Project ATLAS: Improving Project Development through GIS

Ryan Arthur, NCDIT Transportation GIS Unit
Eric Wilson, GeoDecisions, GIS Technical Project Lead

2/13/2019
Project Delivery at NCDOT - The Process

- Step 1: Planning
  - Comprehensive Transportation Planning (20-25 years)
- Step 2: Prioritization and Programming
  - State Transportation Improvement Program (10 years)
- Step 3: Project Development and Env. Analysis
  - Project is funded and proposed project is evaluated for environmental impacts (NEPA/SEPA)
- Step 4: Design
- Step 5: Property Acquisition
- Step 6: Construction
How does NCDOT measure up?

![Bar chart comparing road miles in various states](chart.png)
How did ATLAS get started?

• August 2017, the Environmental Analysis Unit (EAU) here at NCDOT approached the GIS Unit to help them make project delivery more efficient.

• The EAU are heavy GIS users (predictive modeling, field verifications, impact maps) - they wanted to leverage this powerful tool to improve project delivery.
Where does ATLAS fit into Project Delivery at NCDOT?

- **Step 1: Planning**
  - Comprehensive Transportation Planning (20-25 years)
- **Step 2: Prioritization and Programming**
  - State Transportation Improvement Program (10 years)
- **Step 3: Project Development and Env. Analysis**
  - Project is funded and proposed project is evaluated for environmental impacts
- **Step 4: Design**
- **Step 5: Property Acquisition**
- **Step 6: Construction**
Secretary’s Priorities

Better Transportation Service for North Carolina

Our Mission: Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina.

- Prioritization/Programming
- Scoping, Scheduling
- Project Development
- Procurements
- Right-of-Way
- Operations and Maintenance
- Revenue and Cash Model

- Executive Committee for Highway Safety
- Vision Zero
- Technology Pilots
- Planning and Policy
- Mobility Models and Analytics
- Rural Mobility and Economic Development
- Pavements; Signals/ITS
- Mobility Modernization Fund Implementation
- Roadside Appearance
- Bridge and Structures
- Transportation Facilities
- Mobility Performance Data

- Future Revenue Options for Sustained Transportation Delivery
- Debt Capacity Instruments
- Unmanned Aerial Systems and Connected and Automated Vehicle Policy
- Connected and Automated Vehicle Infrastructure and Data
- Industry Technology Advisory Group
- University Center for Transportation Innovation
- Decision Support and Operations Control Data, Integration, Infrastructure, and Analysis Systems Technology

- Recruiting
- Small Business Development
- Benefits/Compensation Reform and Modernization
- Scholarships/Internships/Apprenticeships

- Real Time Internal Performance Measures and Dashboarding
- Real Time External Performance Measures and Dashboarding
- External Communications and Outreach of DOT Services—Planning, Project Development, Construction, Operation, All Hazard Response, Transportation Permits, Vehicle and Driver Services
- Real Time Data Collection, Analysis, Storage, and Reporting Across all Modes, Units, Facilities and Operations to Obtain and Sustain Full Time Situational Awareness
• Goal is to streamline project development by utilizing GIS tools, applications, and data
• Adheres to Secretary’s Priorities for Improved Program Delivery
• Accelerated project delivery has strong economic impact and enhances NC’s economic competitiveness
Current State of Project Development
Future Projects

The [2020-2029 draft State Transportation Improvement Program](https://www.ncdot.gov) consists of 1,663 projects.

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Total Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>86</td>
</tr>
<tr>
<td>Bicycle/Pedestrian</td>
<td>235</td>
</tr>
<tr>
<td>Ferry</td>
<td>6</td>
</tr>
<tr>
<td>Highway</td>
<td>1,266, including:</td>
</tr>
<tr>
<td></td>
<td>- 181 bridge projects</td>
</tr>
<tr>
<td></td>
<td>- 83 interstate maintenance projects</td>
</tr>
<tr>
<td></td>
<td>- 37 safety projects</td>
</tr>
<tr>
<td>Public Transit</td>
<td>23</td>
</tr>
<tr>
<td>Rail</td>
<td>47</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,663</strong></td>
</tr>
</tbody>
</table>
Starting Out

What does expediting project delivery really mean?

Isn't "everything" we do related to project delivery?

What have other DOT's done?

Where is the data to support this?

Who is involved in project delivery?
Disciplines involved

Wetlands & Streams
Protected Species
Sweeping
Historic Resources
Traffic Forecasting
Community Studies
Bicycle & Pedestrian
Right of Way
Utilities

GIS
Current State of Project Development

- No standards for required deliverables
- There is a central repository for project’s and their associated non-spatial data (PDF’s, Word Doc’s etc.) (No spatial data is collected.)
- There is a business process, but it is mostly manual
- GIS data used to do reports is not standard across projects or firms working on projects.
  - Data is downloaded and worked on in ArcMap and becomes out of date
- There is no spatial context for a project or past projects and no central repository for related spatial data
- There are a series of enterprise applications that support different aspects project delivery but these applications are not integrated
Drawings to Diagrams
Overall Picture Takes Shape

- Over 80 interviews with business units across the agency by October 2017.
- Understanding emerges that there are deficiencies with many aspects of the project development process- not just data itself
- The Project Managers need better information before a project begins... "An informed scoping meeting"
Initial Cataloging of Data
Data Facts

• 27 Parent Agencies
• 54 Root Web Service Locations
• 563 Total Layers
• 140 Used in Screening a project

<table>
<thead>
<tr>
<th>Organization</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCDOT, GIS Unit</td>
<td>154</td>
</tr>
<tr>
<td>US Geological Survey (USGS)</td>
<td>75</td>
</tr>
<tr>
<td>NC Center for Geographic Information and Analysis (CGIA)</td>
<td>74</td>
</tr>
<tr>
<td>NC Department of Environmental Quality (DEQ)</td>
<td>60</td>
</tr>
<tr>
<td>US Department of Homeland Security (DHS)</td>
<td>33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organization</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC Department of Environmental Quality (DEQ)</td>
<td>30</td>
</tr>
<tr>
<td>NC Center for Geographic Information and Analysis (CGIA)</td>
<td>21</td>
</tr>
<tr>
<td>US Geological Survey (USGS)</td>
<td>18</td>
</tr>
<tr>
<td>NCDOT, GIS Unit</td>
<td>14</td>
</tr>
<tr>
<td>US Army Corps of Engineers (USACE)</td>
<td>10</td>
</tr>
</tbody>
</table>
Data Breakdown

DATA SOURCES

- Federal: 32%
- State: 63%
- Local: 4%
- Private: 1%
Data Breakdown

DATA SOURCES

- Federal 32%
- State 36%
- NCDOT 27%
- Local 4%
- Private 1%
Data Developed through ATLAS

130 New Layers are being created
## GIS Specific Goals Developed

<table>
<thead>
<tr>
<th>#</th>
<th>Business Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Provide the transportation project community a searchable gateway to all spatial data used in project delivery at NCDOT.</td>
</tr>
<tr>
<td>2.</td>
<td>Create a tool that screens NCDOT STIP projects against spatial project data for significant impact areas.</td>
</tr>
<tr>
<td>3.</td>
<td>Provide a platform for project managers to view their project, their project’s impacts, and other significant information related to managing that project.</td>
</tr>
<tr>
<td>4.</td>
<td>Stand-up an enterprise GIS SDE for NCDOT project data.</td>
</tr>
<tr>
<td>5.</td>
<td>Create enterprise GIS data for project delivery.</td>
</tr>
</tbody>
</table>
From Goals to Tools

Search Tool
April 2019
A gateway to search and retrieve verifiable, current and accurate project related data.

Addresses NCDOT’s need to have consistent data available to Project Managers and Consultants.

Screening Tool
April 2019
A powerful web-based tool to evaluate potential impacts to NCDOT projects using GIS data and predictive modeling.

Allows Project Managers and NCDOT Consultants to understand and coordinate earlier about challenges projects will encounter.

ATLAS Workbench
April 2019
A unified toolset for Project Managers to assess and monitor their projects via the web.

Allows Project Managers and Consultants a common platform to access current project data, historic project data, current deliverable status, and visualize project progress.

Team is also supporting: Automation, Data Creation, and Post Deployment App Management Tool.
Search Tool

• Key Functionality
  – Search for data by document type, DOT discipline, and keyword
  – Download data package in GBD and DGN formats
  – View data package on a map
Search

What Data Are You Searching For?

Search By Document

--Select Document Type--

Search By Keyword

Search By Organization

--Select Organization(s)--

Search Clear
<table>
<thead>
<tr>
<th>Select</th>
<th>Layer Name</th>
<th>Description</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>2012 Integrated Reporting Water Quality Assessments</td>
<td>This data set contains the detailed water quality assessment for the 3,381 waterbodies in North Carolina where assessment data or information were available. The data assessed were from over 5,000 monitoring stations with data and information mostly collected in calendar years 2006-2010. This data set includes parameters assessed and water quality rating.</td>
<td>NC Department of Environmental Quality, Division of Water Resources</td>
</tr>
<tr>
<td>✔</td>
<td>303d and 305b Streams (ESM Layer)</td>
<td>303d and 305b Streams for ESM application hosted by NCDOT.</td>
<td>NCDOT, GIS Engineering Transportation Systems, GIS Unit</td>
</tr>
<tr>
<td></td>
<td>Albemarle - Pamlico National Estuary Partnership Map</td>
<td>AP map is an interactive mapping application designed to provide geographic information about the Albemarle-Pamlico (A-P) watershed and APNEP.</td>
<td>NC Department of Environmental Quality, Albemarle-Pamlico National Estuary Partnership</td>
</tr>
<tr>
<td>✔</td>
<td>Alluvial Fans</td>
<td>Location and attributes of alluvial fan studies. Only the 1-percent-annual-chance flood is mapped for alluvial fans. The alluvial fan could be mapped as: Zone AO areas with depths and velocities; Zone AO areas with just depths; or Zone A, AE, or X. This information is needed for the Summary of Alluvial Fan Analyses and Results of Alluvial Fan Analyses tables in the FIS report.</td>
<td>Department of Homeland Security, Federal Emergency Management Agency</td>
</tr>
<tr>
<td>✔</td>
<td>Anadromous Fish Spawning Areas</td>
<td>NC DEQ maps here: <a href="http://portal.ncdenr.org/web/mf/afsa-maps">http://portal.ncdenr.org/web/mf/afsa-maps</a></td>
<td>NC Department of Environmental Quality, Division of Marine Fisheries</td>
</tr>
</tbody>
</table>

Use checkboxes to select data sets you would like to Download or View on Map, then hit Download or View on Map button. You will then be prompted to define your geographic area of interest.
Screening Tool

• Key Functionality
  – Screen against 60+ key data layers for area impacts
  – Ability to screen STIP and SPOT projects, uploaded study area, or draw a study area
  – Produce screening report that measures impact totals by individual data set
  – Provide ability to download impacts data sets
  – View impact data on a map
Welcome to the Project Development Screening Tool

In order to screen a project study area, you need to complete a few steps:

1. Build Your Study Area
2. Buffer Your Study Area (optional)
3. Select Data to Screen
4. View, Download, and/or Share Your Screening Report

To begin: How would you like to build your Project Study Area?

1. **By Project ID**
   Select if you know your STIP or SPOT ID for the project you are screening.

2. **Upload Study Area**
   Select if you have a study area boundary in .zip format.

3. **Draw Study Area**
   Select if you would like to build your study area using draw tool.
Screen By Project ID

Utilize the Project ID Search and/or select your project from the map with the map Selection Tools. Only projects highlighted on the map will be included in your Study Area when you click Next.

Enter STIP or SPOT ID
Ex. STIP ID: 140914, Ex. SPOT ID: 11141399
Screen By Project ID

Utilize the Project ID Search and/or select your project from the map with the map Selection Tools. Only projects highlighted on the map will be included in your Study Area when you click Next.

Enter STIP or SPOT ID

Example STIP ID: 10914, Ex. SPOT ID: M141398

U.S. 5291

Back

Next
Buffers are required to be:
1. Applied for point and line features
2. No more than 2 miles
Buffers are optional for polygon features.

Distance: 1000
Unit: Feet

© 2018 - North Carolina Department of Transportation
Select the data sets against which you would like to screen your project. Use check boxes to add layers to your screening. Click the layer name to preview the layer on the map, view layer information, or set sub-report fields for specific layers.

- Human Environment
- Natural Environment
- Conservation Area
- Critical Areas (ESM Layer)
- National Conservation Easement Database
- National Wildlife Refuges (>3M)
- NC CAMA Counties (DCM List)
- NC DEQ DCM Coastal Reserve Boundary
### Build Your Screening Report

Enter Report Name and Description of your choice.

<table>
<thead>
<tr>
<th>Report Name</th>
<th>ACEC Presentation Screening - U-5891</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Description</td>
<td>ATLAS screening for ACEC presentation for U-5891.</td>
</tr>
<tr>
<td>STIP ID</td>
<td>U-5891</td>
</tr>
<tr>
<td>SPOT ID</td>
<td>H090577</td>
</tr>
</tbody>
</table>

**Screening Progress:**
- Calculating Impacts: 20 of 63
- Generating Maps: Please wait...

© 2018 - North Carolina Department of Transportation
Number of potential impacts: 14

- Submerged Aquatic Vegetation
- NOAA Essential Fish Habitat
- Hydrography
- NC DEQ Draft 303d Category 5 Assessments
- FEMA Stream Study Type (ESM Layer)
- DWR Trout Waters 2014 (ESM Layer)
- 303d and 305b Streams (ESM Layer)
- NC DEQ Outstanding Resource Waters in North Carolina
- NC DEQ Water Supply Watershed III
- NC DEQ High Quality Waters in North Carolina
Project Development Screening Report

ACEC Presentation Screening - U-5891

Report Description:
ATLAS screening for ACEC presentation for U-5891.

Buffer Size: 1000 Feet

STIP/SPOT ID: U-5891, H090577

STIP/SPOT Description:
U-5891: I-540 TO NORTH OF NC 98. WIDEN TO MULTILANE DIVIDED ROADWAY.

Summary of Potential Impacts

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Potential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Area</td>
<td>Yes</td>
</tr>
<tr>
<td>Fish and Aquatics</td>
<td>No</td>
</tr>
<tr>
<td>Hydrography</td>
<td>Yes</td>
</tr>
<tr>
<td>Category</td>
<td>Count</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Fish and Aquatics</td>
<td></td>
</tr>
<tr>
<td>NC Heritage Fishing Nursery Areas</td>
<td>0</td>
</tr>
<tr>
<td>NOAA Essential Fish Habitat</td>
<td>0</td>
</tr>
<tr>
<td>Submerged Aquatic Vegetation</td>
<td>0</td>
</tr>
<tr>
<td>Hydrograph</td>
<td></td>
</tr>
<tr>
<td>303d and 305b Streams (ESM Layer)</td>
<td>7</td>
</tr>
<tr>
<td>FEMA Stream Study Type (ESM Layer)</td>
<td>5</td>
</tr>
<tr>
<td>NC DEQ Water Supply Watersheds IV</td>
<td>4</td>
</tr>
<tr>
<td>USGS 24K Streams 2014</td>
<td>4</td>
</tr>
<tr>
<td>NC DEQ Water Supply Watersheds</td>
<td>2</td>
</tr>
<tr>
<td>NC DEQ Draft 303d Category 5 Assessments</td>
<td>1</td>
</tr>
<tr>
<td>DWR Trout Waters 2014 (ESM Layer)</td>
<td>0</td>
</tr>
<tr>
<td>High Quality Water and Outstanding Resource Water Management Zones</td>
<td>0</td>
</tr>
<tr>
<td>NC Wild and Scenic Rivers</td>
<td>0</td>
</tr>
<tr>
<td>NOAA Designated Critical Resource Waters</td>
<td>0</td>
</tr>
<tr>
<td>USDA Forest Service Wild and Scenic Rivers</td>
<td>0</td>
</tr>
<tr>
<td>WRC Trout Waters</td>
<td>0</td>
</tr>
<tr>
<td>Physiography</td>
<td></td>
</tr>
<tr>
<td>NCDOT SSURGO Soils</td>
<td>144</td>
</tr>
<tr>
<td>US EPA Level III Ecoregions</td>
<td>1</td>
</tr>
<tr>
<td>US EPA Level IV Ecoregions</td>
<td>1</td>
</tr>
<tr>
<td>Utilities</td>
<td></td>
</tr>
<tr>
<td>NC Public Water Supply Water Sources</td>
<td>5</td>
</tr>
<tr>
<td>NC Water Supply intakes</td>
<td>5</td>
</tr>
<tr>
<td>NC Surface Water Intakes</td>
<td>0</td>
</tr>
<tr>
<td>Sanitary Sewer Systems - Land Application Areas</td>
<td>0</td>
</tr>
<tr>
<td>Sanitary Sewer Systems - Pumping Stations</td>
<td>0</td>
</tr>
<tr>
<td>Water Distribution Systems - Water Pumping Stations</td>
<td>0</td>
</tr>
</tbody>
</table>
ATLAS Workbench

• Key Functionality
  – Flexible in conjunction with policy changes
  – Advanced Map Viewer
  – Integration with SharePoint (Scoping and PreConstruction)
  – Ingestion of standard deliverable data (PDF and spatial data deliverables)
  – View your project within the context of surrounding projects and data for those projects
U-5834

US 25 (Hendersonville Rd) to SR 3157 (Weston Rd). Upgrade existing roadway.
Buncombe

ATLAS Tools

- **ATLAS Workbench**
  Use the Workbench to monitor project status, submit your final project documents, and upload spatial deliverables.

- **ATLAS Data Search Tool**
  Use the Data Search Tool to access GIS datasets from multiple sources in one single search interface.

- **ATLAS Screening Tool**
  Use the Screening Tool to analyze a project study area for natural and human environment impacts based on key GIS datasets.

Precon Project Map
Natural Resources

Is Natural Resources required?
- Yes  ○ No

a. Natural Resources:
- Was Jurisdictional Area Delineation completed?
  - Yes  ○ No

- Were T&E surveys completed?
  - Yes  ○ No

- What effect will the project have on Threatened and Endangered Species or their critical habitat?

- Select species that are potentially impacted:

- Are there any species for which biological conclusions are unresolved?
  - Yes  ○ No

  If so, which and why?

- Has the USFWS requested a Biological Assessment during Section 7 consultation?
  - Yes  ○ No
Has the plant survey been conducted during appropriate season?

1) Yes
2) No

Upload PDF Report

Upload Spatial Data

QA/QC’s data-naming convention, correct TIP etc.

QA/QC’s data-schema validation, correct TIP
Workbench – Snowball Effect

- Put Data into Action
- Harvest Project Data
- Establish Project Data Repository
- Build Tools to Enforce Standards
- Development of Standards
Application Management Tool

Key Functionality

- Add/remove layers
- Manage deliverables types
- Manage workbench questions
- Update About, Application Disclaimers, Additional Resources, and Help
<table>
<thead>
<tr>
<th>Layer Name</th>
<th>Linked Documents</th>
<th>Linked Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 Integrated Reporting Water Quality Assessments</td>
<td>NRTR, FeasibilityDesign</td>
<td>Natural Environment</td>
</tr>
<tr>
<td>2015RareRoadsidePopulations_pt_nodupL.shp</td>
<td>None selected</td>
<td>None</td>
</tr>
<tr>
<td>2016 Traffic Segments Primary</td>
<td>Traffic Forecast, Traffic</td>
<td>Congestion Management</td>
</tr>
<tr>
<td>2016 Traffic Segments Secondary</td>
<td>Traffic Forecast, Traffic</td>
<td>Congestion Management</td>
</tr>
<tr>
<td>303d and 305b Streams (ESM Layer)</td>
<td>5 selected</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>911 Response with Transport Capability</td>
<td>CCR</td>
<td>Human Environment</td>
</tr>
<tr>
<td>911 Response without Transport Capability</td>
<td>CCR</td>
<td>Human Environment</td>
</tr>
<tr>
<td>Air Medical/Specialty Care Transport</td>
<td>CCR</td>
<td>Human Environment</td>
</tr>
</tbody>
</table>
### Configure Controls for Natural Resources

<table>
<thead>
<tr>
<th>Order</th>
<th>Title</th>
<th>Control Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Was Jurisdictional Area Delineation completed?</td>
<td>Yes No</td>
</tr>
<tr>
<td>2</td>
<td>Were T&amp;E surveys completed?</td>
<td>Yes No</td>
</tr>
<tr>
<td>3</td>
<td>What effect will the project have on Threatened and Endangered Species or their critical habitat?</td>
<td>Dropdown</td>
</tr>
<tr>
<td>4</td>
<td>Select species that are potentially impacted:</td>
<td>Multiple Select</td>
</tr>
<tr>
<td>5</td>
<td>Are there any species for which biological conclusions are unresolved?</td>
<td>Yes No</td>
</tr>
<tr>
<td>6</td>
<td>If so, which and why?</td>
<td>Text</td>
</tr>
<tr>
<td>7</td>
<td>Has the USFWS requested a Biological Assessment during Section 7 consultation?</td>
<td>Yes No</td>
</tr>
</tbody>
</table>
ATLAS in the GIS Landscape

Federal Agencies

State Agencies

Local Agencies

ATLAS

NCDOT’s ATLAS Webservices

Teams working on projects for NCDOT using the ATLAS tools
Importance of continued data access

- Government Shutdown
- NCDOT’s ATLAS Webservices
- Agency’s server is down
Important Notes on ATLAS

• We are not eliminating field work
  – Field work is still a major component of all projects. For the first time we will be capturing this data for all projects undergoing environmental evaluation.

• We are not eliminating jobs
  – We are helping project teams do their jobs more effectively and efficiently.

• We are pushing more work earlier in the process to help scheduling, budgeting and scoping

• We are helping to deliver better projects within our program delivery goals by:
  – Improving GIS data and management
  – Improving processes
Questions?

ATLAS@ncdot.gov

- Ryan Arthur, NCDOT GIS Unit rarthur@ncdot.gov
- Eric Wilson, KCI, eric.Wilson@kci.com
- Wendee Smith, North State, w.smith@nsenv.com
- Morgan Weatherford, NCDOT EAU mdweatherford@ncdot.gov
- LeiLani Paugh, NCDOT EAU lpaugh@ncdot.gov