

# **APPLICATIONS OF GEOGRAPHIC INFORMATION SYSTEMS FOR PLANNING AND ENVIRONMENT LINKAGES**

**Peer Exchange Summary**

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October 4–5, 2007, Portland, Oregon



Prepared for:  
Office of Environment, Planning, and Real Estate Services  
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Prepared by:  
Planning and Policy Analysis Division  
John A. Volpe National Transportation Systems Center  
Research and Innovative Technology Administration  
U.S. Department of Transportation

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## I. Summary

On October 4–5, 2007, the Federal Highway Administration's (FHWA) Office of Environment, Planning, and Real Estate Services sponsored a 1.5-day peer exchange focusing on select State Departments of Transportation (DOTs) applications of Geographic Information Systems (GIS) for Planning and Environment Linkages (PEL). The purpose of the peer exchange was to explore how GIS can help accomplish the goals of PEL. Participants at the event, which was hosted by Oregon DOT at its Region 1 Office in Portland, Oregon, consisted of staff from Florida DOT, Idaho DOT, Oregon DOT, South Carolina DOT, Tennessee DOT, Washington DOT, FHWA Oregon Division, FHWA Washington Division, and the USDOT Volpe Center (See Appendix A for complete list of participants).

### *Background*

FHWA's PEL initiative<sup>1</sup> seeks to change the way that transportation decisions are made, by promoting a new approach that considers environmental, community, and economic factors early in the planning stage and carries them through project development, design, and construction. PEL encourages collaboration among agencies throughout the planning process, as mandated by SAFETEA-LU, Section 6001. Some PEL activities include:

- Regional or system wide analysis and documentation of decisions made during planning process
- Understanding of preceding regional decisions and making use of them for seamless transitions into project development for the National Environmental Policy Act (NEPA) and permitting

As part of the PEL initiative, a series of interviews were held as follow-up for states that participated in Linking Planning and NEPA Workshops. During the interviews, participants identified understanding how to apply GIS to conduct environmental analyses in planning as both a need and an area where FHWA could provide assistance. Similarly, one recommendation made as a result of an FHWA-sponsored domestic scan of the state of the practice of GIS for transportation decision making was to conduct more peer exchanges on the uses of GIS for various transportation applications.<sup>2</sup>

Recognizing that GIS and other geospatial applications can help transportation agencies more effectively carry considerations made during planning through the environmental review process, FHWA convened a peer exchange to bring together GIS and planning experts – providing a forum for them to share their experiences and knowledge. This report provides a summary of the presentations and discussions that took place at the peer exchange. It should serve as a resource for other DOTs and transportation agencies looking to learn more about successful implementations – or planned implementations – of GIS for PEL. Lessons learned and recommendations of the participating DOTs are found in the concluding section.

## II. Presentations and Discussion

### Welcome and Introductions

*Mark Sarmiento, FHWA Office of Interstate and Border Planning and Carson Poe, USDOT Volpe Center*

Participating via teleconference, Mr. Sarmiento began the peer exchange by introducing the agenda and recapping the purpose of the meeting. Questions the exchange was intended to address include:

- What is the state of the practice?
- Why did the State DOT do what they did?
- Who was responsible for implementing the activity, application, etc.?
- How was the activity/application accomplished – technically, logically, financially, etc.?

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<sup>1</sup> For more information, visit PEL's website at [www.environment.fhwa.dot.gov/integ/index.asp](http://www.environment.fhwa.dot.gov/integ/index.asp).

<sup>2</sup> The final report for the Executive Scan is available at [www.gis.fhwa.dot.gov/execscan.asp](http://www.gis.fhwa.dot.gov/execscan.asp).

The various GIS-related activities that FHWA's Office of Interstate and Border Planning has supported over recent years were also described during the introductory discussion. Some of these activities have been:

- Development of a GIS in Transportation website ([www.gis.fhwa.dot.gov](http://www.gis.fhwa.dot.gov)), which is home to a searchable database of state DOTs' GIS applications
- Coordination and participation in an executive-level domestic scan of the state of the practice of GIS for transportation decision making, as well as what advancements are expected in the field in the near future<sup>3</sup>
- Convening of an executive-level workshop to develop an action plan for FHWA's involvement in promoting GIS for improved transportation decision making, a plan from which the idea for GIS-related peer exchanges originated

To conclude, Mr. Sarmiento presented several graphs illustrating the results from the American Association of State Highway and Transportation Officials' (AASHTO) previous annual surveys on GIS and transportation. By describing some of the recent national trends, peer exchange participants were given an opportunity to understand where the GIS for PEL discussion falls into the broader context of GIS implementation across the current transportation enterprise.

### **Planning and Environment Linkages (PEL)**

*Gina Barberio, USDOT Volpe Center*

PEL is both an approach to transportation decisionmaking and a FHWA program that considers environmental, community, and economic goals early in transportation planning and carries them through project development, design, construction, and maintenance. The purpose of PEL is to help agencies streamline transportation decisionmaking and improve coordination among transportation and resource agency decisions to develop projects that best serve a community's transportation needs and support other quality of life goals.

Figure 1 below depicts a continuum between systems-level planning (top) and project-level decisions (bottom) at transportation agencies (left) and resource agencies (right). Currently, there is coordination between transportation and resource agencies at the project level under NEPA, including environmental analysis documentation, consultations (such as for the Endangered Species Act), and permitting (such as for the Clean Water Act). PEL strives to strengthen the links between transportation and resource agency systems planning and between transportation agency planning and project development, depicted by the wide purple arrows in Figure 1. Listed adjacent to the arrows are the transportation laws, regulations, and guidance that guide these efforts

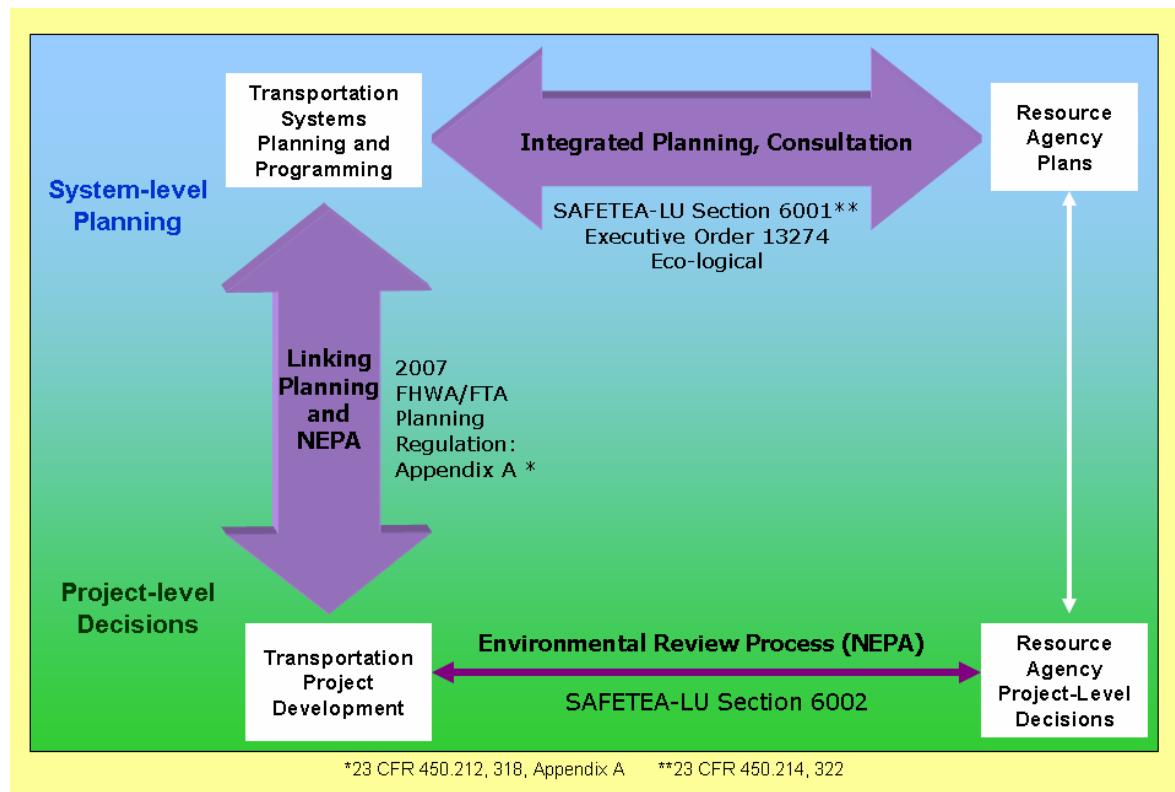
PEL-related activities can benefit the project development process through:

- More effective environmental stewardship
- Minimized duplication of effort
- Reduced delays in project implementation
- Enhanced interagency coordination

In addition, some PEL practices are now required by law. For example, SAFETEA-LU requires transportation agencies to consult with state and local resource agencies to compare transportation plans with conservation plans, maps, and inventories of natural and historic resources. Transportation agencies are also required to identify potential environmental mitigation opportunities.

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<sup>3</sup> The final report for the Executive Scan is available at [www.gis.fhwa.dot.gov/execscan.asp](http://www.gis.fhwa.dot.gov/execscan.asp).



**Figure 1: Planning and Environment Linkages in Decisionmaking Processes**

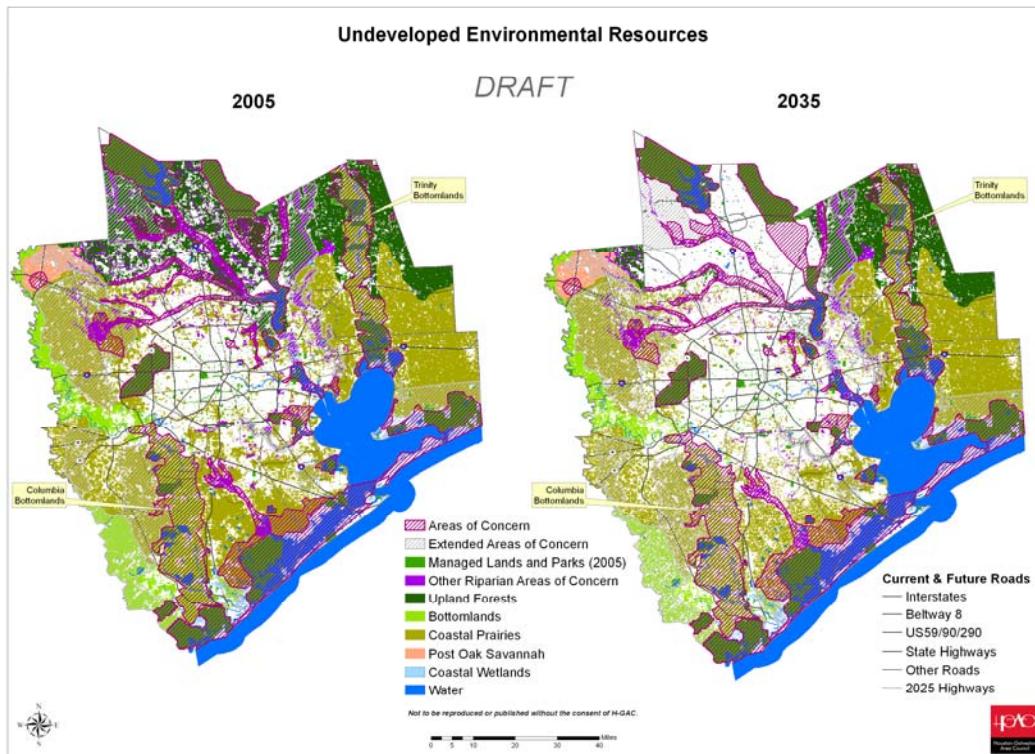
Agencies can use GIS to implement and improve the PEL approach by:

- Documenting existing geographic resource data and sharing data among agencies
- Conducting more in-depth analyses even at high levels of planning
- Using these data and analyses to improve decisionmaking early in the planning process.

Specifically, agencies can use GIS in PEL implementation to:

- Overlay resources data on transportation projects
- Use project screening tools to make planning decisions
- Share tools and data among agencies and update data as they become available
- Carry planning products through project development and the environmental review process.

Figure 2 shows an example of how agencies can use GIS to conduct environmental analyses earlier in planning. The Houston-Galveston Area Council overlaid sensitive resources on proposed transportation projects in long-range planning using the GIS Screening Tool. Transportation agencies can use similar visualization techniques to identify and discuss potential areas of concern in proposed projects. With the right tools and coordination among agencies, agencies can also narrow the list of alternatives of a proposed project before initiating the NEPA process.



**Figure 2: Example of Houston-Galveston Area Council output using the GIS Screening Tool.**

As part of the PEL program, FHWA has developed several initiatives to inform agencies on how to integrate PEL into transportation decisionmaking processes. Activities include:

- **PEL technical assistance program** – provides state and local agencies with guidelines, tools, and financial support to implement PEL.
- **Training** – FHWA is working with the National Highway Institute and National Transit Institute to update planning and environmental courses to include PEL concepts.
- **Linking Conservation and Transportation Planning Workshops** – emphasize the use of information, tools, and methods that can be shared among the transportation community and resource and regulatory agencies.
- **PEL website** – is a clearinghouse of information for stakeholders to learn more about how to apply PEL concepts and tools locally, regionally, and statewide.  
[www.environment.fhwa.dot.gov/integ/index.asp](http://www.environment.fhwa.dot.gov/integ/index.asp)

Over the next year, the PEL program will work more closely with the following interagency efforts that also promote PEL concepts:

- **Eco-Logical** – is a guidance document that describes how to make infrastructure projects more sensitive to wildlife and ecosystems through integrated planning, partnerships, and cooperative conservation.
- **Integrated Planning Work Group** – seeks to overcome challenges and find new opportunities to link planning, project development, and environmental reviews. In the future, outcomes from the Work Group will become an integral part of PEL information and tools.

For more information on PEL, please contact:

**Diane Turchetta**  
FHWA Office of Planning

Phone: (202) 493-0158  
Email: [diane.turchetta@dot.gov](mailto:diane.turchetta@dot.gov)

**Michael Culp**  
FHWA Office of Project Development and  
Environmental Review  
*Comments, Questions, and Answers*

Phone: (202) 366-9229  
Email: [michael.culp@dot.gov](mailto:michael.culp@dot.gov)

- Question: Are measures being taken to determine the effectiveness of PEL?

Answer: FHWA is currently at the beginning stages of implementation of PEL. It is expected that performance measures for PEL will be established over the next year.

### **State DOT Roundtable**

*All Participants – Rachael Barolsky (USDOT Volpe Center) facilitated*

In order to introduce participants to each other as well as to give an overview of their respective DOT's GIS for PEL activities, a brief roundtable discussion was held. Along with the results of a questionnaire distributed in advance of the peer exchange to guide the discussion<sup>4</sup>, the discussion was guided by the following questions:

- Overview of each state's PEL and GIS activities
- How has your state coordinated for PEL-related GIS data / what applications are in place?
- What are your state's needs/challenges?
- What do you want to leave with?

In response, participants broadly outlined what interested them about the planned peer exchange agenda topics and how their own DOT's experience related and could contribute to the dialogue. Because Florida DOT and Oregon DOT gave in depth presentations later during the exchange, information from their respective roundtable overviews are incorporated in this document as part of the "Demonstrations and Presentations" section.

### **Idaho DOT**

*Liza Fox*

Idaho Transportation Department (ITD) has moved back and forth between having a centralized and decentralized GIS program. This has been in part due to turnover in executive level management. When ITD's GIS activities were decentralized, managers faced difficulties in properly utilizing their GIS staff. Now, as ITD's GIS activities are becoming centralized, GIS staff are adapting to the changing culture. The links that GIS can support in PEL seems to be "low-hanging fruit" behind which a GIS program could be organized.

The ITD is also coordinating with Washington DOT (WSDOT) on a pooled fund study to develop a translation tool that will help migrate local inventory data into a statewide database. The end result will be a "smart" data set that allows users to do more analysis than simply edge matching. Before integrating the maps on a large scale, more local data are needed.

#### *Questions from ITD to answer during the peer exchange:*

- How should the right kind of GIS and the best applications of GIS be chosen?
- How can employees, from managers to staff, be best trained on the practical applications of GIS as a decision-making tool?

### **South Carolina DOT**

*Mark Pleasant and Randy Williamson*

Several years ago, South Carolina DOT (SCDOT) environmental staff were part of a pre-construction engineering group. More recently, environmental activities have been moved under the planning division,

<sup>4</sup> Refer to Appendix C to see the questionnaire.

which has encouraged greater communication among planning and environmental staff, as well as with other agencies. SCDOT now funds liaison positions at the US Fish and Wildlife Service (FWS), US Army Corps of Engineers (USACE), State Historic Preservation Office (SHPO), Department of Natural Resources (DNR), and other agencies.

As environmental and planning activities became more integrated at SCDOT, GIS began playing an important role, and it is now being used to help screen projects during long-range planning. The agency currently uses its Advanced Project Planning Report (APPR) as a pre-environmental process document that is based on the GIS screening process. Resource agencies took the lead in establishing the APPR as a communication and decisionmaking tool. New projects must go through an APPR review before they enter the Statewide Transportation Improvement Program (STIP).

One of the challenges in implementing GIS at SCDOT has been the fragmented nature of its use. SCDOT has a GIS department with a centralized GIS, but planning and environment have developed separate GIS to meet their needs.

*Questions from SCDOT to answer during the peer exchange:*

- How has the linkage of planning and environment affected projects downstream? We would like performance measures of time and cost savings, as well as delivering the best project.
- How can we improve our decision-making process using a web-based tool?

**Tennessee DOT**

*Kim McDonough and Jeanne Stevens*

TDOT has a similar reporting process as South Carolina, but uses less GIS. TDOT is developing an extensive statewide environmental management system called SEMS (Statewide Environmental Management System). Data are not yet shared, as TDOT is waiting for the document sharing system to be completed.

TDOT would like to resolve how to overlay roads on buffers with “fuzzy boundaries” around sensitive resources. This would provide for the “correct” interpretation of the data, enabling better decisions. A challenge has been that resource agencies often provide general comments to TDOT but are reluctant to give site-specific comments during long-range planning. Since the agencies often face limited funding and staffing, it is sometimes difficult to plug them into the DOT’s GIS applications, data, and analysis processes.

*Questions from TDOT to answer during the peer exchange:*

- How can TDOT develop a vision for future data sharing and analyses?
- How can GIS and environmental analyses be applied beyond project-level planning and into long-range policy planning?
- How does the transportation planning and project development process shape the data gathering and utilization in the GIS?
- What is the value of having a dedicated team of GIS staff versus bringing GIS training to individual planning and environmental staff? Should GIS staff run analyses or planning/environmental staff?

**Washington DOT**

*Cliff Hall*

WSDOT developed a centralized database, called the Environmental GIS Workbench, which includes data from Federal, state and other agencies. Data are used to flag likely environmental issues affecting project-level planning throughout the state. Currently, WSDOT is determining how GIS activities can be best married with planning activities. The Department’s GIS staff are working closely with planning staff to know and understand what the data requirements are.

*Questions from WSDOT to answer during the peer exchange:*

- How can determining whether data needed in project development are the same data needed for planning level analyses? How can planning and environmental activities be best merged?
- What steps can a DOT take to change organizational culture in a way to encourage data sharing among agencies and with the public?

### **Demonstrations and Presentations**

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*All Participants*

#### **Oregon DOT**

*Milton Hill*

Building off the existing Salmon Resource – Sensitive Area Mapping (SR-SAM) resource inventory for maintenance activities on road corridors, ODOT developed an Environmental Data Management System (EDMS). The EDMS is a collection of projects that focus on the dispersion of environmental spatial data to agency staff. In developing the system, ODOT took an adaptive management approach: it tests and adapts various tools to meet the Department's evolving business process needs. Some examples of current activities include:

- Wetlands Screening Tool – maps wetlands throughout Oregon using soil and national wetlands inventories. The system is transitioning to a web-based tool to allow for greater consistency in analysis among users and an easy to use interface.
- RES and RAZ maps system and access tool – ODOT has a best management practices document called the Blue Book, which separates projects into three categories based on their proximity to environmentally sensitive resources (RES) or restricted activity zones (RAZ). More discussions among planning and environmental staff occur on projects that are near RES and RAZ areas to identify potential areas of concern and possible solutions. The map system aids these discussions by using a variety of electronic data to map environmentally sensitive areas and show what maintenance actions can be taken on a mile-by-mile basis. The access tool provides a simple interface to find maps that identify wetlands, drainages, riparian zones, likelihood of archaeological sites, endangered species sites, and habitat. Maps are used by planning staff and regional environmental coordinators as a quick reference guide to the environmental character and features of an area.
- No Effects Screening Tool – overlays potential projects on resource data layers.

#### *Challenges:*

The DOT data set is separate from resource agencies' data sets, so there is duplication of effort. Unlike the past, resource agencies now have substantially better data in GIS format. Now ODOT can update data with existing resource agency information and is beginning to do so using live feeds from resource agencies. The internal DOT server stores shape files for agency-wide central repository, however, only parts of the DOT know that this system exists. Different offices at the DOT use different GIS tools, and there is not a lot of interaction among offices regarding available tools. In addition, there are concerns about data security and sharing with resource agencies to ensure confidentiality of data, such as with State Historic Preservation Office.

#### *Comments, Questions, and Answers*

- Question: Who drives project selection when screening tools exist – planners or biologists?  
Answer: In writing the scope of work for a consultant, ask GIS specialists and other appropriate staff if the language explains exactly what is being sought. Planning, environmental, GIS, IT, and legal staff may each provide novel input on how to make a better tool. Interaction with and flexibility of a variety customers will allow needs to be better met.

Comment: The appropriate use of data is also very important. A resource may exist even if the data or documentation for it does not exist. Even the best analysis tools require data interpretation.

Comment: Also consider record level resource data, which identify who collected the data and their level of knowledge on the subject matter. Specialists and users can look at this record and account for data quality.

- Question: How does ODOT plan to use these applications in planning and to identify mitigation opportunities?

Answer: The GIS focus at ODOT has been mostly environmental, but planners are also beginning to use GIS tools. Planners are using a Statewide Transportation Improvement Program (STIP) scoping tool, which is currently in ArcGIS and is transitioning to a web-based system. GIS tools are used at the planning project level, but not yet in long range policy planning.

- Question: Are DOTs using GIS as a document management system?

Answer: At ODOT, the Department of Administrative Services coordinates state GIS activities. ODOT is part of a pooled fund to develop framework layers of rivers, terrain, and transportation, some of which are federally required, others were added by Oregon. SR-SAM pays for imagery for roadway corridor. The framework committee worked with the Farm Services Administration to get high resolution color imagery from their flyovers by providing funding support. Oregon is combining data centers from various agencies into one data center with an Oregon Explorer Portal. A web mapping service brings data in as a live feed. As common data sets among agencies continue to be built, greater cost savings and more effective use of resources is likely.

## **Florida DOT**

*Buddy Cunill and Pete McGilvray*

### *Background*

Prior to enactment of the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21), FDOT was faced with three major challenges:

1. Resource agencies became part of the transportation decisionmaking process too late in the process;
2. Information gathered in the planning process did not always make it into project development, which led to duplication of effort; and
3. Information gathered during public involvement was not shared with transportation planners.

Through the Efficient Transportation Decision Making (ETDM) process, FDOT sought to restructure its transportation decisionmaking process in two ways – through technology and through agreements with resource agencies. FDOT realized early in development of ETDM that developing technology was not enough. FDOT needed consensus among agencies and substantial involvement of stakeholders to ensure agencies would contribute data and update the data to a centralized GIS.

FDOT engages resource agencies early in planning and keeps them involved throughout the entire planning and project development processes. FDOT funds 36 positions at resource agencies. Through the Environmental Screening Tool (EST), project information is carried from planning to project development. ETDM has an Internet-accessible interactive database tool that allows the public greater access to information and the ability to comment on areas of concern.

FDOT was able to achieve this substantial change through strong leadership at the DOT and with funding from FHWA. In 1999, FDOT held an executive summit with resource agencies to get proper “buy-in” of process changes. Agencies signed a Memorandum of Understanding (MOU), then FDOT worked with agencies individually to develop Memoranda of Agreement (MOA) and agency operating agreements specifically tailored to each agency’s process. Metropolitan Planning Organizations (MPO) did not sign the MOU, rather MPOs have incorporated ETDM into their business practices.

### *Data Management*

Federal, state, and local agencies provide data to ETDM. Data are not reconciled among agencies, even if two agencies provide data on the same resource. This allows all agencies to use their data for analyses at all points of the decisionmaking process, and gives agencies greater ownership in both the tools and the process. FDOT benefits by channeling its time and resources away from detailed data reconciliation and towards higher level coordination among agencies.

FDOT asks each agency what data they want to see when they conduct analyses, as well as information on the buffers each agency uses to analyze areas around various resources. More data are not necessarily better, which is a common misconception. The only data requirements for ETDM are that agencies have meta data and that the contributing data source requests that data are stored in the database. As agencies collect new data, FDOT is now making data formatting requirements for new data, now that agencies have buy-in into the ETDM process.

Agencies do not think of ETDM as a DOT tool; it is an interagency data sharing system. Each resource agency has a different data update cycle, which is coordinated through the database. The database sends automated requests for agency updates based on that agency's update schedule. Agencies update data through a FTP site.

Different resource agencies can run separate analyses based on the criteria they use to make decisions. Resource agencies determine the Degree of Effect identified in a buffer and intersect query based on their jurisdiction, and input this determination into the EST. If there is a dispute, the EST will ask related questions to the reviewing agency, such as inputting appropriate statutes. If no dispute is recorded, this is also documented in the system.

### *Legal Sufficiency*

Rather than have resource agencies and local entities update data directly to the system, FDOT keeps a copy of the most recent data provided to ETDM. As a project enters certain stages of planning, FDOT can take a "snapshot" of the conditions and data upon which decisions are made throughout the project. The snapshot includes all analyses conducted and all data used in decisionmaking. This supports the Federal Record such that decisions made in the past for a particular project can stand up in court based on information known at a particular point in time, not based on future changes to the resource in question. This snapshot also allows agencies to track changes in a project over time. If a project is in an active review period, data are not updated for that project until the review period has passed.

### *Resource Agency Involvement, Public Involvement, Security and Confidentiality*

Every FDOT district has an associated Environmental Technical Advisory Team (ETAT) that is comprised of representatives from 23 resource agencies. One ETAT member acts as a representative for each resource agency and can update data to the ETDM database for the entire agency. All data updates and comments are, therefore, vetted through one "data custodian", so the system will not receive information from different offices within the same agency. Other staff within an agency have read capabilities to the system, so they can check for incorrect or outdated information and inform the data custodian.

The EST has two versions – a public access site with a simple interface, and a secure website for confidential data, analyses, and decisions. The secure site is considered "draft," while the public site contains "final" information. The secure site contains data purchased from private sources, such as information on all local roads in the state, as well as sensitive data, such as locations of threatened and endangered species or historic properties. All other resource data is available on the public site. All agreements with all agencies are also posted on the public site. ETDM developers worked with the FDOT legal team to develop disclaimers on each site.

Stakeholders receive notifications based on their involvement in the process as decisionmakers or interested parties. Stakeholders can choose how they are notified, such as for particular projects or concerning certain issues. ETDM does not replace other public involvement mechanisms; it only adds to the process. Each ETAT has a Community Liaison Coordinator to aid public involvement in each district. FDOT also hosts public meetings and posts information on the FDOT and ETDM websites. The public can provide comments through the public website, which are provided as a summary in project reporting.

During project reviews, reviewers can access maps and other project-specific information on the secure website. The site has an interactive checkbox that is relevant to the review requirements of each agency. For example, the lead agency can choose to accept or not accept the project purpose and need, while a participating agency can choose understand or do not understand. Reviewers can only access and influence project comments related to their authority within the review process. All agencies involved in ETDM have agreed to a 45-day review and comment period for planning and project level reviews.

Once resource agency project reviews have been submitted, FDOT can review concerns on a particular project or issue. FDOT then responds to the project or issue in a summary Degree of Effect box on the secure site to track both resource agency comments and FDOT responses. These data are automatically entered into the document tracking system once comments are considered official.

Resource agencies can get involved in developing the project purpose and need and conducting alternatives analyses in programming, long before the environmental review process begins. By completing much of the work prior to NEPA, agencies can save time and resources during environmental reviews by carrying these analyses and decisions into the NEPA process.

Resource agencies do not issue permits during programming and planning. Instead, agencies provide information on critical potential permitting issues. ETDM allows agencies to perform the appropriate level of screening at the appropriate time. Long-range planning analyses are separate from programming and project level planning.

#### *Benefits and Costs*

ETDM program development and support cost \$9.1 million from 2000-2007. Resource agencies provided in-kind support (staffing, training, equipment, etc.) of \$3.7 million. Since its inception in 2004, ETDM has saved an estimated \$15.2 million and 38 labor years of effort. The EST and interagency coordination have also allowed FDOT to reduce the risk of cancelling major high profile projects.

The keys to ETDM's success are dedicated IT staff and funded positions with resource agencies. In addition, getting buy-in from agencies is critical. ETDM is not a DOT application; rather it is an agency coordination application. FDOT built ETDM based on resource agency needs for data, analysis, and reporting. Resource agencies conduct analyses of proposed transportation projects based on their areas of expertise – not just during the NEPA process, but throughout transportation decisionmaking. Resource agencies have more ownership of the process, and FDOT does not need to interpret resource agency data, which reduces duplication of effort.

#### *Challenges*

FDOT faces challenges common to all agencies and states, including gaps in data and constraints in both time and funding. It is an ongoing challenge to work with resource agencies to ensure their programmatic initiatives are part of the transportation decisionmaking process early on, so that stakeholders are aware of new initiatives and they are properly incorporated into the ETDM process. As ETDM grows, FDOT would like to incorporate new concepts and tools, such as performance management.

FDOT conducts an annual survey with districts and hosts an annual ETAT summer session to identify data gaps, analysis needs, and value added to projects and decisions. FDOT uses the feedback to further

improve its tools and process. Technology and process development requires an iterative approach, with discussion of the varying needs among different offices (executive level management, planners, environmental staff, etc.)

#### *Comments, Questions, and Answers*

- Question: How early in transportation decisionmaking does ETDM start?  
Answer: Resource agencies are involved from the beginning of the process, from policy development to planning to project development. FDOT scopes projects before they enter the work program, and long before the NEPA process begins. A project's class of action is identified during programming. FDOT can begin to eliminate alternatives at this early stage of the decisionmaking process and include better cost estimates in programming.
- Question: What if ETDM stopped at project screening – would that be enough to streamline the process?  
Answer: Yes, the screening tools allow FDOT to make the best use of transportation resources through more informed decisionmaking. FDOT uses the EST to help prioritize and select projects. However, the larger process also allows FDOT to feed information to MPOs even earlier in planning, so MPOs can determine if their long-range plans are viable. The value of the tool is to have all stakeholders view a project at the same time, document comments, provide feedback, and make decisions based on this iteration among agencies. GIS is one piece of information, but agency coordination and proper interpretation of data are still needed. The web based tool facilitates the exchanges, tracks commitments, and documents every step of the process, but it is the process and the coordination that leads to much of ETDM's success.
- Question: How are points of contact kept up to date in ETDM?  
Answer: Agencies are responsible for keeping their own points of contact up to date in the system. Because resource agency staff view ETDM as "their own" process, they often eagerly call FDOT to identify themselves as the "new contact."
- Question: How does FDOT advertise the tool internally?  
Answer: It is advertised as "just another tool" that can be used. ETDM supplements all the other activities going on within FDOT.
- Question: What technology does FDOT use for GIS?  
Answer: At FDOT, there is a mixed technology environment. Geomedia, ESRI, ArcSDE, Oracle Spatial are some of the resources utilized.
- Question: What is on the secure ETDM site that the public does not see?  
Answer: Sensitive environmental data, such as endangered species information and cultural resources data, is not available to the public.
- Question: How does the public know to register/subscribe with ETDM?  
Answer: ETDM is announced at all public meetings, and flyers are often put up describing ETDM. ETDM Coordinators and project managers encourage the public to sign up via the ETDM website.

#### **Participant Discussions**

*All Participants – Rachael Barolsky (USDOT Volpe Center) facilitated*

***Topic 1: Identifying Existing Transportation and Environmental GIS data; and  
Topic 2: GIS Coordination with Resource Agencies***

After hearing earlier presentations and discussions, the facilitator and participants agreed that in order to be most successful in accessing the best available transportation and environmental GIS data, transportation agencies should coordinate as much as possible with resource agencies. With this

understanding, participants merged the first two of the planned three open-ended discussion topics to complete day two of the peer exchange. Salient comments from the discussions include:

- Data centralizing is important, but data sharing can be difficult. Resource agencies need to be involved not only in data sharing, but in the entire decisionmaking process. Specifically, their involvement can be encouraged earlier. By letting resource agencies analyze their own data, they can be the judge on the quality of their own data and when to update it. Resource agencies want to get involved, particularly when the DOT tries to speak their language.
- Wildlife Action Plans are a great way to start comparing conservation and transportation plans.
- MPOs are also starting to work together for modeling, planning, USGS gap analyses, and scenario planning.
- Indirect and cumulative impacts are a growing concern.
- There is funding at the Federal level available to states that can demonstrate why funding is needed.

*Facilitator: Does your DOT know what to ask from resource agencies?*

- We need to rethink how we use GIS. We have been trying to ask resource agencies for things they were not ready for. Maybe we should focus on coordination first, and then try to get the right data to analyze. Institutionalizing the process can lead to many benefits; even if it takes time to get it right. Once agencies see how process changes can benefit their work, the concepts will sell themselves. When resource agencies are responsible for their own data, the data are trusted by more people. If we ask resource agencies how we can help them improve their process, they will help us come up with solutions.
- Communication with the public is also very important. Find innovative ways to engage the public. For example, in addition to hosting public meetings, consider going to existing meetings of organizations throughout a community to provide information about potential projects and receive feedback from the public.

*Facilitator: Are there issues getting buy-in from leadership and the rest of the DOT? How can change management be promoted?*

- It is a challenge to move people away from thinking about their areas of focus, such as planning, environment, GIS or on a project-by-project basis, and into more conceptual, high-level thinking about the process. Education at both the executive and staff levels is a key way to promote programmatic and process changes. Both leadership and staff will be more willing to make changes when they understand why change is worthwhile.

### ***Topic 3: How to Implement PEL using GIS***

In the first day of the peer exchange, participants discussed how transportation agencies can coordinate with resource agencies both to access GIS data and involve resources agencies early in the planning process. In particular, participants related the discussion to how agencies can use GIS and other geospatial applications to conduct environmental analyses in the planning process. During the third open-ended discussion, participants built on lessons learned in day 1 by discussing how to carry planning level analyses and decisions into the project development and environmental review process so agencies can implement PEL and streamline decisionmaking. Comments are summarized below, with questions following.

- Ensure that business process drives changes to GIS tools, rather than let GIS grow on its own accord. It would be interesting to learn more about different business models in states to see what organizational structures have the most effective GIS and PEL implementation.
- PEL and SAFETEA-LU are big topics of discussion at major meetings. Historically, planning and environment have not been coordinated, which led to delays in project implementation.
- By working with ETATs, FDOT can bring together the right people and data to accomplish its work. FDOT uses data as requested by agencies that contribute data. At the corridor level, FDOT identifies the least cost paths. For statewide plans and planning-level screening, the same ETAT members are

involved in the process looking at the same data, but at a different level of environmental analysis in planning.

- Resource agencies do not need to provide detailed NEPA-level comments for systems-level planning, but it helps if they are involved in the planning process so they are aware of the project and carry early analyses and decisions into the environmental review process. Here is where the need for a defined process and mutual understanding among agencies really matters.
- Think about how GIS can facilitate the integration of planning and environment. GIS cannot be an end in itself. GIS is a vital component to decisionmaking, but not the solution. If information is developed in planning, how can it carry over to the environmental process?

Question: An area of GIS that is often overlooked is pre-classification to identify the level of sensitivity or impact of an area. Instead of overlay analysis, overlay a grid of sensitivity to find the path of least resistance. It requires more work upfront but it is easier to analyze later. Has anyone used this technique?

Response: Yes, FDOT uses a statewide grid for wildlife, which is an integrated grid of resources rather than 15 separate layers of data. Initially, agencies were reluctant to use the ETDM GIS. Now, agencies want an online system for all their projects. They are also using ETDM for ancillary (non-transportation related) benefits to their programs. Agencies realize the value of a clearinghouse where the same data are commonly accessed and viewed. 525 data sets are online and available for download, as long as the data are not sensitive or owned by private organizations. With ETDM, responsibility sits with the owners of the data to conduct their own analyses and interpret their data. The DOT can then do a reality check to see if the results make sense, rather than try to analyze (and potentially misinterpret) the resource agency data. Of course, it requires many meetings and discussions with agencies to get everyone on the same page. Figure out the process first; then worry about the GIS.

Question: Will resource agencies want to take on this responsibility?

Response: By analyzing and interpreting their own data from the beginning of the planning process, resource agencies have a greater opportunity to protect the resources for which they are responsible. It is to resource agencies' advantage to get involved in this way. The DOT wants to facilitate resource agency needs, but it will not tell resources agencies how to do their jobs. Resource agencies identify the data sets. FDOT and resource agencies talk through the questions the resource agencies want to ask about sensitive resources near a project. They can talk through issues with the help of GIS maps and data sets, and then agree on a process.

Question: Do the FDOT agreements apply to all projects?

Response: Agreements with resource agencies are made on a programmatic level rather than at a project level, so process agreements apply to all projects. At the project level, however, agencies can modify their analyses slightly based on specific project needs.

Question: Does FDOT have performance data on a reduction in the number of lawsuits?

Response: Lawsuits come from decisions, not from process, though FDOT has not had many lawsuits. ETDM gives FDOT a better chance to avoid many challenges because all agencies are involved, and the entire decisionmaking process is documented. The DOT will not be able to eliminate lawsuits; however it can make lawsuits more defendable in court through a documented process. Automated notifications can be tracked since they stored in the database. If an agency does not provide a comment, this is also documented in the system. Agencies receive quarterly updates of notification summaries, such as the number of projects on which agencies were notified and the number of response from the agency.

For the I-73 project from Michigan to Myrtle Beach, South Carolina, SCDOT outsourced its GIS analyses. A corridor analysis tool was developed to compile information from 21 agencies, including data from resource agencies, counties, and cities. There were 877 GIS layers, including environmental, roadway, social, economic, and geographic layers that were pared down to 52 useful data layers. The system created alignments based on overlaid resources, which saved a lot of time. The Final Environmental Impact Statement (EIS) for the 47-mile Interstate only took two and a half years to complete; the Record of Decision took three years. In the future, there may be funding and education issues to fully integrate planning and environment, but DOT staff are interested and will share ideas with the executive level. As leadership make PEL a greater priority, staff will also work together in a more integrated way.

Legislatively mandated project prioritization now requires SCDOT planning and environmental staff to work together. Staff must review nine prioritization criteria for each project. All projects are scored and ranked during a meeting with Planning, Environment, GIS, etc. When environmental staff were moved out of engineering and into the planning division, staff could expand their analyses with less influence of funding and having to push project through. South Carolina is in a good position for change to incorporate PEL into its processes.

### **III. Lessons Learned and Next Steps**

On Day 2 of the peer exchange, participants from each state DOT highlighted the lessons they had learned and are learning in their efforts to implement GIS for PEL activities. Representatives from each DOT also expressed planned next steps as a result of the peer exchange. These lessons and potential follow up activities are listed below:

- ***GIS and their maps are not panaceas*** – Maps are just one more input to consider. They do not provide the complete answer. Consider them in coordination with all other inputs.
- ***In the beginning, do not get bogged down in details*** – Get buy-in from upper management first, and include resource agency managers in the discussion from the beginning. A culture shift can occur at the staff level of both agencies at the same time. When managers care, staff will find the time to get involved in an integrated process. Make change a celebration.
- ***Take a team approach to implementing GIS activities*** – It is sometimes difficult to create a process to allow GIS to fold into the variety of a DOT's business functions. An integrated team approach facilitates discussion across disciplines and allows business needs to be better understood.
- ***Partner when possible*** – GIS for PEL is really focused on problem-solving. Solutions are likely more easily achieved with the input of all stakeholders.
- ***Train staff to think conceptually*** – Because project development is a complex process, it is important to have personnel on staff that can think conceptually and visualize how GIS might provide support.

#### **Potential Next Steps**

- Oregon DOT – Learn more about how GIS is being used in planning. One approach would be to have a one-day information technology showcase. FDOT sponsored one (which has now become an annual event), and staff were amazed at the breadth of ongoing IT activities about which they were unaware.
- Idaho DOT – Convene meetings of planning and environmental staffs to discuss how GIS might be used to better link the divisions.
- Tennessee DOT – Improve working relationship between GIS and planning, and consider new approaches for working with resource agencies.
- South Carolina DOT – Invite planning staff to attend monthly meeting that GIS and environment staffs convene.
- Florida DOT – Consider how GIS can be better used for construction and maintenance purposes. Consider performance measures for the ETDM process.
- ***Contact FHWA to learn about resources and funding opportunities*** – FHWA is developing websites, workshops, trainings, and other communication tools to inform stakeholders about both GIS and PEL. In addition, the FHWA Environmental Competency Building program conducts research and

shares information on the current and future multidisciplinary professional development needs of transportation and environmental professionals. There are also funding opportunities from FHWA for other GIS events in Fiscal Year 2008, such as additional peer exchanges.

**Appendix A. Participants List**

**Rachael Barolsky**  
USDOT Volpe Center  
[rachael.barolsky@volpe.dot.gov](mailto:rachael.barolsky@volpe.dot.gov)

**Liza Fox**  
Idaho DOT  
[Liza.Fox@itd.idaho.gov](mailto:Liza.Fox@itd.idaho.gov)

**Kim McDonough**  
Tennessee DOT  
[kim.mcdonough@state.tn.us](mailto:kim.mcdonough@state.tn.us)

**Carson Poe**  
USDOT Volpe Center  
[carson.poe@volpe.dot.gov](mailto:carson.poe@volpe.dot.gov)

**Mark Sarmiento** (*via phone*)  
FHWA Office of Interstate and  
Border Planning  
[Mark.Sarmiento@fhwa.dot.gov](mailto:Mark.Sarmiento@fhwa.dot.gov)

**Randy Williamson**  
South Carolina DOT  
[wiliamsrd@scdot.org](mailto:wiliamsrd@scdot.org)

**Gina Barberio**  
USDOT Volpe Center  
[gina.barberio@volpe.dot.gov](mailto:gina.barberio@volpe.dot.gov)

**Cliff Hall**  
Washington DOT  
[hallcli@wsdot.wa.gov](mailto:hallcli@wsdot.wa.gov)

**Peter McGilvray**  
Florida DOT  
[peter.mcgilvray@fl.dot.state.us](mailto:peter.mcgilvray@fl.dot.state.us)

**Casey Ragain**  
Oregon DOT  
[casey.j.ragain@odot.state.or.us](mailto:casey.j.ragain@odot.state.or.us)

**Sidney Stecker**  
FHWA Washington Division  
[sidney.stecker@fhwa.dot.gov](mailto:sidney.stecker@fhwa.dot.gov)

**Buddy Cunill**  
Florida DOT  
[Buddy.Cunill@fl.dot.state.us](mailto:Buddy.Cunill@fl.dot.state.us)

**Milton Hill**  
Oregon DOT  
[milton.e.hill@state.or.us](mailto:milton.e.hill@state.or.us)

**Mark Pleasant**  
South Carolina DOT  
[Pleasantmd@scdot.org](mailto:Pleasantmd@scdot.org)

**Satvinder Sandhu**  
FHWA Oregon Division  
[Satvinder.Sandhu@fhwa.dot.gov](mailto:Satvinder.Sandhu@fhwa.dot.gov)

**Jeanne Stevens**  
Tennessee DOT  
[Jeanne.stevens@state.tn.us](mailto:Jeanne.stevens@state.tn.us)

**Appendix B. GIS for Planning and Environment Linkages (PEL) Agenda**Portland, Oregon – October 4–5, 2007

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**Goal:** Explore how GIS can help accomplish the goals of PEL.**Wednesday, October 3** Travel Day**Thursday, October 4**

8:00 Meet in hotel lobby to travel to Oregon DOT Region 1 Office, Conference Rooms A&B  
123 NW Flanders – Portland, OR 97209

8:30 – 9:00 **Welcome, Introductions and Background**  
*Mark Sarmiento, FHWA and Carson Poe, Volpe Center*

9:00 – 9:15 **Overview and Update of PEL**  
*Gina Barberio, USDOT Volpe Center*

9:15 – 10:30 **State DOT Roundtable Discussion**  

- What do you want to leave with?
- Overview of each state's PEL and GIS activities
- How has your state coordinated for PEL-related GIS data / what applications are in place?
- What are your state's needs/challenges?

*Break*

10:45 – 11:45 **Oregon DOT Demonstration/Presentation** – Environmental Data Management System (EDMS) builds upon and maintains environmental GIS inventory established in the Salmon resource & Sensitive area Mapping Project (SR-SAM). Program data is stored centrally on agency Intranet and available agency wide via desktop and web based mapping tools. Data is used in Geo-Environmental, Maintenance and Planning sections of Agency. The EDMS Program works extensively with other agencies via agreements to foster interagency data development. Current initiatives include development of field data collection tools for archeology data and a web based "No Effects" screening tool for biologists.

*Lunch*

1:00 – 2:00 **Florida DOT Demonstration/Presentation** – Efficient Transportation Decision Making (ETDM) process links land use, transportation, and environmental resource planning initiatives through early, interactive agency and community involvement. Efficiencies gained by two screening steps and a permitting process built into the transportation planning and project development process.

*Break*

2:15 – 3:15 **Discussion 1** – Identifying existing transportation and environmental GIS data

- What has your state done or would it like to do?
- What are lessons to remember / pitfalls to avoid?

3:15 – 4:15 **Discussion 2** – Accessing resource data

- Has GIS data cooperation with regulatory agencies been achieved? If so, how? If not, why not?
- Who manages environmental GIS data for the state? How is this evolving? Do you have inter-agency agreements in place for GIS data?
- What issues have arisen? How have they been addressed?

**Friday, October 5**

8:00 Meet in hotel lobby to travel to Oregon DOT Region 1 Office, Conference Rooms A&B

8:30 – 9:00 **Day 1 Re-cap**

9:00 – 10:00 **Discussion 3** – Using GIS data effectively in planning  
• What applications are in place and how were they developed?  
• How is your state using GIS to link planning and the environment?

10:00 – 10:45 **Peer Exchange Wrap-Up**

10:45 – 11:00 **Closing**  
*Mark Sarmiento, FHWA*

## Appendix C. State DOT Outreach Questions

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Dear [NAME],

The FHWA aims to organize a Peer Exchange on the topic of using GIS to strengthen linkages between planning and environment, and we invite your state to participate! The Peer Exchange will convene practitioners wanting to know more about how GIS can strengthen the linkages with those who have had successes in this area.

We are contacting you because during a recent phone conversation with the Volpe Center regarding your state's activities relating to Linking Planning and NEPA, you and/or others in your state expressed a desire for more information about the use of GIS in Linking Planning and NEPA.

If your state is interested in participating in the potential Peer Exchange, we would like to solicit your help in putting together a useful and informative agenda. Please take a moment to respond to the following questions:

1. Which specific topics or questions would you like to see discussed? Please rank by preference (1 = most interest)
  - a. Documenting existing transportation and environmental data from resource agencies and other sources
  - b. Achieving cooperation with resource agencies and other owners to access environmental data, including inter-agency agreements
  - c. Developing software tools that allow for information to be overlaid and analyzed for transportation impacts, and to be shared among and within agencies during transportation decision processes, including web access and ability to record comments and decisions at multiple points
  - d. Using the data effectively in a planning process
  - e. Convincing upper management to invest in GIS
  - f. Other (Please explain)
2. Which states have exemplary GIS practices for strong planning and environment linkages that you know of?
3. Do you have any other suggestions or concerns?

If you can send a reply, including whether or not your state wishes to participate, by [DATE], that would be greatly appreciated!