

**2008 NASCIO Recognition Awards Nomination
Commonwealth of Virginia**

**Nomination Category:
Information Communications Technology (ICT) Innovations**

**Title of Nomination:
Virginia Enterprise Road Centerline Project**

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2008 Commonwealth of Virginia NASCIO Award Submission
Category: Information Communications Technology (ICT) Innovations

Project: Virginia Enterprise Road Centerline Project

Executive Summary

Locating people quickly and accurately is a requirement for many government services. There is probably no greater example of this than the provision of 9-1-1 services. While the provision of services like 9-1-1 has historically been locally driven, regional disasters such as hurricanes and tornados and the threat of terror attacks created a need for greater regional collaboration and coordination with state agencies. However, the planning and execution of this level of effort requires all organizations to be on the same page...literally.

Coordinating a response to a regional emergency requires many agencies to share geospatial data. The accurate and consistent locating of incidents and resources is essential to effective coordination. The Commonwealth of Virginia lacked a statewide source of data to act as the basis for this collaboration. Most localities maintain geospatial data for their jurisdictions, but varied formats and data models prevented the sharing of this data at the regional level, let alone at a statewide level. Surveys conducted by the Virginia Information Technologies Agency showed that 157 local agencies and one state agency developed geospatial data and addressing information.

While statewide data that was quite accurate in the urban areas was available from commercial providers, the data for the rural areas lacked accuracy and was not as up to date as was required for public safety applications like 9-1-1.

To address this need, the [Virginia Geographic Information Network](#) (VGIN) initiated the Virginia Enterprise Road Centerline Project to build a statewide data file to be shared by all. Building on the success of the Virginia Base Mapping Program (recognized by NASCIO in 2004), the Commonwealth leveraged some of the savings from that project to fund the initial development of the road centerline file. Now in steady-state maintenance for eight months, the road centerline program provides statewide and regional roads data for a multitude of applications. Though the investment was justified based on public safety applications, the benefits of the project are being realized in a number of other areas, including transportation, economic development and local government management.

Description of the problem and solution

The Virginia Enterprise Road Centerline project was borne out of a multi-agency need for road and addressing data. The Virginia Geographic Information Network ([VGIN](#)) Division of the Virginia Information Technologies Agency ([VITA](#)) managed the overall project and its continued sustainability. Its successful execution was the result of the collaboration of over 158 agencies at the state and local level.

While at least six state agencies needed road network data throughout the Commonwealth of Virginia, the local need provided the critical mass to undertake this project. Most notable were the needs of emergency response. In the past, local public safety agencies used local geospatial data to determine response and manage emergency incidents. With an increase of regional and large-scale emergencies such as hurricanes, flooding and the threat of attacks on the homeland, local emergency responder and 9-1-1 centers needed access to geospatial data for their neighbors and sometimes areas even farther away.

Virginia initially considered purchasing commercially available road data, such as data used in online mapping services or personal global positioning system (GPS) units. This data was readily available and, in urban areas, was quite accurate. Unfortunately, the data in rural areas was lacking in accuracy and latency. The update cycle for the commercial data was significantly longer than what was required by the user community for emergency response. The accuracy of the data also caused problems when overlaying it on other geospatial data created from the state aerial photography. Overlaid geospatial data must align properly or public safety responders could draw incorrect conclusions.

While some local data sharing existed before this project, it was often duplicative and cumbersome as localities tried to align attributes across jurisdictional boundaries each time an update was processed. Compounding this was that the data was often stored in different formats, projections or datums - if the data existed at all. To assess the extent of effort that would be required to develop a statewide road file, Virginia conducted a survey of all entities that maintained road and addressing information. The survey showed a total of 157 local governments and the Virginia Department of Transportation (VDOT) maintain data in a vast variety of formats, including on paper.

In 2003, the Commonwealth was completing the Virginia Base Mapping Program imagery acquisition for the first time and was presented with an opportunity to capture road centerline data from the 2002 digital imagery at a relatively low cost. By doing this, the state would have geospatially accurate data that aligned perfectly with the new imagery. The lines would not have any attribution (names, address ranges, etc.), but that could be transferred from locally-maintained data. Because the most compelling use for this data was in 9-1-1 centers, the Virginia Wireless E-911 Services Board was asked to provide funding; however, savings from the Virginia Base Mapping Program was actually used so it did not require any more funding than had already been committed to the imagery project. The project to construct a single statewide road centerline file started in the fall of 2004.

In addition to the base funding provided, 37 localities received grant funding from the Wireless E-911 Services Board to develop or improve their existing local road centerline file. In some cases, this meant developing the data from paper maps or even developing the addressing system from scratch. For others, this meant applying attribution or changing the format of the data. These grants were awarded to facilitate the local deployment of wireline and wireless enhanced 9-1-1, and these projects supported the road centerline project to ensure that the investments being made could be leveraged. For the process of creating the statewide centerline, the same contractor that managed the imagery project performed the initial development of the road centerline using a standard data model. However, the construction of the single data file was only a small part of the challenge. The bigger question was how to maintain the data over time.

Initially, it was thought that most localities would simply convert to using the state standard data model as their own and would maintain it directly. While a few were willing to do this, most were not. The local data models were customized to meet local needs and could not be modified without impacting many other business processes. Another approach had to be developed.

Instead of force-fitting data standards, Virginia opted to develop an automated change detection tool that would compare the new local road centerline file with the old file. This would quickly identify any changes to the geometry or attribution that could then be applied to the statewide master file. Though it sounds like a simple process, it is quite a complicated and sophisticated application that performs this operation.

As of July 2007, the road centerline project was closed out and the update process has become part of the programmatic business process. The localities and VDOT provide updates on a monthly or quarterly basis, based on the amount of change in their data files. The local agencies provide the files using file transfer protocol (FTP) to the VGIN servers in the native format maintained locally. A VGIN analyst then uses the automated change detection tool to identify all modifications made to the local file since the last update. The analyst reviews those changes, applying the bulk of them very quickly, and resolving any conflict that may be caused by more complicated modifications. The changes are then applied to the statewide master data file, which is shared with all state agencies. To help the local 9-1-1 centers, Virginia prepares copies of regional data files and uploads them to a FTP site on a quarterly basis.

Significance of the project to the improvement of the operation of government

Since its development, the use of the statewide road centerline file has continued to increase. Beyond its most prominent use in 9-1-1, it is being used in transportation, economic development and other public safety applications. Like the statewide imagery project (recognized by NASCIO in 2004), which was repeated in 2006, developing this statewide data file ensures that all agencies have the same base map on which to build applications and other data. Previously, state and local agencies used a variety of data sources to locate geographically referenced data, creating a patchwork quilt of varying accuracy, scales, orientation and age of the data. Such a patchwork severely reduces the efficiency and effectiveness of local, regional, state, and federal business applications that require multi-jurisdictional or regional data. The result is

that an address or a resource is located in slightly different locations depending on the data file used. With an enterprise solution to the provision of this data, everyone is referencing the same location thus improving the services that they are able to deliver, which is especially important when this services are for public safety.

Now that the road centerline file has been finalized and is in steady state maintenance, VGIN continues to leverage the investment by adding additional attribution and services. As an example, VGIN provided the data to the U.S. Census Office so that they can fit their census blocks to the Virginia centerline geometry. Now completed, this will allow demographic analysis of any data also mapped to this base. With all of the data captured through the census, this will allow much deeper analysis of services based on many socio-economic measures. Seamless, high quality road data ensures that data sharing for state and local, public and private business applications including E-911 response, permit tracking, natural resource protection, transportation planning and economic and labor analysis operates at the highest possible efficiency and can be consistently applied anywhere in Virginia.

While the public safety applications of this data justified the investment, new applications continue to be developed. As an example, while this data is showing great benefits within governmental processes and response, the Commonwealth wants to get it into the hands of the citizens so that they can benefit from the improved accuracy over the commercially available data. Most of the commercial data providers gather data updates for localities, though they focus in more densely populated areas where the demand for accurate data is higher. Recognizing the duplication of effort, VGIN staff approached the major commercial providers of road centerline data seeking a partnership. Under this partnership, VGIN provides quarterly statewide updates to the commercial provider, which could then be rolled into their product. Their products are used by citizens of the Commonwealth of Virginia through online mapping services - such as Google Maps, Microsoft Virtual Earth and MapQuest – and personal GPS units – such as Garmin and Tom Tom. In exchange for the data, the Commonwealth receives routing attribution for the enterprise road centerline file, which was not captured initially due to budget constraints.

Benefits of the project

Direct taxpayer savings

With the increased need for regional planning and response, each of the 157 local agencies faced the development and maintenance of road centerline data for their locality and their surrounding region. With this project, each locality need only maintain their local data and they are provided the regional data at no cost (in exchange for their provision of local data). Additionally, each state agency that required this data also saves over building the data themselves or purchasing the data from a commercial provider. Since the initial development was funded through a grant from the Wireless E-911 Services Board, agencies are charged only a percentage of the outgoing cost of the road centerline program. This results in savings of approximately 90 percent to what commercially -data would cost, and with much greater accuracy.

Expedited E-911 response

The high quality of the road centerline data and regional distribution helps with processing wireless 9-1-1 calls. Before wireless telephone service, wireline service routed 9-1-1 calls to the appropriate answering point almost 100 percent of the time. Radio waves do not always behave in a predictable manner and may route to the wrong 9-1-1 center based on the cell tower that processes the call. Without regional data, the 9-1-1 call taker only knows that the call is somewhere outside of their jurisdiction. With the regional data, the call taker can pinpoint the caller's location in a neighboring locality, which is especially important when the caller is near the border of three or more localities.

Enhanced statewide information support

In addition to real dollar savings for every locality, 37 local government partners enjoyed significant improvements in the quality, capabilities, and capacities of their E-911 and geographic information systems (GIS). This project brought *every* locality – urban or rural, large or small - up to a common GIS service level, which can now be leveraged for other data development. Several of these localities had no GIS capability before this project and now have a system that can be used for economic development, planning and zoning, and a multitude of other applications.

Established statewide standard

The statewide road centerline data model is the “foundation” in Virginia for state and local government GIS. Though not initially adopted due to its impact on other processes, many are now slowly migrating to the data model. This ensures that the vast majority of geospatial data collected in the future by state and local governments and partners (i.e. tax parcels, utilities, wetlands, etc.) can be cost-effectively shared and integrated across systems, public and private, and that interoperability is maximized. This will be especially true once the statewide data is available through commercial providers on the major online mapping services.

Return on investment

The enterprise development of the statewide road centerline data on behalf of every local government jurisdiction and state agency saved Virginia taxpayers \$1 to \$2 million dollars (25 to 50 percent) over the estimated cost of individual development. The recurring cost to maintain this data file is roughly equal to the cost for one state agency to purchase the statewide data commercially, which lacks the accuracy to support needs like 9-1-1.

Outcome measures

Outcome measures, such as lives saved or injuries/property damage avoided, are more difficult to determine. However, all of Virginia's 9-1-1 centers now have access to the road centerline data and almost 100 percent of all wireless subscribers in Virginia have access to wireless location technology. This means that almost every wireless call to 9-1-1 now provides a longitude and latitude that can be located on a map. Having accurate maps speeds the processing of locating the call for help. Of course, the faster help is provided, the more lives and property can be saved.