Geocentric Project Tracking - Managing Tomorrow’s Transportation System with GIS

Eric Floss – Transportation Practice Manager

Tuesday September 29, 2009
Agenda

• How GIS is shaping our work?
• Transportation Professionals Increasingly Face Major Challenges:
  – How to Effectively Support Agency-Wide Business Functions: (Data and Systems Integration)
  – Demonstrating and Monitoring the Effectiveness of our Transportation Investments
• Case Studies and Examples
ESRI

Delivering geographic information systems to millions of users
GIS Is Changing Everything...

How We Abstract Our Nation...
- Data & Data Models
- Models
- Workflows
- Maps & Globes
- Metadata

How We Reason About the Nation...
- Patterns
- Processes
- Relationships
- Implications

How We Organize & Communicate...
- Collaboration
- Place Based Approaches
- Integrated Teams

Spatially Integrated Thinking

Digital Geographic Knowledge

Shared Geographic Knowledge

... Providing a New Approach
GIS Is Also Changing How We Work

- Systematic
- Holistic
- Analytic
- Quantitative
- Visual

...And... How We Act
...What Should be Done Can be Addressed

A Science Based Approach
GIS Is Becoming Pervasive

Enabled by Evolving Technologies . . .

• Faster Processing (100x)
• Virtualization
• Increased Bandwidth (1000x)
• Larger Storage
• Mobile
• The Web . . .

. . . and GIS Software

. . . And The Work of GIS Professionals
The Web Is a Strong Platform for GIS

Distributing Geographic Knowledge Everywhere

GIS Professionals Are Building the Content

- Authoritative Data
- High Quality Maps
- Visualizations
- Spatial Analysis & Models
- Rich Applications

Web GIS

And Leveraging this Content . . .

. . . To Serve the Needs of Multiple Users
Key DOT IT Issues

• Integration to Support Agency-Wide Business Functions:
  – Need to provide easy access to data and information: A seamless flow of information regardless of format, platform or location
  – Need to integrate data across the enterprise; to integrate data across the “project lifecycle”
  – Acquire Best of Breed COTS Solutions, and Have Them Seamlessly Integrated
Integration to Support Agency-Wide Business

• Why an Issue? Because Increasingly the Most Valuable Resource Within a DOT is the Information Infrastructure

  – 85 Percent of Data in Modern Organizations is Unstructured*
  
  – 30 Percent of People’s Time is Spent Searching for Relevant Information*
  
  – 60 Percent of CEOs and Agency Directors Feel They Do Not Have the Type of Information Support to Make Good Decisions*
  
  – 90 Percent of Information in a DOT has a Spatial Component

* Source: IBM
Smooth Information Flow?

Transportation Infrastructure Life-Cycle

Planning  Design  Survey  Construction

Maintenance  Operations
Integration Issues

- Data is located at the application level, often in different formats: “Islands of Data”

- Distributed and Heterogeneous Environments: Different OS, RDBMS, Hardware Platforms

- Major Gaps in Information Flow across the Agency

- Desire to Have Technology Support Business Processes, Rather Than “Drive Them”
Obtaining Value from Enterprise Programs

Goal is to provide a long lasting technical architecture that meets business needs and efficiently leverages COTS technology.

Matching technology capabilities to business needs.

An iterative process; maturity takes time!

Instead of...

Business
Applications
Data
Technology
Enterprise Integration

• Why?:

– Project Management and Tracking

– Consistent Project Details through Planning, Design, Construction, Operations and Maintenance: capture full life cycle costs of projects

– Integrated Maintenance and Work Order Management
When to Capture Location Information?

<table>
<thead>
<tr>
<th>State Project Number</th>
<th>Project Name</th>
<th>Federal Aid Project Number</th>
<th>Total Amount Stimulus Funds</th>
<th>Contractor Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000099</td>
<td>WARM SPRINGS RAIL LINE BIKEPED TRAIL</td>
<td>0000099</td>
<td>$1,250,000.00</td>
<td></td>
</tr>
<tr>
<td>0000310</td>
<td>SR 31/US 221 @ SR 37 &amp; SR 11/US 126</td>
<td>0000310</td>
<td>$3,129,018.22</td>
<td>DIXE ROADBUILDERS, INC.</td>
</tr>
<tr>
<td>0000424</td>
<td>SR 5/BANKHEAD HWY/BILL ARP RD @ CS 573/ROSE AVE</td>
<td>0000424</td>
<td>$2,843,620.00</td>
<td>C. W. MATTHEWS CONTRACTING CO., INC.</td>
</tr>
<tr>
<td>0000663</td>
<td>CR 134/COUNTY LINE ROAD @ POLECAT CREEK @ MURRAY CO LINE</td>
<td>0000663</td>
<td>$1,587,137.75</td>
<td>CORNETT BRIDGE, INC.</td>
</tr>
<tr>
<td>0000644</td>
<td>SR 9/US 29 @ PLEASANT HILL/LESTER ROADS</td>
<td>0000644</td>
<td>$11,343,125.45</td>
<td></td>
</tr>
</tbody>
</table>

Map of the region showing the projects' locations.
Design and Estimating
Construction and Project Management
Project and Construction Management

![Project and Construction Management Image]
Project Support from Start to Finish

- Modern Infrastructure Projects are Complex Multi-Year Projects which require careful monitoring, coordination, and management

- Require access to large amounts of data and information in real-time

Australia’s Eastlink Project
Eastlink Project - Real Benefits

• Easy access to accurate and timely information at their fingertips.

• The ease of map production resulted in significant productivity and efficiency improvements, making production 50 percent faster.

• Significant savings were achieved by avoiding the need to outsource these GIS services and through the supply of products and services provided by the GIS solution.

• Automated data collection and validation helped reduce erroneous data entry, ensuring more accurate data.

• Time required to locate and collate information in the system has been dramatically reduced, with this process now 80 percent faster.

• Reporting capabilities and the ability to integrate other corporate systems have provided EastLink with a powerful management tool.
GIS in the Project Life-Cycle

...Continual Stream of incoming Location Data Can Be Managed Using GIS
Performance Dashboards
Benefits of GIS for Performance Dashboards

- Comprehensive view of information
- Make information available across entire organization and external customers (i.e. Public)
- Effectively communicate complex information and data
- Bring together a wide range of information that is presented in a single place
GIS Enables Effective Communication

- Supports integrated dashboards
- Clear presentation of complex material
- Interoperable with other business systems

GIS offers a Proactive Solution
Traffic Dashboard - GDOT

Select Segment:
(1) I-75 NB (from I-285 to Wade Green Road)

WeekDayFilter1:
MONDAY, TUESDAY
Begin Date: 9/1/2008
End Date: 9/30/2008

Weekdays2:
MONDAY, TUESDAY
Begin Date: 9/1/2008
End Date: 11/20/2008

Compare to +/- 1 Std. Dev.
DOT Dashboard Proof of Concept
Performance measures are a way of quickly assessing overall departmental performance. Each dial, chart or graphic communicates the status or value of each performance measure. Click on any performance measure to drill down and see more information.

A prototype built using ArcGIS Server's Flex™ API
The state level map is a way of looking at county differences of factors that may be contributing to the value of an indicator.

Each indicator for the chosen performance measure is now shown at a county level.

Click a column heading to change the data used in the map and chart.

Click a county for a more detailed map.

<table>
<thead>
<tr>
<th>Name</th>
<th>Crashes</th>
<th>Injuries</th>
<th>Deaths</th>
<th>Wkzone</th>
<th>Crash%</th>
<th>Injury%</th>
<th>Death%</th>
<th>Wkzone %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorches</td>
<td>497</td>
<td>218</td>
<td>4</td>
<td>1</td>
<td>1.53%</td>
<td>0.67%</td>
<td>0.0123%</td>
<td>0.00003</td>
</tr>
<tr>
<td>Washing</td>
<td>2807</td>
<td>1004</td>
<td>25</td>
<td>3</td>
<td>1.89%</td>
<td>0.675%</td>
<td>0.0168%</td>
<td>0.00002</td>
</tr>
<tr>
<td>Cecil</td>
<td>1650</td>
<td>732</td>
<td>21</td>
<td>0</td>
<td>1.6%</td>
<td>0.71%</td>
<td>0.0204%</td>
<td>0%</td>
</tr>
<tr>
<td>Talbot</td>
<td>914</td>
<td>283</td>
<td>6</td>
<td>0</td>
<td>2.35%</td>
<td>0.726%</td>
<td>0.0154%</td>
<td>0%</td>
</tr>
<tr>
<td>Baltimore</td>
<td>19168</td>
<td>5114</td>
<td>41</td>
<td>5</td>
<td>3.68%</td>
<td>0.822%</td>
<td>0.0066%</td>
<td>0.00000</td>
</tr>
<tr>
<td>Wicomic</td>
<td>2220</td>
<td>932</td>
<td>15</td>
<td>2</td>
<td>2.28%</td>
<td>0.958%</td>
<td>0.0155%</td>
<td>0.00002</td>
</tr>
<tr>
<td>Worcest</td>
<td>1349</td>
<td>544</td>
<td>10</td>
<td>0</td>
<td>2.6%</td>
<td>1.049%</td>
<td>0.0193%</td>
<td>0%</td>
</tr>
</tbody>
</table>

A prototype built using ArcGIS Server's Flex™ API
A prototype built using ArcGIS Server's Flex™ API
Federal Examples
Recovery.gov
State Government Example

State of Maryland – StateStat Recovery and Reinvestment Site
Maryland StateStat
Local Government Examples

City of Lenexa, KS – Interactive Project Status Map
City of Lenexa, KS

Prairie Star Parkway, K-7 to Canyon Creek Boulevard

Project Information
Project Name: Prairie Star Parkway, K-7 to Canyon Creek Boulevard  
Jurisdiction: City of Lenexa  
Project Phone: Constitution  

Contact Information
Project Manager: Stu Kollar  
Manager’s Email: Stu.kollar@lenexa.ks.us  

Date Information
Start Date: 7/7/2007  
Projected End Date: 10/31/2009  

Project Description
Design and construction of a four-lane, divided arterial roadway including curb and gutter, sidewalks, street lights, storm drainage facilities, water quality features, trails and landscaping. Project will include the use of a roundabout.

Road/Bridge Improvements
City of Lenexa, KS

Prairie Star Parkway, K-7 to Canyon Creek Boulevard

**Project Updates**
- 08/21/09: Asphalt surfacing, pavement marking, signing, and street lighting completed. Contractor working on Mize, Fountain, and Dunraven Fountains.

**Construction**

98% complete

Click on the pie chart for more detailed information

**Total Project Budget:** $8,762,689

- [Graph showing funding sources]
City of Lenexa, KS
Proof of Concept

FedStat
Welcome to FedStat

Welcome to the prototype vision of FedStat.

FedStat provides executive decision makers, government staff and the public access to the most timely and critical geospatial information in the United States Government. By providing transparent access to accurate information, the best possible decisions can be supported while also creating new levels of geographic accountability, visibility and performance monitoring across the Government.

FedStat allows all branches of the Government to publish message packets and dynamic briefings using analytical web services. As the Federal Government faces new and old challenges, FedStat allows the best information to be pushed and pulled across agencies and with the public (with appropriate authorization).

Not only is information shared, but FedStat also supports dynamic and interactive analysis in a collaborative environment.

"...a new era for cooperation, decision support based upon sound geographic knowledge and analysis."
The United States bridge inventory as of December 31, 2008, currently records more than 600,000 bridges across the country, many of which are below current safety standards. At current estimates it would require more than $236 billion to repair or rehabilitate the existing bridges to meet minimum safety and modern operational standards. Failure to repair the aging infrastructure will cause increasingly large number of billions and potential deaths as seen in the August 1, 2007 Failure of the Minneapolis I-35W bridge.
FedStat

Condition of U.S. Bridge Infrastructure

Agency: U.S. Department of Transportation
Date: February 3, 2009

Issue Facts Analysis Action Performance

More than 27% of the nation's bridges are deficient, either structurally or functionally, or contain non-redundant critical components. This represents 193,998 bridges across all 50 states, and the District of Columbia and Puerto Rico. Thirty-one percent of the bridges are more than 50 years old; many are constructed from steel and have undergone severe corrosion of critical components.

Show Structurally Deficient: Map Overlay
FedStat

Condition of U.S. Bridge Infrastructure
Agency: U.S. Department of Transportation
Date: February 3, 2008

Prioritize states and congressional districts based upon the severity of their bridge infrastructure can be useful when determining the allocation of future funding for bridge rehabilitation.

1. California
2. Texas
3. Florida
4. New York
5. Illinois
6. Pennsylvania
7. Ohio
8. Georgia
9. Missouri
10. Michigan

To derive the bridge infrastructure severity for the states and congressional districts, a model was used which summarizes the number of problematic bridges, e.g., structurally deficient, functionally obsolete, fracture critical, etc., for the specified geography. These geographies are then...
To derive the bridge infrastructure severity for the states and congressional districts, a model was used which summarizes the number of problematic bridges, e.g., structurally deficient, functionally obsolete, fracture critical, etc., for the specified geography. These geographies are then...
FedStat
FedStat

FedStat

Top Topic: Condition of U.S. Bridge Infrastructure
Agency: U.S. Department of Transportation
Date: February 3, 2009

Issue Analysis Action Performance

Forced ranking is used to prioritize the deteriorations based on bridge infrastructure severity.

Pilot Study: Minnesota

Bridges in Minnesota have been prioritized on bridge infrastructure severity in the same manner as the states and congressional districts.

Show Minnesota: Map Overlay

Spending Limit: $150,000,000
Apply Limit: 0 / 2 Billion
FedStat
FedStat

Performance: Minnesota (Current Budget)

Total Bridges: 1,160
- Structurally Deficient: 1,160
- Fracture Critical: 222

In Progress: 2% (2008 - 2009)

Topic: Condition of U.S. Bridge Infrastructure
Agency: U.S. Department of Transportation
Date: February 1, 2009

The State of Minnesota has a 20-year plan to budget for and rehabilitate bridges as money is available.

Sign Performance: Chart