Improving NCDOT Project Delivery With GIS

Ryan Arthur NCDOT & Eric Wilson KCI

3/20/2018
Goals of the presentation

• Share the evolving story of a unique project at NCDOT
• Inform you about how GIS will be used to help expedite project delivery in the future
• Highlight the importance of:
  – Proper planning for agency transition
  – Standardization for deliverables and data
  – Utilizing Business Analysis methods to understand a problem
  – Implementing Business process improvements
  – Intra-agency communication and outreach
  – Inter-agency agreements for data sharing
  – Programmatic Agreements for reductions in cost, time, and review.
• Offer additional lessons learned based on this experience
Overall Transportation Project Process

• Step 1: Planning
  – Comprehensive Transportation Planning (20-25 years)

• Step 2: Programming
  – State Transportation Improvement Program (10 years)

• Step 3: Project Development and Env. Analysis
  – Project is funded and proposed project is evaluated

• Step 4: Design

• Step 5: Property Acquisition

• Step 6: Construction
Overall Transportation Project Process

- **Step 1: Planning**
  - Comprehensive Transportation Planning (20-25 years)

- **Step 2: Programming**
  - State Transportation Improvement Program (10 years)

- **Step 3: Project Development and Env. Analysis**
  - Project is funded and proposed project is evaluated

- **Step 4: Design**

- **Step 5: Property Acquisition**

- **Step 6: Construction**
Setting the stage

• NCDOT was not meeting expectations for project development timeframes

• Management expects to meet the goal of “3,2,1”
  – 3 years to complete an Environmental Impact Statement
  – 2 years to complete an Environmental Assessment
  – 1 year to complete a Categorical Exclusion

• This goal was communicated effectively to everyone throughout the agency (this will come into play later…. )
Expectations vs Reality
Catalyst
The Kinston Bypass Project
Kinston Bypass Project

Detailed Study Alternatives

Orange Alignments—Alternatives 1 & I Shallow Southern Bypass

Pink Alignments—Alternatives 63 & 65

Red Alignments—Alternatives 11 & 12

Blue Alignments—Alternatives 51 & 52

Yellow Alignments—Alternatives 31 & 32

Purple Alignments—Alternatives 35 & 36
The Catalyst
Kinston Bypass Experiment

Browntown Road

KINSTON BYPASS
The Catalyst
Kinston Bypass Experiment

• Screening was successful in reducing project development time for by characterizing the project efficiently.

• GIS data was able to be used for several uses throughout the project.

• GIS data was also used on Brownton Road widening project and assisted in that projects ability to be accelerated.
Meanwhile…

```
RE-ORG CHART
```

```
V
?
X
?
X
V
? 
X

```
Decentralization

Centralization and Decentralization
Meanwhile… cont

- The first screening tool appears…

- The Environmental Analysis Unit had created an arcpy tool years ago that screened all STIP projects with about 100 environmental layers.

- Output was a very complicated spreadsheet

- Used to determine which projects should stay at central and which projects can go to divisions
Deadline Given

• Upper management tells Technical Services group to find a solution and get it into place by October 2018.

• Main focus was on screening projects for environmental impacts and building predictive models for some of those key datasets.
A Confluence

Agency Reorganization

+ 3,2,1 Mandate

+ Deadline

Kinston Bypass Experience

+ Screening Tool
An Unorthodox Approach

• In September - August 2017 the Environmental Analysis Unit reaches out to GIS (because of Kinston Bypass project) for help in improving project delivery

• August 2017, EAU holds an “Industry Day” where over 100 contractors met with EAU, GIS, and the agencies upper management
  – NCDOT introduced the project and invited firms to submit resumes of their personnel
Gathering the Knowledge Base

• Teams of disciplines were created, comprised of SMEs in different areas of environmental analysis in project development
  – Wetlands
  – Streams
  – Threatened and Endangered Species
  – Transportation modeling (forecasts, congestion, bike/ped, planning, transit etc.)
  – Sweeping Environmental
  – Hydraulics
  – GIS
  – And more would come
Detective Work

What does expediting project delivery really mean?

What have other DOT's done?

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

Who is involved in project delivery?

Where is the data to support this?
Overall business process takes shape

• Over 80 interviews with business units across the agency by October.

• Understanding emerges that there are deficiencies with all aspects of the project development process- not just environmental data.

• The Project Managers need better information before a project begins... "An informed scoping meeting"
What is project scoping?

**Scoping Objectives:**
- Understand the **Problem** - history and context
- Understand **resources** within the area
- Identify **issues**, constraints
- Discuss **potential ideas** for Solutions
- Plan project **approach & next steps**
Preliminary Understanding

• Realization that consultants and NCDOT folks do not always use the same data from the same source or do not know where the data is located
  – **Deliverable #1 = a search tool**

• At many points throughout the project delivery process, screening could be introduced to help planners, project managers, and consultants understand impacts to their projects for better planning and implementation
  – **Deliverable #2 identified = screening tool**
Preliminary Understanding

• Project managers don’t have a standard tool for managing their projects
  – Deliverable #3 identified = project management platform (interface where PM’s and consultant PM’s can see the status of screenigns, which deliverables are needed and which ones have been completed, and project analytics)

• There are many areas where Business Units are developing key datasets on their local PC’s
  – Deliverable #4= enterprise database
Figuring it out

- After many meetings and many whiteboarding sessions between Eric and Ryan, the big picture starts to emerge
Overall picture takes shape
Visualizations - A Turning Point

• Process Flow chart showed others, at a high level, where in the business process our project would be making improvements
• Crystalized for others the type of improvements there would be
• Power BI examples helped show graphically what a screening could provide
But Wait…

• Other Business Units received the same “3,2,1” message and had started similar efforts.
  – Feasibility Design
  – Governance Office
  – Traffic Forecasting
  – Transportation Planning Division
  – 14 Divisions
  – Central Office

• The visualizations, graphics and interview results quickly moved our project to the forefront as the best option for success.

• Unification of those efforts was a task unto itself
Project ATLAS

- Project ATLAS - Advancing Transportation through Linkages Automation and Screening

- Improve business processes and provide a data access framework to support automated screening of projects in order to reduce project delivery times
Moving from Generalities to Specifics

• The ATLAS effort had now identified that deficiencies existed essentially everywhere but those were not clearly articulated.

• GIS engages Business Analysts to document current Business Processes to gather the specific deficiencies.

• Data associated with those Business Processes is also identified.

• BPMN 2.0 used as a standard to document
Whiteboardin’ and...
Drawings to Diagrams

[Diagram of project delivery process]
Data, Data, Data…

- Disciplines submit all GIS data used in their deliverables.
- Eric builds data repository where our analysts enter data from the discipline’s lists—metadata (location of services, downloads, date of last update, update cycle etc.)
- The repository gets populated with fields for deliverable type, organization, sub-organization etc.
- We link datasets to hard project deliverables and the groups responsible for those datasets to get the whole picture.
- We set out to use this approach for new business process improvements and datasets we’ll be creating through this project.
Improving NCDOT Project Delivery With GIS

Diagram showing the relationship between different departments and agencies, such as Natural Resources Conservation Service, NC Department of Environmental Quality, NC Geodetic Survey, NCDOT, United States Geological Survey (USGS), Traffic Forecast, Preliminary Design Report, and NRTR.
Results of Business Analyst Effort

- Extraordinary amounts of data and processes are at work to accomplish project delivery
- Lack of Standards for deliverables
- Mainly pdf deliverables with no spatial data
- Old/Duplicate Data
- Extraordinary amount of Manual effort
- SharePoint!
Improving NCDOT Project Delivery With GIS

R-3419 - US 158 from US 64-NC 12 to Eastern end of WMB Access Management Dare

Project Site
- Preconstruction Home
- Grant Consulting Firm Access
- Lock/Unlock Plans or Provisions
- Key Documents
- Discipline Specific Links
- Preconstruction Help
- Project Structures
- Project Contacts
- Project Commitments
- Recently Modified

General

Disciplines
- Congestion Management (0)
- Erosion Control (0)
- Geoenvironmental (0)
- Geotechnical (0)
- Human Environment (0)
- Hydraulics (0)
- Intelligent Traffic Systems and Signals (0)
- Location and Surveys (0)
- Natural Environment (0)
- Project Development (0)
- Rail (0)
- Right of Way (0)
- Roadway Design (4)
- Signing and Delineation (0)
- Structures Design (0)
- Utilities (0)
- Work Zone Traffic Control (0)

Collaboration

LET Preparation
Moving Forward

• Requirements documents are taking shape
Moving Forward

Potential for Automation

- Business Understanding
- Data Understanding
- Data Preparation
- Modeling
- Evaluation
- Deployment
Code Management

Visual Studio Team Services

- Code
- Insights
- Build
- Test
- Deploy

C# (Microsoft .NET)

Python

- v0.1
- v0.2
- v1.0

Master

Develop

Feature

Feature
Code Review/Standards

CAST

Achieve Insight. Deliver Excellence.
Team Management
Workflow Modeling
Data Management

Microsoft SQL Server

esri ArcSDE
Conclusion

• October is coming quickly...
  – Search Tool in April
  – Screening Tool by May
  – Project Management Platform in October

• Lots to do
• Staff is motivated