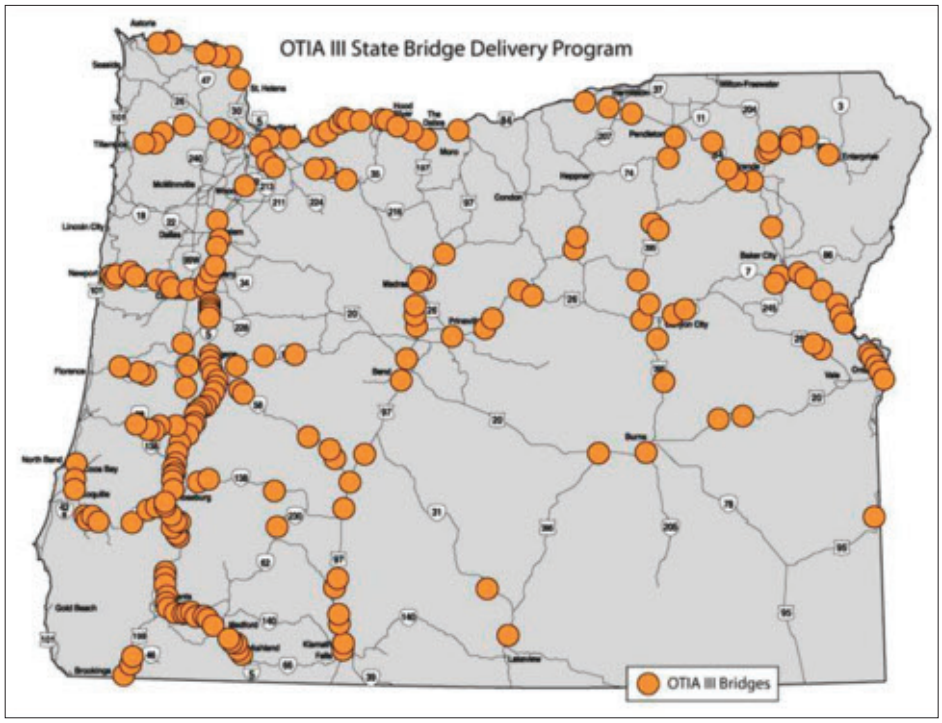
Esri News
for Transportation
Summer 2012

GIS Keeps Traffic Moving during Large-Scale Bridge Repair Project in State of Oregon

By Matthew DeMeritt, Esri Writer

With 12 percent of US bridges declared as structurally deficient by the Federal Highway Administration in 2006, bridge repair remains a top priority of most states. Three years before that, an extensive investigation of Oregon's bridges conducted by the Oregon Department of Transportation (ODOT) found that 365 Oregonian bridges had structural problems that necessitated a large-scale bridge repair plan. Implementing that plan required the department to improve its GIS infrastructure and integrate a new traffic modeling application to ease congestion at multiple construction zones along the state's highway system.



↑ The Oregon Department of Transportation's OTIA III State Bridge Delivery Program is a 10-year, $1.3 billion program to repair or replace hundreds of aging bridges on Oregon's highway system.

Oregon Transportation Investment Act

From 2001 to 2003, Oregon passed a series of funding packages called the Oregon Transportation Investment Act (OTIA I, II, and III) to improve its highway infrastructure. After an investigation that identified 365 bridges in critical need of repair in 2003, ODOT set aside a large portion of OTIA III funding to fix those bridges before Oregon's freight network felt the effect of enforced closures. For the OTIA III State Bridge Delivery Program, ODOT turned to engineering consultants Oregon Bridge Delivery Partners (OBDP), a joint venture between HDR Engineering and Fluor Corporation, to oversee the task of managing the program. One of the primary goals of the program was to reduce the impact on commuter and business traffic during large-scale construction on its road system.

Many of the bridges designed during the early development of Oregon's highway system used a reinforced concrete deck girder (RCDG) design specified in the regulations of that time. As specifications became more stringent in the 1960s, Oregon transitioned to prestressed and post-tensioned concrete bridges that improved structural integrity at a reduced cost. Despite this, many RCDG bridges remained in service past their expiration dates and predictably began to show signs of deterioration on deeper investigation. "In 2001, ODOT inspectors noticed that cracks identified in previous inspections had grown to the point of threatening structural stability," said Jim Cox, assistant manager of major projects at ODOT. "We immediately placed load restrictions on these bridges and started discussion on how to plan repairs with the least impact on commercial and commuter traffic."

GIS and Geodesign

Established in 2004, ODOT's GIS comprised the department's information sharing →

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Welcome

Terry Bills
Esri Industry Manager
Transportation and
Logistics

I recently attended two events that left a strong impression on me. The first was our Second Esri European Aviation GIS Summit, held at Brussels International Airport (you can read a synopsis at http://bit.ly/ISlxl9). A majority of Europe's major airports professionals, along with a number of the European Civil Aviation staff, were in attendance, all presenting their latest developments with Esri technology. It was heartening to see the progress that these agencies have made as more and more of the day-to-day operations of these airports become integrated with GIS. The first day's presentations were from the airports themselves, while the second day was devoted to the European Civil Aviation and the EUROCONTROL initiatives in support of the next generation of air traffic control system—SESAR—in Europe.

The Spanish airports, Amsterdam's Schiphol Airport, and Brussels and Manchester airports are all well on their way to enterprise systems, with GIS supporting workflows across the various divisions at their respective airports. At the same time, many of these airports and civil aviation administrations are being called upon to deliver GIS-based data relating to their airports, which will form part of the infrastructure for the new GPS-based air traffic control systems. As the composition of our summit illustrated, aviation air and land data requirements are certainly beginning to merge.

But by far, the major topic of discussion at GIS-T was the rapid movement of many agencies to the cloud. The Utah DOT's enterprise portal sits on ArcGIS Online for organizations, and a large number of DOTs are beginning to put their public-facing traveler information websites in the cloud for quick scalability and greater flexibility. You will see much more on this in these pages in the coming months.

Enjoy.

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Esri Aeronautical Solution—Airports GIS Package Version 2 Improves Data Quality

The Aeronautical Solution—Airports GIS Package version 2 is now available for download from the Aeronautical Solution Resource Center. This updated offering expands the number and types of preconfigured automated validation checks to include checks used by the Federal Aviation Administration (FAA) during data submission as well as critical and noncritical attributes.

Esri Aeronautical Solution—Airports GIS Package is a software suite specifically developed to help US airports and the consultant community meet the requirements of the FAA Airports Surveying—GIS program. Version 2 includes more than 300 preconfigured validation checks developed from the FAA-18B specification, enabling airports to improve their data quality and better comply with FAA review.

For more information regarding Esri Aeronautical Solution—Airports GIS, visit esri.com/airportsgis.

GIS Keeps Traffic Moving during Large-Scale Bridge Repair Project in State of Oregon

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→ infrastructure to plan and manage roadway projects. To integrate with ODOT's GIS, OBDP designed its system on the same ArcGIS platform for flexibility and scalability throughout the project life cycle and beyond. "We wanted easy adoption of tools and practices to smooth transition during project closeout and ensure usefulness beyond that," said Robb Kirkman, GIS services manager for HDR Engineering. "GIS provided the foundation to start linking program systems, automate tasks, and better mitigate environmental impacts."

Before shovel hit dirt, ODOT collected comprehensive environmental data on more than 400 of its bridge sites to identify nearby environmental resources. Standard ODOT practice involves consultation with experts such as biologists, wetland specialists, and archaeologists to get a better understanding of the effects of construction zones in ecologically sensitive areas. "We took a different approach for the OTIA III bridge program by conducting environmental fieldwork before we did any design," said Cox. "In ArcGIS, we drew a box around a bridge site and identified all the resources inside the box. This allowed the engineers to develop designs that minimized impacts on the surrounding environment."

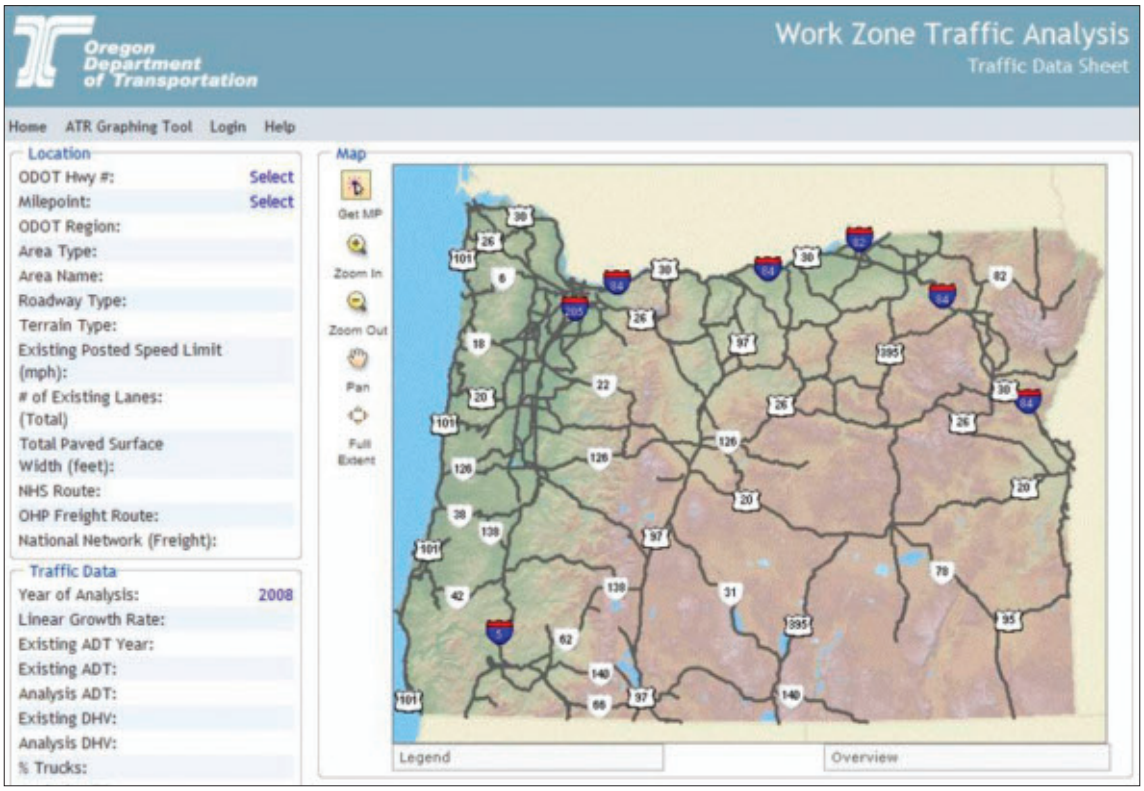
Work Zone Traffic Analysis

Prior to its collaboration with OBDP, ODOT had been using spreadsheets containing traffic counts and automatic traffic recorder information from across the state to document and predict traffic impacts for its various road construction projects. That process could take up to four hours for each scenario because data had to be searched and collected from multiple databases within the agency and then inserted into a spreadsheet. "Gradually, that process evolved to incorporate GIS processes," Kirkman said. "Using macros and automation tools in ArcGIS, ODOT's traffic group was able to automatically populate the spreadsheets with information from the database."

Although much leaner, the spreadsheet-only approach experienced crashes as the database grew ever larger. The traffic team worked with OBDP on a more efficient GIS-based method for running traffic scenarios—one that tightly wove ODOT's geospatial data into a dedicated web-based analysis tool. Using common protocols, the team worked on tying the department's datasets together to give ODOT staff direct access to the department's databases from a single interface. Called the Work Zone Traffic Analysis (WZTA) tool, the application allowed traffic scenarios to be run and shared in a web browser.

WZTA serves as a repository for information on traffic and road data that can be accessed and queried in a browser. The system allows users to view ODOT data to determine the effects on mobility created by lane closures related to construction and roadwork. Today, the department can run traffic scenarios in a matter of minutes, eliminating redundancy and enabling ODOT engineers to modify traffic plans on the fly.

Using a GIS-based interface also improved accuracy by allowing the ODOT analysts to select the location and information for a specific project site from the map itself rather than tabular lists. "Lookup tables using numbering systems aren't intuitive to all users," Kirkman said. "GIS enabled users to find exactly what they were looking for and verify the correct project information within a more appropriate map-based user interface where spatial relationships are more obvious."



→ WZTA and the team that developed it won a 2007 Team Excellence Pathfinder Award from the American Association of State Highway and Transportation Officials.

← The Oregon Department of Transportation repaired the Snake River Bridge on Interstate 84 as part of the OTIA III State Bridge Delivery Program, which will repair or replace hundreds of aging bridges across Oregon.

← As part of the OTIA III State Delivery Program, funds were dedicated to replace the Interstate 5 Willamette River Bridge in Eugene, Oregon. Construction began in May 2009, and the project will be open to traffic in 2013.

Economist Documents Return on Investment

In 2010, ODOT and OBDP documented their experience with the tools to evaluate the impact of ODOT's investments and determine their use after completion of the bridge program. With the assistance of economic consultant Mark Ford, they analyzed every piece of software OBDP created for the OTIA III bridge program to determine the economic benefits and cost to the department. The study concluded that ODOT experienced a combined benefit-cost ratio of 2:1 for all enterprise IT investments related to management of the bridge program.

"ODOT's GIS infrastructure alone returned a [benefit-cost] ratio of 3:1," Ford said. "Integration of formats and standards proved to be important in generating value from the investment."

In addition to these tangible benefits, ODOT experienced three types of intangible benefits that could not be measured. Migrating the data from disparate sources into a unified system allowed OBDP to program consistent analysis methods and reduce the risk of calculation errors. The centralized database also made it easier for ODOT to maintain data integrity and reduce the potential of analysts from different locations working with outdated information. "Systems like ODOT's GIS infrastructure generate accurate, consistent, and timely information for reporting and responding to inquiries," Ford said. "WZTA and GIS in particular have resulted in improved coordination with other agencies and interest groups, increasing the credibility of both ODOT and the bridge program in the eyes of the public and the legislature."

At the beginning of 2011, 351 of the 365 bridges in the OTIA III bridge program were free of construction zone delays. WZTA played a primary role in expediting the construction process by allowing the team to run lane closure traffic analyses in minutes as opposed to hours. The tool is now being used by ODOT on other roadway maintenance and construction projects to quickly determine impacts from lane closures across the state.

Esri on the Road

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Berlin, Germany
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A Look at the Michigan Department of Transportation's Lane Mile Inventory

Cory Johnson and Kevin McKnight, transportation planners at Michigan Department of Transportation (MDOT), discuss developing a GIS-centric lane mile inventory (LMI) to collect and maintain MDOT's lane mile assets. This interview was originally published in the United States Department of Transportation's *GIS in Transportation* newsletter.

What is the history of the LMI?

MDOT, like many other departments of transportation, has struggled with the best method to collect and maintain an LMI. In the past, MDOT Central Maintenance would ask each of MDOT's seven regions to submit annual lane mile totals based on ongoing projects and estimated future construction. But without a system to accurately track these assets based on ongoing operations, it did not take long for numbers to stray from reality. Inaccuracies would force expensive system reviews, which sometimes contained inconsistencies themselves. Additionally, MDOT had multiple lane mile inventories that met slightly different business needs.

In 2009, MDOT leadership decided to search for a new solution that would function as the sole resource for lane miles paired with a process to govern the inventory. MDOT's Asset Management Division was tasked with developing a solution that would meet MDOT's needs to responsibly manage its 9,652 miles of state highway.

What is the purpose of the LMI?

The primary purpose of MDOT's LMI is to provide a critical centralized resource that supports MDOT in delivering annual maintenance and capital funds to MDOT regions (each of which receives a certain amount of maintenance funds per lane mile that it manages).

MDOT defines a lane mile as one mile of roadway that is designed as a driving lane. This straightforward definition was intended to provide a concise starting point and a clear methodology for completing field collection of inventory within one season. As the LMI continues to mature, the definition will be expanded to account for the complex nature of maintaining roadway networks.

Where is the data stored?

The foundation of the LMI is the Michigan Geographic Framework [MGF] centerline GIS file. The centerline file and linear referencing system are maintained by the Michigan Department of Technology, Management and Budget's Center for Shared Solutions [CSS], with funding and staff support provided from MDOT. MDOT's Asset Management Division staff teamed up with CSS to develop routines to migrate the data forward to match ongoing LRS [linear reference system] updates as needed. Syncing the LMI with the MGF allows

↓ PR Finder Application Showing the LMI

data to be centrally stored via Esri's ArcGIS for Server technology, thereby enabling broader accessibility.

How was the inventory completed?

The initial LMI was developed by modifying a copy of the MGF state highway centerline file, enabling it to host the required business data for the LMI. This required data included fields such as number of lanes, lane miles, maintenance responsibility, and a "field checked" date. Two staff members from the Asset Management Division then verified the accuracy of the GIS database in the field.

Once MDOT had established business logic for what constituted a lane and how information would be collected, it only needed a state vehicle, a laptop, ArcGIS for Desktop, and a "hockey puck" GPS receiver. Using this equipment, the two-person crew was able to collect information on the entire lane mile system in one summer season.

How is the inventory maintained?

After MDOT completed its initial investment in collecting the entire system, the LMI entered an ongoing maintenance mode. During this phase, data [was] loaded into an ArcGIS for Server instance. In addition, an official contact person was established within each MDOT region. This contact is responsible for providing Asset Management Division staff with information about any ongoing operations that impact the total number of lane miles. This information provides the specific →

"The LMI will continue to serve as a model of how to develop a GIS-centric solution to meet the larger goals of an organization."

Cory Johnson, MDOT

A Look at the Michigan Department of Transportation's Lane Mile Inventory continued from page 7

→ location data necessary for Asset Management staff to field verify each location and update the LMI as needed.

This "honest broker" role that the Asset Management Division played allows the LMI to function as one consistent resource for MDOT to use in its annual budgeting process.

How does staff access the LMI?

Staff members have several options for accessing the LMI to support their daily duties.

Provided they are on the state network, staff can access the LMI via any Esri desktop GIS software. They can also view the inventory via the PR Finder web application, which is available at www.mcgi.state.mi.us/prfinder. Staff can view the inventory in spreadsheet format broken down by geographic and maintenance responsibility summaries.

How has the use of the LMI benefited MDOT?

The new LMI has provided a reliable process for updating MDOT's inventory, a central resource for information providing statewide consistency, and a means for governing the program. It has resulted in a better use of resources and staff time. It has also enabled MDOT to better compare costs per lane mile across the department and between contract agencies, leading to effective, data-driven business decisions.

The LMI will continue to serve as a model of how to develop a GIS-centric solution to meet the larger goals of an organization.

What were the critical success factors?

The most critical success factor was the fact that MDOT leadership mandated and supported changes to a long-standing program. Leadership also helped encourage staff members to adopt the new LMI solution. Another essential factor was the fact that Michigan had a robust GIS centerline file maintained through CSS. Finally, it was critical to develop partnerships between Asset Management, Central Maintenance, and regional staff.

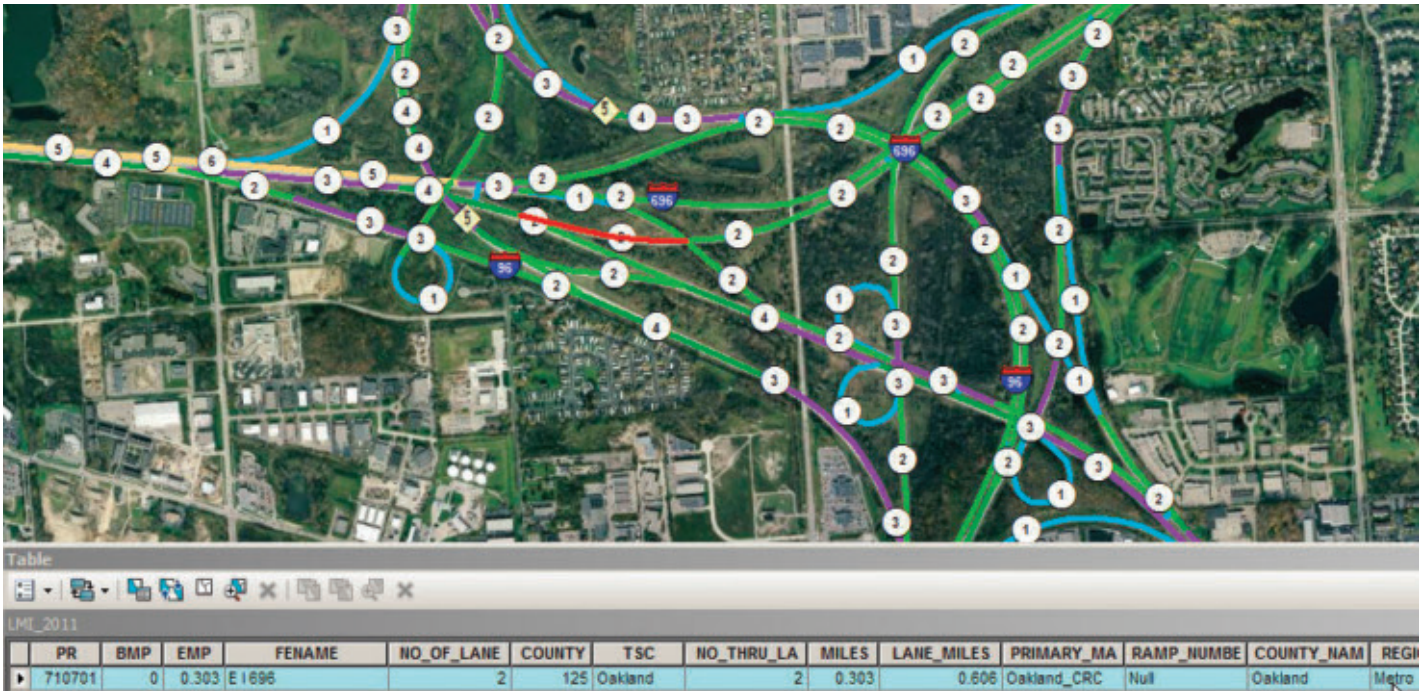
What are future plans for the LMI?

The MDOT staff will continue to improve the LMI's ability to account for difficult issues such as parking, bike lanes, and highway shoulders. There are also ongoing efforts to create a work order-based web solution for the LMI that will take greater advantage of ArcGIS for Server technology and related map services. MDOT is laying the groundwork for implementing an enterprise asset management system; the LMI is one of over 60 databases already loaded into ArcGIS for Server. In 2012, MDOT expects to make some critical decisions regarding enterprise asset management software. This will help to chart a solid and exciting course for the LMI and related asset inventories while ensuring that the LMI remains as a critical resource in the budgeting process.

Get more information on the LMI:

Cory Johnson (e-mail at JohnsonC45@michigan.gov or call 517-335-2931)

Kevin McKnight (e-mail at Mcknightk@michigan.gov or call 517-241-4548)



↑ LMI Displayed in ArcGIS for Desktop

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Bulgarian Railway Network Management Is Streamlined with GIS

"By implementing ArcGIS, NRIC has a modern system that provides access to actual data about the railway network and its ownership throughout all levels of the company."

Erol Mustafov, Bulgarian National Railway Infrastructure Company

Located in the heart of the Balkan Peninsula, the Republic of Bulgaria plays a crucial strategic role for Europe because of its location. It is a transportation crossroads between western Europe, the Middle East, and the Mediterranean, as well as an external border for the European Union (EU). In addition, four international land transport corridors pass through its territory. All these factors make the development and maintenance of the Bulgarian transportation network a critical priority, not only for Bulgaria but also for the Balkan Peninsula and Europe as a whole.

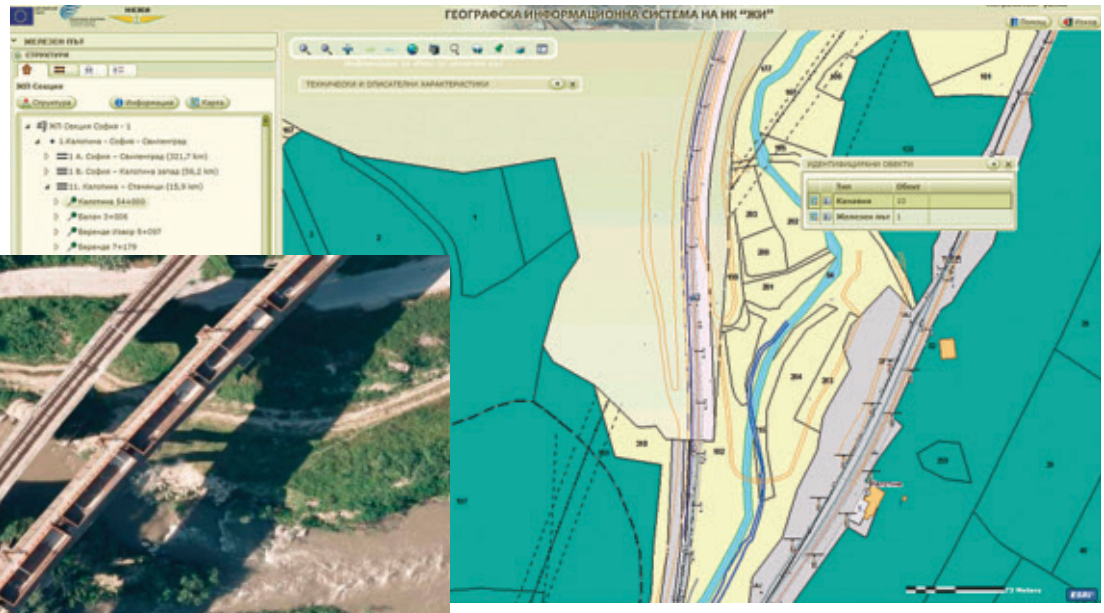
The Bulgarian railway network consists of more than 4,000 kilometers of railway lines, a significant number of which coincide with international transportation corridors. Because of the diverse nature and topography of the country, there are more than 180 spectacular railway tunnels, 970 railway bridges, and 840 grade crossings along the railway network.

To fulfill the needs of Bulgaria's current market economy, as well as those of Europe and the European Union, the Bulgarian railway network is being modernized and developed—a complex task within the responsibilities of the Bulgarian National Railway Infrastructure Company (NRIC)—as much of the railway's infrastructure was built in the middle of the twentieth century.

NRIC is one of the significant economic structures in Bulgaria, with assets worth hundreds of millions of euros. Established by the Bulgarian state government on January 1, 2002, NRIC assumes the management of the entire railway network located in Bulgaria. As the infrastructure manager of the Bulgarian railway, NRIC must comply with Bulgarian requirements for effective management, modernization, and development of the railway network, as well as with EU standards. It also has the obligation to synchronize the information systems of the company with those in other EU countries—a step toward building a common EU spatial infrastructure.

For these purposes, NRIC must collect all the descriptive and spatial information about the railway network and property and other relevant data and implement a centralized integrated information system. For the establishment of a comprehensive GIS, NRIC began a project called Design and Implementation

↓ An orthophoto map with 10 cm resolution of the railway infrastructure of Veliko Tarnova City (Image courtesy of NRIC)



↑ An ArcGIS web application provides information about the railway infrastructure together with cadastral data.

of Geographic Information System for NRIC's Needs. Esri Bulgaria Ltd., Esri's distributor for that country, was the selected contractor—a company with more than 16 years of experience in implementing most of the biggest national GIS projects in Bulgaria.

Activities on the Design and Implementation of Geographic Information System for NRIC's Needs project started in May 2009 and ended in November 2010. NRIC's GIS is based on ArcGIS and is designed for collection, accumulation, storage, transmission, and analysis of spatial and descriptive information about the railway infrastructure, property, ownership, and other relevant data and to provide conditions for improving the operational, commercial, and financial management of the company.

NRIC's GIS provides access to a centralized database with geospatial parameters of the railway infrastructure with the ability to identify its objects and establish their location in space, as well as perform geoanalysis and effectively manage infrastructure operations. This is particularly important for the company, as it helps in providing services to railway operators, emergency response, carrying out planned repairs, and modernization of railways.

The GIS includes two major subsystems: Railway, and Cadastre and Property Register. Each subsystem has both a desktop and web part. Furthermore, digital drawing archive and administration modules were developed. All these components are closely integrated and used together. NRIC is planning to add other subsystems in the future.

ArcGIS provides capabilities for monitoring, evaluating, and analyzing sites and infrastructure facilities to integrate staff responsibilities and address strategic and operational tasks. By improving the management of the railway infrastructure, significant economic performance is achieved.

The system improves the processes for asset management (rail infrastructure and property) and ensures attainment of rail transportation standards in the European Community by introducing modern geospatial information technologies. Moreover, it gives the company the capability to manage cadastral data and technical infrastructure using NRIC's intranet.

GIS supports operation, maintenance and repair, inventory, inspection, investigation and planning, analysis and reporting, decision making, property management, and other workflows.

NRIC's GIS offers many advantages, including quick access to integrated information from different sources, effective management of information in real time, strong analytic capabilities, prioritization of efforts in planning and maintenance, multiple options for information display, and implementation of international standards and models. Being able to rely on Esri Bulgaria's expertise in GIS design and implementation is another benefit.

By implementing ArcGIS, NRIC has a modern system that provides access to actual data about the railway network and its ownership throughout all levels of the company. In addition, the ability to generate various types of reports results in improved planning and management of the company.

The implementation of GIS in NRIC helps improve the quality and efficiency of railway structure management and creates conditions for economic growth. The system gives NRIC an advantage in achieving long-term objectives for sustainable development and modernization of the national transportation infrastructure.

For more information, contact Erol Mustafov, MS, head of the GIS Unit and project manager, NRIC (e-mail: erolmustafov@rail-infra.bg), or Stefan Tchapkansky, technical marketing, Esri Bulgaria (e-mail: stefan@esribulgaria.com).

Florida Department of Transportation on the Map

Department's District 4 Turns to ArcGIS for Better Project Management

By Karen Richardson, Esri Writer

Florida Department of Transportation (FDOT) is in charge of a vast network that includes trains, planes, automobiles, and boats. Almost 120,000 miles of state highways and local roads, more than 700 aviation facilities, 14 seaports, and five active launch facilities are maintained by FDOT to keep the state bustling.

To effectively manage the transportation system, ensuring people and goods can move safely while preserving the lush environment of Florida, FDOT divides the workload between its central office, located in Tallahassee, Florida; seven districts that cover different regions of the state; and one turnpike enterprise, a business unit of FDOT that covers most toll roads in the state. Each district creates and maintains a five-year work program that details specific maintenance and upgrades to roads, bridges, rail lines, and other capital investments of the transportation system.

To get a better idea of the health of the many projects open at any given time, FDOT's District 4 developed a sleek, easy-to-use computerized dashboard connected to a central repository of georeferenced information. Every capital project—and its associated data—is available to FDOT project managers whenever they need it. From this application, created using ArcGIS, project managers have access to more than 100 transportation-rich georeferenced datasets including proposed designs, construction plans, as-built drawings, and straight-line diagrams that are relevant to their projects.

Location, the Common Ground

Any given project has a vast array of information, from scope and schedule to roadway characteristics, asset inventory, as-built construction plans of the existing structure, financial and contractual information, and project location, to name a few. Historically, there has been no central system that maintains this information. Instead, project managers continually navigate between different project databases for financial and contract data and request hard-copy as-builts and diagrams from other departments as they are needed. Gathering information that can be helpful but is not normally collected for a project, such as sidewalk locations, bus stops, school zones, and property ownership, is also difficult. Assembling the data needed for just one project can take hundreds of man-hours.

"There is one element in common between these disparate systems—location," said José Theiler, program services administrator, FDOT District 4. "The only way to relate projects and all the data that is needed is with location-driven information managed with GIS."

FDOT has hundreds of layers of geographic information available to staff. Location information specific to projects is captured through a roadway identification number that is found between every milepost on the freeway. In the case of bridges, the actual geographic coordinates of the structure are used. Staff use ArcGIS to manage all the spatial information from a pool of floating licenses. While most geographic information is stored in one geodatabase, staff also maintain separate geodatabases of project-specific data.

To make this decentralized information easier to access by anyone at District 4 who needs it, such as managers of nearby or adjacent projects and executive staff, Atkins Global was hired. Atkins is the UK's largest engineering and design consultancy and the world's eleventh-largest design firm. The firm worked with District 4 staff to create a project website based on ArcGIS called ProjectSuite. Now, approximately 200 District 4 staff members, including project managers, find, store, and analyze information for every project daily using the website.

ProjectSuite essentially aggregates all the data located in disparate systems and performs nightly data pulls, including from a mainframe located back in the central office in Tallahassee. The most current information from these sources is updated in a single Microsoft SQL Server data warehouse at District 4 and accessed through ProjectSuite.

ProjectSuite Provides a Destination to Access Information

ProjectSuite opens to an easy-to-use dashboard application built on .NET using ArcGIS API for Microsoft Silverlight/WPF. The main screen of ProjectSuite is divided into different panes—the top pane allows the project manager to search for projects of interest, the left pane shows the project manager a list of all the projects that have been assigned to him or her, and a project tree in the top center of the screen allows the manager to set up specific options for each project and type in the project number to see more detailed information.

Once a particular project is selected, all the information available for that location is displayed. This information includes the roadway segment ID, project descriptions from the mainframe, and financial information including key performance indicators (KPIs) based on the project budget and schedule.

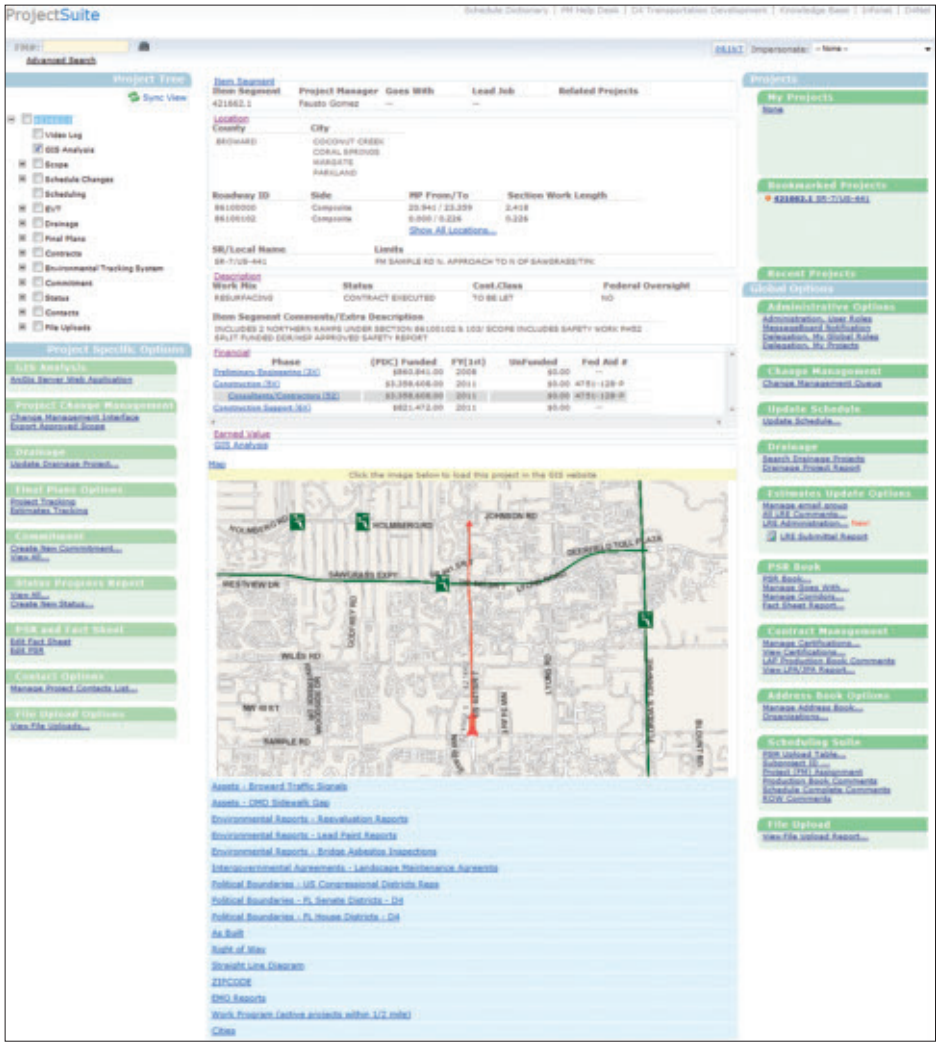
After this displayed data, a list of modules that gives the manager access to databases that are relevant to each project is shown. One of these modules is called Project Impacts, which is how the GIS data is accessed. The interface to this module is an interactive map that displays every active project as a point on the map, along with the boundaries of all the projects. The map and data in this module come from District 4's GIS portal that is built on ArcGIS for Server.

"This interface gives project manager[s] a frame of reference for where their project is," said Manuel Alayon, software development manager at Atkins. "We call this module Project Impacts because it provides information about what is around their projects and allows them to see external factors that may need to be considered for their project completion."

Under the map is a section that shows other information that is tied to certain locations—either roads or bridges—so the project manager can access this easily. Documents such as straight-line diagrams are scanned and stored on a file server and tied to the roadway segment. With a simple click on the segment, the diagram can be opened.

Driving Efficient Projects

ProjectSuite is used throughout the district for many purposes, from denoting which manager



↑ ProjectSuite maps help engineers and executives avoid logistical conflicts.

oversees a particular project to understanding the scope of the project and its development progress. Instead of engineers sorting through thousands of stored, hard-copy as-built plans, all plans from the 1940s to the present have been digitized and are now easily accessed by a click of the mouse. Like with as-built plans, engineers would spend hours sifting through paper maps that contained right-of-way information for each project. Today, access to all this information is quick.

The Project Impacts module has proved to be particularly valuable. By alerting engineers to projects that are close to their own project, issues can be discovered that may impact construction. For example, it would not be practical for two projects next to each other to build at the same time due to staging and sequencing of construction and traffic maintenance. These activities may conflict to a point that roads get completely shut down, something that FDOT tries very hard to avoid.

Tracking location information is obviously much easier using a map. For example, if water is not draining properly on a project, instead of tracking information in a database by typing in the name of a project and making the best guess of where that location actually is, it can now be viewed on a map and the issue noted. After resolution, the data in the database can be updated, and this in turn updates the map. A map showing where and when projects are planned also provides opportunities to save costs associated with resources like fill dirt and heavy equipment that could be more easily shared between nearby jobsites. It is in this way that Project Impacts helps project managers and executives work together more easily to avoid conflicts and realize efficiencies during construction.

"ProjectSuite has become a fundamental tool in the everyday life of staff here at District 4," said Theiler. "The GIS interface makes this a complete package for decision making by a project manager, executive, or anyone around the district."

Making Data Meaningful

The success and functional richness of ProjectSuite prompted the FDOT central office to adopt District 4's dashboard approach for project management throughout the organization. This enterprise effort is the ProjectSuite Enterprise Edition. "The dials and easily customized interface make this application something that people can use easily," said Alayon. "Some can get overwhelmed when they see all the information at once. With ProjectSuite and ProjectSuite Enterprise Edition, beginners can handle a small image and a table of information. More advanced users can move to the map, edit it, and generate reports."

It is with the fluidity of the system that ProjectSuite caters to both audiences, allowing someone to see everything at once or dig around. The important aspect is that users can choose how they view the data—either a portfolio thumbnail of all projects, a graphic representation of certain items such as a critical path diagram for a project's schedule, or even analysis services for the entire data warehouse. "We have a ton of information," said Theiler. "Now we can take all that data and make it mean something, because it is all tied together by location."

For more information, contact José Theiler, PE, FDOT District 4 program services administrator, at Jose.Theiler@dot.state.fl.us or 954-777-4402.

Perth Airport Flies High with Geospatial Intelligence

Australian Airport Gains Enterprise-Wide Access to Location Intelligence Tools

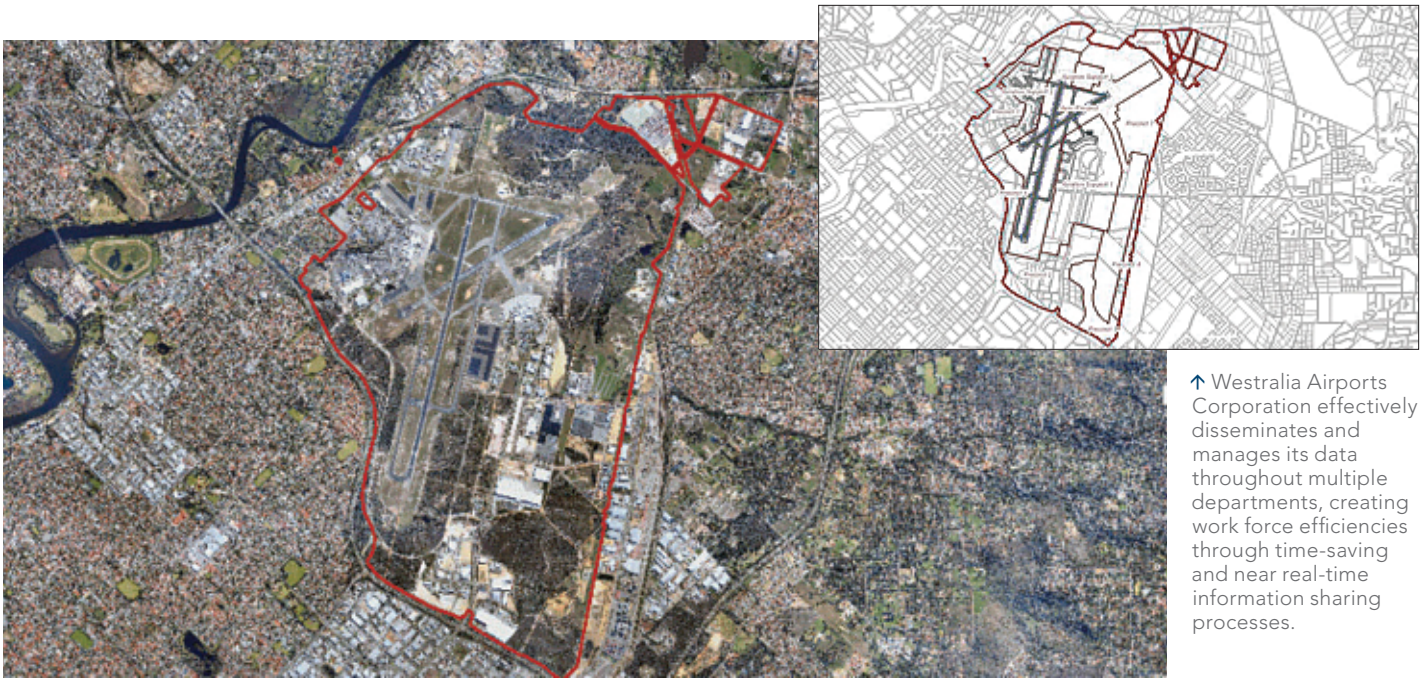
"Location intelligence is vital in planning the airport infrastructure for the construction or relocation of services and the maintenance of airport assets."

Fiona Lander, Westralia Airports Corporation Pty Ltd.

Strategically located in relation to Southeast Asia, Europe, and Africa, Perth Airport is Australia's fourth largest airport in terms of passenger traffic. Under a 99-year lease arrangement with the commonwealth government, the airport is operated by Westralia Airports Corporation Pty Ltd (WAC). The Perth Airport estate encompasses more than 2,100 hectares and is the premier international, domestic, and regional gateway to the state of Western Australia.

Western Australia is home to a strong economy led by natural resources, and since Perth is Australia's most isolated capital city, Perth Airport is a critical infrastructure component in the state. The airport has recently experienced the highest passenger growth rates of any Australian capital city airport, reporting a 7.5 percent increase in passenger numbers for the 2009–2010 financial year. More than 10.4 million passengers traveled through Perth Airport in 2009–2010, and total passenger movements per year are forecast to more than double to 18.9 million by 2029.

To meet this growth projection and prepare for the expansion of terminal facilities, WAC sought to gather more data across the airport estate, taking multiple safety and security, operational, environmental, customer service, commercial, and service infrastructure factors into account. WAC wanted to be able to integrate data from this range of complex interrelated areas and understand how the location of various factors was influencing their use and constraints.



↑ Westralia Airports Corporation effectively disseminates and manages its data throughout multiple departments, creating work force efficiencies through time-saving and near real-time information sharing processes.

To achieve this, WAC required a solution that provided more enhanced spatial information management. During the research and investigation process, WAC contacted Esri Australia Pty. Ltd., Esri's distributor in Australia, which had developed a technology that could help Perth Airport find a corporate-wide location intelligence solution, and the two companies decided to work together on the project.

The team's key goals were to create a solution using ArcGIS technology that would do the following:

- Provide a single authoritative source of spatial information
- Add value to the business and decision-making processes
- Improve efficiencies in repetitive or complex tasks
- Provide an intuitive way to locate information held in business systems
- Ensure that adequate and reliable technology is deployed to support location-based systems and business activities

At the heart of WAC's location intelligence solution was Esri GIS and Dekho software, which was developed by Esri Australia. Based on ArcGIS, Dekho helps WAC integrate information from databases that have a location element, including property and asset management. The software enables WAC to effectively disseminate and manage this data throughout multiple departments, creating work force efficiencies through time-saving and near real-time information sharing processes.

WAC is a significant service provider, managing the power, gas, sewer, water, fuel, drainage, and communications needs of two terminals and more than 200 tenants. It is also effectively the landlord, retail hub, and conservation authority within the Perth Airport estate. The corporate-wide solution enables WAC staff throughout the entire organization to access essential location-related data to support operation of the airport.

"Before we implemented GIS, all spatial information requests were submitted to the Design Office to generate the relevant maps and data," said Fiona Lander, general manager, Corporate Services. "This meant that departments did not have real-time access to information, and the Design Office could become bogged down fulfilling the myriad of simple requests rather than utilizing [staff] skills for design and spatial information management.

"Through the implementation of GIS, we now provide all staff with access to self-serve maps," Lander continued. "These can help with anything from planning the location of a new vending machine to scoping the environmental impacts of building a new warehouse on the estate. With so many stakeholders using location intelligence to get a greater insight into their working area, staff are better informed and therefore empowered to make better business decisions."

Beyond the ability to create maps and visualize where assets are, location intelligence is playing a major role in the planning and development of the expanding airport precinct.

"Location intelligence is vital in planning the airport infrastructure for the construction or relocation of services and the maintenance of airport assets," said Lander. "Through effective use of location intelligence, we will be able to move to a more proactive maintenance schedule and more efficiently allocate and plan resources, resulting in significant cost savings and a better-running suite of assets."

WAC has many more plans for using location intelligence at Perth Airport to optimize workflows and better understand the dynamic nature of the site, for example, further integration with the asset management and maintenance processes, detailed land-use reporting, enhanced utilization of location intelligence for operational activities, and mobile access to GIS.

Spanish Airports and Air Navigation Improves Aeronautical Charting

"Producing some aeronautical charts for the four runways at Madrid Barajas Airport took only one day instead of the traditional six it took before."

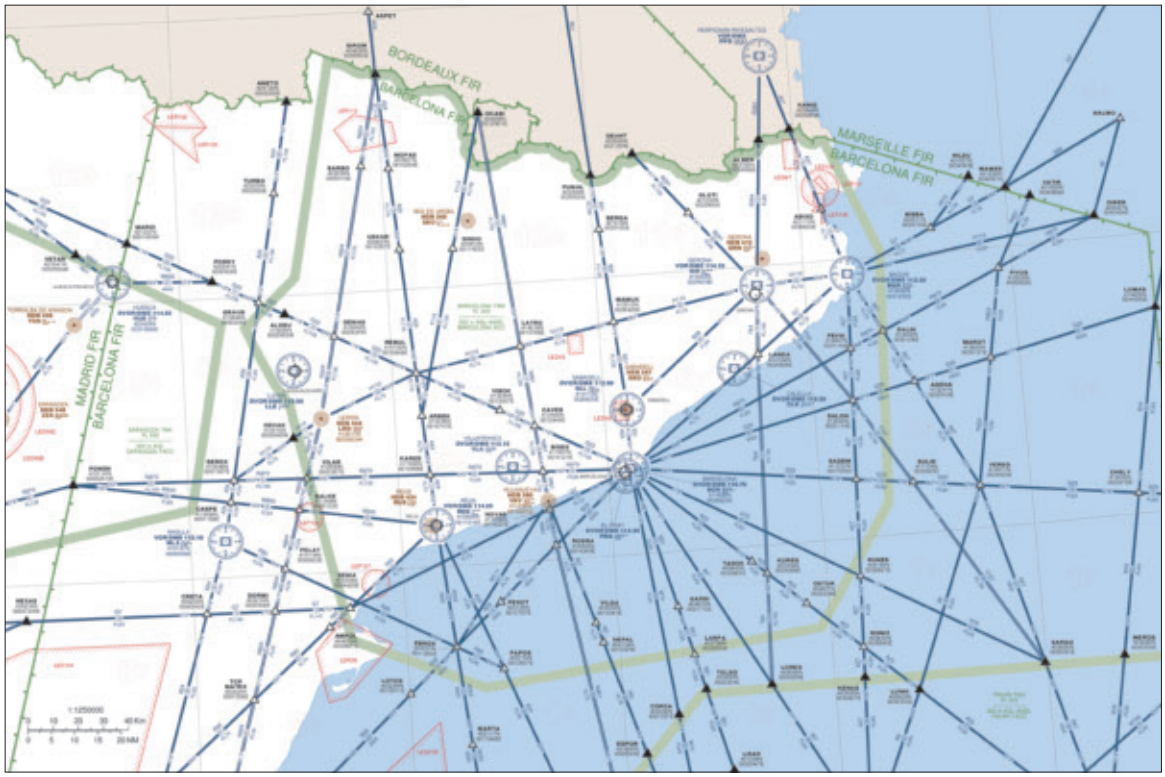
Javier Fenoll Rejas, AENA

More than 190 million passengers pass through airports in the country of Spain each year. Air transport in the country is managed by the Spanish Public Authority for Airports and Aerial Navigation (AENA), headquartered in Madrid, Spain. AENA's mission is to guarantee safe, fluid, effective, and economic air travel. The Aeronautical Information Service (AIS) at AENA is in charge of disseminating the aeronautical information that is critical for this safe and efficient air navigation for 47 airports across the country. This is accomplished by publishing several cartographic products.

AENA maintains 1,000 maps that are updated every 28 days. These maps are used for its AIS, which delivers air navigation and safety-related data to pilots flying in Spanish airspace. Typically more than 50 maps need to be updated every working week. A considerable amount of effort is spent on chart cleanup and quality check operations. Sometimes charts have to be delayed because of lack of time and resources.

Because airspace charts change so frequently, multiple charts are needed to cover each area. Different views of the same data need to be provided to cover the needs of different end users. This creates editing tasks that are often highly repetitive and quality processes that are very time-consuming to maintain coherence between all the products. These tasks make keeping up with the current map production cycle among the biggest challenges AENA faces. The organization is under constant pressure to ensure all products are accurate and up-to-date using the diverse information coming from various data originators.

Due to international agreements, there continues to be a need to produce and distribute paper printed aeronautical charts.



← AENA relies on ArcGIS and Esri Aeronautical Solution to create aeronautical charts.

However, there is a growing demand for access to digital products as well. AENA's legacy systems required separate systems for cartography and digital transmission of data in the industry interchange standard for aeronautical information, Aeronautical Information Exchange Model (AIXM) format. AENA lacked a true central database that could manage both requirements and needed a system to produce high-quality charts both digitally and on paper. The ability to post the charts on the web for publication was also a necessity.

After researching available solutions, the Aeronautical Information Division at AENA selected Esri technology as part of the agency's aeronautical information management system, named INSIGNIA. The technology implemented includes ArcGIS for Server Enterprise and Esri Aeronautical Solution. The technology solutions provide AENA with the flexibility it required to manage complex, critical aeronautical information in a spatial environment that is centered on an aeronautical geodatabase.

The system allows design, production, and printing of high-quality charts to AENA specifications, conforming to International Civil Aviation Organization (ICAO) standards. These charts include detailed instrument approach procedures, which are documents to be followed by pilots for a particular type of approach to a runway. Prescribed altitudes and headings to be flown, as well as any obstacles, terrain, and potentially conflicting airspace, are depicted. Standard Instrument Departure charts can also be created and provide flight crews with information to facilitate their departures from airports. Enroute charts provide detailed information that is used for instrument flight and include information on navigational fixes such as waypoints, intersections, standard airways, airport locations, and minimum altitudes for flight. The system also supports interoperable messaging using AIXM.

Publishing the data in a geodatabase makes it possible for AENA to use the Open Geospatial Consortium, Inc., standard technologies like the Web Feature Service (WFS) and provide maps and charts via the Internet without fear of users changing the data. This opens the door for a completely new range of products and services, allowing improved, more efficient, and safer use of aeronautical information. AENA is able to use this ability and transition from the productcentric services it provides today to the datacentric service of tomorrow.

The transition to GIS for data management and cartography was a major cultural shift for the organization. Despite this, AENA is already receiving benefits from its improved processes and workflows. For example, performing the obstacle analysis used to produce some aeronautical charts for the four runways at Madrid Barajas Airport took only one day instead of the traditional six it took before.

ArcGIS geoprocessing tools and geodatabase-centric map production have automated tasks and improved workflows, leading to reduced production hours and dramatically increasing cost-effectiveness by improving overall data management and usage. Aeronautical Solution has allowed high-quality cartographic products to be generated using more automation from the central geodatabase. This improves the coherence between products and allows AENA to create more tailored products that meet the specific needs of its clients. With the ArcGIS system, AENA has gained the flexibility needed to generate new cartographic products and deliver spatial services across the organization. It is able to do this with the same resources and is finding new commercial opportunities, creating a healthy business model.

For more information, contact Javier Fenoll Rejas at jfenoll@aena.es.

Reducing Roadway Fatalities and Increasing Public Awareness through GIS

By Brian N. Hilton and Thomas A. Horan

With approximately 40,000 automobile fatalities a year, traffic safety is a major public health issue. Unfortunately, alarming statistics like that don't always get the commensurate attention they deserve. While researching the role of information technology in making emergency response systems more effective, Claremont Graduate University (CGU) professor Tom Horan noticed that geographic information about traffic fatalities wasn't being used to its fullest potential.

"I've been working on a variety of research studies on health and transportation," said Horan, speaking from CGU's School of Information Systems and Technology (SISAT). "I started to think about the public health problem that these fatalities represent." Automobile accidents are the number-one killer of teenagers in this country. With the intent to increase understanding on this issue, Horan undertook a project to make US traffic fatality statistics accessible from an easy-to-use website.

SafeRoadMaps was developed by SISAT research faculty member Brian N. Hilton, who teaches classes in GIS solution development at SISAT, along with several SISAT students. Working under the technical direction of Hilton, the team created the SafeRoadMaps website, which offers a variety of features, including interactive maps that display for visitors where vehicular fatalities have occurred in their community. When visitors type an address or ZIP Code into SafeRoadMaps, the site displays information from state geodatabase records. SafeRoadMaps uses data from the Fatality Analysis Reporting System (FARS) provided by the National Highway Traffic Safety Administration for the years 2001–2010.

"SafeRoadMaps displays the key data on automobile accidents," said Horan. "Visitors can discover when the accident occurred, how people were involved, whether the fatality was a driver or pedestrian, and whether alcohol or some other inebriate was involved." The site also displays a photo of the location where the accident occurred. FARS contains data on all fatal traffic crashes within the United States where each case has more than 100 coded data elements that characterize the crash, the vehicles, and the people involved.

Since its inception in 2008, the SafeRoadMaps website has logged almost 12 million hits. It serves a variety of user types and needs and houses an expanding spatial database.

Horan observed, "ArcGIS for Server provides us with the ability to more easily integrate our growing quantity and variety of data sources, allows us to perform more complex spatial queries, provides advanced geoprocessing functionality, and facilitates the creation of map tiles on the fly. In addition, we're using ArcGIS Viewer for Flex for rapid user interface development, something that was time-consuming and unwieldy with the previous implementation."

SafeRoadMaps version 1 was publicly launched on July 28, 2008, and integrated a range of spatial data regarding motor vehicle crashes, transportation policy legislation, and driver behavioral data presenting a visual representation of traffic safety across the United States. SafeRoadMaps version 2 was launched on July 1, 2009, and extended this functionality to include national heat maps as a visual means for communicating the spatial density of traffic fatalities. Concurrent with the analysis and development of the national heat maps, the top 100 rural and urban hot spots were identified. SafeRoadMaps version 3 was launched on July 1, 2010, and included data for all years that contain georeferencing information and featured several new user-friendly interfaces for travelers, policy researchers, and analysts—My Travel, My Community, My State, and Analysis & Tools. Hot spot analysis was also extended across both spatial (rural/urban) and temporal (summer/nonsummer) dimensions.

The SafeRoadMaps site is part of a multiyear collaboration with the University of Minnesota's National Center for Excellence in Rural Safety (CERS). Lee Munnich, the center's director, noted that "SafeRoadMaps has provided an invaluable tool for communicating about the issue of traffic safety and raised national policy awareness to this public health problem."

While the site was created for public use, Horan has been approached by a variety of organizations, such as driver's education programs, about creating specialized SafeRoadMaps modules. Additionally, throughout its development, Horan has briefed James L. Oberstar, former US representative (Minnesota's 8th congressional district) and chairman of the House Transportation and Infrastructure Committee (2007–2011), who has also championed its use. Though Horan's research is novel and unique, he points out that it's on the continuum of the work that created the field of public health: "Epidemiology got its start when there was a cholera outbreak in London. An intrepid researcher named John Snow mapped the cases and discovered it was originating from a specific public water pump. What we're trying to do is bring that same sensibility—a map, a visual tool that can help people understand the problem of public safety—and improve upon it."

The maps have helped millions understand road conditions and prevent fatal car accidents.

For more information, contact Thomas A. Horan, PhD, professor, or Brian N. Hilton, PhD, clinical assistant professor, both at the School of Information Systems and Technology, Claremont Graduate University, 130 East Ninth Street, Claremont, California 91711 (phone: 909-621-8209, fax: 909-621-8564, e-mail: tom.horan@cgu.edu or brian.hilton@cgu.edu), or visit www.saferoadmaps.org.

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