Q: WHAT IS ANOTHER FIVE LETTER WORD FOR TRUCK?

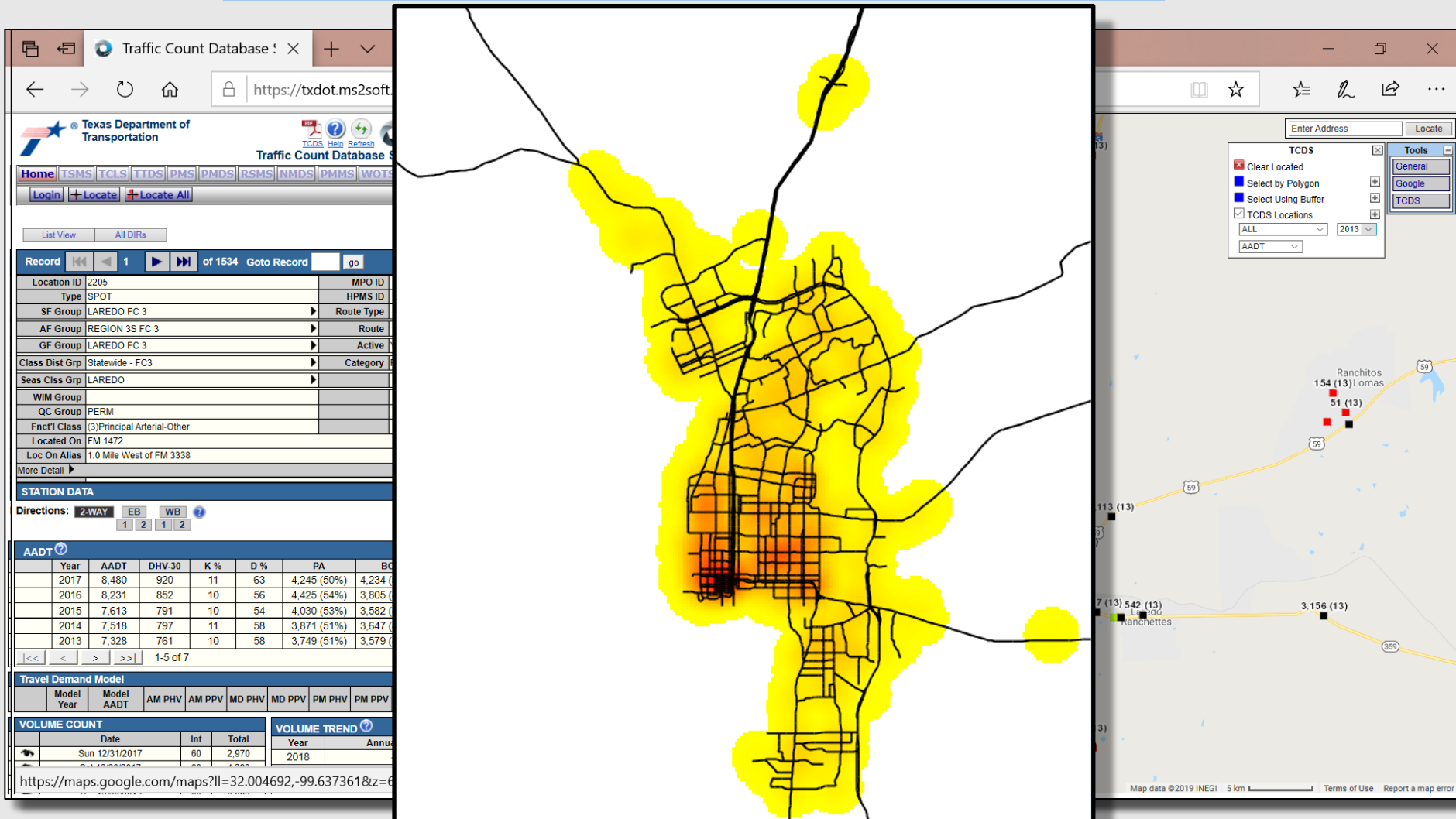## A: AXLES

Estimating Truck Traffic using geoprocessing tools

TxDOT Count Collection Program

Statewide Analysis and Reporting System (STARSII)

- Permanent automatic traffic recorders (ATRs), and

- Traffic collected each hour of the day and every day (entire year).

- On-system (TxDOT maintained), and
- Off-system.

* Bicycles and scooters will not register. Smart fourtwos® cars may be counted as motorcycles

Dual Pneumatic Tubes:

- Speed data, and

- Vehicle classification (VC) data.

Single tubes count axles only

TxDOT Count Collection Program

| On-System	Off-System
H = Highway count station	CR = County road or city street (non-urban)
T = Town count station	CS = City street or county road screenline
SP = SPR (*permanent traffic recorder*)	CE = City street or county road external
AT = ATR (*permanent traffic recorder*)	RP = Ramp count station (*discontinued*)
E = External station	U = Urban station
S = Screenline station	U# = urban station # (letters) and numbers
	HP = Highway Performance Monitoring System (HPMS) • 1-999 annual HPMS count • 1000-1999 NHS HPMS count • 5000-8999 HMPS count (every 5 years)

Manual Vehicle Count (MVC)
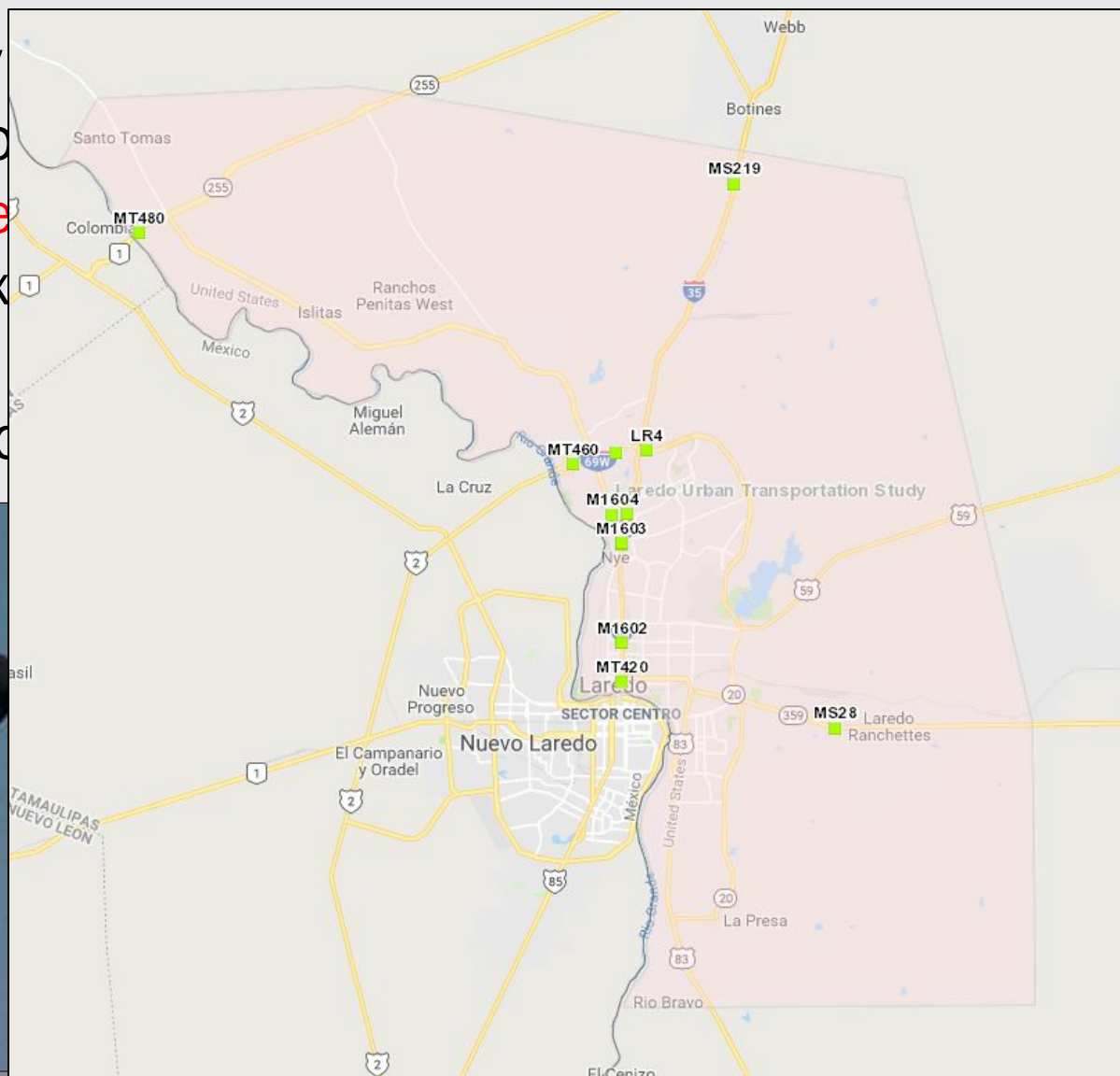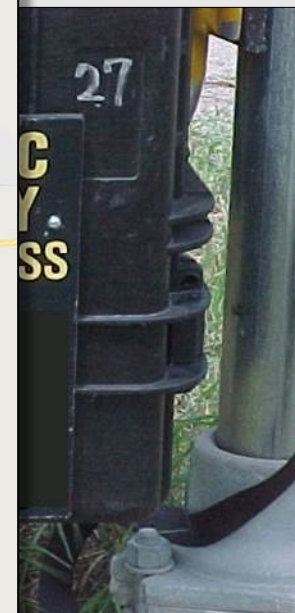
- Collect v
  - Video   actors:
    - Ve
    - Ax

- Collected

Two Count Types:

1. Annual – collected every year, and

2. Urban – collected every five years

Travel Demand Models (TDMs) Calibrated or Validated to Urban Count Collection Schedule
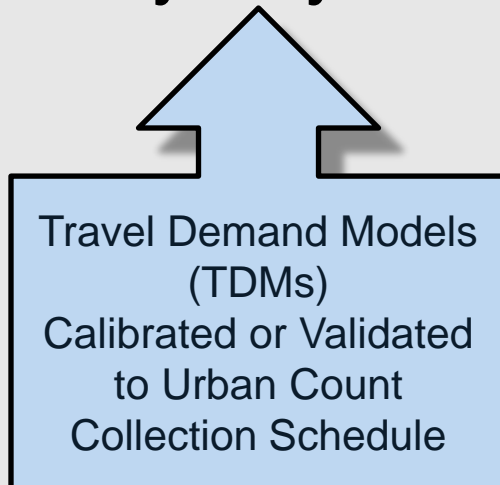
1. Gas-tax distribution process

   – HPMS vehicle miles of travel [VMT]

2. VMT Projections

3. Corridor Analysis

4. Vehicle activity/mix

   – *Truck (oil & gas sectors, wind farms)*

5. Travel demand models

   – *Use both annual and urban counts as an input*

Legend: 35¢ OR GREATER | 25-34.9¢ | LESS THAN 25¢
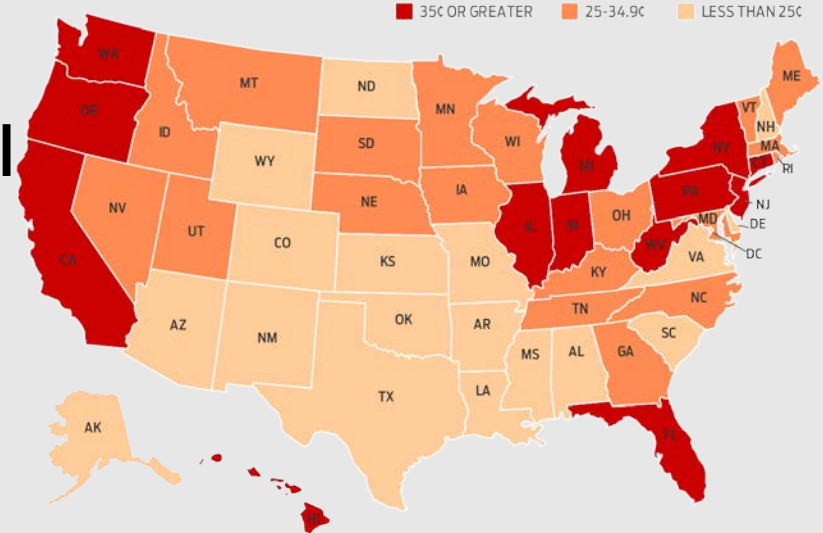
$$Percent\ Match = \frac{Volume}{\textcolor{red}{Count}}$$

$$RMSE = \sqrt{\frac{\sum(\textcolor{red}{Count} - Model)^2}{N}}$$

$$\%\ RMSE = \left(\frac{RMSE}{\frac{\sum \textcolor{red}{Count}}{N}}\right) * 100$$

Comparisons performed by:
- Functional class
- Facility type
- Area type
- Screenlines
- Volume group

1. Utilizes average non-summer, weekday traffic (ANSWT)

   – Typical Monday thru Thursday,

     • Non-holiday traffic, and

     • Schools are open.

2. TxDOT presents counts as average annual daily traffic (AADT)

   – Adjusted for vehicle mix and season

   Not all counts mean the same thing

TxDOT Count Traffic Analysis and Reporting:

❑ Average Annual Daily Traffic

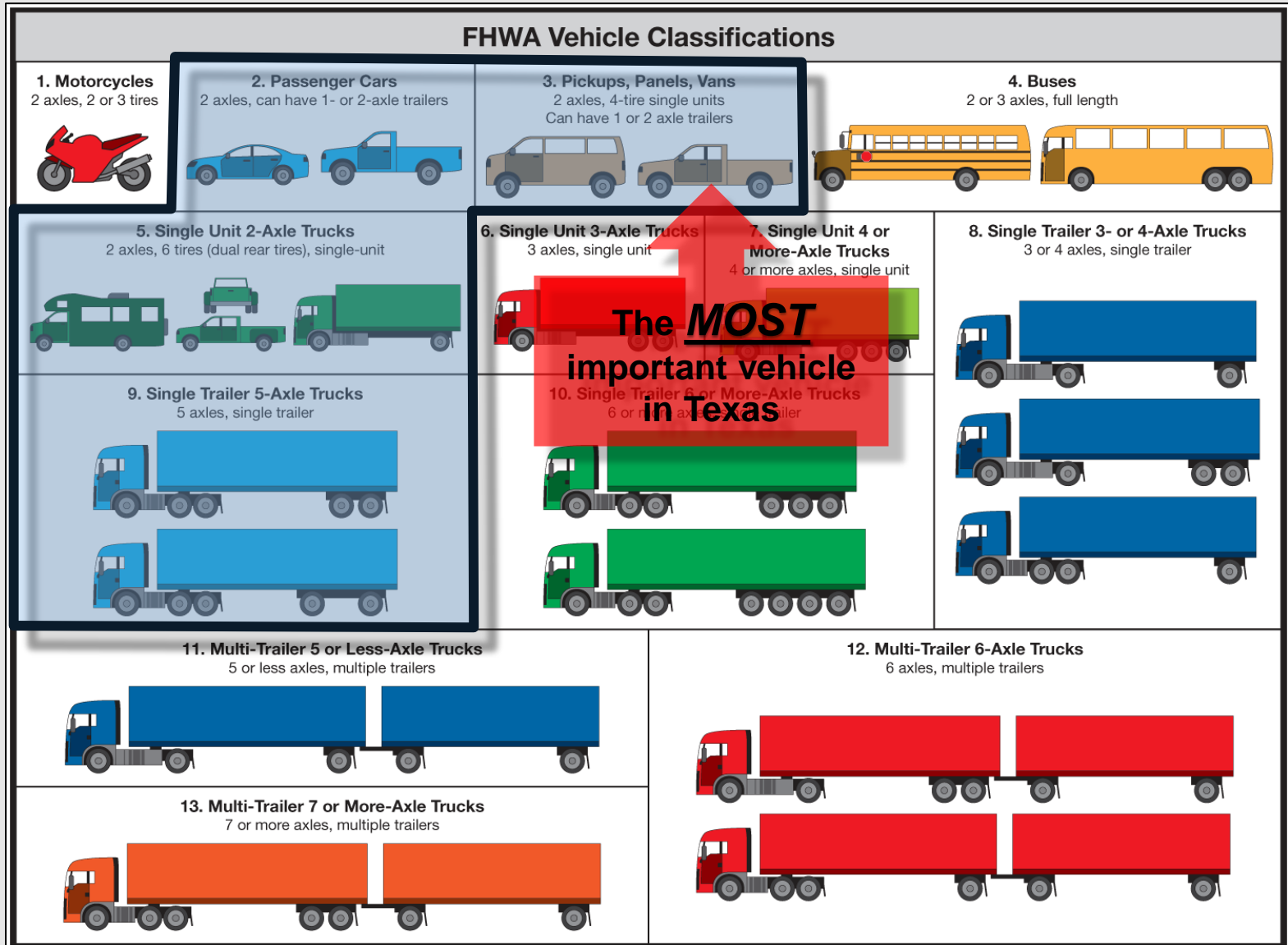$$AADT = 100\% \ axles * \textcolor{red}{Axle \ Factor} \ \textcolor{red}{*} \ Seasonal \ Ajustment \ Factor$$

TxDOT Travel Demand Models:

❑ Average Non-Summer Weekday Traffic (<u>TDM</u> Vehicles)

$$ANSWT = 100\% \ axles \ * \ \textcolor{red}{Axle \ Factor}$$

FHWA Vehicle Classifications

1. Motorcycles
2 axles, 2 or 3 tires

2. Passenger Cars
2 axles, can have 1- or 2-axle trailers

3. Pickups, Panels, Vans
2 axles, 4-tire single units
Can have 1 or 2 axle trailers

4. Buses
2 or 3 axles, full length

5. Single Unit 2-Axle Trucks
2 axles, 6 tires (dual rear tires), single-unit

6. Single Unit 3-Axle Trucks
3 axles, single unit

7. Single Unit 4 or More-Axle Trucks
4 or more axles, single unit

8. Single Trailer 3- or 4-Axle Trucks
3 or 4 axles, single trailer

9. Single Trailer 5-Axle Trucks
5 axles, single trailer

10. Single Trailer 6 or More-Axle Trucks
6 or more axles, single trailer

11. Multi-Trailer 5 or Less-Axle Trucks
5 or less axles, multiple trailers

12. Multi-Trailer 6-Axle Trucks
6 axles, multiple trailers

13. Multi-Trailer 7 or More-Axle Trucks
7 or more axles, multiple trailers

The _MOST_ important vehicle in Texas

Background on Axle Factors

- Purpose is to numerically depict auto and truck counts as a share of the total

- A 0.50 axle factors (AF) = 100% 2-axle vehicles (i.e. all cars, pickups, vans and motorcycles)

$$\% \, Trucks = 1 - (AF \, * 2)$$

Axle-Factor Lookup Table (previous method):

- Limited vehicle class or "Perm" sites;
- Tremendous amount of professional judgement: and more importantly,
- *Agnostic to locally specific activities.*

	FUNCL	ATYPE	AXLE_FACTO
1	1		0.47
2	1		0.47
3	1		0.47
4	1		0.49
5	1		0.50
6	1		0.50
7	1		0.47
8	1		0.47
1	2		0.46
2	2		0.46
3	2		0.46
4	2		0.49
5	2		0.49
6	2		0.50
7	2		0.46
8	2		0.46
1	3		0.45
2	3		0.36
3	3		0.45
4	3		0.47
5	3		0.48
6	3		0.49
7	3		0.45
8	3		0.45
1	4		0.40
2	4		0.40
3	4		0.40

	FACILITY TYPE	AREA TYPE	Decreasing →		
		1	2	3	4
Increasing ↓	Freeways	0.449	0.444	0.440	0.435
	Other Fwys	0.460	0.455	0.449	0.444
	Expressways	0.465	0.460	0.455	0.449
	Frntg Rds	0.465	0.460	0.455	0.449
	Ramps	0.465	0.460	0.455	0.449
	P Arterials	0.471	0.465	0.460	0.455
	M Arterials	0.476	0.471	0.465	0.460
	Collectors	0.482	0.476	0.471	0.465

	FACILITY TYPE	AREA TYPE	Increasing →		
		1	2	3	4
Decreasing ↓	Freeways	9	10	11	12
	Other Fwys	7	8	9	10
	Expressways	6	7	8	9
	Frntg Rds	6	7	8	9
	Ramps	6	7	8	9
	P Arterials	5	6	7	8
	M Arterials	4	5	6	7
	Collectors	3	4	5	6

Input percent trucks and axle factor will be calculated
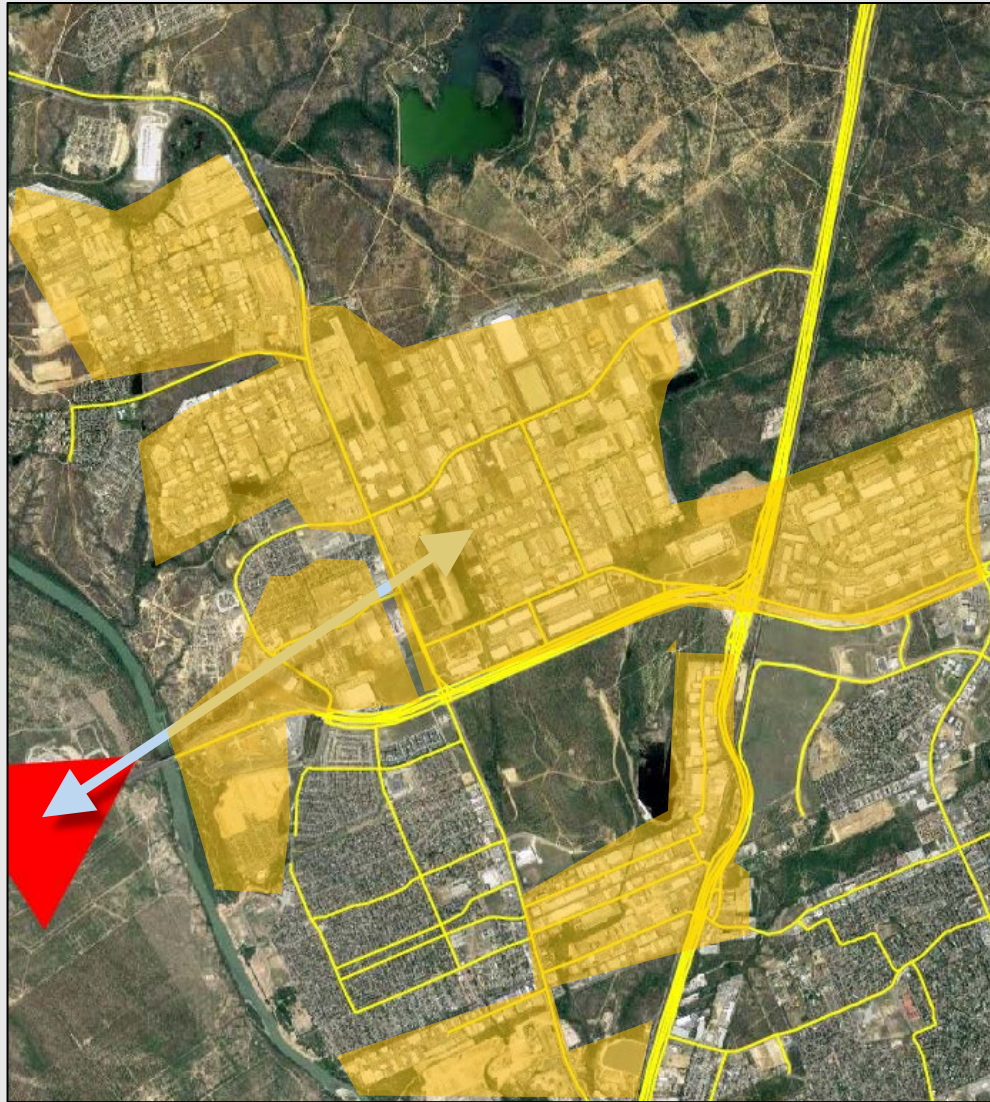
- International trade between countries,
- Movement to/from and between warehouses,
- Movement to/from rail, and
- Movement to other parts of U.S.

- International POEs
- Truck Warehouses
- Railroad

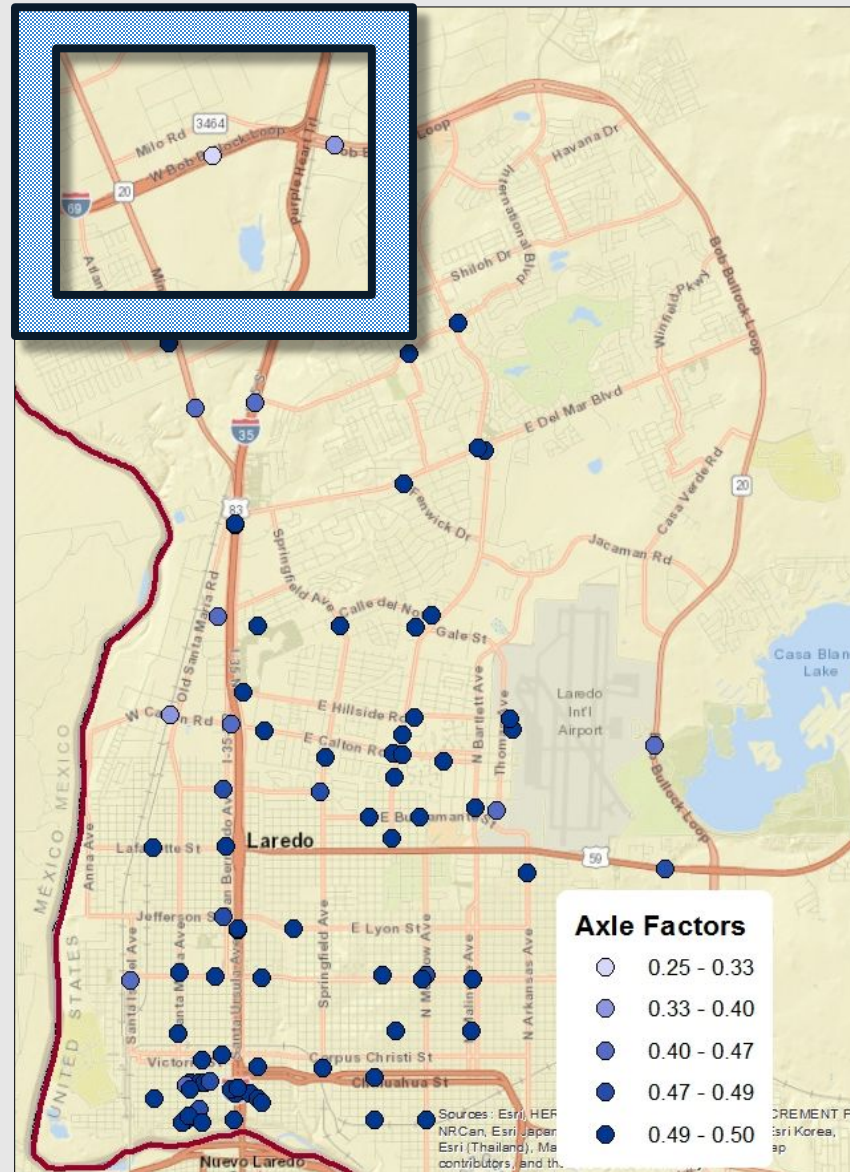Initial Axle-Factors Show Nearly 50% cars near Truck Warehouses & Mines Road

- TransCAD

  – Contour and Areas of Interest (AOI) tools

- ArcGIS Pro

  – Kriging

  – Spline

  – Natural Neighbor

  – ★ IDW (Inverse Distance Weighting) ★

Inverse Distance Weighting (IDW) Tool

Geoprocessing

IDW

Parameters | Environments

* Input point features

* Z value field

* Output raster

Output cell size

Power 3

Search radius .... Variable

Number of points 12

Maximum distance

Input barrier polyline features

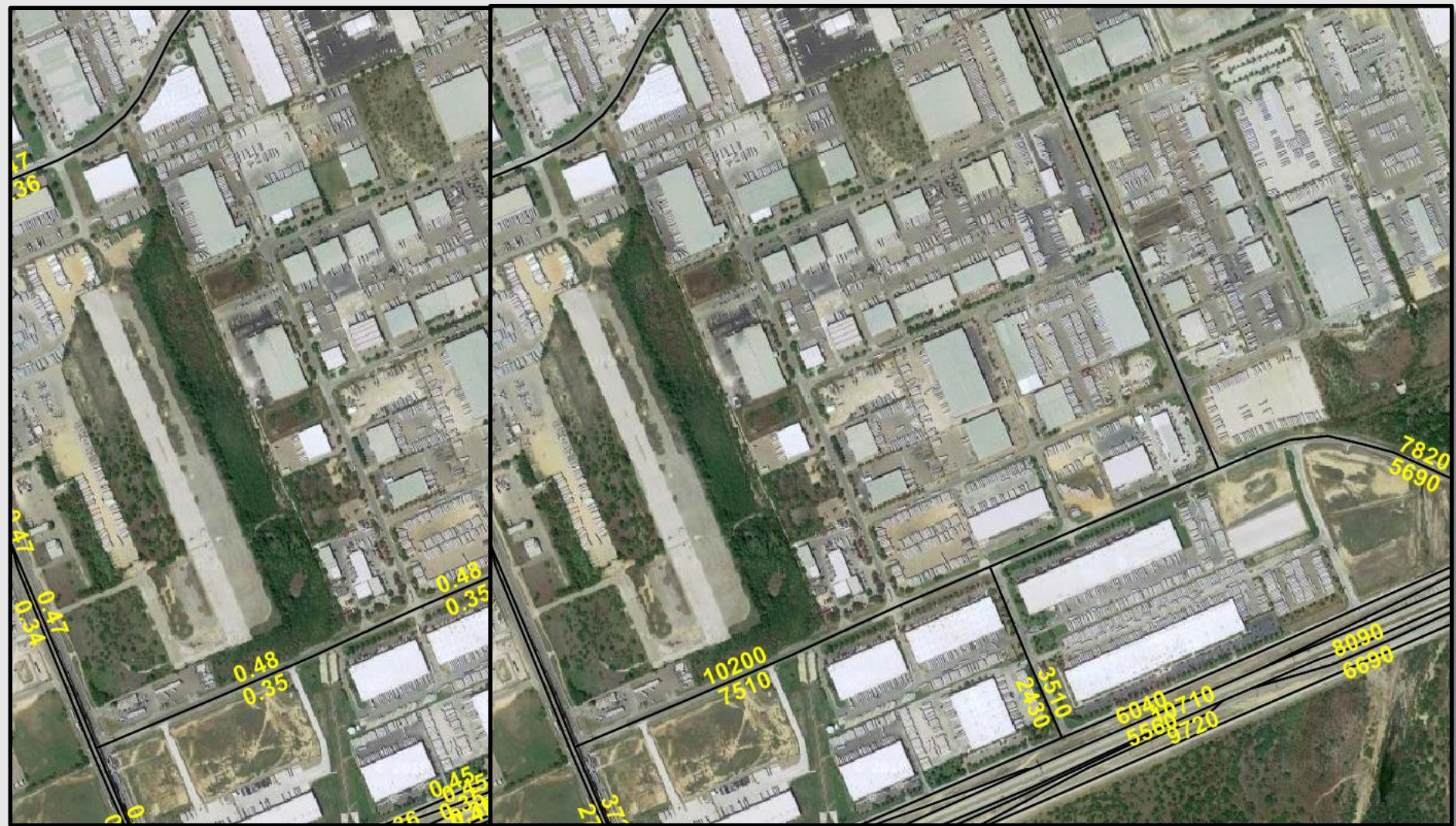●Set Power (3).

Best results were ●without an input barrier.

Axle Factor Range
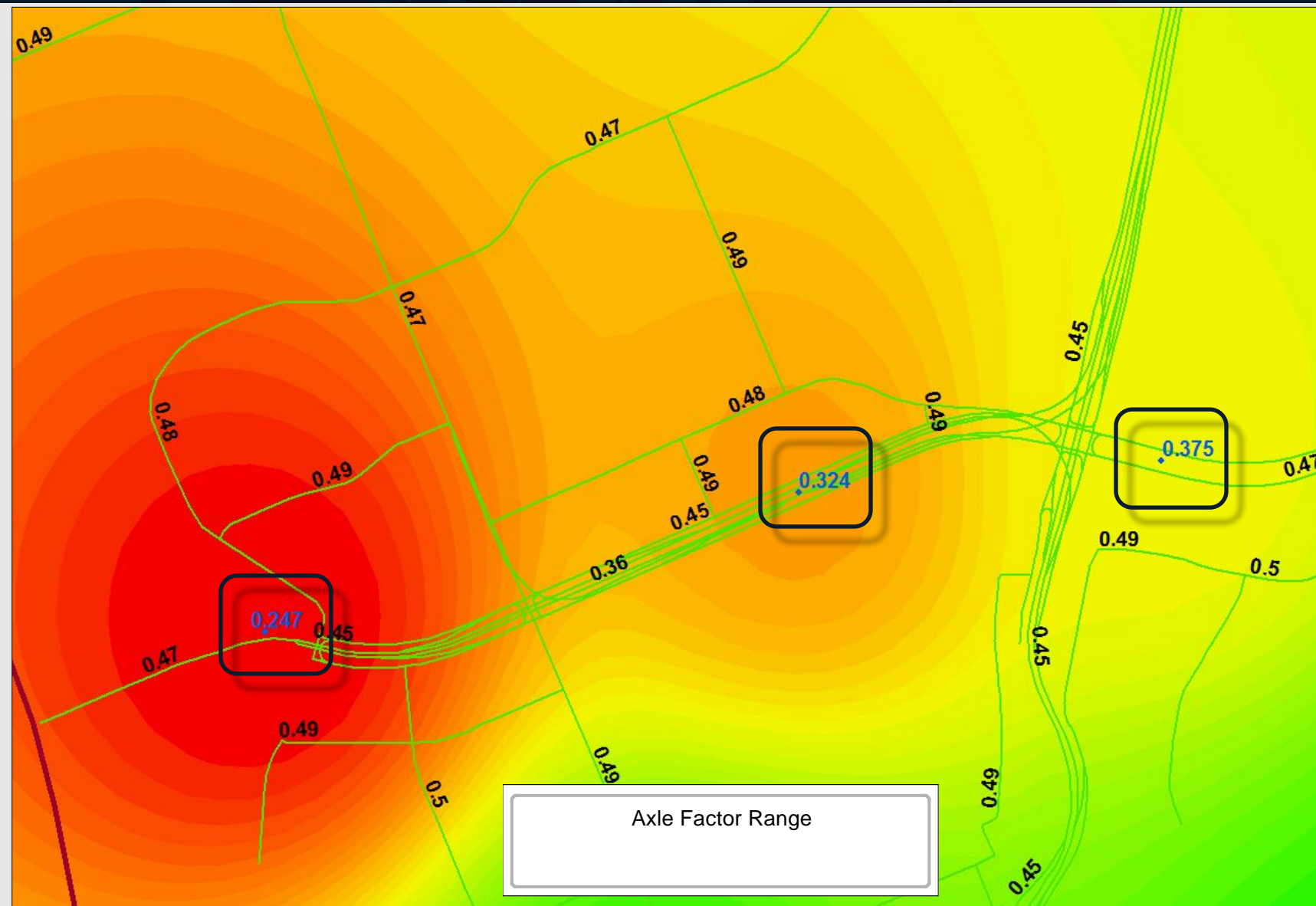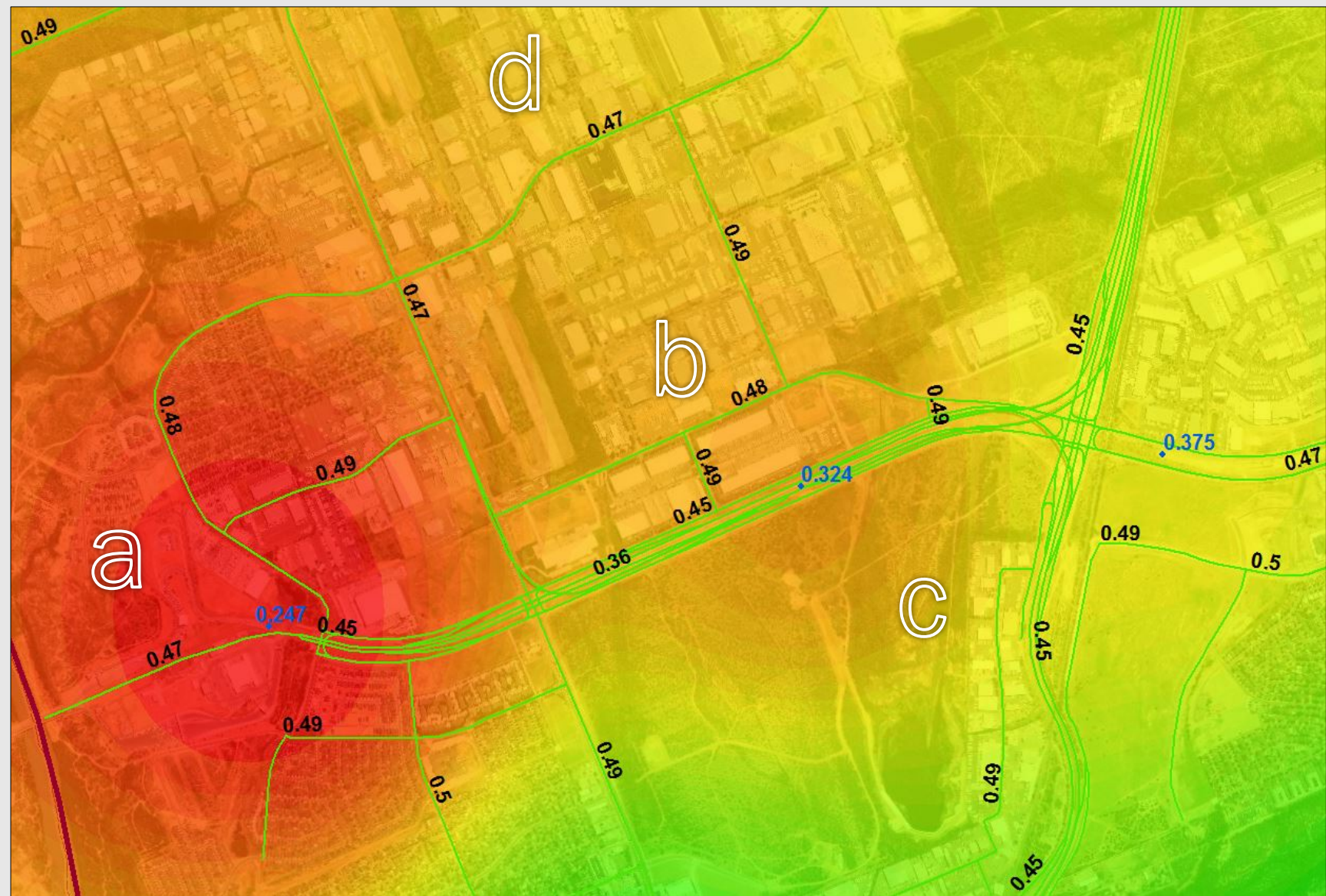
Work Flow Summary
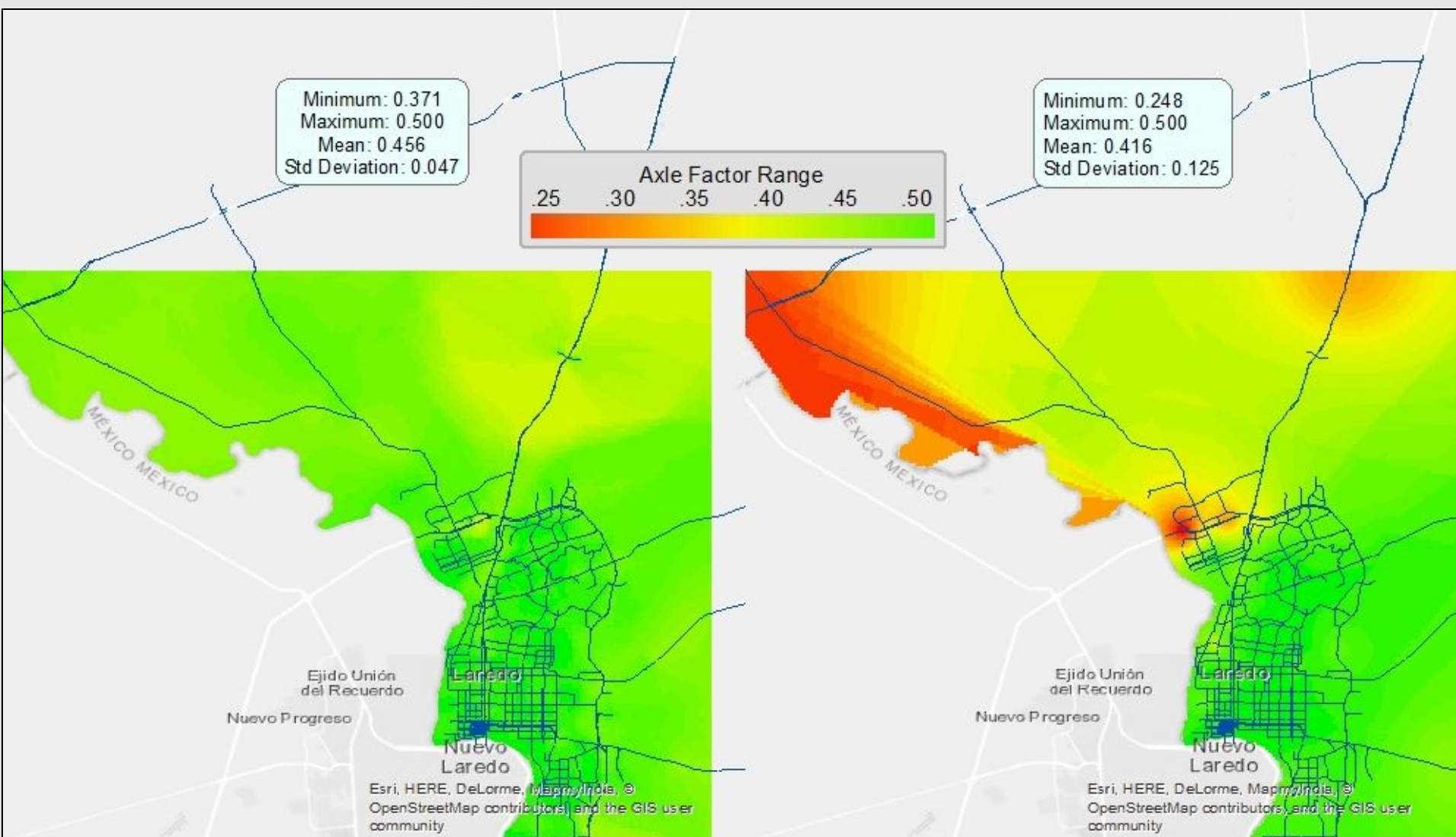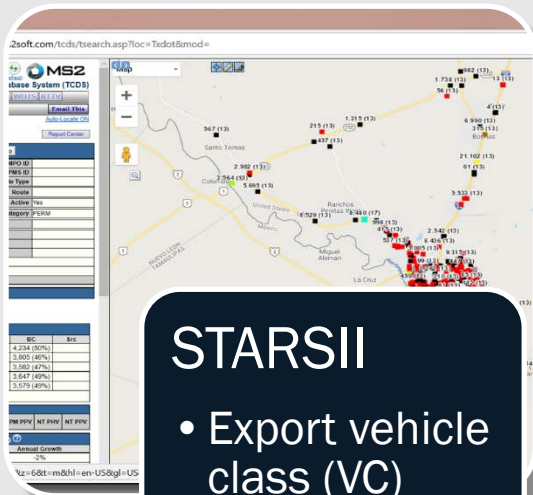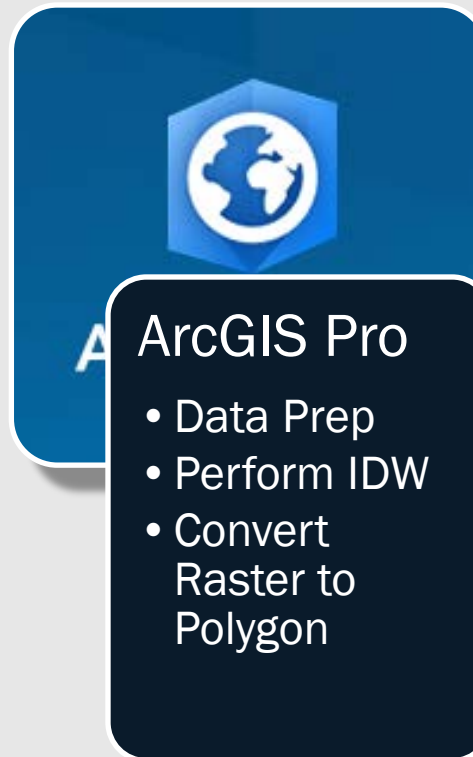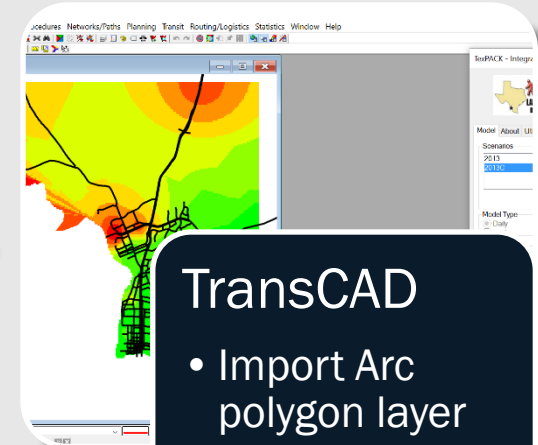

STARSII
- Export vehicle class (VC) stations

ArcGIS Pro
- Data Prep
- Perform IDW
- Convert Raster to Polygon

TransCAD
- Import Arc polygon layer
- Overlay attributes onto highway line segments
- Complete axle factor associations

- Limited coverage of classified stations from which the IDW is based.
  - ❖ The fallback is to use axle factors assigned by analysts along with a lookup table for areas outside of IDW coverage.

- The IDW tool allows for a greater degree of accuracy when assigning axle factor over traditional methods. It is more tunable and location-specific and can be tailored to different model areas quite easily.

Summary Laredo Count Inventory

Functional Classification	Counted VMT Lookup-Table Method	Counted VMT IDW Method	% Difference VMT Delta
Interstate Freeways			
Other Freeways	52,860	32,274	-39%
Expressways	11,948	12,321	3%
Principle Arterials	949,182	930,758	-2%
Minor Arterials	241,355	235,007	-3%
Collectors	180,335	162,618	-10%
Frontage Roads	26,509	35,561	34%
Ramps	66,394	66,302	0%
ALL	1,528,583	1,474,841	-4%

Acknowledgements

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