LSIORB Time of Day Model

Kentucky Model Users Group
June 14, 2011

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Presentation Overview

Project Background

Phase 1: Data/Interim Model/Estimation

- Interim TOD Model
- Data Collection
- Data Sets
- Phase 2 Specification

Phase 2: TOD Structure & Results

- LSIORB TOD Model Structure
- Validation Results

Phase 3: Traffic Forecasts

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Project Background

- Kennedy Interchange/Louisville Bridges EIS approved early 2000s.

- Funding difficulties necessitated tolling options.

- KYTC & Bi-state Bridge Authority needed improved model.

- Model development elements:
  - 7-month time frame
  - Massive data collection
  - Time of day assignment needed
  - Model is a project model, not official KIPDA model

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Interim TOD Model

- Model Design/Assumptions
- Validation

Model Design / Assumptions

- Develop period flows
  - AM Period (6 to 9)
  - Mid Day (9 to 3)
  - PM Period (3 to 6)
  - Overnight (6pm to 6am)
- Within the structure of the Existing KIPDA Model (09PlanA)
  - Model structure
  - Validation targets
  - Forecasts

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Model Design / Assumptions

- Trip Distribution (Daily)
  - Freeflow Travel Time: Non Work
  - Congested Travel Time: Work
- Mode Choice (Daily)
  - Reduce by Transit Trips
- Matrix Preparation
  - Disaggregate AM / MD / PM and NT Trip Tables
  - Define Interstate and Intrastate Trips by Period
- Traffic Assignment
  - Assign Interstate and Intrastate Trips by Period

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Model Design / Assumptions

Parameters	KIPDA Existing Model	Interim TOD Model
Volume Delay Parameters	BPR (Alpha = 0.15, Beta 4.0)	Modified HCM Parameters
Assignment Convergence Criteria	2000 = 0.01 Forecasts = 0.001	2000 = 0.01 Forecasts = 0.001
Assignment Iterations	100	100
US 31 Penalty	1.5 Minutes by Direction	0
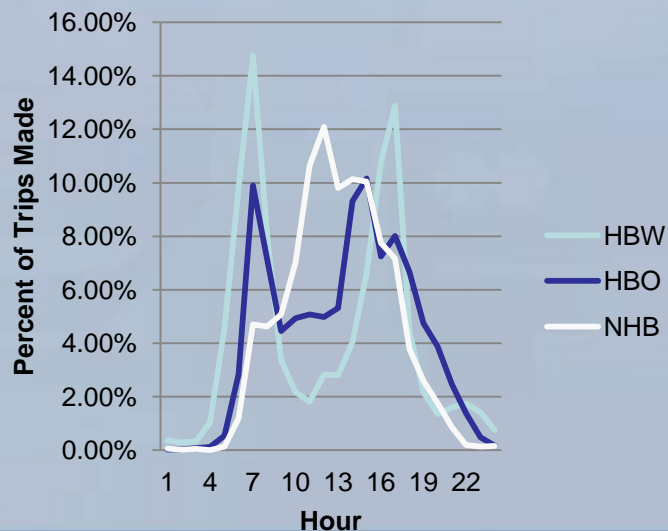
- Time of Day factors defined from Household Survey

- Capacity
  - Daily / 10 * Period Length

- Assignment parameters part of validation

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Model Design / Assumptions

- Toll can be represented as time penalty
  - Reflect in trip distribution
  - Assignment path choice
- "Suppression"
  - Trips will change PA orientation based on travel time + penalty
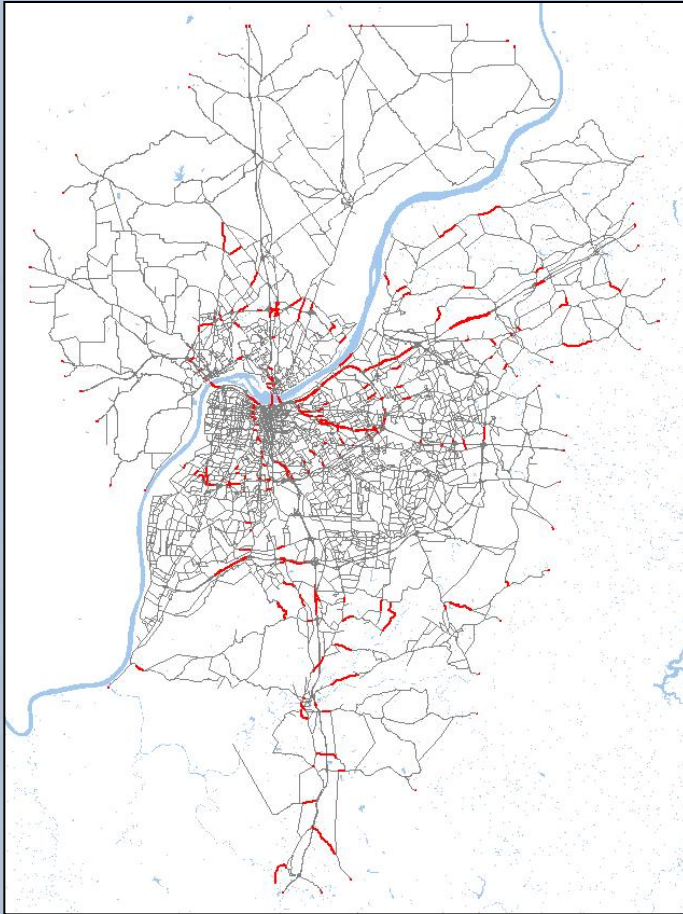- Toll added via Prohibitor / Penalty

Validation - Background

- The Interim TOD Model was validated to the same standards as the Existing KIPDA Model

- Validation based on the aggregation of the period flows

- Limited structural changes could be made because of consistency with Existing KIPDA Model

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Validation - Counts

- Counts used for validation based on the 2000 09PlanA KIPDA network

- Reviewed counts
  - Missing directional volumes
  - Two way volumes
  - Missing counts

- 257 Locations

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Validation

- Criteria
  - VMT Error
    - Facility Type
    - Area Type
    - County
  - Percent RMSE by Volume Group
  - Ohio River Bridges

- Adjustments
  - US 31 Time Penalty
  - Volume Delay Function Parameters
  - Assignment Convergence

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Validation Results

VMT Error by Facility Type

Facility	N	DAILY	Run1	Run2	Run3	Run4	Run5	Run6	Run7
Freeway	50	8.96	16.57	12.65	12.21	16.27	12.22	16.24	8.96
Div Art	13	2.67	-4.39	4.23	4.56	-4.37	4.23	-4.16	2.72
UnDiv Art	131	1.83	-5.23	-3.64	-2.77	-4.68	-2.82	-4.73	1.39
External	53	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21
One Way	9	-12.49	-18.30	-17.07	-17.32	-15.75	-13.45	-15.33	-10.91
Ramp	1	-3.53	3.37	1.86	3.38	3.42	1.92	3.29	-3.33
Overall	257	8.81	13.17	10.74	10.56	13.21	10.80	13.20	8.98

VMT Error by Area Type

AREA	N	DAILY	Run1	Run2	Run3	Run4	Run5	Run6	Run7
11	2	1.51	10.03	13.33	14.30	4.04	4.16	4.06	-1.96
12	2	7.20	2.08	-2.97	-3.95	0.88	-4.29	0.86	5.98
21	11	0.63	-0.39	-7.53	-8.77	-1.37	-8.66	-1.46	0.39
31	37	-23.91	-19.49	-19.40	-19.86	-18.18	-17.52	-18.22	-22.91
41	101	0.23	3.36	2.34	2.46	3.35	2.34	3.32	0.29
43	12	44.60	54.25	48.38	47.76	54.27	48.37	54.32	45.24
45	2	174.78	104.70	99.68	98.92	105.09	99.75	105.09	173.60
53	7	46.65	47.02	49.19	49.66	47.03	49.19	47.03	46.28
55	83	22.85	26.31	21.40	21.36	26.27	21.39	26.27	22.50

Validation Results

VMT Error by County

COUNTY	N	DAILY	Run1	Run2	Run3	Run4	Run5	Run6	Run7
Bullitt	31	30.95	33.46	32.29	32.35	33.43	32.30	33.45	30.8941
Clark	28	-17.89	-15.53	-13.65	-13.31	-15.89	-14.23	-15.91	-18.4847
External	53	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.20513
Floyd	12	-16.64	-17.72	-18.16	-17.33	-17.68	-17.75	-17.75	-16.9303
Jefferson	110	5.92	11.05	8.16	7.83	11.14	8.29	11.13	6.270009
Oldham	23	36.76	39.54	35.48	35.65	39.52	35.47	39.51	36.41023

Percent RMSE by Volume Group

VOL_CLASS	N	DAILY	Run1	Run2	Run3	Run4	Run5	Run6	Run7
Overall	263	51.51	53.87	57.98	58.72	53.58	57.58	53.57	51.54
<1,000	25	122.46	121.37	127.32	125.51	122.33	127.45	122.26	122.50
1,000-2,500	28	89.09	85.21	102.54	102.69	88.54	105.08	88.49	89.05
2,500-5,000	28	72.94	77.42	64.79	70.83	76.48	63.90	76.43	73.29
5,000-10,000	46	74.56	75.44	75.16	74.07	75.59	75.73	71.83	73.78
10,000-25,000	73	48.65	39.62	46.64	45.79	39.45	46.31	40.65	48.63
25,000-50,000	48	41.74	43.65	46.68	41.42	43.64	46.67	43.68	41.88
50,000+	15	22.74	30.64	33.72	42.81	30.28	33.14	30.25	22.56

Validation Results

Percent of Trips by Period (Interim TOD Model)

Period	HBW	HBO	NHB
AM (6 - 9)	32.64%	19.90%	10.52%
PM (3 - 6)	30.25%	25.42%	24.96%

Average Time of Day Percentages(2001 NHTS)

Period	HBW	HBO	NHB
AM (7 - 9)	30.1%	11.2%	7.5%
PM (3 - 6)	25.35	25.0%	23.3%

Model vs. Count Period Distribution

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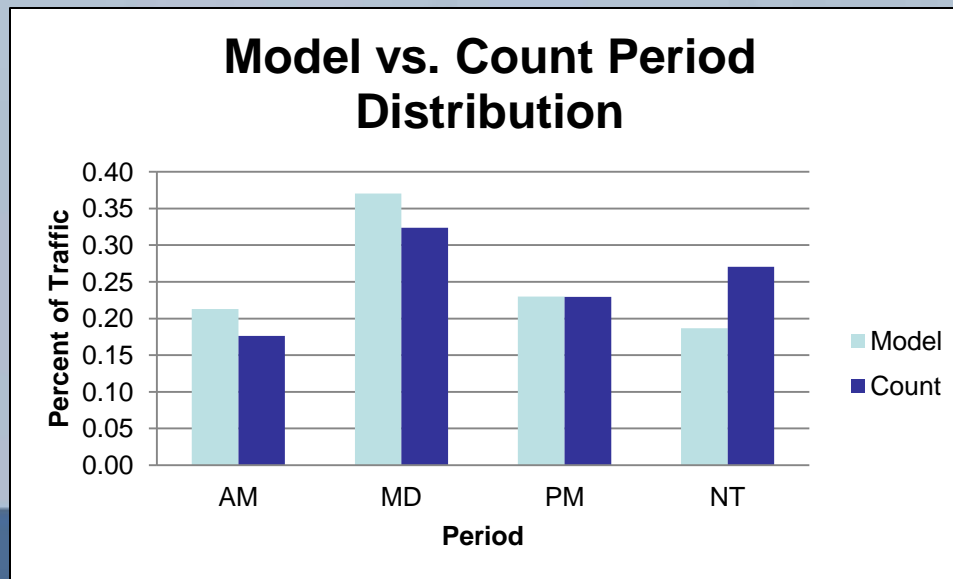
Results – Period ORB by Crossing

- Daily Volumes
- Period ORB by Crossing
  - Compare results by direction and year
  - Decrease in non-peak direction on existing crossing in 2020 with the opening of the East End Bridge
  - Growth from 2020 to 2030 in both directions
- Period ORB by Year
  - Compare results on all crossing by direction by year

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Results – Daily ORB

Location	2000			2020		2030	
	Count	KIPDA	Period	KIPDA	Period	KIPDA	Period
Clark BA (SB)	19600	6502	11003	2149	11080	0.05	12130
Clark AB (NB)		11220	8904	14456	12962	15006	13679
I-65 SB	62375	65622	64877	76146	72545	89833	81126
I-65 NB	62375	61000	65481	66802	69994	75111	78523
I-64 EB	40400	43354	40282	47576	44442	50786	48069
I-64 WB	40400	43258	40641	45903	44817	50967	48483
East End SB				26617	27101	31954	32035
East End NB				27327	25658	31488	30614

- Model was validated against 2000 counts on bridges
- Compared the aggregated period flows ("Period") to the Existing KIPDA Model forecasts ("KIPDA")
- Difference on Clark
  - Removal of time penalty that caused travel time imbalance

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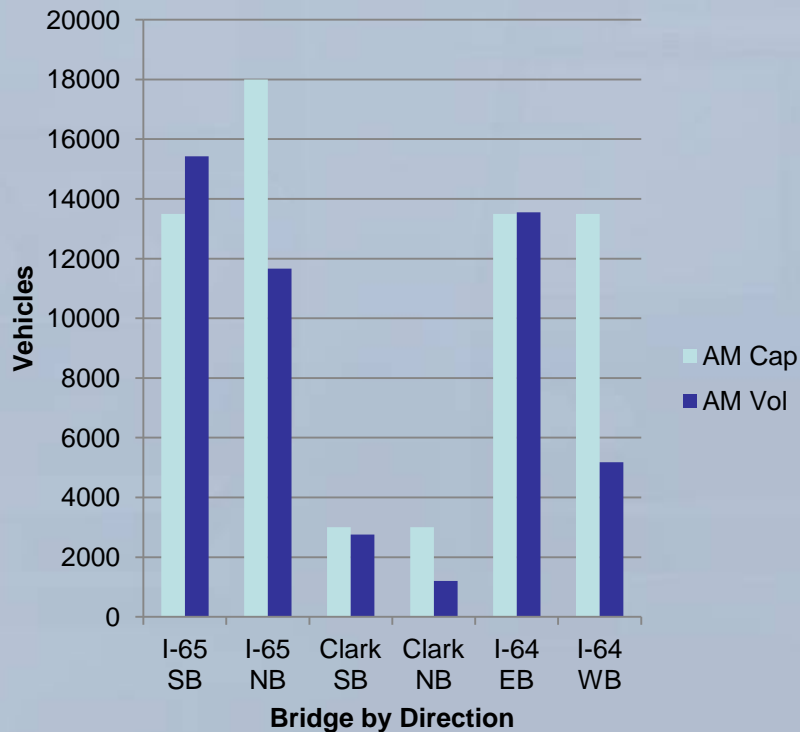
Results – Period ORB by Year
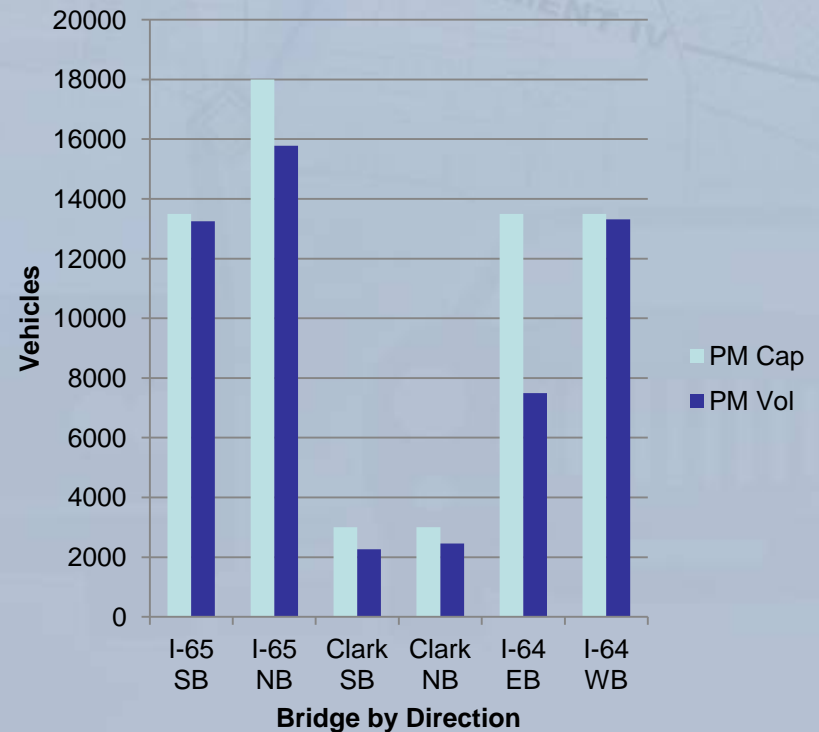
Results – Period ORB by Year

2030 AM Period Flow vs. Capacity

2030 PM Period Flow vs. Capacity

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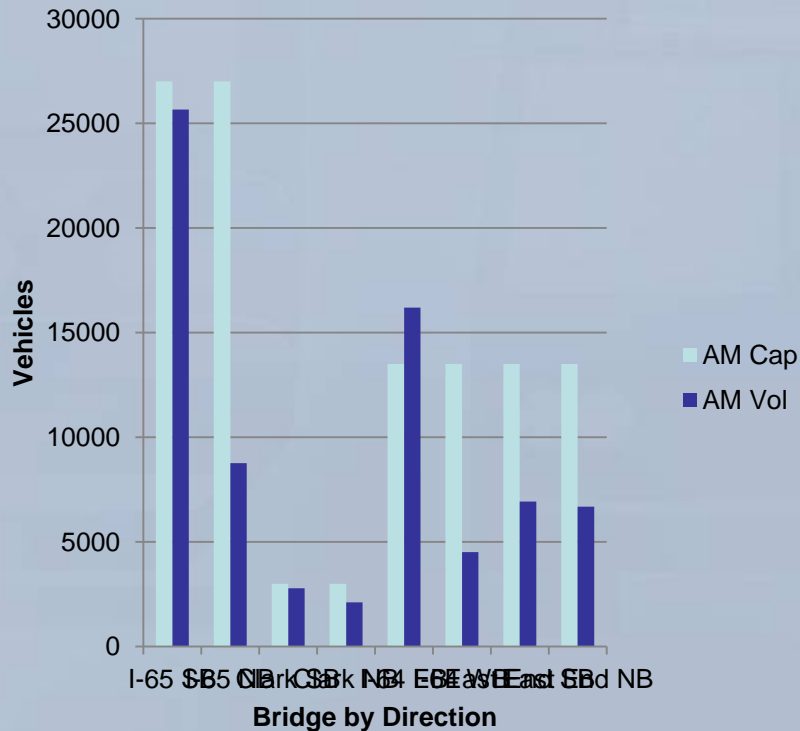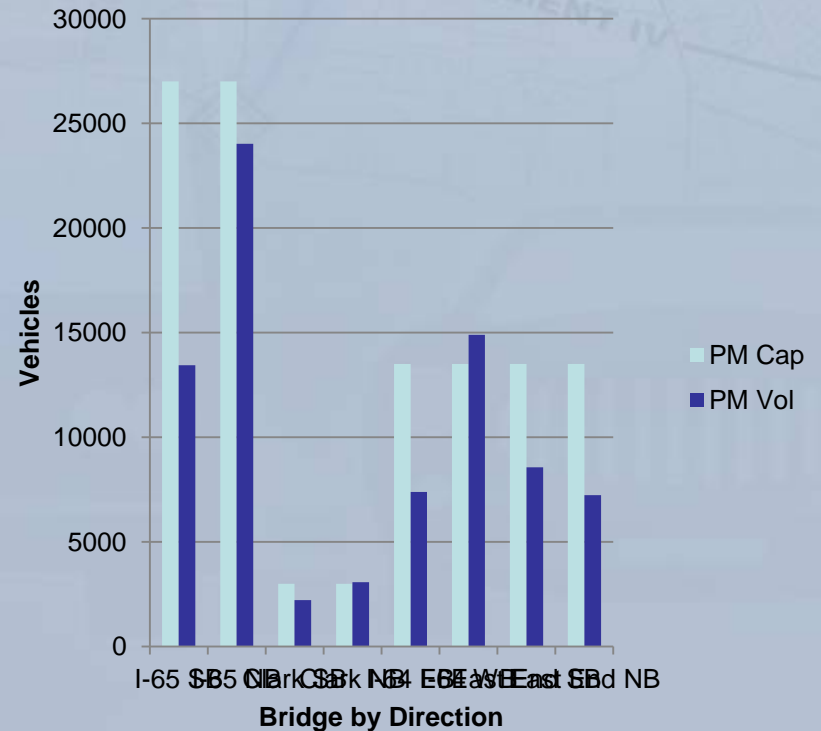
Data Collection

- Bridge/ramp volumes
- Origin-destination surveys

2010 Bridge Volumes/Truck Percents

	I-65 Kennedy Bridge	I-64 Sherman Minton Bridge	US 31 Clark Memorial Bridge
AADT	122,900	81,900	21,900
Light Truck Percentage	8.4%	3.7%	1.5%
Heavy Truck Percentage	12.7%	7.3%	0.1%

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2010 Volumes

I-65 Kennedy Bridge Southbound
59,833
(12,370/9,070)

I-65 Kennedy Bridge Northbound
63,079
(9,562/14,616)

I-64 Eastbound to I-65 Northbound
8,975 (2,177/1,555)

I-65 Southbound to I-64 Eastbound
21,824
(4,802/3,175)

I-64 Westbound to I-65 Southbound
22,564
(6,517/2,727)

I-65 Southbound to I-64 Westbound
5,685 (916/614)

I-64 Westbound to I-65 Northbound
22,165
(3,380/5,009)

I-65 Northbound to I-64 Eastbound
24,300
(2,705/6,508)

I-64 Eastbound to I-65 Southbound
7,795 (1,198/2,129)

I-65 Northbound to I-64 Westbound
10,526
(1,676/2,462)

I-65 Southbound
32,324
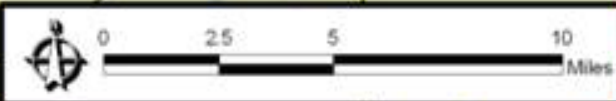(6,652/5,281)

I-65 Northbound
31,939
(4,005/8,052)

# of Lanes

Ramp Daily Volume
(AM Volume 6am-9am / PM Volume 3 pm-6pm)

1
2
4

I-65 SB
18,445 AADT
6.8% Light Truck
36.7% Heavy Truck

I-65 NB
18,317 AADT
7.7% Light Truck
37.6% Heavy Truck

I-71 SB
29,095 AADT
8.1% Light Truck
21.8% Heavy Truck

I-71 NB
28,167 AADT
21.1% Light Truck
21.8% Heavy Truck

I-64 Bridge WB
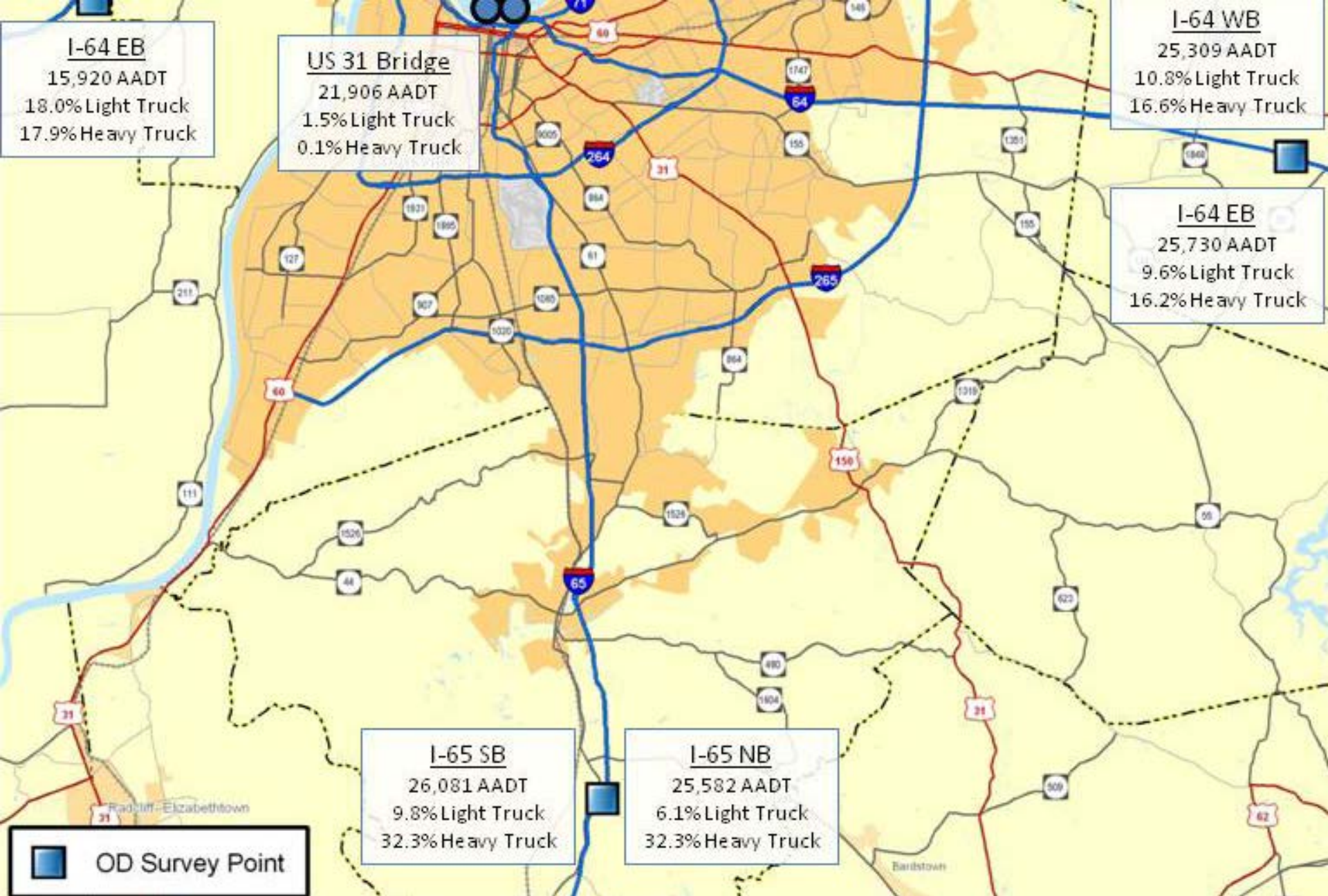39,567 AADT
4.2% Light Truck
7.1% Heavy Truck

I-65 Bridge NB
63,079 AADT
7.1% Light Truck
11.2% Heavy Truck

I-64 Bridge EB
42,357 AADT
3.2% Light Truck
7.4% Heavy Truck

I-65 Bridge SB
59,833 AADT
9.8% Light Truck
14.2% Heavy Truck

I-64 WB
15,826 AADT
8.3% Light Truck
18.0% Heavy Truck

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I-64 EB
15,920 AADT
18.0% Light Truck
17.9% Heavy Truck

US 31 Bridge
21,906 AADT
1.5% Light Truck
0.1% Heavy Truck

I-64 WB
25,309 AADT
10.8% Light Truck
16.6% Heavy Truck

I-64 EB
25,730 AADT
9.6% Light Truck
16.2% Heavy Truck

I-65 SB
26,081 AADT
9.8% Light Truck
32.3% Heavy Truck

I-65 NB
25,582 AADT
6.1% Light Truck
32.3% Heavy Truck

OD Survey Point

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Origin/Destination Survey

- Conducted at five interstate locations on September 29, 2010

- Locations were on edge of KIPDA boundary and represent through interstate trips

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Origin/Destination Survey Statistics

Site	Useable Plates	ADT	Percent Utilized
I-65 in IN NB (Site 1)	11,934	18,317	65.2%
I-65 in IN SB (Site 1)	12,526	18,445	67.9%
I-71 in KY NB (Site 2)	23,288	28,167	82.7%
I-71 in KY SB (Site 2)	21,867	29,095	75.2%
I-64 in KY EB (Site 3)	22,124	25,730	86.0%
I-64 in KY WB (Site 3)	20,338	25,309	80.4%
I-65 in KY NB (Site 4)	21,646	25,582	84.6%
I-65 in KY SB (Site 4)	18,648	26,081	71.5%
I-64 in IN EB (Site 5)	9,823	15,920	61.7%
I-64 in IN WB (Site 5)	8,680	15,826	54.8%
Total	170,874	228,472	74.8%

Indiana

(1)

SR 62

US 42

I-65

(2) I-71
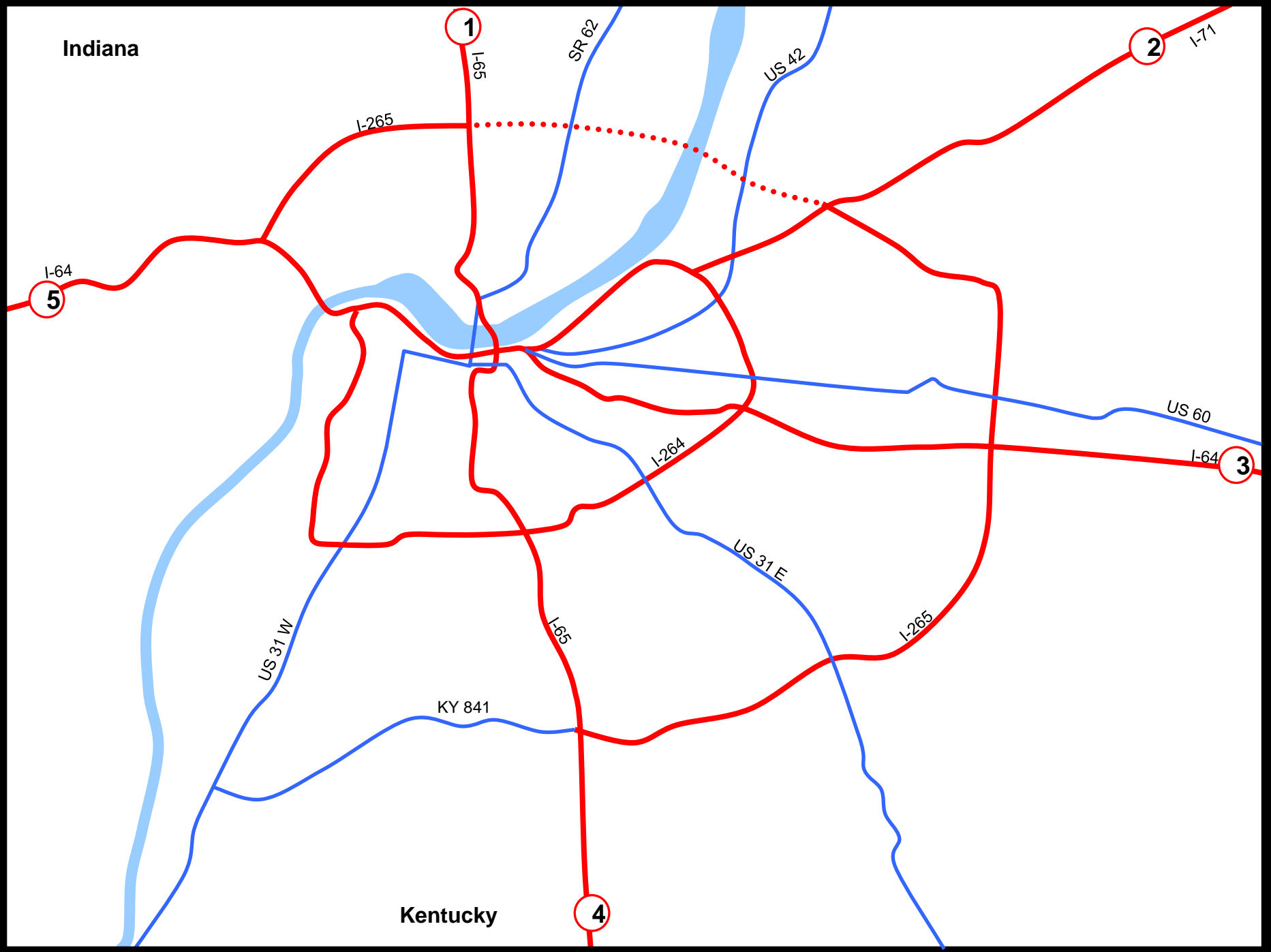
490 cars + 350 trucks

510 cars + 510 trucks

I-64

(5)

710 cars + 460 trucks

US 60

I-64 (3)

710 cars + 470 trucks

US 31 W

1,280 cars + 2,110 trucks

1,330 cars + 1,980 trucks

US 31 E

I-65

I-265

Kentucky

(4)

Indiana

I-265

US 42

I-64

5

US 60

280 cars + 170 trucks

170 cars + 170 trucks

900 cars + 920 trucks

950 cars + 790 trucks

1

2

3

190 cars + 100 trucks

180 cars + 80 trucks
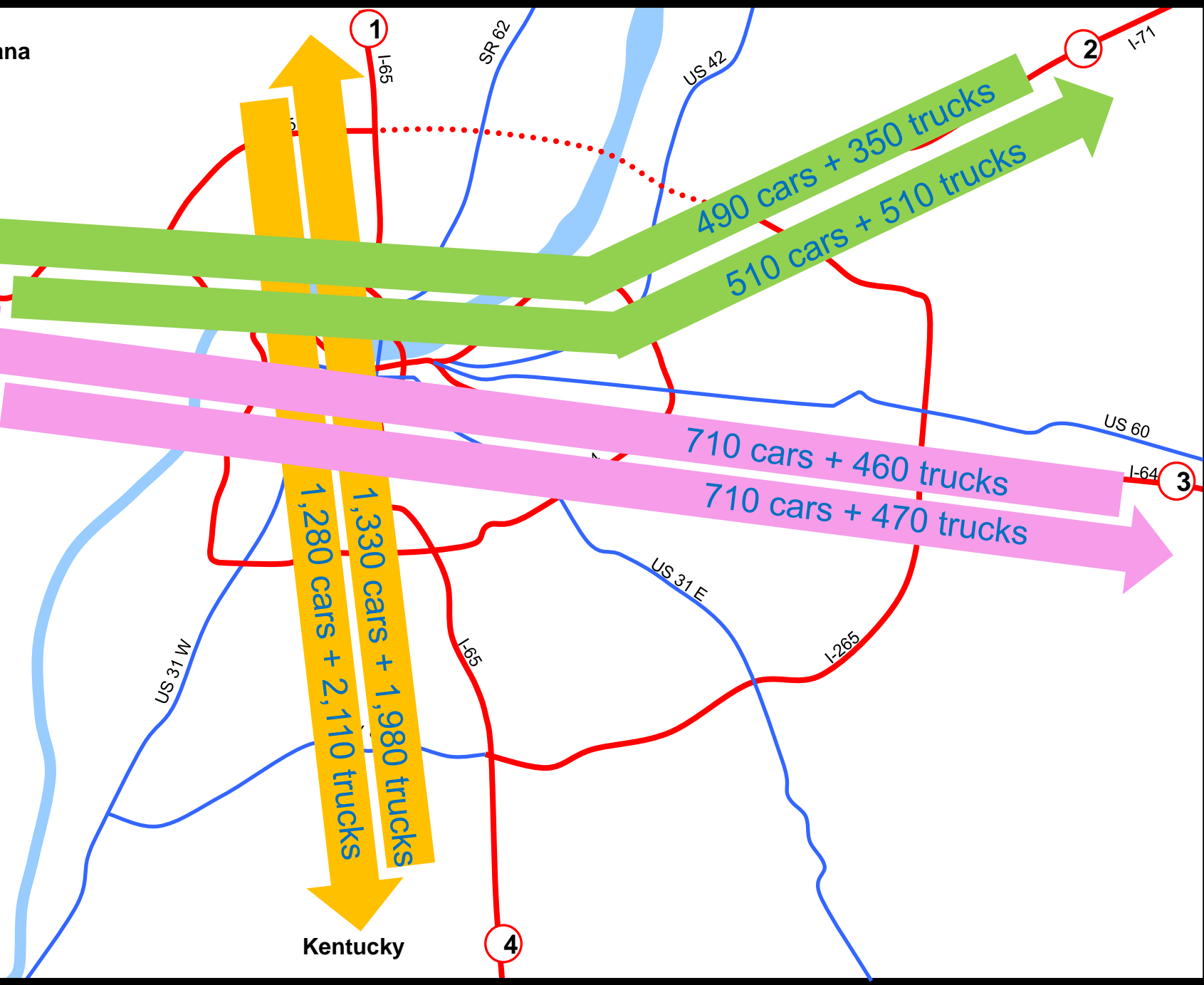
US 31 W

US 31 E

I-65

I-265

Kentucky

4
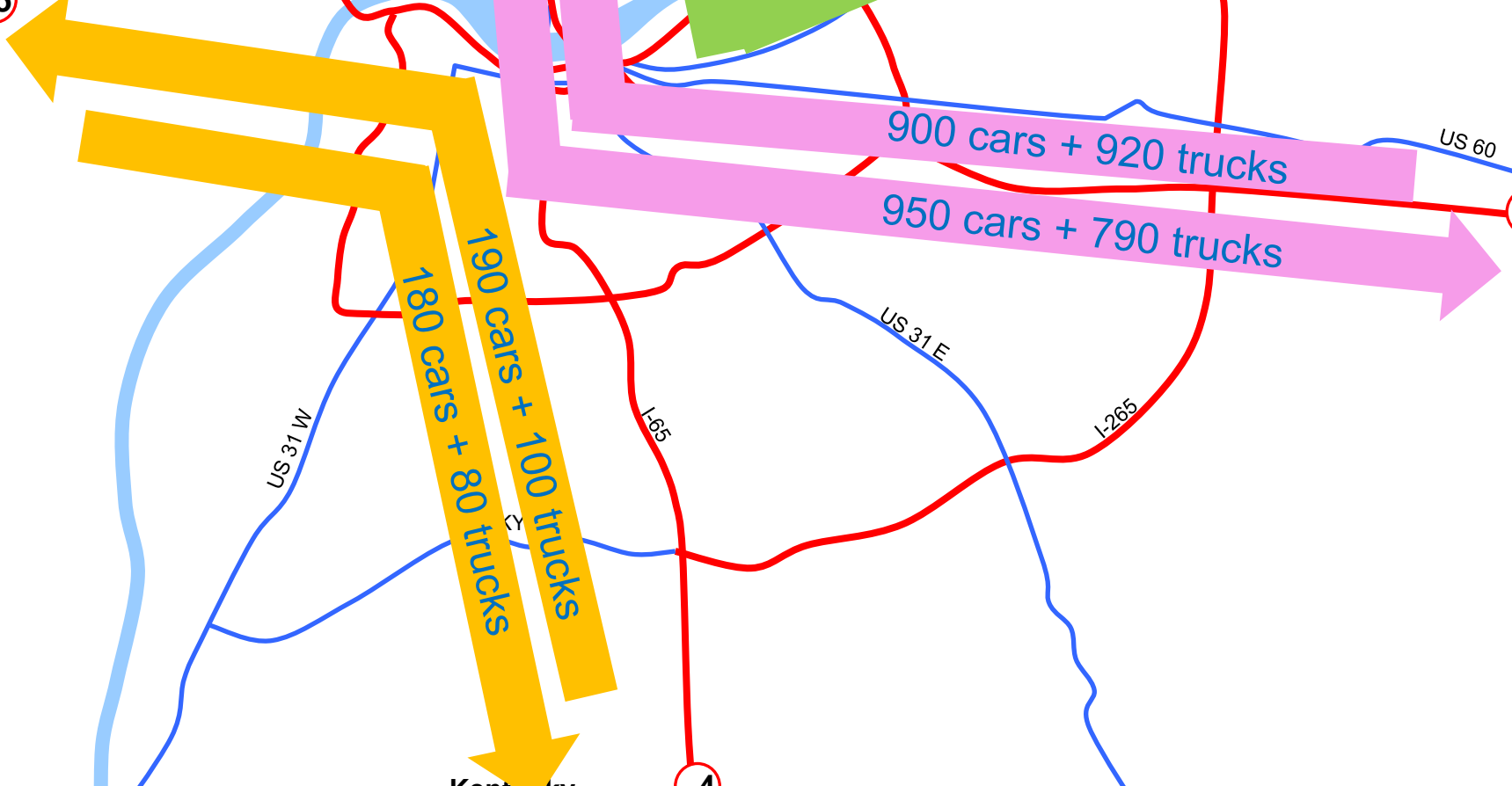
Daily Number of License Plates Captured at Downstream Survey Site - Passenger Vehicles

	1	2	3	4	5	Total
1	0	187	870	1,558	644	3,259
2	275	0	191	1,167	527	2,160
3	805	209	0	157	701	1,872
4	1,484	1,211	165	0	235	3,095
5	695	553	645	214	0	2,107
Total	3,258	2,160	1,872	3,095	2,107	12,493

Daily Number of License Plates Captured at Downstream Survey Site - Trucks

	1	2	3	4	5	Total
1	0	148	1,028	2,071	395	3,642
2	158	0	150	2,623	773	3,704
3	1,003	162	0	259	1,176	2,601
4	2,111	2,535	229	0	241	5,115
5	371	860	1,193	161	0	2,585
Total	3,643	3,705	2,601	5,113	2,585	17,647

Data sets

- Highway network
- Socioeconomic data
- Traffic count station
- Signal location
- Transit

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Highway Network

- 2007 Base year

- Developed by KIPDA

- Adding following attributes:
  - Cnt_Stat_ID
  - AM_COUNT
  - MD_COUNT
  - PM_COUNT
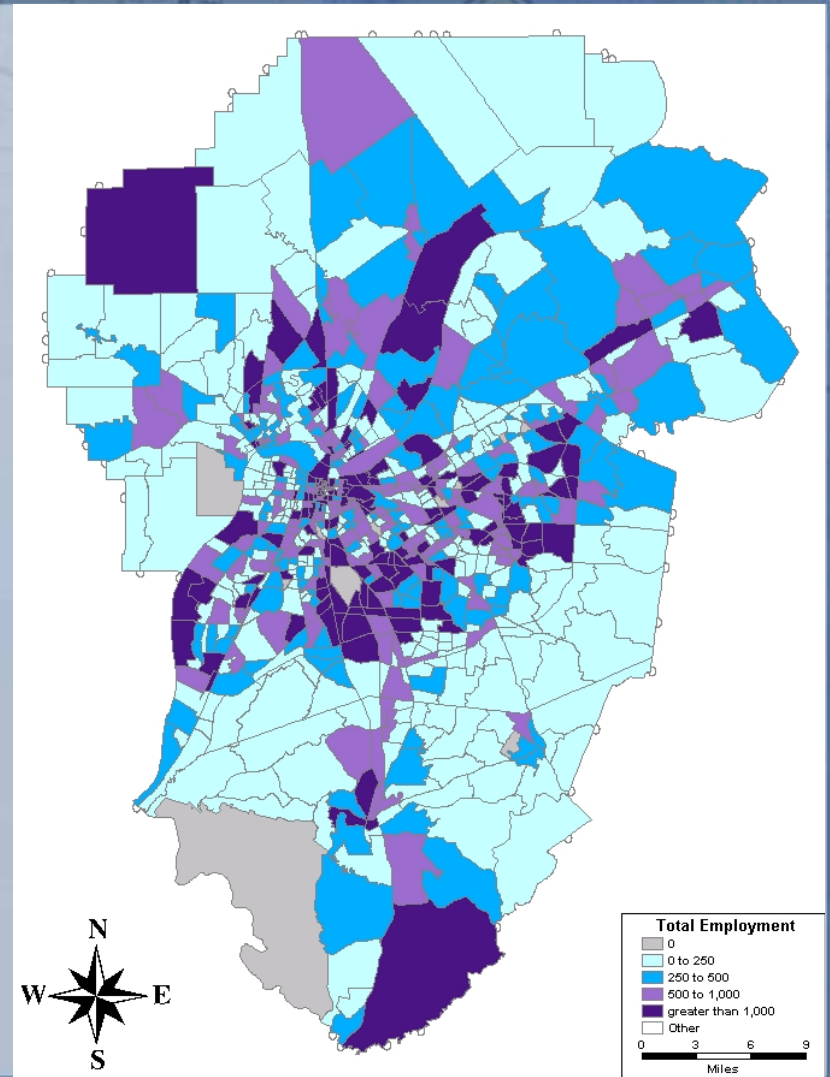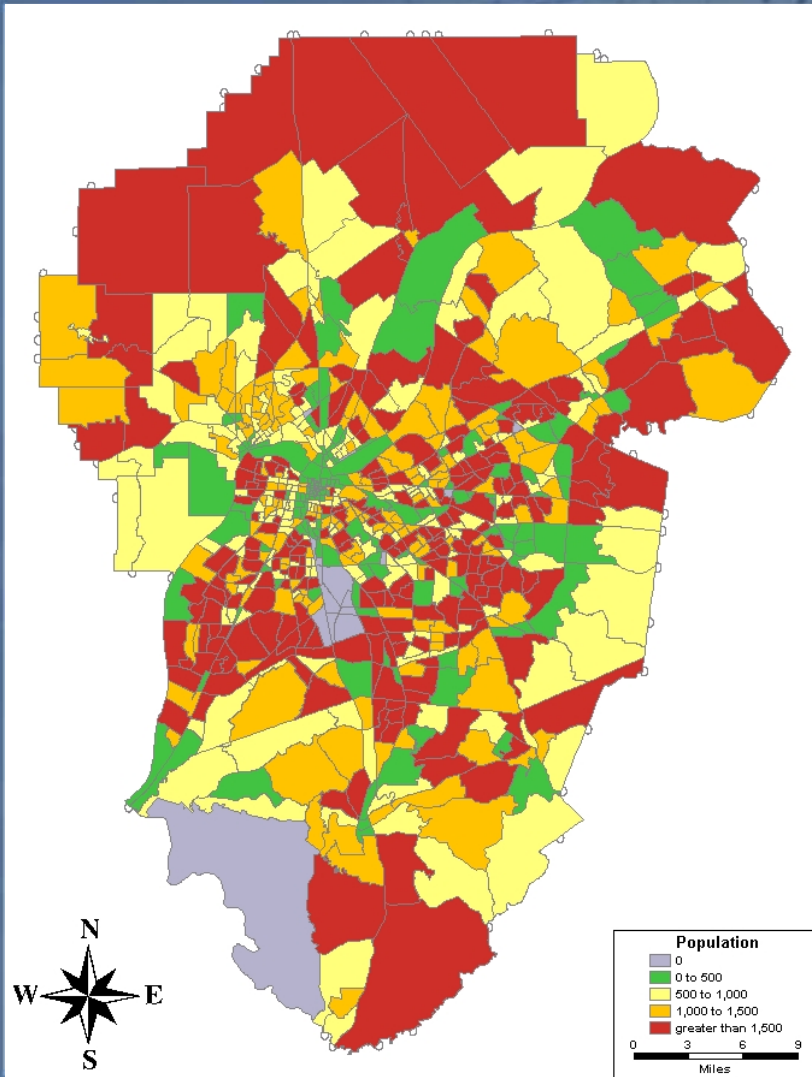 - NT_COUNT
  - Signal_ID
  - CycleLength
  - Percent_Green

Roadways
- Freeways / Interstates
- Divided Arterials
- Undivided Arterials
- Collectors
- Local Streets
- Centroid Connectors
- One-way Streets
- Ramps

0 3 6 9
Miles

Counties
- Bullitt
- Clark
- Floyd
- Jefferson
- Oldham

0 3 6 9
Miles

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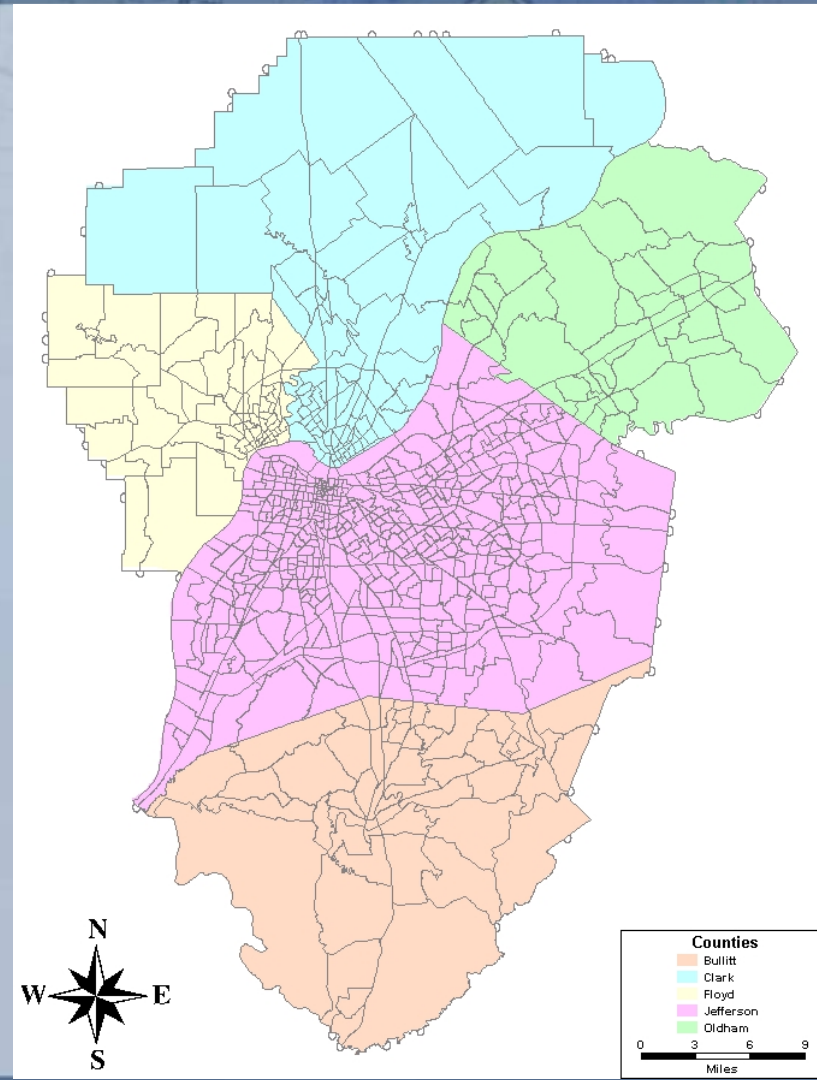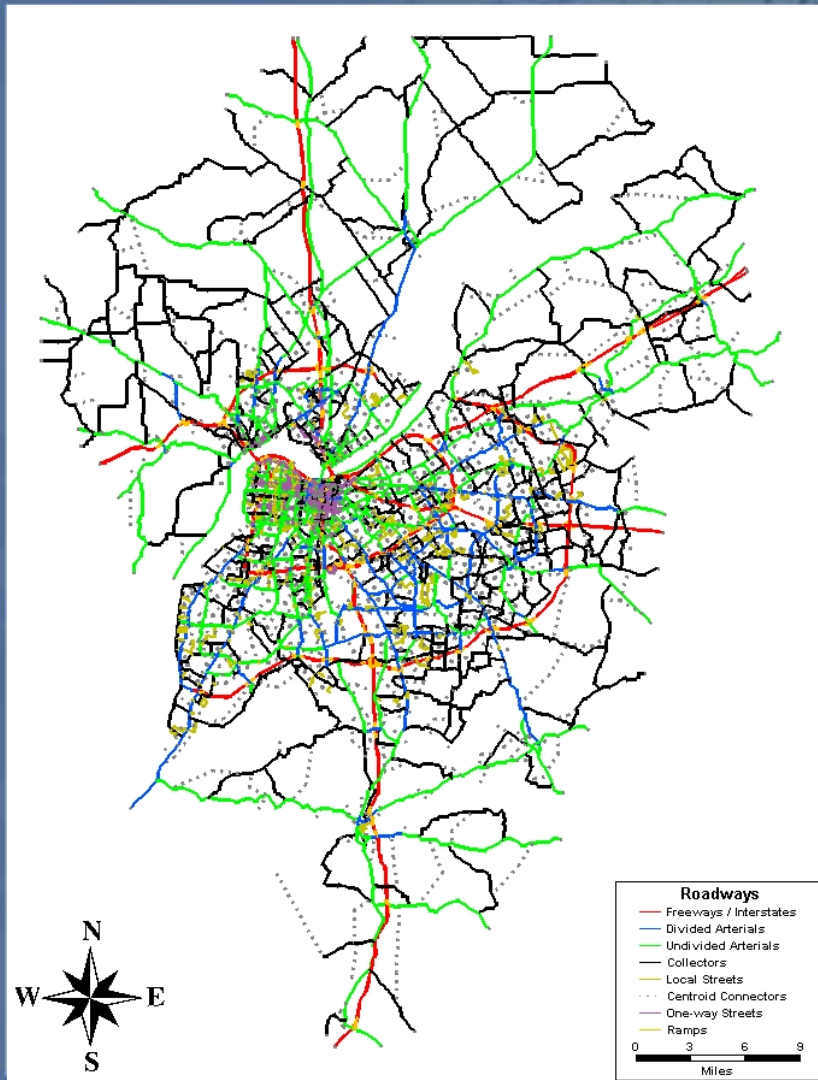
Socioeconomic Data

- ## Why 2007 base?
    - 2010 Census not yet available
    - Linear interpolation between 2000 and 2009 SE datasets is efficient
    - Consistent with current KIPDA model update efforts

Socioeconomic Data

Year	2000	2007	2009	2030
Population	947,150	996,465	1,010,555	1,131,733
Households	389,016	416,160	423,915	494,909
Employment	496,376	560,098	578,304	779,216

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Population
- 0
- 0 to 500
- 500 to 1,000
- 1,000 to 1,500
- greater than 1,500

Total Employment
- 0
- 0 to 250
- 250 to 500
- 500 to 1,000
- greater than 1,000
- Other

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Traffic Count Stations

- Data from 1,391 locations

- Used 2007 or 2008 or 2009 for validation

	# of Counts	Percent of Total
ADT & TRK	534	38.4%
ADT & HOUR	749	53.8%
ADT & TRK & HOUR	269	19.3%
TOTAL	1391	100.0%

LSIORB Model
Map layers
— Highway Network
• ADT Counts
• ADT & Truck Counts
• ADT & Hourly Counts
• ADT, Hourly & Truck Counts

0 2 4 6
Miles

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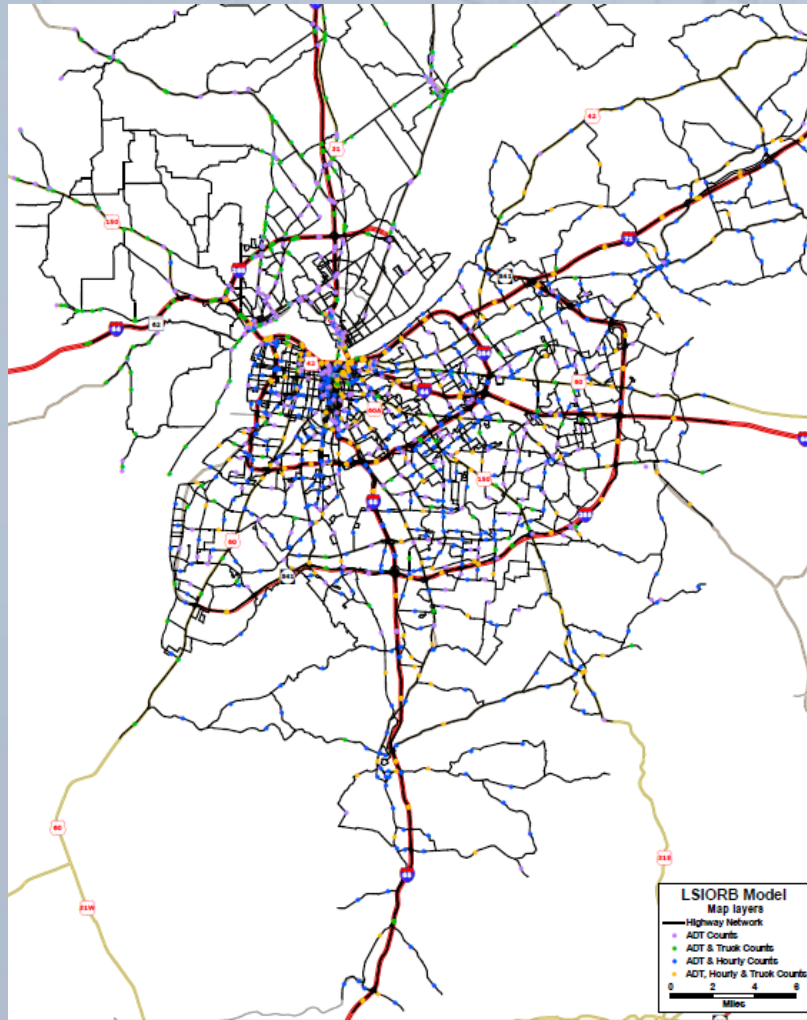
Signal Locations

- Gathered signal data at 1,119 locations from several sources
- Collect specific cycle length data in Indiana and downtown Louisville & estimated elsewhere.

Source	Location	Notes
KYTC/District 5	Bullitt and Oldham Counties	signal locations, not geo-coded, no cycle lengths
Louisville Metro Govt., Department of Public Works	Jefferson County	signal locations, lat-long coordinates, some cycle lengths
Indiana DOT	Clark and Floyd Counties	signal locations, cycle lengths
KIPDA	Clark and Floyd Counties	supplemental signal locations, no cycle lengths

LSIORB Signal Locations
- Jefferson County - Metro Owned
- Jefferson County - State Owned
- Bullitt County
- Oldham County
- Clark County
- Floyd County

PM Period Cycle Length
- 80 seconds
- 94 seconds
- 140 seconds
- 180 seconds
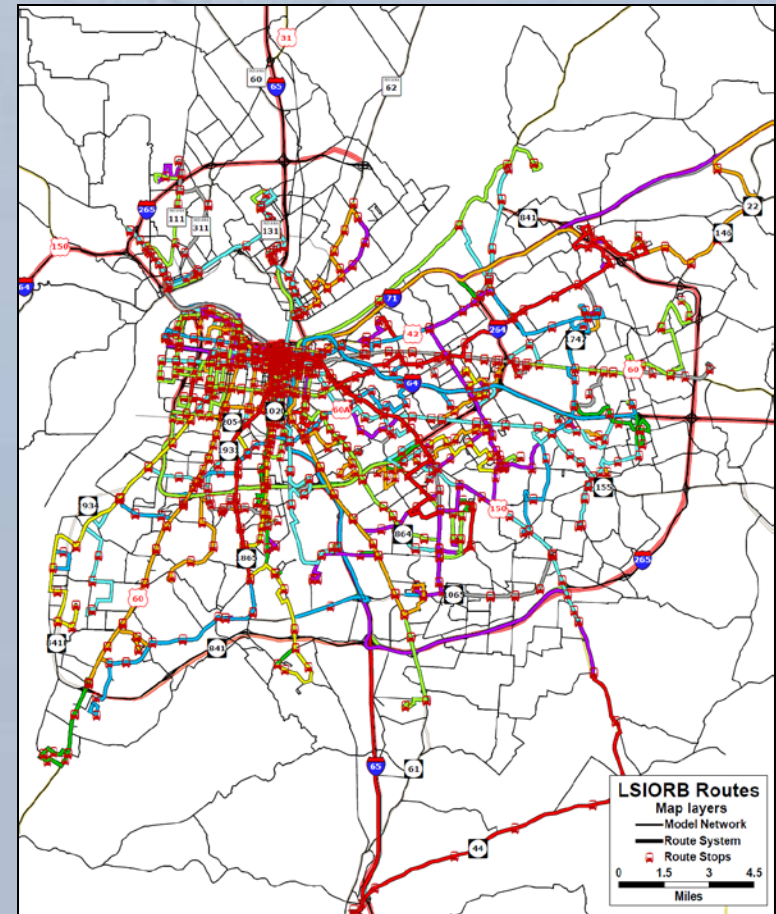- 210 seconds

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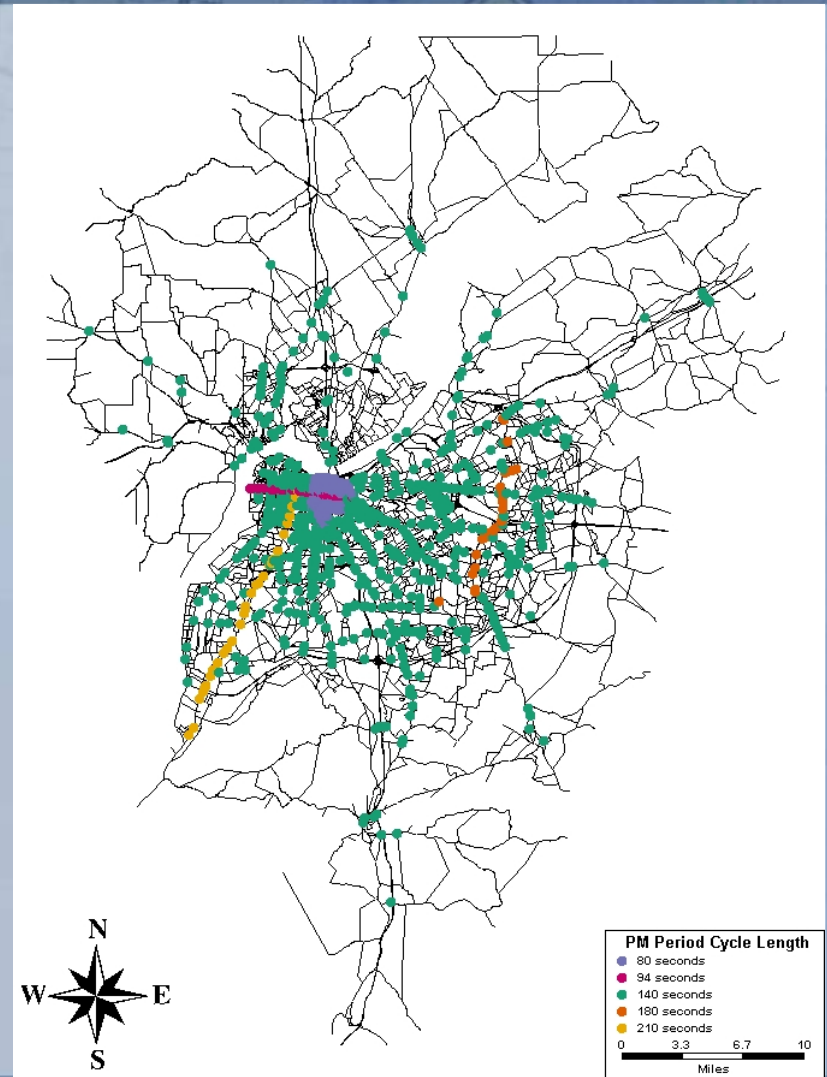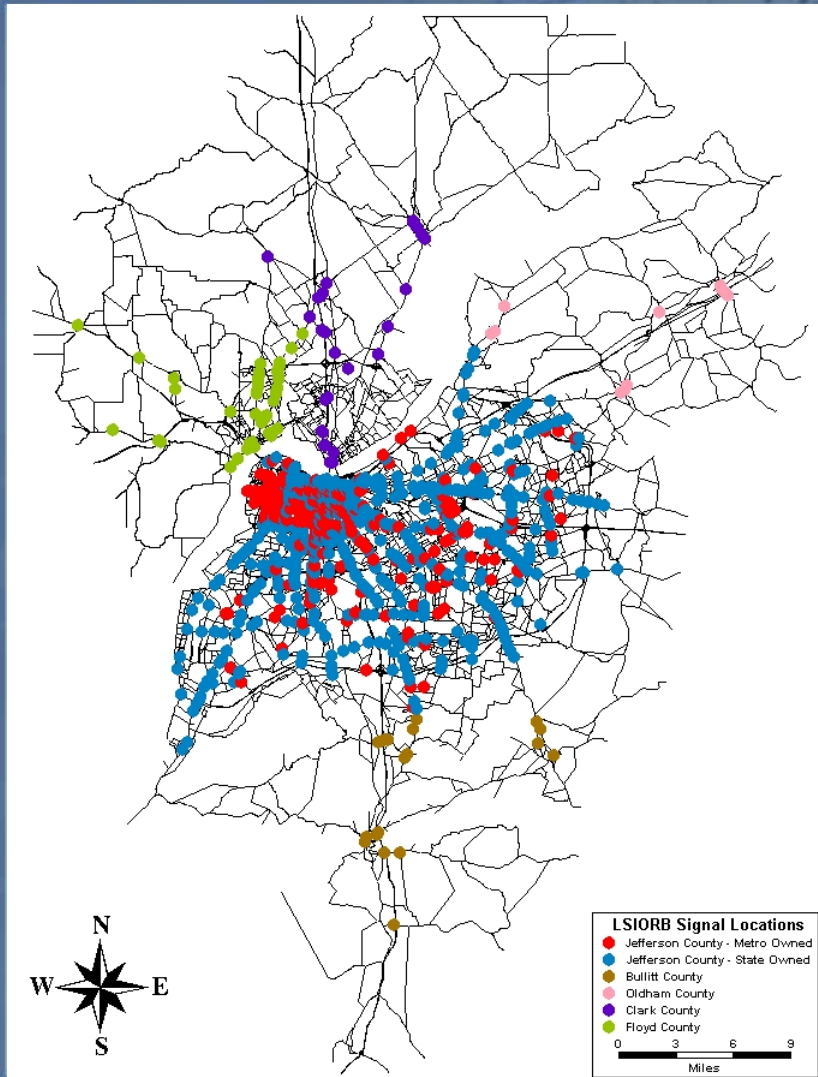
Input Data – Transit Network

- Route Layer
  - 48 Total Routes
  - 18 Express Routes
  - 30 Local Routes
    - Includes 3 circulator routes
- Route Attributes
  - Fare Cost
  - Transfer Cost
  - Headway
- Route Segments
  - Varying Headways

LSIORB Routes
Map layers
Model Network
Route System

0   3.3   6.7   10
Miles
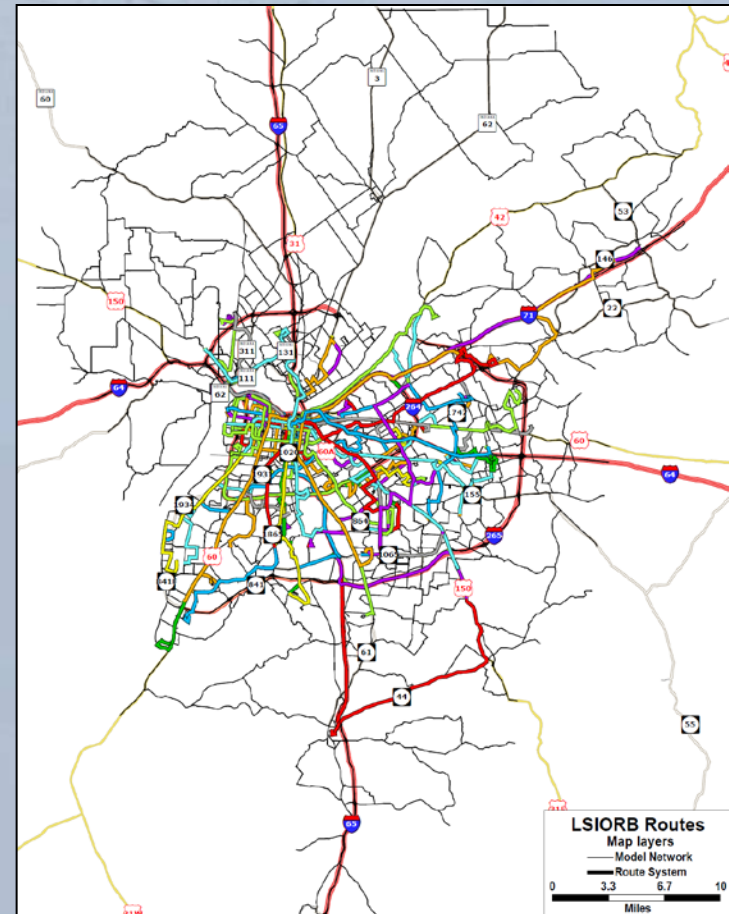
Input Data – Transit Network

- Stop Layer
  - Frequent Local Bus Stops
  - Park-and-Ride Lots
- Highway Layer
  - Walk Access Links
    - Associated with all stops
    - ¼ mile access buffer
  - Drive Access Links
    - Associated with PNR Lots
    - 5 mile access buffer
- Node Layer
  - Park and Ride Lots
  - ID tagged to Stop Layer

LSIORB Routes
Map layers
— Model Network
— Route System
🚌 Route Stops
0   1.5   3   4.5
Miles

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Phase 2 Model Specification

- Phase 2 Model criteria
  - Review of existing model: TG, skims, TD, Mode share, assignment, feedback
  - Changes from KIPDA model: external model, GIS-DK, trip purpose stratification, TOD structure, mode choice, truck model, traffic assignment
- Considerations:
  - Refinement to the periods to include the PM peak shoulders
 - Development of improved speed and capacity logic

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Consideration of Peak Periods
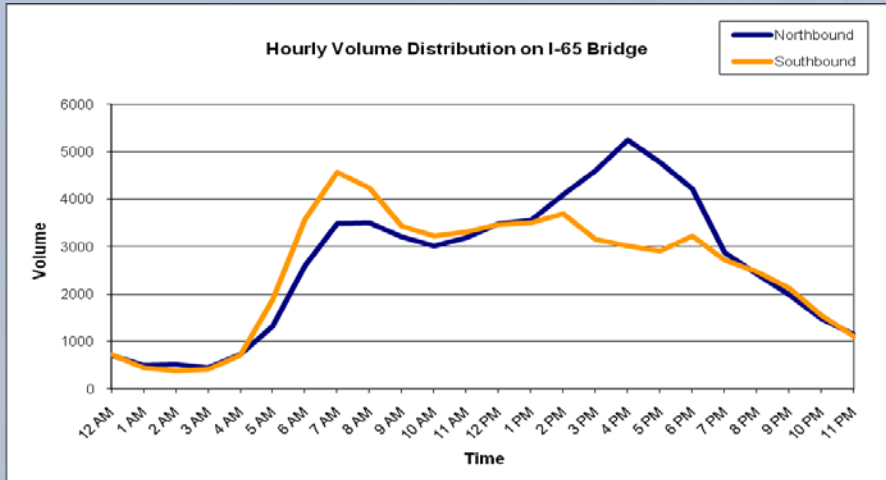
Hour	Percent	Period
Midnight - 1am	1.02%	
1am - 2am	0.67%	
2am - 3am	0.56%	
3am - 4am	0.61%	5.78%
4am - 5am	0.92%	
5am - 6am	2.00%	
6am - 7am	4.33%	
7am - 8am	7.16%	18.01%
8am - 9am	6.51%	
9am - 10am	5.11%	
10am - 11am	4.83%	
11am - Noon	5.16%	
Noon - 1pm	5.52%	32.56%
1pm - 2pm	5.61%	
2pm - 3pm	6.34%	
3pm - 4pm	7.11%	
4pm - 5pm	7.76%	22.86%
5pm - 6pm	7.99%	
6pm - 7pm	5.83%	
7pm - 8pm	4.34%	
8pm - 9pm	3.62%	
9pm - 10pm	3.02%	20.78%
10pm - 11pm	2.32%	
11pm - Midnight	1.65%	
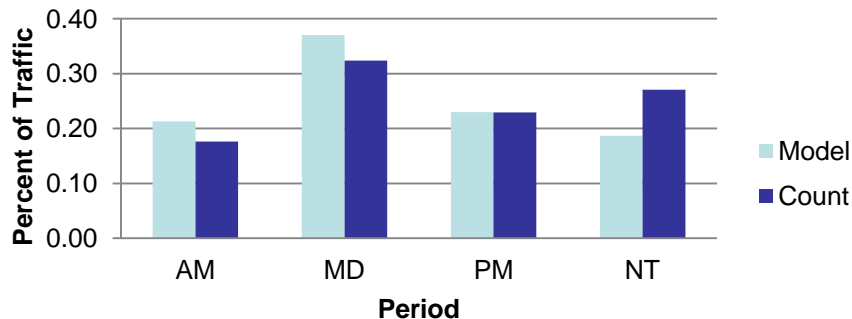
Speed and Capacity Issues
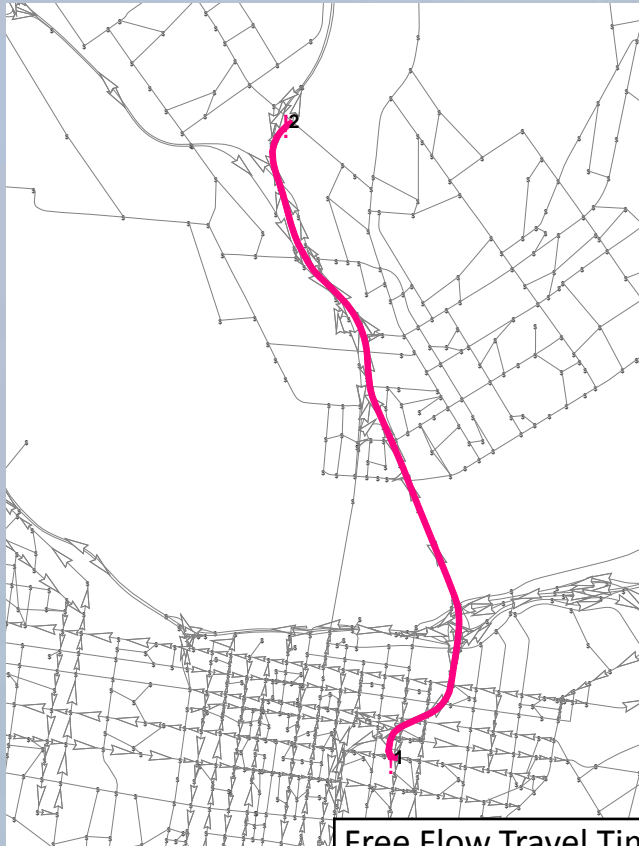
| Free Flow Travel Time	NB	SB
Via I-65	4.1929	5.1806
Via US 31	5.3495	5.2898

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Model Structure – Design

- Network
  - Free Flow Speed
    - Posted Speeds / Network Review
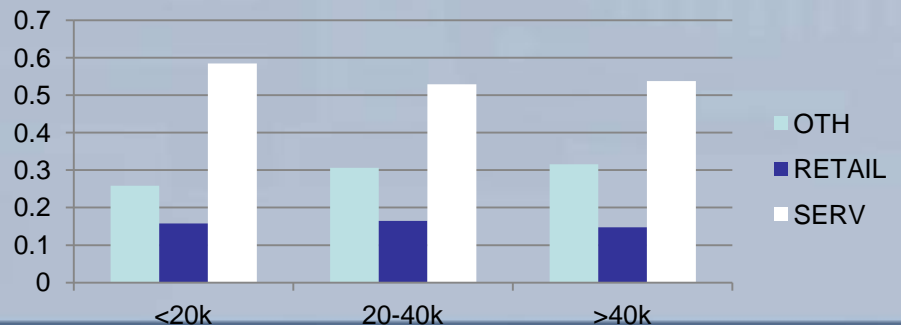   - Signalization and Uniform Delay
  - Capacity
  - Transit

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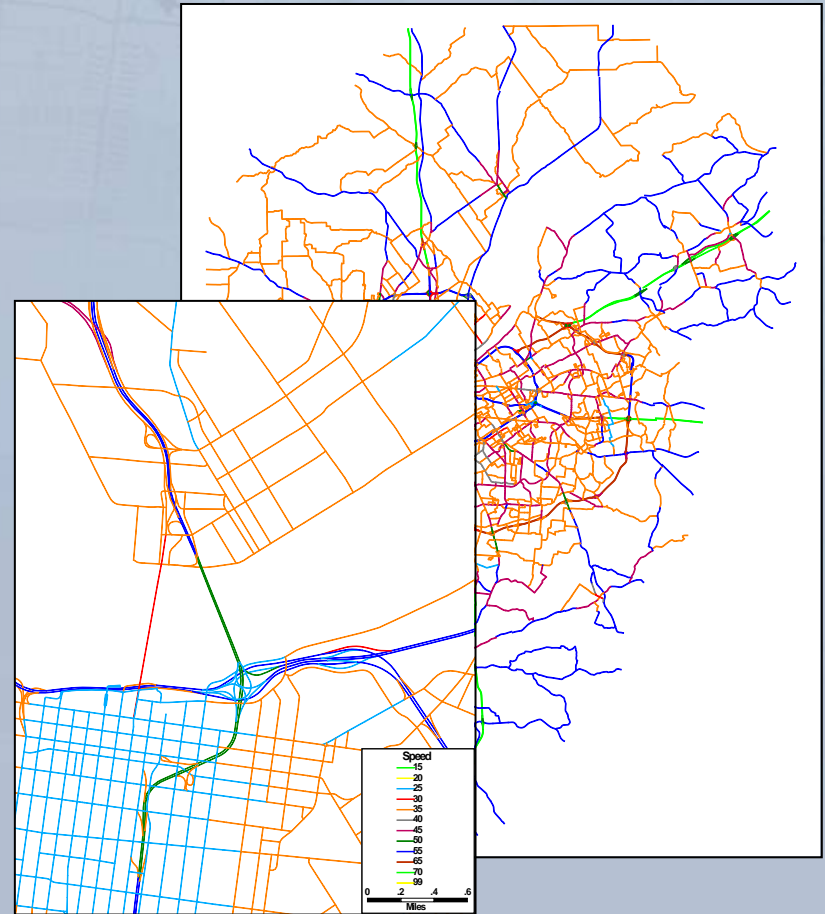
Model Structure – Design

- Trip Generation
  - Disaggregation of households into income categories
  - HBW by Income
  - KIPDA equations
    - Adjusted to account for truck trips

Distribution of Households by Income
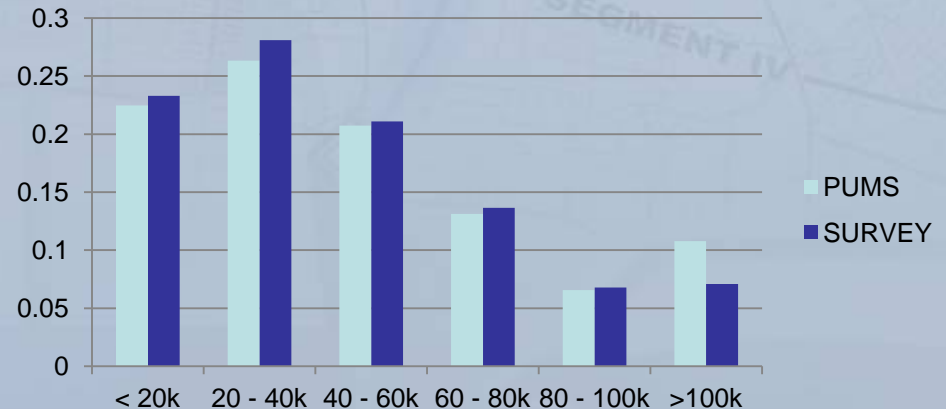
Employment by Income Group

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Model Structure – Design

- Trip Distribution
  - Traditional gravity models
  - Generalized cost
    - Adjusted Travel Time + Operating Cost / VOT
  - Estimated new friction factors
    - Congested (Feedback)
    - Generalized cost

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Model Structure – Design

- Mode Choice
  - Nested Multinomial Logit Model
  - Modes
    - Auto: DA, SR2, SR3
    - Transit: Local and Premium
    - Non Motorized: Walk and Bike
  - Access Modes
    - Walk
    - Drive
  - Consistent definition of time and cost
    - Highway network travel times
    - VOT and VOC

Mode	Variable				
	IVTT	OVTT	COST	Transfers	CBD
Private Vehicle	Drive Time	Terminal Time	Parking Cost (currently inactive), Generalized Cost for Peak (HBW) and Mid-day (other Purposes) based on vehicle occupancy 1, 2, 3	N/A	Flag for CBD zone
Transit	Transit Time	Wait, Transfer, Access, and Egress Time	Auto Operating Cost * Distance + Fare Cost. Operating cost is only applied for the drive access. Fare cost is discounted by 25% for HBW.	Number of Transfers	Flag for CBD zone
Non-Motorized	Walk Time	Terminal Time	N/A	N/A	Flag for CBD zone

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Model Structure – Design

- Traffic Assignment / Time of Day
  - Time of Day post mode choice
  - 8 Periods
    - AM Peak (3 Hours)
    - Mid Day (6 Hours)
    - PM Peak (3 Hours)
    - Night (12 Hours)
  - Assignments for each period
    - Revised HCM volume delay functions
    - Capacity (Hourly & Period Factors)

Legend: FREEWAY, RAMP, ART, ART, LOCAL, BPR

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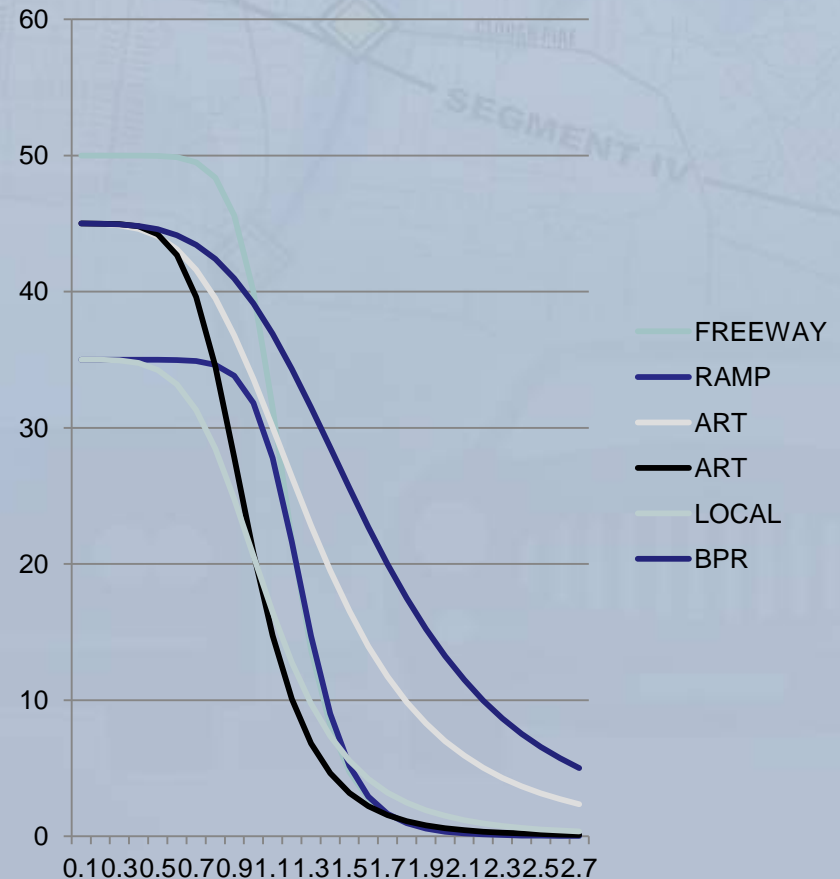
Model Structure – Design

- Feedback
  - MSA Feedback
    - Assignment congested speeds weighted and skimmed
    - Output skims compared to test convergence
  - Work Trips
    - Maximum congested time by direction (AM and PM)
    - Skim used for trip distribution and mode choice
  - Non Work Trips
    - Maximum congested time by direction (MD)
    - Skim used for trip distribution and mode choice
  - Traffic Assignment
    - Uses new trip tables
    - Free flow traffic assignment

Model Structure – Design

- Truck Model
  - Combined Truck Flows
    - Light + Heavy Truck
  - ODME Truck Trip Table
    - QRFM Seed Truck Flows
    - Adjusted to Counts
  - Lack of classification counts
    - "Truck" percent only
  - Time of Day
    - Disaggregated using hourly truck counts
  - Assignment
    - Assigned simultaneously

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Model Structure - Output

- Volumes
  - Hourly
  - Period (AM, MD, PM, NT)
  - Daily
  - Volume
    - Occupancy (DA, SR2, SR3)
    - Purpose (HBW, HBO, NHB, EI, EE)
    - Income (by Group)
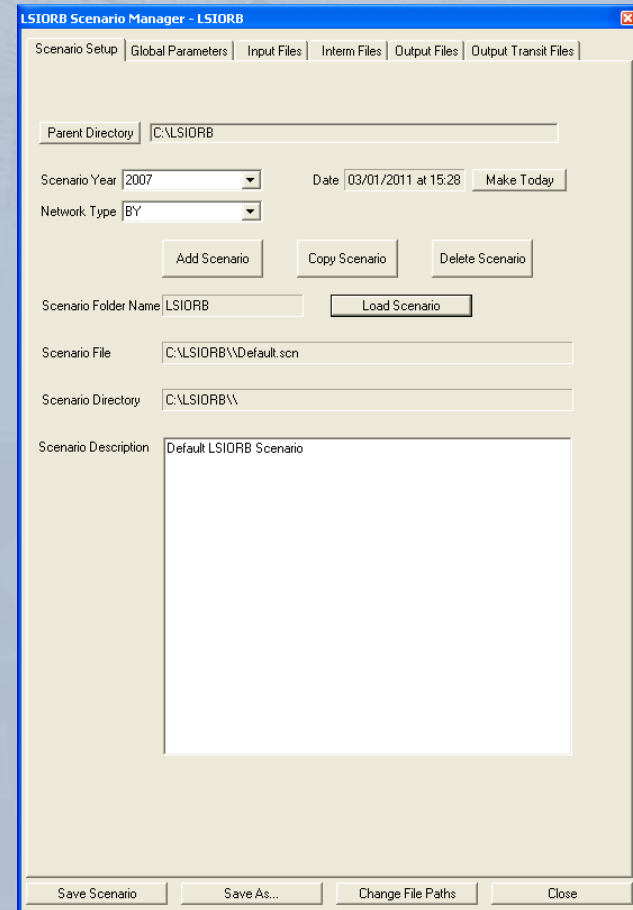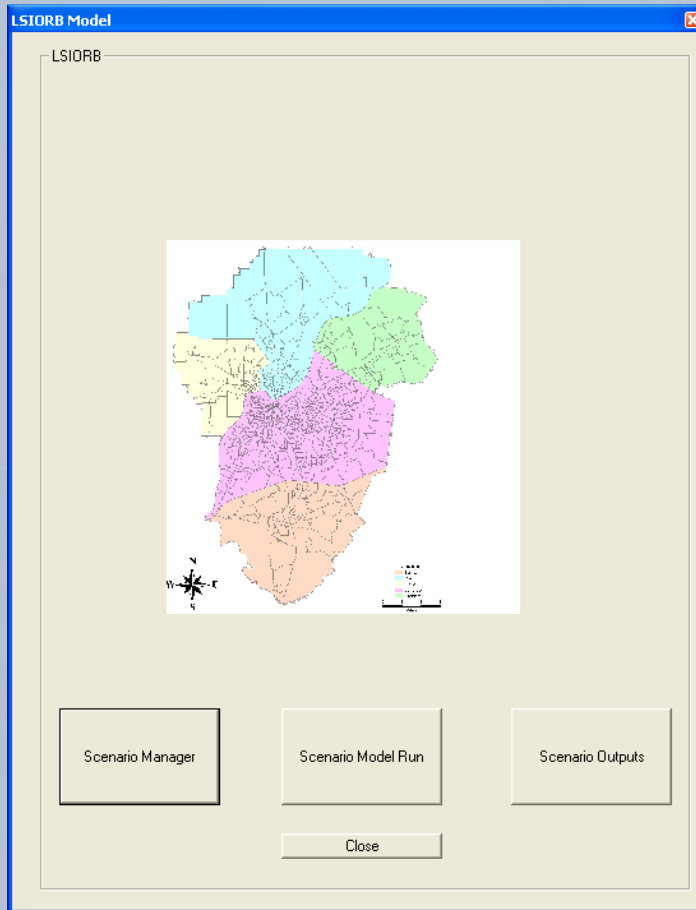
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Model Structure - Interface

- Custom developed graphical user interface.
- All model run information is saved as a scenario file:
  - Inputs
  - Parameters
  - File locations
- GUI has 3 three components
  - Scenario Management
  - Model Run
  - Post Processing

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Model Structure - Interface

Model Structure - Interface

Validation

- Trip Generation
  - Reasonableness of trip rates
- Trip Distribution
  - Journey to Work
  - Average Trip Length (Survey vs. Model)
- Mode Choice
  - System-wide mode shares
- Time of Day
  - Traffic by Period
- Traffic Assignment
  - Aggregate Measures
  - Percent RMSE
  - River Screenline

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Trip Generation

COUNTY		HBW	HBO	NHB	POP	HH
21111	JEFFERSON	605,485	1,826,447	507,616	697,570	300,250
21029	BULLITT	42,765	66,171	13,866	73,321	27,045
21185	OLDHAM	38,583	95,758	13,300	52,985	18,796
18019	CLARK	81,311	248,249	61,161	103,107	42,665
18043	FLOYD	57,338	175,315	86,944	72,851	28,883
TOTAL		825,481	2,411,941	682,887	999,834	417,639

COUNTY		POP	HH	TEMP	SEMP	REMP
21111	JEFFERSON	697,570	300,250	436,376	75,166	176,057
21029	BULLITT	73,321	27,045	19,261	3,399	4,617
21185	OLDHAM	52,985	18,796	18,077	2,922	6,446
18019	CLARK	103,107	42,665	57,839	10,019	14,260
18043	FLOYD	72,851	28,883	33,122	5,681	11,278
TOTAL		999,834	417,639	564,675	97,188	212,659

COUNTY		HBW/HH	HBO/HH	NHB/HH	TRIP/HH
21111	JEFFERSON	2.0	6.1	1.7	9.8
21029	BULLITT	1.6	2.4	0.5	4.5
21185	OLDHAM	2.1	5.1	0.7	7.9
18019	CLARK	1.9	5.8	1.4	9.2
18043	FLOYD	2.0	6.1	3.0	11.1
TOTAL		2.0	5.8	1.6	9.4

- KIPDA 09PLANA Production and Attraction Rates
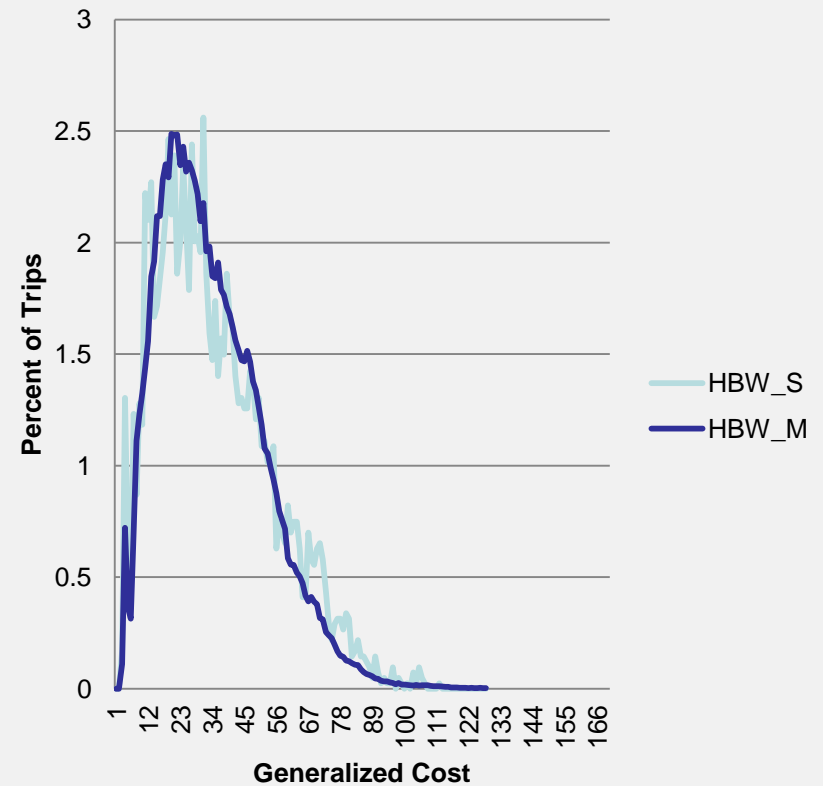- Productions adjusted by county to account for truck flows

Trip Length Validation (Survey vs. Model)

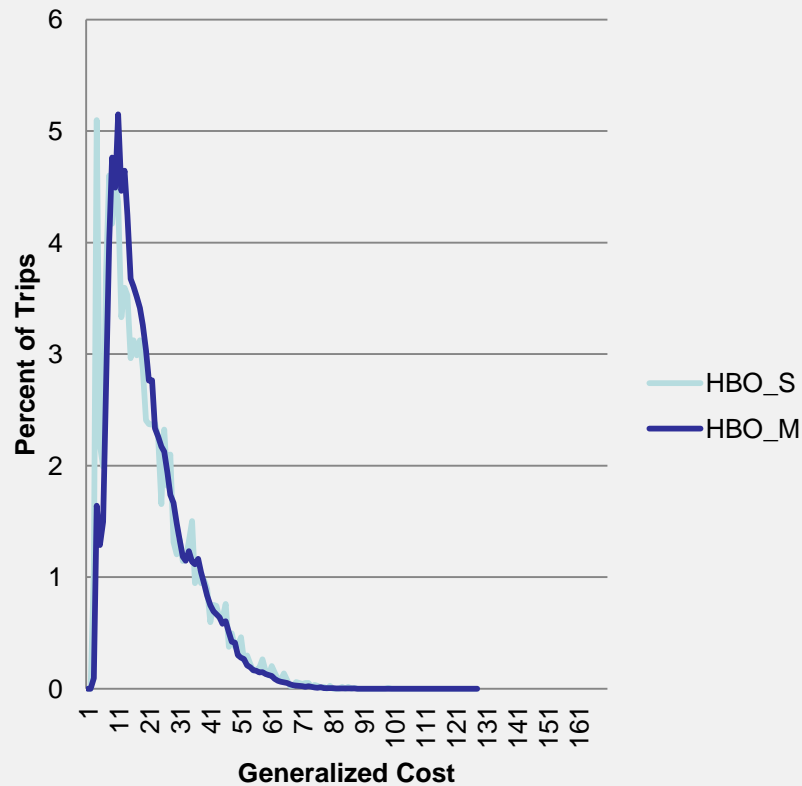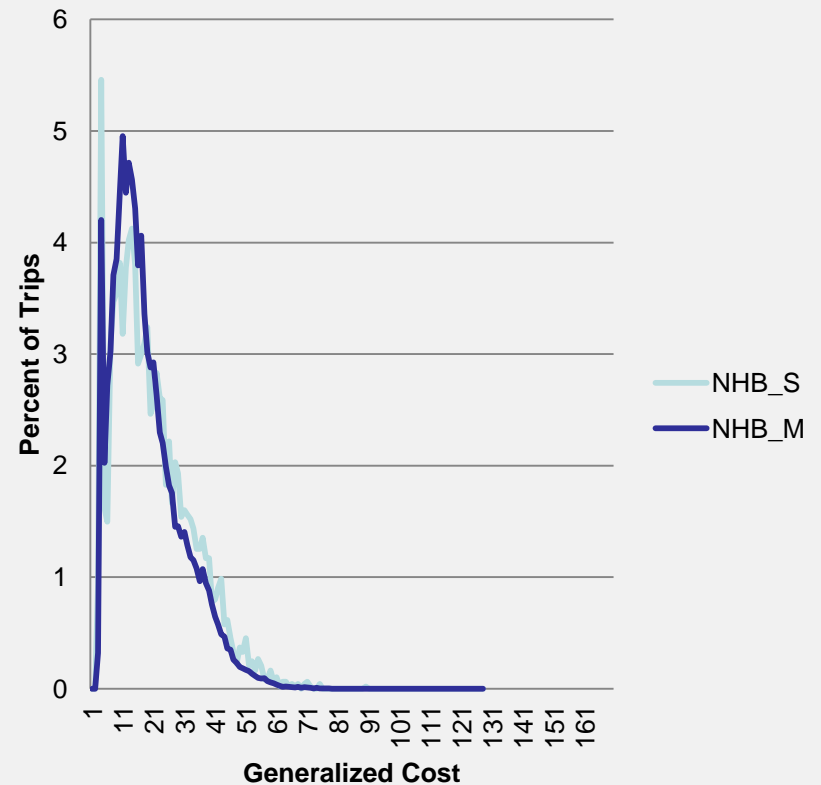**Average Trip Length (Composite Time)**
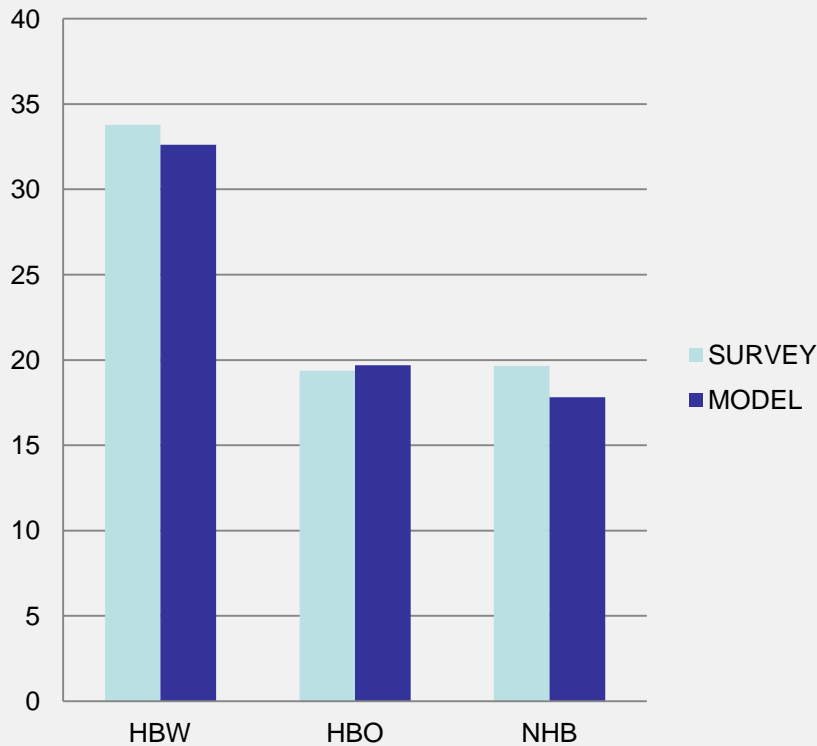
Average Trip Length - HBW

Trip Length Validation (Survey vs. Model)

Journey to Work

ACS JTW (2006-2008)

RESIDENCE		WORKPLACE					
		Clark IN	Floyd IN	Bullitt KY	Jefferson KY	Oldham KY	
Clark	IN	24,275	6,755	140	18,020	295	49,485
Floyd	IN	6,655	14,910	95	12,615	115	34,390
Bullitt	KY	370	270	9,740	23,330	195	33,905
Jefferson	KY	6,365	2,015	3,215	305,805	2,745	320,145
Oldham	KY	235	70	50	15,595	8,190	24,140
		37,900	24,020	13,240	375,365	11,540	

RESIDENCE		WORKPLACE				
		Clark IN	Floyd IN	Bullitt KY	Jefferson KY	Oldham KY
Clark	IN	49.1%	13.7%	0.3%	36.4%	0.6%
Floyd	IN	19.4%	43.4%	0.3%	36.7%	0.3%
Bullitt	KY	1.1%	0.8%	28.7%	68.8%	0.6%
Jefferson	KY	2.0%	0.6%	1.0%	95.5%	0.9%
Oldham	KY	1.0%	0.3%	0.2%	64.6%	33.9%

LSIORB TOD

RESIDENCE		WORKPLACE					
		Clark IN	Floyd IN	Bullitt KY	Jefferson KY	Oldham KY	
Clark	IN	40,527	17,179	422	22,709	474	81,311
Floyd	IN	15,406	31,083	195	10,448	206	57,338
Bullitt	KY	1,021	412	8,360	32,222	750	42,765
Jefferson	KY	18,217	9,215	15,660	548,616	13,776	605,485
Oldham	KY	970	391	543	26,065	10,614	38,583
		76,141	58,280	25,181	640,059	25,820	

RESIDENCE		WORKPLACE				
		Clark IN	Floyd IN	Bullitt KY	Jefferson KY	Oldham KY
Clark	IN	49.8%	21.1%	0.5%	27.9%	0.6%
Floyd	IN	26.9%	54.2%	0.3%	18.2%	0.4%
Bullitt	KY	2.4%	1.0%	19.5%	75.3%	1.8%
Jefferson	KY	3.0%	1.5%	2.6%	90.6%	2.3%
Oldham	KY	2.5%	1.0%	1.4%	67.6%	27.5%

Time of Day Validation

Total VMT by Period
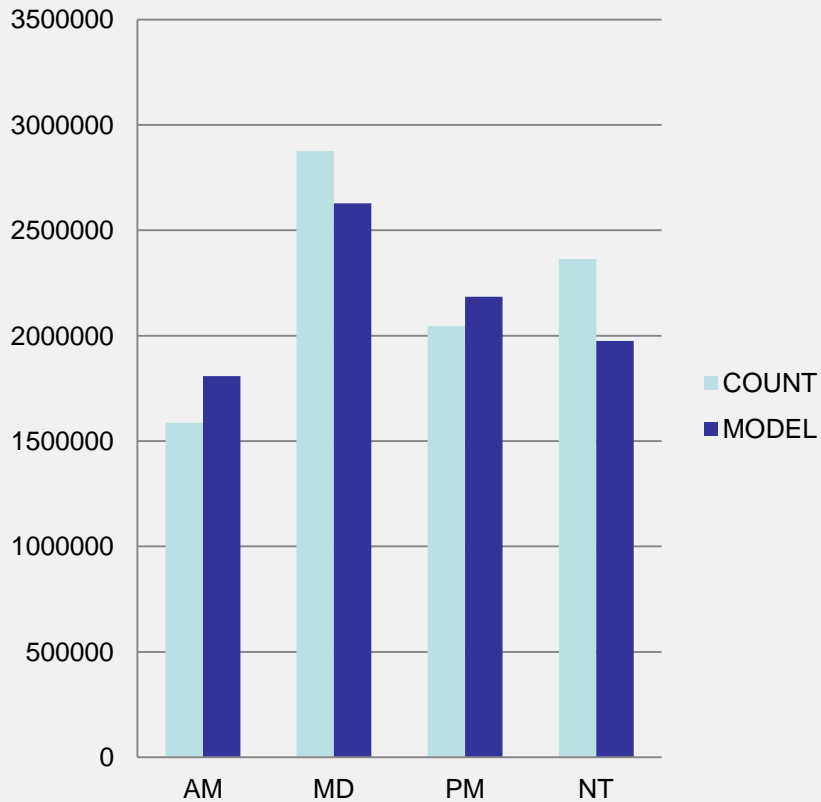
Period	HBW	HBO	NHB	TOTAL	COUNT	MODEL
AM (6 - 9)	21.9%	8.4%	3.1%	9.9%	17.9%	21.0%
Mid (9 - 3)	27.4%	34.5%	47.7%	36.2%	32.4%	30.6%
PM (3 - 6)	17.0%	25.7%	28.7%	24.6%	23.1%	25.4%
Overnight	33.7%	31.4%	20.5%	20.4%	26.6%	23.0%
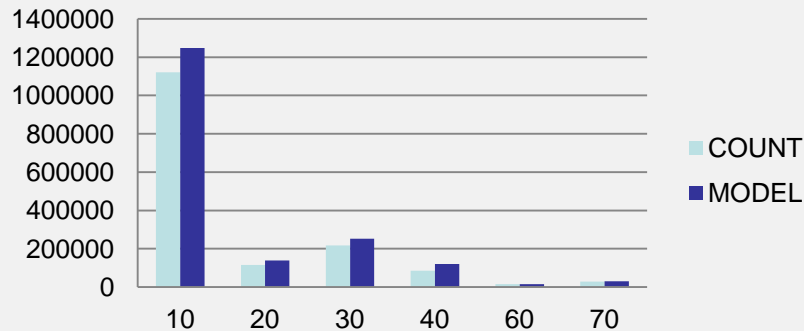
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Time of Day Validation
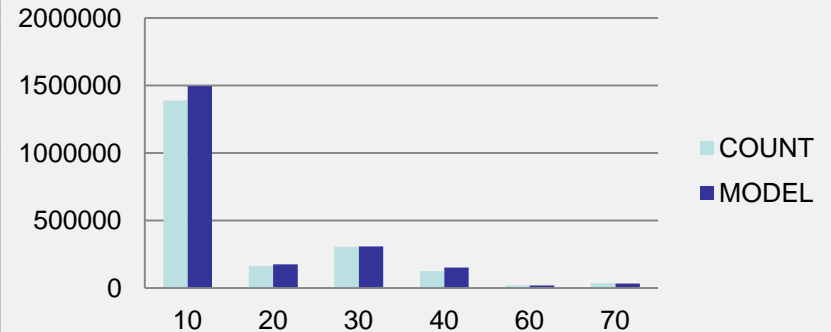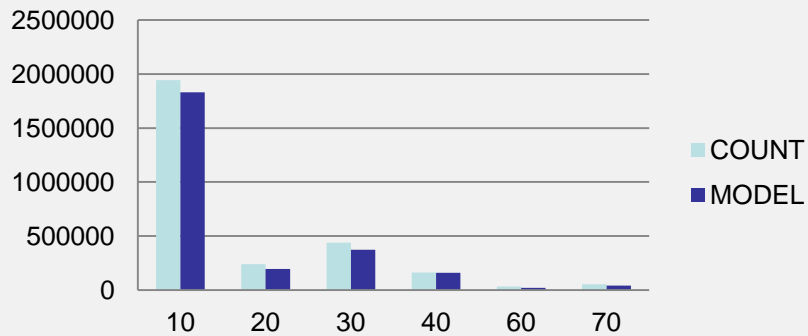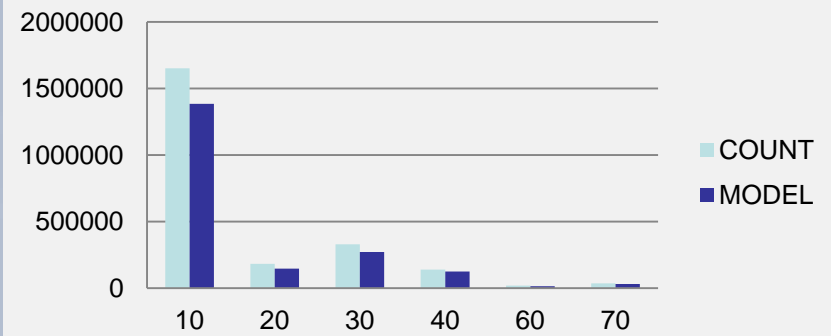
VMT Error by Facility Type

VMT	CRITERIA	09PLANA			LSIORB	
		COUNTS	DAILY	INTRIM	COUNTS	LSIORB
Freeway	7	50	8.96	8.96	181	3.92
Div Art	10	13	2.67	2.72	180	-4.63
UnDiv Art	10	131	1.83	1.39	406	-2.87
External	N/A	53	-7.21	-7.21		
LOCAL	15				350	4.97
One Way	10	9	-12.49	-10.91	90	-11.92
Ramp	15	1	-3.53	-3.33	58	-9.50
Overall	5	257	8.81	8.98	1265	1.52

Facility Type: Absolute VMT Error

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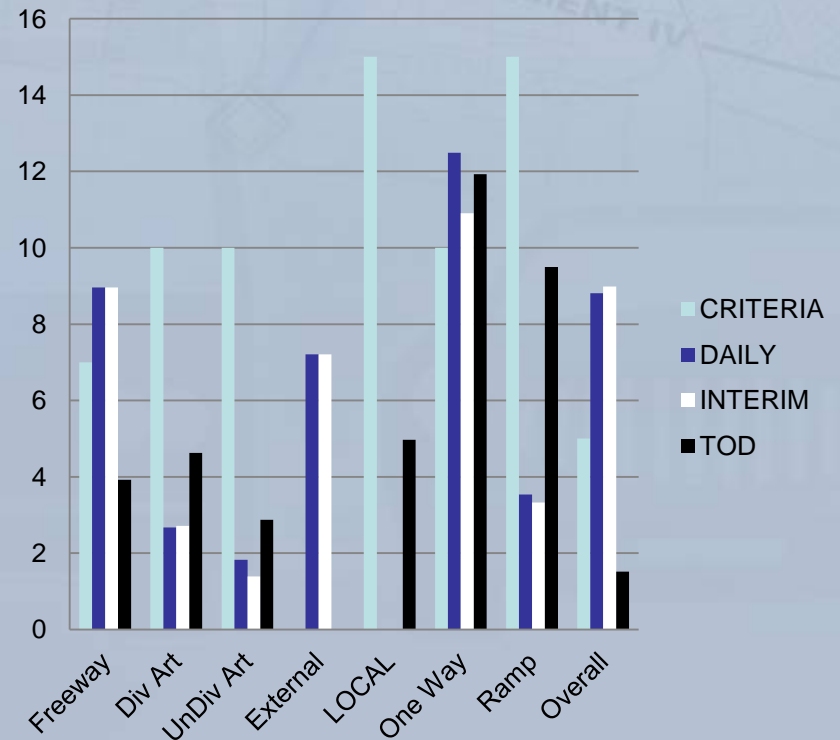
VMT Error by Area Type

AREA	CRITERIA	09PLANA			LSIORB	
		COUNTS	DAILY	INTERIM	COUNTS	LSIORB
11	10	2	1.51	-1.96	44	-11.09
12	10	2	7.20	5.98	12	2.67
21	10	11	0.63	0.39	53	7.18
31	10	37	-23.91	-22.91	211	-5.44
41	10	101	0.23	0.29	601	-1.40
43	10	12	44.60	45.24	61	-3.23
45	10	2	174.78	173.60	26	3.57
51	10				6	-1.82
53	10	7	46.65	46.28	36	-7.51
55	10	83	22.85	22.50	217	12.32

Area Type: Absolute VMT Error

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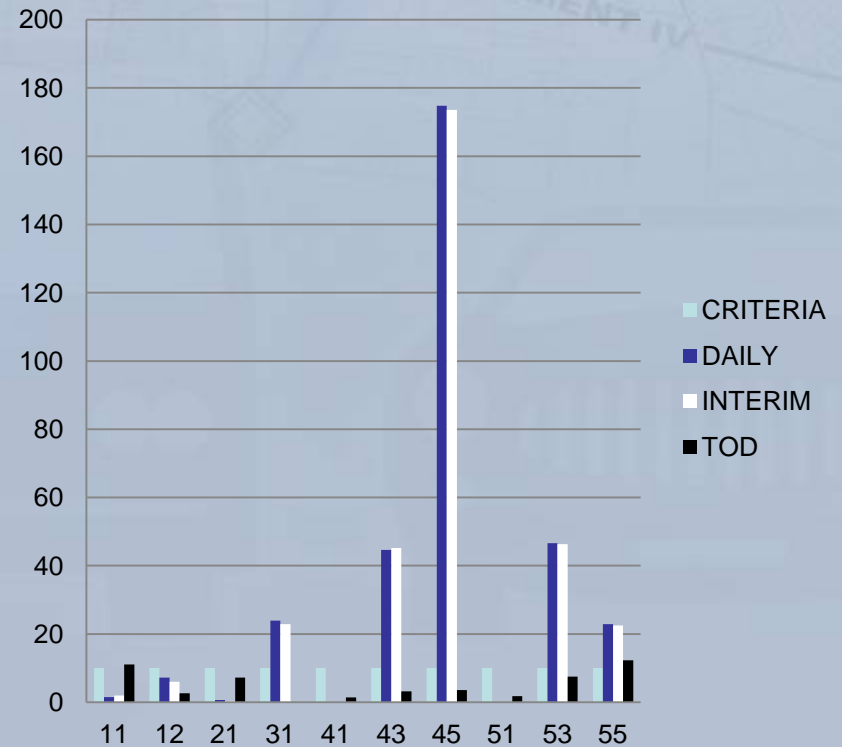
VMT Error by County

COUNTY	CRITERIA	09PLANA			LSIORB	
		COUNTS	DAILY	INTERIM	COUNTS	LSIORB
Bullitt	10	31	30.95	30.89	98	13.10
Clark	10	28	-17.89	-18.48	184	11.01
Floyd	10	12	-16.64	-16.93	119	1.69
Jefferson	10	110	5.92	6.27	772	-1.71
Oldham	10	23	36.76	36.41	92	6.83

County: Absolute VMT Error

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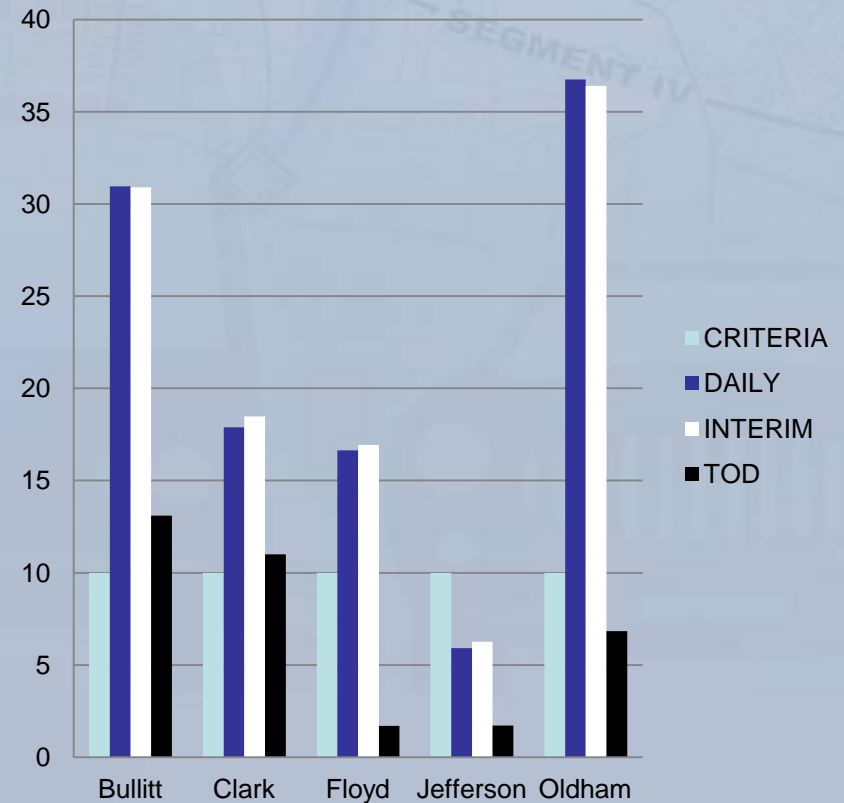
Percent RMSE by Volume Group

VOL_CLASS	CRITERIA	09PLANA			LSIORB	
		COUNTS	DAILY	INTERIM	COUNTS	LSIORB
Overall		263	51.51	51.54	1266	35.10
<1,000	151	25	122.46	122.50	76	170.77
1,000-2,500	134	28	89.09	89.05	120	91.26
2,500-5,000	80	28	72.94	73.29	163	68.61
5,000-10,000	65	46	74.56	73.78	316	53.86
10,000-25,000	59	73	48.65	48.63	388	33.94
25,000-50,000	37	48	41.74	41.88	167	17.60
50,000+	41	15	22.74	22.56	36	16.42

Percent RMSE
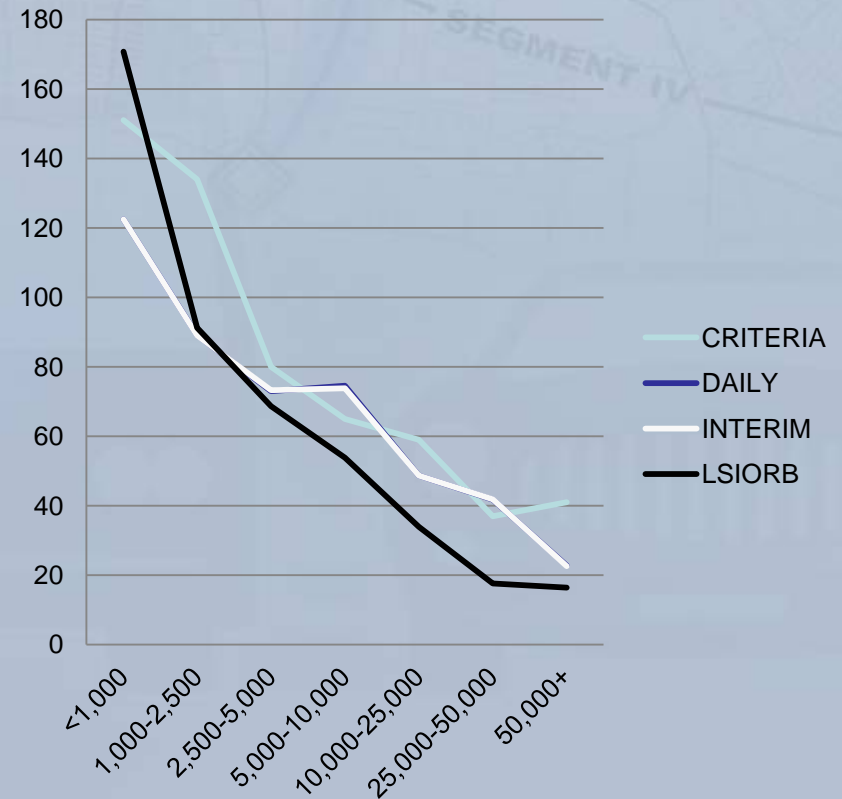
ADT Screenline – Ohio River

Bridges	09PLANA			LSIORB	
	2000	DAILY	INTERIM	2007	LSIORB
I-64EB	40,400	43,354	40,282	38,370	41,291
I-64WB	40,400	43,258	40,641	38,370	40,419
Clark Mem	19,600	17,723	19,908	21,906	13,520
I-65 SB	62,375	65,622	64,877	60,711	61,515
I-65 NB	62,375	61,000	65,481	60,711	63,640
TOTAL	225,150	230,957	231,189	220,068	220,384

Daily ADT by Bridge

Count vs. Model Flow

Forecast Development

ID	Intersection Name
1	Mellwood at Spring
2	Mellwood at I-64 EB
3	Mellwood at I-64 WB
4	Mellwood at Frankfort
5	Story at Frankfort
6	Story at I-64 WB
7	Story at I-64 EB
8	Story at Spring
9	3rd St at River Rd/I-64 WB
10	2nd Stat River Rd/I-64 EB
11	Jefferson at Brook
12	I-65 SB at Jefferson
13	Jefferson at Floyd
14	Jefferson at Preston
15	Liberty at I-65 NB
16	Liberty at Preston
17	Muhammad Ali at Preston
18	Muhammad Ali at I-65 NB
19	Muhammad Ali at I-65 SB
20	Muhammad Ali at Floyd

LEGEND

Intersection Turning Movement
Forecast Needed

KENNEDY INTERCHANGE
IN-PLACE ALTERNATIVE
TRAFFIC FORECAST NEEDS

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Forecast Development

- Network Development
  - Based on 09PlanA Kennedy Interchange
  - Highway improvements based on Horizon 2030 Project List
  - Transit routes added to the 2030 network

- Socioeconomic Data
  - 2030 10PLANA Assumptions

- Externals
  - Forecasts based on historical counts, and KIPDA assumptions
  - EE based on expanded video OD results

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Credits

- KYTC – Gary Valentine, Amy Thomas and Scott Thomson

- KIPDA – Andy Rush and Randy Simon

- CTS – Anthony Pakeltis

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