



U.S. Department of Transportation  
Federal Highway Administration

**Office of Safety Research and Development**

# **GIS Linkages with the SHRP2 Roadway Information Database**

Presented at the  
**GIS-T Symposium**

Des Moines, IA

April 22, 2015

**GENEX**  
SYSTEMS

**CAMBRIDGE**  
SYSTEMATICS

# Presentation Outline

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- “GIS Linkages with SHRP 2 RID” Project Overview
- RID Data Elements
- RID Structure
- RID Linear Referencing System and Conflation Process
- Analytical Possibilities Supported by the RID
- Additional Data Sources and Potential Linkages with the RID

# “GIS Linkages with the SHRP2 RID”

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- Objective: Provide an assessment of the analytical possibilities associated with data linkages to the RID, including:
  - An assessment of the data available in the RID and the supplemental datasets
  - The identification of other available unique data sources that can link with the RID to offer additional insight into traffic safety performance
  - A detailed assessment of the analytical possibilities associated with these linkages

# Project Schedule

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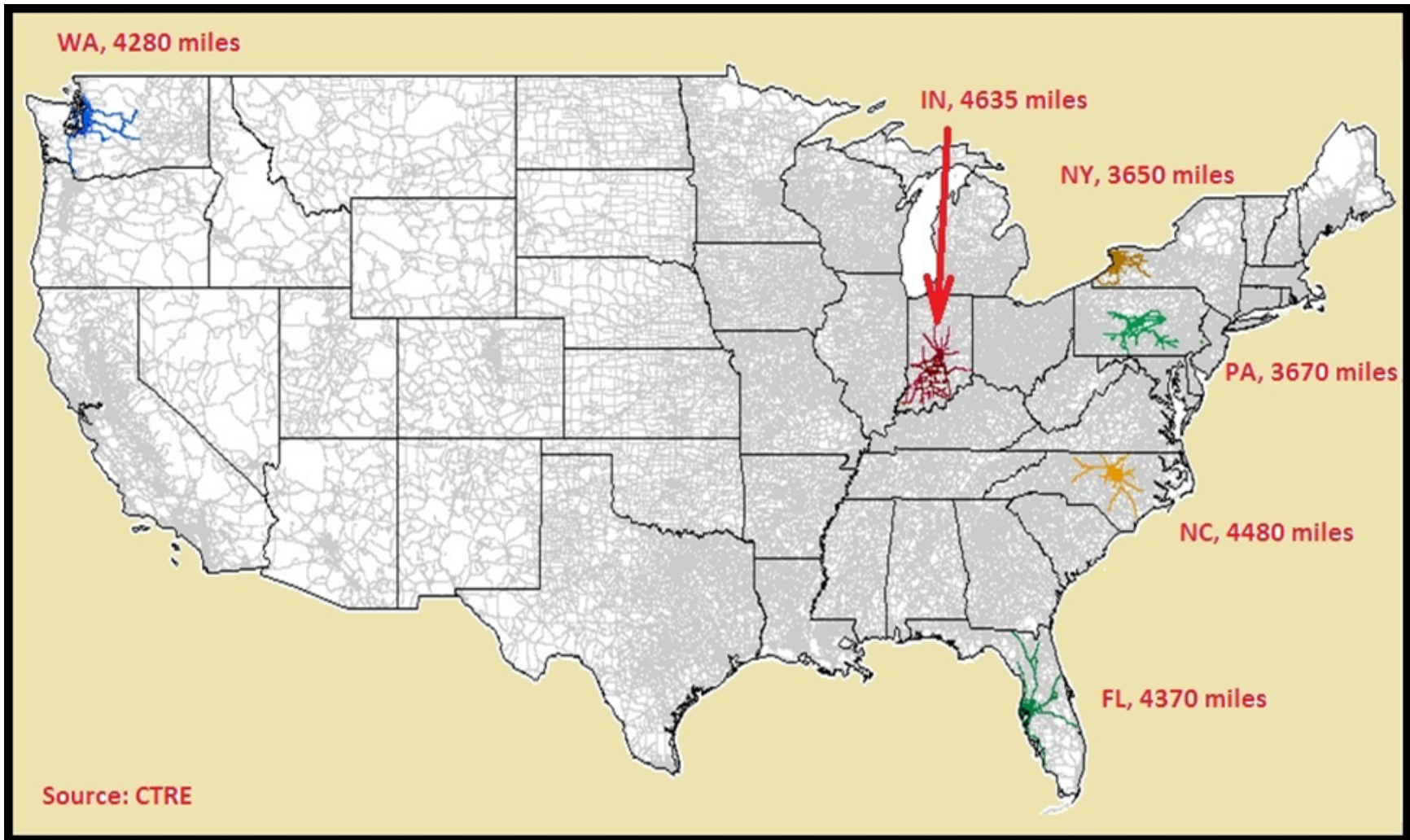
- Performance Period: Sept. 2014 – Sept. 2015
- April 2015: Draft RID Analysis Report
- May 2015?: Final RID Analysis Report
- May 2015: Innovative Data Sources Memo
- June 2015: Innovative Data Sources Case Study Outline
- July – Sept. 2015: Final Report / Briefing

# RID Data Elements

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1. S04B Roadway Attributes
2. 2012 HPMS Submittals
3. Supplemental State Road Inventory Data
4. Road Centerline Geometry and LRS Network
5. Supplemental Data

# S04B Roadway Data Coverage



# RID Structure

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- Maintained as a set of 6 Geodatabases
  - Separate Geodatabase for each study area state
- Geodatabase content
  - Road centerline network for entire state (Esri Streetmap)
  - LRS route network (built from centerline network)
    - All roads in counties covered by S04B data collection
    - Federal-aid (HPMS) roads in all other counties
  - Road inventory data items (point or line features with same geometry as road centerline network)

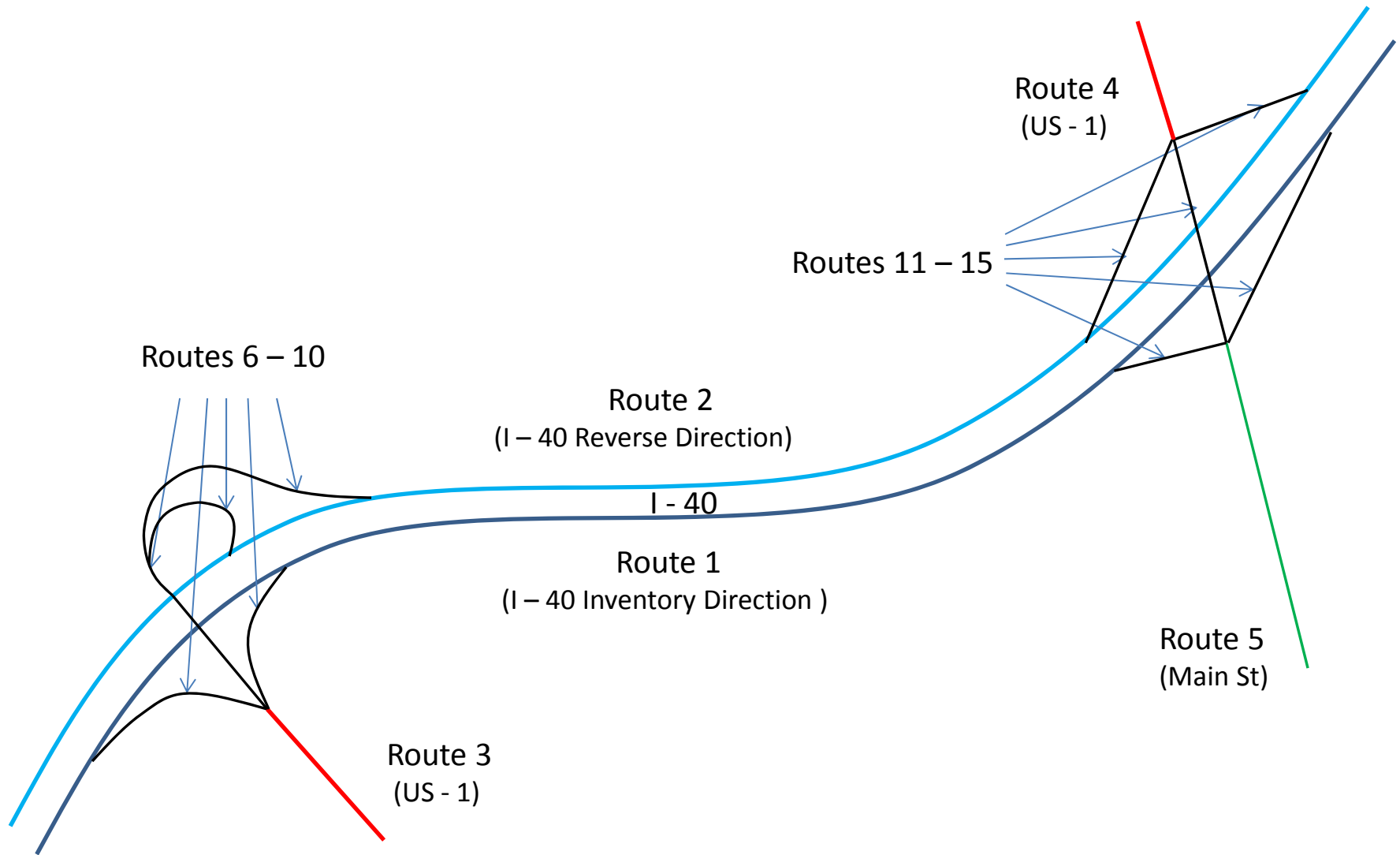
# RID Linear Referencing System

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- Common LRS design for all 6 study areas
  - Built from Esri Streetmap centerline network
  - Unique routes based on
    - FUNC\_CLASS
    - ST\_NAME
    - Travel Direction
    - Link Connectivity
  - No coincident or disconnected routes allowed
  - Route length based on combined shape-lengths of component Streetmap segments



# LRS Route Design



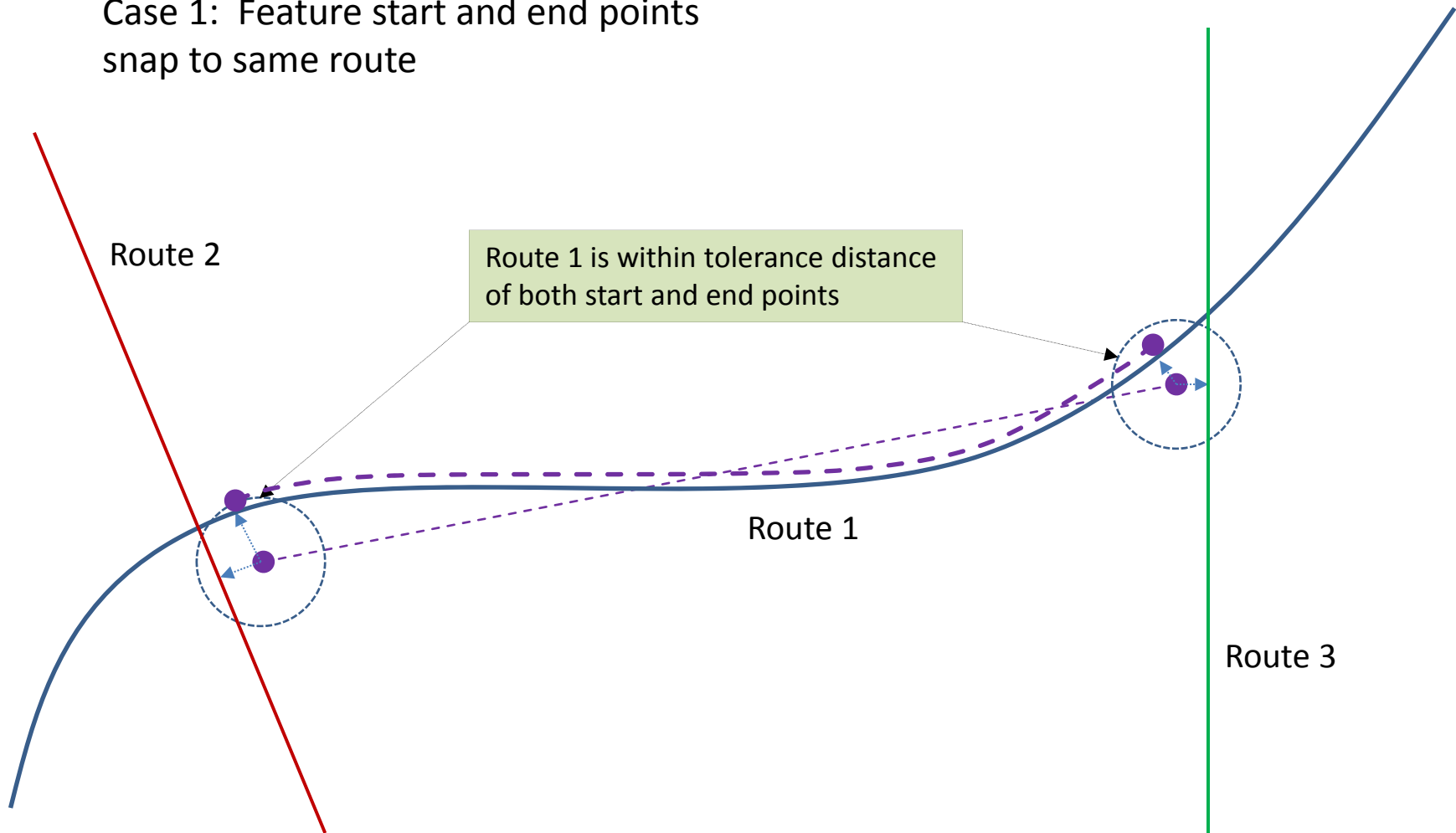
# RID Linear Referencing System

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- Reasons for not using State DOT LRS
  - Most State DOTs did not include local roads in their 2012 LRS
  - Each State DOT LRS is designed to support changes in route alignment and re-specification
    - Adds additional complexity
    - Unnecessary for RID, which represents a “snapshot” in time
  - Creating a simplified, common LRS structure reduces the learning curve for potential users

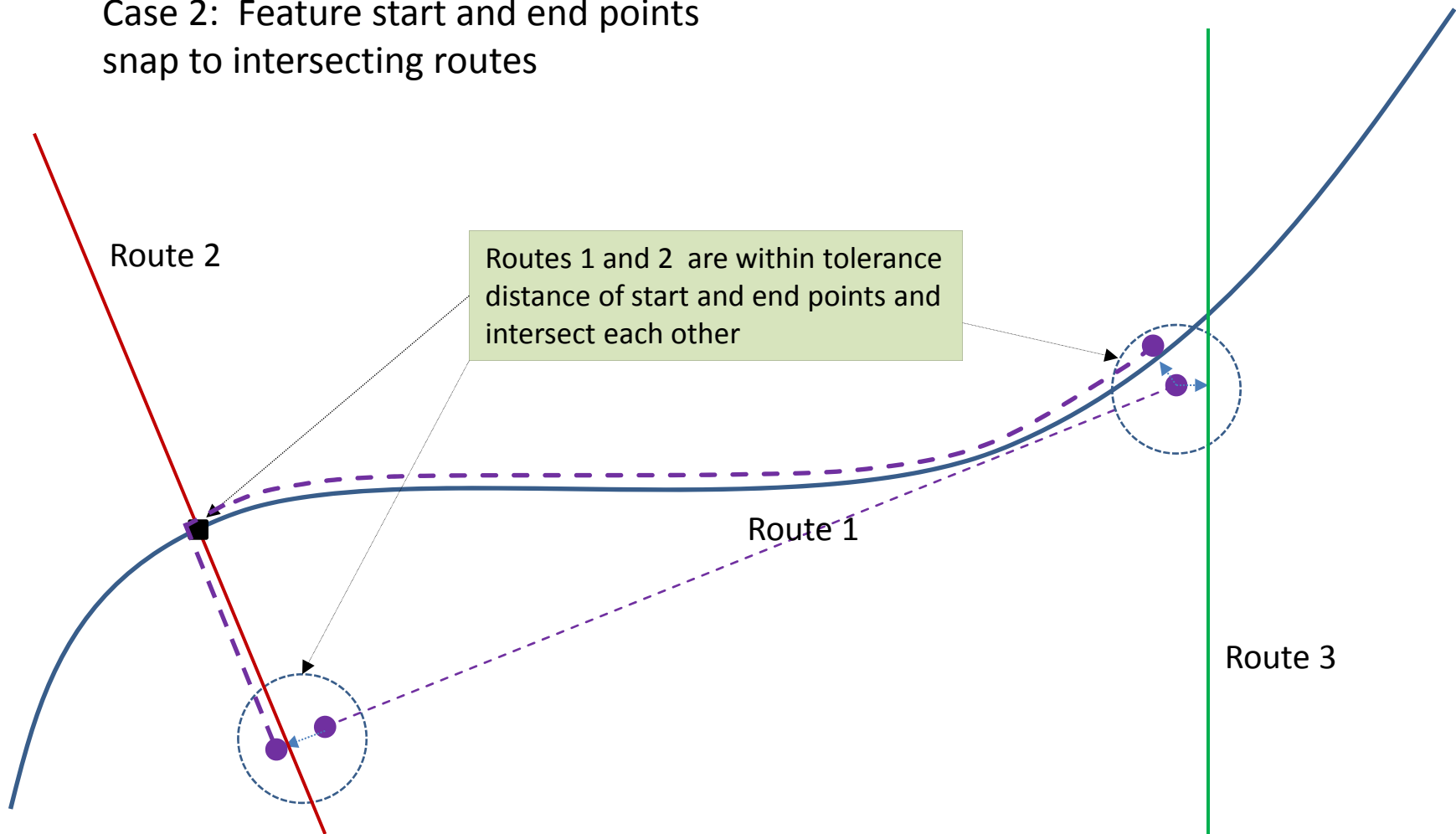
# Conflating Roadway Data to LRS

Case 1: Feature start and end points snap to same route



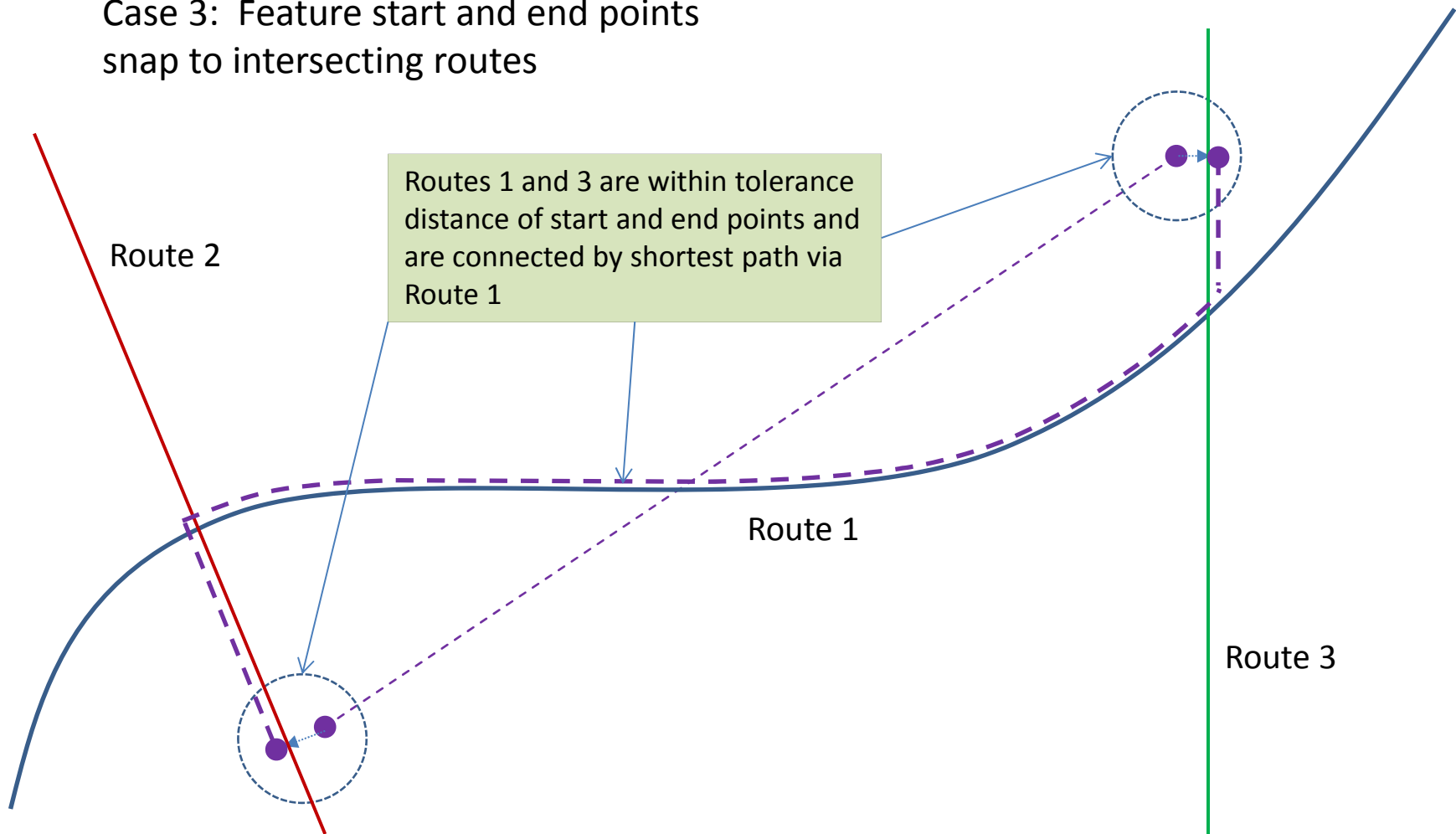
# Conflating Roadway Data to LRS

Case 2: Feature start and end points snap to intersecting routes



# Conflating Roadway Data to LRS

Case 3: Feature start and end points snap to intersecting routes



# Conflation Process Considerations

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- Automated procedure correctly matched over 95 percent of roadway attributes to Streetmap network
  - Centerline network is missing a road segment where S04B contractor collected roadway data.
  - Near intersections, attribute could be conflated to wrong road segment (typically point or short linear features)
  - Many errors picked up in QA/QC process, but some may remain
- Route lengths are not calibrated to ‘Ground truth’
  - Based on digitized lengths of Streetmap road segments
  - Does not account for effects of elevation or digitizing imprecisions
  - From/To measure differences should not be used to estimate lengths of linear features

# Analytical Possibilities Supported by the RID

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- Categories:
  - Without Linkage to the Naturalistic Driving Study (NDS) data
  - With Linkage to the NDS data

# Analytical Possibilities Supported by the RID

## *Without Linkage to the NDS Data*

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- Micro-level safety analysis
  - Calibration of existing Highway Safety Manual (HSM) Part C prediction models ([highwaysafetymanual.org](http://highwaysafetymanual.org))
  - Development of Crash Modification Factors (CMF)
  - Development of Safety Performance Functions (SPFs)
  - Applying the HSM Roadway Safety Management Process (HSM Part B)
  - Highway safety surrogate measures
  - Support initial stages of Road Safety Audits



# Analytical Possibilities Supported by the RID

## *Without Linkage to the NDS Data*

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- Macro-level safety analysis
  - Applying the HSM Part B process at the macro-level
  - Safety evaluation of transportation systems in the planning stage
  - Large scale assessment of risk factors
- Alignment extraction models

# Analytical Possibilities Supported by the RID

## *With Linkage to the NDS Data*

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- Crash and near-crash studies
  - “Near crash” as a surrogate measure of safety
  - Estimating crashes from the predicted number of near-crashes
- Calibrating and developing analysis/simulation models, e.g.
  - Interactive Highway Safety Design Model (IHSDM)  
Design Consistency, Driver/Vehicle, Traffic Analysis Modules  
([www.ihsdm.org](http://www.ihsdm.org))

# Additional Data Sources and Potential Linkages with the RID

- National Performance Management Research Data Set (NPMRDS)
  - NPMRDS travel time data (5 minute intervals) can be converted to travel speeds
  - Link with RID to use real-time speed data in safety analyses
- HERE Stakeholder Application Data
  - Incident database covers a variety of events captured by traffic survey stations/sensors (e.g., congestion, construction, mass transit, road hazards)
  - Link with RID to study effect of specific incident types on safety
- Highway Safety Information Systems (HSIS)
  - Roadway based system that provides annual crash, roadway and traffic data from select states (CA, WA, MN, IL, OH, ME, NC, UT, MI)
  - Link detailed crash data with RID; common states are WA and NC

# Additional Data Sources and Potential Linkages with the RID

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- NEMESIS (National Emergency Services Information System)
  - Effort to standardize data collected by EMS agencies
  - Link with RID to evaluate the network service condition and identify potential evacuation impacts
- National Climate Data Center (NCDC)
  - Temperature, wind speed, precipitation, etc. available as raster grids for entire US; data collected at weather stations
  - Link weather data with RID to analyze effect of weather on crashes, pavement performance, etc.
  - Temporal analysis of weather effects on road safety performance

# Additional Data Sources and Potential Linkages with the RID

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- Long-Term Pavement Performance (LTPP) Data
  - Managed by FHWA Office of Infrastructure R&D; monitors over 2400 pavement sections throughout US and Canada
  - Data on distress, roughness, structural capacity, traffic, etc. are systematically collected
  - Link with RID to gain additional insight into the relationship between crashes and pavement condition

# Questions?

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