ALL ROADS NETWORK OF LINEAR REFERENCED DATA (ARNOLD) PHASE 1 - NETWORK DEVELOPMENT

Executive Sponsor: Tom Church, Cabinet Secretary/Tamara P. Haas, P.E., Asset Management and Planning Division Director

Business Owners: Yolanda Duran, NMDOT Data Management Bureau
Joann Girard, Business Support IT Project Manager
Project Certification for Project Closure
July 27, 2016
Phase 1
FHWA Pooled Fund Study
• Create statewide LRS network that complies with MAP-21 requirements
• Combine NMDOT legacy LRS network currently housed in TIMS with the following sources:
  • E911
  • ProMiles
  • Navajo
  • Federal (BLM, USFS, BIA, NPS, USCOE, Army, BOR, DOE & FWS)
• Establish processes to identify and incorporate network changes

Project Timeline
• Start: Nov, 2014
• Complete: 5/1/2016

Project Phase
• Closure – July 2016

Phase 2
Stand up Esri Roads & Highways and Migrate NMDOT TIMS Data
• Stand up Esri R&H test and production environments
• Migrate Phase 1 LRS to Esri environments
• Migrate TIMS asset data, including Bridge, Traffic & HPMS Data (some data sourced from Mandli)

Project Timeline
• Start: Aug, 2016
• Complete: Nov/Dec, 2017

Project Phase
• Planning

Phase 3
Connect Other NMDOT LRS-Dependent Systems and Data Sources
• Prioritize interfaces for other NMDOT systems to connect to Phase 2 Esri R&H Implementation
• Includes the following systems:
  • Pavement Management
  • Maintenance Management
  • STIP
  • Traffic
  • Bridge Management
  • Outdoor Advertising
  • Right of Way
  • Crash

Project Timeline
• Start: Oct/Nov, 2017
• Complete: TBD

Project Phase
• Not yet started
In September, 2014, detailed planning for a monolithic ARNOLD project commenced.

During Discovery, in October 2014, NMDOT identified overall project costs to develop a LRS ranging from $900K-$1.8M. Cost range was vendor-dependent. Discussions began with FHWA to identify methods and options to reduce cost, while maintaining the goals and business requirements of the project.

In May, 2015, the project was restructured to a phased project, with Phase 1 purely for development of the LRS.

FHWA recommended NMDOT join the Pooled Fund Study, with 9 other states, with FHWA providing Federal oversight of the Study deliverables and contractors. Funding participation requirement to develop the LRS fell to the current final project total of $227,463.75.
1. Full Integration of Legacy NMDOT LRS with E911, City/County, Tribal and Federal geodatabase data to create an integrated, continuous, statewide LRS network that complies with Federal MAP-21 requirements.

2. Create a strategic plan to enable on-going maintenance of the statewide LRS network as both external source and internal NMDOT data changes over time to ensure the LRS accurately represents the most up-to-date statewide road network data.

Outcome:
- The project met the above goals fully
A continuous, statewide Linear Referencing System (LRS) that meets the MAP 21 ARNOLD requirements

Strategic plan developed to support on-going maintenance of Linear Referencing System (LRS) as input sources improve data in the future

Provide a solid foundation to allow ARNOLD Phase 2 Project to efficiently proceed with creation of ESRI Roads & Highways environment and legacy NMDOT asset data migration to the new LRS network

Outcome:
- The project met the above goals fully
- All business goals achieved
- All data required for ARNOLD Phase 2 project complete and in-place, and ready for handoff to Phase 2 project team
- We conflated LRS data from many sources including but not limited to, E911, Navajo, various Federal roads, as well as NMDOT’s own roadway network to create the new LRS.
- This new network was successfully used for the 2016 FHWA HPMS submittal and is now the network of record for the NMDOT.
- Participation in FHWA Pooled Fund Study significantly lowered originally estimated ARNOLD Program cost by utilizing economy of scale (multiple state cost share).
## Project Phases and Deliverables

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Milestone</th>
<th>Detail</th>
<th>Due Date</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation – Closeout</td>
<td>IV&amp;V</td>
<td>IV&amp;V Support across ARNOLD Program Phase 1 and Phase 2</td>
<td>12/31/2016</td>
<td>Independent Verification &amp; Validation</td>
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<tr>
<td>Initiation</td>
<td>Discovery</td>
<td>Enterprise LRS and Road Inventory Discovery Workshop and Implementation Planning</td>
<td>10/31/2014</td>
<td>Project team, Implementation methodology, Overview of Project Tasks and Deliverables, Project Plan and Data Review Document</td>
</tr>
<tr>
<td>Initiation</td>
<td>Discovery</td>
<td>FHWA Pooled Fund Study Kickoff &amp; Discovery Workshop</td>
<td>12/31/2014</td>
<td>Project team, Implementation methodology, Overview of Project Tasks and Deliverables and Project Plan</td>
</tr>
<tr>
<td>Planning</td>
<td>Requirements</td>
<td>ARNOLD Development Plan</td>
<td>7/22/15</td>
<td>Produce statement of work to develop and maintain the ARNOLD network.</td>
</tr>
<tr>
<td>Implementation</td>
<td>Data Creation</td>
<td>Aggregation and conflation of City, County and Municipal “All-Road” geodatabases to one master road network geodatabase.</td>
<td>3/31/2015</td>
<td>Data Cleansing and Migration Methodology and Materials, Review Data Cleansing and migration test database</td>
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<tr>
<td>Implementation</td>
<td>Strategic Plan</td>
<td>Create Strategic Plan for on-going maintenance of LRS</td>
<td>5/1/2016</td>
<td>Strategic Maintenance Plan</td>
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<tr>
<td>Post-Closeout</td>
<td>Support</td>
<td>Handoff to Phase 2 project team</td>
<td>Aug 2016</td>
<td>Data and Methodology Review with Phase 2 project team</td>
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## Total Cost of Ownership

<table>
<thead>
<tr>
<th>Description</th>
<th>FFY14</th>
<th>FFY15 &amp; FFY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV&amp;V Independent Validation &amp; Verification</td>
<td>$7,490.00 (POD Amount Spent)</td>
<td>N/A</td>
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<tr>
<td>Consulting Services Project Management, LRS Geodatabase Creation under FHWA Pooled Fund Study</td>
<td>Esri Discovery cost $19,973.75</td>
<td>$200,000.00 (Pooled Fund)</td>
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<tr>
<td>Software Licenses</td>
<td>Included in existing Enterprise License Agreement (ELA)</td>
<td>Included in existing ELA Agreement</td>
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<tr>
<td>TOTAL</td>
<td>$27,463.75</td>
<td>$200,000.00</td>
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Involving FHWA very early in the project provided the best guidance for this project (participation in the Pooled Fund Study), which saved the State $700,000 versus the initial projected project cost. The project was well managed and an accurate Linear Referencing System (LRS) was developed.

An IV/V contract for this project was initiated early in the project but was terminated when FHWA became the primary on the project. When the project was restructured to utilize the FHWA Pooled Fund Study, FHWA assumed all contractual responsibility so contracts for this project were managed directly by FHWA.

- Via the Study, and FHWA’s direct oversight, NMDOT was able to streamline development of the LRS and incorporate learnings from the other states participating in the Study. These learnings were incorporated into the LRS itself, as well as the strategic management plan developed to ensure the LRS is more easily maintainable going forward.

- This project experienced several staff changes, including both NMDOT IT Project Manager and Roadway Inventory Program manager. While the project remained on track during these transitions a formal continuity of operation plan would have streamlined the process.
Questions?