GPS MAPPING 70K MILES OF LOCAL ROADS IN 5 YEARS

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CONTRACT DELIVERABLES

- Updated Database Tabular Data
- GPS Center Lines for Local Roads
- Local Road Data Incorporated into State Network
- Audit Files to Track Key Features
- Automated System for TDOT
- Training

TDOT

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Tennessee Roadway Information Management System (TRIMS)

- Client/Server Application
- Linear Reference System Database (Oracle)
- Roadway Inventory, Structures, Crash, Traffic, Pavement, Photolog, etc.
- Development of Web Based E-TRIMS

DATABASE TABLES UPDATED

- *Road System* – Parent table; Establishes routes
- *Route Feature* – Event Data
- *Geometrics* – Speed Limits, No. of Lanes, Land Use, 1 or 2 Way Traffic)
- *Roadway Description* – Road Cross Section (Left to Right)
- *Road Segment* – Functional Class, Road Name, In City, etc.)

LRS SPATIAL NETWORK

- GPS Data Delivered as Text Files
- Geometry created in Oracle using GeoMedia Pro
- Feature for Highway Segments
- Feature for Intersection Records (used as calibration points)
- Production Database Refreshed after Completion

POST DELIVERY PROCEDURES

- GPS Examination
- TRIMS Data QC Reports
- Create Spatial Network
- Final QA/QC
- Import into TRIMS Database
- TRIMS QA/QC
- Maps Generated and Field Checked

PROJECT STATUS

- 5 Year Project Ends in August 2012
- Field Data/Post Processing Completed
- Over 67,000 Miles of Roadway Inventory Collected
- Software Enhancements Include Updates to VB10 and Windows 7
- New Horizontal/Vertical Curve and Stop/Passing Sight Distance Data

LESSONS LEARNED - TDOT

- Do Your Homework and Draft RFP to Include all Requirements
- Test Procedures in Pilot County
- Automation Needed for QA/QC
- Expect and be Ready to Address Unforeseen Hurdles

NMC’s Process

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Convert TRIMS Data

- Converts 5 export files to 6 working files

Update TRIMS Data in Field

- Run routes in forward or reverse inventory direction
- Field software displays current data
- Crews record hotkeys and digital voice notes
- Actions stamped with GPS time and DMI logmile values
- Collect continuous GPS and auxiliary sensor data

NMC Field Inventory Vehicle

- **Dead Reckoning System allows mapping in areas of GPS blockage**
  - Aircraft gyro for heading
  - Barometer for elevation
  - Distance measuring instrument (DMI) for elapsed distance
  - Dead reckoning computer to control the data

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Edit Screen

03091541.LST | Co: 50 | Rte: 0A539001 | Recs: 51 | Rec No: 9 | Navstar Mapping Corporation Voice Data Entry System PATENT # 5,170,164

2

Status Code: M | MSLINK: 309473 | Item Code: 05 | GIS Code: 101 | Sort Name | Num | INTERSECTION - 4-WAY INT (LOCAL) 101 05 -

Descr: A609 S. MAIN ST. RT. & LT.

Add MSLINK Only | Insert TRIMS Rec | Swap TRIMS Rec | Calc GPS Time | Calculated Time

Orig LM: 000.000 | | 0.000| 309473|05|A609 S. MAIN ST. RT. & LT.

DMI LM: 0.000 | Ref Record: A609 S. MAIN ST. RT. _LT.

TRIMS Codes | Review Edit Notes

Record Type: V | Evt No: 25 | GPS Time: 165486.453 | CUL File Name: 0A539001 | Sgmt Code: Y | Proj. Dist: -42

1

TRIMS LM	NEW LM	FEATURE DESCRIPTION
000.000	000.000	***NUMBER OF THRU LANES - BEGIN 2***
000.000	000.000	***NUMBER OF LANES - BEGIN 2***
000.000	000.000	***BEGIN ILLUMINATION***
000.000	0.000	VOICE 14 (10 FPS)
000.000		A609 S. MAIN ST. RT. & LT.
000.000	0.000	BEGIN SPRING ST.
000.000	0.000	1-WAY STOP

3

GEOM Cmd Buttons:	Access Control	Direction	Illum:	Land Use	Terrain Type	ROW Rt	Num Lns	Thru Lns	Speed Limit	Truck Spd Lmt	School Zone	School Spd Lmt
Current Geometrics	NONE	1/2 Way 2	Y	RESIDENTIAL	ROLLING	36	2	2				

4

Go To Next Vce | Next Rec | Insert Copy | G Insert Next NTX | Store Time/LM | Save Note | Next Rte File

Play Highlite Vce | Prev Rec | Move Rec Up | W Insert Prior NTX | Insert Time/LM | S Begin | Prior Rte File

RePlay Last Vce | X - Ignore Rec | Move Rec Dn | J Store Highlite Rec | Add 1-Way Stop | Y Proj Begin | Next LST File

Move To Last Vce | Remove From TRIMS | Restore Orig. | K Insert Stored Rec | Begin Rd Name | E End | Quit

Z Proj End

5

Status Code: O | RD Break: BegLM 000.000 | EndLM 000.140 | Len: 0.140 | BRK Recs: 7 | Rec No: 1 | Rt Pvmt Width

	LEFT Roadway							Median/ Center Lane	RIGHT Roadway							ADD'L LANE
	LEFT Side			Pvmt	RIGHT Side				LEFT Side			Pvmt	RIGHT Side			
	Drain	Shldr	Aux Ln		Aux Ln	Shldr	Drain		Drain	Shldr	Aux Ln		Aux Ln	Shldr	Drain	
Type									29	20		19		20	29	
Width										1		18		1		
Comp.									40	05		06		05	40	

Review Breaks For Curr. Rte:

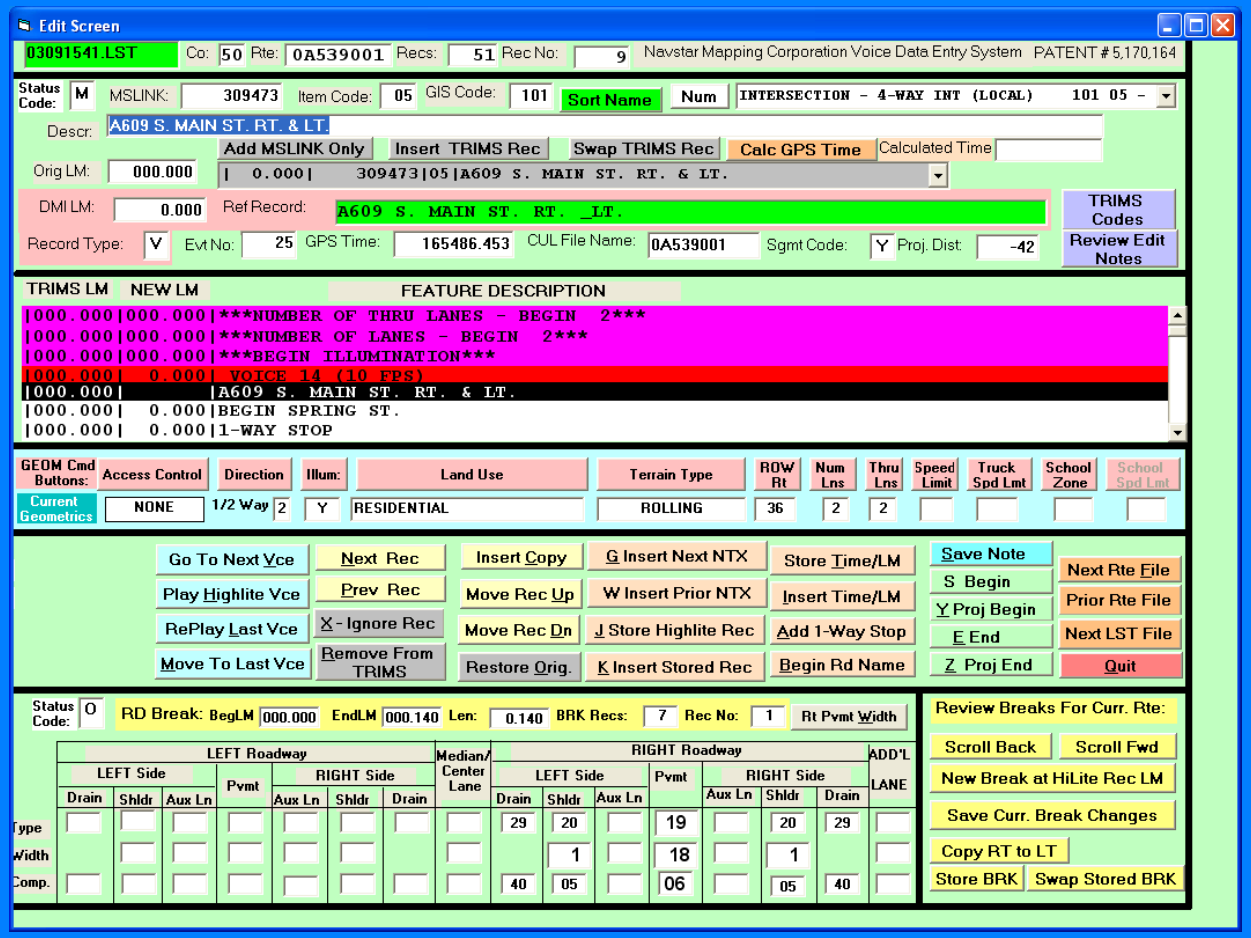
Scroll Back | Scroll Fwd

New Break at HiLite Rec LM

Save Curr. Break Changes

Copy RT to LT

Store BRK | Swap Stored BRK



Voice note example 1:

Voice note example 2:

Voice note example 3:

- **Operator performs windshield survey**
  - Changes or new features require voice note
  - Unchanged existing TRIMS features are simply tagged
- **Edit software plays voice notes automatically**

Edit Software Output Files

- **.CUL** – Contains the feature description information and codes to update the TRIMS Route feature table
- **.GPS** – Contains the final road track records for the route in an NMC working file format as well as a matching record for each record in the .CUL file
- **.G** – Contains the information to update the TRIMS Geometrics table
- **.RD** – Contains the Information to update the TRIMS Roadway Description table

Intersection Convergence

- Locates matching intersections based on a distance buffer
- Calculates/determines heading values of intersections
- Projects along heading values to a common lat/long value
- Relocates intersections and associated features to the common lat/long value

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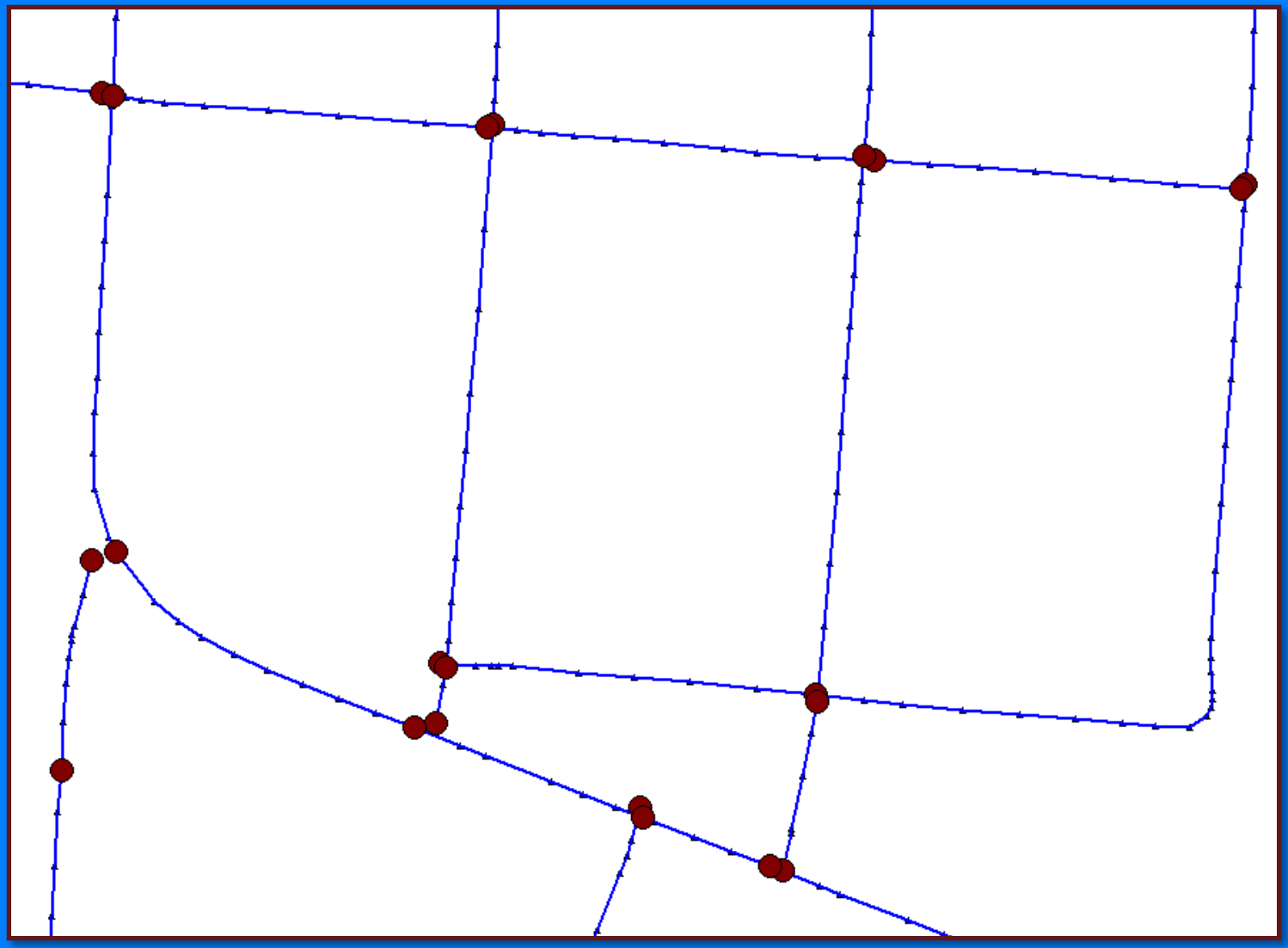
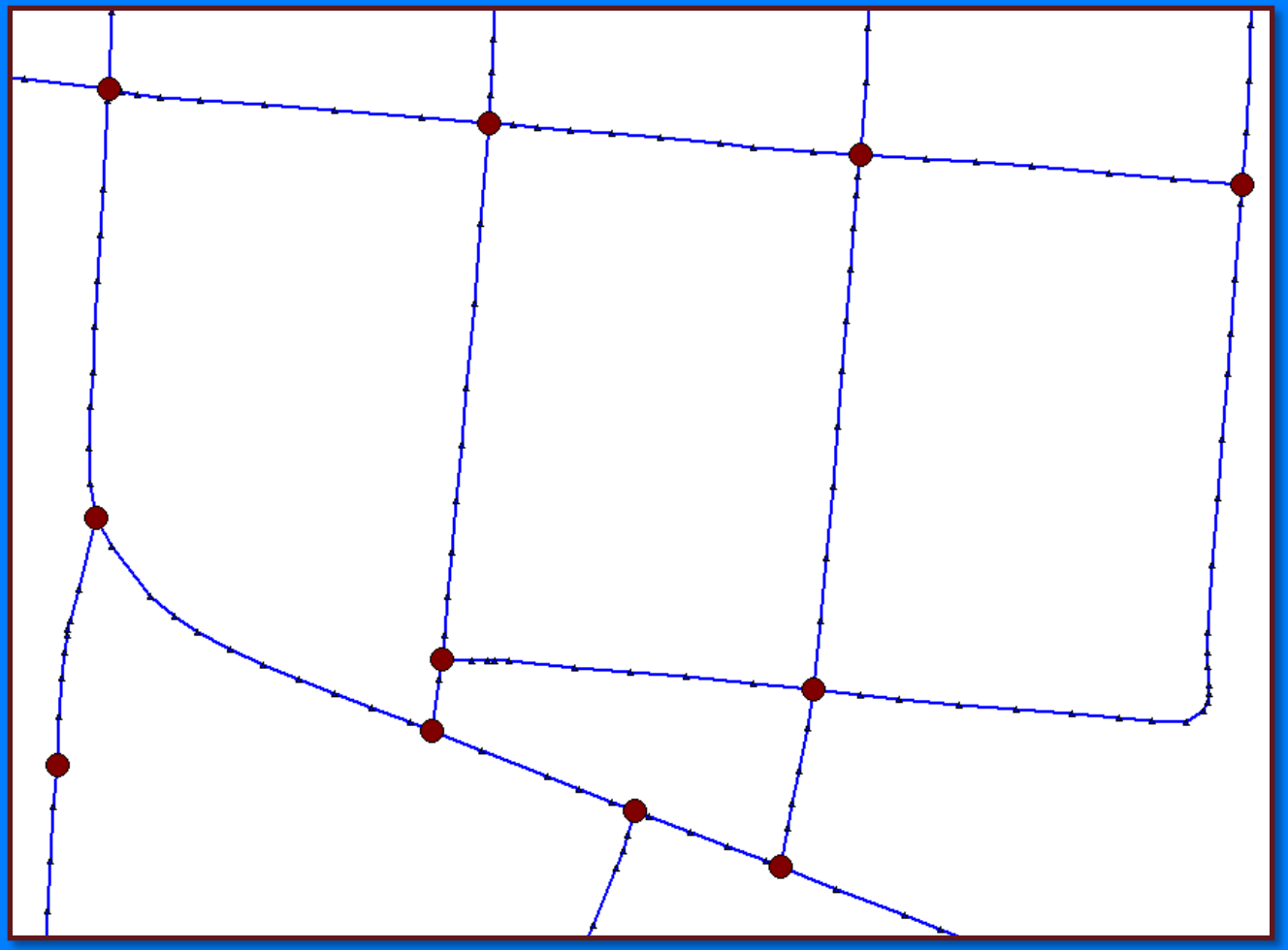
Before Intersection Convergence



After Intersection Convergence



•Converged intersection locations are automatically updated in both routes

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Post-Processing

- Verify the integrity of graphics
- Verify integrity of the data that will go back into TRIMS

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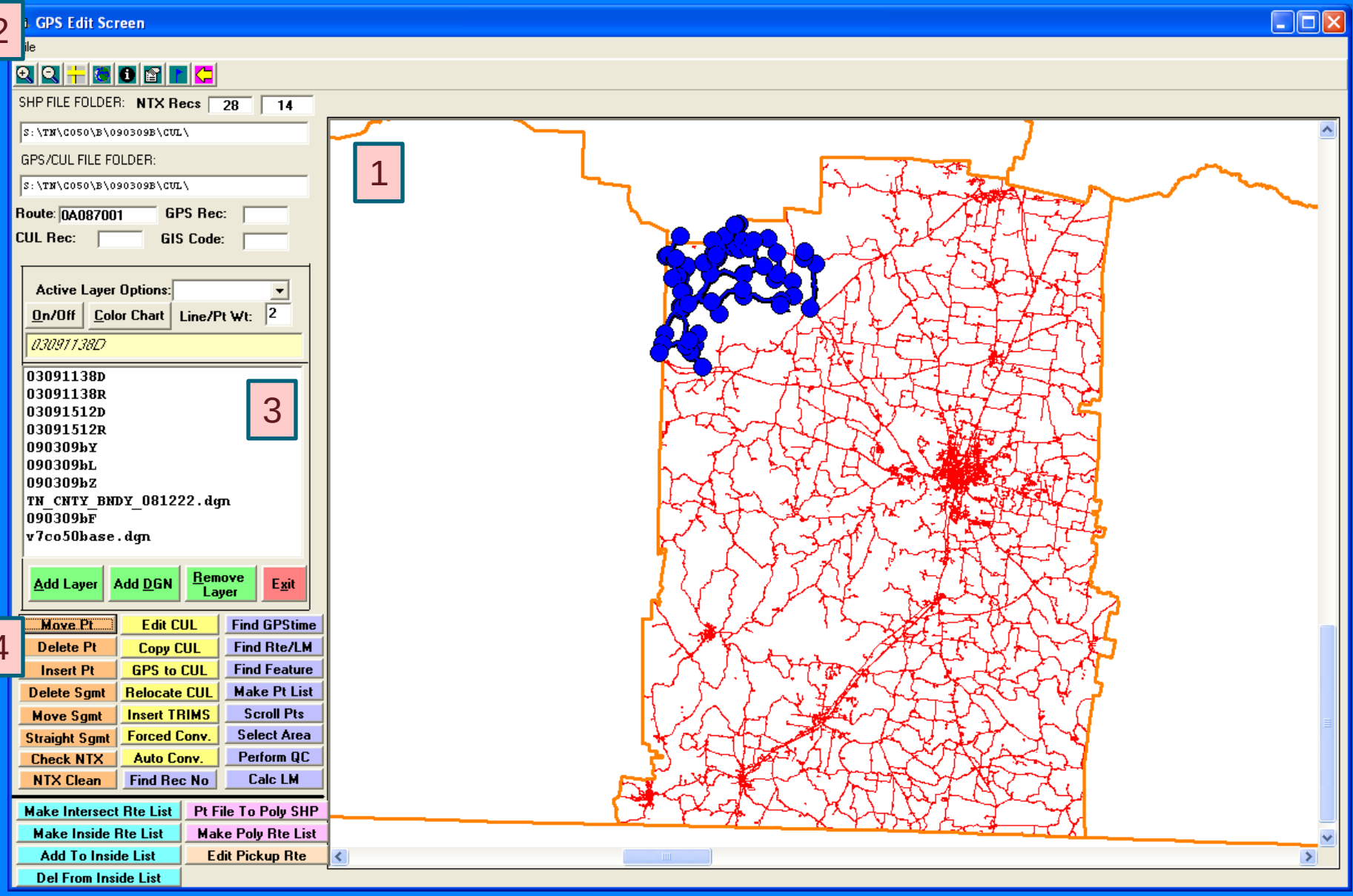

Data Quality Assurance

- Software and Audit Files Allow us to Check for:
  - Common edit errors
  - MSLINK numbers
  - Matching intersections
  - Consistent road names
  - Orphan intersections

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Output Data

- Provide TDOT with:
  - Files for graphics generation
  - Five updated TRIMS files in text format

Lessons learned

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Field Procedure

- County order
  - Proximity
  - Terrain/time of year
- Contingency plans for inclement weather
- Periodic equipment checks
  - Weekly DMI calibration
  - Frequent tire pressure checks and adjustments

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Office Procedure

- QC data often and early
  - Audit files
  - Swap between vehicles
- County processing times differ
  - New routes, urban vs. rural, coverage
- Always room for improvement
  - Software improvement suggestions
  - Annual review of processing steps

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Project Summary

- Collected, processed, and delivered 67,000 miles of local roads with 2 two-person field crews in 5 years.
- Average data miles collected per day: 67
- 135,000 local roads delivered

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QUESTIONS?