Enterprise Linear Referencing System: Where Are We?



West Virginia Department of Transportation
Division of Highways

Geospatial Transportation Information Section





Agenda

- മ Background
- **Project Status**
- ກ Lessons
- Near Future Plan
- ည Qs & As

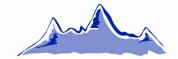


Background



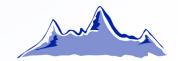
Background

- ഇ Current LRS
- മ Major Issues
- മ Goal & Objectives



Current LRS

- Development Completed in 2008
 - Centerline Geometry: Acquired in 2003
 - Measures: DMI Driven Distances Acquired Since 1960's
- State Maintained Routes Only
- So One LRM: Countywide Milepoint LRM
- Maintained Using Esri ArcGIS
 - Stored in SDE GDB on ArcSDE + MS SQL Sever
 - Edited in ArcGIS Desktop
- Published as Shapefiles/Web Services
- Published on Official Highway Maps



Issues

- **500** No Non-State Maintained Public Roads
- െ No Temporality
- A Statewide Milepoint LRM Needed
- Disconnection from Road Inventory Log (RIL)
 - RIL: Official Roadway Measure Source
- No System Integration w/ Exterior Business Systems
 - Multiple Versions → Out of Sync



Goal & Objectives

Geospatial Strategic/Business Plan

- 1st Version in 2010
- 2nd Version in 2012

ഇ Goal

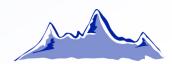
- To Develop an Enterprise LRS for WVDOT & External Users
- ∞ Objectives
 - Based on Modern LRS Data Model (e.g. Temporality)
 - Support FHWA Requirements
 - Statewide Road Network of All Public Roads
 - Sole Official Source to Locate Features & Attributes
 - Seamlessly Integrated with RIL
 - Part of WVDOT Enterprise GIS Infrastructure
 - Part of WVDOT Enterprise IS Infrastructure
 - Easy to Maintain



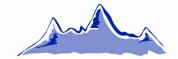
Challenges

- **Development of LRS Data Model**
 - Integration of RIL and LRS
- Data Preparation
 - Conflation of State Maintained Routes and Non State Public Roads
 - Integration of RIL and GIS
 - Data Cleanup
- Esri Roads & Highway (R&H) Solution
- Lack of Resources
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 - Understaffed
 - Few Experts on R&H
 - Few Successful Cases of R&H Implementation





Project Status



2014: A static copy of LRS was provided to wvOASIS in January. Data cleanup continued. Model improved w/ RIL added. ...

2012: Data conflation completed. Data cleanup continued. wvOASIS (ERP) became a key potential user of ELRS.

2013: Transcend Spatial & Esri hired to implement R&H and system integration and improve calibration. Model improved w/ a new LRM & railroads added. Data cleanup continued.

2011: WVDOT initiated the project after Esri R&H demo at GIS-T. First LRS data model developed by Esri. Data conflation started. Data cleanup started.

Major Sub-Projects

- Esri Roads & Highways Implementation
- **So Calibration System Improvement**



Esri R&H Implementation

Multiple Phases

- Phase 1: Prototyping
- Phase 2: Deployed in Test Environment
- Phase 3: Deployed in Production Environment
 - Planning
- ∞ R&H Version 10.2.2



Comprehensive LRS Data Model

- ഇ Two LRMs
- െ Network Gaps
- ഇ Concurrent Routes
- മ Road Inventory Log
- Model Minimum Inventory of Roadway Element (MMIRE)



Complete Roadway Centerline Dataset

M All Public Roads

- State Maintained
- Non-State Maintained
- န္တာ Ramps
- ∞ Crossovers
- ည Dual Carriageways
- **Railroads**
- **Railroad Trails**



Workflows

Workflow Manager Extension

Versioning

50 Three Generic Workflows

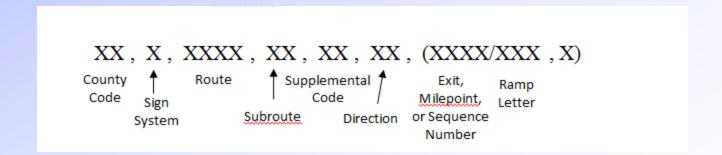
- Commissioner's Order Process
- Route Editing
- Event or Roadway Characteristics Editor (RCE) Editing

- LRS Manager
- Route Editor
- RCE Editor



Counntywide Milepoint LRM

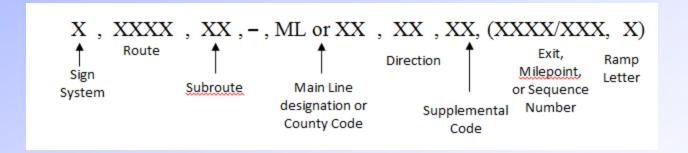
- Measures are reset at county boundaries for all routes except for Interstates whose measures are continuous across the state.
- യ Widely Used at WVDOT
- - Examples: 20201190017NB; 20201190017NB058AF





Statewide Milepoint LRM

- masures are continuous for all routes across the state.
- ജ Route ID Definition
 - Example: 1006400-MLNB00; 2011900-20NB17058AF







Supplemental COUNTY LIST Sian System Code 1 = Interstate 00 Not Applicable 2 = US01 Barbour 20 Kanawha Preston 01 Alternate 3 = WV 02 Berkeley 21 Lewis 40 Putnum 02 Wve 03 Boone 22 Lincoln Raleigh 4 = CO03 Spur 04 Braxton 23 Logan Randolph 5 = N/A04 North 05 Brooke 24 McDowell 6 = STATE PARKS AND FOREST ROADS 43 Ritchie 05 South 7 = FANS 06 Cabell 25 Marion 44 East Roane 06 26 Marshall 45 8 = HARP 07 Calhoun Summers 07 West 08 Clav 27 Mason 46 Taylor 9 = Other 08 business 09 Doddridge 28 Mercer Tucker 0 = MNS (Municipal Non-State) North Bound (Business) 10 Favette 29 Mineral 48 Tyler R= Railroads (WV State Rail Authority) South Bound (Business) 11 Gilmer 30 Mingo 49 East Bound (Business) Upshur T= Trails U = USFR- United state forest road 12 Grant 31 Monongalia 50 Wavne West Bound (Business) 13 Greenbrier 32 Monroe Webster 13 Truck Route 14 Hampshire 33 Morgan Wetzel 14 Bypass Loop 15 Hancock 34 Nicholas 53 Wirt 15 16 Hardy 35 Ohio 54 Wood Toll 16 17 Harrison 36 Pendleton Wyoming 17 Ramp Reserved for Other Statewide Continuous 18 Jackson 37 Pleasants features Other 19 Jefferson 38 Pocahontas City Streets Non-State 21 Footbridges * The direction will be NB, SB, EB, and WB on routes that always have dual geometry (sign system 1 and 2). The direction is 00 on routes that are bidirectional (single geometry, sign system 3 and above). Where WV or County routes switch from single to dual Historical Bridges geometry, the main direction of travel (normally north bound or east bound) will have direction as 00 while the opposite direction will Connector have directional characters (normally SB or WB). New/Proposed Crossover (btwn dual geometry) ** If the ramp is also part of an existing route, the routeid will remain the same as the connected route. Otherwise, the ramp routeid is Emergency Crossover the route id for the highest sign system (interstate, us etc) or lowest route number if in same sign system with the addition of the exit number and ramp letter. The exit number is the mile point of the exit. Mile point is also used at the end of emergency cross over routeid. Left Turn Lane Right Turn Lane 51 Rail Trail Abandoned *** In creating the route layer in ArcGIS we drew lines over every segment of road. This created the possibility of additional lines not in

the RIL. Currently these pieces are mainly undocumented wye segment of road. This created the possibility of additional lines from the RIL. Currently these pieces are mainly undocumented wye segments. The decision was made to use the sequence number (exit segment) of the field to account for duplicate routeid designation. For the first instance of any route, the sequence number is blank. For the first duplicate, the sequence number would be 001 and increment as needed (example: 0240032000200 is the first wye on route 32. If second wye present, routeid would be 02400320002000001).

**** Railroads and Rail Trails in the LRS are only for WV State Rail Authority lines. County Code and sign system will always be 99, and R or T respectively. Each line has a unique route number. Small spurs will be given the main line route number and a unique Sub Route number. Supp Code and Direction are 00.

Measures

ഇ DMI Driven Distance

State Maintained Routes: Interstates, US Routes, WV Routes, etc.

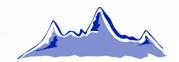
Geometry Length ■

- Non-State Maintained Public Roads/Local Streets
- Ramps
- Cross Overs
- Railroads
- Railroad Trails



Railroads

- ച്ച Sign System "R"
- ∞ County Code "99"
- ∞ Supplemental Code "99"
- Sub-Route Code for Tracks
- Direction Code "00"
- Geometry Length for Measures
- ന്റെ RouteID Examples
 - Countywide Milepoint LRM: 99R0001019900
 - Statewide Milepoint LRM: R000101-990099



Calibration System Improvement

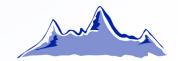
ည Objectives

- Review Current Calibration System
- Make Recommendations

- Beginning & Ending Points
- Measures from RIL

Calibration in R&H

- Beginning & Ending Points
- Intersections
- Break Points for Network Gaps & Concurrent Routes
- Measures from RIL & Geometry Length



System Integration

- LRS Network Updates
- Event Relocation

- R&H Interface w/wvOASIS Agile's Asset Management System
 - Version 7
- R&H Interface w/ Deighton's Pavement Condition System
 - Version 9
- R&H Interface w/ Transmetric's Traffic Server



Interface w/ wv0ASIS Agile's System

- Between Agile's Asset Management System & Esri R&H
 - Agile's System V. 7
 - R&H V. 10.2.2
- Data Exchange for LRS Updates & Related Event Updates
- Functional Design Completed May 2013
- System Testing in November 2014
- In Production by July 2015





wv0ASIS

2010 Our Advanced Solution w/ Integrated Systems

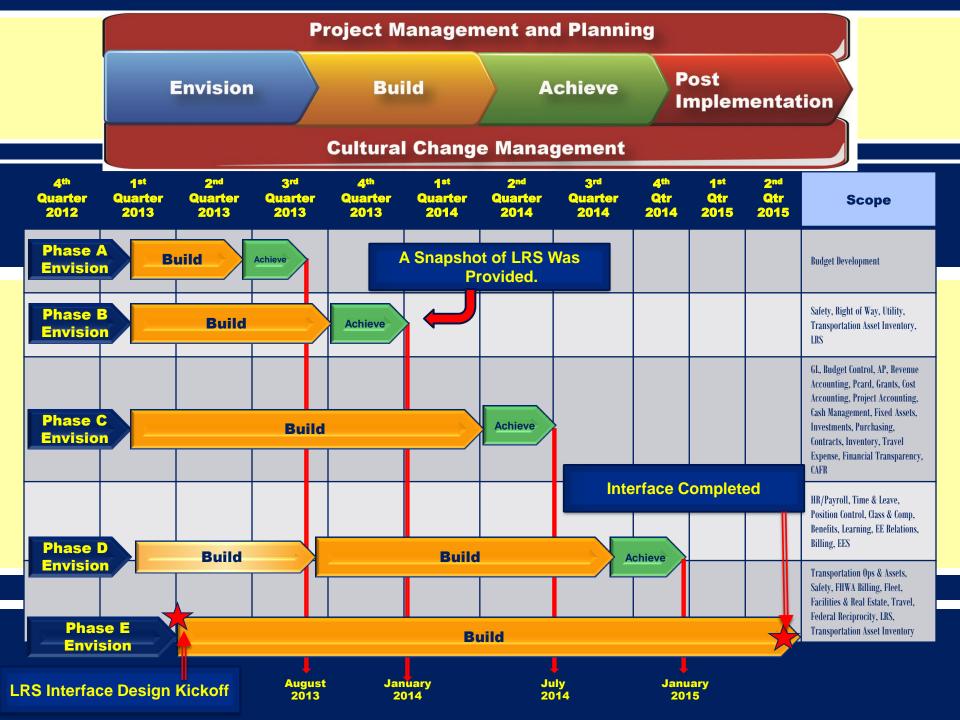
ഇ Goals

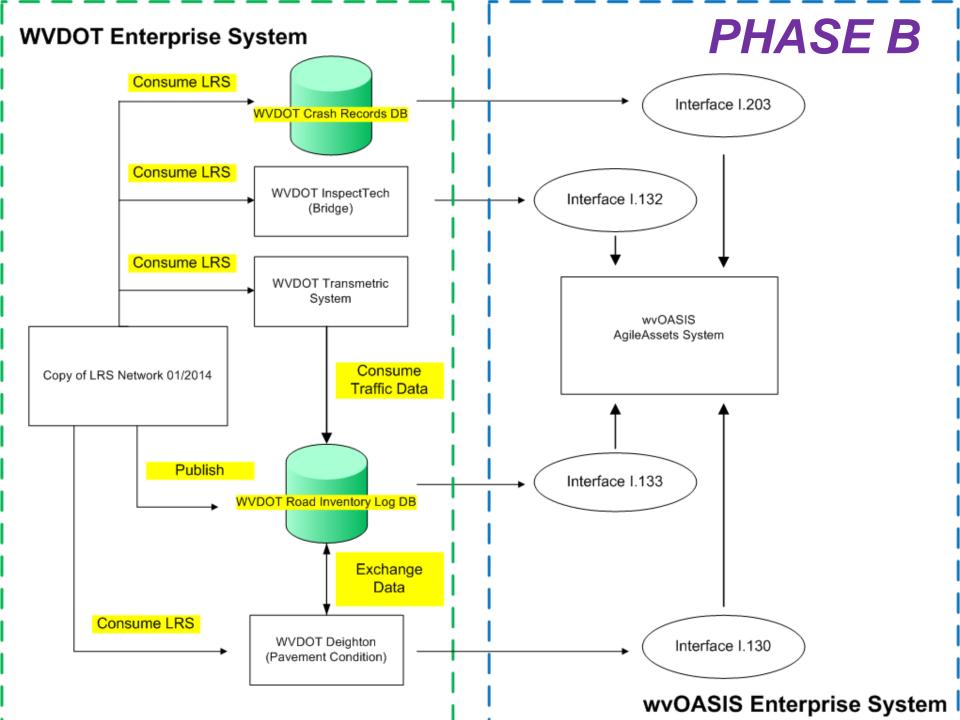
- Replace multiple outdated, stand-alone system w/ one integrated ERP System
- Standardize business processes & practices across the state
- Facilitate timely access to information for daily business

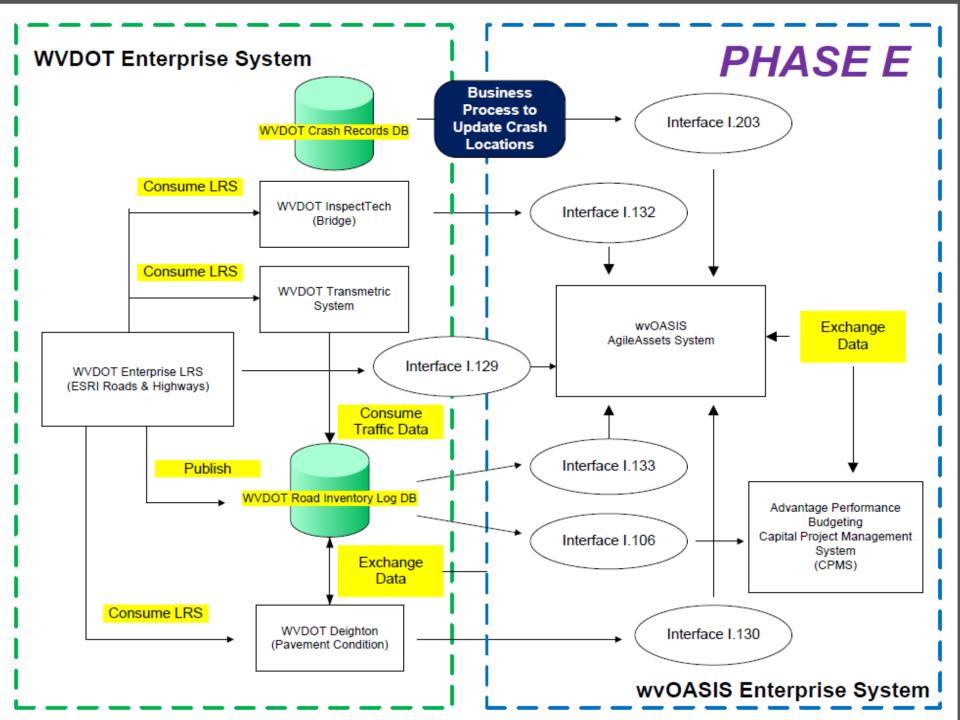
ກ Multiple Phases

- Phase B: Safety, ROW, Transportation Asset Inventory, LRS, & GIS
- Phase E: Transportation Asset Inventory, Transportation Operations
 Management, Capital Planning, Fleet, Facilities, Real Esate, & the
 Interface w/ Esri R&H

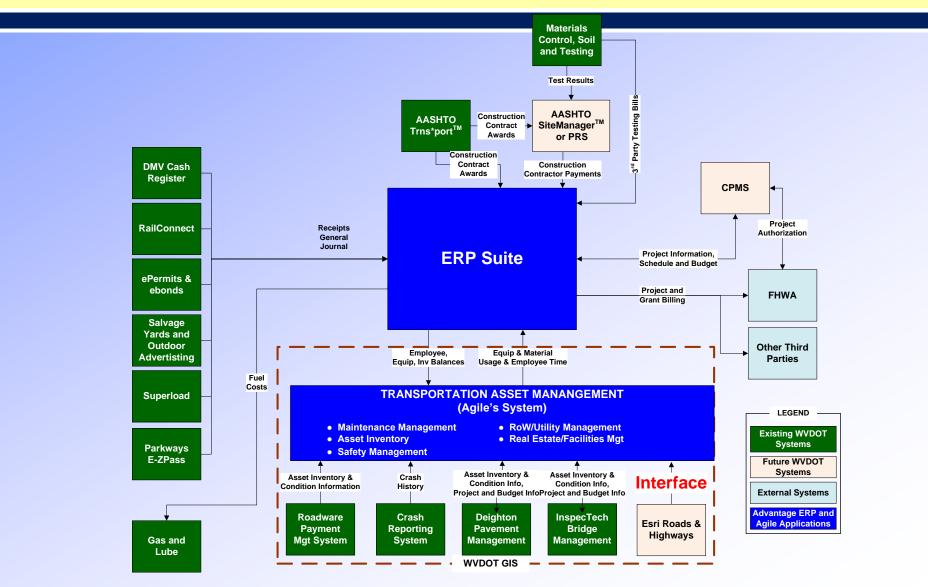




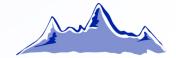




WVDOT Future ERP System Overview



Lessons



Lessons

- May Have a Strategic/Business Plan
- Do an Enterprise System Design
- **EXECUTE** Leverage External Resources
- Don't Deploy Two Systems Simultaneously!



Near Future Plan



Near Future Plan

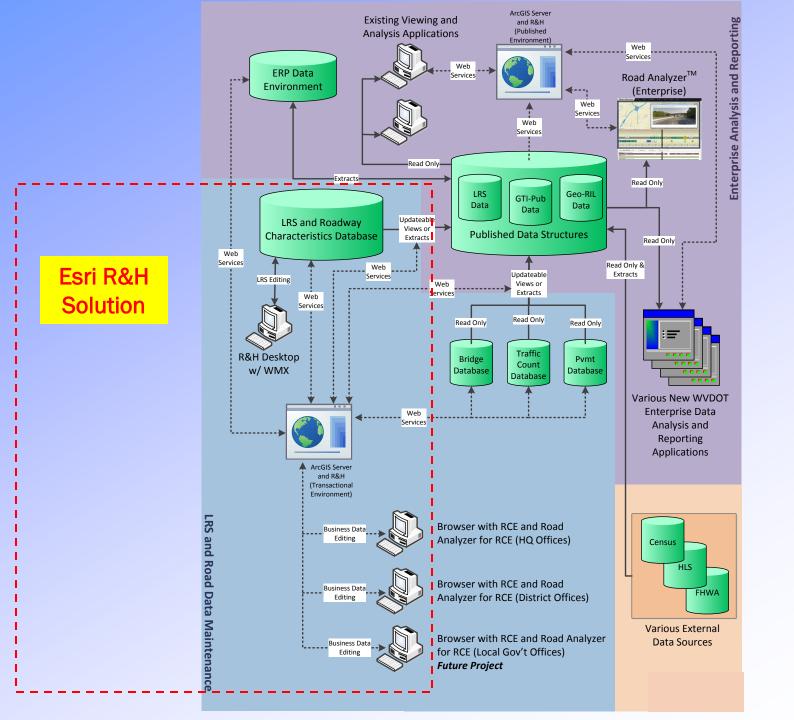
െ By March 2015

- Deploy Esri R&H in Production Environment Phase 3 (TBD)
- Get the Interface w/ Agile's System Ready for Deployment
- ы Keep Cleaning up the Data
- Mork w/ Business Programs to Improve Asset Data
- ∞ Configure
 - Support More Workflows
 - Make RCE More User Friendly

Solution Customize

- Extend R&H Functionality
- Support More System Integration
- Make LRS More User Friendly
- ച്ച Improve
 - Add New LRMs (Address Ranges, Cross Street Referencing, etc.)





Qs & As



Thanks to

- န္တာ IRG
 - Chuck Larson
- န္တာ AgileAssets
 - Abhishek Bhargava
 - Eric Perrone
 - Phil Hardy
 - Siamak Saliminejad
 - Tyler Pauley
 - Etc.
- ള Esri
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 - Silvia Casas
 - Will Isley
 - Etc.
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 - Bill Schuman
 - Jesse Jay
 - Steven Korzekwa
 - Etc.

ກ Others

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- Lingyang Chen
- Marla Johnson
- Robert Maynard
- Robin Goff
- Roger Dorsey
- Shiriedel Acayan
- Etc.

