

GEOGRAPHIC INFORMATION SYSTEMS APPLICATIONS FOR TRANSPORTATION RIGHT-OF-WAY

July 22 – 24, 2008, Lee's Summit, Missouri

Summary Report on a Follow-Up Peer Exchange



Prepared for:
Office of Interstate and
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I. Summary

On July 22–23, 2008, the Federal Highway Administration's (FHWA) Office of Interstate and Border Planning and Office of Real Estate Services sponsored a 1.5– day peer exchange focusing on select state Departments of Transportation (DOTs) applications of geographic information systems (GIS) in the right-of-way (ROW) area. Purposes of the peer exchange, which was a follow-up to a peer exchange held in August 2007 on the same topic¹, were to:

- Provide participants with an update on the progress of the National Cooperative Highway Research Program's (NCHRP) *Project 8-55A Developing a Logical Model for a Geospatial ROW Information Management System*;
- Allow participants from the 2007 peer exchange to describe the progress each has made over the last year in developing their respective GIS for ROW applications; and, more generally,
- Give state DOTs with noteworthy GIS applications for ROW the opportunity to share their knowledge and experiences with each other and with state DOTs in the beginning stages of implementing GIS in the ROW area.

Participants at the event, which Missouri DOT hosted at its District 4 Office in Lee's Summit, Missouri, consisted of staff from the Arkansas State Highway and Transportation Department (AHTD), California Department of Transportation (Caltrans), FHWA Headquarters, Federal Aviation Administration (FAA), Minnesota DOT, Missouri DOT, Nevada DOT, Oregon DOT, USDOT Volpe National Transportation Systems Center, Virginia Tech University, Washington DOT, and Wisconsin DOT (See Appendix A for complete list of participants).

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II. Background

As noted in the summary report for FHWA's first peer exchange on GIS in the ROW area, the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (the Uniform Act), established the rules, policies and procedures for acquiring real property, or ROW, and the relocation of individuals and businesses affected by federally-funded projects. The law was enacted to guarantee that people whose real property is acquired, or who are compelled to move as a result of projects receiving federal funds, will be treated fairly and equitably and will receive assistance in moving from the property they occupy. The USDOT is designated as the Federal Lead Agency for the Uniform Act — a responsibility that is delegated to FHWA.

Over recent years, as their appreciation and understanding of how geospatial applications might enhance ROW decisions has matured, some state DOTs have begun using GIS to automate their ROW functions. To help encourage the exchange of experiences and knowledge in the burgeoning field, in August 2007 FHWA sponsored a 1.5-day peer exchange focusing on transportation agencies' GIS applications in the ROW area. The Transportation Research Board's (TRB) NCHRP Project 8-55 and 8-55A, which describe the initial steps in automating the information technology (IT) process required for ROW acquisition and management, were also important discussion topics at the peer exchange.

To continue promoting the advancement of transportation agencies' geospatial technology use for ROW purposes, FHWA's Office of Interstate and Border Planning and Office of Real Estate Services sponsored a second peer exchange, following up on the 2007 event. This report provides a summary of the presentations made and conversations held at the 2008 peer exchange. It should serve as a resource for other DOTs and transportation agencies looking to learn more about the implementation of GIS for ROW. The report concludes with a section on the lessons participants stated having learned and recommendations they make for moving forward.

Presentations and Discussion

Day 1 — Wednesday, July 23, 2008

The peer exchange's first day comprised a discussion of outcomes from the first stage of TRB's NCHRP Project 8-55 and the status of its second phase, Project 8-55A; a roundtable discussion focused on the participating DOTs' GIS for ROW current activities; and, demonstrations of selected applications of GIS for ROW.

Welcome and Introductions

Kathy Facer, FHWA Office of Real Estate Services

Mark Sarmiento, FHWA Office of Interstate and Border Planning

As an introduction, Ms. Facer thanked participants for traveling to the peer exchange and encouraged them to continue providing her with ideas for future peer exchanges or other outlets for sharing experiences among states. Resources are available for FHWA to support activities beyond this exchange. For example, another option for convening counterparts in other states is through video conferencing. FHWA's Office of Real Estate Services has great flexibility in scheduling video conferences. It was suggested that one topic for a video conference be to create an NCHRP proposal or problem statement.

Concurring, Mr. Sarmiento described a number of activities FHWA's Office of Interstate and Border Planning has supported over the last several years that promote GIS implementation and/or knowledge exchange at and among state DOTs. Recently, FHWA has published:

- Case studies on the uses of visualization for transportation purposes. The cases are intended to be helpful to transportation agencies in identifying effective techniques for enhancing and streamlining the project development process²;
- *Business Models for Implementing Geospatial Technologies in Transportation Decision-Making: Phase Two*, a report describing a number of state DOTs' business models for implementing geospatial technologies in transportation decision-making³; and
- *Key Practices for Implementing Geospatial Technologies for a Planning and Environment Linkages (PEL) Approach*, a report presenting three case studies that illustrate how GIS has been used to implement the FHWA's PEL approach⁴.

Peer exchange participants were encouraged to visit FHWA's GIS in Transportation website (www.gis.fhwa.dot.gov), which is home to a searchable database of state DOTs' GIS applications and to submit GIS for ROW papers to be considered for the 2009 GIS-T Symposium to be held in Oklahoma City, OK.⁵

Overview of NCHRP Project 8-55 A

Kitty Hancock, Virginia Tech University

Building upon her presentation during the 2007 GIS for ROW peer exchange, Ms. Hancock discussed the status and schedule for the NCHRP *Project 8-55A Developing a Logical Model for a Geospatial ROW Information Management System*, a second phase of NCHRP Project 8-55.⁶

The purposes of the phase two research, which focuses on the appraisal, acquisition, relocation, and property management aspects of ROW, are to:

- Develop an enterprise-level logical model for a prototypical geospatially enabled ROW information management system⁷;
- Demonstrate a crosswalk between the logical model and DOT enterprise systems now in use; and

- Deliver executive summaries that demonstrate the usefulness and validity of the logical model.

The process for completing the research effort will consist of building a logical model, testing the logical model on select state DOTs, and writing executive summaries that describe why a state DOT might consider geospatially enabling a ROW information system and what it would take to do so. The logical model, which is being developed in Uniform Modeling Language, will include sequence diagrams and collaboration diagrams and be a model for how a state DOT could refine ROW business processes. The logical model is expected to be completed by October 2008.

For the case studies, state DOTs will be selected based on the extent to which the ROW system could connect to other systems in the organization, the extent of their GIS development, and the state DOT's willingness to participate. To further examine the logical model for suitability and functionality and to demonstrate that the product is useful for ROW functions, a series of scenario tests are planned. The goals of the tests are to:

- Learn the source and format of external information;
- Identify the format for information coming from ROW systems;
- Identify logical "breaks", inconsistencies, dead ends;
- Uncover unique, state-specific requirements;
- State performance measures;
- Outline the process for implementing an information management system;
- Conduct training; and
- Certify staff and consultants

Results of the scenario tests will be used to update the logical model and develop guidance for implementing the system, including a discussion of the ramifications, costs and benefits of doing so.

In advance of the scenario tests, the study team conducted a survey of all state DOTs. Twenty-two of 52 responded. According to the responding DOTs:

- 86% (19 of 22) of responders had an information system that could measure ROW in some form:
 - 31% (6) had a stand alone ROW information system.
 - 32% (11) had a ROW information system that is part of a larger DOT information system.
 - 16% (3) had a ROW information system linked to a GIS.
- 64% (14) had ROW offices that use GIS.
- 5% (10) had ROW offices with staff trained in GIS.
- 82% (18) had ROW offices that interact with other GIS offices within the DOT.

Results for state DOTs' future plans indicated that:

- 82% (18) were planning to expand their ROW information systems.
- 50% (11) were planning to replace their ROW information systems.
- 59% (13) were planning to add a GIS component.

Comments, Questions, and Answers

- Question: Do DOTs legal staff get involved in appraisal activities?

Answer: In most states, legal staff only becomes involved in appraisal activities if the activities go to condemnation. However, it depends on what is meant by "legal staff." For Minnesota DOT, anything that requires a legal signature, including all property title activities, must involve legal staff.

- Question: Should access be provided to the draft report from the second phase?

Answer: State DOTs should view the preliminary report products as a recipe from a recipe book that has not been published yet. If information in the draft materials is useful, then state DOTs are encouraged to incorporate the information into their business processes, as appropriate. However, state DOTs should keep in mind that the study is not blessed until the NCHRP panel blesses it; the draft should not be publicly distributed. The timeframe for publishing is currently unknown.

- Question: Will there be a session on the study at the 2009 Transportation Research Board (TRB) conference?

Answer: Ms. Hancock is planning to make a presentation on the study. When details are more finalized, FHWA's Office of Real Estate Services will help announce the presentation as widely as possible.

- Question: Are the executive summaries expected to be useful?

Answer: When the study was initially proposed, the executive summaries were the primary product requested. Both the researchers and the NCHRP panel anticipate the executive summaries will be a valuable resource for state DOTs.

- Question: Can the survey given to states be made available, and can the survey results be posted on FHWA's GIS in Transportation website?

Answer: The survey is available in Appendix C of the phase 1 report. FHWA will inquire as to whether the results can be posted on the GIS in Transportation website.

- Question: What does it mean to be "geospatially enabled"?

Answer: For the NCHRP study, a ROW information system was characterized as "geospatially enabled" if the system had more than a tracking component and allowed for analysis of the parcel data by various GIS tools. Two key aspects of geospatial enablement of ROW data are that the data can be visualized and that parcel data layers can be created and maintained.

- Question: Creating parcel-level GIS data was all the rage at the county level during the 1980s and 1990s. Perhaps we can learn from their experiences. Are there counties out there that have geospatial parcel data, perhaps created through tax record information?

Answer: Many counties do have parcel level GIS system. Some counties do not have any GIS data at all. For example, in Arkansas, only 7 out of 75 counties have a GIS. There are some counties in the country that have only gotten email access in the last two years. There are also counties where the assessor knows all of the records by memory. If something were to happen to those assessors, the lack of digital record could be problematic.

- Comment: Software vendors often do not seem to have the robustness that state DOTs need. They often try to make their software products either too GIS-centric or too parcel management-centric. Additionally, some have demonstrated that they do not understand the ROW process, but instead simply insert ROW terminology into previously developed models. At this point in time, most of their products do not seem to capture the business perspectives of the FHWA ROW guide or of state DOTs.
- Comment: Researchers working on the study should be wary of relying solely on the state DOTs responding to the survey to select case study examples. There may be some state DOTs who did not answer the survey that may be good candidates.
- Comment: Parcel data sets are extremely dynamic. As soon as the parcels are sold, the data sets are in need of being updated. This can be a challenge. In Clark County, Nevada digital parcel data are updated every two weeks, but there is a backlog of three months.

- Comment: NCHRP proposals need to have the support of several states as well as the American Association of State Highway and Transportation Officials (AASHTO). The 2009 AASHTO ROW and Utilities Sub-committee meeting is in Oklahoma City. The sub-committee meeting would be a good venue to solicit support for future NCHRP studies related to geospatially enabling ROW functions.

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State DOT Roundtable

All Participants

Facilitator: Kathy Facer, FHWA Office of Real Estate Services

All participants were given the opportunity to provide a brief overview of their respective organization's GIS for ROW activities. State DOTs that were on the agenda and scheduled to present more in depth information — Minnesota DOT (Mn/DOT), Missouri DOT (MoDOT), and Nevada DOT (NDOT) — agreed to introduce their activities last during the roundtable discussion. Day one time constraints caused MoDOT and Washington DOT (WSDOT) to give their talks on day two of the peer exchange. For purposes of report organization and clarity, summaries of all presentations, including those given on day two are included in the section below.

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Demonstrations and Presentations

All Participants

Arkansas DOT (Arkansas State Highway and Transportation Department)

Robert Fuhler and John Kendrick

The Arkansas DOT reported that it is in the process of developing a ROW-related GIS. Examples of GIS technology applications include:

- Where data are available, queries are run on project locations to develop mailing lists for public involvement meetings;
- Methodology development and testing using assessor/tax records data in conjunction with AHTD projects; and
- GIS Section team members who are fluent in ESRI, Intergraph and Trimble provide assistance with techniques and methodologies to other sections for the implementation of GIS technologies, subsequently allowing the AHTD to receive reciprocal GIS data from those business areas.

AHTD's Environmental GIS Section has scanned and georeferenced older maps, including hand-drawn maps for historical locations of land plot information. Currently, the Section is focusing on the methods, incorporation and consolidation of scanned maps into a geospatial database. Ultimately, AHTD would like to offer digitized ROW data for all locations. AHTD is considering developing a land acquisition system that displays geospatial ROW data for all locations as well as project relocation and condemnation phases.

One of the state's primary GIS and ROW-related projects is the County Assessors Mapping Program (CAMP)⁸, a cooperative partnership between the Arkansas Assessment Coordination Department (AACD), the Arkansas Geographic Information Office (AGIO), and participating counties. CAMP is a two-phased project that focuses on developing geospatially-referenced cadastral mapping for Arkansas. The first phase of the project involves using centroids to upload parcel data, as just under half of the state's 75 counties are covered with centroids (the rest are covered by polygons). The centroids can also be joined with tax records, which help ROW and cost estimates. Ultimately, more information will be added to the parcels via the centroids.

California DOT

Mark Turner

Caltrans' Right of Way Management Information System (ROWMIS), a replacement to its legacy Integrated Right of Way System (IRWS), is a user interface application to the new ROW tabular relational database. Unlike IRWS, which was based on a non-relationship database, ROWMIS was developed to help reduce inefficiencies related to ROW planning and management.

The new application provides ROW management, agents, and staff with a secure centralized database and standard input/output to facilitate planning and management of highway projects and parcel acquisition. It is a web-based java application that was developed entirely in-house with Caltrans programmers and ROW and ROW engineering staff. The primary advantage of ROWMIS over IRWS is that all information stored in ROWMIS is directly accessible by anyone with an access account through Oracle's web based Discoverer application. Discoverer allows a user to query and analyze data, and fields have been established to geospatially-enable data analysis and integration.

The ROWMIS database contains project, parcel and acquisition information and the last page of the ROWMIS Manual contains data field and key information. Currently, there are two ROWMIS applications: the ROWMIS viewer, which is a read-only version, and the ROWMIS manager version. ROWMIS can provide supporting data for cost estimate maps, which depict potential parcel areas and project footprints. The maps superimpose the project footprint to show the potential impacts of projects on various tax parcels.

Caltrans reported that the state legislature has emphasized disposal of excess parcels as a revenue source. To visually identify the impacts of transportation activities on land, Caltrans is now using Google Earth to display surplus properties and permits to enter and construct. Using Google Earth allows maps to display parcels' proximity to highway and geographic features as well as the terrain relief. The maps, which are currently available only internally, facilitate real property retention review, which confirms parcels available for disposal. A Google Maps movie has been added to dynamically visualize ROWMIS data; a narration may accompany this movie if desired. While Caltrans has offered online auction information for the past 15 years, maps could be used to enhance a parcel sales brochure: for example, a public land auction could link to parcel map imagery in its table of contents. Ultimately, Caltrans envisions having a system that allows users to view and query maps in a Google Earth type environment.

To date, ROWMIS has been rolled out to 9 of Caltrans' 12 district offices, with delivery to the remaining 3 districts expected by the end of July 2008. Since its inception, over 200 enhancements to ROWMIS have been made and more than 500 staff members have started to actively use it.

Some challenges to ROWMIS implementation have included:

- Difficulties with converting data from legacy systems to Oracle systems.
- Overcoming resistance to change; the change process is very slow.
- Difficulties finding training and support due to remote locations.
- Refining and improving the system relies on balancing time, money, and IT support.
- Establishing a project manager; currently, a project committee manages ROWMIS implementation.

In the future, Caltrans would like to develop a forms generation capability for ROWMIS, add utilities, railroad, and relinquishment information to the database, and further enhance information regarding condemnation, estimating, structures, and relocation assistance modules. Furthermore, Caltrans would like ROWMIS to automatically update posting tables for direct input into ROW record maps. Another future goal is to incorporate ROWMIS tables and exported data into survey and GIS mapping projects, which would enable potential customers to see the usefulness of GIS/ROWMIS applications.

products, and software required by various offices in the Department. The result of this survey indicated that key data were alignments, ROW mapping, and engineering surveys, and that the mapping priority should include horizontal survey control data. Another finding was that offices would like more training on

Google Earth. Using the survey results, Caltrans is creating a roadmap of a strategic path for further ROW mapping development.

Comments, Questions, and Answers

- Question: Have the enhancements increased the number of parcel bids?

Answer: It is hard to say. Caltrans is aggressively trying to sell its excess land and wants to take advantage of directing resources to these areas in order to better market these properties.

- Question (asked by Mark Turner and addressed to the group): What were the best practices for determining the project manager to develop a DOT land management system?

Answer (from the group): There were several best practices. First, it was important to determine a project manager who was at the senior ROW level. In addition, using in-house resources for this effort was useful. While it is a good idea to get input from technical experts, project management skills are different. Having an 'outsider' as a project manager should also be considered because 'outsiders' will bring neutrality to the process and operate without pre-conceived notions. This process will inspire the agency to improve and change its internal business processes. In terms of whether a project manager should be hired in or outside IT, it depends on the skill sets available. Finally, it is important to hire a strong manager with the backing of upper management.

Federal Aviation Administration

Rick Etter

The Federal Aviation Administration (FAA) is developing a ROW document management system that is expected to be completed in 2009. The system will serve approximately 3,400 airports, each of which has aeronautical charts being digitized in GIS format. The system, which has cost \$200K to develop, is being funded by FAA under its operations budget.

Smaller airports have fewer parcels to maintain than larger sized airports, which often spend millions of dollars on systems for managing airport operations. Some of the latter, such as in Seattle, utilize enterprise GIS, while others use GIS in conjunction with quality control systems. The goal is to develop systems that are immediately verifiable and to move away from reactive 'coping' strategies to more developed systems that can proactively anticipate needs. FAA is using these airports' lessons learned to facilitate the development of its ROW document management system. The goal of the effort is to improve the way FAA manages certain business processes related to ROW.

Minnesota DOT

Jay Krafthefer and Kevin Leonard

Mn/DOT reported on progress made in developing the Right of Way Electronic Acquisition Land Management System (REALMS), which was initially implemented in 2005 and also described in the 2007 GIS-ROW peer exchange.⁹

REALMS is a web-based, online, statewide system that allows users to quickly access and search ROW information, visualize and track parcel geometry, and customize and generate ROW reports. To build the system in a time- and cost-effective manner, Mn/DOT purchased a software product used by the Virginia Department of Transportation, the Right-of-Way and Utilities Management System (RUMS), and used VB.NET in conjunction with Oracle to modify RUMS to meet Mn/DOT's business needs. The total cost for developing REALMS will be approximately \$2 million. This total cost does not include an estimate of \$168K to fund the visualization work and \$358K to fund map conversion to a spatially-enabled format. To maintain cost-efficiencies, Mn/DOT is using internal resources as much as possible to develop the system. There are 150 users of REALMS, which is accessible to Mn/DOT staff and consultants. A user group required to enter data into the system.

Initiated in April 2008, REALMS Phase II is now complete. Phase III of REALMS and an associated mapping project will focus on two goals: (1) converting ROW maps into standardized digital parcels to make REALMS spatially-enabled; and (2) building REALMS into a comprehensive work environment for

project scoping. Because these two goals are interrelated, Mn/DOT expects that both will need to be accomplished simultaneously. Phase III work completed to this point includes development of several project teams (e.g., an executive team, a steering team of engineers/office directors, a core team of higher level practitioners, a technical team of IT staff, and a business area team) and refinement of high-level requirements and standards for parcel geometries, parcel status, and data entry.

Once fully implemented, Mn/DOT anticipates that REALMS will minimize errors and delays on ROW projects, improve confidence in enterprise parcel data, and facilitate better project decision-making. Furthermore, REALMS is expected to offer significant time- and cost-savings due to its ability to quickly produce and visualize standardized ROW data.

Mn/DOT presented a sample welcome screen for REALMS. To capture and preserve the continuity of institutional knowledge, REALMS has a 'help' feature that provides complete information about individual functions. In addition, REALMS offers a technical help feature. Other elements on the REALMS website include:

- A tutorial on system navigation and disciplines;
- A Frequently Asked Question section;
- Capabilities to generate work forms and reports such as GASB; and
- Report querying.

Mn/DOT then displayed a sample REALMS mockup screen. Color-coded parcels indicate project status and make it easy to 'trigger' next project phases. REALMS also offers legal descriptions and property appraisal information as well as electronic parcel files.

With progression into Phase III, Mn/DOT's business areas have established several issues for future consideration. For example, it was previously sufficient to track only the presence or absence of parcel complexity indicators such as environmental conditions. A new priority is to more accurately display these conditions (e.g., contaminant sources such as a well) in relationship to a parcel's boundaries. Furthermore, Mn/DOT would like to have the ability to perform quality assurance (QA) and quality control (QC) on REALMS by displaying, for instance, lack of data for a particular parcel. Mn/DOT anticipates that a QA/QC process may better give better incentive for business areas to address and resolve data errors.

With assistance from a consultant, Mn/DOT developed a business plan in March 2008 to address the need for modernizing ROW mapping services. As part of this plan, a study questionnaire was provided to internal and external stakeholders to assess mapping effort and delivery priorities. Subsequently, a five-phase plan was produced to provide a timeline and structure for enterprise ROW mapping system implementation. Phase 1 involved creating the business plan and is now complete. Phase 2, which is scheduled from July to December 2008, will focus on building pilot ROW digital maps to establish appropriate standards, requirements, and data development methods. Phase 3 will begin in January 2009 and focuses on converting legacy data for inclusion in digital parcels. During this Phase, a priority will be eliminating data conversion backlogs that currently exist. Phase 4 will spatially-enable the digital parcels by linking ROW maps to an ArcGIS server. This latter phase is now being implemented concurrently with REALMS Phase III and is scheduled for completion in January 2009. Finally, Phase 5 will highlight ways to make REALMS a comprehensive project management approach at Mn/DOT.

Challenges

- Developing REALMS as a solution that is trusted by its users, accurate, and effective in meeting business needs without delay; some prior Mn/DOT IT projects have not been immediately successful.
- Building and maintaining Mn/DOT's institutional knowledge about REALMS when consultants have been hired to help develop REALMS. This is mitigated by knowledge transfer requirements in the contract.
- Competing against consultant budgets — Mn/DOT now faces a requirement to analyze IT projects over \$100k to determine whether the work can and should be completed in-house.

- Funding scarcity — While Mn/DOT's upper-level management recognizes the critical need for REALMS, finding funding sources for REALMS has sometimes been difficult. However, more funding is expected to be available soon.

Mn/DOT concluded its presentation by reporting on REALMS' successes to date. According to user feedback, REALMS has been effective in meeting customers' needs. Mn/DOT has been especially responsive to feedback noting aspects of REALMS that need improvement. While such feedback can be negative in nature, it demonstrates that users are accessing the system and trying to use it to facilitate accomplishing their day-to-day work.

Comments, Questions, and Answers

- Question: Is REALMS used to replicate how Mn/DOT works or is it an example of a process improvement?

Answer: Mn/DOT used REALMS as a 'Trojan horse' to re-engineer the business process. REALMS is also used to increase accountability to the central office and better execute the chain of command. Prior to REALMS, re-deploying individuals from one district to another was difficult; there was no standardized system in place.

- Comment: REALMS' capability to visualize utilities is useful; this capability will allow better cost projections. Furthermore, visualizing data can help to minimize errors. It is easier to visualize how proposed projects might affect ROW rather than reading this information in a tabular format.
- Comment: Two crucial components of REALMS are its ability to visualize and view parcels as well as create and maintain them. Without the parcel layer, the system will not be geospatially-enabled.
- Comment: Sometimes the cost of mapping does not match the value represented by the actual property or geography. Having a high level of visual detail for the property may be considered an investment.

Nevada DOT

Halana Salazar and Eric Warmath

To enhance its ROW management operations, Nevada DOT (NDOT) is partnering with Smart Data Strategies (SDS) to implement the Integrated Right of Way Information Network (IRWIN). The goal of IRWIN is to improve and integrate the information systems used for managing ROW and to provide this information in real-time to state employees. IRWIN, which was developed as a result of a legislative audit, will take advantage of work done by the GIS section to create a historical road network showing most of the system changes over time. This will allow users to perform queries and receive results for a specific place or time. Various documents and contract plans in the EDMS will then be linked with GIS to facilitate work processes. The EDMS portion alone is expected to save hundreds of man hours each year in ROW processes and other divisions needing access to contract plans. The system, which is expected to be completed in March 2009, will:

- Integrate with NDOT's GIS, Public Lands Survey System data, and Video logging system;
- Integrate with NDOT's EDMS, offering a GIS interface to allow users to track their work processes and access stored documents from a centralized information center;
- Allow the public and internal staff to process and track encroachment permits associated with NDOT's ROW;
- Manage an inventory of all properties NDOT uses or owns;
- Track and monitor all outdoor advertising permits; and
- Integrate with NDOT's Integrated Financial System.

IRWIN also consists of a series of user interface screens customized for the major ROW area workflows, including:

- Acquisition Module;
- Property Management Module;
- Project Management Module;
- Permits Dashboard;
- Encroachment Permits Module;
- Billboard Module;
- Junkyard Module; and
- Document Linkage.

IRWIN's Electronic Document Management System (EDMS) was built on Documentum ApplicationXtender 5 (AX5) software since the product was already in house and met NDOT's specified system requirements. Other specifications are:

- Oracle 10g database that functions as a electronic storage, organizer, and document management
- Scan stations located at each permitting office throughout the state — Once IRWIN is fully implemented, the AX5 system will be turned over to the Records Manager for use within NDOT, with each division at NDOT having the capability to setup their own document imaging section using the existing system. Documents will be able to be inserted directly into the application the same way files can be saved to local machines.
- DiskXtender v6.0 to give the state the capability to expand the primary and/or secondary storage onto any number of additional devices or media types, optimizing capacity while giving users a seamless access of data regardless of the storage location.
- RecordsManager v5.4 for ApplicationXtender for record retention and archiving, configured to state standards for electronic documentation.

The budget for IRWIN, which has been fixed and expires June 30, 2009, was approximately \$5.6M. The project is currently about 3% under budget.

Challenges

- Developing a material sites database then finding an owner to maintain it due to the number of work units involved: Materials, ROW, Environmental, and Archeology.
- Delays in training staff in GPS/GIS due to GIS software migration.
- 89% of NV's lands are federal lands, mostly owned by the Bureau of Land Management (BLM). BLM has not completed a cadastral survey of the entire state. For this reason, the Public Land Survey System (PLSS) — the basis for most land transfers and ownership in the western U.S., maintained and regulated by BLM — has been critical to documenting ROW placements prior to 1976 when mileposts were implemented. NDOT plans to include its own data in PLSS to strengthen control along roadways, but due to lack of available staff, no complete maintenance strategy has been developed to date for that layer.
- Creating a ROW parcel data layer has been a challenge because the accuracy and resolution of existing external sources of ROW data are not currently at NDOT's desired level of detail. It is hoped that in the future the process improvement and time saved by IRWIN can be re-invested in creating and maintaining an NDOT parcel layer by the ROW Division.

Lessons Learned

- All of the lessons in Jeff Meyers' *The Worst Mistakes in GIS Project History*, as published in Geospatial Solutions July 2002.
- Index data — Index documents as if the system was being used as a stand-alone application. Good indexing allows for the cross-linkage of many types of documents and multiple applications

- Avoid unrealistic scope and being locked in to inflexible positions on standards, software, schedule, or methodology.
- Assemble as strong a team as possible, involving the most knowledgeable people at every level where possible.
- Obtain executive sponsorship and end-user buy-in especially at district levels.
- Limit application development projects to five years. If certain staff are lost, critical knowledge and skills can also be lost.
- Get IT involvement at both the management and technician levels.
- If using a consultant project manager, keep the project manager focused on organizational goals and continued team building. A poor project manager can cause problems at many levels.

Comments, Questions, and Answers

- Question: How did you persuade the Materials Division to participate?

Answer: Personal relationships helped. The Materials Division called the GIS staff and asked to participate.

Oregon DOT

Mike Stone

In 2007, prior to the first GIS-ROW Peer Exchange, Oregon DOT (ODOT) released a FileNet Enterprise Content Management (ECM) application that allowed for rudimentary searches for ROW content. As part of the implementation of the FileNet ECM system all of ODOT's parcel maps were scanned, georeferenced, and data regarding each parcel (township/range/section at a minimum) was captured and indexed by the placement of centroids.

Since that time, ODOT has worked to develop a GIS front end to the system. Released in June 2008, the enhanced FileNET ECM allows users to zoom in to see various parcel data, including map number, file number, record number, deed date, history of deed sales, explanation of why ODOT purchased the property, and information on the relevant road. ODOT has established a minimum set of data that must be captured before being entered into the system, which is home to over 100,000 files; hundreds of ODOT personnel that had never previously seen ROW files now have direct access to them. A downside has been that urban areas could have over 100 or more pages of data.

The system was developed using funding (\$4M) provided as part of a legislative mandate requiring that property records be made freely available. Approximately \$3.2 million dollars of the funding were provided for an effort to take ECM to the next level of using automated workflows and file management. The final "look and feel" of the system is not currently known, as the primary focus has been to build a foundation from which the entire agency can work and to which data can be moved.

Future

An effort to map acquisition workflows, defined by ODOT as zero percent scoping to final design, with the parcels the DOT will acquire, has nearly been completed for the system. It is expected that the legal description creation process and the appraisal description process will be automated next, after which relocation, condemnation, acquisition activities will be moved into the system. Eventually, ODOT would like to use the system to make mass acquisition cost estimates based on historical data and prices, or have access to all documents available through a GIS interface that displays the parcel polygon (instead of the current centroids).

In June 2009, ODOT plans to release a web-based e-forms application with extranet capabilities, because the Department has many contractors who need access to and can contribute information themselves. The application is planned to have completely virtual, 'high-fidelity' forms that allow users to add specific pieces of data that others cannot manipulate.

Through all these efforts, ODOT staff members are trying to develop a model of what data should be captured and maintained to maximized cross-division communication.

Wisconsin DOT

Andrew Kottke

Wisconsin DOT's (WisDOT) Bureau of Highway Real Estate has used a Microsoft Access database to help manage ROW functions since the early 1990s. WisDOT is currently researching what alternatives there might be to replace the Access database. The process has been lengthy and has focused on the question of building a new application or replacing the current database with an off-the-shelf application. Whichever route is chosen — a decision is expected by December 2008 and implementation to follow — it is unlikely that the first iteration will be geospatially enabled. WisDOT may take that step in a future phase of the project.

WisDOT does operate various applications related to ROW functions. Some of these are:

- Transportation Utility Management System (TUMS) — WisDOT assembled a team of Utility Coordinators, IT/IS Professionals, and Management to develop a statewide database/application to reduce the time and resources required to identify, track, and manage correspondence between the necessary parties during the lifetime of the highway project, in accordance with the WisDOT Guide to Utility Coordination.
- Highway Access Management System (HAMS) — HAMS is a one-stop web portal that brings together diverse information to deal with all questions related to driveway permits and land division reviews. HAMS combines the capabilities of several components into one spatially driven web interface, enabling straightforward interaction between end-users and the system. WisDOT has scanned its maps — digitizing information on each map's township, range, and section — and will be inserting these and other data in HAMS.

Missouri DOT

(Day 2 — Thursday, July 24, 2008)

David Ordway and Jay Whaley

During the 2007 GIS-ROW peer exchange, MoDOT personnel demonstrated the Department's Realty Asset Inventory Management System (RAI), which was placed in production in July 2007. The system is a statewide, computerized, relational database that allows staff to identify all the DOT's realty assets and assists in identifying properties that are no longer needed for highway purposes. It also houses documentation on all sales, leases, and excess properties, as well as references to other realty of interest, such as environmental, cultural, historical, and wetland mitigation sites.

On Day 2 of the 2008 peer exchange, MoDOT discussed the history leading up to RAI development and the application's current status. Emphasizing that it is not finished implementing everything it plans to in regards to the RAI and that the Department is still learning itself, MoDOT also described some of the lessons it had realized in the RAI development process:

- Involve as many appropriate ROW and other staff as possible.
- Have other staff trained in all aspects of an application (history, rationale for development, technical aspects, etc.) in order to minimize disruptions when key staff are lost.
- Identify and understand the DOT leadership's expectations, funding constraints, and desired results early in the process.
- Think big first, then scale back as necessary.
- Keep in mind that it is never too late to start.

Currently, MoDOT continues to refine the RAI, as well as to finalize its Right of Way Parcel Acquisition database. The Department is also developing training in order to educate staff on how to use the applications. In the future, MoDOT expects to refine solid base data, add polygon editing capabilities, and have ROW data management systems and mapping systems work hand-in-hand in real time.

Demonstration

MoDOT concluded its presentation with a demonstration of a TMS viewer mock application that interacts with TMS base data. MoDOT showed how a user could click on the polygon for a given parcel and then be able to view all of the TMS data about that parcel. When creating a parcel polygon, MoDOT will build a shape first then make revisions based on historical data as available and warranting change. Because MoDOT uses Oracle Spatial, staff members are able to build shapes based on X-Y coordinate information acquired in the field.

Comments, Questions, and Answers

- Question: Who built the application and did MoDOT districts test it?

Answer: MoDOT used in-house consultants to develop the application. There was no request for proposals. MoDOT staff members responsible for ROW acquisition tested the application. On the inventory side, the districts did not test the application. Instead, staff members responsible for ROW inventory data were asked to provide what information they had. Application developers took the data and inserted them into the system, afterwards asking the inventory staff to review and comment.

- Comment: The application seems to be a good application for general asset management. MoDOT Response: The ROW data resides in the database just as any other asset data does. They are treated the same.
- Comment: As a developer, spatially enabling a ROW information system is fairly easy. Data acquisition seems to be where challenges are encountered.

Washington DOT

*Gerry Gallinger and Jordyn Mitchell
(Day 2 — Thursday, July 24, 2008)*

Washington DOT provided updates on the status of its ROW system that was described during the 2007 GIS-ROW peer exchange. Developing the system was a larger undertaking than originally anticipated. The Relational Database Management System (RDBMS) portion is expected to be online soon, while the GIS portion is in development. The system is server-based and is intended to track the progress of individual parcels through the ROW process. When complete, the system will help integrate WSDOT's CAD-based mapping environment with a spatially-enabled parcel level RDBMS. As a result, WSDOT anticipates that it will be able to better manage property acquisitions, financial data, and project/property costs. ROW management and reporting will also be standardized across the state's 39 counties and 15-20 state and federal government agencies located there. The proposed GIS system will be data-driven; changing the data will change the map, eliminating the need to make manual map updates.

To consolidate parcel data collected for the state in the ROW system, WSDOT is investigating using Bentley ProjectWise. Projectwise is an enterprise content and workflow management software suite with several security controls to help teams improve quality, reduce rework, and meet project deadlines. Projectwise also has a module that can translate data between CAD and GIS systems.

Ultimately, the GIS layer in the property management system will 'tie together' parcel information from all scanned maps. The Real Estate Map Information System (REMIS) database, which is nearly complete, tracks these scanned maps and their attribute information. Maps produced before 1980 are not in tabular form; therefore, some of this information is not included in the Parcel RDBMS. Developing REMIS allows capture of this second source of data.

With new funding received for the current biennium, WSDOT has scanned new deeds and is scanning and indexing 40,000 maps for inclusion in the GIS layer of the property management system. A 'hotlink' feature has been proposed for the system that would allow users to access a PDF file of the deed directly from the parcel map. To enable this feature, however, WSDOT would need to re-scan the deeds into PDF files.

WSDOT reported that an ongoing challenge to developing the property management system is finding funding, as the WSDOT budget does not include any discretionary monies for planning projects. Furthermore, it is difficult to maintain funding once it has been provided. Due to difficulty with receiving assured funding for the next biennium, WSDOT has curbed efforts on the ROW system's GIS layer, but intends to apply for future funding to ensure completion of this work. WSDOT is now prioritizing development of a cost-benefit analysis and a proof of concept prototype that would demonstrate to upper-level management the value of the GIS layer; this task was an original impetus for the NCHRP Project 88-5 proposal.

Other challenges include an ongoing need to clarify the difference between ROW plan maps, which include planned property functions, and real estate maps, which include information about what projects were actually completed. Within the department, different users may employ different terms to refer to these maps.

WSDOT then reported on several lessons learned and top tips. First, it is important to clearly define the organization's business needs so as to build an appropriate ROW system. For instance, an "active" project database would include current, dynamic information while an "archive" database will include more static information no longer required for an active project but necessary for parcel inventory and management. Different geospatial data will be needed depending on whether the ROW system is active or archived.) WSDOT also emphasized the importance of creating a data-sharing environment to enable contractors to share data with the agency. Standards must be developed to ensure efficient data-sharing. These include not only attribute standards, but data exchange methods (ftp, disc, etc.), data format, geospatial projection, and frequency. WSDOT intends to develop the archive area first and then apply that environment to the active areas.

Other current ROW-related activities in Washington State include creation of a working group to develop a new statewide parcel framework. The working group is comprised of individuals from 15 state agencies and meets monthly. The goal of the statewide parcel framework working group is to standardize and concentrate parcel data in one location, and determine standards for data-filing, -editing, and -collection. This work includes development of a licensing agreement between 39 counties. To develop this framework, WDOT provided a survey to counties to identify common denominators for managing and maintaining parcel data. The survey then informed a data standardization scheme that could be folded into the statewide framework.

Comments, Questions, and Answers

- Question: Is the property management system funded as a line item for fiscal years 2008 and 2009?

Answer: WSDOT has to make a specific request for a project before it can be funded. WSDOT has a pending request for funding the ROW system but the probability of approval is quite small. Nevertheless, it is important to be persistent with identifying funding source. The executive summary developed from the NHCRP 8-55 A Phase 2 work will help emphasize to the legislature the importance of this funding.

- Question: Can WSDOT develop the property management system in-house?

Answer: GIS development is unfunded. However, funding was originally available, so WSDOT will proceed as it is able. One unexplored funding source may be the Environmental Office, which has a requirement about stormwater infrastructure — an element that appears on ROW maps. Given the common needs of the Environmental Office and Real Estate Services to better manage stormwater infrastructure, new funding opportunities may exist.

- Comment: MnDOT has developed an interagency agreement with St. Cloud University. Students from the university work with MnDOT on geo-referencing. The interagency agreement has allowed MnDOT to cut costs associated with geo-referencing and make the work more financially feasible.
- Comment: Missouri DOT had a meeting with the Department of Natural Resources (DNR) to discuss loss of Conservation Resource Program lands as a result of lease non-renewals.

The DNR would like to improve its management of lands bought through fees and easements. It may be important to go to the legislature to access funding to develop a sub-level parcel map identifying land that is fee versus easement.

- Comment: Iowa DOT got legislative funding for a Continuously Operating Referencing Station (CORS) network. In this case, farmers advocated strongly for this funding so that they could develop GPS for farming activities.
- Comment: Funding ROW could also tie to carbon sequestration and climate change. There are many alternative funding avenues to consider that perhaps have not been considered in the past.
- Comment (from WSDOT): State agencies have collaborated to share orthoimagery through sharing an ESRI Image server. In the future scanned imagery may be available on this server along with orthoimagery.

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IV. Observations and Lessons Learned

All Participants

To conclude the event, participants gave an overview of their general observations made during the peer exchange. Participants also summarized some of the lessons their respective organizations had learned in their efforts to develop, enhance, and maintain ROW applications as well as geospatially enable them where funding and staffing resources have allowed.

Observations

- Some peer exchange participants remarked that it was interesting to hear the different stories of discovery regarding who is actually interested in the ROW data state DOTs have and where additional sources of ROW data might be. Participants agreed that there may be many non-traditional places from which ROW data and/or knowledge could be acquired and that unexpected customers of those data should not be unexpected.
- Several participants commented that the peer exchange was useful in illustrating that many states are facing similar challenges. To some participants, it was reassuring to see that their state's direction, struggles, and progress towards geospatial enablement of ROW data were not significantly different from that of others.
- Participants should contact Ms. Hancock if they are interested in hearing when logical model updates are made (occurs roughly every two months). Additionally, if a state DOT is interested in being a case study state for phase two of NCHRP Project 8-55 A, someone from that DOT should contact Ms. Hancock. Case study research is likely to occur during early 2009.
- A benefit of geospatially enabling ROW data and information systems that is often overlooked is the improved ability to respond quickly to management. The applications are getting to the point where managers can obtain answers him/herself, eliminating staff time required in responding to extra requests.

Lessons Learned

- **Ensure that staff members from other offices within the DOT are involved in the development of GIS for ROW applications** — GIS applications are ultimately built for customers across the organization. Obtaining the input of end users early in the application development process will help guarantee cohesion between what is needed and what is delivered.
- **Stay apprised of the developments with the NCHRP Project 8-55A Phase Two study** — the executive summaries that are being produced as a result of the second phase of work are expected to be useful resources for informing executive leaders about the process, costs, and benefits associated with geospatially enabling a ROW information system.

- **Be concise in describing to executives the utility of GIS for ROW applications** — Executives are not necessarily impressed with the speed in which maps that have been scanned can be retrieved using ROW information systems. Instead, they are often more interested in how quickly the necessary players can be engaged, decisions can be made, ROW can be delivered, and how the system helped.
- **Have project managers who are outside of the process of developing GIS for ROW applications manage the projects** — While it is necessary to have skilled technical staff involvement in the development of GIS for ROW applications, it is equally important to have these projects managed by people not involved directly. Project managers who are a step or two away from the actual application development process are less likely to overlook details and may often ask questions that the technical staff inadvertently miss or ignore. Depending on the staff skills available, these project managers may need to come from outside of an IT office.
- **Resist the tendency to let consultants dictate an application's future** — Sometimes state DOTs are desperate to get results and they hastily accept the consultant's word as complete fact. There is risk in accepting their word as the only word. Consultants may market an application built for another state(s) without considering the context of new, inquiring states.

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Appendix A. Participants List

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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Appendix B. GIS for ROW Agenda

GIS for ROW Agenda

July 23-24, 2008

Lee's Summit, Missouri

Tuesday, July 22

Travel Day

Coordinate rides from the airport to hotel on the Super Shuttle as flight

Wednesday, July 23

8:00am

Meet in hotel lobby to travel to MoDOT District 4 Conference Room

8:30 – 9:00

Welcome and Introductions

Kathy Facer and Mark Sarmiento, FHWA

9:00 – 10:15

Overview of NCHRP Report

Kitty Hancock, Virginia Tech

10:15 – 10:30

Break

10:30 – 12:00

State DOT Roundtable The 2007 participants should give a quick report on their work. The agenda for the roundtable is www.gis.fhwa.dot.gov/gisrow.asp

12:00 – 1:30

Working Lunch — Networking

1:30 – 4:30

Demonstrations/Presentations

Nevada DOT — Presentation on the current status of GIS/ROW systems learned

Thursday, July 24

8:00am

Meet in hotel lobby to travel to MoDOT District 4

8:30 – 9:15

Day 1 Re-cap and Next Steps

Kitty Hancock, Virginia Tech

9:15 – 10:30

Roundtable Question and Answer

10:30 – 11:00

Peer Exchange Key Points and Wrap-Up

Kathy Facer and Mark Sarmiento, FHWA

Adjourn and Fly Home

Footnotes

¹ Summary report from the August 2007 Peer Exchange on Applications of GIS in the ROW Area: www.gis.fhwa.dot.gov/gisrow.asp. ([back](#))

² Visualization Case Studies — A Summary of Three Transportation Applications of Visualization: www.gis.fhwa.dot.gov/documents/visual_toc.htm. ([back](#))

³ Business Models for Implementing Geospatial Technologies in Transportation Decision-Making: www.gis.fhwa.dot.gov/bus_model_rpt_3-08/bus_model_rpt.htm. ([back](#))

⁴ Key Practices for Implementing Geospatial Technologies for a Planning and Environment Linkages Approach: www.gis.fhwa.dot.gov/documents/geospatialPEL_rpt.htm. ([back](#))

⁵ GIS-T Symposium website: www.gis-t.org/. ([back](#))

⁶ Research Results Digest 310: Integrating Geospatial Technologies into the Right-of-Way Data-Management Process, NCHRP Project 8-

55: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_310.pdf,

Appendices: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w95.pdf. ([back](#))

⁷ To provide feedback on the logical model, see www.nvc.vt.edu/ceege/kitty/NCHRP/default.htm. ([back](#))

⁸ More information about CAMP available at the following link: http://www.gis.state.ar.us/Programs/Programs_current/CAMP_index.htm. ([back](#))

⁹ For more information about REALMS, see Mn/DOT's Office of Land Management website at: www.olmweb.dot.state.mn.us/. ([back](#))