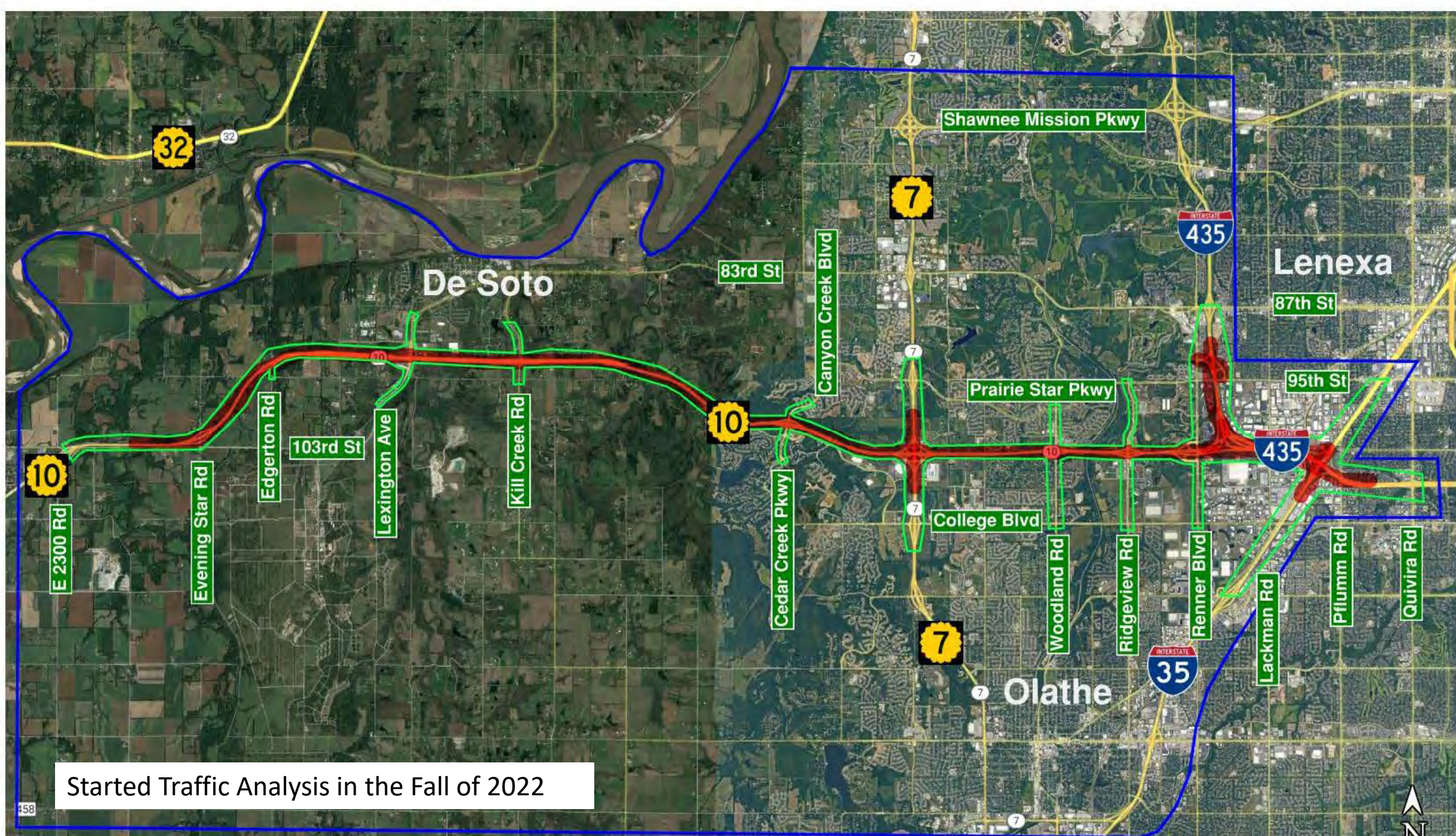# Agenda

1. K-10 Capacity Improvements Study Overview

2. 5-County Travel Demand Model Update

3. Community Based Land Use Scenario

4. Results

5. Questions

K-10 Capacity Improvements Study Overview

Google Search: K-10 Capacity Improvements Project

Started Traffic Analysis in the Fall of 2022
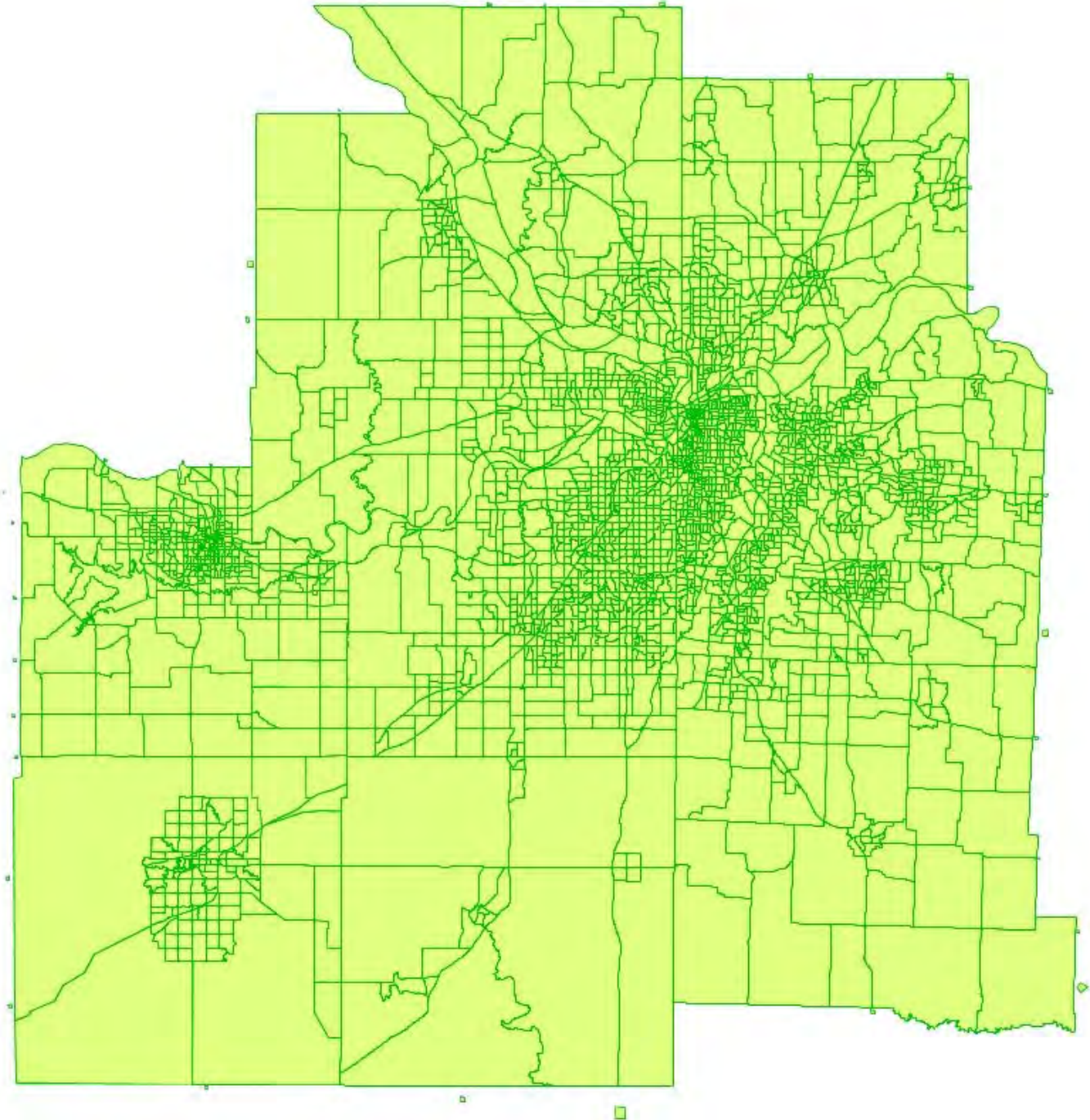
5-County Travel Demand Model Update

Agenda

- Zone and Socio-Economic Data
- Roadway Network
- Replica Data as Validation Data
- Trip Generation
- Trip Distribution
- Mode Choice
- Time of Day
- Assignment Validation
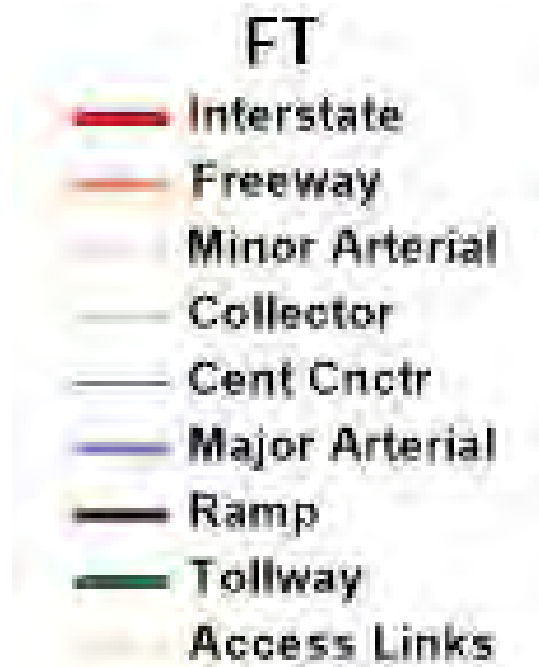- Next Steps

Zone Structure

- Combined MARC and Douglas
- Added Ottawa model zones, then aggregated
- Added remainder of Franklin County

Socio-Economic Data

- Used 2019 housing and employment data from MARC and Douglas

- Developed 2019 for Franklin County using ACS and Census data along with Woods and Poole

- 2050 data provided by MARC and Douglas

Network

- Combined MARC and Douglas
- Added Franklin County

FT

- Interstate
- Freeway
- Minor Arterial
- Collector
- Cent Cnctr
- Major Arterial
- Ramp
- Tollway
- Access Links

Replica Data as Validation Source

- Replica provides various levels of travel information for use in the K10 model development. Replica utilizes a synthetic population based on various datasets including counts, cellular based travel patterns and other data to estimate person movements. The Replica data was extracted and processed at three different levels.

- Replica dataset 1 - County to county travel movements by purpose, time of departure and mode

- Replica dataset 2 - Trip by trip travel movements including origin and destination purposes and travel time

- Replica dataset 3 - Select link data for each of K10 model's external zones including trips to other external zones

- Replica dataset 4 – Time of day departure data by trip purpose and hour

Trip Purposes

- Total person travel is divided into various Trip Purposes
  - Home based work (HBW)
  - Home based school (HBSCH)
  - Home based shop (HBSHP)
  - Home based social/recreational (HBSR)
  - Home based other (HBO)
  - Non-home based work (NHBW)
  - Non-home based non-work (NHBO)
  - Truck

Trip Generation

- Initial Rates from 5 County Model

| Purpose	Replica Productions	Bal. Replica Attractions	Replica Attractions (excl. Externals)	Model Productions	Model Attractions	P Ratio	A Ratio	A Ratio (wo Ex)
HBW	1,383,699	1,383,699	1,332,416	1,402,498	943,410	1.014	0.682	0.708
HBSch	763,358	763,358	735,066	832,282	832,282	1.090	1.090	1.132
HBShp	1,039,356	1,039,356	1,000,835	1,380,333	1,403,906	1.328	1.351	1.403
HBSR	908,699	908,699	875,020	1,744,564	1,564,708	1.920	1.722	1.788
HBO	1,216,786	1,216,786	1,171,689	564,970	530,252	0.464	0.436	0.453
NHBW	1,025,715	1,025,715	987,700	1,027,777	719,350	1.002	0.701	0.728
NHBO	1,921,007	1,921,007	1,849,810	1,342,159	1,220,557	0.699	0.635	0.660
Truck	477,113	477,113	459,430	525,892	525,892	1.102	1.102	1.145
Totals	8,735,733	8,735,733	8,411,966	8,820,474	7,740,357	1.010	0.886	0.920

Trip Generation

- Revised Trip Rates

Purpose	Replica Productions	Bal. Replica Attractions	Replica Attractions (excl. Externals)	Model Productions	Model Attractions	P Ratio	A Ratio	A Ratio (wo Ex)
HBSR	908,699	908,699	875,020	872,282	782,354	0.960	0.861	0.894
HBO	1,216,786	1,216,786	1,171,689	1,129,939	1,193,067	0.929	0.981	1.018

Trip Length Distribution

- Replica and Model Times Synched
  - Compared Replica Trips on Model Skims

HBO

Legend: Replica (Original) — Model — Replica (Model Skims)
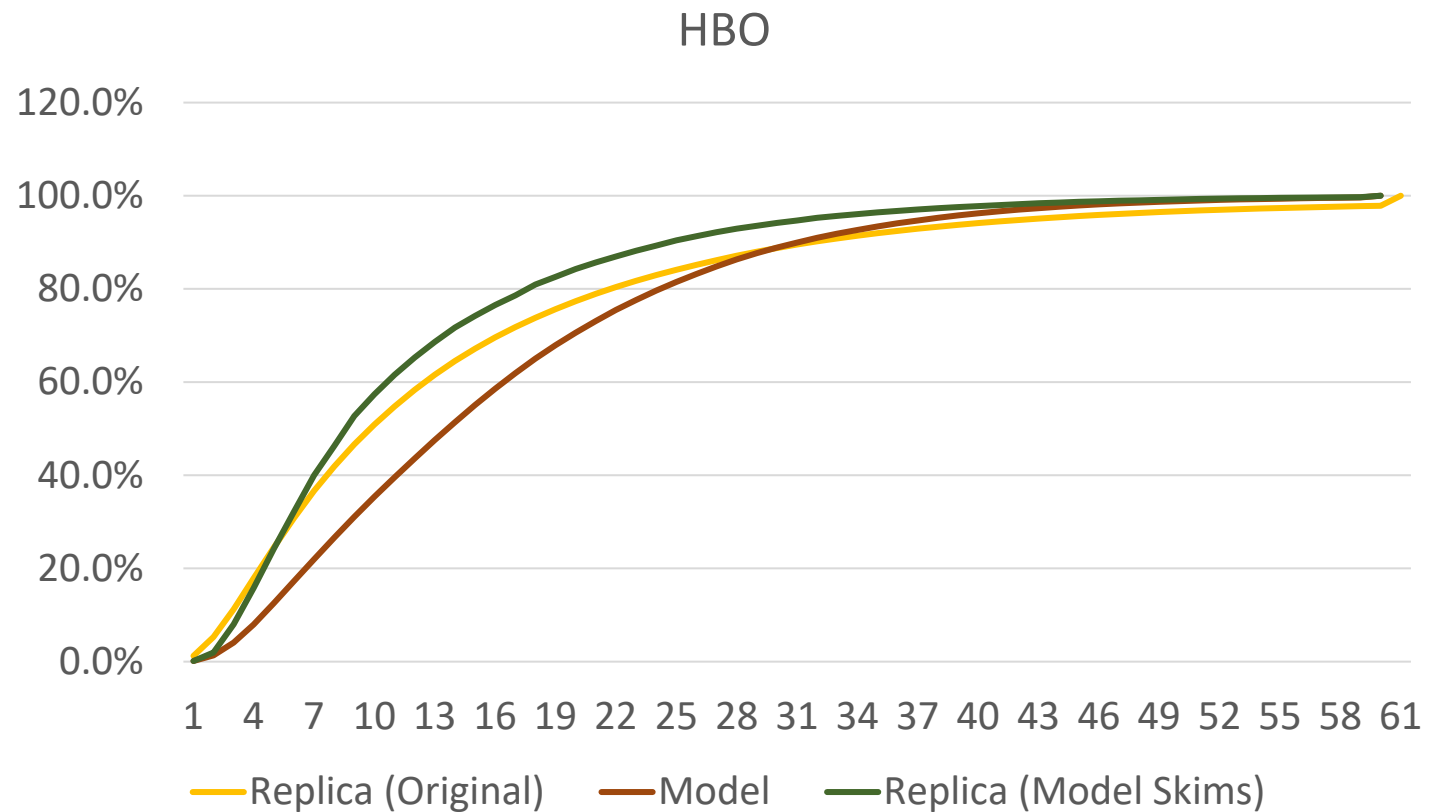
Trip Length Distribution

- Adjusted Coefficients to Generally Shorten Trip Lengths
  - Conducted for all purposes

HBO

Legend: Initial Model — Replica (Model Skims) — v6 — v11 — v12
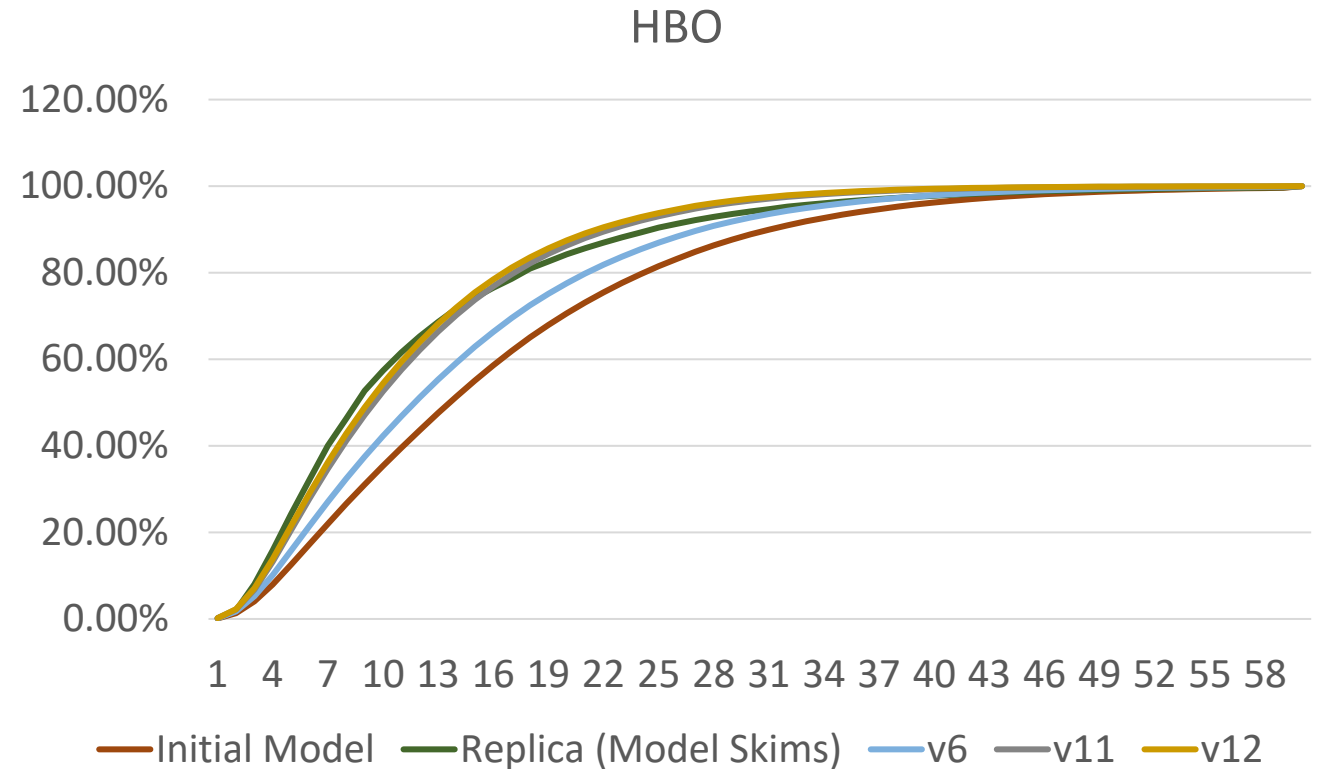
Trip Distribution

- County to County Origin to Destination Person Trip Flows by Purpose (HBW)

Replica

	Cass	Clay	Douglas	Franklin	Jackson	Johnson	Leaven.	Miami	Platte	Wyand.
Cass	58.6%	1.4%	0.1%	0.1%	25.7%	12.0%	0.1%	0.5%	0.5%	1.0%
Clay	0.5%	55.1%	0.1%	0.0%	24.6%	6.9%	0.3%	0.1%	9.6%	2.9%
Douglas	0.1%	0.4%	82.4%	1.7%	2.5%	8.8%	1.9%	0.2%	0.4%	1.6%
Franklin	0.3%	0.0%	4.3%	80.1%	1.0%	9.5%	0.2%	4.1%	0.1%	0.4%
Jackson	2.5%	5.9%	0.2%	0.0%	72.2%	14.2%	0.3%	0.1%	1.7%	2.8%
Johnson	1.2%	1.8%	0.9%	0.4%	15.5%	71.3%	0.5%	1.3%	0.8%	6.3%
Leaven.	0.1%	1.0%	2.7%	0.1%	3.8%	6.2%	76.9%	0.0%	2.4%	6.9%
Miami	1.2%	0.3%	0.6%	3.7%	3.3%	25.9%	0.0%	63.3%	0.1%	1.7%
Platte	0.5%	26.1%	0.5%	0.0%	20.9%	8.6%	2.3%	0.0%	36.0%	4.9%
Wyand.	0.5%	3.2%	0.6%	0.1%	12.9%	26.3%	2.4%	0.4%	2.0%	51.6%

Model

	Cass	Clay	Douglas	Franklin	Jackson	Johnson	Leaven.	Miami	Platte	Wyand.
Cass	31.3%	2.7%	0.1%	0.1%	37.4%	23.7%	0.1%	1.3%	0.7%	2.7%
Clay	0.4%	45.8%	0.1%	0.0%	27.7%	7.6%	0.6%	0.0%	10.4%	7.4%
Douglas	0.2%	0.6%	70.3%	1.9%	3.9%	17.8%	1.7%	0.3%	0.5%	2.7%
Franklin	0.6%	0.8%	7.3%	51.8%	5.6%	28.5%	0.5%	2.4%	0.4%	2.1%
Jackson	2.1%	7.2%	0.1%	0.0%	65.4%	17.3%	0.2%	0.1%	1.4%	6.3%
Johnson	0.9%	1.8%	0.4%	0.2%	16.9%	71.6%	0.4%	0.5%	0.9%	6.4%
Leaven.	0.2%	4.5%	2.6%	0.1%	9.9%	18.8%	41.8%	0.1%	7.7%	14.2%
Miami	3.8%	1.2%	0.6%	1.2%	9.7%	44.8%	0.3%	34.8%	0.6%	3.0%
Platte	0.3%	19.7%	0.1%	0.0%	20.9%	11.2%	3.1%	0.1%	32.3%	12.4%
Wyand.	0.3%	7.1%	0.2%	0.0%	29.6%	26.1%	1.5%	0.1%	4.8%	30.3%

Mode Choice

- Initial Model

Trip Purpose	Auto (Person) Trips	Transit Trips
HBW	1,295,554	14,852
HBSHOP	1,364,645	7,316
HBSR	855,588	7,685
HBO	1,969,820	15,437
NHB	2,374,718	7,240
Total	7,860,325	52,530
Replica	7,321,546	51,403

- Revised Parameters

| Trip Purpose	Auto (Person) Trips	Transit Trips
HBW	1,295,408	14,930
HBSHOP	1,257,047	5,736
HBSR	845,643	8,056
HBO	1,963,890	17,358
NHB	2,339,843	6,858
Total	7,701,831	52,938
Replica	7,321,546	51,403

External Trips

- Used Replica Select Link analysis
    - through trip (EE) table
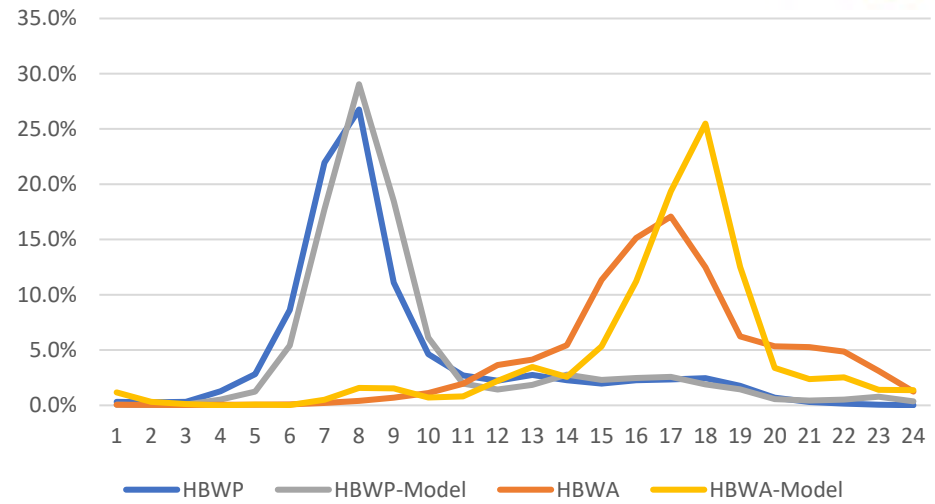   - Magnitude of external-internal trips (EI/IE) at each external

Time of Day

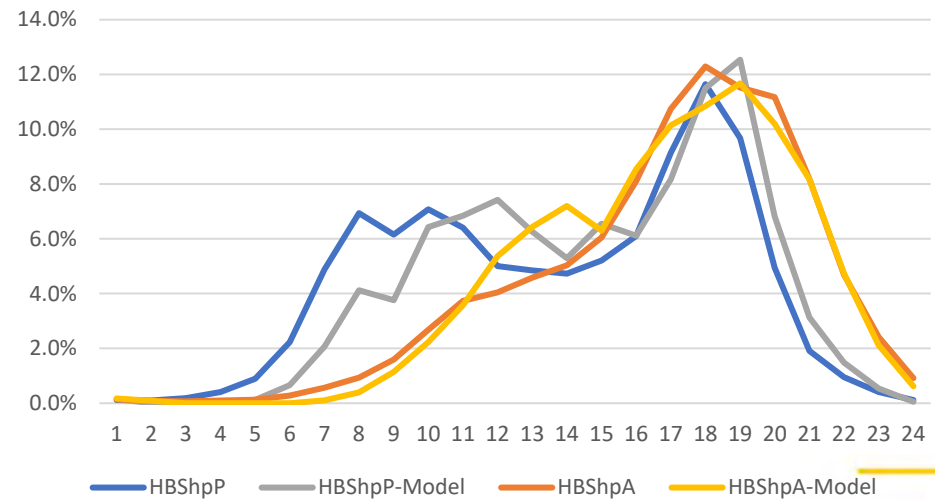- Compared Replica and Model by purpose

HBW

HBO
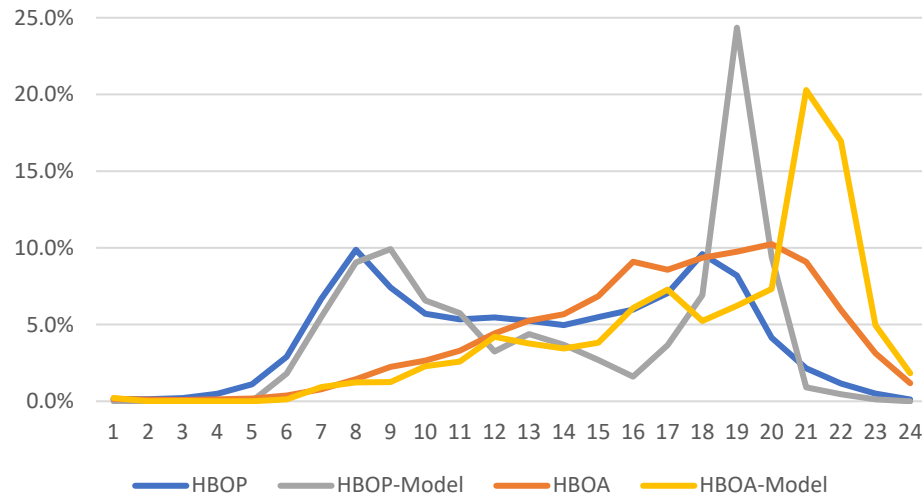


HBShp

Regional Traffic Assignment Validation

- Targeting R-squared > 88% and %RMSE <39%
- Assessed by Facility Type and Area-Facility Type
- Modified select Area-Facility Type speeds in lookup table

| R-Squared	89.2%	>88%
%RMSE	37.5%	<39%

| Facility Type	Desc	# of Links	Count	Assignment	Vol/Cnt
1	Interstate	88	4,342,712	4,143,902	95.4%
2	Freeway	75	1,770,557	1,672,038	94.4%
3	Min Art	133	839,570	855,184	101.9%
4	Collector	89	324,662	360,592	111.1%
5	Cntrd Conn	0	-	-	#DIV/0!
6	Maj Art	183	2,197,141	2,348,889	106.9%
8	Ramps	60	622,647	472,692	75.9%
9	Tolled	8	157,356	173,194	110.1%
		636	10,254,645	10,026,493	97.8%

Broader K10 Corridor Assignment Validation

- K10 corridor is over-assigned with model speeds well below 70 mph posted speed

- I-70 over-assigned
- K32 significantly over-assigned

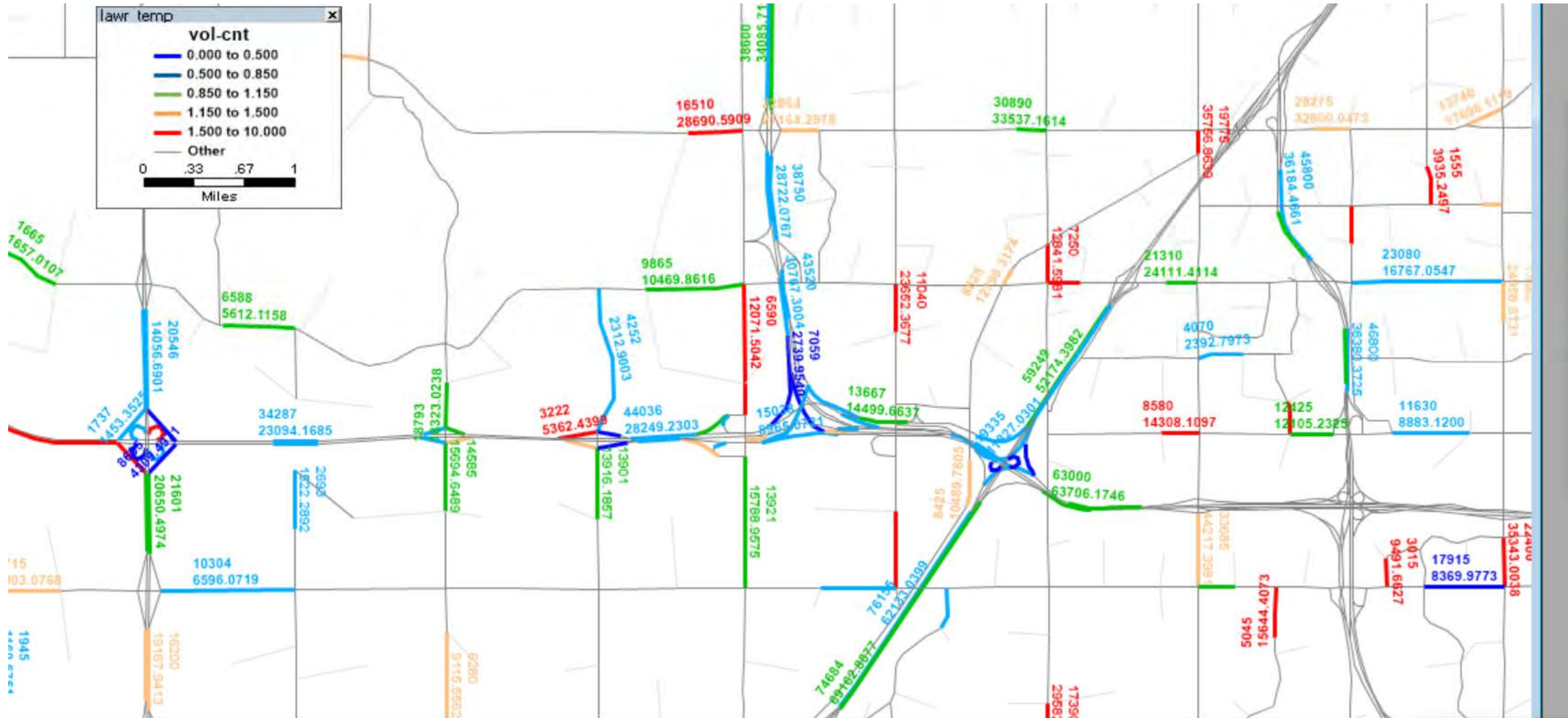- Underlying trip table has too many Douglas to MARC trips, particularly Johnson County
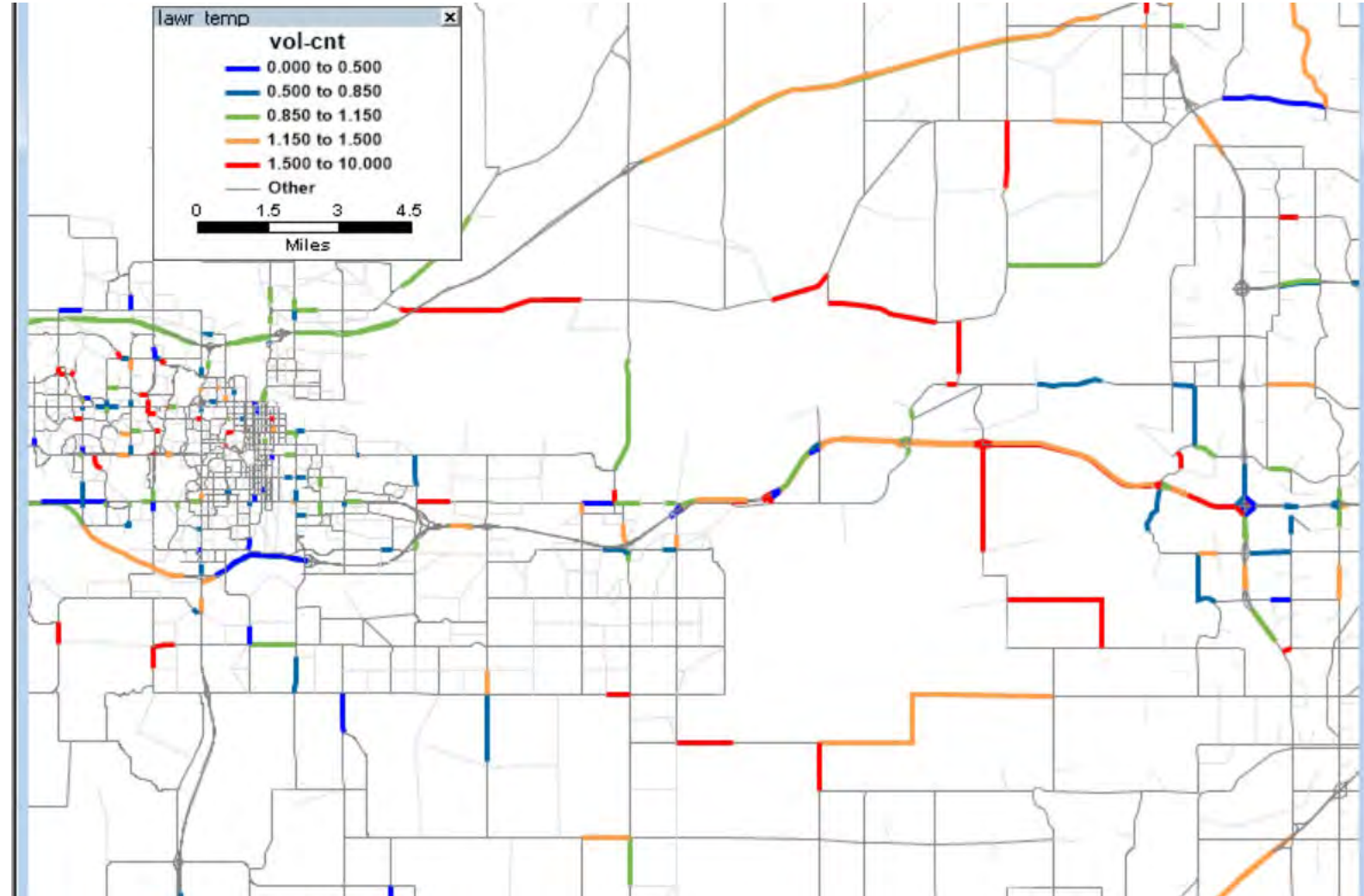
K10 Assignment Validation
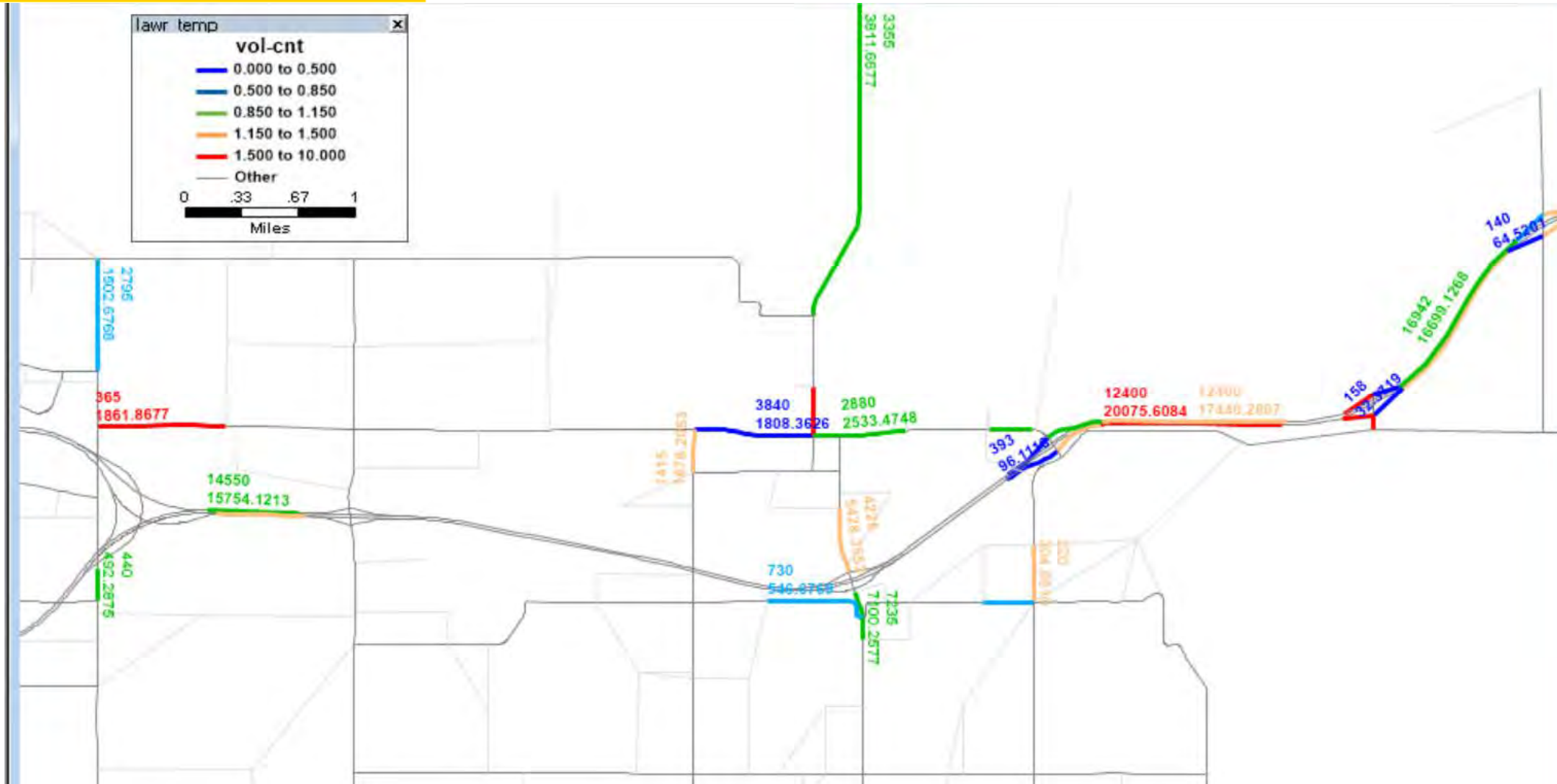
K10 Assignment Validation
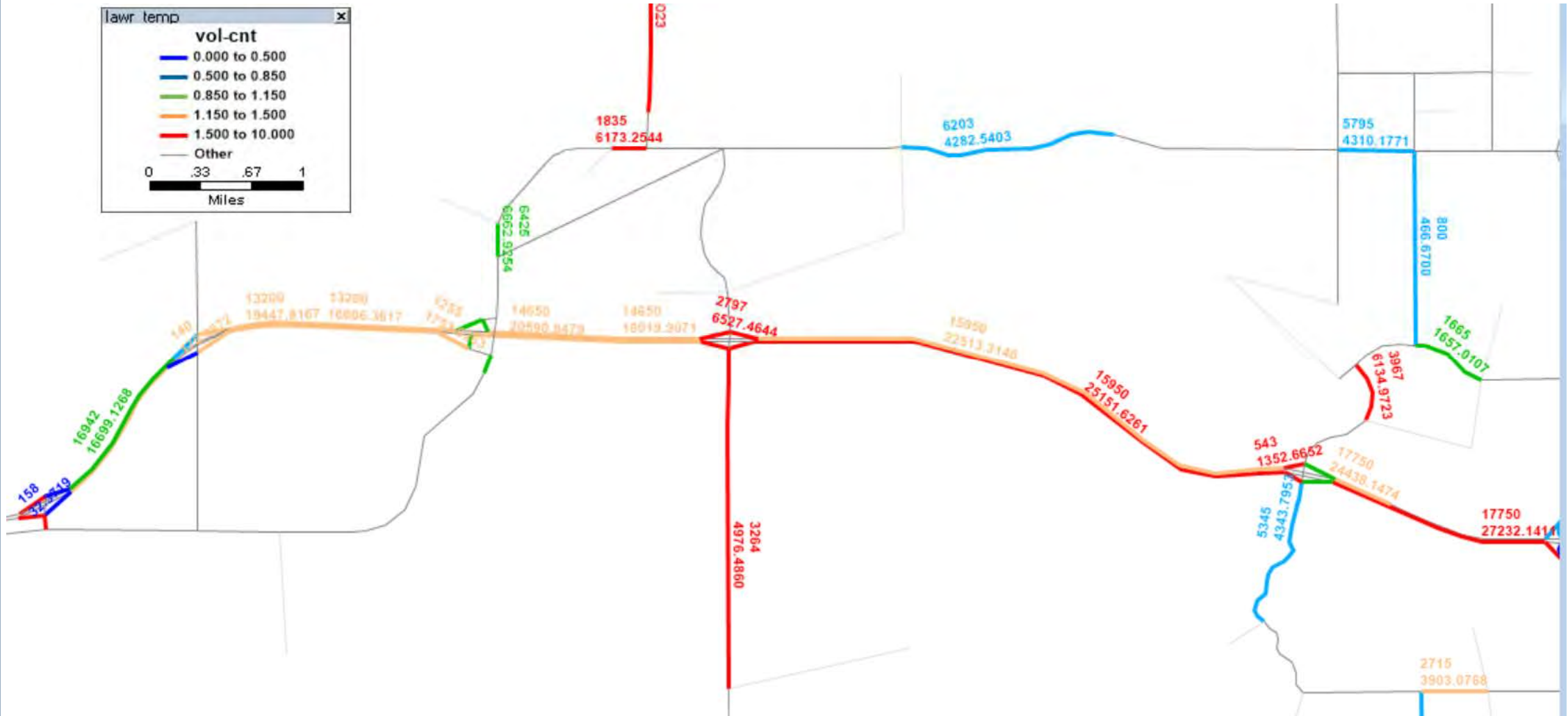
K10 Assignment Validation

Introducing K Factor

- County to County K Factor of 0.6 from Douglas to Johnson
- Apply to all Purposes
- Alternatively increase Douglas to Douglas from 1 to 1.5-ish…..

- Look to reduce total demand on K10 and hopefully increase speeds closer to 70 mph

Trip Distribution – K Factor

K10 CORRIDOR

Douglas to Johnson K=0.6

Replica

	Cass	Clay	Douglas	Franklin	Jackson	Johnson	Leaven.	Miami	Platte	Wyand.
Cass	58.6%	1.4%	0.1%	0.1%	25.7%	12.0%	0.1%	0.5%	0.5%	1.0%
Clay	0.5%	55.1%	0.1%	0.0%	24.6%	6.9%	0.3%	0.1%	9.6%	2.9%
Douglas	0.1%	0.4%	**82.4%**	1.7%	2.5%	**8.8%**	1.9%	0.2%	0.4%	1.6%
Franklin	0.3%	0.0%	4.3%	80.1%	1.0%	9.5%	0.2%	4.1%	0.1%	0.4%
Jackson	2.5%	5.9%	0.2%	0.0%	72.2%	14.2%	0.3%	0.1%	1.7%	2.8%
Johnson	1.2%	1.8%	0.9%	0.4%	15.5%	71.3%	0.5%	1.3%	0.8%	6.3%
Leaven.	0.1%	1.0%	2.7%	0.1%	3.8%	6.2%	76.9%	0.0%	2.4%	6.9%
Miami	1.2%	0.3%	0.6%	3.7%	3.3%	25.9%	0.0%	63.3%	0.1%	1.7%
Platte	0.5%	26.1%	0.5%	0.0%	20.9%	8.6%	2.3%	0.0%	36.0%	4.9%
Wyand.	0.5%	3.2%	0.6%	0.1%	12.9%	26.3%	2.4%	0.4%	2.0%	51.6%

Initial Model

	Cass	Clay	Douglas	Franklin	Jackson	Johnson	Leaven.
Cass	31.3%	2.7%	0.1%	0.1%	37.4%	23.7%	0.1%
Clay	0.4%	45.8%	0.1%	0.0%	27.7%	7.6%	0.6%
Douglas	0.2%	0.6%	**70.3%**	1.9%	3.9%	**17.8%**	1.7%
Franklin	0.6%	0.8%	7.3%	51.8%	5.6%	28.5%	0.5%
Jackson	2.1%	7.2%	0.1%	0.0%	65.4%	17.3%	0.2%
Johnson	0.9%	1.8%	0.4%	0.2%	16.9%	71.6%	0.4%
Leaven.	0.2%	4.5%	2.6%	0.1%	9.9%	18.8%	41.8%
Miami	3.8%	1.2%	0.6%	1.2%	9.7%	44.8%	0.3%
Platte	0.3%	19.7%	0.1%	0.0%	20.9%	11.2%	3.1%
Wyand.	0.3%	7.1%	0.2%	0.0%	29.6%	26.1%	1.5%

K=0.6 Douglas to Johnson

	Cass	Clay	Douglas	Franklin	Jackson	Johnson	Leaven.
Cass	30.8%	2.8%	0.1%	0.1%	37.5%	23.9%	0.1%
Clay	0.4%	45.0%	0.0%	0.0%	27.9%	8.2%	0.6%
Douglas	0.3%	0.8%	**71.3%**	2.3%	5.1%	**13.8%**	2.0%
Franklin	0.7%	0.9%	5.9%	49.3%	5.9%	29.5%	0.4%
Jackson	2.1%	7.3%	0.1%	0.0%	65.0%	17.6%	0.2%
Johnson	0.9%	1.9%	0.3%	0.2%	17.0%	71.4%	0.4%
Leaven.	0.2%	4.6%	2.1%	0.1%	10.4%	19.4%	41.4%
Miami	3.7%	1.3%	0.5%	1.8%	10.0%	45.3%	0.3%
Platte	0.3%	19.6%	0.1%	0.0%	21.3%	11.7%	3.0%
Wyand.	0.3%	7.3%	0.2%	0.0%	29.4%	26.7%	1.4%

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K10 Assignment with K=0.6

Without K

With K

REMOVES 2500 to 5000 VEHICLES FROM K10
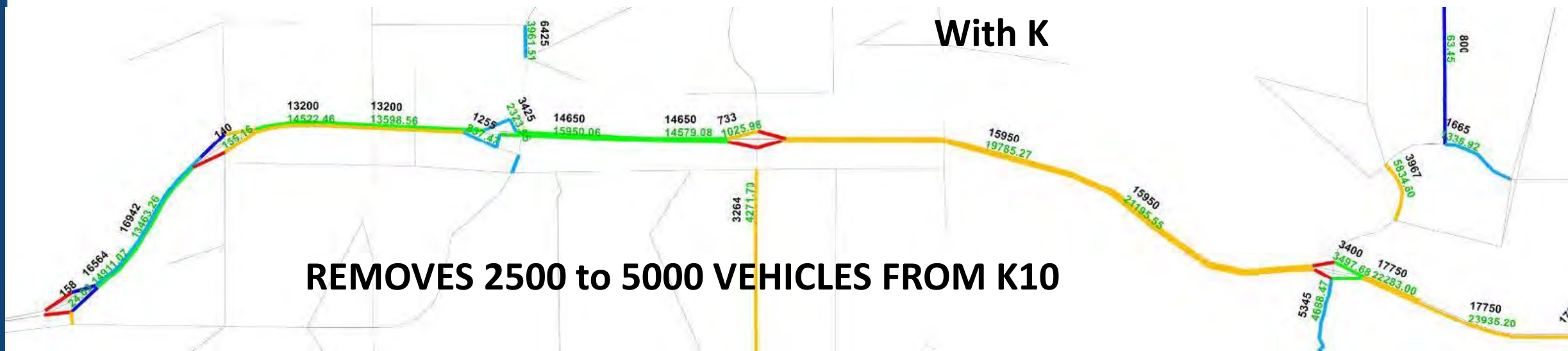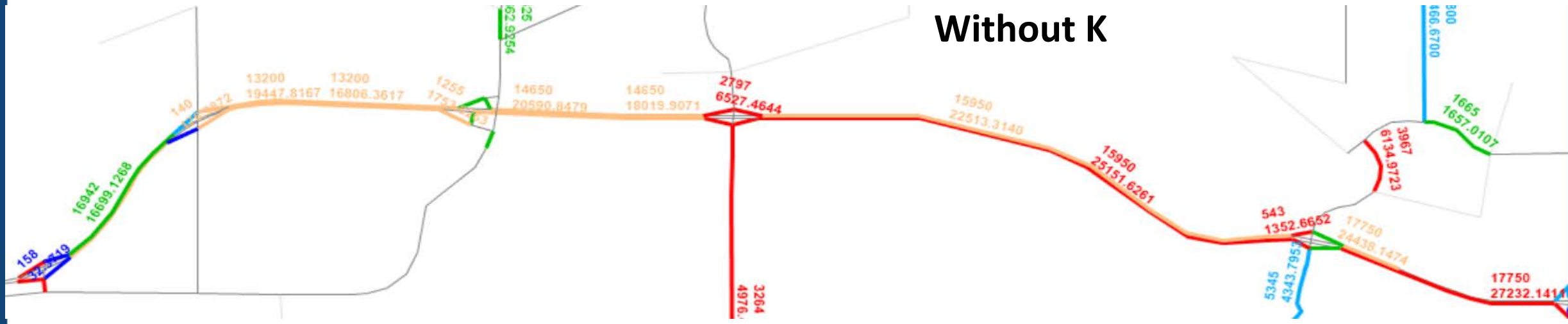
Regional Traffic Assignment Validation

- Using K=0.6 for Douglas and Johnson

R-Squared	89.2%	>88%	89.3%	89.3%
%RMSE	37.5%	<39%	37.4%	35.2%
	V9 (no K)		V10 (with K)	Base19_24 (with K)
Facility Type Desc	Vol/Cnt		Vol/Cnt	Vol/Cnt
1 Interstate	95.4%		95.5%	95.0%
2 Freeway	94.4%		92.8%	98.4%
3 Min Art	101.9%		101.8%	103.2%
4 Collector	111.1%		110.7%	108.5%
5 Cntrd Conn	#DIV/0!		#DIV/0!	#DIV/0!
6 Maj Art	106.9%		106.9%	101.0%
8 Ramps	75.9%		75.3%	80.2%
9 Tolled	110.1%		111.1%	105.7%
	97.8%		97.5%	97.3%

Model Summary

- ➤ Utilized Replica as Survey Data
  - ➤ Trip Generation
  - ➤ Trip Distribution
  - ➤ Mode Choice
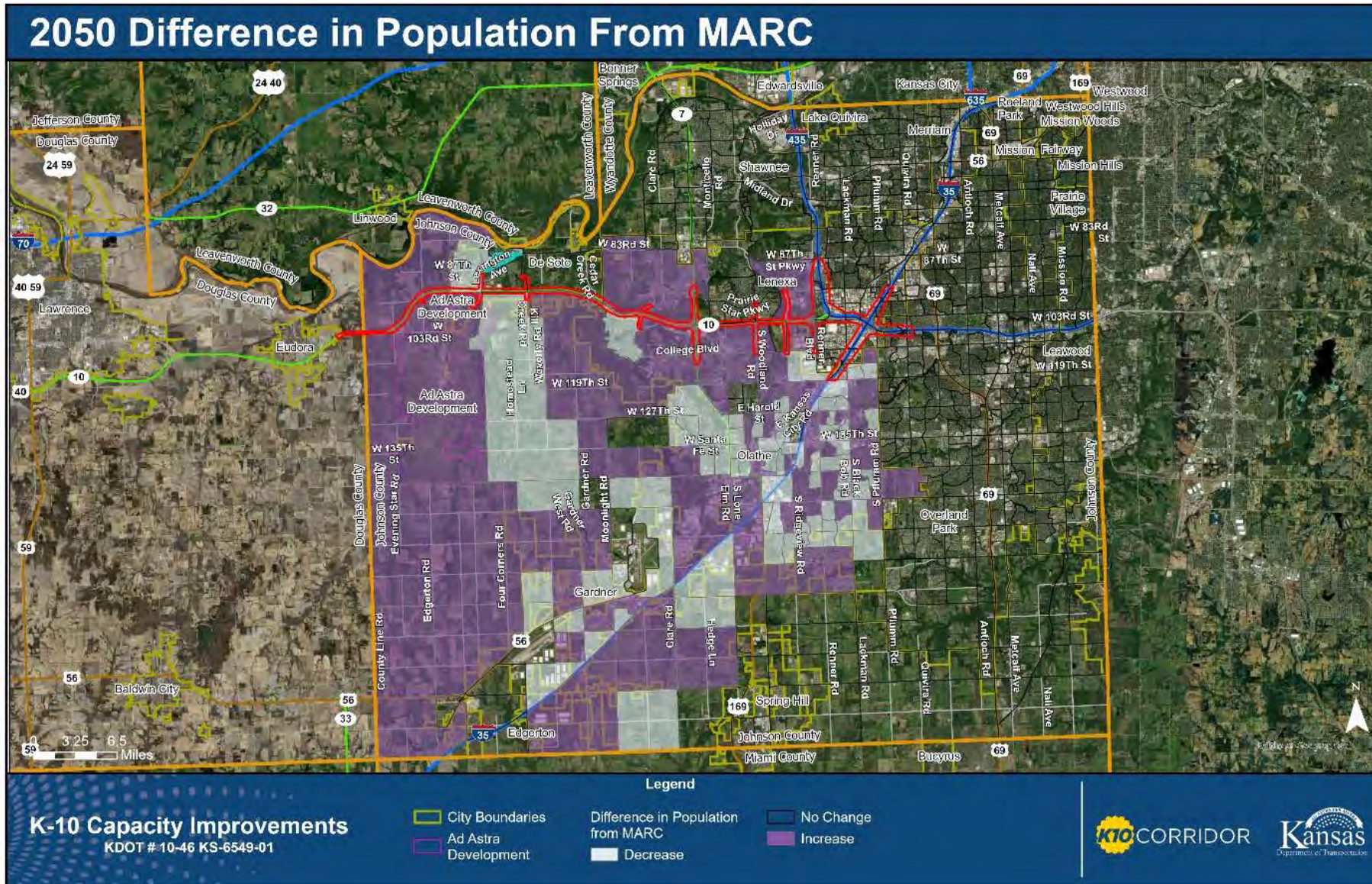 - ➤ Time of Day
  - ➤ External Volumes

Community Based Land Use Scenario

Community Based Land Use Changes

K10 CORRIDOR

	No Change	Community Modified	Study Team Modified with Direction from Community
Johnson County (Unincorporated)	●		
Franklin County	●		
Douglas County/Lawrence	●		
Leavenworth County		●	
Olathe		●	
Lenexa		●	
Gardner		●	
Edgerton			●
De Soto			●
Astra Enterprise Park			●

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Community Land Use Updates

	Population				
	MARC / Douglas Co. 2019 Population	**2050**			
		MARC / Douglas Co.	**Community Updated Above MPO**	**Total**	**Percent Change**
Johnson County Unincorporated	5,007	17,741	0	17,741	0%
Franklin County	25,403	26,975	0	26,975	0%
Douglas County MPO/ Eudora	143,848	158,319	0	158,319	0%
Leavenworth County/ Tonganoxie	81,886	99,991	5,755	105,746	6%
Olathe	141,280	182,708	10,723	193,431	6%
Lenexa	59,316	83,579	32,688	116,267	39%
De Soto	6,950	19,386	0	19,386	0%
Edgerton	1,789	6,156	8,844	15,000	144%
Gardner	22,727	30,515	15,966	46,481	52%
Astra Enterprise Park	1,572	4,662	-3,090	1,572	-66%
Total	**489,778**	**630,032**	**70,886**	**700,918**	**11%**

Population Differences from MARC

2050 Difference in Population From MARC

Legend

K-10 Capacity Improvements
KDOT # 10-46 KS-6549-01

City Boundaries
Ad Astra Development

Difference in Population from MARC
Decrease

No Change
Increase

Community Land Use Updates

	Employment				
	MARC / Douglas Co. 2019 Employment	**2050**			
		MARC / Douglas Co.	**Community Updated Above MPO**	**Total**	**Percent Change**
Johnson County Unincorporated	2,502	5,165	0	5,165	0%
Franklin County	9,608	15,066	0	15,066	0%
Douglas County MPO/ Eudora	51,682	61,430	0	61,430	0%
Leavenworth County/ Tonganoxie	22,801	26,397	0	26,397	0%
Olathe	69,437	100,783	38,311	139,094	38%
Lenexa	59,096	77,986	1,650	79,636	2%
De Soto	3,020	5,192	4,650	9,842	90%
Edgerton	1,121	6,630	0	6,630	0%
Gardner	4,587	15,979	0	15,979	0%
Astra Enterprise Park	411	827	15.488	16,315	1873%
Total	**224,265**	**315,455**	**60,099**	**375,554**	**19%**

Employment Difference from MARC

2050 Difference in Employment From MARC

Results

Traffic Forecast – Total K-10

K10 CORRIDOR

Two-Way K-10 2060 No-Build Volume Profile Comparison

2060 Community Based Land Use Forecast

2060 MARC Land Use Forecast

2023 Balanced Traffic

INTERSTATE 435

Legend:
- 2023 Balanced Traffic Count
- 2060 MARC Land Use Forecast
- 2060 Community-Based Land Use Forecast

X-axis categories: Church St to E 2300 Rd, E 2300 Rd to Evening Star Rd, Evening Star Rd to Edgerton Rd, Edgerton Rd to Lexington Ave, Lexington Ave to Kill Creek Rd, Kill Creek Rd to Canyon Creek Blvd, Canyon Creek Blvd to K-7, K-7 to Woodland Rd, Woodland Rd to Ridgeview Rd, Ridgeview Rd to Renner Blvd, Renner Blvd to I-435

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Preliminary Traffic Conclusions

- Community-based and MARC traffic forecasts are very similar east of K-7

- Community-based land use results in higher traffic forecasts west of K-7

- Lack of additional capacity is resulting in volumes being under projected east of K-7 in the No-Build scenario

- Volumes at the Evening Star & Lexington interchanges are dramatically larger due to Panasonic and Astra Enterprise Park

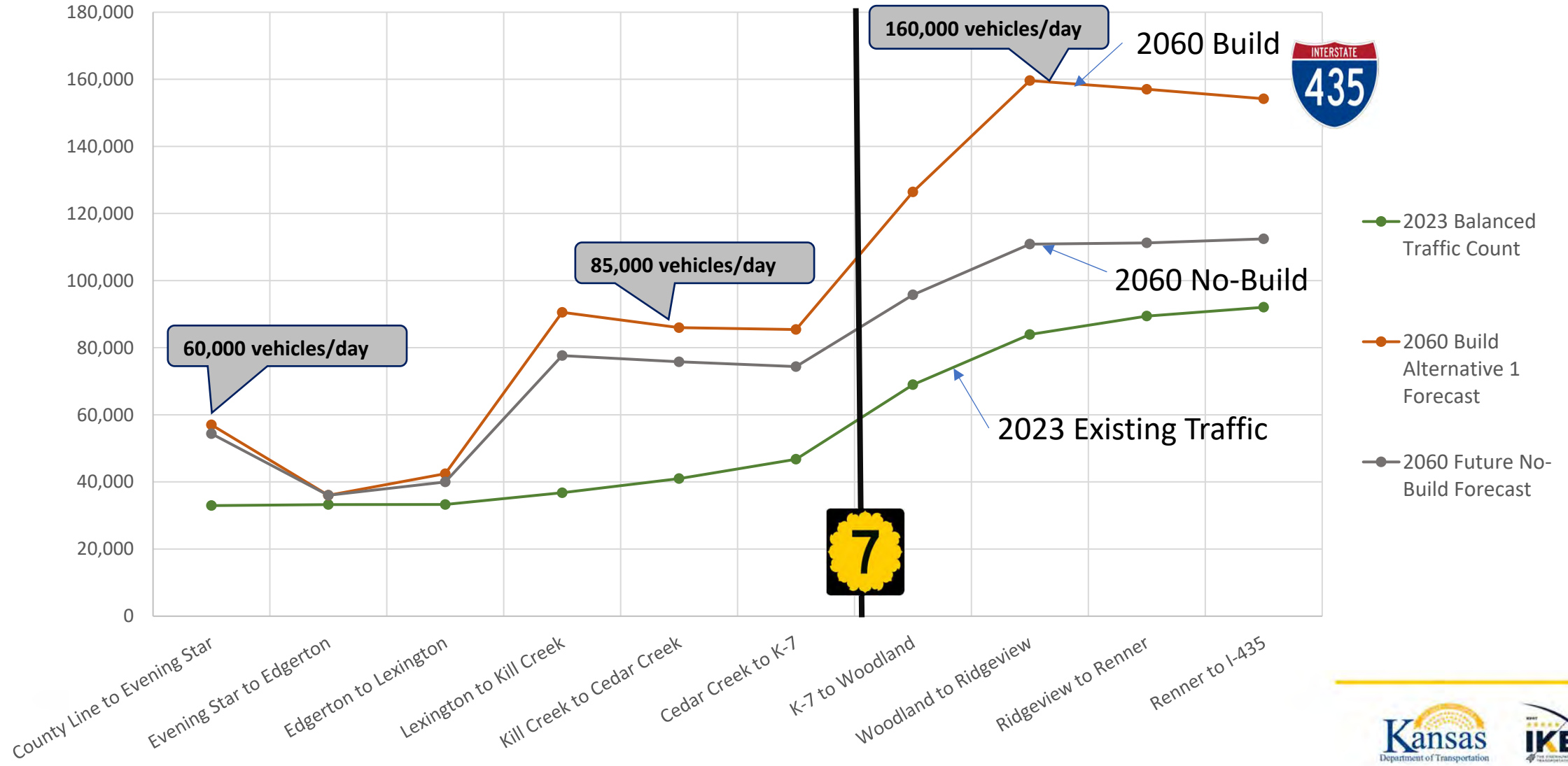- 6-lane K-10 is justified west to Lexington Avenue by 2060

Traffic Forecast – Total K-10

Two-Way K-10 2060 No-Build Volume Profile Comparison
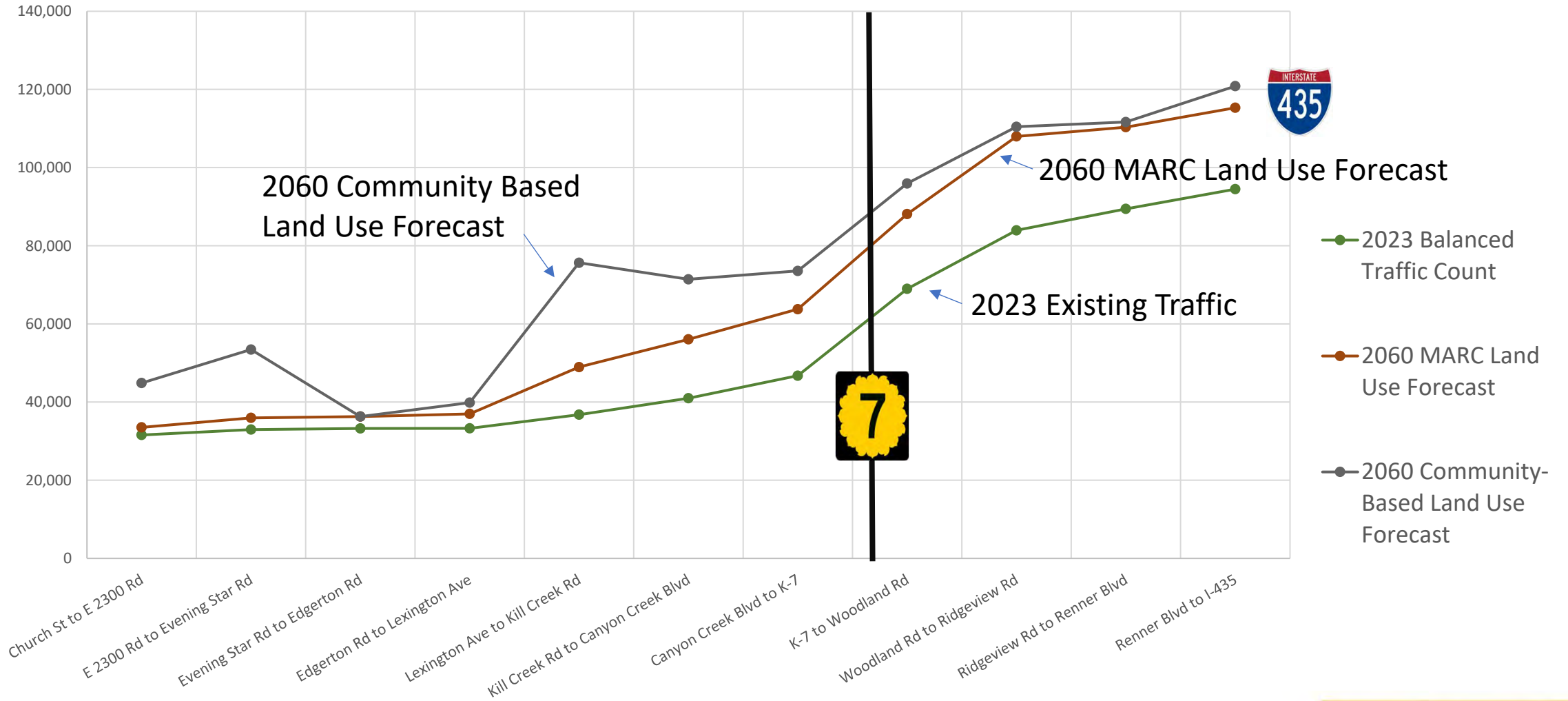
Traffic Forecast
2060 – BUILD (6-lane K-10)

Two-Way 2060 No-Build vs. Build Volume Profile Comparison

Questions?