The Kansas Road Centerline Conflation Project

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**What is Conflation?**

Conflation happens when the identities of two or more individuals, concepts, or places, sharing some characteristics of one another, seem to be a single identity — the differences appear to become lost. In logic, it is the practice of treating two distinct concepts as if they were one, which produces errors or misunderstandings as a fusion of distinct subjects tends to obscure analysis of relationships which are emphasized by contrasts. However, if the distinctions between the two concepts appear to be superficial, intentional conflation may be desirable for the sake of conciseness and recall. -

Conflation

Merging KDOT road centerline attributes to NG911 road centerlines
What’s important for NG911

- What is the emergency?
- Where are you at?
- What road are you on?
- What is around you?
- Do you know the address?
- Resources – the who, what, where
  - Hospitals, Hydrants, Helicopters
  - Access, Entrances, Keyboxes

Andy Griffith Show, https://www.youtube.com/watch?v=NPYKZobZAz0
What’s important for KDOT

- What is a public Road?
- How is the road paved?
- How many miles long is it?
- What’s the Functional classification?
- Is it designated a State Highway or a ramp?
- DOT Business
  - Roads, Bridges, Culverts, Facilities, Information
  - Traffic and Safety
  - Maintenance and Construction

Dukes of Hazzard, Season 1: https://www.youtube.com/watch?v=OF-ZRsAK6G8
NG911 in Kansas

- Ongoing Maintenance

- State GIS Portal
  - https://www.kansasgis.org/initiatives/NG911/index.cfm

- NG911 in Kansas
  - http://www.kansas911.org/106/NG911

- NENA, i3 ESInet Detailed Specs
Variables To Consider

- **Node Valence Comparison**
  - Beginning of line
  - End of line

- **Azimuth Comparison**
  - Reversed directionality
  - Consistent directionality
  - Difference in directionality

- **Feature Length Comparison**

- **Spatial Comparison**
  - Feature X vs Feature Y
  - Feature Y vs Feature X

- **Naming Comparison**
  - Levenshtein Methodology
Weighted Scoring of Variables

• Weighted Scoring System (flexible)
  – .025 – Beginning Intersection (valence) Compare
  – .025 – Ending intersection (valence) Compare
  – .500 – Azimuth Compare
  – .200 – Spatial Intersection Compare
  – .050 – Length Compare
  – .200 – Naming Compare
QA/QC of Results

• Conflation Score vs Conflation Rank
  – Weighted Score %
  – Conflation group ranking
    • Order by Score %
    • One to Many
    • One to One
Relationship Lines

Quality Control Results
100,000 scale
Quality Control Results
50,000 scale

Relationship Lines
Relationship Lines

Quality Control Results
10,000 scale
Relationship Lines
Relationship Lines

Quality Control Results
GOOD
Comparison Output

• Comparison Table
  – Source layer feature ID
  – Target layer feature ID
  – Confidence score

• Comparison Metrics
  – Match rate
  – Confidence intervals

• Record from each DOT file which are not found in the merged data
Conflation can be MESSY

- Conflation Results
- Features from Layer X not in Layer Y
- Features from Layer Y not in Layer X
Why did KDOT do this?

- dual carriageway for divided state highways
- To create a supply of roadway information
- An LRS reset was needed for our ARNOLD
- The NG911 data remediation project took off
- Good practice – create and recycle, don’t recreate
USDOT - HPMS and NENA

- NENA doesn’t have geometry standards
- ARNOLD has clear geometry standards
  - Dual carrigway
- The Kansas NG911 data standards weren’t thorough enough, thus the data is not very standardized
- My opinion, I’d like to see HPMS require addresses to force the issue
What are the challenges?

The conflation was based on a snapshot in time over the course of a couple years.
A lot of processing to create the routes from this data.
A lot of data editing to create routes from this data.
Closing the divergence from the current data to the data from the snapshot in time.
What did we do Well?

• **The Kansas Story**
• Conflation specifications: items to conflate
  – LRS key
  – mileages
  – begin/end node ID’s for Traffic count sections
  – lags for geometry direction flips
  – Flags for interpolated mileages
What would we do differently?

• Better detail on the standards
• Overlapping or Parallel road centerlines for address ranges
• Especially when trying to implement LRS from this geometry
• Will develop agreements and MOUs
Final Thoughts...

Whereas the 911 Council GIS Subcommittee provides GIS data standards and support per the Kansas 911 Act (KSA 12-5362 et seq)...and is tasked to deliver 911 services and enhancements using available grant funds;

whereas the NG911 GIS Data standards include standards specific to Highways (public roads) in a GIS to the extent necessary for 911 service delivery and National Emergency Number Association Standards, which include address data standards but not geospatial representation standards;

Whereas the KDOT reports all public road mileage to FHWA no later than June 1 of each year to FHWA headquarters per 23 CFR 460, and the public road mileage is used to apportion 23 USC 402 funds for highway safety programs, and detailed geospatial data standards are provided in support of the ARNOLD (All Road Linear Referencing System) requirements;
Final Thoughts – Why?

Whereas Kansas law enforcement officers dispatched using the 911 systems report certain vehicular crashes to the Secretary of Transportation per KSA 8-1611, which are described by, located on, and referenced to road names and intersections as per the NG911 GIS;

Whereas the secretary of transportation may enter into all contracts and agreements necessary to cooperate with the United States department of transportation or any of the other federal departments or agencies and may do and perform all acts required of a state agency to obtain all benefits under the terms and provisions of federal legislation mentioned in the preceding section or any subsequent federal legislation relating to highways, roads or streets or relating to the various other modes and systems of transportation per KSA 68-402;
Final Thoughts – Why?

Whereas highway GIS Specifications are authorized under 23 U.S.C. 315, which places the responsibility on the Secretary of Transportation for all management decisions affecting transportation. 23 CFR 420.105(b) requires the States to provide data that support FHWA's responsibilities to the Congress and the public;

Whereas regulations governing the FHWA State Planning and Research (SPR) funded work programs [23 Code of Federal Regulations (CFR), Part 420] outline responsibilities for furnishing FHWA adequate information for administering the Federal-aid highway program;
Final Thoughts – Why?

Whereas the Kansas one map act requires the implementation of an overall Kansas land and geographic resources program through the use of a geographic information system which requires cooperative methods for development and maintenance of spatial data between state and local governments in Kansas, and the Kansas GIS Policy board;

Whereas KDOT is required to incorporate specific quantifiable and measurable anticipated improvements for collection of Model Inventory Roadway Elements – Fundamental Data Elements (MIRE FDEs) into their State Traffic Records Strategic Plan update by July 1, 2017. [23 CFR 924.11(b)], and I have access to the FDEs on all public roads by September 30, 2026. [23 CFR 924.11(b)].
How

• KDOT, 911 Council, Stakeholders to review road data requirements and technology solutions
• KDOT, 911 Council, Stakeholders coordinate resources to collect, maintain, and support roadway data using the Linear referencing systems meeting FHWA specifications for HPMS/ARNOLD/MIRE and NENA specifications for NG911 Data Elements
• Data Governance, including documentation outlining roles and responsibilities of agencies and parties involved in providing or using highway information.
• Parties to review recommendations for improvements needed to fulfill the MIRE FDE requirement, and develop strategies that consider:
  – The current status of MIRE FDE collection efforts, including FDEs currently maintained (or not maintained) in the roadway inventory as well as the public roads for which the FDEs are collected;
  – Appropriate data collection methodology;
  – Coordination with other agencies (within State, local, and tribal jurisdictions); Prioritization criteria for collecting MIRE FDE on all public roads; and
  – The schedule and estimated costs for data collection efforts. The result of this planning effort should be specific, measurable, achievable, realistic and time-bound strategies for the collection, maintenance, and management of MIRE FDE. States should follow National Highway Traffic Safety Administration guidance on State Traffic Records Strategic Plans. [23 CFR 1200.22(c)].
• use of USDOT safety and highway program funds for developing and improving roadway data in Kansas