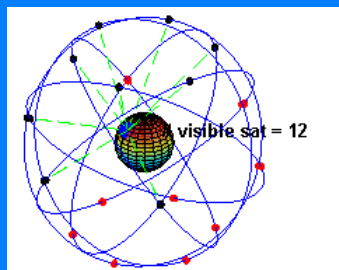# PROJECT:
GPS MAPPING 70K MILES OF LOCAL ROADS IN 5 YEARS (Ai)

Mike Lewis

Vice President

Navstar Mapping Corporation (NMC)

June 13, 2012

Email - mike_lewis@navstarmapping.com

Navstar Mapping Corp. History

o **Incorporated October 27, 1987**

o **Full time business operation since 1990**

o **Grown to 10 full time/3 part time employees**

Customer List

- Tennessee Department of Transportation - Planning Division
- Tennessee Department of Transportation - Maintenance Division
- Alaska Department of Transportation and Public Facilities – Planning Division
- Alaska Department of Transportation and Public Facilities – Maintenance Division
- Nebraska Department of Roads – Planning Division
- Nebraska Department of Roads – Information Systems Division
- Washington State Department of Transportation – Planning Division
- Mississippi Department of Transportation – Planning Division
- Pike County, Mississippi – Mapping Department
- Pike County, Mississippi – 911 Office
- Warren County, Mississippi – Mapping Department
- South Dakota Department of Transportation – Planning Division

Customer Vehicle Installations

NMC/TDOT History

o **1990 – First Contract to replace manual paper and pencil inventory updates**

o **1997 -> 2003 – Sold 2 RoadMapper Systems for TDOT to collect and process**
    @ 37,000 miles of Interstate, State Highways, and Functional Routes

o **2007 -> 2012 – Automated Inventory Local Roads Project**

o **1990 ->2012 – Under production and development contracts on continual basis**

Automated Inventory (Ai)
Project Overview

1. Update existing 55K miles in TDOT database in 95 counties on a county by county basis

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7. Deliver updated data to TDOT in text format

3 Categories of Roadways in TN

1. Interstate/State Highways

3 Categories of Roadways in TN

1. Interstate/State Highways

2. Functional Classification of Highways

   Routes that carry vehicles between Interstate/State Highways to/from Local Roads

3 Categories of Roadways in TN

1. Interstate/State Highways
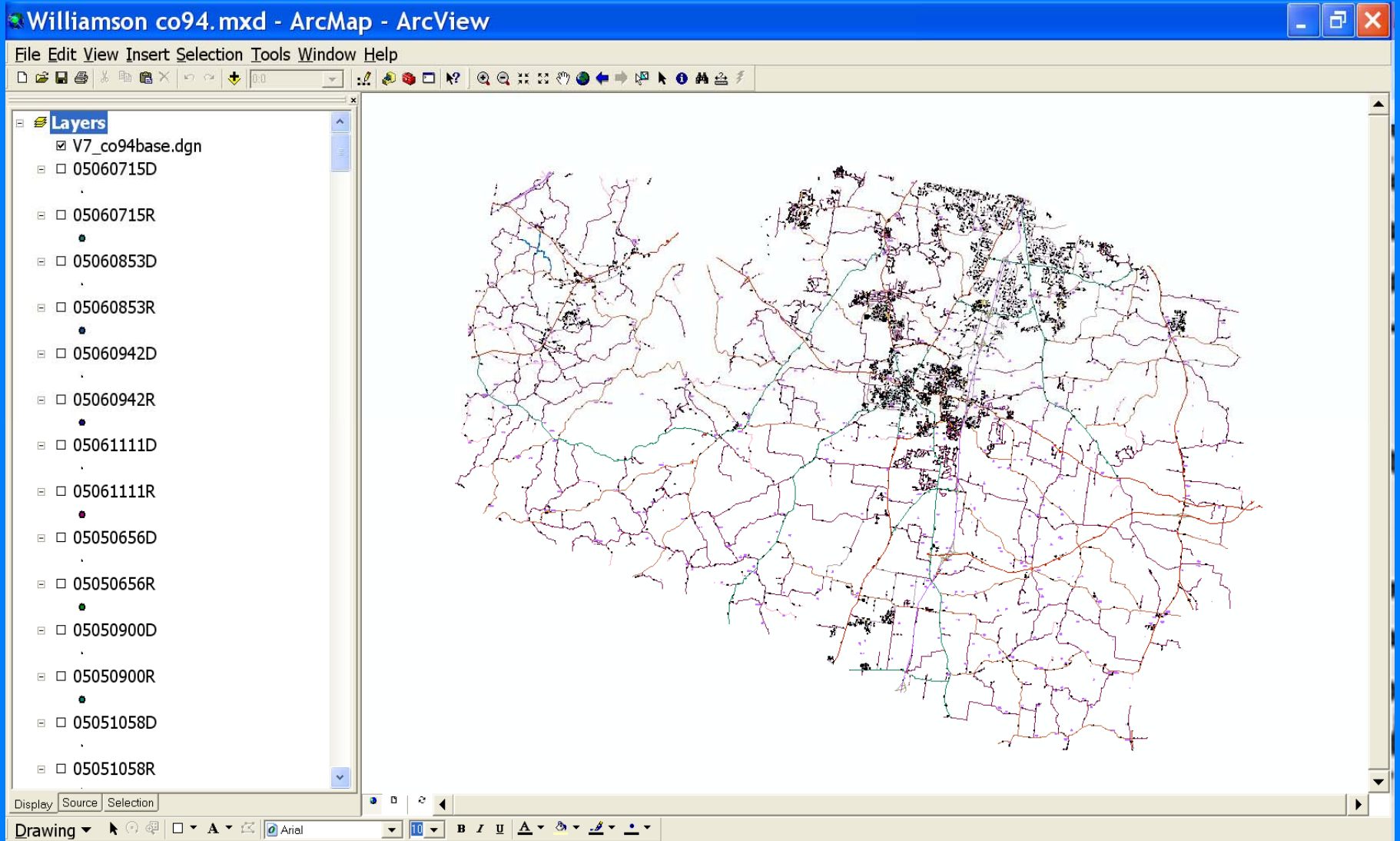
2. Functional Classification of Highways

   Routes that carry vehicles between Interstate/State Highways and Local Roads

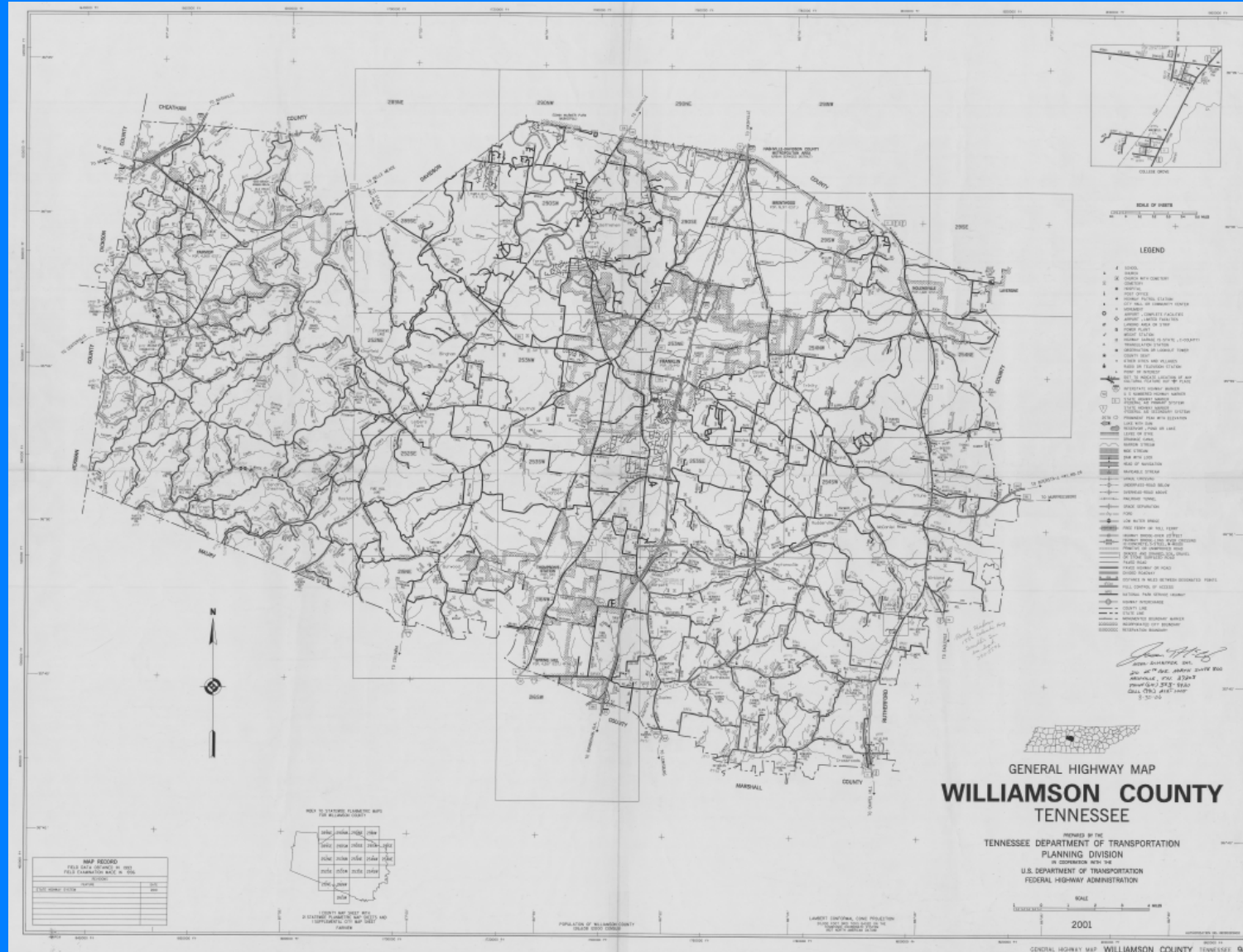3. Local Roads

   Residential/Neighborhood Roads
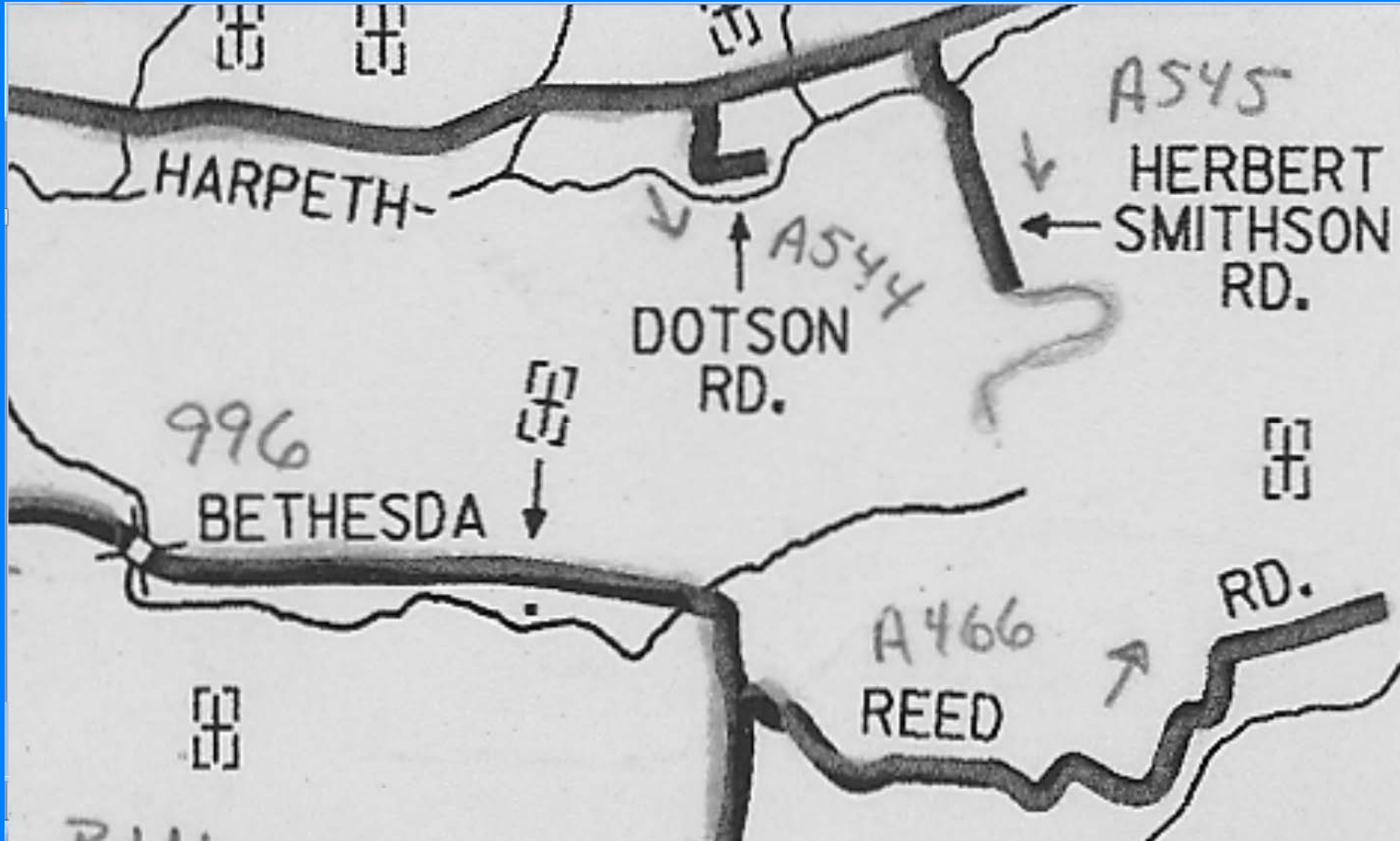
Microstation DGN Base Map

Typical TN County Map

Zoomed-in County Map

Road Name, Route #, & Directional Arrow

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

5 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 etc.*

- Roadway Description – *Road Cross Section (Left to Right)*

- Road Segment – *Functional Class, Road Name, In City, etc.*

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NAVSTAR MAPPING CORPORATION

TDOT

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- Always keep underlying data in sync with graphics during cartographic cleansing

NMC Field Inventory Vehicle

<u>Two Person Crew</u>

Driver – Safely drive and Operate Distance Measuring Instrument (DMI)
Operator – Update existing database on notebook controlled system

Positioning Hardware

- **Numetrics Distance Measuring Instrument (DMI)**
- **Trimble AG332 DGPS**
- **NMC's AuxBox**
- **OmniSTAR VBS L1 only,** code phase pseudo-range solution

NMC AuxBox

- **Dead Reckoning System allows mapping in areas of GPS blockage**

  - Aircraft gyro for heading

  - Barometer for elevation

  - DMI Wheel Sensor and Targets for accurate elapsed distance

  - Dead reckoning computer to format and package the data at 5 p.p.s.

Voice Data Entry System
patent #5,170,164

- **Notebook computer controlled field data collection system**
- **Position information written to data file when action key is pressed**

- **Action keys:**

  1st <Spacebar> keypress tags record under highlight with position and begins audio .wav recording

  2nd <Spacebar> keypress turns off audio .wav recording and resets system for next feature

  Hokey – Pressing the corresponding hotkey letter automatically inserts and tags pre-canned text description

  <Enter> keypress automatically tags the current data record with position information

DIGITAL CAMERA ENHANCEMENTS
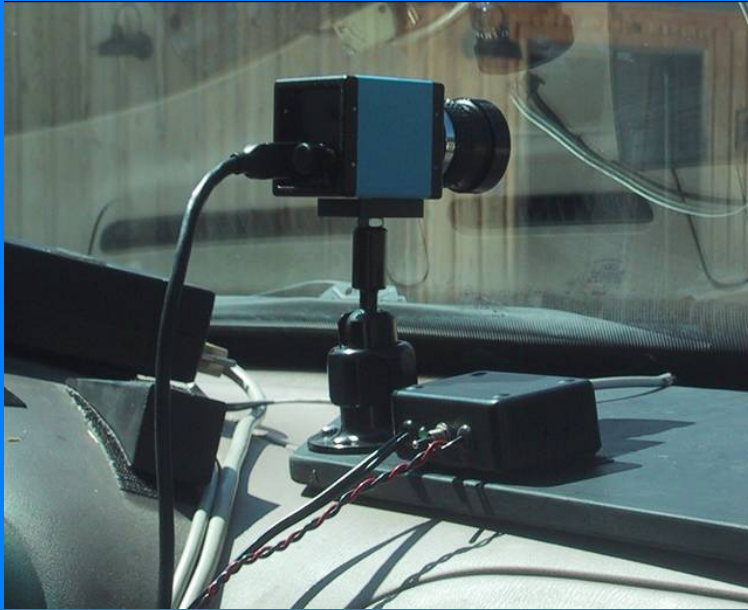
- Jpeg's captured every 52.8 ft or .001 miles

- Each jpg Labeled with route, date, time and elapsed distance

- Only store images that correspond with action keys (GPS tags)

- Office edit software automatically displays image to editor

INV_MAP (Inventory Map)
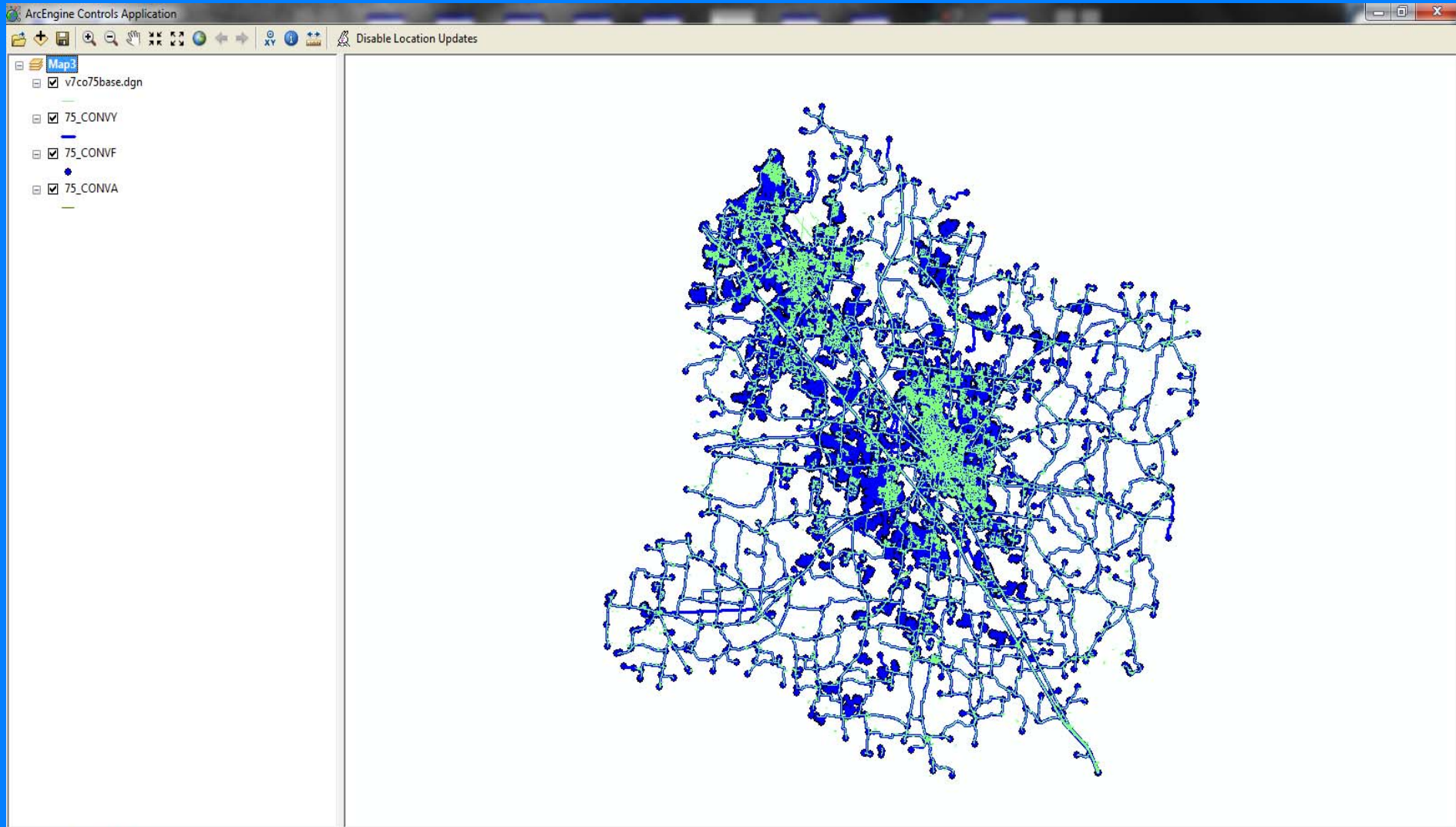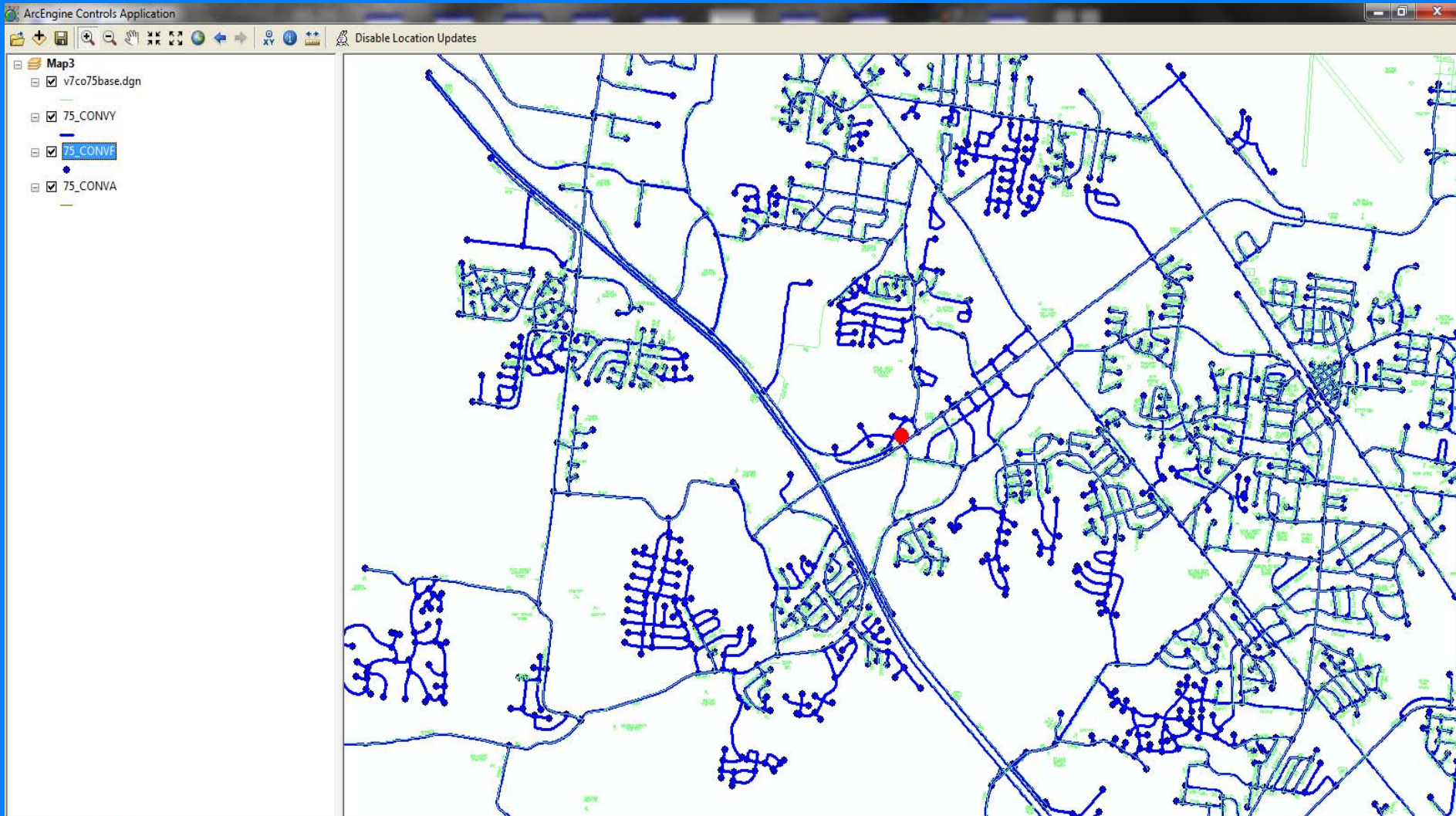
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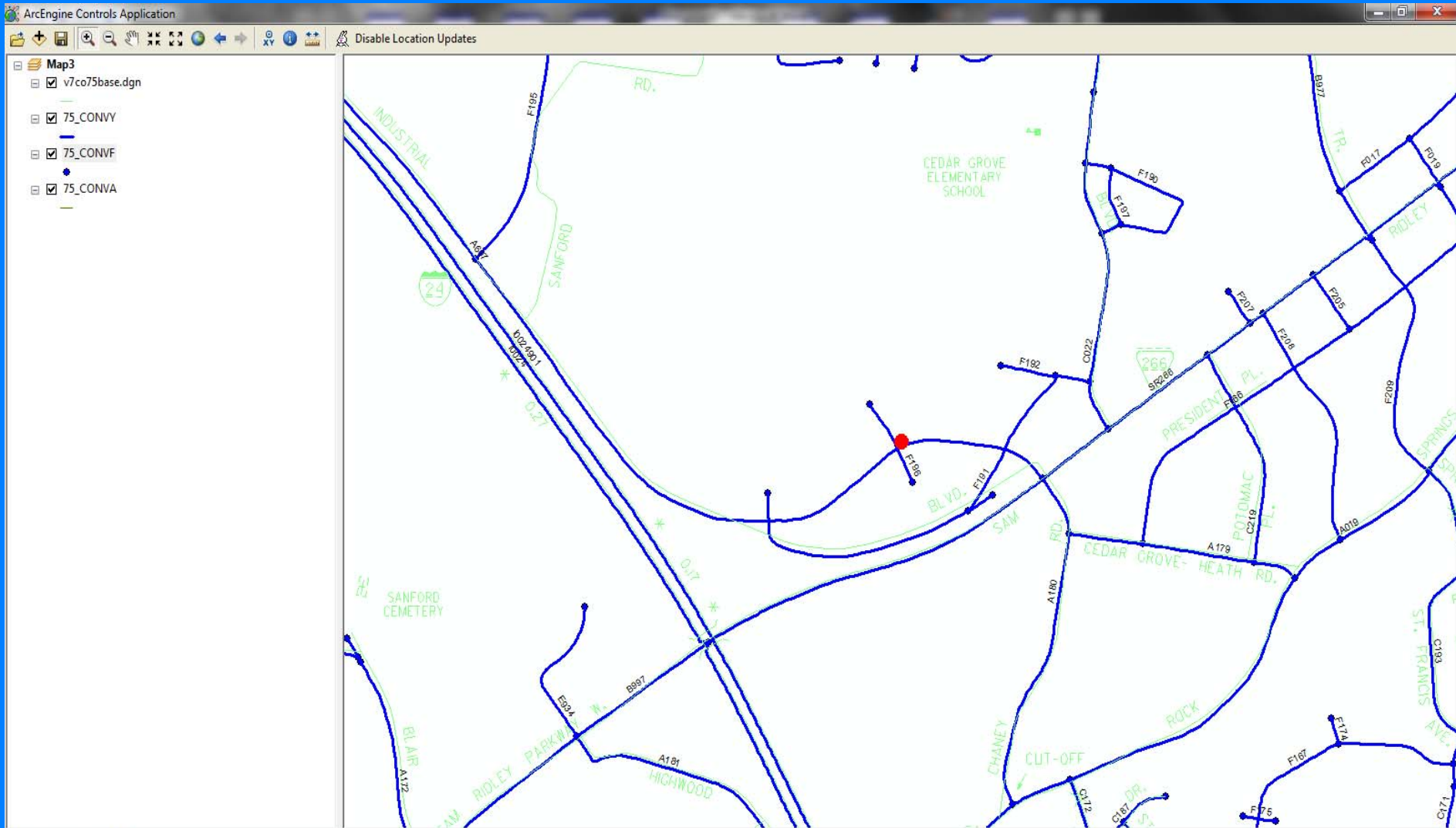
Ai Project Workflow Description

Convert TRIMS Data

- Convert 5 export files to 6 working files

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 database data
•Field Crews record hotkeys and digital voice notes
•Actions stamped with GPS time and DMI logmile values
•Collect continuous GPS and auxiliary sensor data

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Process Data in Office

• Update data based on the field crews' voice notes
• Generate working files to use in post-processing
• Converge intersections

NAVSTAR MAPPING CORPORATION

VDES SCREEN

000.109 | MILES | MPH 40 | Navstar Mapping Corporation Voice Data Entry System | PATENT # 5,170,164

CO: 75 | RTE: 0A001001

TRIMS LM | NEW LM | Rte Name: OLD ALMAVILLE RD. | LST File: 06051702

```
|*******|*******|***************************************************************|
|*******|*******|***************************************************************|
|  0.000|       ||SR-96 FRANKLIN RD. RT. & LT.                                  |
|  0.000|       ||1-WAY STOP                                                    |
|  0.010|       ||LIVING WORD TABERNACLE CHURCH LT.                             |
|  0.460|       ||CULVERT: BRANCH                                               |
|  0.870|       ||D101 SHORES RD. RT. & LT.                                     |
|  0.870|       ||1-WAY STOP                                                    |
|000.000|       ||***ACCESS CONTROL - BEGIN NONE***                             |
|000.000|       ||***DIRECTION - BEGIN 2 WAY***                                 |
|000.000|       ||***LAND USE - BEGIN RURAL              0***                   |
```

	LEFT Roadway						MEDIAN or Center Lane	LEFT 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

Current Break | BegLM 0.000 | EndLM 0.870 | Brk No: 1

	LEFT Drain	LEFT Shldr	LEFT Aux Ln	Pvmt	RIGHT Aux Ln	RIGHT Shldr	RIGHT Drain	Center	Drain	Shldr	Aux Ln	Pvmt	Aux Ln	Shldr	Drain	ADD'L
Type																
Width										2		18		2		
Comp.									40	05		15		05	40	

Next Break | BegLM | EndLM | Brk No:

GPS Status: | Evt No: 3
Doing Position Fixes.
GPS Settings-<F7> Key: | OPEN
SV's/Strength:
DGPS Age:
GPS Gap: 0
PDOP: 2.6
Sats Used:
GPS Time:252360.000
AUX: 915 | RTG: 166

| HotKey:	A	D	I	Use Voice for Updates	N	R	S	K	T	Z
Current Geometrics	Access Control	1 or 2 Way	Illum.	Land Use	Num Lns	ROW-LT	Spd Lmt	Trk Spd Lmt	Terrain Type	Sch Zone
		2			Thru Lns	ROW-RT				School Spd

ACTION KEYS:

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

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

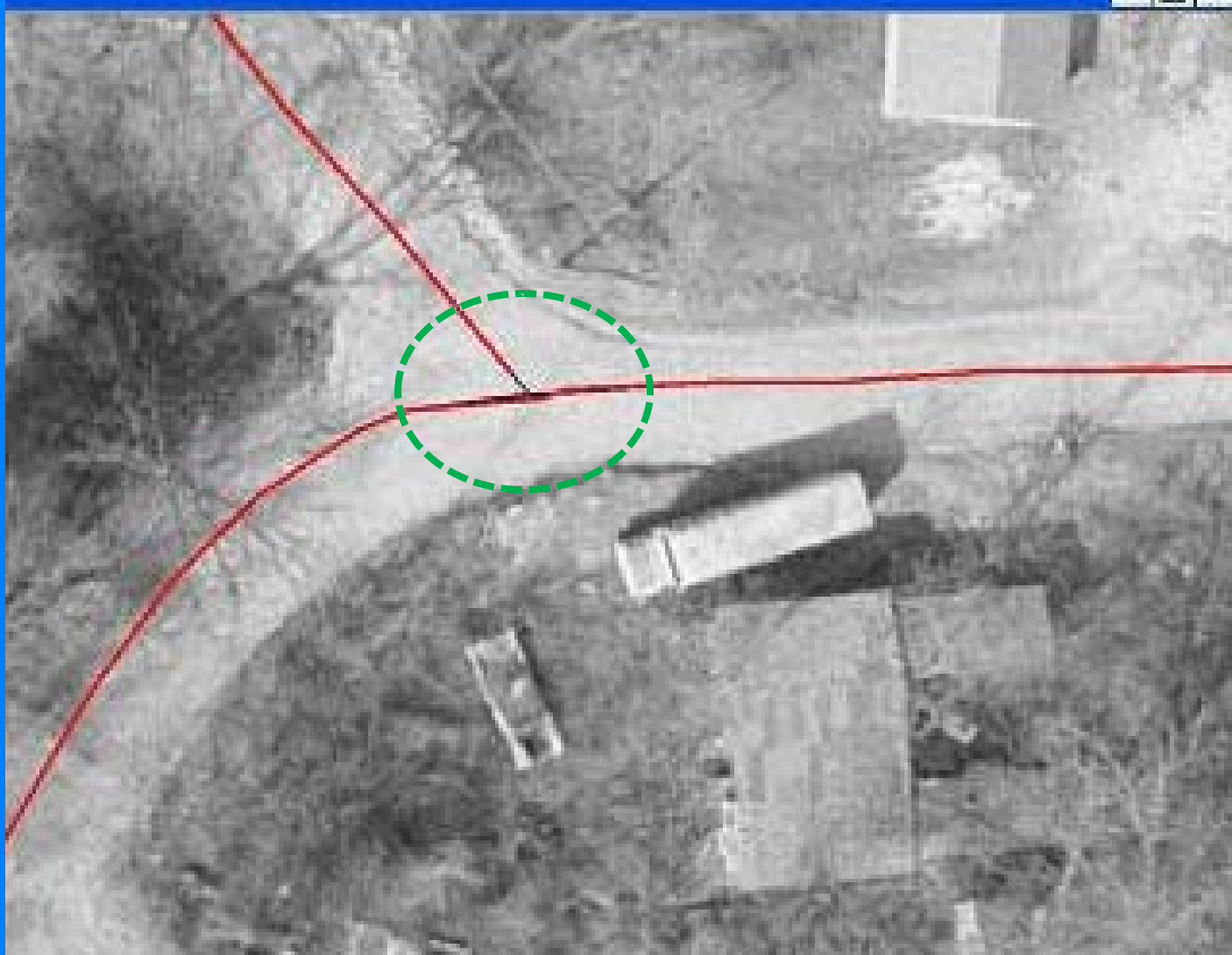- Relocates intersections and associated features to the common lat/long value

Before Intersection Convergence
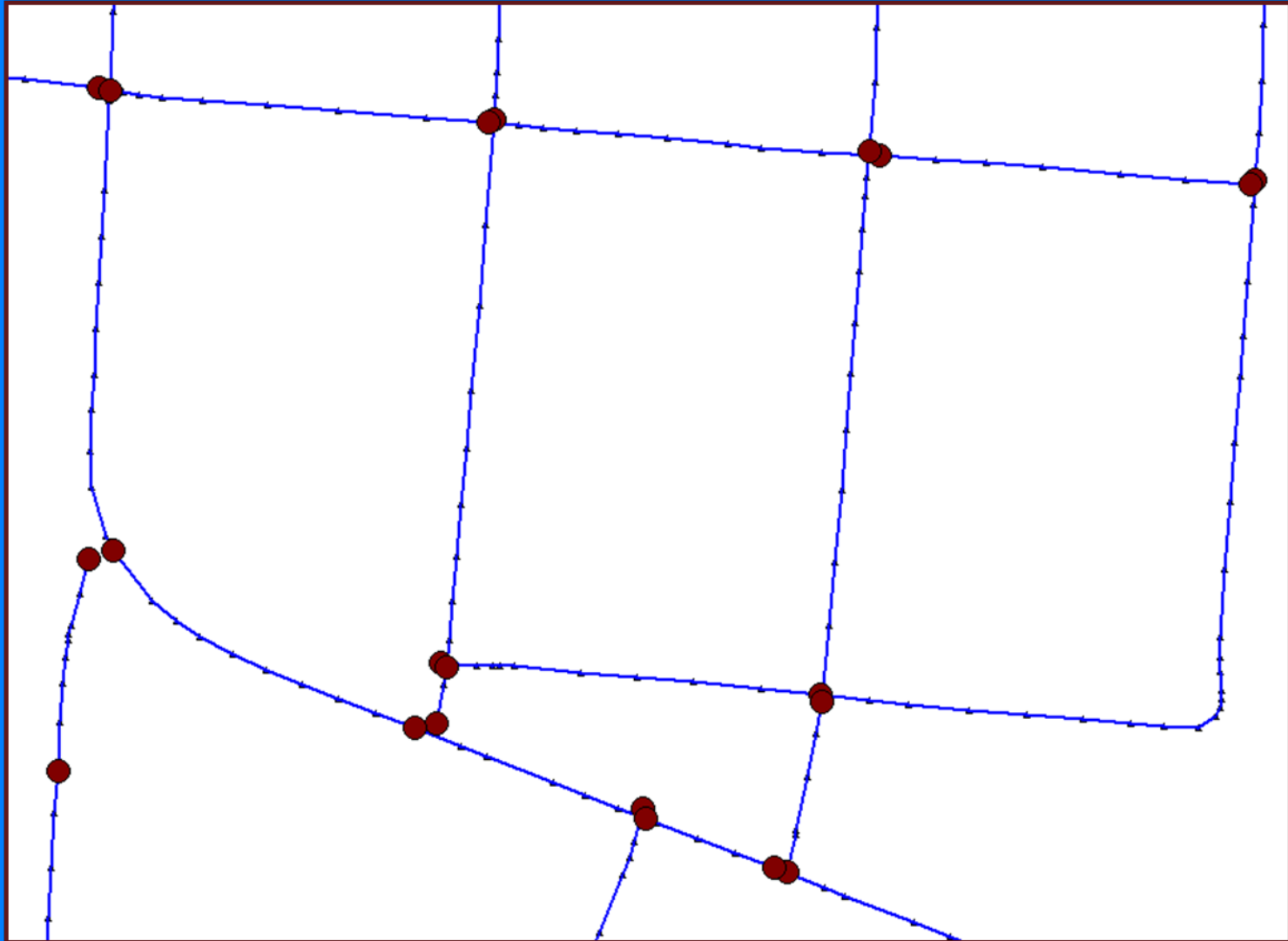
After Intersection Convergence
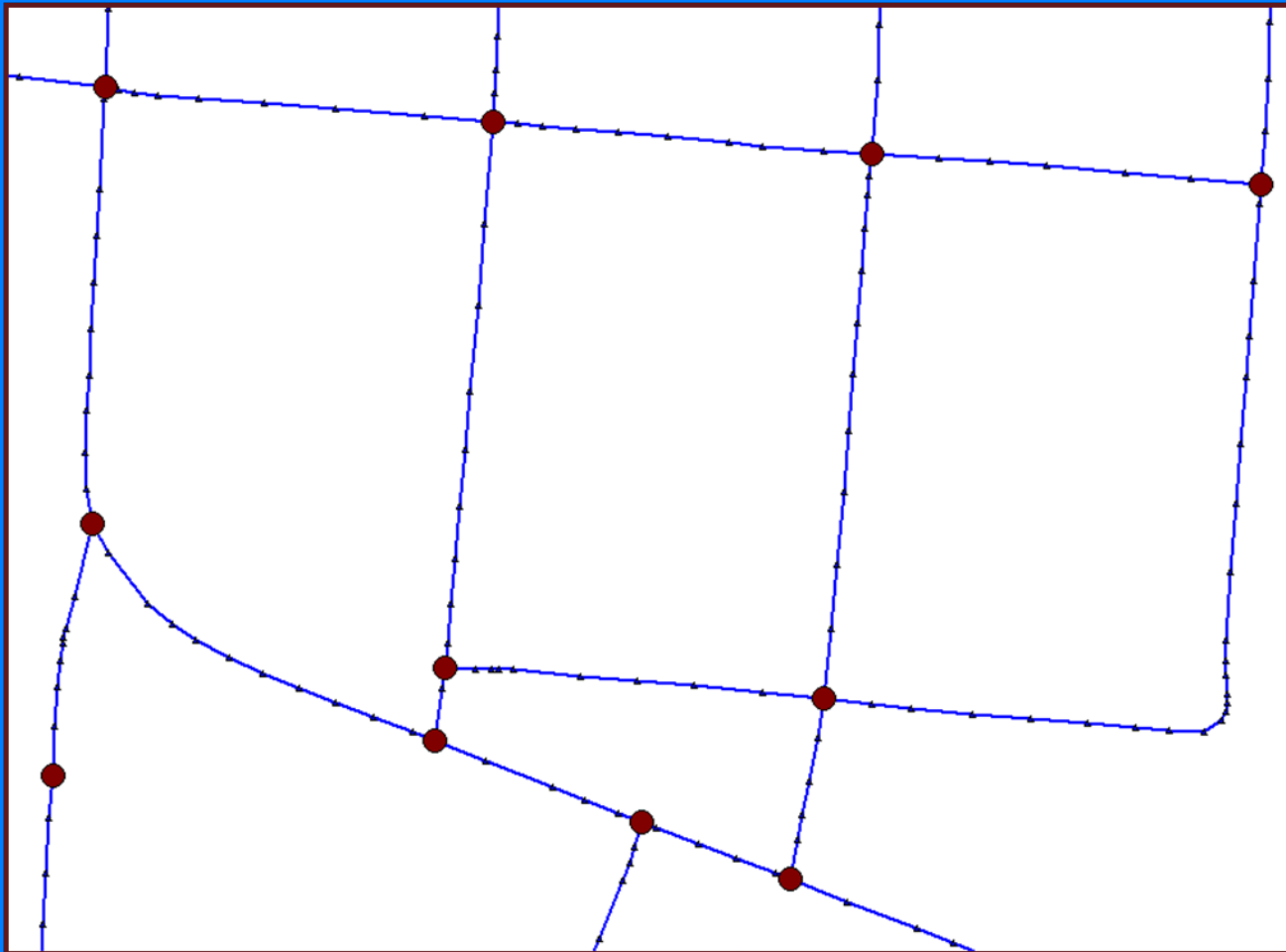
•Converged intersection locations are automatically updated in both routes
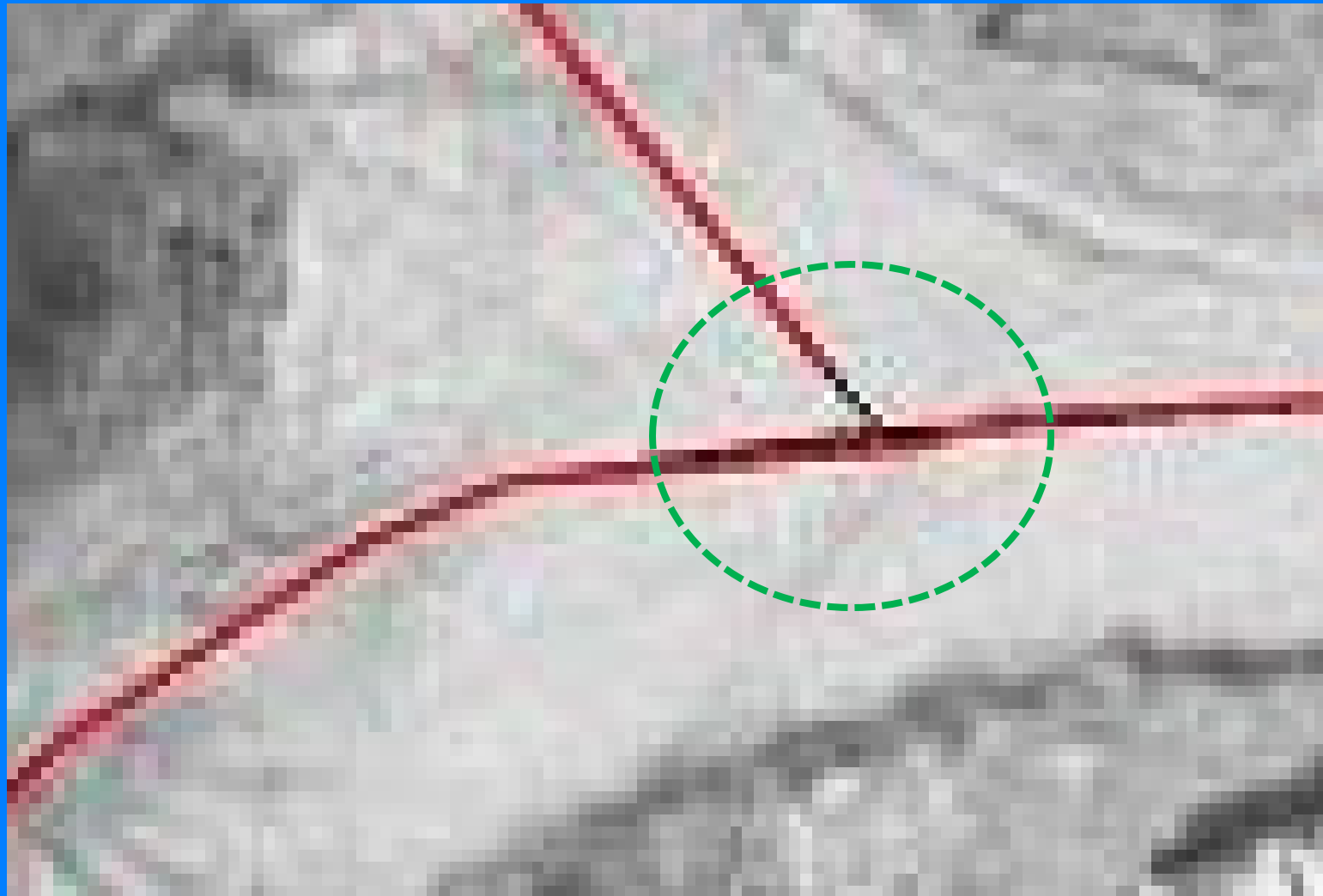
INTERSECTION UNDER-SHOOT

INTERSECTION UNDER-SHOOT

RED = NON-CONVERGED   BLACK = FINAL CONVERGED

INTERSECTION OVER-SHOOT

RED = NON-CONVERGED   BLACK = FINAL CONVERGED

INTERSECTION OVER-SHOOT

RED = NON-CONVERGED   BLACK = FINAL CONVERGED

TYPICAL CONVERGED ROADTRACK

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Process Data in Office

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- Generate working files to use in post-processing
- Converge intersections

Post-Processing

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

NAVSTAR MAPPING CORPORATION

TDOT

2 GPS Edit Screen

File

SHP FILE FOLDER: **NTX Recs** 28 14

S:\TN\C050\B\090309B\CUL\

GPS/CUL FILE FOLDER:

S:\TN\C050\B\090309B\CUL\

Route: 0A087001   GPS Rec:

CUL Rec: GIS Code:

1

Active Layer Options:

On/Off   Color Chart   Line/Pt Wt: 2

03091138D

3

03091138D
03091138R
03091512D
03091512R
090309bY
090309bL
090309bZ
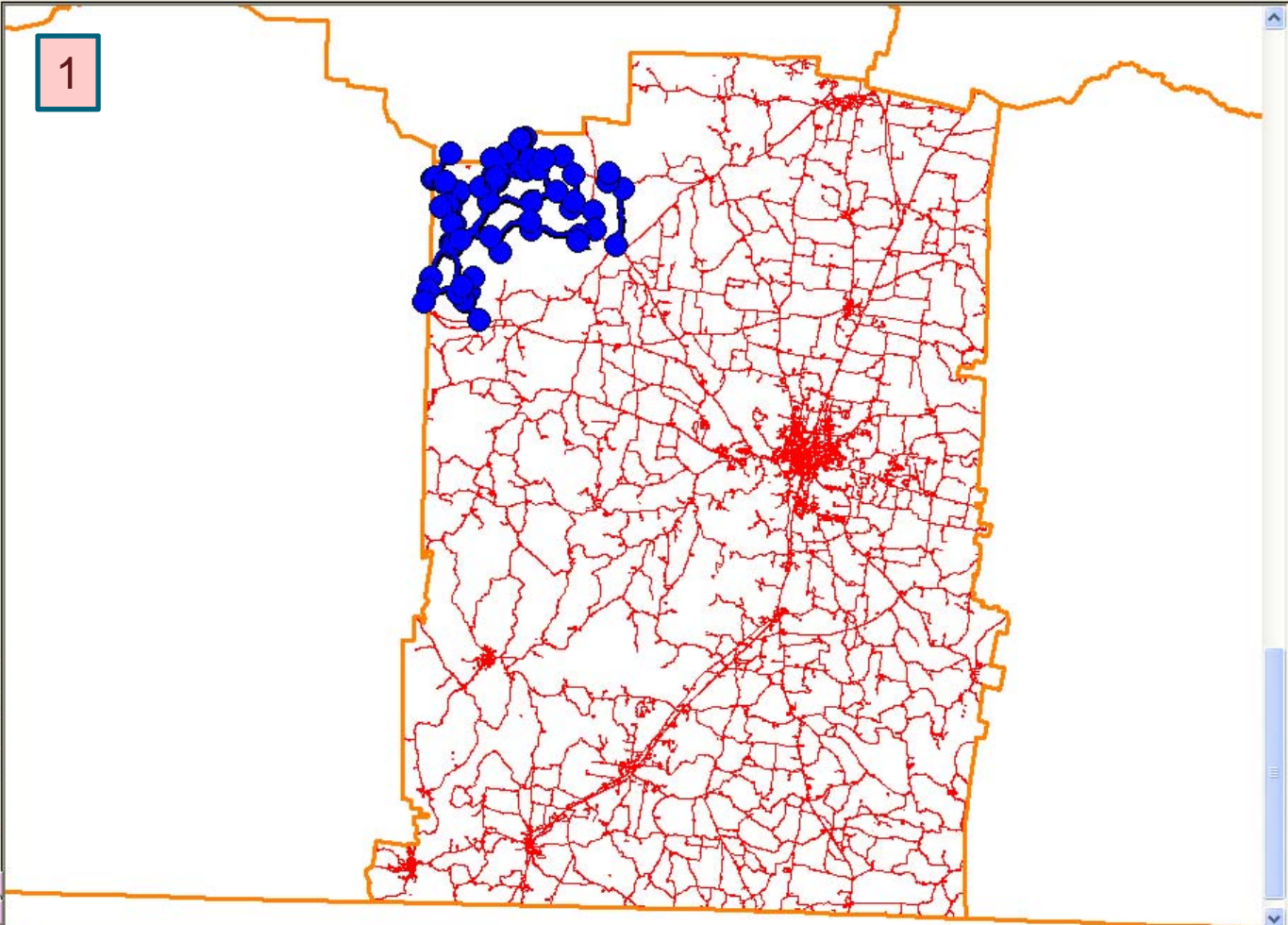TN_CNTY_BNDY_081222.dgn
090309bF
v7co50base.dgn

Add Layer   Add DGN   Remove Layer   Exit

4

Move Pt	Edit CUL	Find GPStime
Delete Pt	Copy CUL	Find Rte/LM
Insert Pt	GPS to CUL	Find Feature
Delete Sgmt	Relocate CUL	Make Pt List
Move Sgmt	Insert TRIMS	Scroll Pts
Straight Sgmt	Forced Conv.	Select Area
Check NTX	Auto Conv.	Perform QC
NTX Clean	Find Rec No	Calc LM

Make Intersect Rte List   Pt File To Poly SHP
Make Inside Rte List   Make Poly Rte List
Add To Inside List   Edit Pickup Rte
Del From Inside List

PROJECT STATUS

- 5 Year Project Ends in August 2012
- Field Data/Post Processing Completed
- Over 70k Miles of Roadway Inventory collected, processed, and delivered
- 2 – two person field crews, 2 vehicles
- 10 hour day – 4 days per week
- Average data miles collected per day = 67
- 135,000 local roads delivered

QUESTIONS?

We would like to work closer to home…

mike_lewis@navstarmapping.com
office - 512-339-4564