Crossroads in Automation

TxDOT's Statewide Intersection Inventory Solution

Texas Department of Transportation

November 13, 2025

Meet the Team

Chris Bardash

- Manager
- Project Lead
- UI/UX and logic cultivator

David Prosack

- Front-end developer
- FME Extraordinaire

John Phillips

- Resident Database Geek
- Spatial Data Guru

Khan Mortuza Bin Asad

- Open-Source Whisperer

Goals for the presentation

01 Introduce new data source and its value

02 Explain how it was built and key challenges

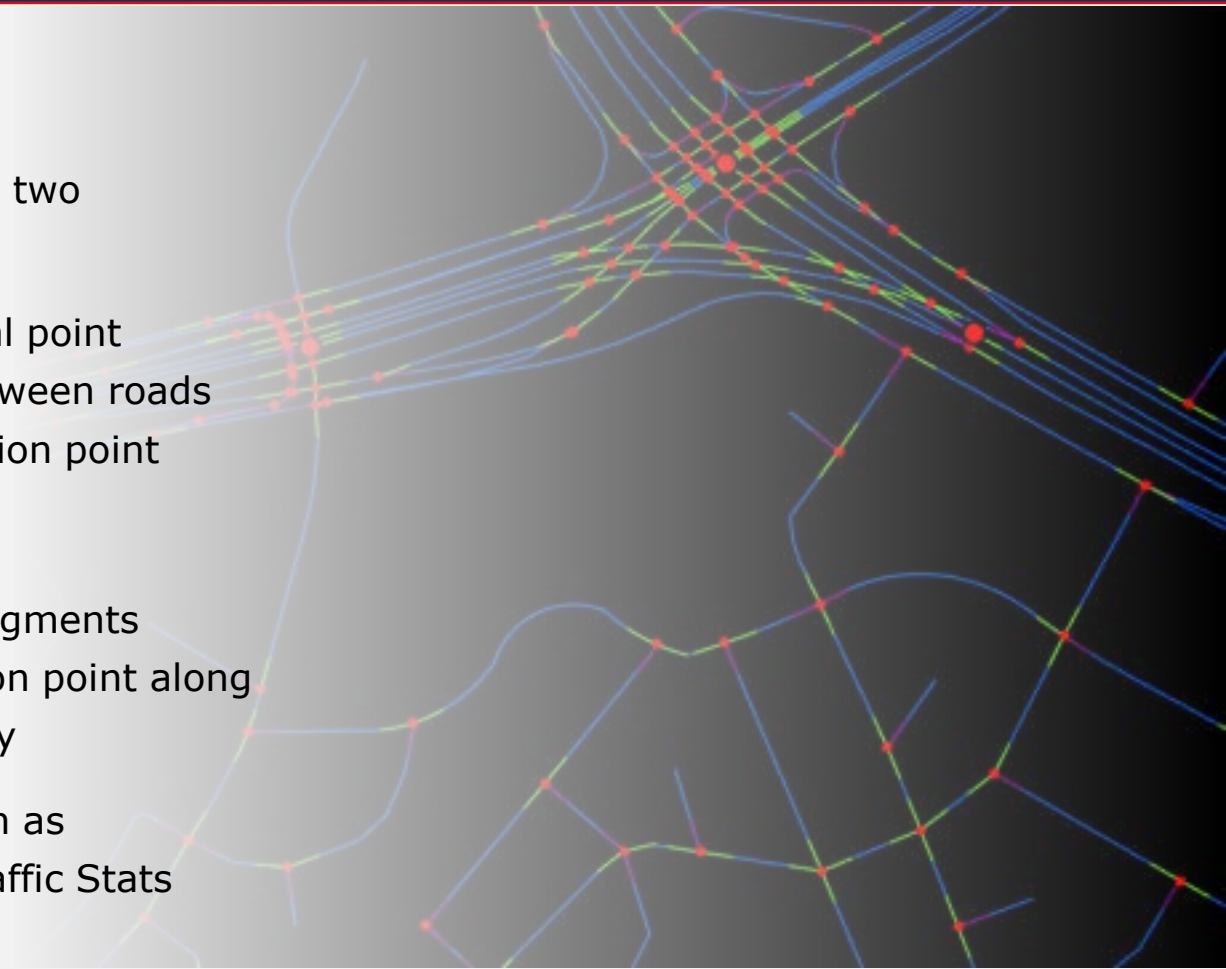
03 Gather feedback to improve usability

What is an Intersection Inventory?

An inventory of points for each intersection of two or more roads, along with lines representing the approaches to those intersections.

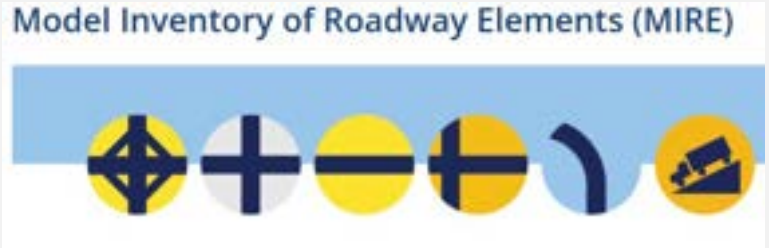
Terminology

- **Intersection point** – Where two roadbeds meet
- **Interchange point** – Central point representing interchange between roads with more than one intersection point
- **Approach Leg**
  - Short linear referenced segments extending from intersection point along each participating roadway
  - Used to model assets such as Functional System and Traffic Stats



Why is it necessary?

- Required by federal law
  - MIRE - Fundamental Data Elements (FDEs)
  - Due September 2026
- Facilitates many other applications within the department



What is it used for?

Primarily intended to facilitate safety analysis

Use cases:

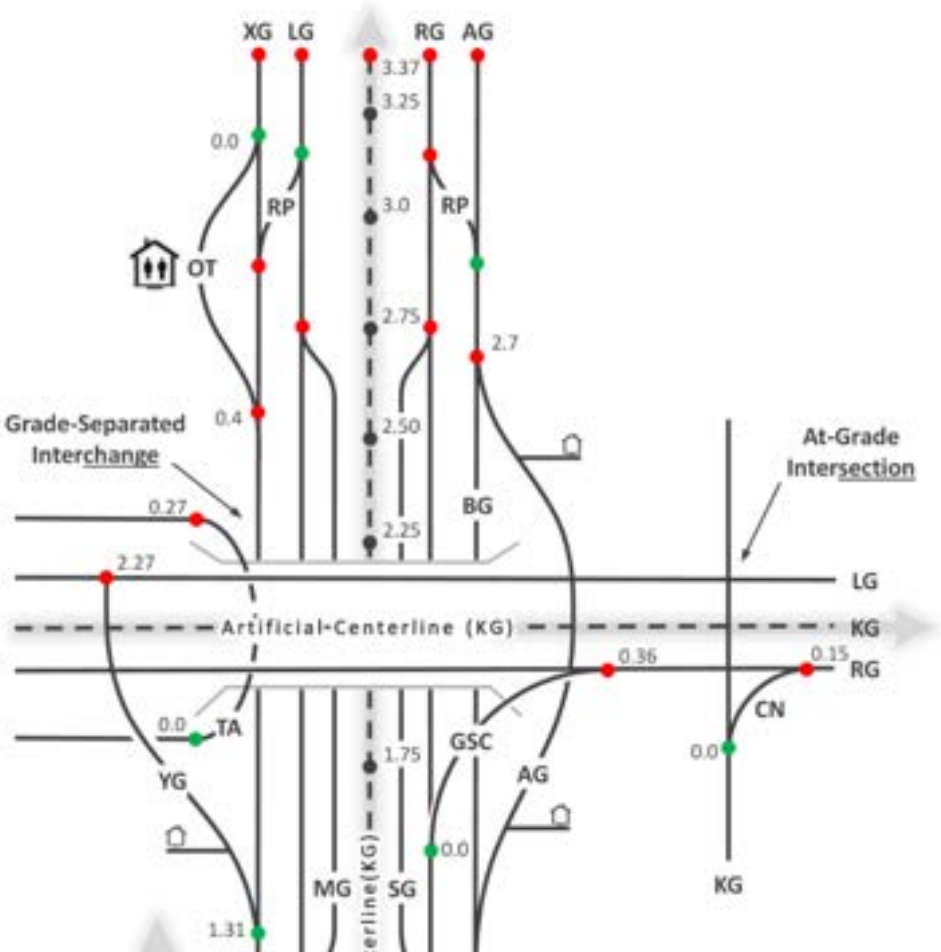
- Relate crashes to an intersection or interchange
- Identify problematic intersections to look at contributing factors, such as design, speed, traffic volume, etc.
- Inventory ADA facilities
- Locate innovative intersections
- Turning movements counts used for intersection design and traffic signal timing

Our Design Approach

- COTS solutions costly and constraining
- We have the expertise internally
- Used FME to generate the intersections
- Logic to determine interchange associations rather than polygons
- Entire network rather than a subset
- All data stored on our Oracle DB
- Approach legs generated next using SQL
- Everything shared to AGO

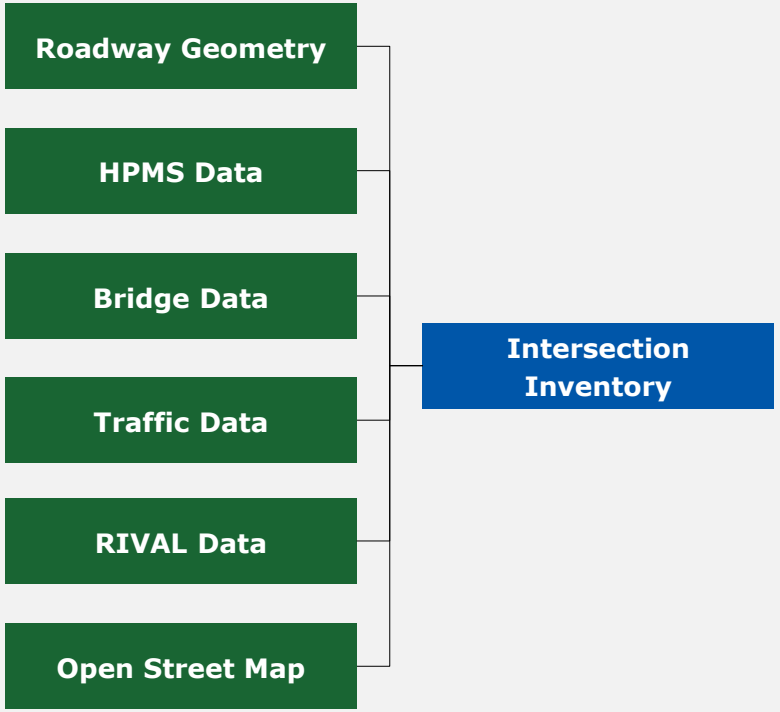
Challenges

- 562,184 roadway segments in our Geospatial Roadway Inventory Database (GRID)
- Complex roadway network
- Topology issues
- Multiple data sources



Meet the data

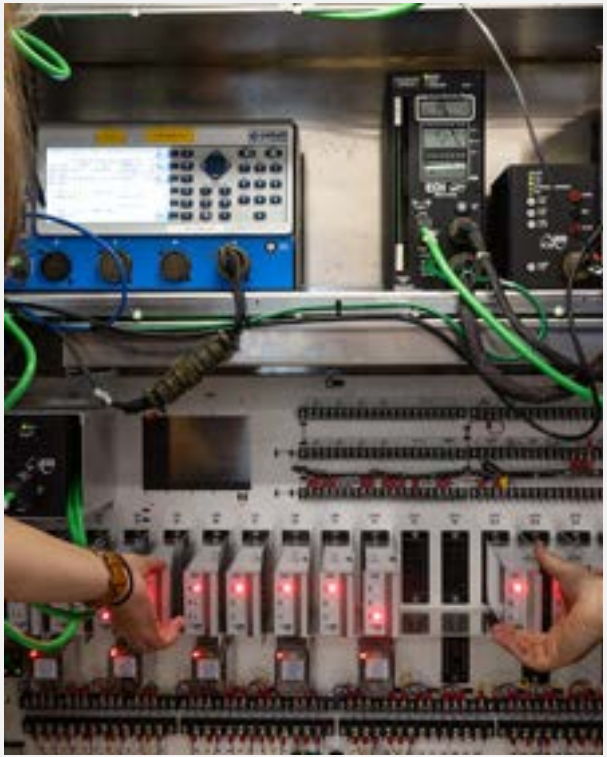
- Most data are stored in GRID
  - e.g. Functional Class, AADT
- Working with other divisions for traffic control devices, etc.
- RIVAL data (Cyclomedia data collection)
  - Linear bridge data
- OSM data extracted and snapped to our network



Building a custom app

Why we chose a custom solution over out-of-the-box (OOTB) software:

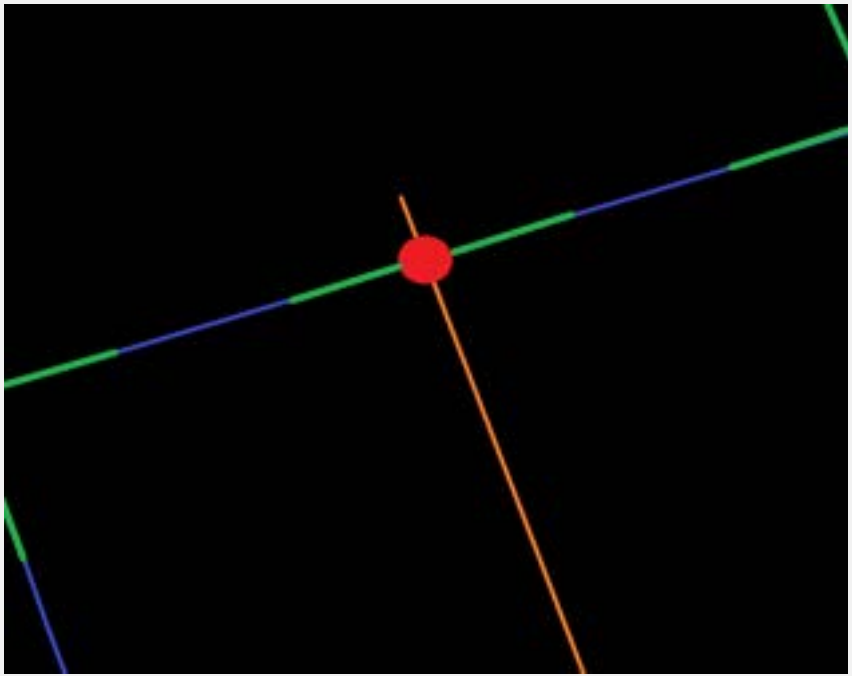
- **Cost Savings**: Avoided expensive OOTB solutions
- **Functionality**: Tailored to our specific needs
- **Expertise**: We had the skills to build it ourselves



Getting Started – Data Cleanup

- Before building the intersection inventory, we performed extensive data cleanup
- Focus Areas:
  - Snapping & Topology corrections
  - Mainly undershoots & overshoots
- Approx 300k of 550k roads touched by QC efforts

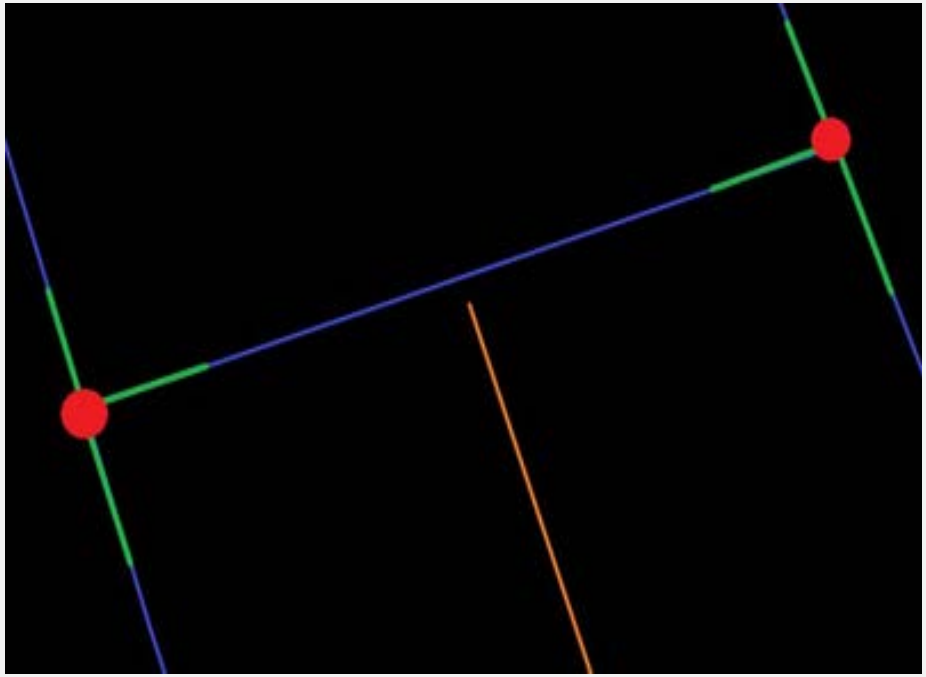
Overshoots



- Line of interest (orange) overshoots the intersecting route
- False positive ‘leg’ created
- Intersection type incorrectly modeled as four way instead of T-type

Undershoots

- Line of interest (orange) does not connect to the nearby line
- One intersection point and two approach legs are omitted

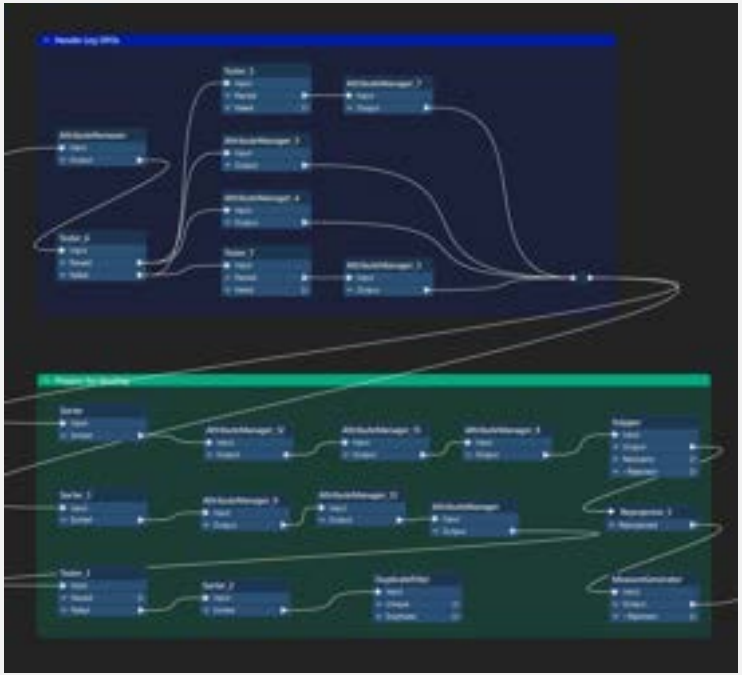


Proof of Concept & Development

- Engaged with stakeholders early and throughout
- Aim for process that:
  - Runs nightly or frequently
  - Completes in a short runtime
- Integration with our system of record (GRID)
  - Housed in Oracle
  - Access to spatial tools and other DB tables for better analysis and automation

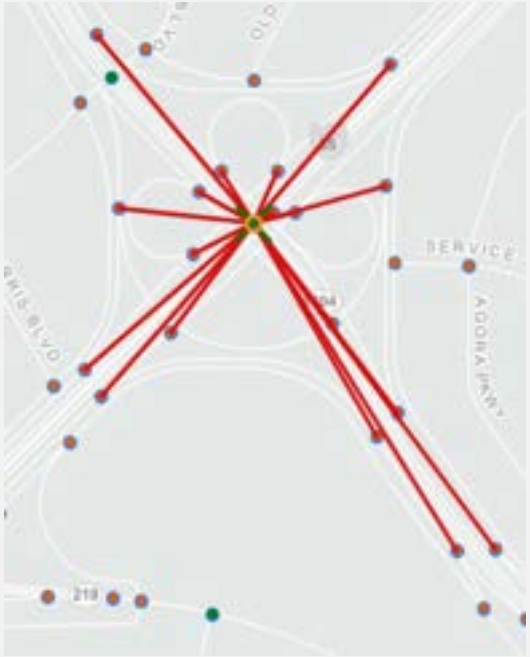
Point Generation

- FME Workbench
- Intersected lines and transferred route data onto points
- Unique name assigned
- Primary route determined according to hierarchy
  - Interstate > US Hwy > State Hwy
  - Ex: IH0035,US0090

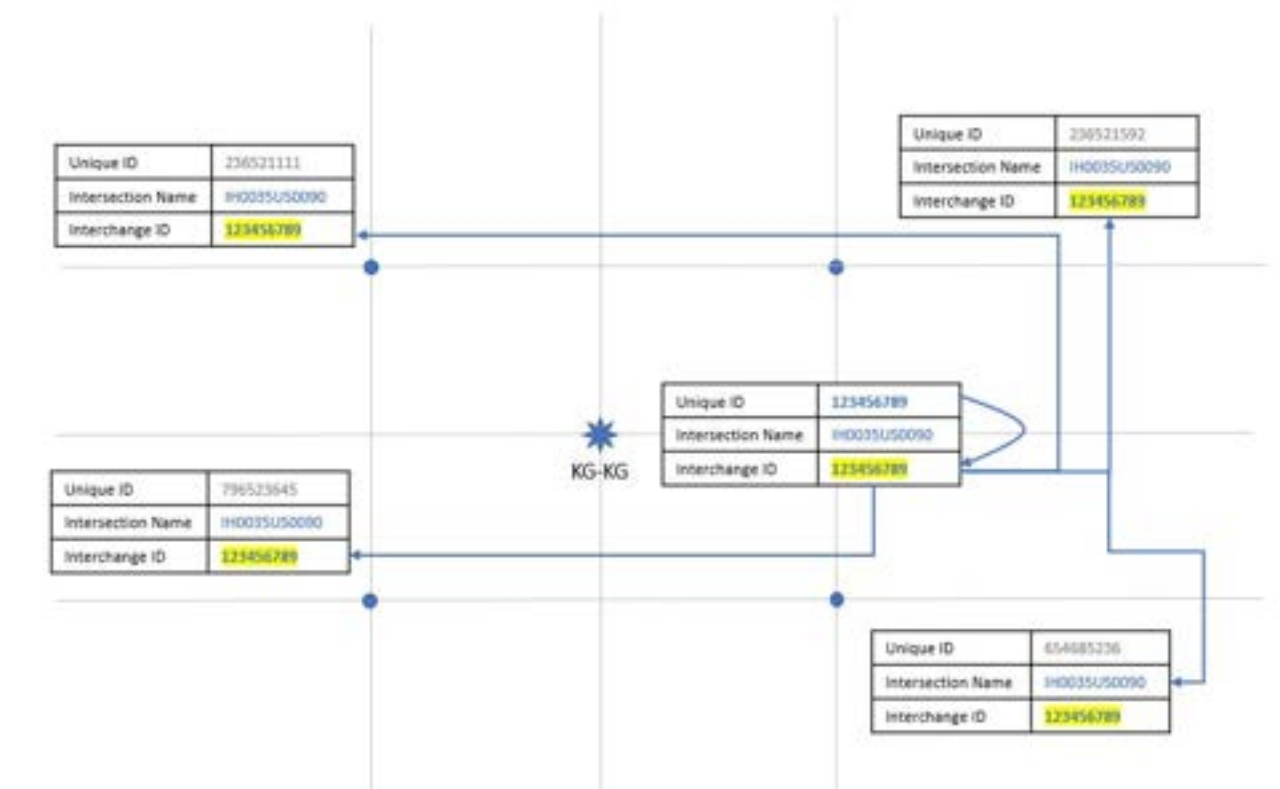


Assigning Interchanges

- Chose tabular logic-based assignments over polygons
- Why not polygons?
  - Frequent updates required with every road network change
  - Too complex for our network (e.g., toll roads, managed lanes, frontages)
  - Intersections that do not participate in the interchange may be included



Tabular Interchange Logic Overview

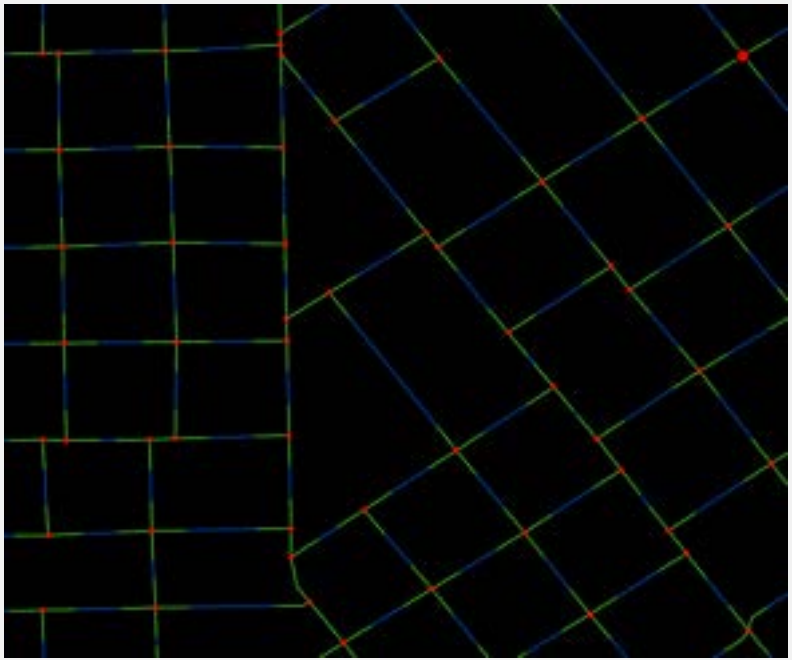


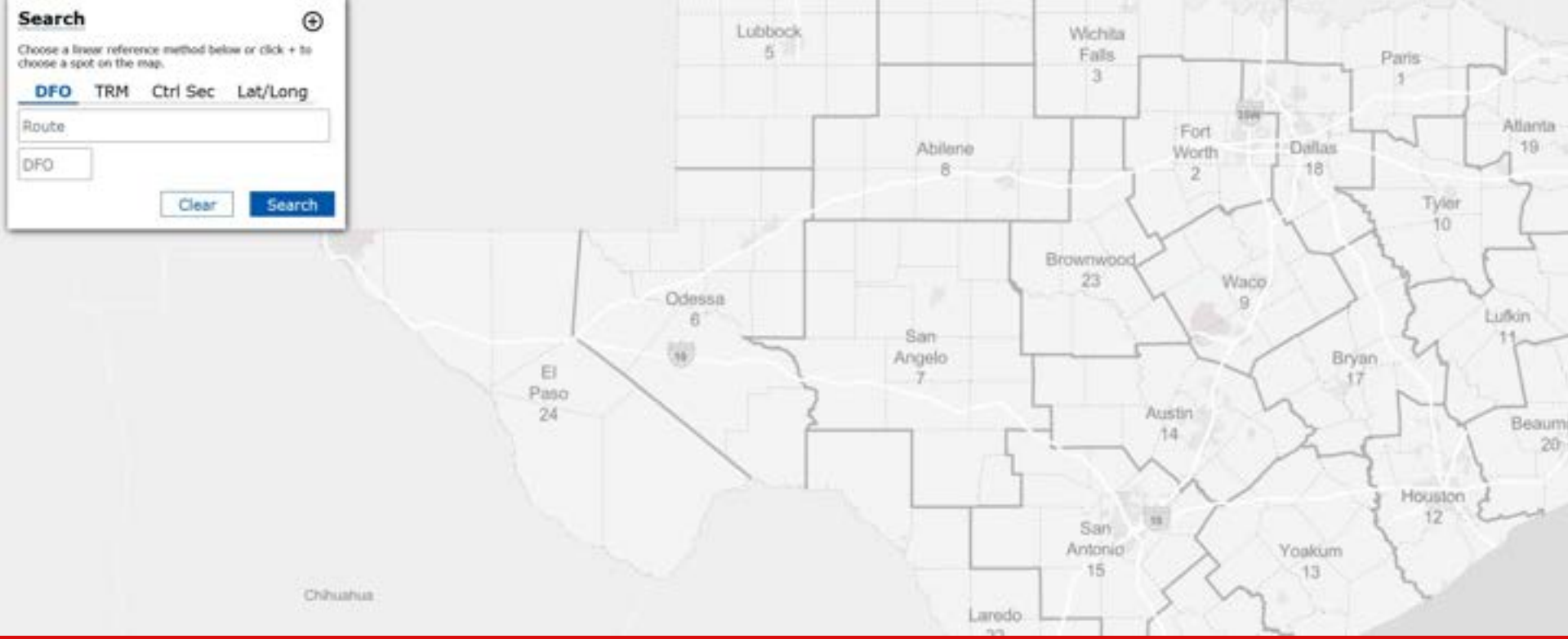
Interchange Logic Challenges:

- Where tabular solution fails, distance is used. Examples:
  - Different roadbeds of the same route may intersect each other
  - On system roadbed intersections matched to nearest interchange point
  - Grade Separated Connectors (duplicate route name)
  - Loops may intersect the same route twice
    - Max distance of 6000’ enforced

Leg Generation

- FME workbench/Oracle Spatial
- Dynamic Segmentation +/- 0.02 mi
  - Length could be variable for future projects
- Measures retained on geometry for routing assets
  - Key for flexibility with adding data





Intersection App Demo

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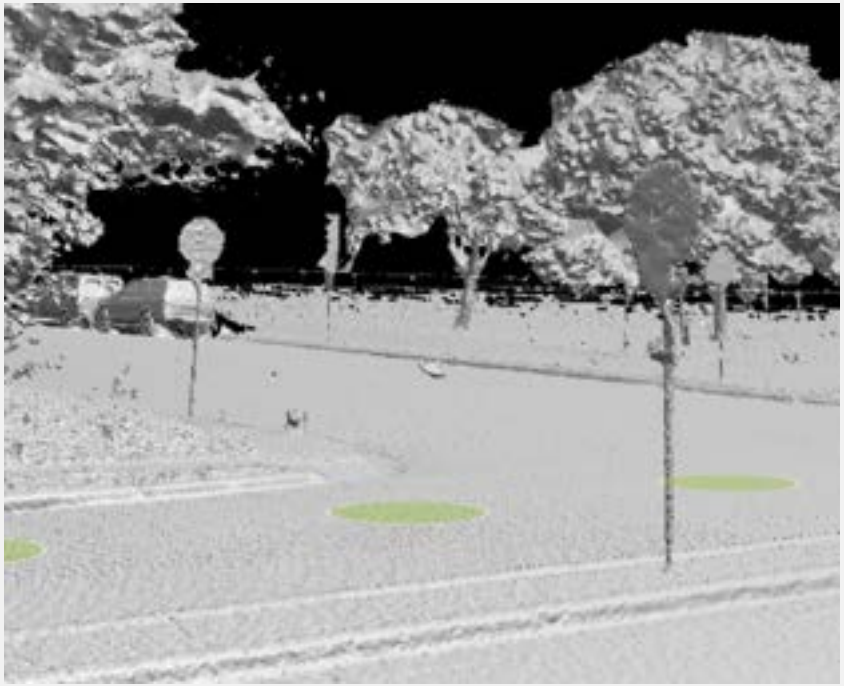
Stakeholder outreach

Engaging with key stakeholders will help ensure that the inventory is useful for their purposes.

Internal TxDOT Divisions
GIS for Transportation Symposium
TxDOT GIS Conference
GIS Forum

What's Next?

- **Integration of data from other divisions**
  - Bridge, Traffic Safety, Crash
- **Further Cyclomedia integration**
  - Asset extraction from RIVAL project
- **OpenStreetMap (OSM)** data for:
  - Driveways, Traffic control devices
- **Integration in Geometry Editing Process**
  - Edit in conjunction with roadways
  - Consistent Intersection IDs



Tech Stack (Nerdy stuff)

- **Database:** Oracle
  - Eventual integration with data editing processes (Geometry Editing Module)
- **Data Processing:** Python, SQL (Oracle Spatial), FME
- **Visualization:** Web-based GIS application
  - Vue, Geoserver
- **API:** TxDOT LRS API, Cyclomedia ‘Streetsmart’ API

Notable FME Transformers

- **NeighborPairFinder** - (undershoots) - Creates point at nearest line, adds to line
- **LineOnLineOverlayer** (overshoots) - Intersects all lines and looks for ‘dangles’ to delete under certain threshold
- **Intersector** (points) - Creates points at intersections of lines
- **LineOnPointOverlayer** (legs) – Allows relationship between points and roadway network to be established
- **Snipper** (legs) – Cuts legs to specified length
- **MeasureGenerator** (legs) – Allows legs to be 3-dimensional for routing assets

Review and Key Takeaways

- The layer is available on our AGO
- It is still in BETA until Sept 2026
- FME is a powerful tool
- Integrating with your system of record has powerful benefits
- You can do it, and you should….before AI takes your job
- If you have use cases for the II, we'd love to talk to you

https://txdot.maps.arcgis.com/home/item.html?id=724734c49423472aa2ec265e75b9a142

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Questions?

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