*	***Project ID***	*Number/String*		*FHWA*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Type of individual being relocated: Owner in mobile home Owner not occupant of mobile home Tenant in mobile home	String		Relocation Agent	FHWA (PGD)
		Attribute	Mobile home considered Realty or Personalty	String		Relocation Agent	FHWA (PGD)
		Attribute	Mobile home and/or site	String		Relocation Agent	FHWA (PGD)
	III.4.2.1. Moving Expenses for Mobile Homes	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Cost for moving mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for packing personal property	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for moving personal property	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for disconnecting and reconnecting appliances	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for moving attached appurtenances	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for repairs to move mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for insurance on mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for transportation of mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost for temporary lodging for mobile home occupants	Number		Relocation Agent	FHWA (PGD)
		Attribute	TOTAL Moving Costs	Number		Relocation Agent	FHWA (PGD)
	III.4.2.2. Replacement Housing Determination for Mobile Homes	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Ownership or Occupancy tenure	String		Relocation Agent	FHWA (PGD)
		Attribute	Type of Replacement housing: Site and mobile home, Mobile home only, Site only	String		Relocation Agent	FHWA (PGD)
		Attribute	Site available *	Boolean		Relocation Agent	FHWA (PGD)
		Geospatial	Location of replacement site	polygon/point		Relocation Agent	FHWA (PGD)
		Attribute	Assistance type	String		Relocation Agent	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
III. RELOCATION	III.4.2.4. Replacement Housing Payments	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Difference - rent - mobile home *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Rent of comparable mobile home site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Market rent-Displacement mobile home site*	Number		Relocation Agent	FHWA (PGD)
		Attribute	Difference - rent - mobile home site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Value of displaced mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of repairs/modifications *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Moving cost of mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Related expenses *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of comparable conventional dwelling *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Salvage trade-in value - MH *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Market price displacement MH site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Total RHP payment - MH (<$22,500)	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of comparable mobile home *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Acquisition price of displaced mobile home*	Number		Relocation Agent	FHWA (PGD)
		Attribute	Price differential offer- mobile home	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of comparable mobile home site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Acquisition price of displaced mobile home site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Price differential offer-mobile home site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Actaul cost of replacement property *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of comparable replacement property *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Acquisition price of displaced dwelling and site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	DS & S mobile home purchased *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Set-up charges *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Replacement site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Site improvements *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Total to purchase MH and site *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Total price differential payment	Number		Relocation Agent	FHWA (PGD)
	III.4.2.5. Site Only	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Payment for site only	Number		Relocation Agent	FHWA (PGD)
	III.4.3.1. Non-Residential Actual Cost Payment	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Mover type	String		Relocation Agent	FHWA (PGD)
		Attribute	Inventory list	String		Relocation Agent	FHWA (PGD)
		Attribute	"Actual" cost of moving	Number		Relocation Agent	FHWA (PGD)
		Attribute	Specifications and instructions for the move	String		Relocation Agent	FHWA (PGD)
		Attribute	Bids or estimates *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Regular rates of pay *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Rate charged by local moving firms *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost incurred by business for equipment *	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost-Management time for overseeing the move *	Number		Relocation Agent	FHWA (PGD)
		Attribute	TOTAL PAYMENT	Number		Relocation Agent	FHWA (PGD)
	III.4.3.2. Non-Residential Reestablishment Expense Payment	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Costs for searching for a new site	Number		Relocation Agent	FHWA (PGD)
		Attribute	Fixed payment for replacement site (RS)	Number		Relocation Agent	FHWA (PGD)
		Attribute	Business-Economic activity location	Boolean		Relocation Agent	FHWA (PGD)
		Attribute	Business-Employees > 500	Boolean		Relocation Agent	FHWA (PGD)
		Attribute	Re-establishment payment (<$10,000)	Number		Relocation Agent	FHWA (PGD)
		Attribute	Repairs and improvements of RS	Number		Relocation Agent	FHWA (PGD)
		Attribute	Redecoration of RS-paint, paneling, etc	Number		Relocation Agent	FHWA (PGD)
		Attribute	Advertising of RS-Construction & installation	Number		Relocation Agent	FHWA (PGD)
		Attribute	Utilities to RS	Number		Relocation Agent	FHWA (PGD)
		Attribute	Licenses, fees and permits-Not paid in moving expenses	Number		Relocation Agent	FHWA (PGD)
		Attribute	Feasibility survey, soil testing and marketing studies	Number		Relocation Agent	FHWA (PGD)
		Attribute	Professional services-Purchase and Lease of RS	Number		Relocation Agent	FHWA (PGD)
		Attribute	Increased cost of operation for 2 yrs	Number		Relocation Agent	FHWA (PGD)
		Attribute	Impact fees or one-time assessments	Number		Relocation Agent	FHWA (PGD)
		Attribute	Other costs	Number		Relocation Agent	FHWA (PGD)
		Attribute	TOTAL PAYMENT	Number		Relocation Agent	FHWA (PGD)
	III.4.3.3. Non-Residential Alternate Actual Payment	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Cost of moving	Number		Relocation Agent	FHWA (PGD)
		Attribute	Appraised value of the personal property	Number		Relocation Agent	FHWA (PGD)
		Attribute	Sale proceeds	Number		Relocation Agent	FHWA (PGD)
		Attribute	Cost of sale	Number		Relocation Agent	FHWA (PGD)
		Attribute	Substitute equipment-Cost of new equipment	Number		Relocation Agent	FHWA (PGD)
		Attribute	Substitute equipment-Sale of old equipment	Number		Relocation Agent	FHWA (PGD)
		Attribute	Substitute equipment-No market-Property's value for continued use	Number		Relocation Agent	FHWA (PGD)
		Attribute	Substitute equipment-No market-Moving cost	Number		Relocation Agent	FHWA (PGD)
		Attribute	TOTAL PAYMENT	Number		Relocation Agent	FHWA (PGD)
	III.4.3.4. Fixed In-lieu Payment	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Annual income year 1	Number		Relocation Agent	FHWA (PGD)
		Attribute	Annual income year 2	Number		Relocation Agent	FHWA (PGD)
		Attribute	Average income--In Lieu Payment	Number		Relocation Agent	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
IV. PROPERTY MANAGEMENT	IV.1.2. Tenant Selection	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Tenant ID	*Number/String*	*PenDOT*	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Tenant name	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Credit check	Boolean	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Financial statement	BLOB	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Agreement to terms and conditions	Boolean		Prop. Mgmt. Agent	FHWA (PGD)
	IV.1.3. Lease Agreement	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Tenant ID	*Number/String*	*PenDOT*	*State/Local agency*	FHWA (PGD)
		Attribute	Date of Lease	Date		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Term of Lease	Number		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Personal liability insurance	BLOB		Prop. Mgmt. Agent	FHWA (PGD)
		Document	Lease Agreement	**	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
	IV.1.4. Maintenance Agreements	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Tenant ID	*Number/String*	*PenDOT*	*State/Local agency*	FHWA (PGD)
		Attribute	Description of level of maintenece	String	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Type of structure	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Age and condition of structure	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Term of Lease	Number		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Level of tenant maintenance	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Property maintenance method	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Cost of agreement	Number		Prop. Mgmt. Agent	FHWA (PGD)
	IV.2.1. Property Sales	*Primary Key*	***Project ID***	*Number/String*	*New Mexico*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*New Mexico*	*State/Local agency*	*Unique ID*
		Primary Key	*Inventory ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Geospatial	Cadaster (property boundary)			State/Local agency	
		Attribute	Right-of-way non-requirement explanation	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Status of parcel: desirability for parks, recreations, etc	String	New Mexico	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Remainder or uneconomic remnant	Boolean		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Plan of Right-of-way to be disposed	String	New Mexico	Prop. Mgmt. Agent	FHWA (PGD)
		Document	Intent to Dispose of Property	**		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Type of disposition	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Sales price	Number	New Mexico	Prop. Mgmt. Agent	FHWA (PGD)
	IV.2.2. Relinquishments	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Inventory ID*	*Number/String*		State/Local agency	*Unique ID*
		Attribute	Description of use for other right-of-way	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Agency involved	String		Prop. Mgmt. Agent	FHWA (PGD)
	IV.3.1. Owner Retention	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	List of improvements	String	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Code review (moving structures)	Boolean		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Basis of retention value	**	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Retention value	Number	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
	IV.3.2. Sale of Improvements	*Primary Key*	***Project ID***	*Number/String*	*New Mexico*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*New Mexico*	*State/Local agency*	*Unique ID*
		Attribute	Date of vacation by occupant	Date		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Date of sale advertisement	Date		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	List of improvements	String	New Mexico	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Performance bond from purchaser	BLOB		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Sales price	Number	New Mexico	Prop. Mgmt. Agent	FHWA (PGD)
	IV.3.3. Clearance / Demolition	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Document	Contract for right-of-way clearance	**	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Cost of clearance	Number		Prop. Mgmt. Agent	FHWA (PGD)
	IV.3.4. Inventory Management	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Inventory ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Geospatial	Cadaster (parcel boundary)			State/Local agency	
		Attribute	Condtion of parcel	String		Prop. Mgmt. Agent	
		Attribute	Environmental condition: wetland, hazardous materials, etc	String/Boolean		Prop. Mgmt. Agent	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

Function	Activity	Data Type	Data Element Description	Data Format	Application(s) using this Data Element	Element Source	Source of Data Element
IV. PROPERTY MANAGEMENT	IV.3.5. Rodent Control	*Primary Key*	***Project ID***	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*RUMS, PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Date occupant vacates	Date		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Periodic inspection	Date		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Rodent infestation	Boolean		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Contract ID	Number/String	RUMS, PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Contract type	String	RUMS, PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Cost of rodent control	Number	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
	IV.3.6. Security	*Primary Key*	***Project ID***	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*	*PenDOT*	*State/Local agency*	*Unique ID*
		Attribute	Security method used	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Cost of security	Number	PenDOT	Prop. Mgmt. Agent	FHWA (PGD)
	IV.4.1. Airspace Marketing	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Policy considerations*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Legal considerations*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Demographics*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Valuation of airpspace*	Number		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Advertising*	String		Prop. Mgmt. Agent	FHWA (PGD)
	IV.4.2. Airspace Development	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Compatibility*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Insurance*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Requests for Proposals*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Source of Funds*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Safety*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Engineering and Construction*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Inspections*	String/date		Prop. Mgmt. Agent	FHWA (PGD)
	IV.4.3. Airspace Management	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Document	Lease Agreement	**		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Maintenance*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Insurance*	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Monitoring*	String		Prop. Mgmt. Agent	FHWA (PGD)
	New Access Points	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Name - Request initiator	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Purpose of the request	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Relationship with other highway plans	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Distance to activities or communities to be served	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Size of activities or communities to be served	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Description of present access	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Description of proposed access	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Traffic and operational analysis of present access	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Traffic and operational analysis of proposed access	String		Prop. Mgmt. Agent	FHWA (PGD)
	Access Changes	*Primary Key*	***Project ID***	*Number/String*		*State/Local agency*	*Unique ID*
		Primary Key	*Parcel ID*	*Number/String*		*State/Local agency*	*Unique ID*
		Attribute	Reasons for change	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Effect on the highway system	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Effect on the adjecent property	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Size of activities or communities to be served	String		Prop. Mgmt. Agent	FHWA (PGD)
		Attribute	Perception of highway facility to be gained by public and others	String		Prop. Mgmt. Agent	FHWA (PGD)

* If applicable
** Represents a document
*** BLOB - Binary large object

APPENDIX D

SURVEYS

Two written surveys were completed during this project. The initial survey was a screening survey presented below, which was distributed to attendees of the 2005 AASHTO/FHWA Right of Way and Utilities Subcommittee Conference in Austin, Texas. The purpose of this survey was to identify states that were actively using geospatial technologies in their day-to-day activities. States responding positively to the first survey received the second, more detailed survey on how geospatial technologies were being used in their organizations. This survey, along with the corresponding cover letter is presented after the screening survey.

NCHRP Project 8-55: Integrating Geo-Spatial Technologies into the Right-of-Way Data-Management Process
SURVEY

1. Does your State ROW/Utilities agency use GIS? **STATE NAME:**_____

☐ Yes ☐ No

2. If No, are you planning to incorporate GIS in the future?

☐ No ☐ Yes (in short term, 0-5 yrs) ☐ Yes (in long term > 5 yrs)

(if you answered No to Question 1, please skip to Question 6)

3. Which ROW Functional Area(s) use GIS? *(check all that apply)*

☐ Planning & Environmental Assessment
☐ Condemnation
☐ Surveys/ROW Engineering
☐ ROW Plans and Maps
☐ Relocation Assistance
☐ Utility Relocation/Management
☐ Property Appraisal
☐ Property/Asset Management
☐ Outdoor Advertising Control
☐ Appraisal Review
☐ Titles
☐ Corridor Preservation
☐ Property Acquisition
☐ Certification/Procedure
☐ Other_____

4. How often is GIS used for ROW/Utilities applications in your agency?

☐ Not at all ☐ Rarely ☐ Occasionally
☐ Regularly ☐ Frequently

5. Who uses GIS? *(check all that apply)*

☐ ROW/Utilities Staff ☐ Public ☐ Contractors (utility providers, etc.)
☐ Other Transportation Staff: Dept(s)_____ ☐ Other_____

6. What other technologies does your agency use? *(check all that apply)*

☐ Data Warehouse ☐ GPS ☐ Web Interface
☐ Data Integration/Standards ☐ Real-Time Data Collection ☐ Imagery
☐ Other_____

7. Please provide contact information:

Name:_____ Phone:_____ Email:_____

Agency name & address:_____

_____

Thank you for your time in completing this survey.

For further information please contact:
Dr. Kathleen Hancock, 703-518-2718, hancockk@vt.edu or Dr. Nicholas Koncz, 703-518-2717, Koncz@vt.edu.
Please return survey to:
Virginia Tech Center for Geospatial Information Technology, Suite 610, Alexandria, VA 22314.

Center for Geospatial Information Technology

2060 Torgersen Hall, Virginia Tech
Blacksburg, Virginia 24061
Office: 540-231-8490 Fax: 540-231-7532
http://www.cgit.vt.edu/ cgit@vt.edu

1101 King St, Suite 610, Virginia Tech
Alexandria, VA 22314
Office: 703-518-2718 Fax: 703 518-3145

June 8, 2005

The Virginia Polytechnic Institute and State University (Virginia Tech), under the AASHTO-sponsored National Cooperative Highway Research Program (NCHRP), is conducting Project 8-55, "Integrating Geo-Spatial Technologies into the Right-of-Way Data-Management Process." The objectives of this research are to: (1) identify the data elements that need to be included in a data model for a ROW information system that includes a geospatial component and (2) provide examples of return on investment when geospatial capabilities are added to such systems.

One aspect of this research is the development of a series of case studies documenting existing geospatially enabled information management and/or decision support systems for ROW activities. These are systems that incorporate geographic information systems (GIS) or other computer-based mapping at some point in the process. ROW issues have the potential to cause substantial delays and increased costs. With the advent of computers and particularly desktop computing, many agencies have migrated to some form of digital information management. Unfortunately, using these technologies is often difficult due to (1) lack of off-the-shelf solutions that meet specific needs and the necessity of customizing these systems, (2) requirement for re-education and re-engineering needed in the conversion from paper-based processes to electronic systems (3) establishment of communications between agencies that may not have interacted before and which have proprietary approaches to their own information. These issues are often compounded by the general inability to show a direct return on investment for implementing these technologies to decision makers who must allocate the necessary funds. This project provides one step in addressing these issues.

We are asking you to complete the enclosed questionnaire which is intended to obtain information on state transportation ROW information systems that are currently being used in practice and to identify whether geospatial technologies (GIS), advanced information management, and/or data integration are part of these systems. One specific goal is to document returns on investment for geospatially enabled systems. We will use the results of this questionnaire to identify systems for inclusion as case studies for this research. If your agency's system is selected, we will contact the person listed on the questionnaire for further information to complete the case study. The results of this project will include (1) a comprehensive list of ROW data elements, (2) case studies on geospatially enabled information systems used by state transportation agencies, and (3) a literature review of current geospatially enabled systems.

We realize that you receive many inquiries like this and that they consume a substantial amount of your time. We sincerely appreciate your participation in this effort. A copy of the results of this survey will be sent to you when the data have been compiled. If you have any questions, please

contact me at (703) 518-2718 or hancockk@vt.edu . A detailed description of the project can be obtained at http://www4.trb.org/trb/crp.nsf/NCHRP+projects under Area 8.

Sincerely,

Kathleen Hancock, Ph.D., P.E.
Associate Director, Center for Geospatial Information Technology
Associate Professor, Via Department of Civil & Environmental Engineering

Cc: TRB State Representative

NCHRP Project 8-55: Integrating Geo-Spatial Technologies into the Right-of-Way Data-Management Process
SURVEY

Person completing survey:
Name: _____
Phone: _____
Email: _____
Agency name & address: _____
_____
_____

Person to contact for questions: ☐ Same as above
Name: _____
Phone: _____
Email: _____
Agency name & address: _____
_____
_____

Which ROW functional areas use a system that includes GIS or computer mapping? *Check all that apply*

For this survey, "system" is any computer-based program, data management tool, decision support system, document tracking tool, etc that your agency uses to perform its activities.

Functional Area	If uses GIS ☑	If stand alone program ☑	If part of a more comprehensive system ☑	Name of System (how you refer to the system)
Planning & Environmental Assessment				
Surveys/ ROW Engineering				
ROW Plans and Maps				
Property Appraisal				
Appraisal Review				
Property Acquisition				
Condemnation				
Title Management				
Relocation Assistance				
Certifications/ Procedure Review				
Property / Asset Management				
Utility Relocation / Management				
Outdoor Advertising Control				
Corridor Preservation				
Other_____				

Please complete Questions 1 through 16 for each system checked above. Make additional copies of these pages as necessary.

SYSTEM NAME (Functional Area)_____

1. Briefly describe how GIS is used in this system.

_____

_____

2. How often is this system used in your agency?

___Rarely
___Occasionally
___Regularly

3. Who uses this system? *Check all that apply*

___ROW/Utilities Staff
___Other Transportation Agency Staff: specify_____
___Consultants
___Contractors: Utilities, etc
___Public
___Other: specify_____

4. How long has your agency been using this system?

___0 to 12 months
___More than one (1) year
___More than five (5) years

5. What is the current stage of system implementation of this system?

___Fully implemented, no additional work planned
___Implemented, additional functionality planned
___Implemented, links to other applications planned
___Implemented, integration with a larger system planned
___Currently in use but still being developed

6. How was this system developed?

___Existing system purchased from a vender/consultant without customization:
Name of vender/consultant_____
___Existing system purchased from a vender/consultant, customized by vender:
Name of vender/consultant_____
___Existing system purchased from a vender/consultant, customized in house:
Name of vender/consultant_____
___Developed specifically for your agency by consultants
___Developed specifically for your agency by in-house staff
___Other: Specify_____

7. Who is responsible for maintaining this system?

___ROW staff
___Transportation department/agency IT (information technology) staff
___Consultants
___Other: specify_____

8. Who is responsible for providing technical assistance for this system?

___ROW staff
___IT (information technology) staff
___Vender
___Consultants
___Other: specify_____

9. Do you have documentation for this system? *Check all that apply*

___Yes, manual(s): ____Users Manual ____System Manual
___Yes, on-line "help"
___Yes, our own "cheat sheets"
___No

10. What advanced technologies does this system use (in addition to GIS)? *Check all that apply*

___GPS
___Wireless/mobile data input
___Web interface
___Imagery
___Data warehouse
___Data integration
___Other: specify_____

11. What geospatial (GIS) data layers does this system use? *Check all that apply*

	Data Layer	Source
____	Parcel boundaries/Tax data	
____	Parcel ownership data	
____	Road centerlines or polygons	
____	Demographic data	
____	MLS data	
____	Hazardous materials sites	
____	Special Areas (ie wetlands, historic districts)	
____	Building footprints	
____	Aerial imagery	
____	Asset location (utilities, etc)	
____	Other: specify_____	
____	Other: specify_____	

The "Source" should be who provides your agency with this data layer. If it is accessible through a data warehouse or the internet, indicate the agency who manages the source data. Please be as specific as possible.

12. How has this system benefited operations in your agency? *Check all that apply*

___Reduced personnel time
___Reduced project delivery time
___Reduced costs
___Improved coordination between activities
___Improved streamlining
___Improved decision making
___Improved quality of work
___Improved volume of work
___Improved communications
___Other: specify_____

13. Provide any additional comments about benefits that your agency has recognized since implementation of this system.

_____
_____
_____
_____
_____

14. What were the major barriers (internal and external), if any, that your agency experienced during planning and implementing this system?

_____
_____
_____
_____
_____

15. List any disadvantages that your agency experiences in using this system?

_____
_____
_____
_____
_____

16. If you could "re-do" this system and/or it's implementation, what would you differently?

_____
_____
_____
_____
_____

Thank you for your time in completing this survey.

For further information please contact:
Dr. Kathleen Hancock, 703-518-2718, hancockk@vt.edu
or Dr. Nicholas Koncz, 703-518-2717, Koncz@vt.edu.

Please return the completed survey to:

Virginia Tech Center for Geospatial Information Technology
1101 King St. Suite 610
Alexandria, VA 22314
or
Fax: 703-518-3145

APPENDIX E

SURVEY RESULTS

E1.0 SCREENING SURVEY

Responses to the Screening Survey are presented in Table E-1. Checkboxes indicate affirmative answers. Shaded columns show affirmative answers by agencies indicating that they use geospatial technologies in their ROW activities. Question marks (i.e., "???") indicate potential misunderstandings. These misunderstandings include providing a "No" answer for using GIS and a "Yes" answer for using GIS in property/asset management and a "No" answer for using GIS and the state used as a case study in the GIS Implementation of SDOT ROW Programs (Saka, 2004).

E2.0 DETAILED SURVEY RESPONSES

TABLE E-1 GIS Right-of-Way screening survey

	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS	KY	LA	MA	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE	NH	NJ	NM	NV	NY	OH	OK	OR	PA	PR	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY	Sum
Does your State ROW agency use GIS?																																																					
Yes				☑					☑	???	☑	???					☑			???	☑		☑	☑	☑	☑		☑				☑	☑	☑	???	???	☑			☑				☑				☑	☑				**22**
No			☑							☑		☑	☑	☑	☑			☑		☑										☑	☑				☑	☑		☑	☑	☑		☑			☑				☑		☑	**19**
Are you planning to add GIS in the future?																																																				
No																																																					
Yes (Short Term)			☑							☑		☑						☑		☑						☑					☑				☑	☑		☑		☑				☑				☑		☑	**14**
Yes (Long Term)													☑	☑	☑								☑						☑														☑							☑			**7**
Which ROW Functional Areas use GIS?																																																				
Planning & Environ. Assessment									☑																☑									☑			☑					☑				☑					**6**
ROW Plans and Maps									☑		☑	☑												☑		☑								☑	☑							☑				☑				☑	**10**
Property Appraisal									☑																								☑	☑		☑															**4**
Appraisal Review									☑																								☑	☑		☑															**4**
Property Acquistion									☑																								☑	☑																	**3**
Condemnation									☑																																												**1**
Relocation Assistance																																	☑																				**1**
Property/Asset Management												☑								☑	☑				☑								☑	☑			☑															**7**
Titles									☑																								☑																			**2**
Certification/Procedure																																																					**0**
Surveys/ROW Engineering									☑														☑	☑	☑	☑							☑	☑							☑				☑					**9**
Utility Relocation/Management																							☑		☑								☑	☑											☑							**5**
Outdoor Advertising Control																				☑														☑											☑							**3**
Corridor Preservation									☑																																												**1**
Other																				☑													☑																				**2**
How often is GIS used in ROW?																																																					
Not at all																				☑																																			**1**
Rarely												☑											☑																																**3**
Occasionally									☑												☑			☑	☑	☑							☑					☑															**9**
Regularly											☑																																											**1**
Frequently																																		☑																				**1**
Who uses GIS?																																																					
ROW/Utilities Staff									☑		☑	☑									☑		☑	☑		☑							☑	☑			☑					☑									**12**
Public																								☑										☑																		**2**
Contractors																								☑	☑									☑								☑									**4**
Other Transportation Staff									☑		☑										☑		☑		☑						☑		☑	☑	☑		☑			☑			☑								**12**
Other																																		☑											☑							**2**
What other technologies are used?																																																					
Data warehouse									☑									☑						☑	☑					☑	☑			☑	☑	☑						☑				☑					**11**
GPS									☑	☑					☑					☑			☑	☑	☑	☑					☑			☑			☑				☑	☑	☑			☑	☑			☑		**18**
Web interface			☑							☑					☑								☑	☑							☑			☑			☑	☑		☑	☑							☑			**12**
Data integration/standards																							☑	☑										☑					☑							☑						**5**
Real-time data collection													☑		☑			☑					☑	☑	☑						☑			☑			☑									☑			☑		**11**
Imagery																				☑				☑	☑						☑			☑										☑							**7**
Other																								☑																								☑					**2**

TABLE E-2 GIS or computer mapping in ROW functional areas

Activity	Property Appraisal	Appraisal Review	Property Acquisition	Condemnation	Title Management	Relocation Assistance	Certification / Procedure Review	Property / Asset Management	Planning & Environmental Assessment	Surveys / ROW Engineering	ROW Plans and Maps	Utility Relocation / Management	Corridor Preservation	Outdoor Advertising Control	Other	Total Functional Areas that include GIS
Process Flow Ref.**	**I.**	**I.0.8.**	**II.**	**II.2.**	**II.5.**	**III.**		**IV.**	**A.**	**B.**	**B.**	**C.**	**D.**	**E.**		
Arizona	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	1
California	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	3
Delaware	NA	Y	Y	NA	NA	Y	N	Y	N	Y	Y	NA	Y	NA	N	7
Florida	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	11
Georgia	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	NA	NA	NA	NA	N	8
Iowa	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	1
Kansas	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	2
Maryland	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	2
Massachusetts	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	Y	N	6
Minnesota	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	4
Mississippi	Y*	Y*	Y*	Y*	Y	Y*	Y*	Y	Y*	Y*	Y*	Y*	N	Y*	N	13
New Mexico	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	1
New York	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	2
Ohio	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	2
Oklahoma	Y	Y	N	N	Y	N	N	Y	N	N	N	N	N	N	N	4
South Carolina	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	1
Texas	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	2
Virginia	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
Total States Indicating GIS Use	5	6	5	3	4	5	3	9	5	6	7	2	2	4	4	

* Indicates use of GIS software but not a geospatially enabled system
** Reference to Process Flow Diagrams used for identifying data elements, see Appendix C
Shaded areas indicate use of geospatial technology
NA - Out sourced or information not known or not considered as ROW activity

TABLE E-3a Activity : I. Property Appraisal

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Massachusetts	Y	Y	N	Pictometry & ArcView
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM
Oklahoma	Y	N	Y	GRIP

TABLE E-3b Activity : I.0.8. Appraisal Review

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Delaware	N	Y	N	Real Estate Management
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Massachusetts	Y	Y	N	Pictometry & ArcView
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM
Oklahoma	Y	N	Y	GRIP

TABLE E-3c Activity : II. Property Acquisition

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Delaware	N	Y	N	Real Estate Management
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Massachusetts	Y	Y	N	Pictometry & ArcView
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM

TABLE E-3d Activity : II.2. Condemnation

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Mississippi	N	Y	Y	CADD, Micosoft suite, Parcel Tracking software, PDPM

TABLE E-3e Activity : II.5. Title Management

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM
Oklahoma	Y	N	Y	GRIP

TABLE E-3f Activity : III. Relocation Assistance

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Delaware	N	Y	N	Real Estate Management
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Massachusetts	Y	Y	N	Pictometry & ArcView
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM

TABLE E-3g Activity : Certification / Procedure Review

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Mississippi	N	N	Y	Micosoft suite

TABLE E-3h Activity : IV. Property / Asset Management

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Arizona	Y	Y	N	Property Mgmt. Parcel Inventory
California	Y	NI	NI	Excess Land Tracking GIS Website
Delaware	Y	Y	N	Geo Media, Real Estate Management
Florida	N	N	Y	RWMS
Georgia	N	N	Y	T-Pro
Maryland	Y	N	N	Extraland
Massachusetts	Y	Y	N	Pictometry & ArcView
Minnesota	Y	Y	N	Traffic Sign Inventory
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software
New Mexico	Y	N	N	ESRI ARCMAP 9
Oklahoma	Y	N	Y	GRIP

TABLE E-3i Activity : A. Planning & Environmental Assessment

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
California	Y	NI	NI	NI
Iowa	Y	Y	N	Wetland Mitigation Tracking System
Minnesota	Y	Y	N	Minnesota Model
Mississippi	Y	Y	Y	GIS, CADD, Micosoft suite, Parcel Tracking software, PDPM
Ohio	Y	N	Y	IT
South Carolina	Y	N	N	NI

NI - Not Indicated

TABLE E-3j Activity : B. Surveys / ROW Engineering

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
California	Y	NI	NI	NI
Delaware	N	Y	N	Intergraph
Florida	N	Y	N	CADD
Minnesota	Y	Y	N	Satewide Parcel Map Inventory
Mississippi	Y	Y	Y	GIS, CADD, Geopack, Carlson, Micosoft suite, Parcel Tracking software, PDPM
New York	Y	N	N	ESRI Software Products

NI - Not Indicated

TABLE E-3k Activity : B. ROW Plans and Maps

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
California	Y	NI	NI	NI
Delaware	Y	N	N	Geo Media
Florida	N	Y	N	CADD
Minnesota	Y	Y	N	ROW Map Spatial Index
Mississippi	Y	Y	Y	GIS, CADD, Geopack, Carlson, Micosoft suite, Parcel Tracking software, PDPM
New York	Y	N	N	ESRI Software Products
Texas	Y	Y	N	San Antonio GIS Mapping System

NI - Not Indicated

TABLE E-3l Activity : C. Utility Relocation / Management

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Mississippi	N	Y	Y	Micosoft suite, Parcel Tracking software, PDPM
Texas	Y	Y	N	GIS Utility Database

TABLE E-3m Activity : D. Corridor Preservation

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Delaware	Y	Y	N	Geo Media, Real Estate Management
Kansas	Y	Y	N	K-GATE

TABLE E-3n Activity : E. Outdoor Advertising Control

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
Florida	Y	Y	N	ODA - IMS
Massachusetts	Y	Y	N	Pictometry & ArcView
Mississippi	N	N	Y	Micosoft suite
Ohio	Y	N	Y	IT

TABLE E-3o Activity : Other

State	GIS used	Stand alone	Part of Comprehensive system	Name of the system
California	NI	NI	NI	Cost Estimate Mapping
Kansas	Y	Y	N	HAPS
Maryland	Y	N	N	Existing R/W Research
Minnesota	Y	Y	N	(PCA Requirements) Roadway Maintenance Inventory

NI - Not Indicated

TABLE E-4 Summary of systems using GIS by ROW activity

		ROW Activity (Number relates to Process Flow Diagram, Appendix C)														
		Property Appraisal	Appraisal Review	Property Acquisition	Condemnation	Title Management	Relocation Assistance	Certification / Procedure Review	Property / Asset Management	Planning & Environmental Assessment	Surveys / ROW Engineering	ROW Plans and Maps	Utility Relocation / Management	Corridor Preservation	Outdoor Advertising Control	Other
Name of System(s)	State	I.	I.0.8.	II.	II.2.	II.5.	III.		IV.	A.	B.	B.	C.	D.	E.	
Property Mgmt. Parcel System	Arizona	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
Not Indicated	California	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
Not Indicated	California	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
Not Indicated	California	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Intergraph	Deleware	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
Geo Media	Deleware	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
Real Estate Management	Deleware	N	Y	Y	N	N	Y	N	N	N	N	N	N	N	N	N
Geo Media, Real Estate Management	Deleware	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N
CADD	Florida	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N
RWMS	Florida	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
ODA-IMS	Florida	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
T-Pro	Georgia	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
Wetland Mitigation Tracking System	Iowa	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
K-GATE	Kansas	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N
HAPS	Kansas	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Extraland	Maryland	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
Existing R/W research	Maryland	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Pictometry & ArcView	Massachusetts	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	Y	N
Minnesota Model	Minnesota	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
Satewide Parcel Map Inventory	Minnesota	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
ROW Map Spatial Index	Minnesota	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
Traffic Sign Inventory	Minnesota	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
Roadway Maintenance Inventory	Minnesota	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
GIS, CADD, Micosoft suite, Parcel Tracking software, PDPM	Mississippi	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
GIS, CADD, Geopack, Carlson, Micosoft suite, Parcel Tracking software, PDPM	Mississippi	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N
Micosoft suite, Parcel Tracking software, PDPM	Mississippi	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y	N	N	N
Micosoft suite	Mississippi	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N
CADD, Micosoft suite, Parcel Tracking software, PDPM	Mississippi	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
Micosoft suite, Parcel Tracking software	Mississippi	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
ESRI ARCMAP 9	New Mexico	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
ESRI Software Products	New York	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N
IT	Ohio	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N
GRIP	Oklahoma	Y	Y	N	N	Y	N	N	Y	N	N	N	N	N	N	N
Not Indicated	South Carolina	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
San Antonio GIS Mapping System	Texas	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N
GIS Utility Database	Texas	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N
TOTALSYSTEMS		5	6	5	3	4	5	3	9	4	6	8	3	2	4	3

Shaded areas indicate use of GIS software

TABLE E-5a Activity : Property Appraisal

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Oklahoma	GRIP	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	Y	Y	Y

NI - Not Indicated

TABLE E-5b Activity : Property Appraisal

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Oklahoma	GRIP	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-5c Activity : Property Appraisal

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Oklahoma	GRIP	N	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	N

NI - Not Indicated

TABLE E-5d Activity : Property Appraisal

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Oklahoma	GRIP	N	N	Y	N	N	N	Y	N	Y	N	N

NI - Not Indicated

TABLE E-6a Activity : Appraisal Review

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Delaware	Real Estate Management	Occasionally	Y	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Oklahoma	GRIP	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	Y	Y	Y

NI - Not Indicated

TABLE E-6b Activity : Appraisal Review

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Delaware	Real Estate Management	NI						N	Y	Y	N	N	Y	N	Y	N	NI			
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Oklahoma	GRIP	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-6c Activity : Appraisal Review

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Delaware	Real Estate Management	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Oklahoma	GRIP	N	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	N

NI - Not Indicated

TABLE E-6d Activity : Appraisal Review

State	Name of the system	Data Layers in the System: Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Delaware	Real Estate Management	Y	N	Y	N	N	N	Y	N	Y	N	Y
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Oklahoma	GRIP	N	N	Y	N	N	N	Y	N	Y	N	N

NI - Not Indicated

TABLE E-7a Activity : Property Acquisition

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y

NI - Not Indicated

TABLE E-7b Activity : Property Acquisition

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N

NI - Not Indicated

TABLE E-7c Activity : Property Acquisition

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N

NI - Not Indicated

TABLE E-7d Activity : Property Acquisition

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-8a Activity : Condemnation

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Mississippi	CADD, Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y

NI - Not Indicated

TABLE E-8b Activity : Condemnation

		Who developed						Who maintains				Technical assistance					Documentation			
State	Name of the system	Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Mississippi	CADD, Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N

NI - Not Indicated

TABLE E-8c Activity : Condemnation

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Mississippi	CADD, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N

NI - Not Indicated

TABLE E-8d Activity : Condemnation

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Mississippi	CADD, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-9a Activity : Title Management

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Oklahoma	GRIP	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	Y	Y	Y

NI - Not Indicated

TABLE E-9b Activity : Title Management

		Who developed						Who maintains				Technical assistance					Documentation			
State	Name of the system	Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Oklahoma	GRIP	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-9c Activity : Title Management

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Oklahoma	GRIP	N	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	N

NI - Not Indicated

TABLE E-9d Activity : Title Management

State	Name of the system	Data Layers in the System: Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Oklahoma	GRIP	N	N	Y	N	N	N	Y	N	Y	N	N

NI - Not Indicated

TABLE E-10a Activity : Relocation Assistance

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Delaware	Real Estate Management	Occasionally	Y	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y

NI - Not Indicated

TABLE E-10b Activity : Relocation Assistance

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Delaware	Real Estate Management	NI						N	Y	Y	N	N	Y	N	Y	N	NI			
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N

NI - Not Indicated

TABLE E-10c Activity : Relocation Assistance

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Delaware	Real Estate Management	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N

NI - Not Indicated

TABLE E-10d Activity : Relocation Assistance

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Delaware	Real Estate Management	Y	N	Y	N	N	N	Y	N	Y	N	Y
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-11a Activity : Certification / Procedure Review

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Mississippi	Microsoft suite	Occasionally	NI						Y	N	N	N	N	N	Y	Y

NI - Not Indicated

TABLE E-11b Activity : Certification / Procedure Review

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Mississippi	Microsoft suite	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N

NI - Not Indicated

TABLE E-11c Activity : Certification / Procedure Review

		Advanced technologies in addition to GIS							Benefits to your agency									
State	**Name of the system**	**GPS**	**Wireless/ Mobile data input**	**Web interface**	**Imagery**	**Data warehouse**	**Data integration**	**Other**	**Reduced personnel time**	**Reduced project delivery time**	**Reduced costs**	**Improved coordination between activities**	**Improved streamlining**	**Improved decision making**	**Improved quality of work**	**Improved volume of work**	**Improved communications**	**Other**
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Mississippi	Microsoft suite	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N

NI - Not Indicated

TABLE E-11d Activity : Certification / Procedure Review

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Mississippi	Microsoft suite	Y	Y	Y	Y	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-12a Activity : Property / Asset Management

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Arizona	Property Mgmt. Parcel Inventory	Occasionally	N	N	N	N	N	Y	Y	N	N	N	N	N	N	Y
California	Excess Land Tracking GIS Website	Regularly	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N
Delaware	Geo Media, Real Estate Management	Occasionally	Y	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Florida	RWMS	NI														
Georgia	T-Pro	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Maryland	Extraland	Regularly	Y	N	N	N	N	N	N	Y	N	N	N	N	N	Y
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Minnesota	Traffic Sign Inventory	Regularly	N	Y	N	N	N	N	Y	N	N	N	N	N	N	Y
Mississippi	Micosoft suite, Parcel Tracking software	Occasionally	NI						Y	N	N	N	N	N	Y	Y
New Mexico	ESRI ARCMAP 9	Regularly	N	N	N	N	N	Y	N	N	Y	N	N	N	N	Y
Oklahoma	GRIP	Regularly	Y	Y	N	N	N	N	N	N	Y	N	Y	Y	Y	Y

NI - Not Indicated

TABLE E-12b Activity : Property / Asset Management

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Arizona	Property Mgmt. Parcel Inventory	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	Y	Y	Y	N
California	Excess Land Tracking GIS Website	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	N	N	NI			
Delaware	Geo Media, Real Estate Management	NI						N	Y	Y	N	N	Y	N	Y	N	NI			
Florida	RWMS	NI																		
Georgia	T-Pro	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	N
Maryland	Extraland	N	N	N	Y	N	N	N	Y	N	N	Y	Y	N	N	N	N	N	N	Y
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Minnesota	Traffic Sign Inventory	N	Y	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	N	Y	N	N
Mississippi	Micosoft suite, Parcel Tracking software	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
New Mexico	ESRI ARCMAP 9	Y	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	Y
Oklahoma	GRIP	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-12c Activity : Property / Asset Management

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Arizona	Property Mgmt. Parcel Inventory	Y	N	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	N	N	N
California	Excess Land Tracking GIS Website	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	N	N	N
Delaware	Geo Media, Real Estate Management	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N
Florida	RWMS	NI																
Georgia	T-Pro	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	N
Maryland	Extraland	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Minnesota	Traffic Sign Inventory	Y	Y	N	Y	N	N	N	Y	N	N	Y	Y	Y	N	N	Y	N
Mississippi	Micosoft suite, Parcel Tracking software	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
New Mexico	ESRI ARCMAP 9	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Oklahoma	GRIP	N	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	N

NI - Not Indicated

TABLE E-12d Activity : Property / Asset Management

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Arizona	Property Mgmt. Parcel Inventory	Y	Y	N	N	N	N	N	Y	Y	Y	Y
California	Excess Land Tracking GIS Website	Y	Y	N	N	N	N	N	N	Y	N	N
Delaware	Geo Media, Real Estate Management	Y	N	Y	N	N	N	Y	N	Y	N	Y
Florida	RWMS	NI										
Georgia	T-Pro	N	N	N	N	N	N	N	N	N	N	N
Maryland	Extraland	Y	Y	Y	N	N	N	N	N	N	N	N
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Minnesota	Traffic Sign Inventory	N	N	Y	N	N	N	N	N	N	N	Y
Mississippi	Micosoft suite, Parcel Tracking software	Y	Y	Y	Y	N	N	N	N	Y	Y	N
New Mexico	ESRI ARCMAP 9	Y	Y	Y	Y	N	N	Y	N	Y	N	N
Oklahoma	GRIP	N	N	Y	N	N	N	Y	N	Y	N	N

NI - Not Indicated

TABLE E-13a Activity : Planning & Environmental Assessment

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
California	Route estimating	Regularly	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N
Iowa	Wetland Mitigation Tracking System	Regularly	N	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Minnesota	Minnesota Model	NI	N	Y	N	N	N	Y	N	N	Y	Y	N	N	N	N
Mississippi	GIS, CADD, Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Ohio	IT	Regularly	N	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
South Carolina	Planning & Environmental Assessment	Regularly	N	Y	Y	N	N	N	N	N	Y	N	Y	N	Y	N

NI - Not Indicated

TABLE E-13b Activity : Planning & Environmental Assessment

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
California	Route estimating	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	N	N	NI			
Iowa	Wetland Mitigation Tracking System	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	N	N	N	Y
Minnesota	Minnesota Model	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	GIS, CADD, Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Ohio	IT	N	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	Y	N
South Carolina	Planning & Environmental Assessment	Y	N	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	Y	Y	N	N

NI - Not Indicated

TABLE E-13c Activity : Planning & Environmental Assessment

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
California	Route estimating	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	N	N	N
Iowa	Wetland Mitigation Tracking System	Y	N	N	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N
Minnesota	Minnesota Model	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N
Mississippi	GIS, CADD, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Ohio	IT	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
South Carolina	Planning & Environmental Assessment	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	N

NI - Not Indicated

TABLE E-13d Activity : Planning & Environmental Assessment

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
California	Route estimating	Y	Y	N	N	N	N	N	N	Y	N	N
Iowa	Wetland Mitigation Tracking System	N	N	Y	Y	N	N	Y	N	Y	N	Y
Minnesota	Minnesota Model	N	N	N	N	N	N	Y	N	N	N	Y
Mississippi	GIS, CADD, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Ohio	IT	N	N	Y	Y	N	N	Y	N	Y	N	N
South Carolina	Planning & Environmental Assessment	N	N	Y	Y	N	Y	Y	Y	Y	Y	N

NI - Not Indicated

TABLE E-14a Activity : Surveys / ROW Engineering

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
California	Route estimating	Regularly	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N
Delaware	Intergraph	Occasionally	Y	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Florida	CADD	NI														
Minnesota	Statewide Parcel Map Inventory	Regularly	Y	Y	Y	Y	Y	N	N	Y	N	N	Y	N	N	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
New York	ESRI Software Products	Regularly	N	Y	N	N	N	N	N	N	Y	N	Y	Y	N	N

NI - Not Indicated

TABLE E-14b Activity : Surveys / ROW Engineering

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
California	Route estimating	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	N	N	NI			
Delaware	Intergraph	NI						N	Y	Y	N	N	Y	N	Y	N	NI			
Florida	CADD	NI																		
Minnesota	Statewide Parcel Map Inventory	N	N	N	Y	N	N	Y	N	N	N	Y	Y	N	N	N	Y	Y	N	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
New York	ESRI Software Products	N	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	Y	N	Y	N

NI - Not Indicated

TABLE E-14c Activity : Surveys / ROW Engineering

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
California	Route estimating	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	N	N	N
Delaware	Intergraph	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N
Florida	CADD	NI																
Minnesota	Statewide Parcel Map Inventory	N	N	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	Y	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
New York	ESRI Software Products	Y	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N

NI - Not Indicated

TABLE E-14d Activity : Surveys / ROW Engineering

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
California	Route estimating	Y	Y	N	N	N	N	N	N	Y	N	N
Delaware	Intergraph	Y	N	Y	N	N	N	Y	N	Y	N	Y
Florida	CADD	NI										
Minnesota	Statewide Parcel Map Inventory	N	N	Y	N	N	N	N	N	N	N	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
New York	ESRI Software Products	Y	N	Y	N	N	N	N	N	N	N	N

NI - Not Indicated

TABLE E-15a Activity : ROW Plans and Maps

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
California	Route estimating, ROW document retreival system GIS website	Regularly	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N
Florida	CADD	NI														
Minnesota	ROW Map Spatial Index	Regularly	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
New York	ESRI Software Products	Regularly	N	Y	N	N	N	N	N	N	Y	N	Y	Y	N	N
Texas	San Antonio GIS Mapping System	Regularly	Y	N	Y	N	Y	N	N	Y	N	N	Y	N	N	Y

NI - Not Indicated

TABLE E-15b Activity : ROW Plans and Maps

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
California	Route estimating, ROW document retreival system GIS website	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	N	N	NI			
Florida	CADD	NI																		
Minnesota	ROW Map Spatial Index	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	NI			
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
New York	ESRI Software Products	N	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	Y	N	N	N
Texas	San Antonio GIS Mapping System	N	N	N	N	Y	N	N	Y	N	N	Y	N	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-15c Activity : ROW Plans and Maps

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
California	Route estimating, ROW document retreival system GIS website	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	N	N	N
Florida	CADD	NI																
Minnesota	ROW Map Spatial Index	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
New York	ESRI Software Products	Y	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Texas	San Antonio GIS Mapping System	N	N	N	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-15d Activity : ROW Plans and Maps

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
California	Route estimating, ROW document retreival system GIS website	Y	Y	N	N	N	N	N	N	Y	N	N
Florida	CADD	NI										
Minnesota	ROW Map Spatial Index	N	N	Y	N	N	N	N	N	N	N	Y
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
New York	ESRI Software Products	Y	N	Y	N	N	N	N	N	N	N	N
Texas	San Antonio GIS Mapping System	N	N	N	N	N	N	N	N	N	N	N

NI - Not Indicated

TABLE E-16a Activity : Utility Relocation / Management

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Texas	GIS Utility Database	NI	Y	Y	N	N	N	N	Y	N	N	NI				

NI - Not Indicated

TABLE E-16b Activity : Utility Relocation / Management

		Who developed						Who maintains				Technical assistance					Documentation			
State	Name of the system	Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Texas	GIS Utility Database	N	N	N	N	N	Y	N	Y	N	N	Y	N	N	N	N	Y	N	N	N

NI - Not Indicated

TABLE E-16c Activity : Utility Relocation / Management

State	Name of the system	Advanced technologies in addition to GIS: GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Benefits to your agency: Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Texas	GIS Utility Database	Y	N	Y	Y	N	Y	N	NI									

NI - Not Indicated

TABLE E-16d Activity : Utility Relocation / Management

		Data Layers in the System										
State	**Name of the system**	**Parcel boundaries/ Tax data**	**Parcel ownership data**	**Road centerlines or polygons**	**Demographic data**	**MLS data**	**Hazardous materials sites**	**Special areas (wetlands, historic districts)**	**Building footprints**	**Aerial imagery**	**Asset location (utilities, etc)**	**Other**
Mississippi	Microsoft suite, Parcel Tracking software, PDPM	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Texas	GIS Utility Database	N	N	Y	N	N	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-17a Activity : Corridor Preservation

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Delaware	Geo Media, Real Estate Management	Occasionally	Y	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Kansas	K-GATE	Regularly	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	N

NI - Not Indicated

TABLE E-17b Activity : Corridor Preservation

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Delaware	Geo Media, Real Estate Management	NI						N	Y	Y	N	N	Y	N	Y	N	NI			
Kansas	K-GATE	N	N	N	N	Y	Y	N	Y	N	Y	N	N	N	N	Y	Y	Y	N	N

NI - Not Indicated

TABLE E-17c Activity : Corridor Preservation

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency										
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Delaware	Geo Media, Real Estate Management	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N
Kansas	K-GATE	Y	N	Y	Y	N	Y	N	N	N	N	Y	N	Y	N	N	Y	N

NI - Not Indicated

TABLE E-17d Activity : Corridor Preservation

State	Name of the system	Data Layers in the System										
		Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Delaware	Geo Media, Real Estate Management	Y	N	Y	N	N	N	Y	N	Y	N	Y
Kansas	K-GATE	N	N	Y	N	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-18a Activity : Outdoor Advertising Control

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
Florida	ODA - IMS	Regularly	Y	N	Y	N	N	N	N	N	Y	N	Y	N	N	N
Massachusetts	Pictometry & ArcView	Regularly	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N
Mississippi	Microsoft suite	Occasionally	NI						Y	N	N	N	N	N	Y	Y
Ohio	IT	Occasionally	N	Y	N	N	N	N	N	Y	N	N	N	Y	N	N

NI - Not Indicated

TABLE E-18b Activity : Outdoor Advertising Control

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
Florida	ODA - IMS	N	N	N	Y	N	N	Y	N	Y	N	Y	N	N	N	N	N	N	Y	N
Massachusetts	Pictometry & ArcView	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N
Ohio	IT	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	Y

NI - Not Indicated

TABLE E-18c Activity : Outdoor Advertising Control

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
Florida	ODA - IMS	Y	N	Y	Y	N	N	N	Y	N	Y	N	Y	Y	Y	Y	N	N
Massachusetts	Pictometry & ArcView	Y	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Mississippi	Microsoft suite	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N
Ohio	IT	Y	N	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N

NI - Not Indicated

TABLE E-18d Activity : Outdoor Advertising Control

State	Name of the system	Data Layers in the System: Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
Florida	ODA - IMS	N	N	Y	N	N	N	N	N	N	N	Y
Massachusetts	Pictometry & ArcView	N	N	N	N	N	N	N	N	Y	N	N
Mississippi	Microsoft suite	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Ohio	IT	N	N	Y	N	N	N	N	N	Y	Y	N

NI - Not Indicated

TABLE E-19a Activity : Other

State	Name of the system	How often used	Who uses						How long			Stage of Implementation				
			ROW/ Utilities	Other Transportation staff	Consultants	Contractors	Public	Other	0 to 12 months	> 1 year	> 5 years	Fully implemented, No additions planned	Implemented, Additions planned	Implemented, links to other application planned	Implemented, Integration with larger system planned	Currently in use, still being developed
California	Cost Estimate Mapping		NI													
Kansas	HAPS	Regularly	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	N
Maryland	Existing R/W Research	NI	Y	N	N	N	N	N	Y	N	N	NI				
Minnesota	(PCA Requirements) Roadway Maintenance Inventory	Occasionally	N	Y	N	N	N	Y	Y	N	N	N	N	N	N	Y

NI - Not Indicated

TABLE E-19b Activity : Other

State	Name of the system	Who developed						Who maintains				Technical assistance					Documentation			
		Purchased from consultant No customization	Purchased from consultant Customized by vendor	Purchased from consultant Customized in-house	Developed specifically for your agency by consultants	Developed specifically for your agency in-house	Other	ROW staff	Transportation department IT staff	Consultants	Other	ROW staff	IT staff	Vendors	Consultants	Other	Yes, Manuals	Yes, Online help	Yes, Cheat sheets	No
California	Cost Estimate Mapping	NI																		
Kansas	HAPS	N	N	Y	N	N	N	N	N	N	Y	N	Y	N	N	Y	Y	N	N	N
Maryland	Existing R/W Research	N	N	N	Y	N	N	N	Y	N	N	Y	N	N	N	N	N	Y	N	N
Minnesota	(PCA Requirements) Roadway Maintenance Inventory	N	N	N	N	Y	N	N	Y	N	Y	N	Y	N	N	Y	N	N	N	Y

NI - Not Indicated

TABLE E-19c Activity : Other

State	Name of the system	Advanced technologies in addition to GIS							Benefits to your agency									
		GPS	Wireless/ Mobile data input	Web interface	Imagery	Data warehouse	Data integration	Other	Reduced personnel time	Reduced project delivery time	Reduced costs	Improved coordination between activities	Improved streamlining	Improved decision making	Improved quality of work	Improved volume of work	Improved communications	Other
California	Cost Estimate Mapping	NI																
Kansas	HAPS	Y	N	Y	Y	N	Y	N	N	Y	N	Y	Y	N	N	N	Y	N
Maryland	Existing R/W Research	N	N	N	N	N	N	N	NI									
Minnesota	(PCA Requirements) Roadway Maintenance Inventory	Y		Y								Y					Y	

NI - Not Indicated

TABLE E-19d Activity : Other

State	Name of the system	Data Layers in the System: Parcel boundaries/ Tax data	Parcel ownership data	Road centerlines or polygons	Demographic data	MLS data	Hazardous materials sites	Special areas (wetlands, historic districts)	Building footprints	Aerial imagery	Asset location (utilities, etc)	Other
California	Cost Estimate Mapping	NI										
Kansas	HAPS	N	N	Y	N	N	N	N	N	Y	Y	N
Maryland	Existing R/W Research	N	N	Y	N	N	N	N	N	N	N	N
Minnesota	(PCA Requirements) Roadway Maintenance Inventory	N	N	Y	N	N	N	N	N	N	N	Y

NI - Not Indicated

TABLE E-20 Benefits of the system

State	System	Comments
Arizona	Property Mgmt. Parcel System	Not yet fully developed or efficiently used.
California	Routing Estimate, Excess Land Tracking GIS Website, R/W Document Retrieval System GIS Website	Caltrans' district-11 won an award last year's ESRI conference.
Delaware	Intergraph, Geo Media, Real Estate Management	Provides large sacle maps that were almost impossible to be prepared before like property, wetlands, aerial photos etc.
Florida	ODA-IMS	Payment of permit fees has become much more prompt, as the permit holders have seen the accuracy of the data demonstrated.
Georgia	T-Pro	Better statewide interoffice sharing and tracking of project data.
Iowa	Wetland Mitigation Tracking System	Main benefit is the ability to track wetland mitigation areas.
Minnesota	Minnesota Model	Cost savings documented at $3 million per year.
Minnesota	Statewide Parcel Map Inventory	Improved communications and awareness of parcel data development state wide.
Minnesota	ROW Map Spatial Index	Paved way for full spatial query of map data.
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	The availability of data releaed to the acquisition side of ROW is now immediate through GIS. Formerly the hard copies of chages took up to a week to reach the person who needed them.
New Mexico	ESRI ARCMAP 9	GIS centralizes all data for easy retrieval.
Ohio	IT (Planning & Environmental Assessment)	Timely access to data and improved decision making.
Ohio	IT (Outdoor Advertising Control)	Timely access to data and improved decision making.
Oklahoma	GRIP	GRIP provieds easier access to information.
South Carolina	Planning & Environmental Assessment system	GIS gives us technical merit in the decision making process.
Texas	San Antonio GIS Mapping System	Reduction in ouside calls for row maps and reduction of staff members time to find and copy maps

TABLE E-21 Barriers encountered during the system implementation

State	System	Comments
Arizona	Property Mgmt. Parcel System	There was minimal interdepartmental help and information/ asset sharing to assist us in getting our system to be operational
California	Routing Estimate, Excess Land Tracking GIS Website, R/W Document Retrieval System GIS Website	Funding, lack of awareness and understanding, lack of traning, lack of satte and federal data models and standards, no commonality in data formats, standards and accuracies, redundant data entry between project and record management systems, budgetary constraints and lack of statewide vision and plan for a digital land records information system.
Florida	ODA-IMS	Allowing internet access through the firewall while maintaining security of the data.
Georgia	T-Pro	Optimum performance requires nwtwork connection. Data entry and tracking very difficult using dail-up connections.
Iowa	Wetland Mitigation Tracking System	Securing accurate and up-to-date data.
Kansas	K-GATE	Bureaucratic inertia and lack of resources to develop further(additional) application.
Kansas	Highway Access Permit System	Fear of something 'new'.
Maryland	Extraland	Still working to get the word out that the system exists. Arcview is required to utilize the system.
Minnesota	Statewide Parcel Map Inventory	Collecting data about data, planning and implementing ongoing maintenance.
Minnesota	ROW Map Spatial Index	Cordinating difficulties with electronic document management system.
Minnesota	Traffic Sign Inventory	Volume of signs is massive and data collection had to be broken down into parts, multiple provided data which made integration hard.
Minnesota	Roadway Maintenance Inventory	Developing department infrastructure for web interface.
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Existing work schedules made it impossible to expand the time to learn and implement the software. Other big hindrance is that the push from the upper management has not been there. GIS has been talked about at their conventions and meetings, but remains a mystery to them. Of cousre, GIS is a "management" tool above all. But, all our upper managers have seen is a large expenditure of funds and a few computers geeks palying aroung with the data. No existing personnel had the time to undertake the project (GIS in ROW).
New Mexico	ESRI ARCMAP 9	No specialized instructors. You have to take the initiative to learn and apply. Not many people do that or they do not have the time.
New York	ESRI Software Products	Funding and staff shortages
Ohio	IT	Integration of local data sets
Oklahoma	GRIP	Cost and lack of vision for future development.
South Carolina	Planning & Environmental Assessment system	Obtaining sensitive data from other agencies.
Texas	San Antonio GIS Mapping System	Manpower/ time to implement statewide, funding to outsorce scanning operations

TABLE E-22 Disadvantages using this system

State	System	Comments
California	Routing Estimate, Excess Land Tracking GIS Website, R/W Document Retrieval System GIS Website	Takes more care and time maintaining the information beforehand. The cost of retraining and cooperating in new ways across the larger organization. Genrally we failed to initiate or sustain the additional effort to fully implement GIS. Full conversion of ROW parcel and uitltity maps into CADD and/or GIS though is very beneficial, tight capital outlay support budgets have not been able to fund staff engaging in such long-term, infrastructure imporvements. Lower positional-accuracy of imagery, tax-assessor parcels, and other GIS layers, may lead to costly or dangerous mistakes when property agents interpret a GIS ma, or engineer's design around GIS utiltity lines.
Delaware	Intergraph, Geo Media, Real Estate Management	Large volume of data that needs oversight to keep updated.
Maryland	Extraland	Easily identify extraland parcels available to other offices for wetland mitigation reforrestation etc.
Minnesota	ROW Map Spatial Index	Maintaining the system and expanding the use due to software and support costs.
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	As people becam aware of the possibilities, there is beginning to be a higher demand for more and more projects to be placed on GIS. This is not yet been possible with our manpower to keepup with ongoing projects, much less, completed projects.
Oklahoma	GRIP	Learning curve requires time.

TABLE E-23 If the system and/or its implementation can be re-done, what would be done differently?

State	System	Comments
Arizona	Property Mgmt. Parcel System	For the purpose of encouraging quicker development of a workable GIS system, arguments of gain in efficiency of process and increase in program effectiveness would be reinforced, citing anticipated better maintainance of owned property, minimized cost, reduced liability, and quicker disposition of excess land.
California	Routing Estimate, Excess Land Tracking GIS Website, R/W Document Retrieval System GIS Website	System has not been in use long enough to learn many lessons
Delaware	Intergraph, Geo Media, Real Estate Management	Use different software.
Florida	ODA-IMS	Technology(GIS) got updated. Toady there are better methods for accomplishing tasks and we would like to incorporate these.
Iowa	Wetland Mitigation Tracking System	Integartion into larger system would be ideal and is being planned now.
Kansas	K-GATE	Follow the technology to re-engineer the process rather than forcing the technology to conform to the process.
Massachusetts	Pictometry & ArcView	MHD's information technology section is craeting an asset management database with various layers of data that will be useful in determining property values while preparing or reviewing appraisals.
Maryland	Extraland	Not to use arcview software package.
Minnesota	ROW Map Spatial Index	Currently being redesigned for web use.
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	I had review the advantages of the system more user friendly and more of an industry standard The utility of the system should be hammered into management's head and they should be demanding data that they can use and in a format and in a time period which provides them with the decision making abilities.
New Mexico	ESRI ARCMAP 9	I wish I had time to make all of the ROW use GIS - it is the perfect tool for our type of work
Ohio	IT (Planning & Environmental Assessment)	Would not do a lot differently.
Oklahoma	GRIP	Invest for additional functionality, provide more 'IT' resources and provide additionall training to staff rather than 'here it is'.
South Carolina	Planning & Environmental Assessment system	Implement a system in which upper management coulod access GIS data withour any formal training or knowledge of GIS.

TABLE E-24 Description of GIS usage in the system

State	System	Comments
Arizona	Property Mgmt. Parcel System	Aerial maps and data layers define and store information on acquired land parcels for maintenance, leasing and disposal purposes
California	Routing Estimate	Produces ROW data sheet which includes key map, scale drawings with APN info and total acreage and amount of take for each parcel
California	Excess Land Tracking GIS Website	Excess land's staff can view zoomable maps of Excess Lands locations, along with the property status, using the new Excess Lands GIS website.
California	R/W Document Retrieval System GIS Website	To retrieve scanned right-of-way map documents via a map search interface
Delaware	ROW	To prepare maps with aerials and tax map information for planning and to display state owned lands.
Florida	ODA-IMS	Signs are plotted by Lat/Long on a base map showing roads' location and other location reference information
Georgia	T-Pro	To track project activity from concept to construction with ROW managing specific parcel data and progress for each project in their work program.
Iowa	Wetland Mitigation Tracking System	To access the inventory of wetland mitigation properties from a standalone database at the current time.
Kansas	K-GATE	This is a GIS based information server. It can access any spatially enabled data in KDOT and display it.
Kansas	Highway Access Permit System	Used for inventory validation and spatial measurements
Massachusetts	Pictometry & ArcView	Appraisers and Reviewers download images of property being acquired and comparables as part of appraisors.
Maryland	Extraland	All state owned extraland parcels are identified on mapping with a centeroid for information.
Maryland	Existing ROW Research	Allows the user to point and click on a map and bring up right of way plat information.
Minnesota	Minnesota Model	A GIS based statistical model to identify archeological sites for transportation site avoidance and survey design.
Minnesota	Statewide Parcel Map Inventory	To report information on Parcel/ Cadastral data developers and maintained by local, tribal and federal Government.
Minnesota	ROW Map Spatial Index	Uses GIS tools to spatially query final ROW maps, ROW plats and railroad maps.
Minnesota	Traffic Sign Inventory	To manage sign inventory, create reports of signs and generate work orders to replace signs.
Minnesota	Roadway Maintenance Inventory	GIS is used to provide inventory of maintenance tasks to ******
Mississippi	GIS, CADD, Geopack, Carlson, Microsoft suite, Parcel Tracking software, PDPM	Uses GIS in it's long range decision making. ROW division is gearing up it's GIS to facilitate the acquisition process and archives.
New Mexico	ESRI ARCMAP 9	Property management unit in the right of way section uses GIS for 90% of its tasks from entering requests to selling excess properties on the internet.
New York	ESRI Software Products	Currently being used as an acquisition inventory tool
Ohio	IT (Planning & Environmental Assessment)	As a decision making tool.
Ohio	IT (Outdoor Advertising Control)	As a decision making tool and as inventory of billboards
Oklahoma	GRIP	Used in all ROW activities for mapping.
South Carolina	Planning & Environmental Assessment system	Office of planning uses GIS for environmental screening of long range plan projects. GIS census data is also used in the development of transportation models that predict future traffic volume.
Texas	San Antonio GIS Mapping System	Scanned ROW maps in the San Antonio District are linked to roadways on the district map via the internet. Customers may select a section of theroadway and the associated ROW maps will be available for viewing and printing.
Texas	GIS Utility Database	As utilties are permitted or adjusted they are integrated into a GIS system for inventory. This is part of a research study and two implementation projects.

APPENDIX F

AASHTO/FHWA 2005 RIGHT OF WAY AND UTILITIES CONFERENCE VENDOR SUMMARY

This appendix provides a summary of information from vendors at the 2005 AASHTO/FHWA Right-of-Way and Utilities Subcommittee Conference with an indication of whether and how they use geospatial technologies. They are categorized as follows:

Database Technology Vendors
CADD/Survey Technology Vendors (Implied)
CADD/Survey Technology Vendors (Stated)
CADD/GIS-Compatible Technology ROW System Vendors
GIS Technology ROW Vendors

Database Technology Vendors

Coates Field Service, Inc.
4800 N. Santa Fe, Oklahoma City, OK 73118
www.coatesfieldservice.com
Summary: ROW database management is one of the services this company provides. This service encompasses producing ownership lists, progress reports, right-of-way records using software as MS Access. Coates coordinates and provides quality control for surveying and mapping services, performed by others, as well as assists in route selection.

Spitzer & Associates
1308 West Avenue, Austin, TX 78701
Summary: Property Databases and Inventories is one of the services this company provides. No other information is provided, nor could a company website be found.

CADD/Surveying Technology Vendors (Implied)

American Acquisition Group, LLC
5600 Mariner Street, Suite 104, Tampa, FL 33609-3443
www.americanacquistion.com
Summary: Neither the brochure nor the company's website mentions the use of technology or systems used; however, the company has a licensed surveyor on staff with experience with utility mapping and relocation surveys, which may indicate that they use GPS & CADD technologies.

Smith-Roberts Land Services, Inc.
2200 N.W. 50th Street, Suite 100, Oklahoma City, OK 73112
www.srls.net
Summary: Neither the brochure nor the company's website mentions the use of technology or systems used, however, the company has licensed surveyors on staff which may indicate that they use GPS & CADD technologies.

CADD/Surveying Technology Vendors (Stated)

Gorrondona & Associates, Inc.
6707 Brentwood Stair Road, Suite 50, Fort Worth, TX 76112
www.ga-inc.net
Summary: Subsurface Utility Engineering (SUE), utility coordination and professional land surveying are services of this company. GPS and CADD software (AutoCAD/Microstation) are used for various types of surveys and utility location.

Universal Field Services, Inc.
P.O. Box 35666, Tulsa, OK 74153-0666
www.ufsrw.com
Summary: Records Management, primarily financial, is one of the services this company provides. From Universal's website, they develop project database management systems and database tracking software. Additionally Universal does GSP OSP mapping, inventory, scanning and data processing. No other information is provided.

CADD/GIS-Compatible Technology ROW System Vendors

Bentley Systems, Inc.
685 Stockton Drive, Exton, PA 19341
www.bentley.com
Summary: Bentley developed ROW land acquisition management software modules (Bentley ROW office) running on top of Oracle DBMS. ROW Office includes appraisal, relocation, and property management functions in addition to acquisition. The software allows connections to Microstation (CADD) and probably to other Bentley geospatial products (not stated).

GIS Technology ROW Vendors

BEM Systems, Inc.
100 Passaic Avenue, Chatham, NJ 07928
www.bemsys.com
Summary: This company provides project-based ROW services using GIS, GPS and CADD technologies. Additionally, through its' EMIS division, this company has created web-based ROW acquisition support system software (i.e., PAECETrak) which relies on SQL Server, Internet Explorer and uses ESRI GIS technology (i.e., ArcIMS).

Halff Associates, Inc.
8616 Northwest Plaza Drive, Dallas, TX 75225
www.halff.com
Summary: This company provides surveying and mapping services using GPS, CADD (e.g., Intergraph and MicroStation) GIS (i.e., ESRI and MapInfo), image processing (e.g., ERDAS) and data management technologies for Subsurface Utility Engineering and construction management.

H.C. Peck & Associates
2399 Blake Street, Suite 180, Denver, CO 80205
www.hcpeck.com
Summary: This company is a SBE/MBE business that provides ROW surveying and mapping services. H.C. Peck has a licensed engineer and surveyor on staff. No other information is provided.

MACTEC
16650 Westgove Drive, Suite 600, Addison, TX 75001
www.mactec.com
Summary: MACTEC provides ROW services, especially Subsurface Utility Engineering (SUE) and utility coordination. This company uses digital electromagnetic locators, ground penetrating radar, document and asset management systems, GPS, CADD (e.g., MicroStation, AutoCAD, Geopak) and GIS.

Pharos Corporation
P.O. Box 1569, 123 Second Avenue South, Edmonds, WA 98020
www.pharoscorp.com
Summary: Pharos provides data management and administrative support though research, documentation, tracking and organization services. These include GIS and aerial mapping of corridors and parcels and computer-based parcel research. No other information is given.

Smart Data Strategies
357 Riverside Drive, Franklin, TN 37064
www.sds-inc.com
Summary: This company provides real property intelligence through software, data conversion services, professional integration services and data maintenance services in transportation, asset management, forestry/land management, agriculture and land acquisition markets. Their DREAMaps land records management system, for ROW processes, uses an enterprise approach and is built upon core ESRI GIS technology.

TBE Group
380 Park Place Blvd., Suite 300, Clearwater, FL 33759
www.tbegroup.com
Summary: Survey and mapping services are conducted by this company. These services include GPS, photogrammetry, digital orthophotography, ground penetrating radar, CADD (i.e., Microstation) and GIS technologies for projects in outdoor advertising, Subsurface Utility Engineering (SUE), utility coordination, acquisition and relocation.