Transportation GIS Trends

Esri • Summer 2011

GIS for Transportation

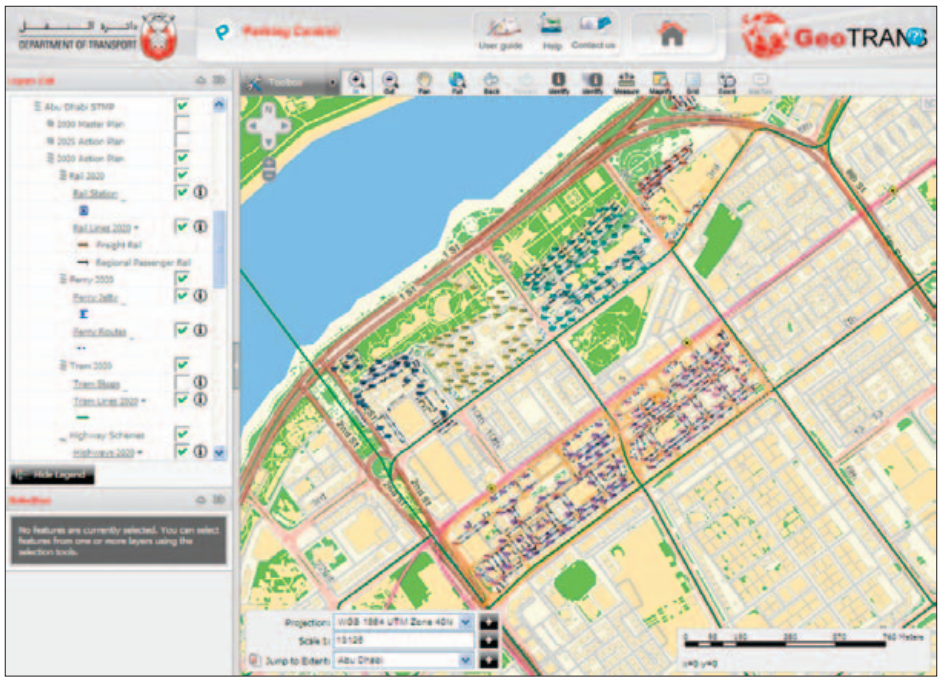
Abu Dhabi DOT Deploys Enterprise GIS to Serve Transportation Plans

By Saed Abu Helwa, Technical Director, GISTEC

On the coast of the Arabian Gulf rests one of the most modern and fastest-growing cities in the world, Abu Dhabi. The Emirate of Abu Dhabi has witnessed a huge growth in infrastructure and construction projects in recent years, such as the famous mega projects of developing the Yas and Saadiyat Islands into tourist and travel destinations.

The Department of Transport (DOT) is the organization in the Abu Dhabi government that's responsible for delivering an effective transportation system that contributes to the economic growth, quality of life, and environmental sustainability of the fast-growing emirate. DOT's authority is to regulate, plan, and develop an efficient and well-integrated transportation system that serves the public interest by enhancing mobility with safe, secure, and environmentally responsible travel in the aviation, maritime, public transport, and highways sectors.

As part of Abu Dhabi 2030 (the country's infrastructure plan), DOT needed to acquire, build, and implement the best GIS technology possible. Because Abu Dhabi's DOT is a fairly young organization, it has only recently adopted GIS. DOT realized that a robust GIS system was required to support the planning and daily operational and business needs of building, managing, and maintaining a state-of-the-art transportation network as well as new public transportation services.



The GeoTRANS web viewer displays the different parking types, such as premium and standard, within Abu Dhabi City.

DOT conducted an in-depth evaluation of the different GIS technologies before deciding on Esri's ArcGIS Server and Latitude Geographics Group Ltd.'s Geocortex Essentials technology. Based on the ArcGIS platform, Geocortex provides flexible core elements as well as out-of-the-box tools, processes, and features that would give DOT the ability to build and maintain an evolving web-based mapping solution. The project was awarded to GISTEC, the Esri distributor for the United Arab Emirates (UAE), in cooperation with GeoSolveIT, a United Kingdom company that is expert in building transportation GIS solutions.

Several key objectives were to be achieved by the completion of the project:

- Build the foundation transportation data model, infrastructure, and database for the GIS within DOT.

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In This Issue

On the Road

Visit Esri at the following conferences:

American Association of Port Authorities Annual Convention
September 11–15, 2011
Seattle, Washington, USA

International Highway Engineering Exchanges Program (IHEEP) Conference
September 11–15, 2011
Winnipeg, Manitoba, Canada

Transport Security Expo and Conference
September 13–14, 2011
Olympia, London, UK

GIS in Public Transportation Conference
September 13–15, 2011
St. Petersburg, Florida, USA

Railway Interchange 2011
September 18–21, 2011
Minneapolis, Minnesota, USA

POST-EXPO
September 27–29, 2011
Stuttgart, Germany

American Public Transportation Association (APTA) Expo
October 3–5, 2011
New Orleans, Louisiana, USA

American Trucking Association (ATA) Management Conference & Expo
October 15–18, 2011
Grapevine, Texas, USA

ITS America/World Congress
October 16–20, 2011
Orlando, Florida, USA

Airports Council International (ACI) World/Africa General Assembly, Conference & Expo
November 7–9, 2011
Marrakech, Morocco

Gulf Traffic
December 12–14, 2011
Dubai, United Arab Emirates

Talking Transportation

Terry Bills
Esri Industry Manager
Transportation and Logistics

Alexander Gerschenkron, the famous economic historian, once posited a benefit for those countries that come late to economic development: they could introduce the latest technology and thus jump over some of the standard development paths followed by their predecessors. Our lead story on Abu Dhabi Department of Transport (DOT) indicates that much the same analogy can be applied to GIS. In just a little over a year and a half, Abu Dhabi DOT has been able to achieve remarkable results.

Starting with a careful database design process, the DOT has been developing a comprehensive spatial data model designed to not only accommodate the requirements of each transportation mode but also provide a model allowing the integration of information across those modes. This data model is designed to manage and maintain all the DOT's tabular and spatial data and provide the underlying data infrastructure supporting all its subsequent business and operational workflows. DOT staff consciously examined the operational practices of leading transportation agencies and designed this architecture with great care. In this way, they were able to implement a number of successful systems in a very short period of time. A number of valuable lessons can be drawn from this example.

Several of the stories in this month's edition highlight the fact that GIS has now become an integral part of managing a modern transportation infrastructure. Whether capturing and cataloging the Navajo Nation's vast road inventory or alerting the public to real-time road closure information, GIS has become a central component of any strategy to more effectively manage a transportation infrastructure. Increasingly however, transportation agencies need to not only better manage infrastructure but also communicate their effectiveness to their citizens. Performance measurement, sustainability, and public accountability and transparency are critical components of responsive public agencies in the modern environment, and GIS can significantly add value to all these efforts. We will see more and more examples of these initiatives in coming issues.

In the meantime, I encourage you to enjoy this issue, and I hope that it will stimulate further thoughts in your own organization.

Terry C. Bills

Online

Visit us at esri.com/transportation.

Follow us on Twitter at twitter.com/esritransport.

You will find more news and information specific to GIS for the transportation industry in *ArcNews*, a quarterly magazine for the GIS community.
Visit esri.com/arcnews.

ArcLogistics Update Gives Drivers a Break

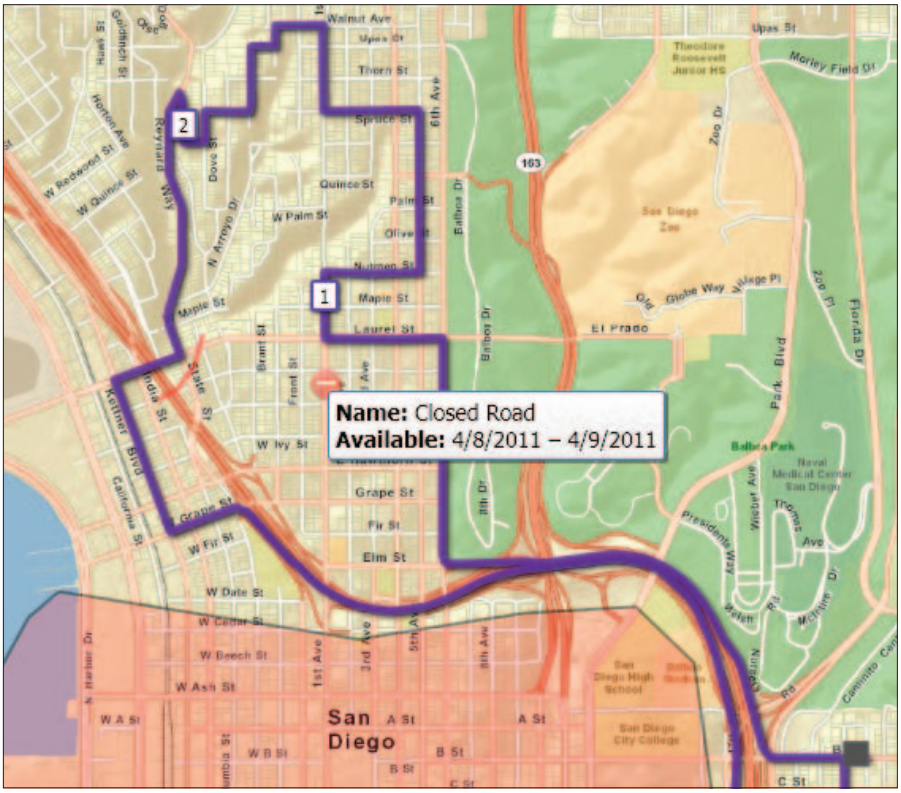
Thanks to a recent ArcLogistics update, users now have more options to create efficient route plans that reflect reality. New settings provide drivers with multiple breaks throughout the day such as 15-minute and 1-hour-lunch breaks. These new settings will help dispatchers better account for the actual time it takes to complete a route when creating the day's plan. Additional driver break settings include the ability to have breaks occur after a certain number of driving hours or after a certain amount of total work time.

Additionally, dispatchers can now build in actual arrival and departure delays. An example of an arrival/departure delay would be the amount of time a driver has to take to find parking or exit a large facility such as an apartment complex or corporate campus. The new arrival/departure delay settings are in addition to setting actual service times for each stop (once the driver or crew can actually start work) and help ensure that actual service time at each stop is being considered during route planning.

Because ArcLogistics is web based, Esri's development team is able to push these small, regular improvements to customers on a frequent basis.

Another improvement made to ArcLogistics is the inclusion of several new barrier types, including "slow-down" polygons that allow for tunable speed settings on all streets within the polygon. Dispatchers with local knowledge of a town or neighborhood can use the polygons to override speed limits on the streets within the polygon to better reflect vehicle speeds at certain times of the day.

To see a complete list of all the improvements in the recent update and to try ArcLogistics for free for 30 days, visit esri.com/arclogistics.



Create multiple barriers that affect your route, such as slow-down polygons and point barriers.

Case Studies Wanted

Share the benefits of your GIS work with colleagues by submitting case studies for future issues of this newsletter. Case study articles can be a full page or half a page, up to 800 words. We also like to include high-resolution screen shots or photography with the articles. To submit a case study article, contact Marshall Cammack at mcammack@esri.com or Terry Bills at tbills@esri.com.

Esri Career Opportunities

Are you looking for a career where you can apply your industry expertise in a challenging new way? Join Esri and help broaden the applicability of GIS in the transportation sector.

Solution Engineer, Commercial—Work closely with account executives to understand client requirements and help formulate appropriate GIS solutions.

Senior Project Manager, Transportation Services (Atlanta, Georgia)—Use your domain expertise to lead the development and growth of the GIS services business in the transportation industry.

Learn more and apply online at esri.com/careers.

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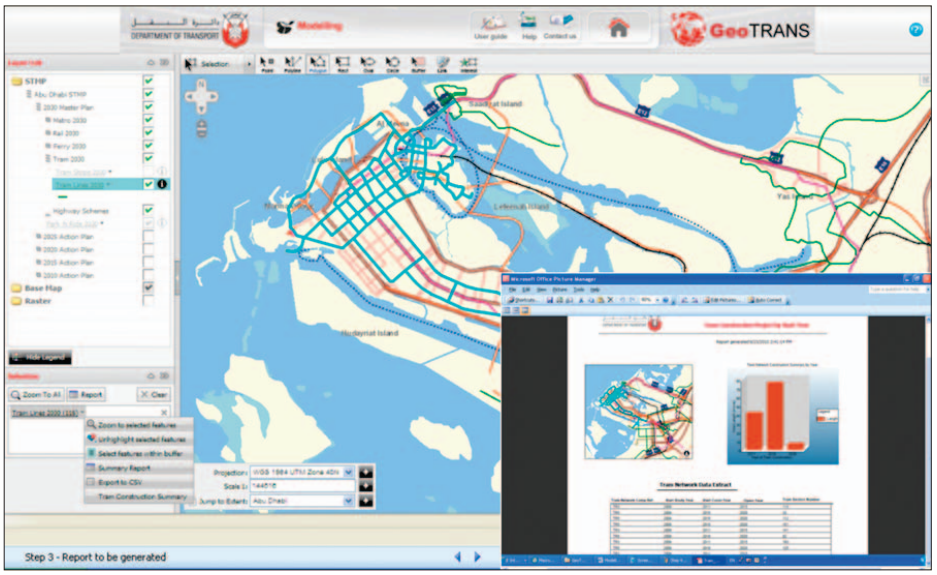
Abu Dhabi DOT Deploys Enterprise GIS to Serve Transportation Plans

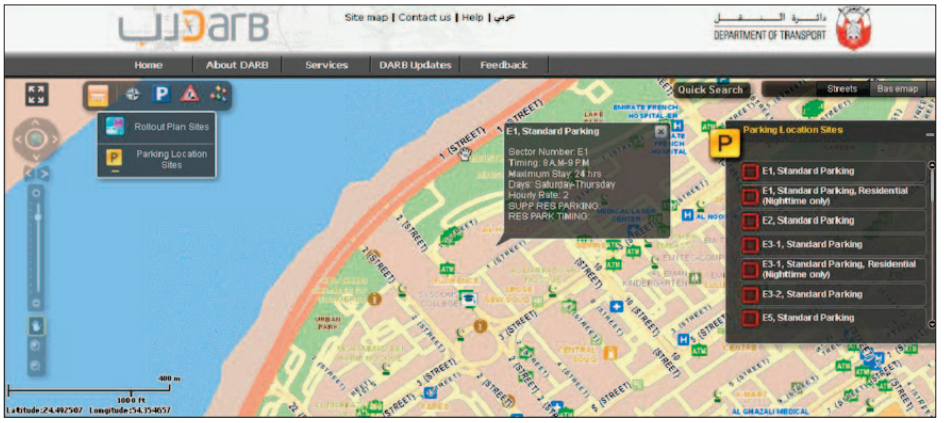
- Use GIS data for planning, design, construction, operations, and maintenance processes.
- Build a public Internet portal (DARB) to deliver services such as driving directions, bus route information, and road works information.
- Explore the capabilities to provide GIS services and data to Abu Dhabi government organizations via Abu Dhabi Spatial Data Initiative (AD-SDI).
- Identify the enterprise GIS road map for DOT, which would focus on building the platform to create and integrate GIS applications with other DOT business systems such as No-Objection Certificate (NOC), transportation impact studies (TIS), road works, and permits.
- Build GeoTRANS, an enterprise-level intranet portal that would provide accurate and reliable geospatial information and services to various DOT sectors such as surface, aviation, and maritime transportation.

In July 2010, the GeoTRANS system was launched on the DOT intranet to support all the organization's sectors and included an interface to the AD-SDI. The GIS was used to integrate the isolated datasets of different departments into a single geodatabase that encompasses Surface Transport Master Plan (STMP) data; the complete, emirate-wide road network; and information on parking, TIS, and accidents. Today, the GeoTRANS GIS portal is supporting and enhancing DOT's daily business in terms of planning, network operation, public awareness of road works projects, and much more. This project is an excellent example of fast-track implementation of a successful enterprise GIS for transportation in a place with the highest demands in terms of functionality and workflows due to the rapidly growing infrastructure in Abu Dhabi Emirate.

The following is a brief description of some of the services provided by the GeoTRANS intranet portal for DOT users:



Here, the GeoTRANS web viewer shows the proposed construction length of selected tramlines for each year.



With the DARB public viewer, citizens can see the parking areas in Abu Dhabi City with parking rates and time allowed.

Routes and driving directions are displayed in the DARB public viewer based on user choice of start and destination options.

Modeling Application

This application disseminates key information on DOT's 2030 Surface Transport Master Plan, a long-term conceptual transportation infrastructure strategy outlined for Abu Dhabi. A website contains information on the master plan and the respective five-year action plans (2015, 2020, and 2025). The site shows the planned conceptual locations for the metro, tram, rail, highway, park and ride, and ferry services. The website will be regularly maintained to show STMP updates. The website also has basemap layers and various useful and frequently referenced datasets, such as imagery

and other basemap datasets (e.g., highway routes).

Safety Application

This application currently contains road safety data, including summary information about accident hot spots. This is used to support engineers in visual analysis of the summary accident data.

Parking Application

This application provides users with information about parking locations and assets, both on- and off-street, including the DOT-managed parking facilities.

Transportation Impact Studies Application

The TIS application disseminates information concerning traffic count surveys. The site shows the location of proposals and the remediation/mitigation measures associated with a specific traffic study area. The application also has basemap layers and other useful and frequently referenced datasets, such as imagery and utilities, to support highway engineers.

Bus and Taxi Application

This application provides rich information about existing bus routes and bus stops as well as taxi facilities, including lay-by and stand locations. It allows users to analyze and manage data with respect to other activities in DOT and reflect the same on the public portal site for public use and dissemination.

DARB Public Portal

While GeoTRANS provided advanced tools and functionalities for the DOT's internal end users to access maps, tools, analytics, and reports, DOT envisioned its public portal, DARB (www.darb.ae), as the main gateway to share maps and services with citizens in the United Arab Emirates, using a fast and simple, map-based interface. All the services were planned and implemented in English as well as Arabic languages to cater to both the local culture and the diversified expatriate community of the UAE. Some of the main services that have been launched for the public are car travel, bus travel, aviation, maritime, and the DARBI (Geofeedback) applications.

The following is a summary of DARB transportation services offered to the public:

Car Travel

There is a wide range of services offered to the public in this application. It can help users find driving directions and parking areas, understand future parking plans, and locate roadwork and detours.

Bus Travel

The Bus Travel application can help users find bus routes within Abu Dhabi City, Al Ain, and Western Region as well as intercity bus services. Users can find the map displaying the complete bus route based on the origin and the destination options specified. Additionally, they can also discover the points of interest that are along the selected bus route.

Aviation

Many services are offered to the public in the Aviation application. It can help users find locations of and driving directions to airports and obtain parking and airport terminal information.

Maritime

This application helps users find the locations of and bus routes to ferry terminals from various parts of Abu Dhabi.

DARBI

Public users can use the map in this innovative feature in the DARB portal to record any incidents pertaining to road asset, parking, bus shelter, street lighting, and road conditions. Users can click on the map and choose the type of incident to be reported, enter all the required information about the incident, and even upload photos. Incident reports are sent to DOT's Customer Care department for further action. Once an issue is addressed by DOT, the user receives an e-mail with a link to open the Geofeedback map directly in DARB and see the status of the incident report.

For more information, contact Saed Abu Helwa, GISTEC (e-mail: Saed.abuhelwa@gistec.com).

The GeoTRANS intranet portal provides geospatial information and services for Abu Dhabi Department of Transport.

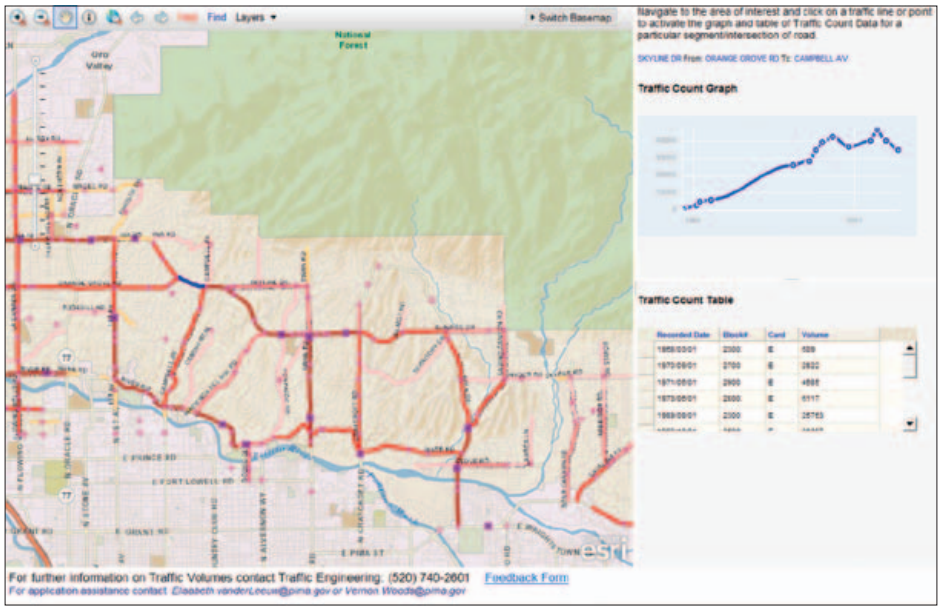
Visualizing Traffic Counts

By Elisabeth Van Der Leeuw, Senior GIS Analyst, and Ray Brice, Senior GIS Analyst, Pima County ITD, Tucson, Arizona

Pima County, Arizona, is located in the heart of the beautiful Sonoran Desert and is larger than the state of New Jersey. Spanish settlements in the area date to the late seventeenth century, and the Native American presence spans many thousands of years. Today, the county is home to nearly a million people.

In Pima County, the Department of Transportation (DOT) has maintained historic traffic counts on many of the road segments since 1968. With the help of the county's GIS group, clients such as government consultants, designers, Realtors, and the DOT's Traffic Engineering department will now have a more user-friendly interface utilizing some of the newer GIS and web technologies. The DOT Traffic Count Map serves traffic and intersection count data to the public as well as other agencies statewide.

The Pima County Courthouse is a landmark that is familiar to the county's nearly one million citizens.



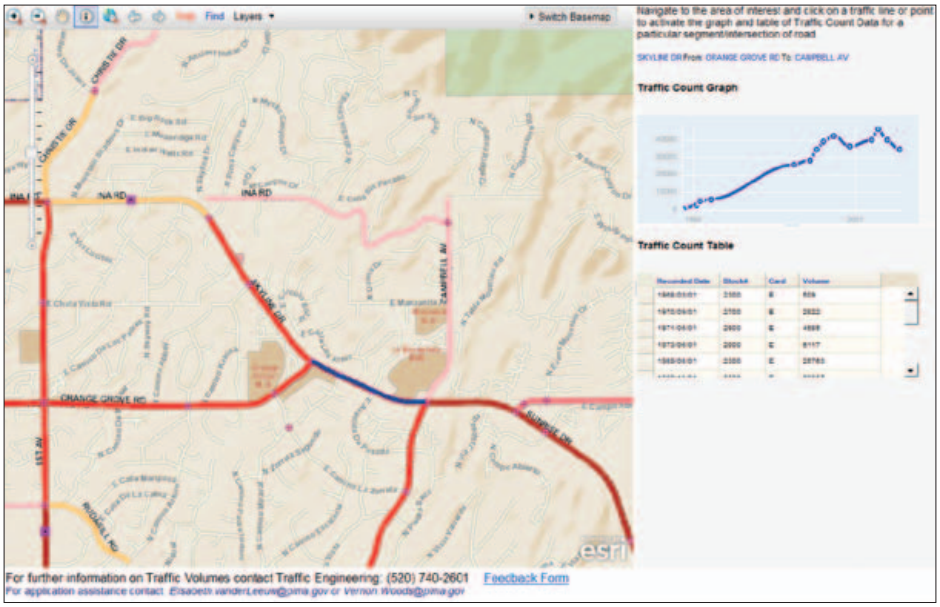
Pima County DOT's Traffic Count Map serves traffic and intersection count data via the web to the public and other statewide agencies.

The result is a highly interactive map displaying the county's most up-to-date traffic count data. The application gives users a visual context for traffic counts, both in terms of the general location of the count and the number of vehicles. It allows access to Pima County Traffic Engineering's historic traffic count data, displayed via an easy-to-interpret trend line with a corresponding tabular representation. The application (http://gis.pima.gov/apps/trafficcounts/dottrafficcounts.htm) is intended to serve traffic count data to both the public and internal users in an easy-to-navigate GIS application.

The web-based application, created using Esri's ArcGIS for Server, shows information such as major roads' average daily traffic and intersection approach counts. Information provided in the application helps users conducting engineering safety and traffic impact studies and determining which routes are used most and where new roads or new developments should be located. In the future, the application will also show minor-road average daily traffic counts as well as turning movement and crash data.

The new website is an improvement over the previous application, which provided static PDF documents showing road segments and average daily traffic counts. Typical users of traffic count data such as contractors, Realtors, and designers can now see the road segments spatially. In addition to the visual interface, the dynamic map also provides historic traffic counts for individual segments that graphically display trends.

GIS layers used in the map did not exist previously in the Pima County GIS library. The Traffic Engineering department maintains its data in SQL Server tables. A process was created to map the traffic count segments and intersection points using linear referencing. For this, some initial data cleanup was required to linearly reference the traffic count segments with the street route layer. During this cleanup process, GIS fields were added to traffic engineering data tables and populated with the same road name that is used in the street route layer, eliminating discrepancies such as misspellings and abbreviations. An automated nightly scheduled task is run to create the GIS layers, using a Python script to



Traffic Count Map is a highly interactive map application that displays the county's most up-to-date traffic data.

display route events.

The Traffic Count Map application was created using Esri's ArcGIS API for JavaScript along with a Dojo toolkit, used to eliminate browser idiosyncrasies. The JavaScript API was chosen due to the fact that it was free, plus it was the platform that was most accommodating to the level and experience of the developer.

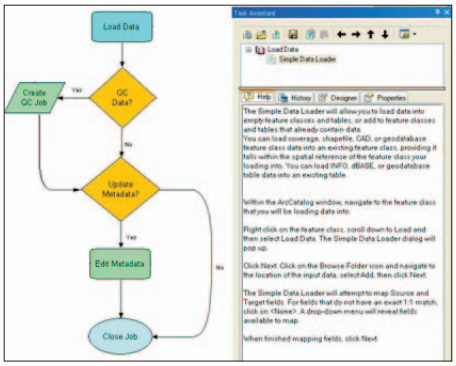
A dynamic optimized map service displaying the traffic count layers was created in ArcGIS Server. The layers were symbolized at various scale ranges according to the most recent count taken for each particular segment of road. Historic traffic counts were added as tables to the MXD, providing access to the data through the state's Representational State Transfer (REST) system. Several county basemaps containing various reference layers were also created to improve the performance of the application for a large number of potential users. A daily cache update process, based on changes made to dynamic reference layers, was put in place to provide timely updates that the county user base has come to expect. Dojo chart and table widgets were configured to display historic road and intersection traffic count data upon selection of the corresponding feature displayed in the application.

For more information, contact Denise Silvester, senior civil engineering assistant, Pima County DOT/Traffic Engineering (e-mail: Denise.Silvester@dot.pima.gov).

Esri Aeronautical Solution Supports FAA's Airports GIS

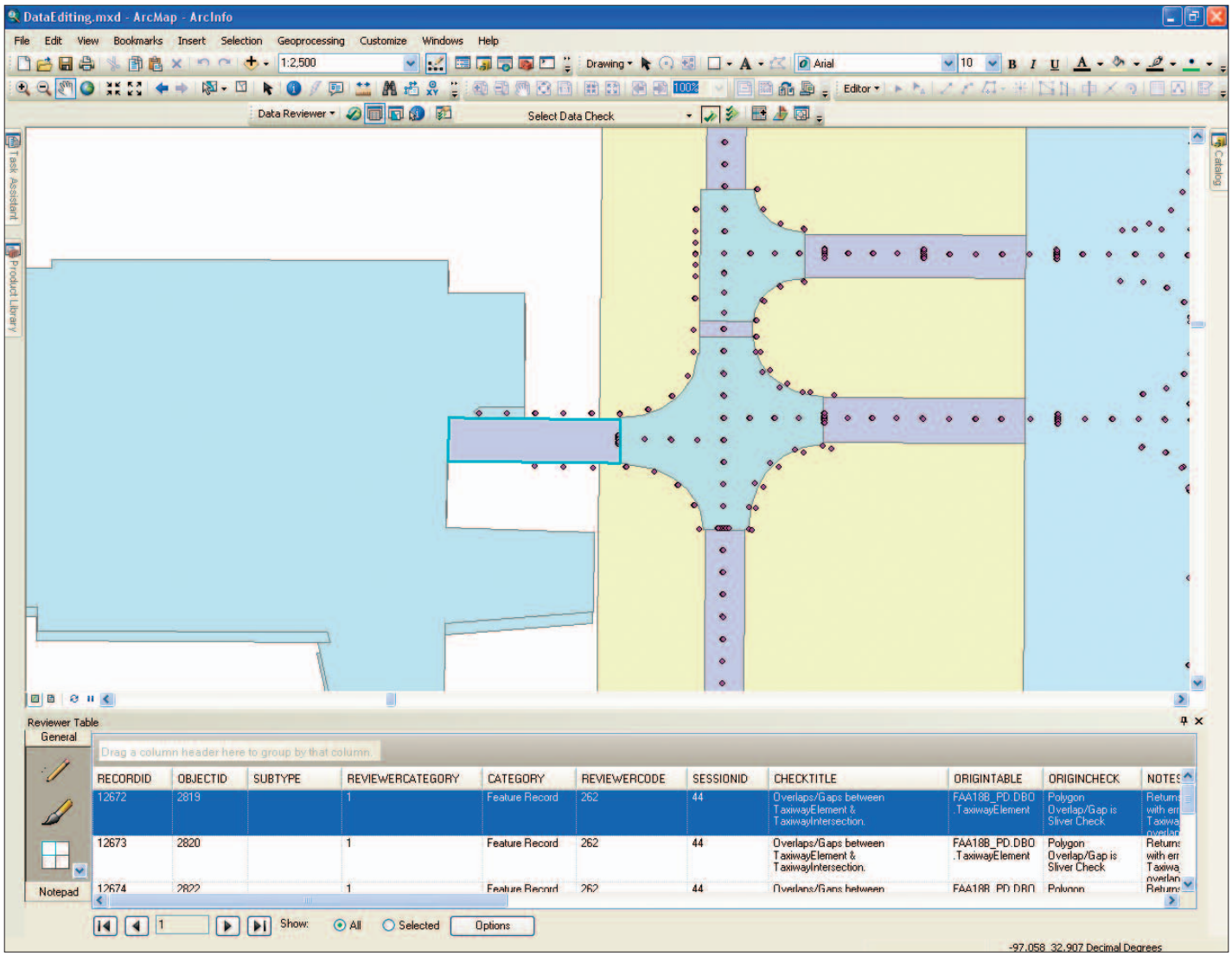
Geographic information continues to play a pivotal role in the planning, management, and operation of America's airports. Traditionally, for all new construction or capital improvement projects, survey crews would go into the field and collect data, providing their airport customers with deliverables such as CAD drawings, engineering diagrams, and paper as-built drawings. Storage rooms at airports have become filled with volumes of paper plots and documents, making it a challenge to quickly answer simple questions regarding the current condition of a particular structure or other feature at an airport.

When airports submitted new or updated plans to the Federal Aviation Administration (FAA) for approval, reams of paper drawings were printed and mailed between offices. By the time the documents were received and reviewed, weeks or even months often had passed. A more agile and efficient process, integrating the latest information technologies, was needed.

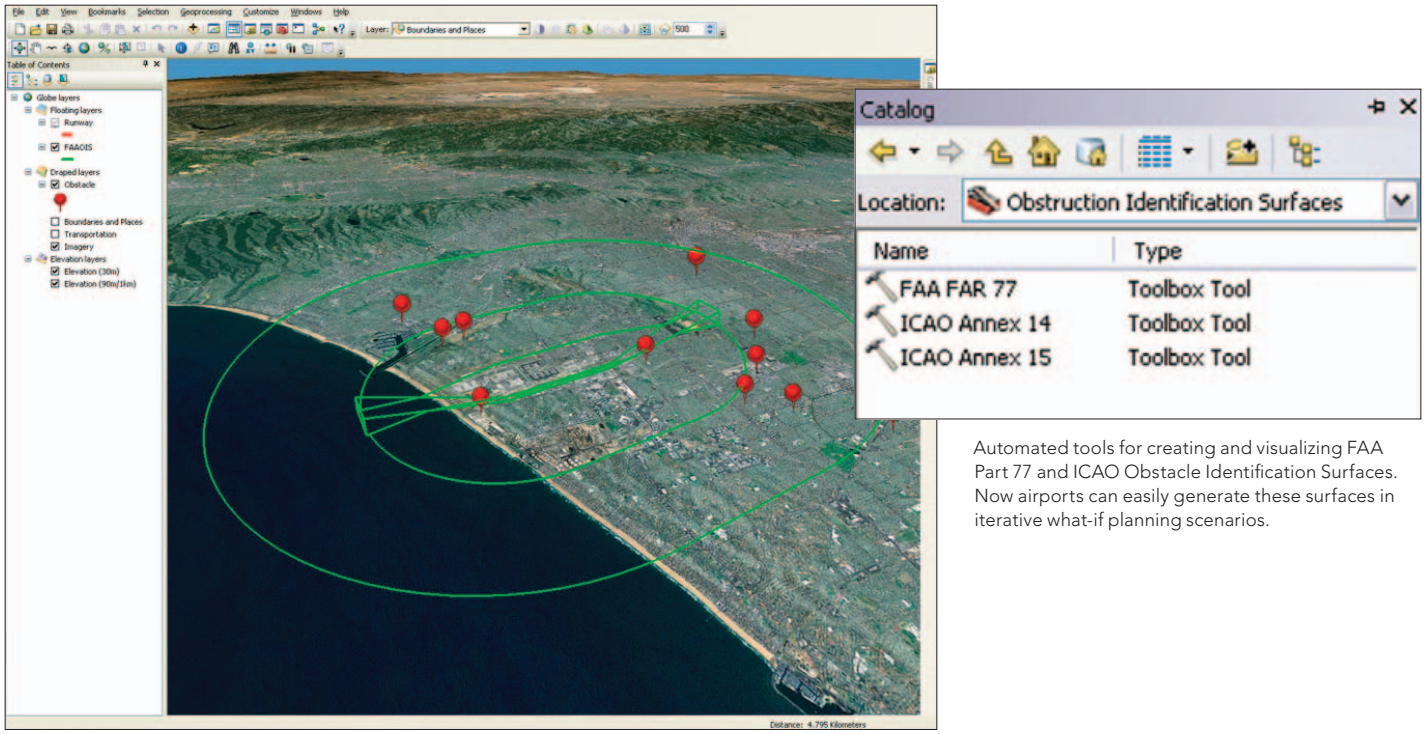


Automated tools for creating and visualizing FAA Part 77 and ICAO Obstacle Identification Surfaces. Now airports can easily generate these surfaces in iterative what-if planning scenarios.

In response to these and other issues, the FAA Office of Airports has begun to revolutionize the way it oversees and manages US airports. With the publication of Advisory Circular 150/5300-18B, the FAA has established a comprehensive digital data standard and road map from which the old "paper" way of doing business is out and GIS is in. This regulatory document forms the basis of Airports GIS, which will allow the FAA to collaborate and analyze current airport data to facilitate better decision making. The system uses consistent and accurate data that will be verified through a rigorous quality assurance process. Additionally, Airports GIS is



Automated data validation tools come with over 300 preconfigured checks developed from the FAA's 18B specification.



Automated tools for creating and visualizing FAA Part 77 and ICAO Obstacle Identification Surfaces. Now airports can easily generate these surfaces in iterative what-if planning scenarios.

a key enabler for the administration's next-generation Air Transportation System, also known as NextGen.

By establishing a single authoritative source for survey and mapping data for airports in the United States, the web-enabled Airports GIS database can be leveraged by both internal and external customers to assist users with regulatory and organizational requirements. Airports GIS will serve as the one-stop access portal to a variety of airport mapping and operations resources. Airports GIS will provide web tools for the creation of products such as electronic Airport Layout Plans (eALP). Airport airspace analysis and obstacles will be evaluated against design standards and used to assist in the establishment of instrument approach procedures. The Airports GIS infrastructure will provide the FAA with new and innovative ways to offer and use digital GIS data to improve and synchronize airport development, management, and operations activities.

To support these new capabilities, the Airports GIS database requires accurate and high-quality data. The FAA Office of Airports has produced a comprehensive suite of regulatory, procedural, and management guideline documents for collecting and submitting Airports GIS data. Supporting these guidelines, the Office of Airports and its partners will perform comprehensive validation checks on data submitted to Airports GIS as part of the review process. Airport sponsors and consultants face challenges in submitting quality data that complies with these regulations without the need for reworking.

While some airports have compiled and used GIS data for many years, a large number have never worked with digital geographic information. Whether familiar with GIS data or not, complying with these new federal regulations can be a daunting task. Because of that, Esri Aeronautical Solution now includes tools, templates, and workflows that have been developed specifically to assist airports and their consultants in meeting the data requirements set forth by the FAA's Airports GIS program.

Key Airports GIS capabilities that are available with the Esri Aeronautical Solution include the following:

- Preconfigured airport layout and map templates that can be used out of the box or easily customized to an airport's specific requirement
- Customizable workflows providing structured, step-by-step instructions incorporating software automation that simplify recurring tasks associated with preparing, reviewing, and submitting Airports GIS data to the FAA
- Automated data validation tools with more than 200 preconfigured checks developed from the FAA's 18B specification
- Preconfigured 18B data editing templates that make the creation and management of Airports GIS consistent and efficient
- Automated tools for creating and visualizing FAA Part 77 and ICAO Obstacle Identification Surfaces
- Ready-to-use 18B geodatabase template provided by the FAA that eliminates costly and time-consuming database design and helps to ensure consistency and compliance with 18B requirements

Esri is committed to its partnership with the airport community and supporting the FAA's Airports GIS program. As the program continues to mature and evolve, Esri will continually expand and update Aeronautical Solution support for this initiative. New tools and templates will be offered via download from the ArcGIS Resource Center (resources.arcgis.com/content/esri-aeronautical-solution/10.0/about).

For more information, or to ask questions regarding the Esri Aeronautical Solution or Airports GIS, contact aero@esri.com.

Charting the Roads That Connect the Vast Navajo Nation

Using GIS to Assess and Manage Tribal Transportation Infrastructure

by Emily Meyertholen, Esri Writer

Spanning approximately 27,000 square miles across three states, the Navajo Nation is the largest sovereign nation in the contiguous United States. It has a strong presence in US government and often leads the way in tribal efforts at the national level to promote key areas such as economic development, health care, and education. Despite its prominence, the sheer size and remote nature of the Navajo Reservation presents unique challenges in managing its infrastructure and resources.

Consider, for instance, the road inventory that tribes submit each year to the Indian Reservation Roads (IRR) program, which maintains the official inventory of reservation roads in the United States and is designed to allocate federal funding to tribal governments for transportation planning and road maintenance activities.

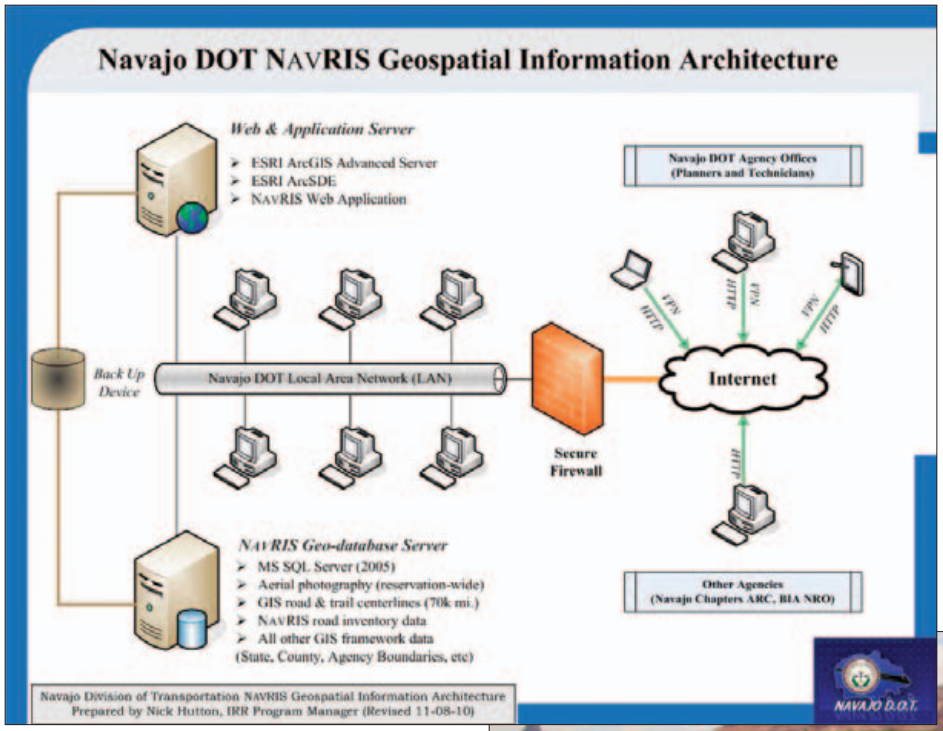
A component of the broader Integrated Transportation Information Management System (ITIMS) program, the Bureau of Indian Affairs (BIA) Division of Transportation (DOT) maintains the national reservation road inventory in the Road Information Field Data System (RIFDS). Each year, as part of the IRR program, tribes are eligible to submit their road inventory data to their BIA regional office. There are approximately 560 nationally recognized tribes within the 12 BIA regions. The Navajo Nation submits its road inventory to BIA Navajo Regional Office (BIA-NRO) in Gallup, New Mexico.

The original Navajo road inventory was far from comprehensive. In early 2006, the tribe's official RIFDS inventory contained approximately 9,800 miles of roads. Roughly 6,000 miles were BIA roads, and the remaining 3,800 were primarily state and county roads along with very few tribal roads. Navajo transportation officials determined that the road inventory was substantially underperforming in two key areas:

Road Mileage Quantity: The current inventory reflected only a small percentage of the reservation's tribal roads. It was widely believed that there were thousands of miles of tribal public roads that were eligible for the inventory but were not included.

Data Quality: Of the 9,800 miles of roads in the 2006 inventory, only a portion generated funding in the RIFDS allocation formula. Some roads in the existing inventory were missing key pieces of information, which excluded them from funding. Misinterpretations of program regulations resulted in a lack of quality data, exacerbating the effect of the low mileage numbers.

Near the intersection of the three states across which the Navajo Nation lies, Shiprock in New Mexico plays a significant role in Navajo history and tradition.



The NAVRIS Geospatial Architecture

To address these issues, in April 2006, the Navajo Division of Transportation launched a proactive and aggressive campaign that would expand its internal capacities, establish a systematic method for identifying eligible public tribal reservation roads, remove subjectivity from regulations, and build a system to improve both the quantity and quality of the road inventory data. With the support of the Navajo Nation Transportation and Community Development Committee (TCDC) and under the direction of former Navajo Division of Transportation director Tom Platero, the Navajo inventory team and consulting project manager Nick Hutton embarked on an innovative and challenging endeavor that would span more than four years.

The first step was to fortify the Navajo DOT's existing technology infrastructure. New, enterprise-class servers were put in place; network bandwidth was expanded; and new data was collected. The Navajo DOT implemented a spatially enabled, multitiered, web-based information architecture that was part of an integrated hardware and software solution provided by the INLINE Corporation (now IceWEB) and Esri. IceWEB servers were preloaded with ArcGIS Server Enterprise edition and Microsoft SQL Server and were preconfigured to optimize system performance. This saved many hours of work by allowing the Navajo project team to focus on developing core programs and data instead of testing and tweaking the new system.

The next step was to obtain and develop the required data. The project team was able to acquire brand-new, reservation-wide aerial photography that had been captured as part of a joint project between the Department of Interior and the State of New Mexico. Once the imagery was loaded onto the new system, it was time to start digitizing road centerlines.

Along with a team of GIS technicians using Esri's ArcGIS technology, GIS consultant and Esri partner Data Transfer Solutions (DTS) began the digitization process. It wasn't until this time that the team realized the full extent of the project. After several months of heads-up digitizing, the team mapped more than 70,000 miles of roads and trails. While not all of the digitized centerlines were eligible for the official IRR inventory, the potential challenges associated with managing these roads were daunting to DOT officials. This realization underscored the notion that automation would be an absolute necessity in the development of the Navajo DOT road inventory system. While the GIS techs continued the digitization process, the programming staff at DTS and the Navajo DOT project team were busy developing the inventory management system.

More than 70,000 miles of roads and trails are mapped in NAVRIS.

The team concluded that the system must be secure; web based; geospatially enabled; usable by staff members, both with and without GIS expertise; and capable of mapping automation—specifically, strip mapping automation. In addition, the team identified the need for a robust querying component that included bidirectional filtering between the map interface and the filtering page.

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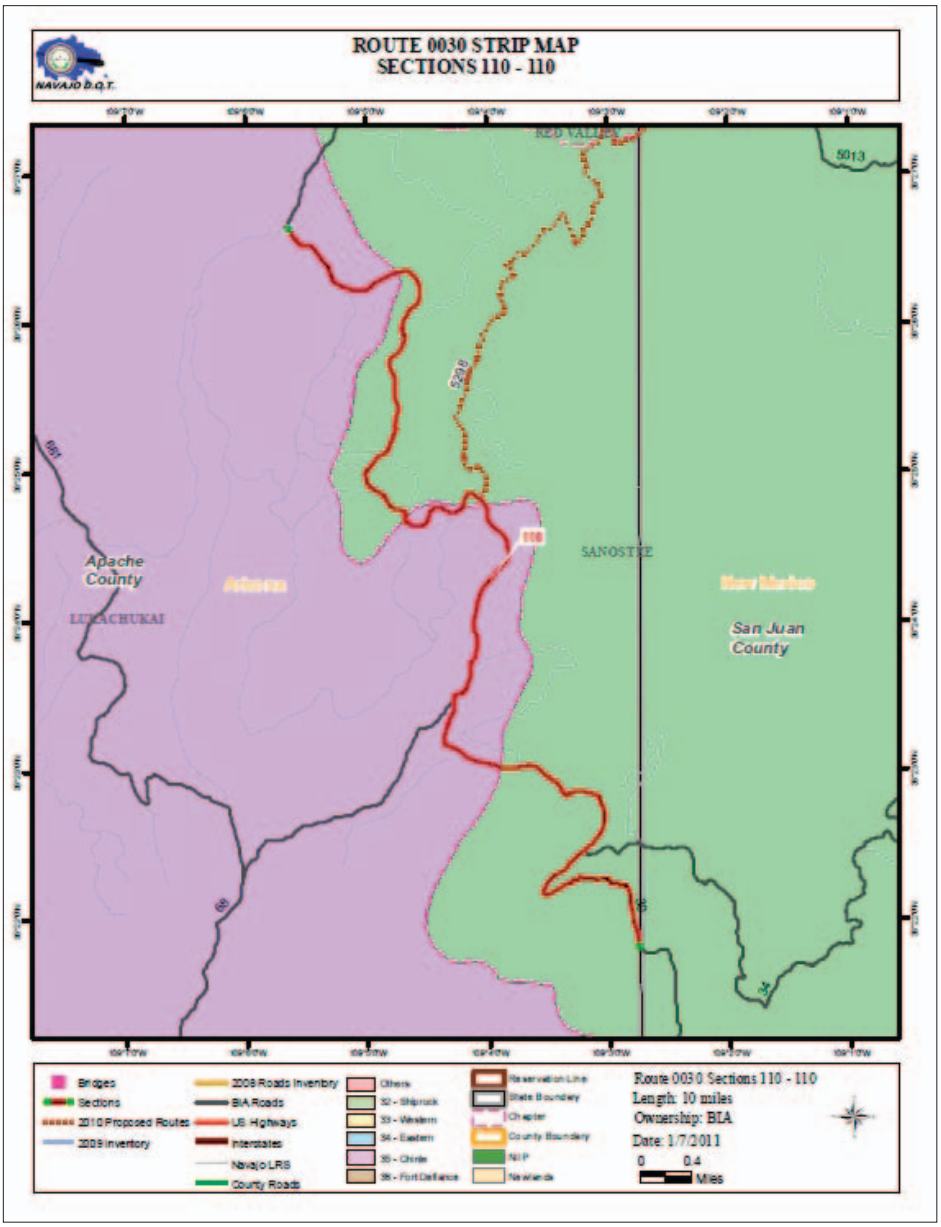
Charting the Roads That Connect the Vast Navajo Nation

What emerged was a system the Navajo DOT calls the Navajo Roadway Inventory System (NAVRIS). In addition to web, GIS, and automation capabilities, NAVRIS incorporates a series of validation scripts to ensure that the data is entered in accordance with program requirements.

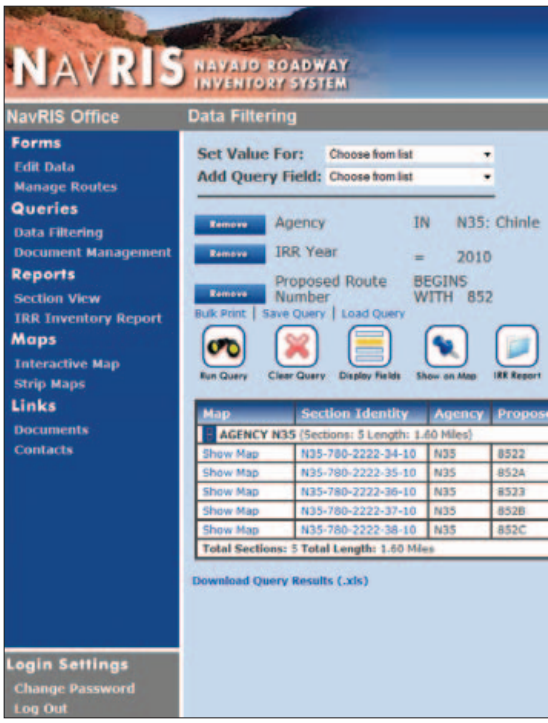
One of the most challenging aspects of the project was establishing consistent interpretations of the IRR program regulations between BIA-NRO and the Navajo DOT staff. This took many months of research in collaboration with BIA-NRO chief engineer Harold Riley and his staff. To the credit of both agencies, considerable common ground was established, and the findings were subsequently programmed into the core automation and validation logic of NAVRIS. As a result, the percentage of roads questioned by the BIA because of missing or incorrect data declined dramatically.

> To date, the Navajo Region has received a 15-fold return on the Navajo DOT's initial investment in the IRR project. This adjusted allocation will allow critical transportation infrastructure improvements supporting access to education, employment, health care, and other services for the nation's widespread residents.

As of the 2010 IRR submission cycle, the Navajo DOT had significantly increased the number of miles in its inventory. It grew from 9,800 miles in 2006 to nearly 16,000 miles, including approximately 6,000 miles of tribal roads. The additional mileage and updates to the existing data increased the Navajo Nation's IRR funding by an average of 30 percent, compared to its 2006 funding level. To date, the Navajo Region has received a 15-fold return on the Navajo DOT's initial investment in the IRR project. This adjusted allocation will allow critical transportation infrastructure



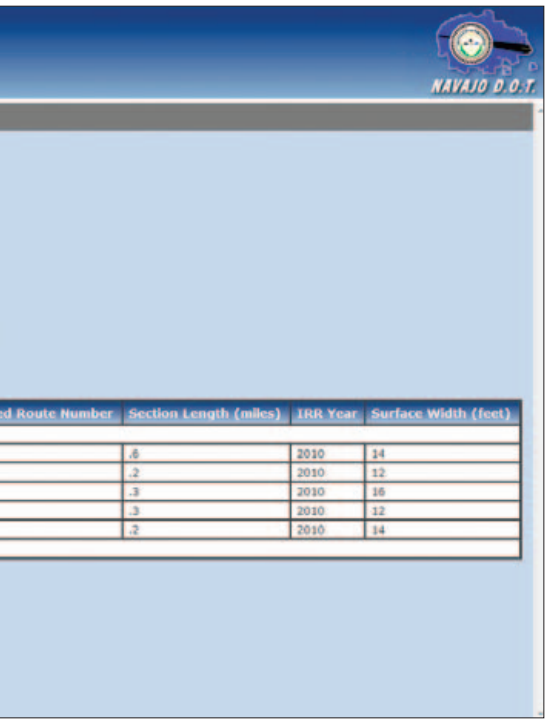
Strip maps like the one shown here can be automatically generated.



Bidirectional Filtering of Data between the Map Interface and the Filtering Page

improvements supporting access to education, employment, health care, and other services for the nation's widespread residents.

In addition to the development of the NAVRIS system, the Navajo IRR project team also established a series of programmatic policies and standards to supplement the technology. Due to the rural nature of the reservation, determining the public eligibility of tribal roads has historically been a difficult process. In an effort to establish consistency in properly identifying a public tribal road, the Navajo DOT developed a public roads identification guideline that provides a checklist of characteristics that a road must possess before it can be considered public.



The Navajo DOT also established a methodology for determining the proper functional classification of roads, which was another area lacking clear guidelines between the BIA and the tribe.

By creating NAVRIS and the supplemental policies and standards, the Navajo Division of Transportation has developed a systematic approach to maintaining its road inventory. Beyond supporting the immediate needs of the federal IRR program, NAVRIS serves as the foundation for a comprehensive infrastructure management system to support Division of Transportation activities.

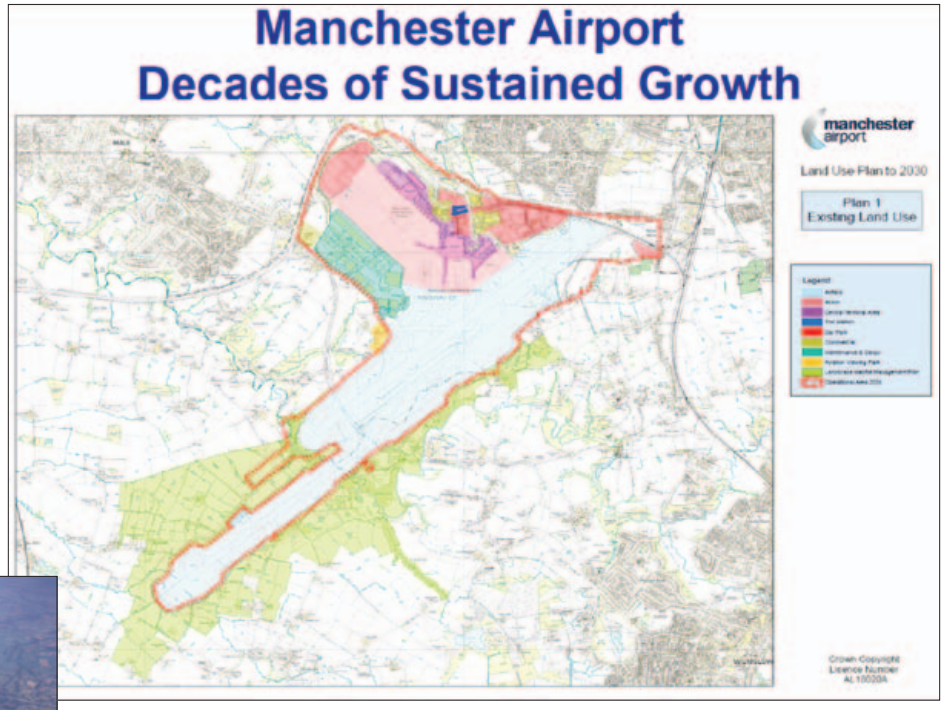
Today, the Navajo DOT continues to develop NAVRIS as part of its ongoing IT strategy. NAVRIS offers the first consistent, verified interpretations of IRR regulations and the ability to programmatically generate the required BIA deliverables. By taking the initiative to build a geospatial road inventory program that helps define and facilitate the IRR process, the Navajo Division of Transportation has become a stronger, more sophisticated tribal entity with more time and resources to support the development and maintenance of its expansive infrastructure.

For more information, contact Jonah Begay, Navajo Division of Transportation GIS supervisor, at jbegay@navajodot.org, or Nick Hutton, director of asset management at Data Transfer Solutions, Inc., at nhutton@dtsgis.com.

Flexible GIS Ensures Business Sustainability in the UK

Situated on 1,544 acres, Manchester Airport in the United Kingdom operates as a small city, serving 22.7 million passengers and handling 151,000 tons of freight each year. As a sustainable business, the airport itself employs 19,700 people working at 310 different companies at the facility. The airport is positioned to grow to serve 50 million passengers within 30 years with the support of government initiatives in the country.

Managing the space used at the airport is no small feat. From car parks and retail shops to runways and habitat areas, Manchester Airport must be effective when running its business. To add to the challenge, the airport never sleeps; it must remain operational 24/7. For this innovative organization, the airport's management created a planning team tasked with finding the best way, through the use of technology, to tackle problems faced by different business units. Given the mission to become better than all other airports by making the customer's journey a positive experience, Manchester Airport knew it needed a solution that could manage all aspects of the airport's business: economic, social, and environmental.



Using GIS to plan its sustained growth until 2030, Manchester Airport currently serves 23 million passengers a year.

Begin with Noise Contours

"Our question at the time was how many parcels are inside the noise contour," explains Vickie Withnell, chief technology officer at Manchester Airport. "If noise contours are areas, or polygons, then we could overlay that onto our surrounding properties map and count how many were inside. We easily saw how many homeowners might qualify for specific programs to help mitigate noise, such as installation of soundproof window glazing. The CAD-based system we were using at the time just couldn't do that."

Airport authorities began evaluating alternative technologies and decided that the value of Esri technology was immediately clear. Thus, Manchester Airport began using GIS in the late 1990s specifically to map noise contours. With approximately 26,000 properties affected by moderate to high noise levels, GIS was invaluable in managing where the properties were located and which services were utilized by individual owners and keeping check on complaints.

Now the Whole Airport Finds Value in GIS

From this project, the use of GIS spread organically through the airport and now touches on all aspects of its operation: retail, planning, marketing, development, and airfield operations; community relations; ground transportation; environmental planning; and utilities. The Planning Department is now primarily focused on GIS, specifically employing ArcGIS Server, since "everything we could do in PowerPoint or with pictures, we can do better with GIS," says Withnell. "In the end, GIS has proven to be a flexible solution, allowing us to manage data, model new scenarios, and create easy-to-understand presentations for growth and management at our facility."

Managing the retail side, with its 130 shops and restaurants and retail sales pulling in excess of US$447 million a year, GIS has proved its usefulness once more. From initial planning for a retail outlet to ensuring proper licensing and store expansion, ArcGIS assists in visualizing the impact of each store on airport operations. "The airport has a waiting list for available space, so GIS is necessary for us to manage our space effectively," says Withnell.

Part of the challenge in making the airport an enjoyable place to visit is ensuring its accessibility. To that end, Manchester Airport expects to reduce the overall number of passengers who drive to the airport by 40 percent and staff who drive by 50 percent. GIS has been invaluable for managing Manchester rail hub improvements, a US$74 million investment for the airport. Using the software, the

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Flexible GIS Ensures Business Sustainability in the UK

Planning Department analyzed where best to place car parks and plan 24-hour bus, rail, and coach times and routes based on mapped demographics, the existing transportation network, and travel times.

"GIS assisted us in every aspect, even planning for and averting standard social dangers when traveling late at nonpeak hours," emphasizes Withnell. By providing skylink travel to airport buildings late at night and staff with safety advice, train travel is an effective means to get to and from the airport.

Being a good corporate citizen is important to the airport, as well. This translates into proactively assisting in education and ecology in surrounding areas. On the education front, the airport has developed literacy programs for use by schoolchildren online and at the airport and as an outreach to schools. GIS is used to create school address lists for mailing educational packs to surrounding schools. Ecology means managing habitat areas effectively and in compliance with environmental controls. The airport is flanked by British countryside, and GIS helps ensure that creatures like the Great Crested Newt, bats, and badgers continue to live in comfort.

"Managing the land and understanding the habitat area sometimes means changing the landscape," says Withnell. "GIS helps us manage the land, from creating new ponds in the correct locations to ensuring that new development doesn't encroach on our wildlife areas."

The Results

For more than 10 years, GIS has helped Manchester Airport in the process of transforming itself from merely a transportation hub into a sustainable business. ArcGIS for Server has assisted in mapping, analyzing, and mitigating the business, social, and environmental aspects of the airport, ensuring that it remains a profitable business that is sensitive to its impact on the community. Having data managed centrally allows it to be kept up-to-date easily and shared effectively with contractors and other agencies. This saves time and ensures that the data is accurate, consistent, and timely.

Using ArcGIS for Server, Withnell estimates that the airport is saving upwards of US$220,000 and 1,200 person-hours a year just in operational costs of map production and data collection.

"GIS is an efficient way to manage time, effort, and budgets," explains Withnell. "It integrates seamlessly into our business and evolves with our needs, helping us fulfill our stated aims of being a responsible neighbor, investing in our community, and spending money on the things that really matter."

For more information, contact Vickie Withnell, Group Planning, Manchester Airport (e-mail: vickie.withnell@manairport.co.uk).

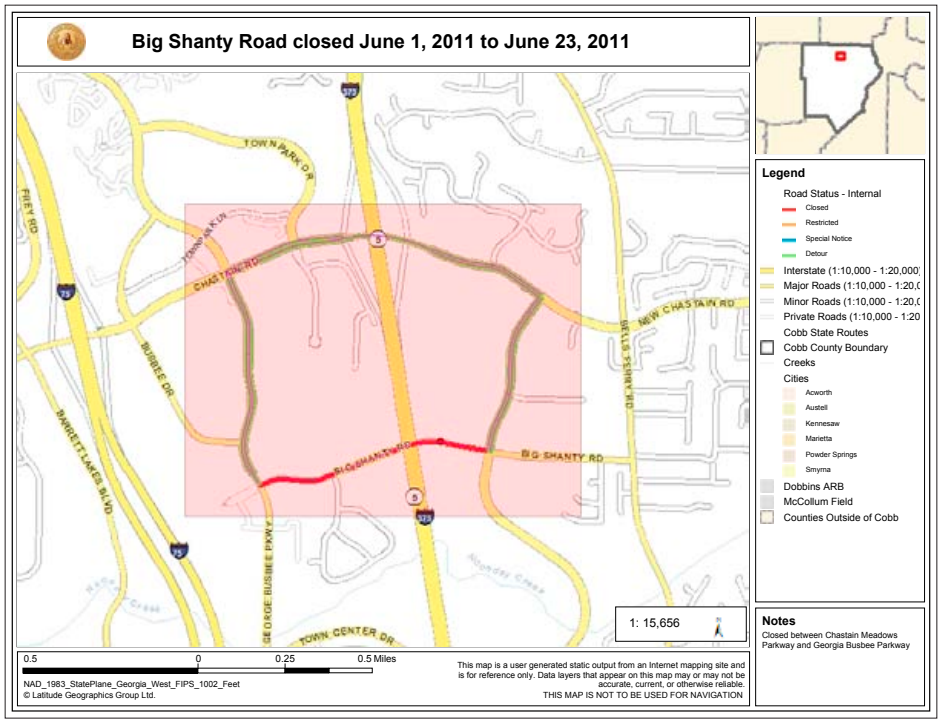
Cobb County Gets Up-to-Date with Road Condition Information

In September 2009, a severe flood hit Cobb County, Georgia. During the emergency, elected officials received different answers on exactly how many of their 8,800 streets were closed due to flooding. The county's challenge in collecting accurate data and distributing road-closure information to the 715,000 residents highlighted the need for improved tracking and monitoring of road status.

After the crisis abated, the differences were attributed to the fact that emergency services, the police department, and the Department of Transportation (DOT) counted road closures differently. For example, if the county's emergency services department had three address points of a road closure, it would count them as being three individual closures, whereas the DOT would lump the three points together and count them as a single closure.

To address the communication issues that had been faced during the flood, Cobb County has recently built a regional transportation management center (TMC). It is the hub of transportation information for the county. The TMC manages traffic conditions, signal maintenance, and special traffic events for the 2,500 miles of road within the six cities in the county.

Chris Pruitt, traffic and operations supervisor at Cobb County, says, "We need to get the information to the elected officials, to emergency services, and to the citizens. More important is our internal need to know what the statuses of our roads are."



This map, generated by Road Status Information System, shows a planned road closure. It depicts the point of closure, the road segment affected by the closure, and a recommended detour.

In September 2010, to further address the DOT's need for up-to-date road conditions, Cobb County installed Geocortex Essentials by Latitude Geographics Group Ltd. Geocortex provides off-the-shelf components that enable people to be more efficient in designing, building, and maintaining Esri ArcGIS for Server applications.

The recent deployment of the Geocortex Essentials Road Status Information System has enabled Pruitt and the DOT to collect and distribute information on road closures and detours associated with disruptive events like construction, accidents, and special events. Rather than information being channeled to elected officials through several different sources, it is now funneled directly to the TMC, which then redistributes the information. Explains Pruitt, "That information comes from a variety of sources—police, gas providers, emergency services—and then we decide how we will respond to the incident."

Cobb County's regional transportation management center is the hub of transportation information for the county.

Pruitt has been happy in that Geocortex Essentials has been straightforward to use and easy for staff to learn. The DOT has needed a way to decrease its turnaround time when deploying new features. "We've found that we've had a little bit of internal training, but really, folks have caught on pretty quick," says Pruitt. "There are a lot of potential users for this, some that may not be experienced in the GIS setting."

Pruitt has some ideas for improving the current workflow. "A future addition we're considering is a tracking system for lane closures from Geocortex Essentials. We'd also like to put in some kind of travel time system." Pruitt

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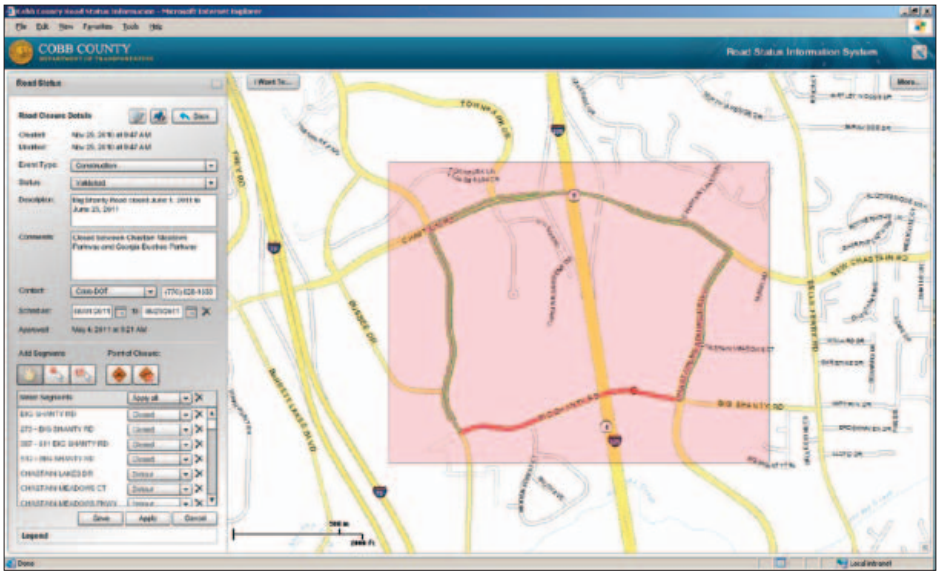
Up-to-Date Road Condition Information

would like to supplement county maps with the current state travel-time system, Georgia Navigator, which provides travel times and speed indicators on interstate highways. "We'd like to supplement this program to our regional arterials that are not on the state route system but are carrying 50,000–60,000 vehicles per day," states Pruitt. "We really want to get that travel time out to the public."

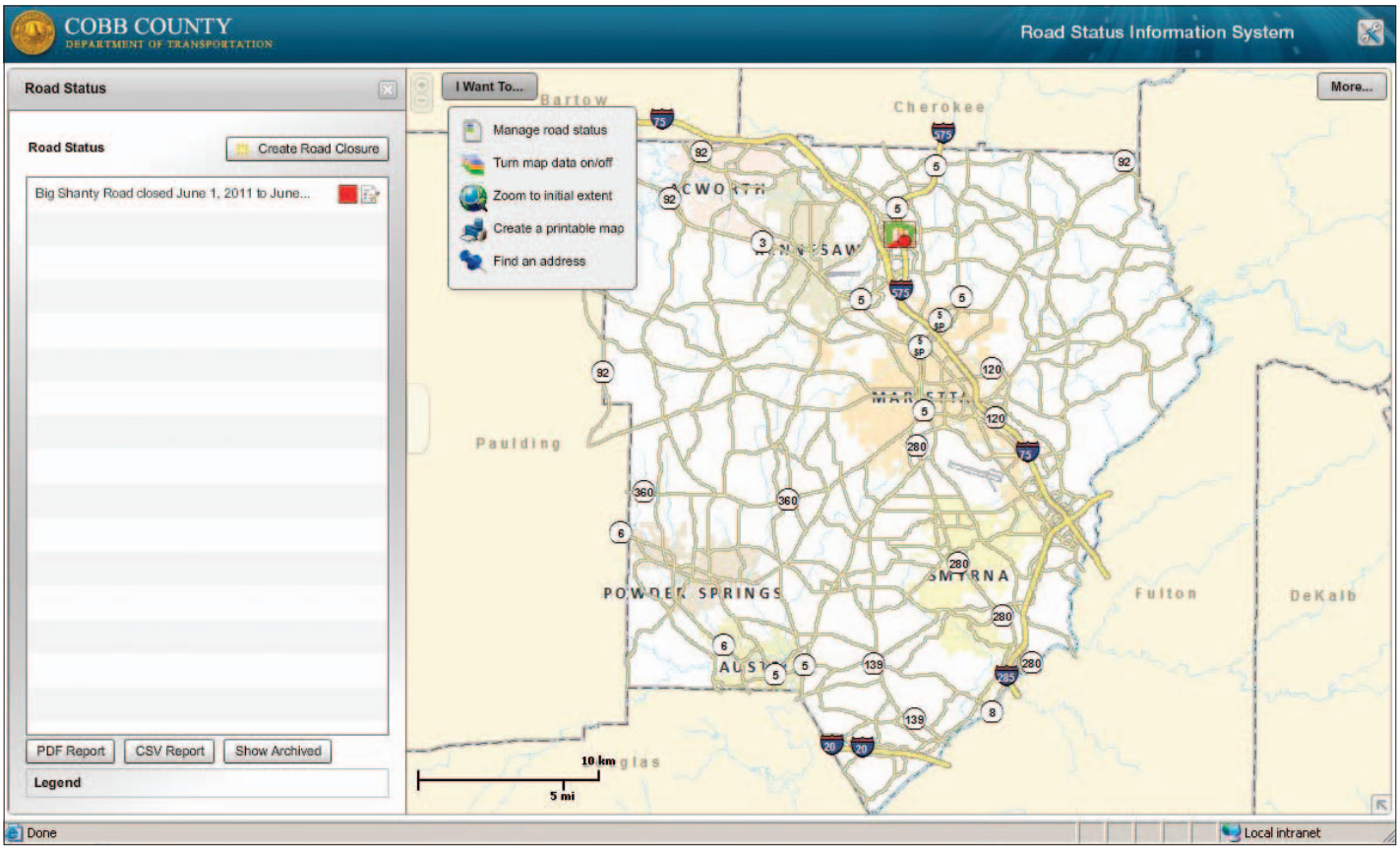
Summary reporting is also on Pruitt's wish list for the DOT "so we can provide one concise report to the public, to the elected officials, or for our own use. This will give us the same dataset so that when we have another flood, hopefully the problems are nothing like what we had in September 2009. We want to make sure that we can provide complete information to whoever needs it."

Like many of the 4,400 full-time employees at Cobb County, Pruitt is anticipating that another flood will impact the region in the future. "In a big incident like that, the cities would most likely call the county for some help and we would be able to update the road status," says Pruitt. "I think that this is one point where we at the DOT regionally can continue to improve our coordination and efforts with our partners. It will ensure that we send one message to the public and the elected officials."

For more information, contact Lynn Biggs, GISP, GIS supervisor, Cobb County Department of Transportation (e-mail: lbiggs@cobbcounty.org).



Road closures can be entered and managed by DOT staff in the RSIS internal-facing application through a defined workflow. Multiple editors can access the RSIS simultaneously to provide updated road closure information as an emergency event unfolds.



The Cobb County Road Status Information System is a purpose-specific Flex Viewer application that was created for Cobb DOT staff to better manage road closures due to unplanned incidents, such as a storm, as well as road closures due to planned activities, such as road construction. As an external-facing application, it provides an effective way for Cobb County DOT to communicate to the public the status of the county road network.

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