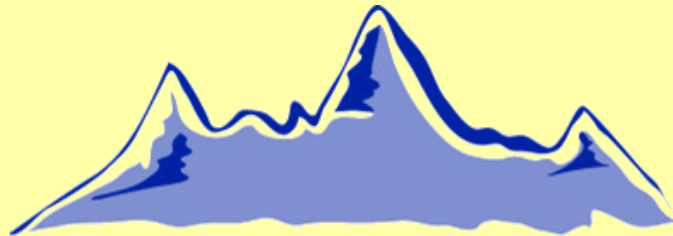


# Enterprise Linear Referencing System: Where Are We?

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October 8, 2014



West Virginia Department of Transportation  
Division of Highways

Geospatial Transportation Information Section

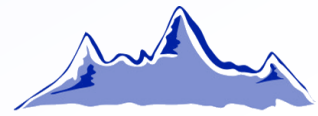


# Agenda

- ☞ Background
- ☞ Project Status
- ☞ Lessons
- ☞ Near Future Plan
- ☞ Qs & As



# Background



# Background

- ☞ Current LRS
- ☞ Major Issues
- ☞ 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
- ☞ 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

- ∞ 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

- 1<sup>st</sup> Version in 2010
- 2<sup>nd</sup> Version in 2012

## ∞ 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

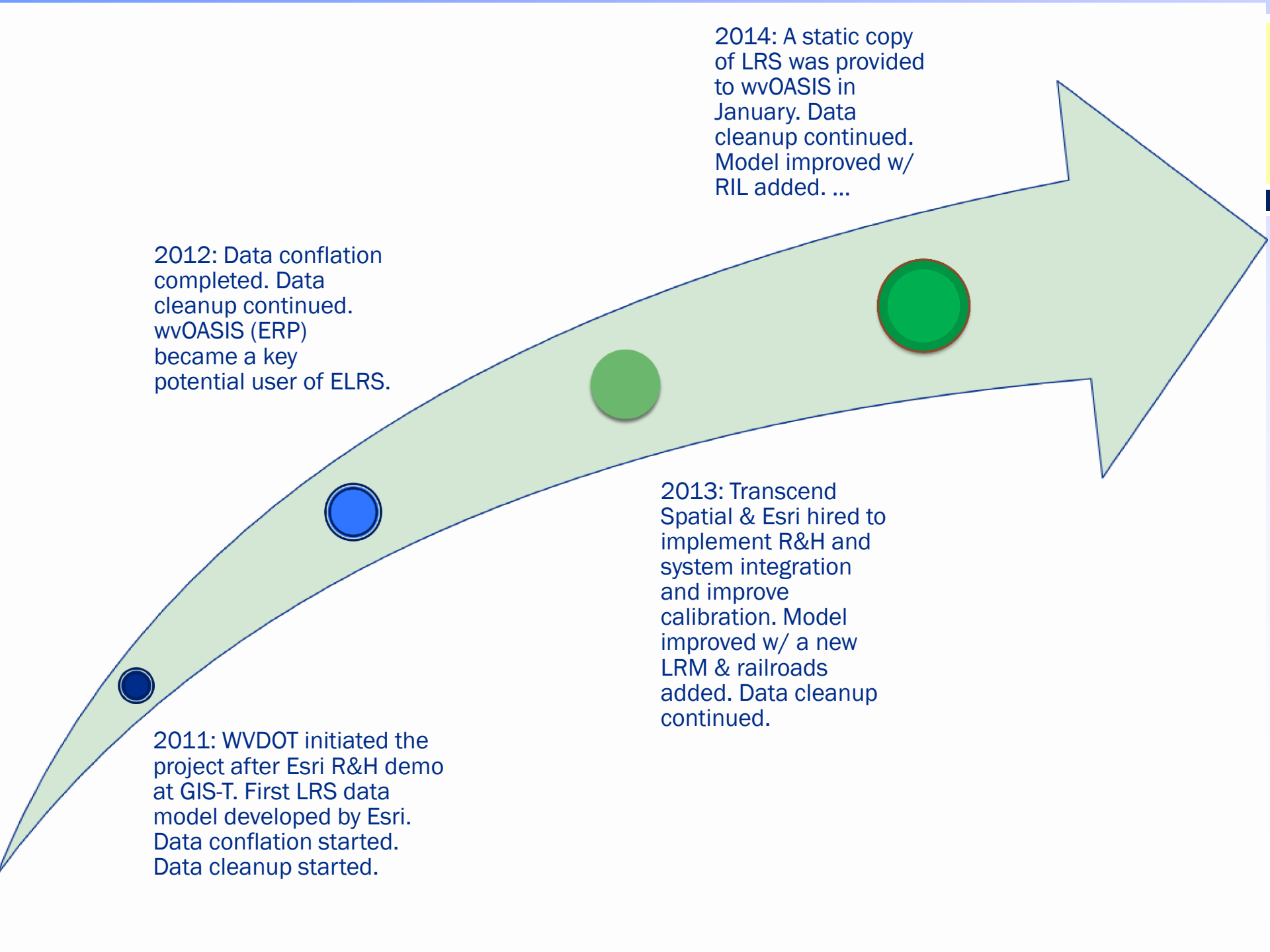
- Understaffed
- Few Experts on R&H
- Few Successful Cases of R&H Implementation





# 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
- ∞ Calibration System Improvement
- ∞ System Integration



# 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

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



# Complete Roadway Centerline Dataset

- ☞ All Public Roads
  - State Maintained
  - Non-State Maintained
- ☞ Ramps
- ☞ Crossovers
- ☞ Dual Carriageways
- ☞ Railroads
- ☞ Railroad Trails



# Workflows

## ☞ Workflow Manager Extension

- Versioning

## ☞ Three Generic Workflows

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

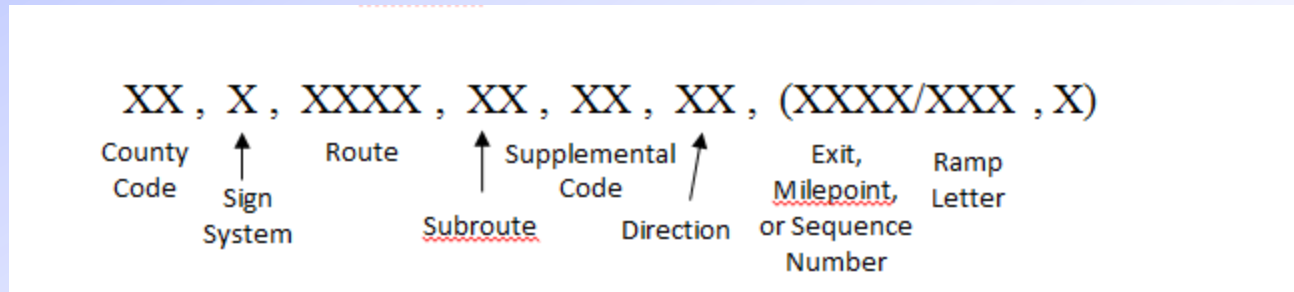
## ☞ Three Roles

- LRS Manager
- Route Editor
- RCE Editor



# Countywide Milepoint LRM

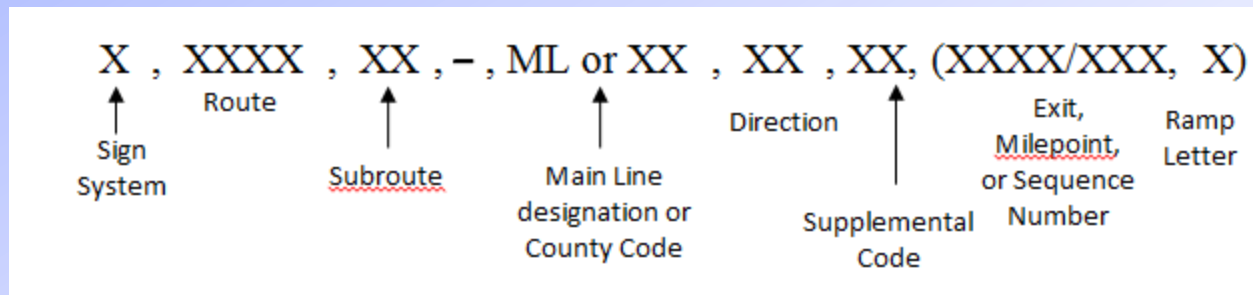
- ∞ Measures are reset at county boundaries for all routes except for Interstates whose measures are continuous across the state.
- ∞ Widely Used at WVDOT
- ∞ Route ID Definition
  - Examples: 20201190017NB; 20201190017NB058AF





# Statewide Milepoint LRM

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





# Measures

## ∞ 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

- ☞ Sign System “R”
- ☞ County Code “99”
- ☞ Supplemental Code “99”
- ☞ Sub-Route Code for Tracks
- ☞ Direction Code “00”
- ☞ Geometry Length for Measures
- ☞ RouteID Examples
  - Countywide Milepoint LRM: 99R0001019900
  - Statewide Milepoint LRM: R000101-990099



# Calibration System Improvement

## ∞ Objectives

- Review Current Calibration System
- Make Recommendations

## ∞ Current Calibration

- 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

## ∞ Two APIs Published by R&H

- LRS Network Updates
- Event Relocation

## ∞ Three Interfaces

- 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/ WV OASIS 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



# WV OASIS

## ☞ Our Advanced Solution w/ Integrated Systems

### ☞ 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

### ☞ Multiple Phases

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





# Project Management and Planning

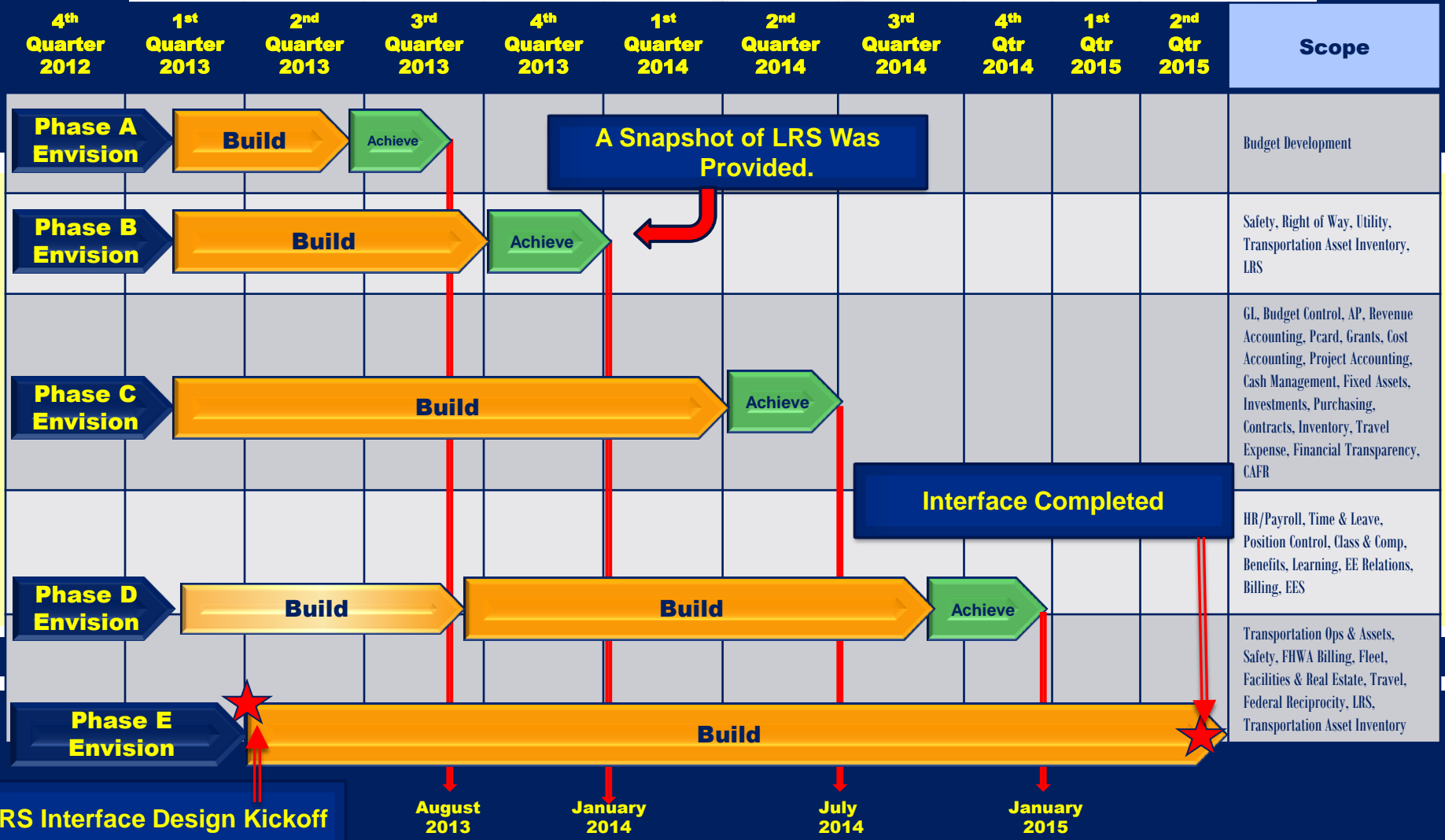
Envision

Build

Achieve

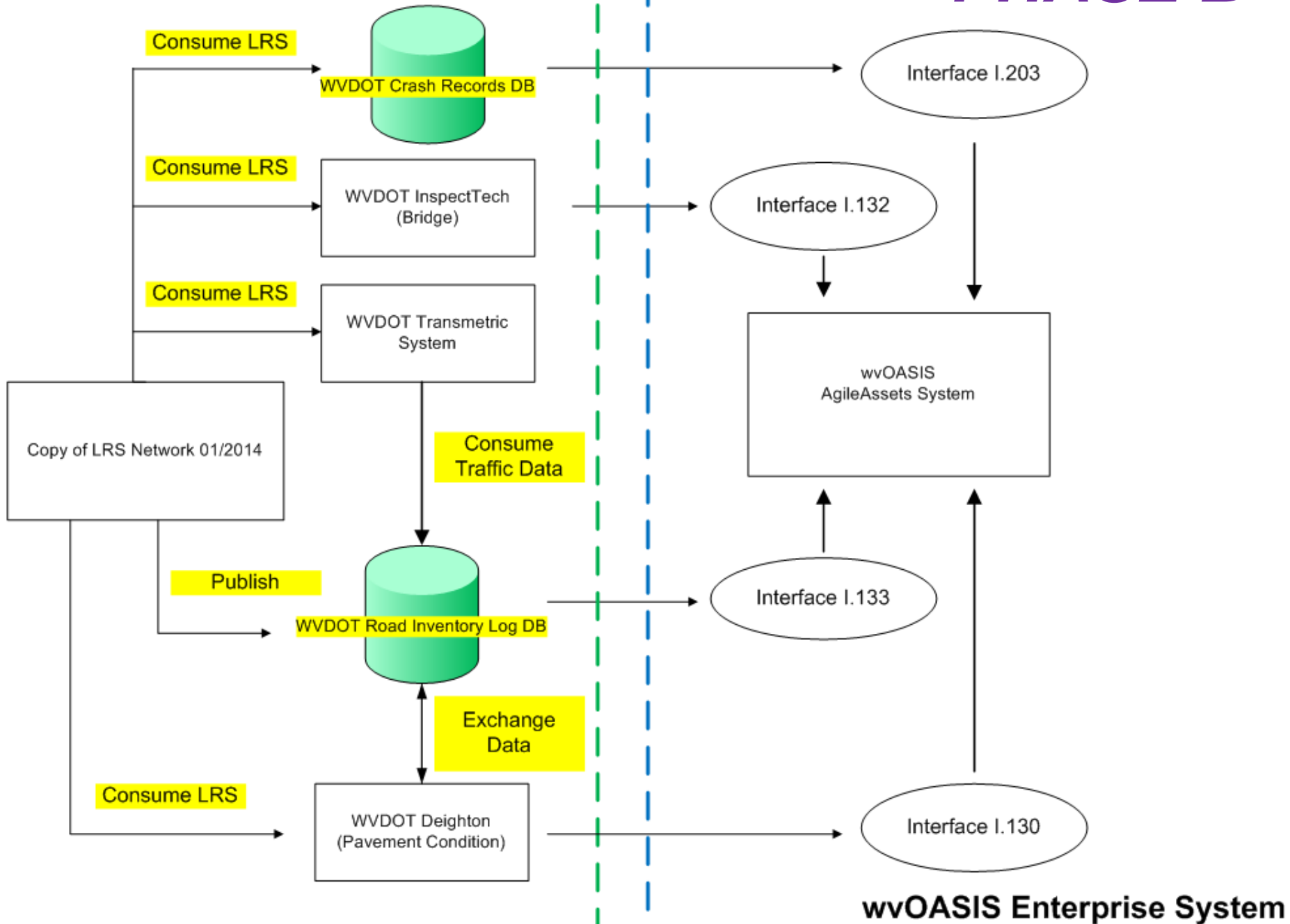
Post Implementation

# Cultural Change Management



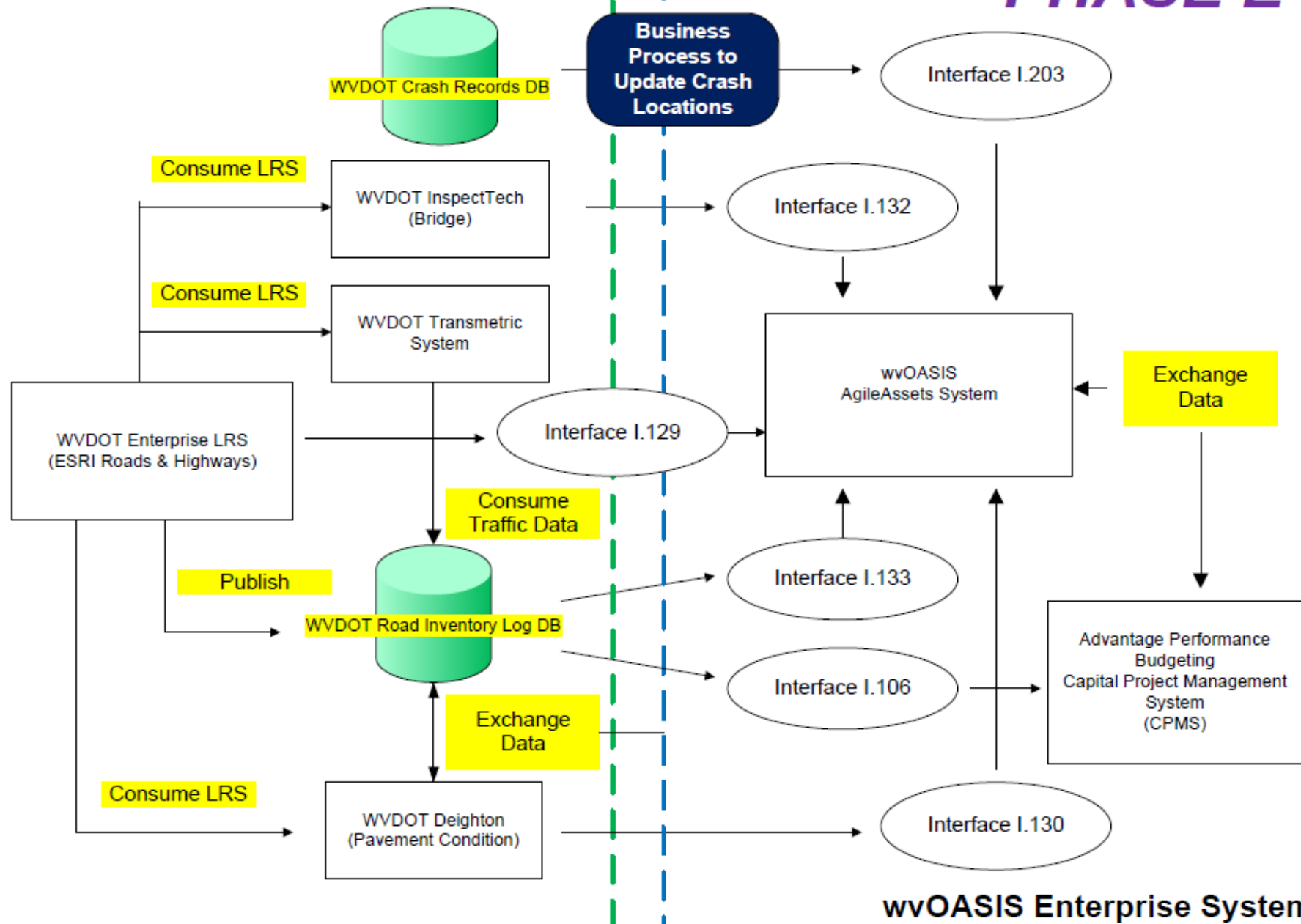
# WVDOT Enterprise System

# PHASE B

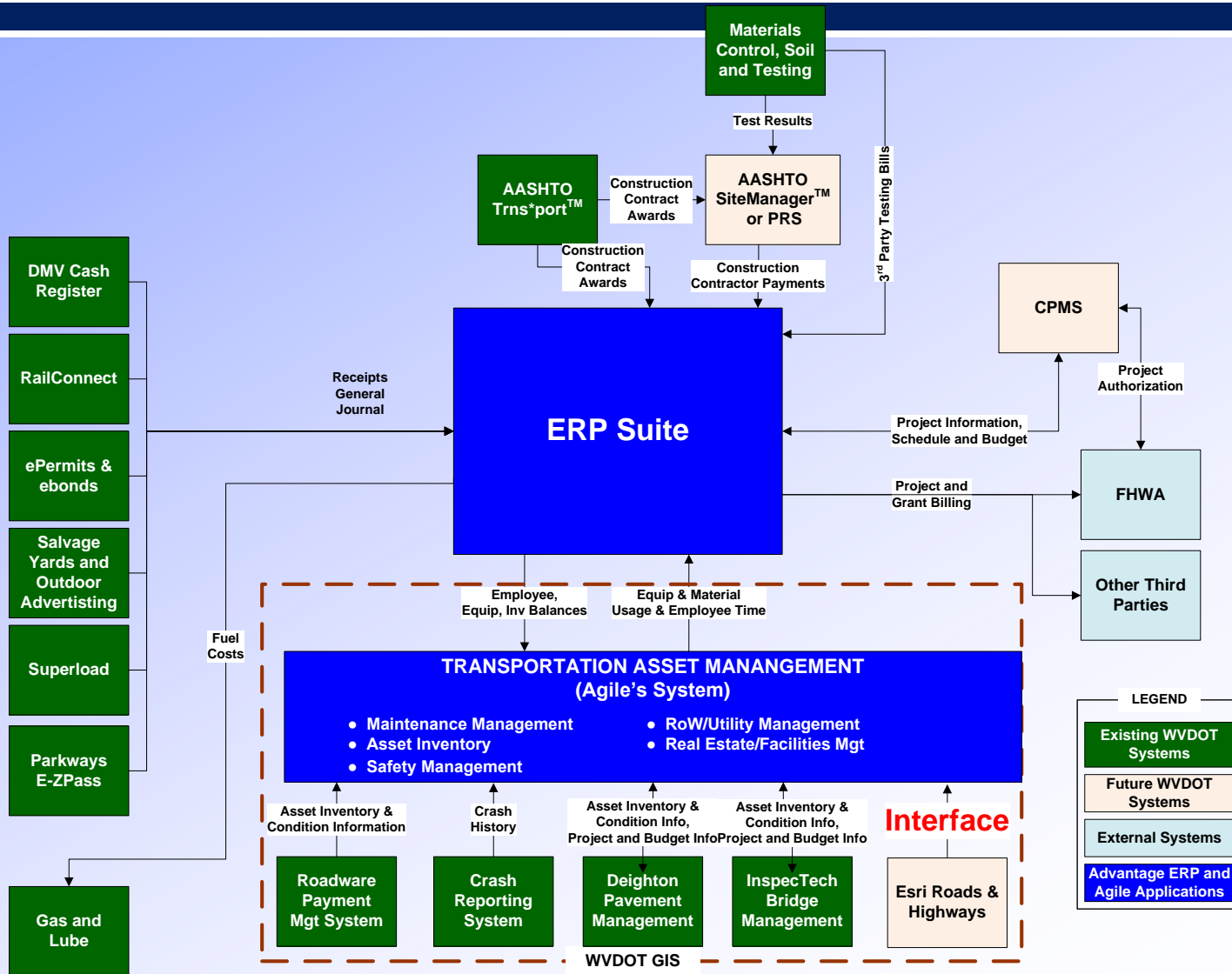


# WVDOT Enterprise System

# PHASE E



# WVDOT Future ERP System Overview



# Lessons



# Lessons

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



# Near Future Plan



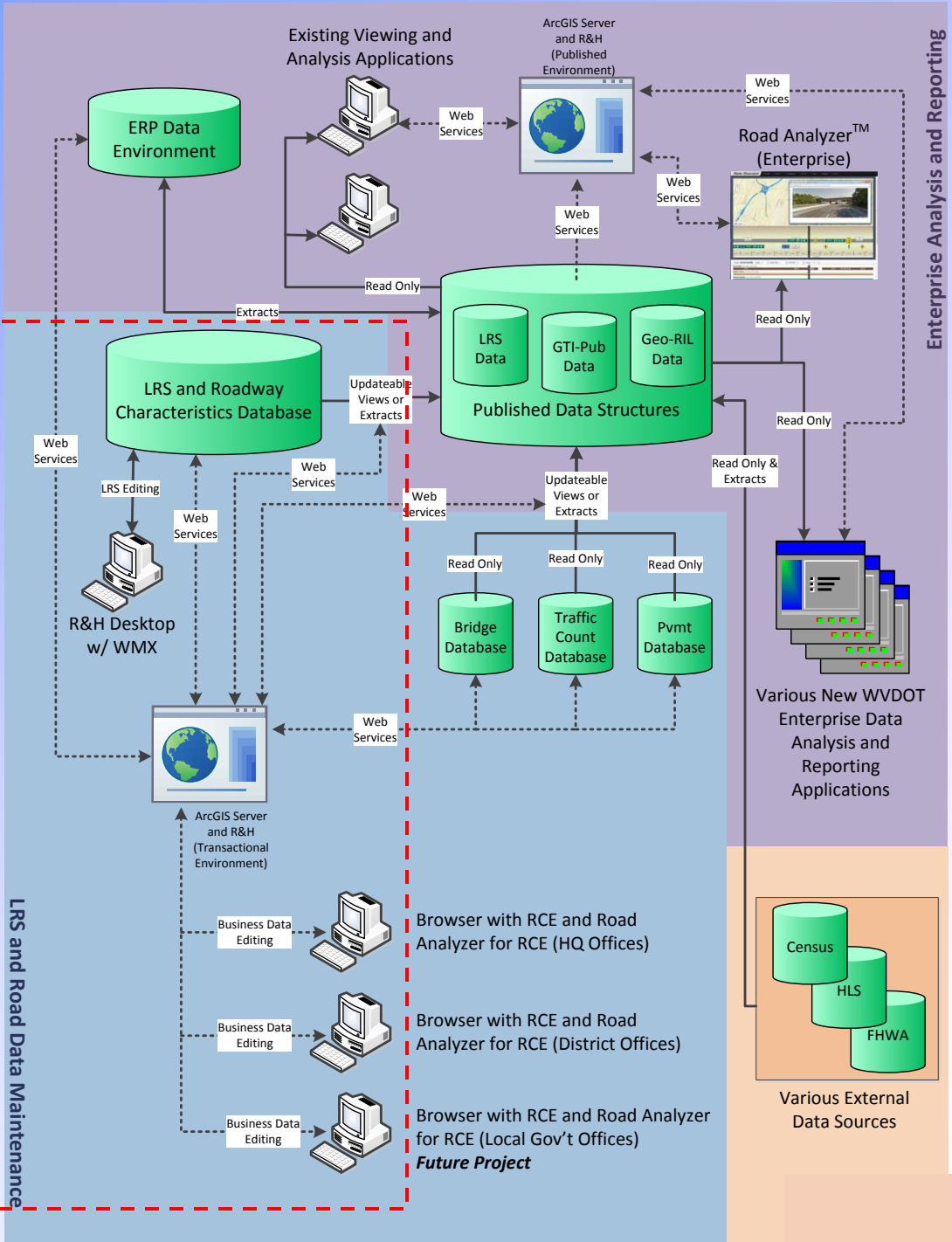
# Near Future Plan

- ∞ By March 2015
  - Deploy Esri R&H in Production Environment – **Phase 3 (TBD)**
  - Get the Interface w/ Agile's System Ready for Deployment
- ∞ Keep Cleaning up the Data
- ∞ Work w/ Business Programs to Improve Asset Data
- ∞ Configure
  - Support More Workflows
  - Make RCE More User Friendly
- ∞ Customize
  - Extend R&H Functionality
  - Support More System Integration
  - Make LRS More User Friendly
- ∞ Improve
  - Add New LRMs (Address Ranges, Cross Street Referencing, etc.)

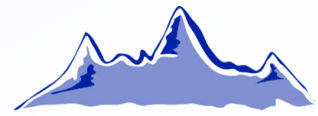




# Esri R&H Solution



Qs & As



# Thanks to

## ☞ IRG

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## ☞ AgileAssets

- Abhishek Bhargava
- Eric Perrone
- Phil Hardy
- Siamak Saliminejad
- Tyler Pauley
- Etc.

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- Silvia Casas
- Will Isley
- Etc.

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- Bill Schuman
- Jesse Jay
- Steven Korzekwa
- Etc.

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- Etc.

