Multi-Resolution Modeling with DTA
Existing Deployments

A Information Sharing Workshop for Dynamic Traffic Assignment

Yi-Chang Chiu, Eric Pihl, Nick Renna

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Resource Center, Michigan Division
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Who else are using DTA (Federal)?

- FHWA - Integrated Corridor Management
  - 2 out of 3 pioneering sites (Minneapolis and Dallas)
- FHWA – Exploratory Advanced Research Program
  - Integrating land-use, activity-based model and DTA
- FHWA – Real-Time Traffic Estimation and Prediction
  - TrEPS – for real-time ITS based active traffic management

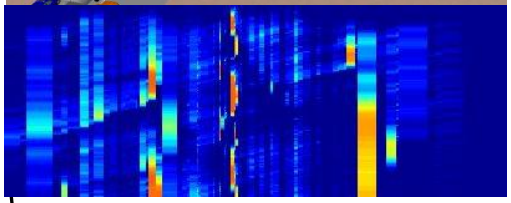
Who else are using DTA (Federal)?

- TRB – Strategic Highway Research Program (SHRP2)
  - **C04** - Improving Our Understanding of How Highway Congestion and Pricing Affect Travel Demand
  - **C05** - Understanding the Contribution of Operations, Technology, and Design to Meeting Highway Capacity Needs
  - **C10** - Partnership to Develop an Integrated, Advanced Travel Demand Model and a Fine-Grained, Time Sensitive Network
  - **L04** - Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools
  - **R11** - Strategic Approaches at the Corridor and Network Level to Minimize Disruption from the Renewal Process

Who else are using DTA (Federal)?

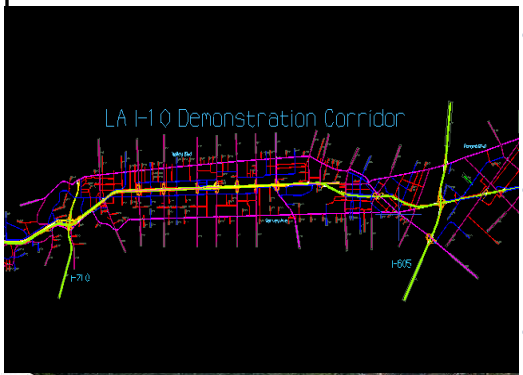
- EPA – Motor Vehicle Emission Simulators (MOVES)
  - "When fully implemented, MOVES will serve as the replacement for MOBILE6 and NONROAD for all official analyses associated with regulatory development, compliance with statutory requirements, and national/regional inventory projections."
  - Official released Fall 2009
  - Tighter integration with regional traffic simulation models

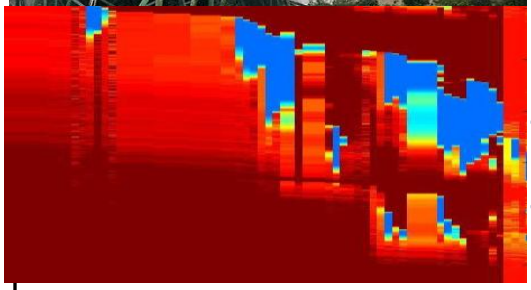
Who else are using DTA (States)?



- IH corridor improvement (North Carolina)
- IH work zone planning (ELP, TX-2004)
- Evacuation operational Planning (Houston, TX, 2007, Baltimore, MD, 2005, Knoxville, TN, 2003)
- Florida turnpike system traffic and evacuation analysis (FDOT Turnpike)
- Downtown improvement (ELP, TX, 2004)
- ICM AMS modeling (Bay Area, CA, 2007)

Who else are using DTA (States)?





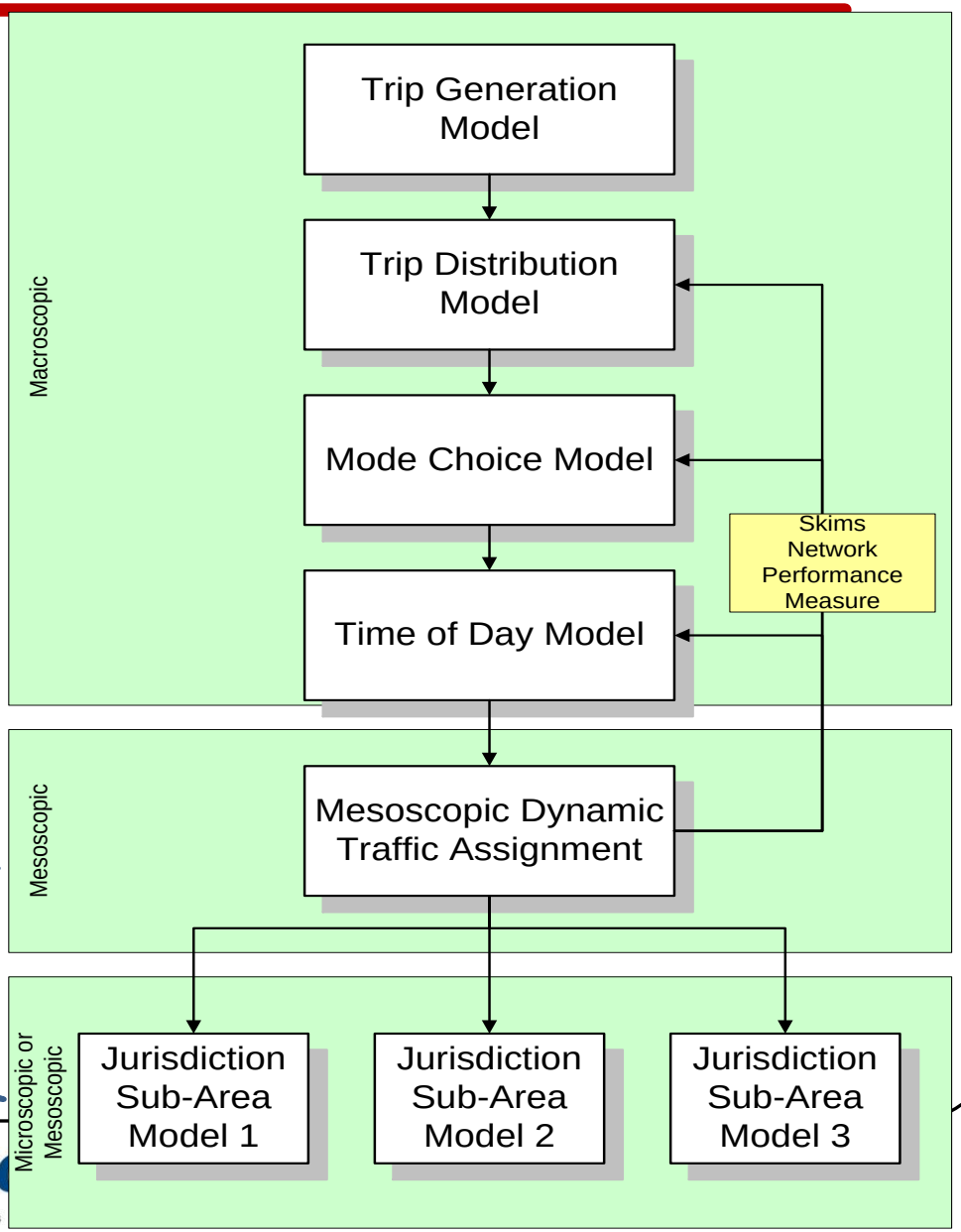
- **Military deployment transportation improvement in Guam** (PB, **FHWA**)
- **Interstate highway corridor improvement** (TTI, **TxDOT**, **ELPMPO,** Kittleson**, ADOT**)
- **Value pricing** (ORNL, **FHWA**; SRF, **Mn/DOT**, TTI, **TxDOT**, UA, **CDOT/DRCOG**)
- **Evacuation operational planning** (TTI, **TxDOT**, UA, **ADOT**; LSU, **LDOT**; Noblis, **FHWA**; Univ. of Toronto, Cornell Univ. Jackson State Univ., **MDOT**, Univ. of Missouri, **MDOT**)
- **Integrated Corridor Management modeling** (CS, **FHWA**, **MAG**, NCSU, **NCDOT**)
- **Pilot studies** (Portland Metro, DRCOG)
- **Activity-based model integration** (UA/CS, **SHRP2 C10**, **FHWA EARP**)
- **Work zone impact management** (**SHRP2 R11**)

Compatibility with Existing Modeling Framework

- Trip-based framework
  - Replace static assignment
  - Sub-area analysis in micro traffic models
  - Relative standard

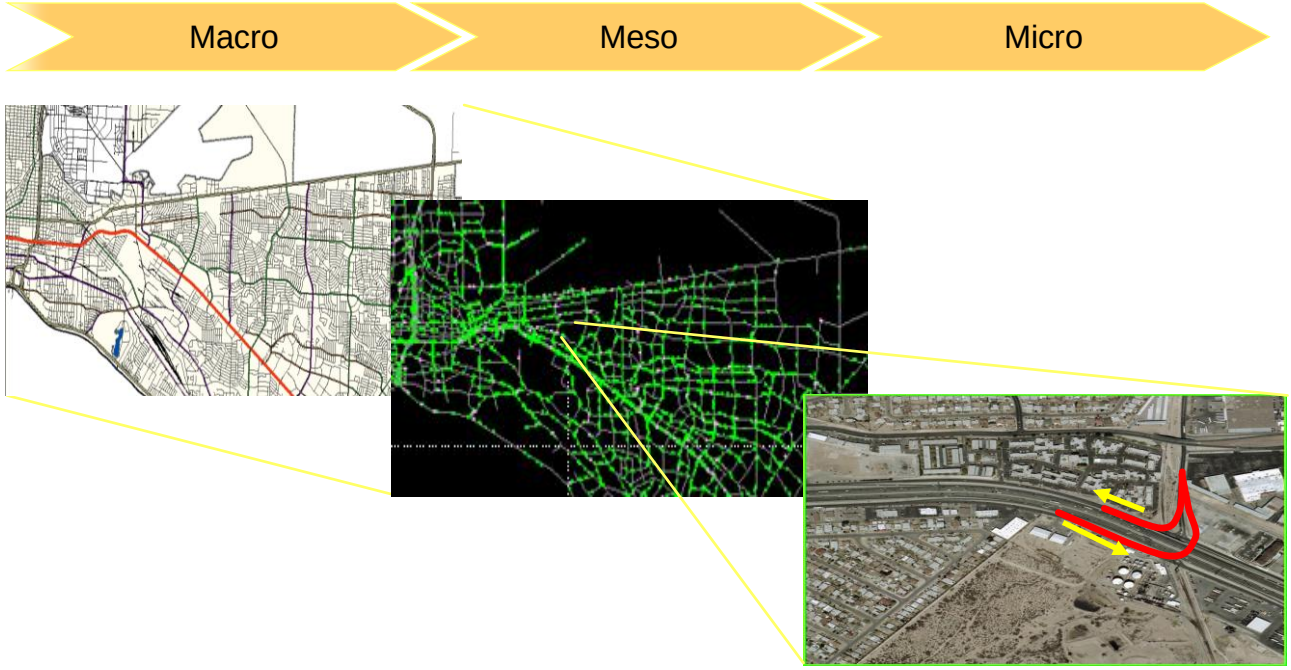
Strategic Modeling

Mission-Driven Modeling



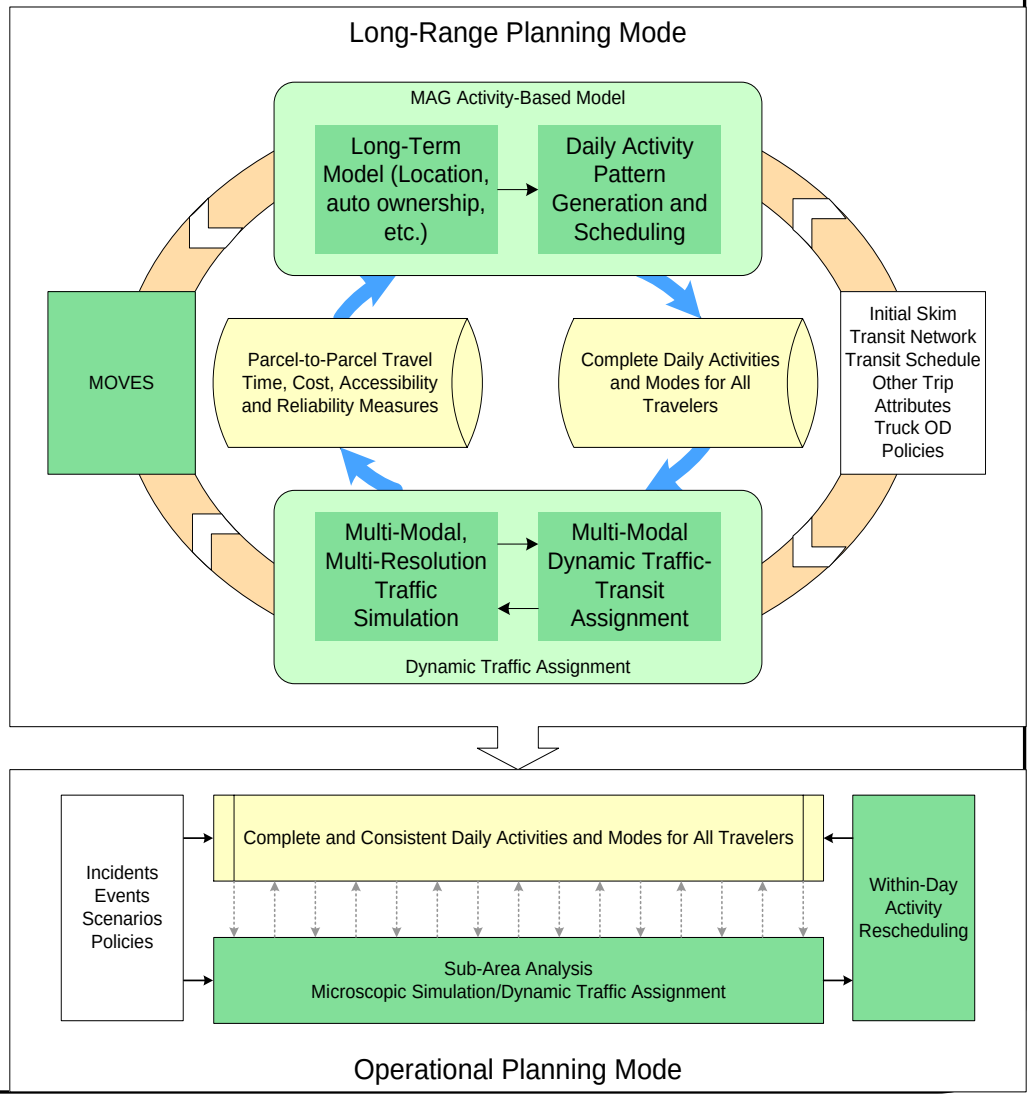
Capability Expansion not Replacement

- Multi-Resolution Modeling - Synergize existing model capabilities
  - Dynamic view of entire system
  - Rapid and consistent sub-area analyses



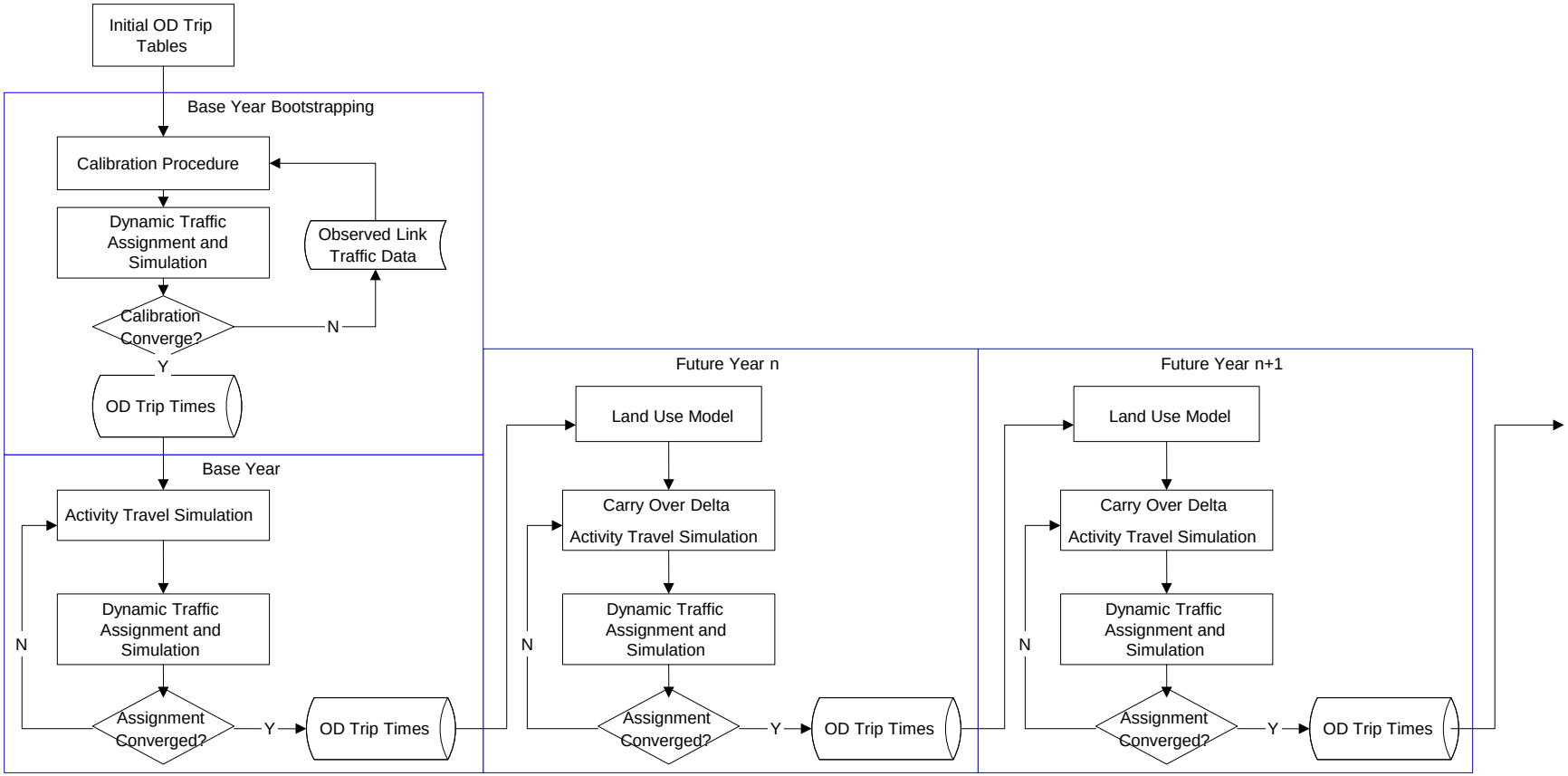
Compatibility with Existing Modeling Framework

- Activity-Based Model
  - Customization needed
  - Due to diversified ABM model structure
- Expanded opportunities for addressing both planning and operations issues
- SHRP2 C10 open source, completed in 2012 (DAYSIM-DynusT)



UrbanSim-OpenAMOS-MALTA/DynusT

- Evolutionary modeling, completed in 2011



What is Multi-Resolution Modeling (MRM)?

- Integrating macro, meso and micro traffic analysis tools with different levels of resolution and capabilities for the purpose of achieving a specific goal
  - Analyze network at both the system-wide and localized levels simultaneously

	Dynamic		Static
	0.1-1 second	5-10 seconds	
Intersections	Micro Sim		
Corridor	Micro Sim	DTA	
Regional		DTA	TDM

What is Multi-Resolution Modeling (MRM)?

- Addresses issues that may fall beyond the reach of both:
  - Macroscopic models: large scale but static
  - Microscopic models: dynamic but small-scale
  - DTA: dynamic and large-scale
- The scenarios of interest may result in shifts of network or corridor-wide traffic flow patterns
  - Significant change to roadway configuration
  - Certain corridor management strategies

- Many commercial packages allow us to perform microscopic analysis by extracting sub-area directly from TDM, why do we need DTA as the "middle man?"
- To answer this, let's look at the following question:

Which of the following best explain v/c>1

1. It should not have happened in model as in real life volume cannot exceed capacity
2. "V" actually means demand assigned or wanting to use the facility. v/c > 0 means demand exceeds capacity and congestion would occur
3. V/C is just the output of the TDM. It does not mean much

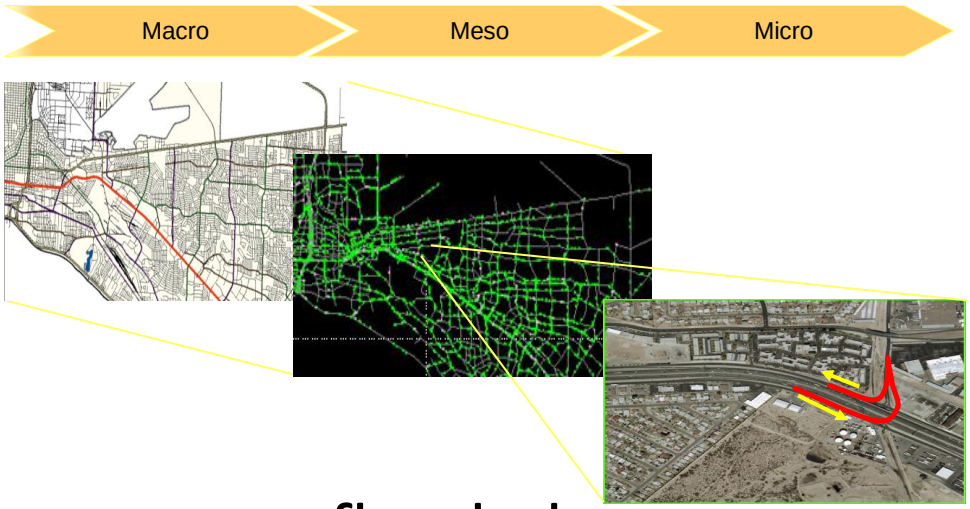
0%

15

0 of 30

Issue with Macro-Micro Integration

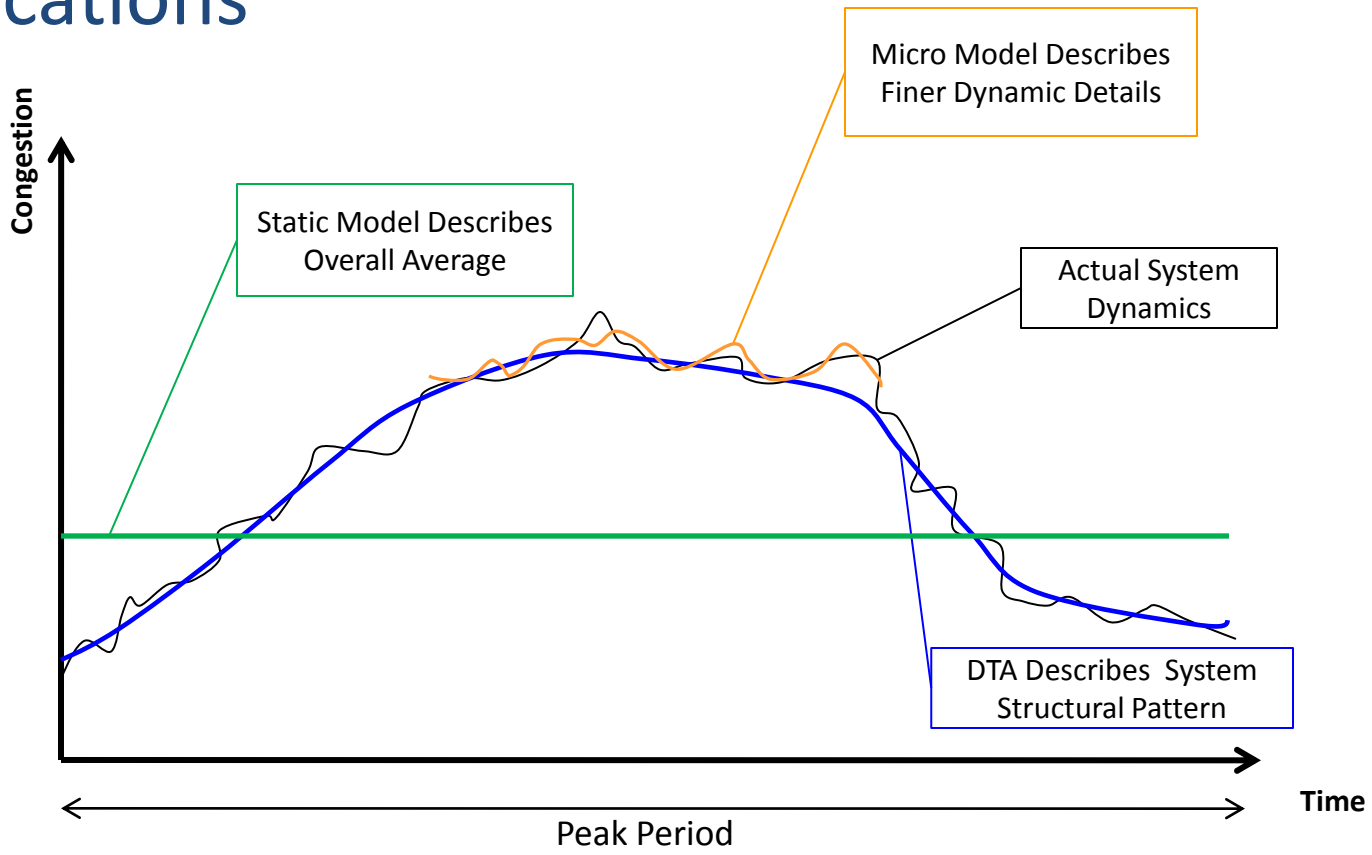
- OD flow arriving at boundary of sub-area is not constrained by roadway capacity outside the sub-area



- Consequences
  - Too much demand, sub-area over flooded
  - Hand-tweaking as calibration in baseline case
  - Min prediction power for future year cases

Macro-Meso-Micro

- Bridge macro and micro for a wide range of applications



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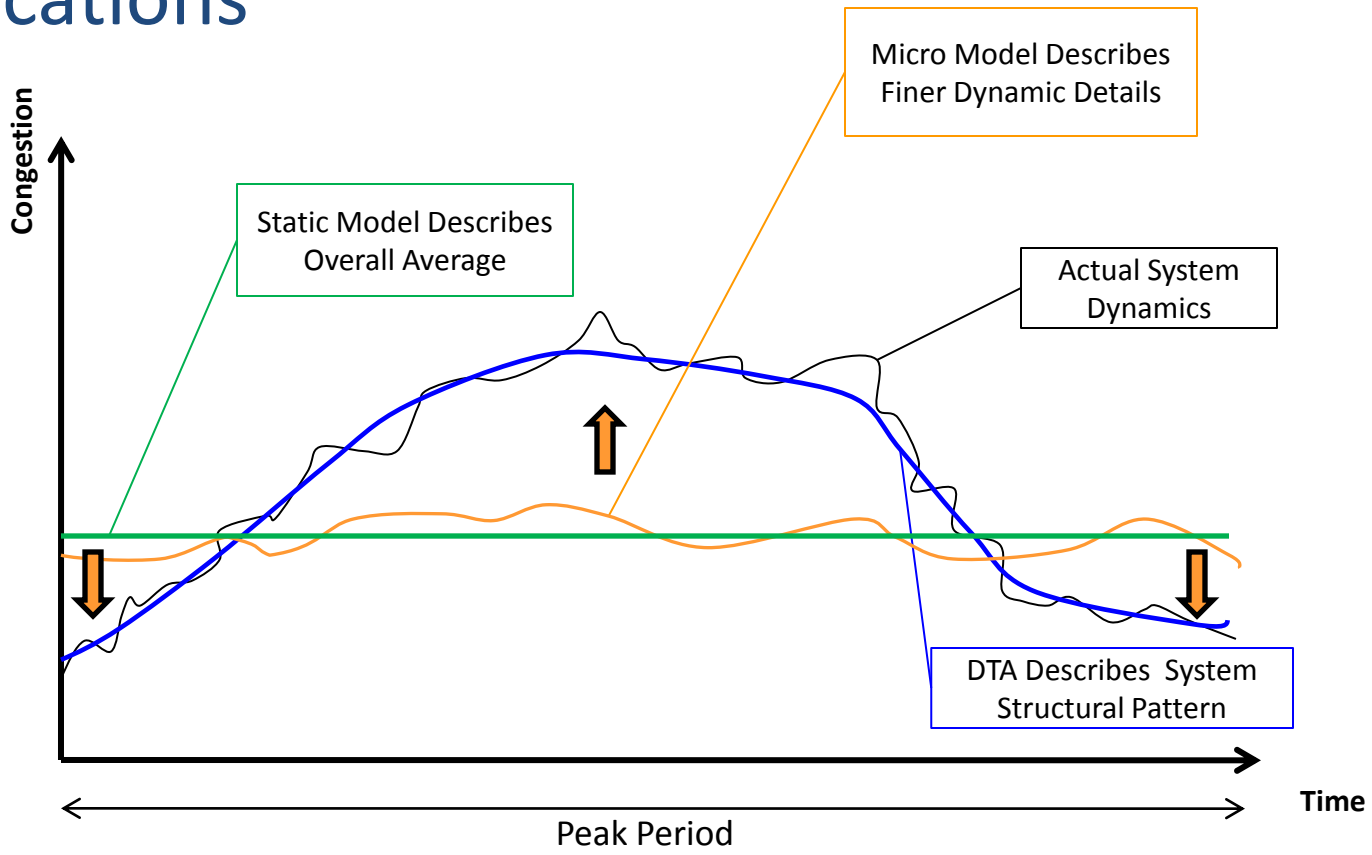

Capability Expansion not Replacement

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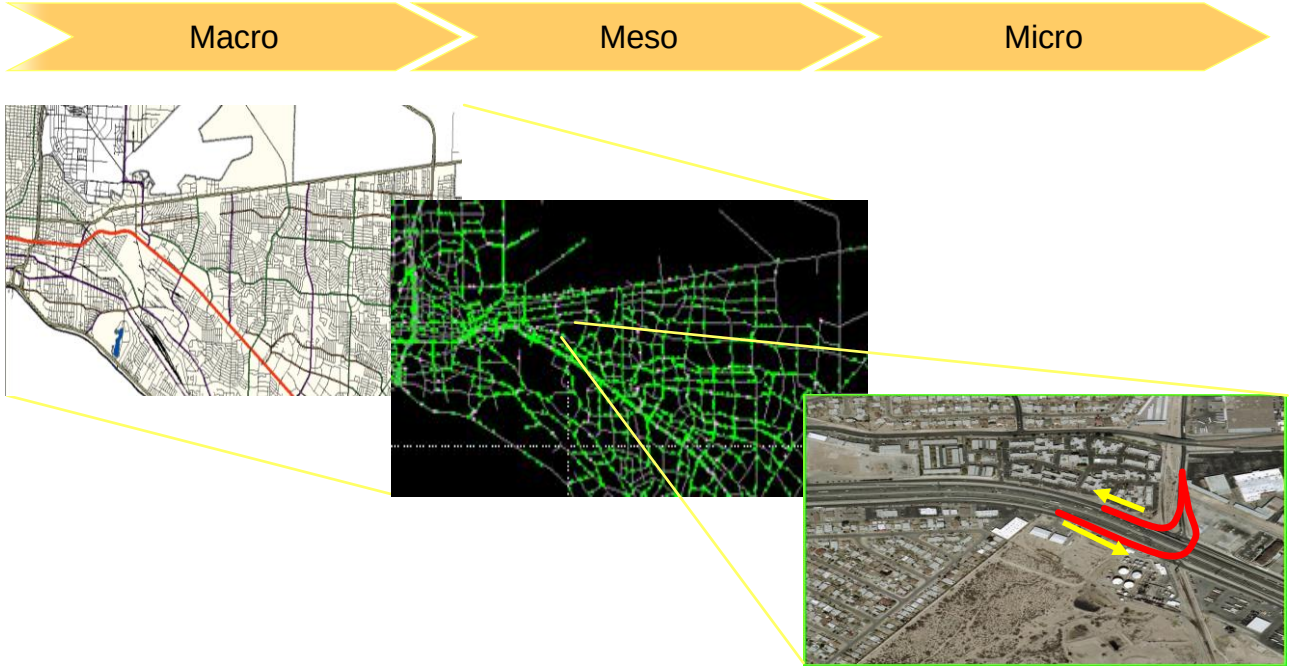


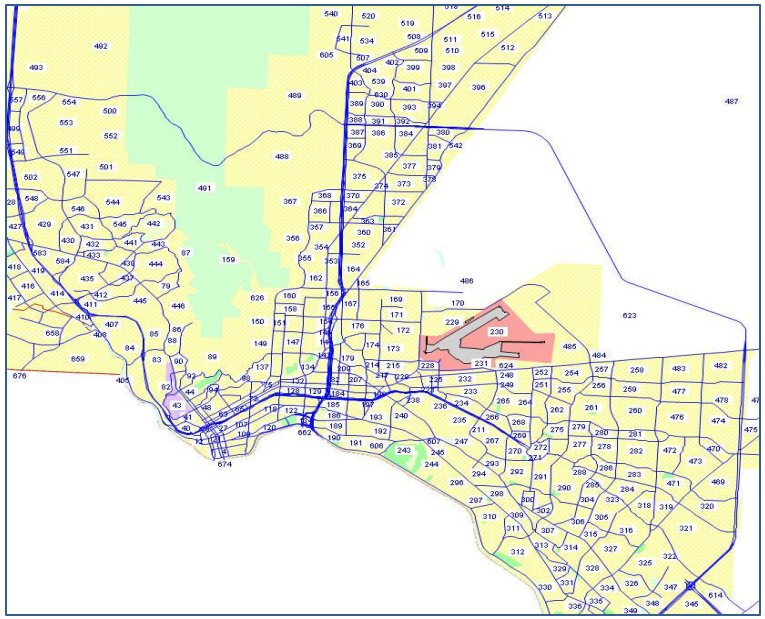
Why is MRM Important?

- Macro, meso and micro models are not mutually exclusive
- They are complimentary to one another and can accomplish optimal modeling capabilities
- Retain the best characteristics of each model
  - Incorporate multiple trip purposes
  - Realistic representation of regional traffic in baseline and future years
  - Provide realistic inputs to micro models
  - A wide range of visual representation of model outputs

A Recent MRM RFP (DVRPC)

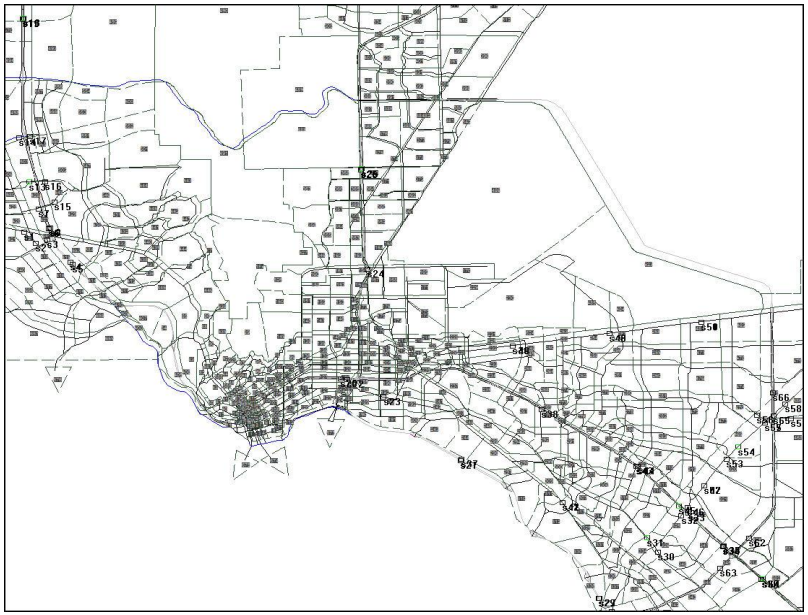
- See RFQ

Network Conversion



TDM

Links
Nodes
Zones

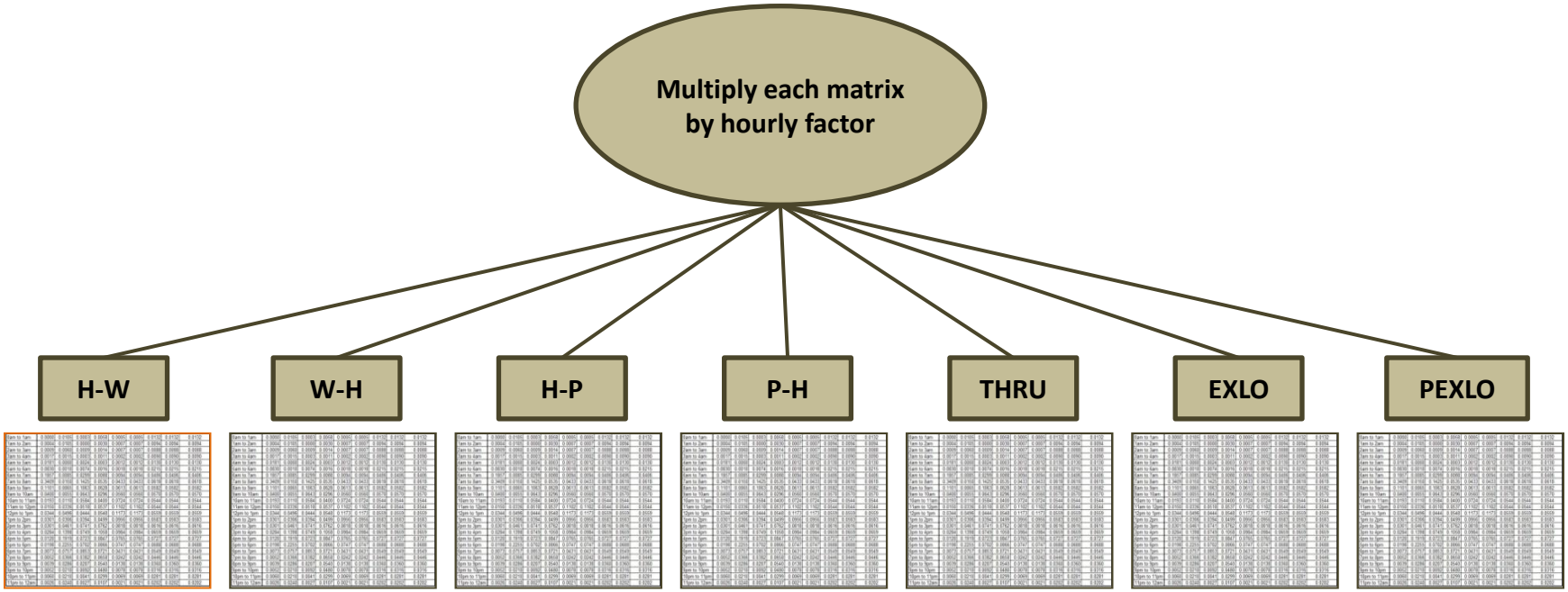


DTA model

Network Conversion

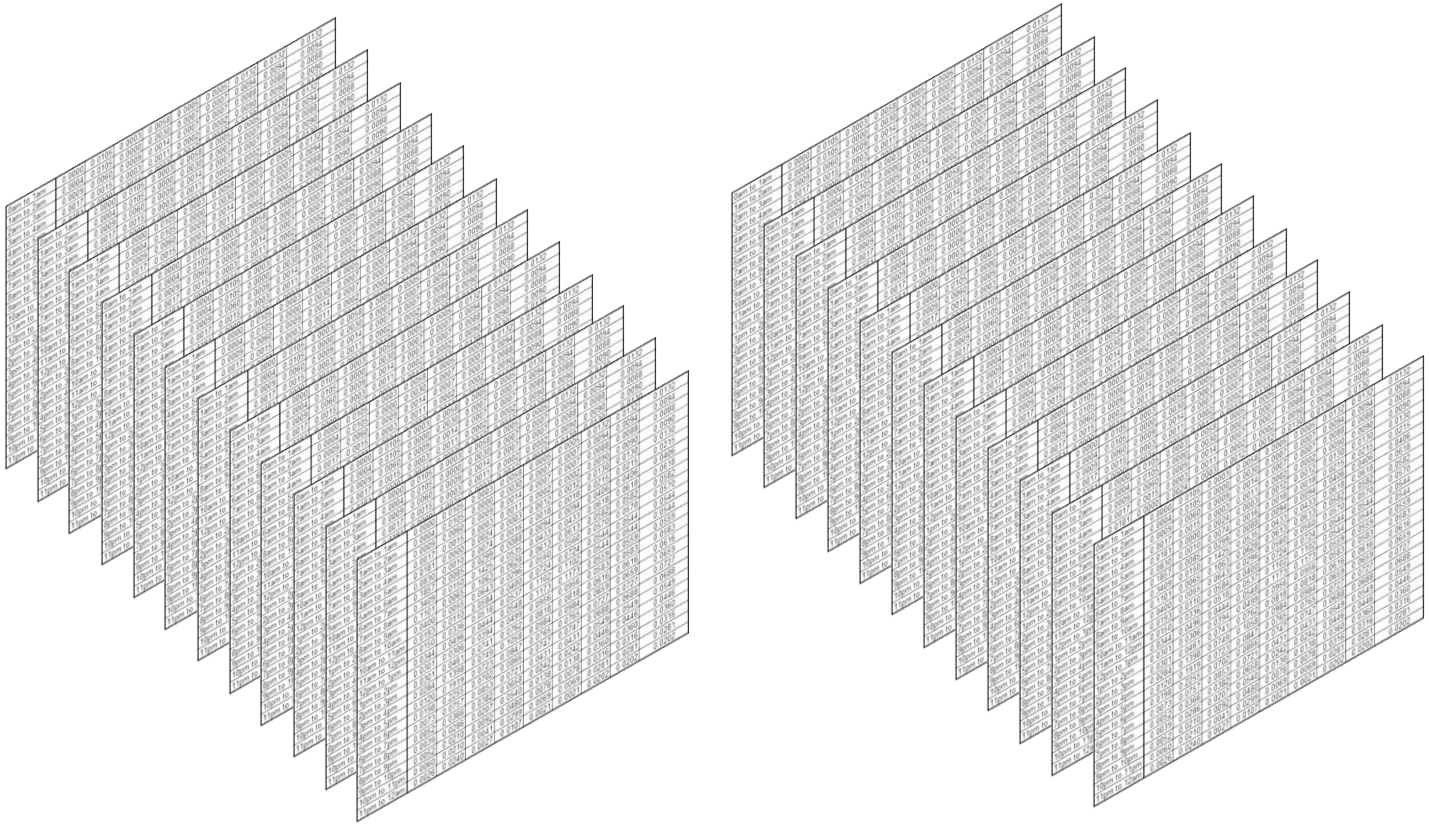
- Convert the GIS layer of the travel demand model to mesoscopic format
- Disaggregate 24-hour matrix based upon car & truck
  - Home to work
  - Work to home
  - Home to private
  - Private to home
  - Thru
  - External local
  - Non-home based external local
- Multiply each matrix by corresponding hourly factor

Network Conversion



Summation of matrices gives you directional 1-hour matrix

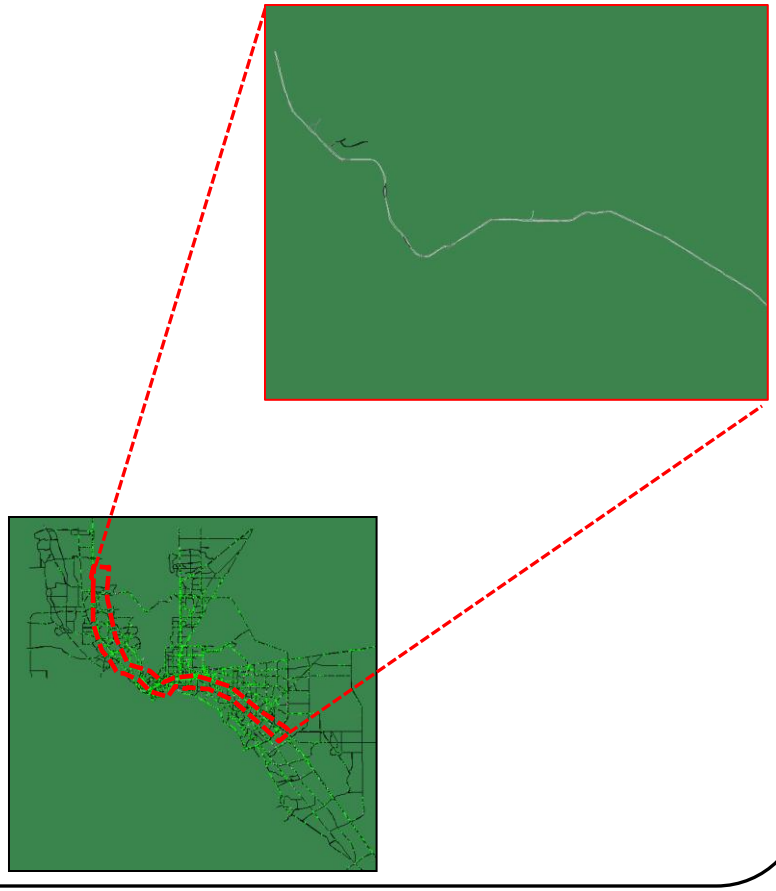
Network Conversion



24 - one hour matrices

Network Conversion

- Network run to DUE
- Sub-area cut
  - Remove unneeded sections of network
  - Renumbering of new zones, nodes and links
  - Retain paths and flows that travel through the sub-area

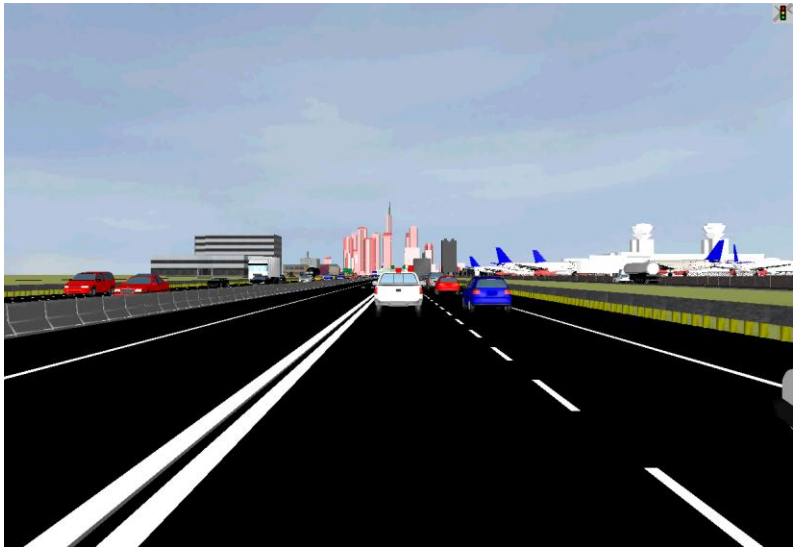


Network Conversion

- Meso-Micro Converter
  - Developed by researchers from TTI and UA
  - Converts roadway network to Macro network
  - Retains network geometry
  - Converts all time-dependent paths and flows
  - Creates separate transportation systems (car, truck)

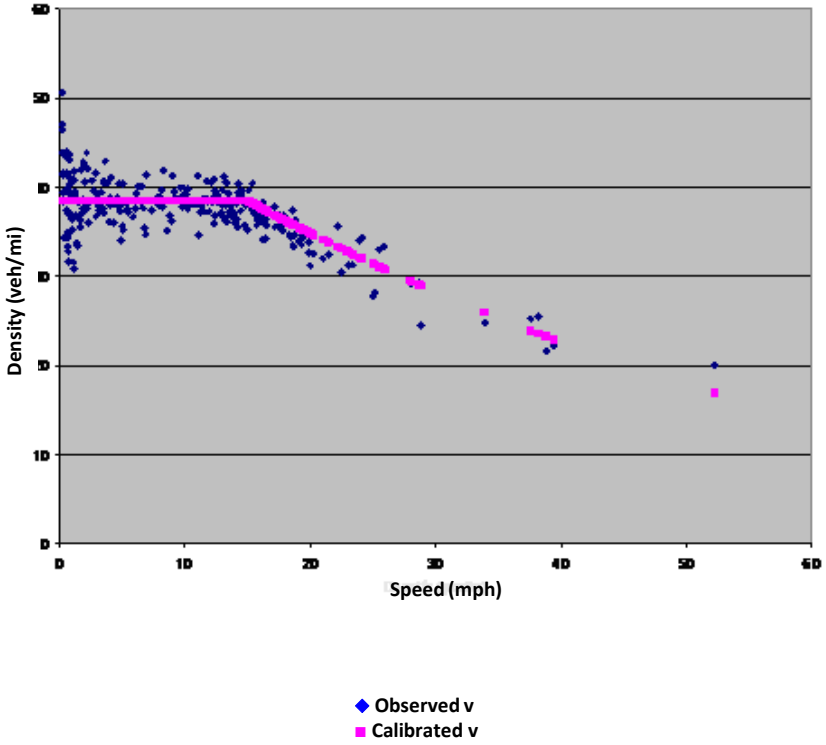
Network Conversion

- Microscopic model
  - Calibrate Micro model to reflect realistic roadway conditions
  - Perform detailed “fine-grained” analyses
    - Speed profile for individual lanes
    - Lane-changing behaviors
    - Vehicle interactions at merge areas
  - Create 3-D graphics for presentations



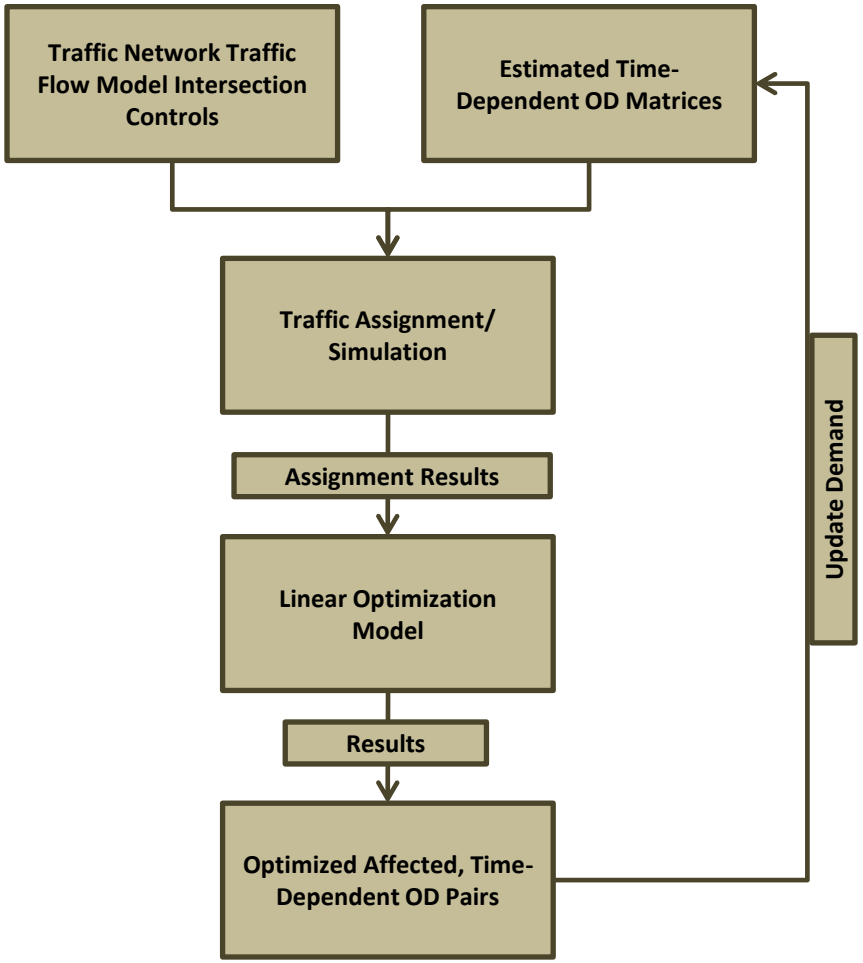
Calibration

- Traffic flow model
  - Traffic simulation in DynusT is based upon the Anisotropic Mesoscopic Simulation (AMS) model
  - Moves vehicle based upon speed-density (v-k) relationship
  - v-k relationship is derived from Greenshields equation



Calibration

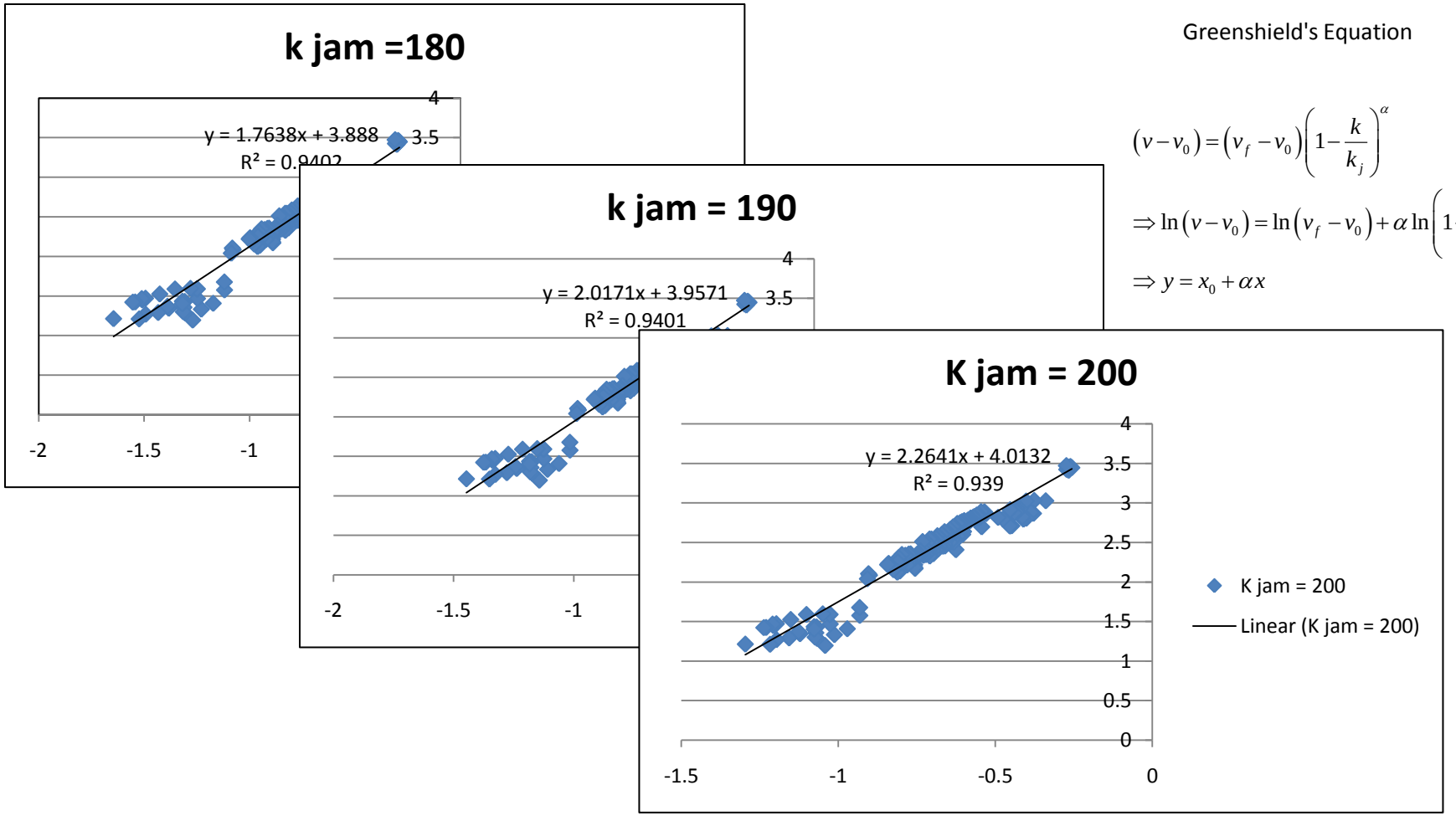
- Time-dependent OD
  - Minimize the deviation between simulated and actual screen line counts & speed profile
  - Iterative process
  - Program solves linearized quadratic minimization problem
  - Results in updated OD matrices



Consistency

- Network
  - Lane configuration
  - Geometric design
- Paths and flows
  - Verify same origin/destination paths
  - Verify number of vehicles generated
- Speed profile
  - Perform field data collection to determine speed and vehicle counts
  - Obtain v-k curve from simulation output
  - Calibrate models with field data

Consistency



Greenshield's Equation

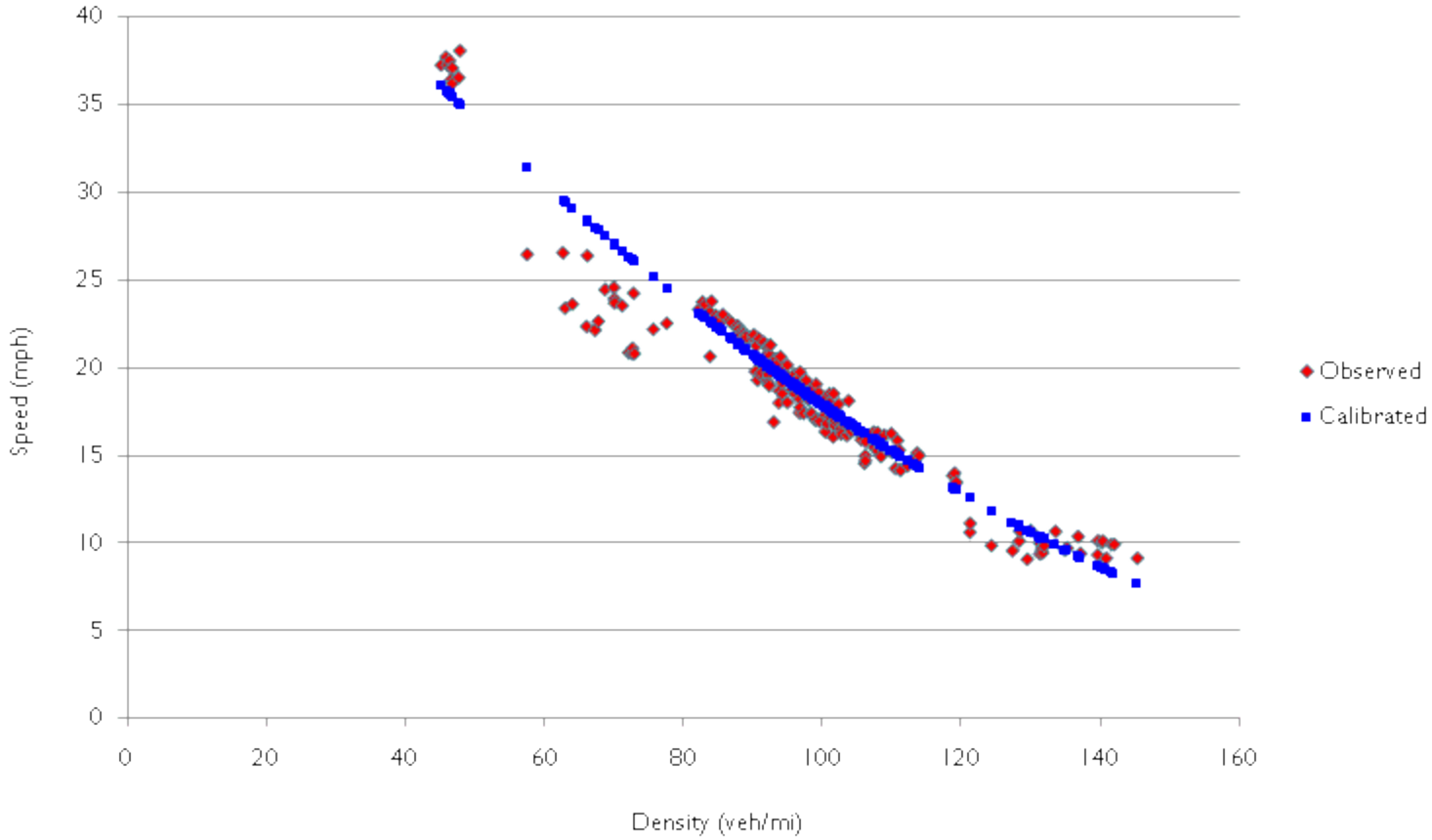
$$(v - v_0) = (v_f - v_0)\left(1 - \frac{k}{k_j}\right)^{\alpha}$$

$$\Rightarrow \ln(v - v_0) = \ln(v_f - v_0) + \alpha \ln\left(1 - \frac{k}{k_j}\right)$$

$$\Rightarrow y = x_0 + \alpha x$$

The density at which traffic stops

Consistency



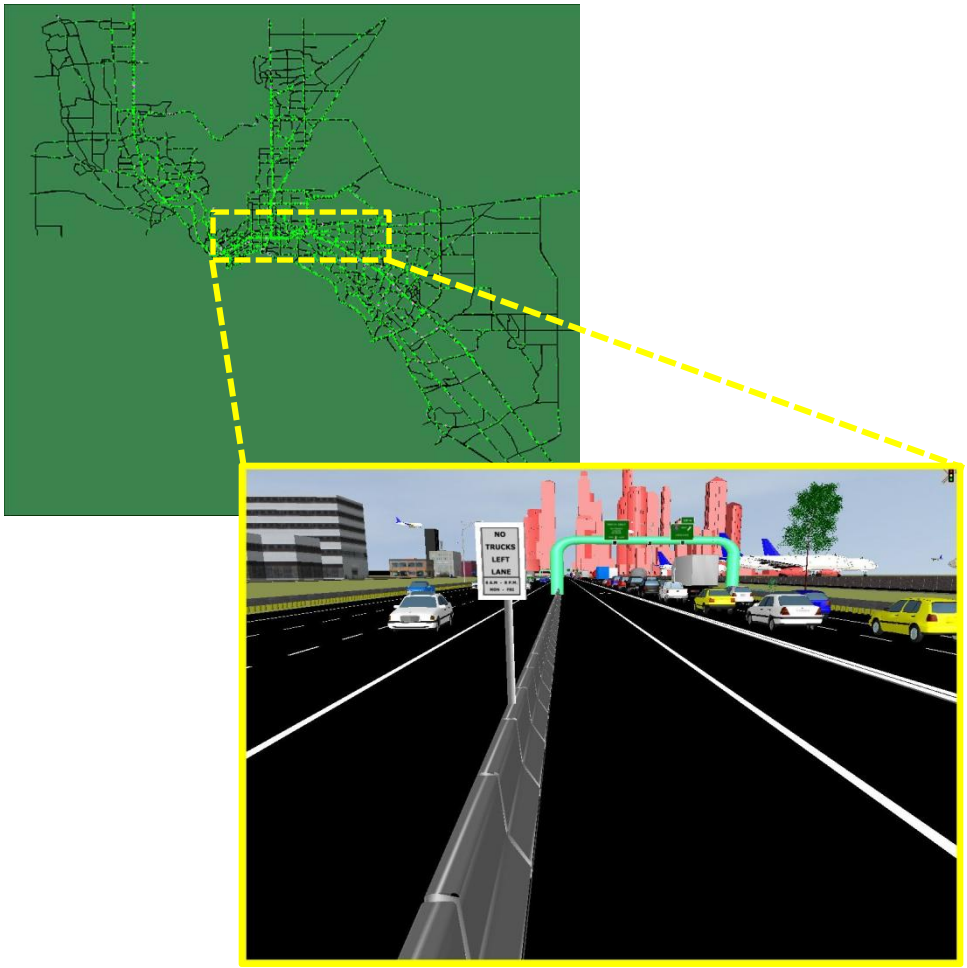
Speed profile calibrated with field data

Case Study 1 – Truck Restricted Lanes (TTI)

- Analyze the effectiveness of restricting trucks from left-most fast lane on freeway
- 22-mile corridor of I-10 in El Paso, TX
- Analyze a.m. peak, p.m. peak, & mid-day
- Determine benefits
  - Speed on left-most lane
  - Acceleration/Deceleration patterns
  - Vehicle interactions at merge areas
  - Does grade play a significant role on truck speeds?
- How should we model this?

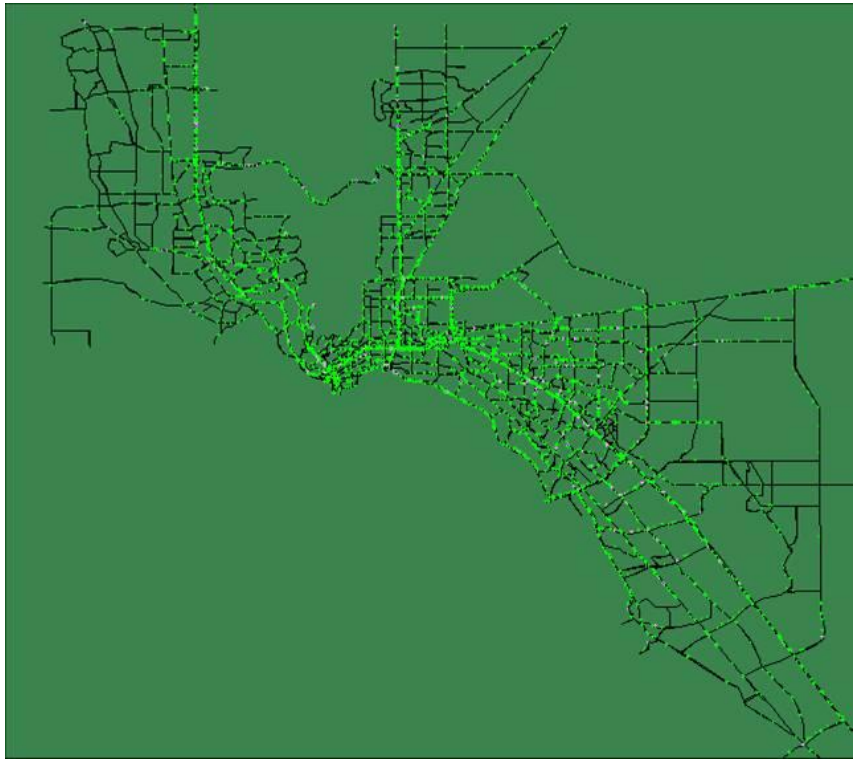
Case Study 1 – Truck Restricted Lanes (TTI)

- DTA model estimates region-wide truck and car trajectories (time-dependent paths and flows)
- Micro model gives detailed I-10 truck lane operations with truck trajectories



Case Study 1 – Truck Restricted Lanes (TTI)

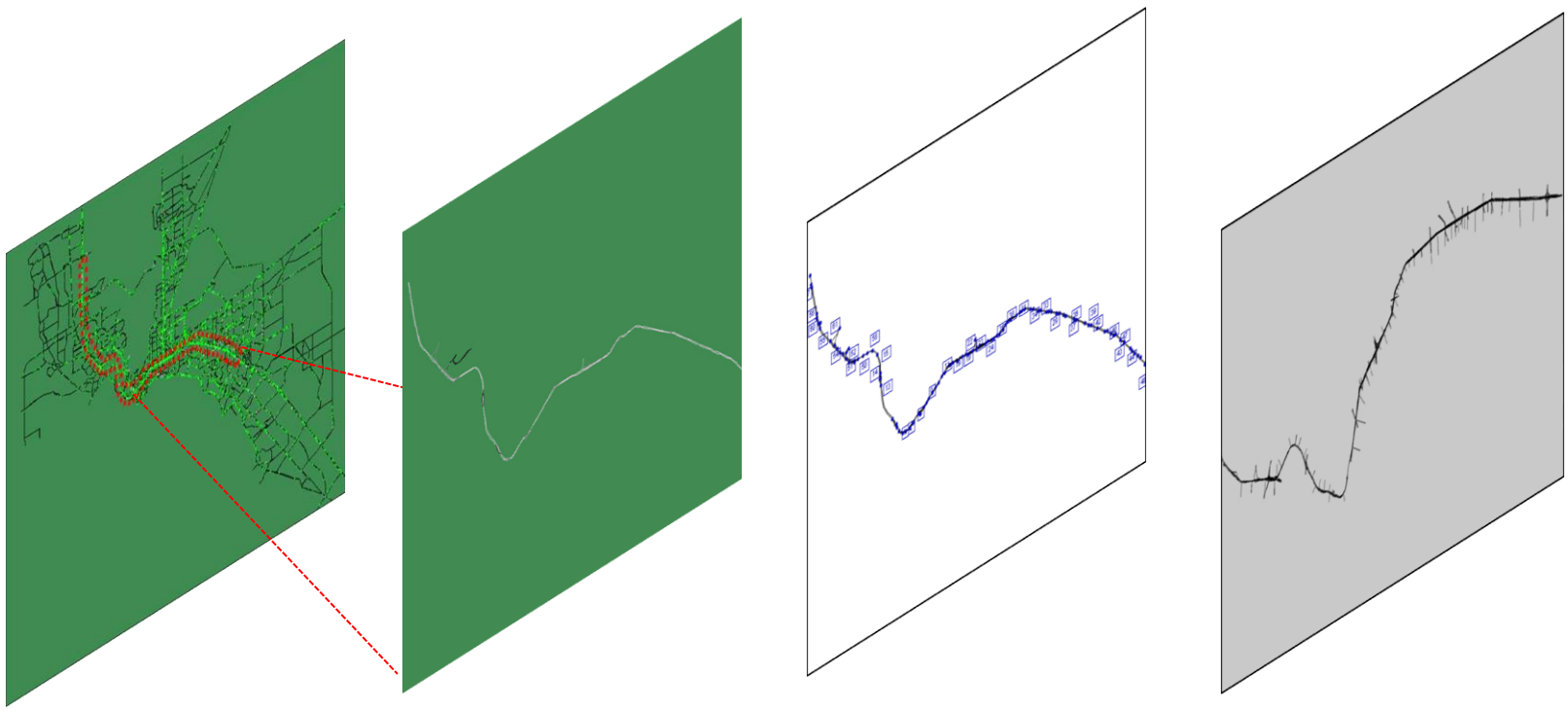
- Simulate entire El Paso network to equilibrium conditions
- Use separate demand matrices for auto & truck



Case Study 1 – Truck Restricted Lanes (TTI)

- Sub-area cut of corridor was extracted
- Conversion tool was used to translate the roadway network, paths & flows to macro model
- Using macro models export capability, a microscopic simulation model was imported to microscopic format

Case Study 1 – Truck Restricted Lanes (TTI)



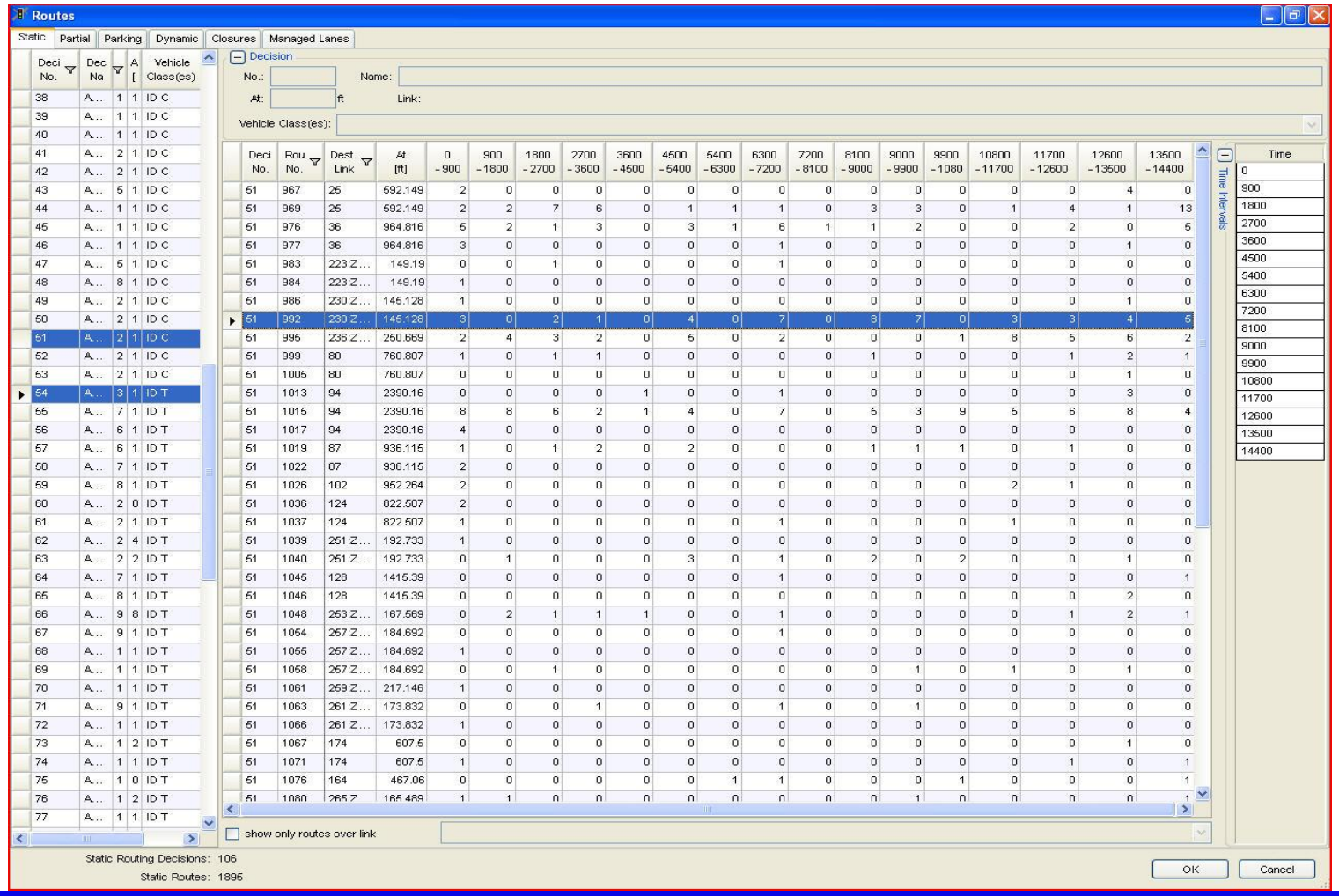
DTA model → Sub-Area → Macro model → Micro model

Conversion tool

Case Study 1 – Truck Restricted Lanes (TTI)

- If modifications in the micro model change driver behavior (alters routes), changes must be reflected in DTA model and conversion process begins again.
- If no additional changes are needed, micro model development begins

Case Study 1 – Truck Restricted Lanes (TTI)



Deci No.	Dec Na	A	[	Vehicle Class(es)
38	A...	1	1	ID C
39	A...	1	1	ID C
40	A...	1	1	ID C
41	A...	2	1	ID C
42	A...	2	1	ID C
43	A...	5	1	ID C
44	A...	1	1	ID C
45	A...	1	1	ID C
46	A...	1	1	ID C
47	A...	5	1	ID C
48	A...	8	1	ID C
49	A...	2	1	ID C
50	A...	2	1	ID C
51	A...	2	1	ID C
52	A...	2	1	ID C
53	A...	2	1	ID C
54	A...	3	1	ID T
55	A...	7	1	ID T
56	A...	6	1	ID T
57	A...	6	1	ID T
58	A...	7	1	ID T
59	A...	8	1	ID T
60	A...	2	0	ID T
61	A...	2	1	ID T
62	A...	2	4	ID T
63	A...	2	2	ID T
64	A...	7	1	ID T
65	A...	8	1	ID T
66	A...	9	8	ID T
67	A...	9	1	ID T
68	A...	1	1	ID T
69	A...	1	1	ID T
70	A...	1	1	ID T
71	A...	9	1	ID T
72	A...	1	1	ID T
73	A...	1	2	ID T
74	A...	1	1	ID T
75	A...	1	0	ID T
76	A...	1	2	ID T
77	A...	1	1	ID T

Deci No.	Rou No.	Dest. Link	At [ft]	0 - 900	900 - 1800	1800 - 2700	2700 - 3600	3600 - 4500	4500 - 5400	5400 - 6300	6300 - 7200	7200 - 8100	8100 - 9000	9000 - 9900	9900 - 1080	10800 - 11700	11700 - 12600	12600 - 13500	13500 - 14400
51	967	25	592.149	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
51	969	25	592.149	2	2	7	6	0	1	1	1	0	3	3	0	1	4	1	13
51	976	36	964.816	5	2	1	3	0	3	1	6	1	1	2	0	0	2	0	5
51	977	36	964.816	3	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
51	983	223:Z...	149.19	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
51	984	223:Z...	149.19	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	986	230:Z...	145.128	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
51	992	230:Z...	145.128	3	0	2	1	0	4	0	7	0	8	7	0	3	3	4	5
51	995	236:Z...	250.669	2	4	3	2	0	5	0	2	0	0	0	1	8	5	6	2
51	999	80	760.807	1	0	1	1	0	0	0	0	0	1	0	0	0	1	2	1
51	1005	80	760.807	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
51	1013	94	2390.16	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0
51	1015	94	2390.16	8	8	6	2	1	4	0	7	0	5	3	9	5	6	8	4
51	1017	94	2390.16	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1019	87	936.115	1	0	1	2	0	2	0	0	0	1	1	1	0	1	0	0
51	1022	87	936.115	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1026	102	952.264	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
51	1036	124	822.507	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1037	124	822.507	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
51	1039	251:Z...	192.733	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1040	251:Z...	192.733	0	1	0	0	0	3	0	1	0	2	0	2	0	0	1	0
51	1045	128	1415.39	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
51	1046	128	1415.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
51	1048	253:Z...	167.569	0	2	1	1	1	0	0	1	0	0	0	0	0	1	2	1
51	1054	257:Z...	184.692	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
51	1055	257:Z...	184.692	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1058	257:Z...	184.692	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0
51	1061	259:Z...	217.146	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1063	261:Z...	173.832	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
51	1066	261:Z...	173.832	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1067	174	607.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
51	1071	174	607.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
51	1076	164	467.06	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1
51	1080	265:Z	165.489	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1

Time Intervals

Time
0
900
1800
2700
3600
4500
5400
6300
7200
8100
9000
9900
10800
11700
12600
13500
14400

106 Origin/Destination links - 1895 Routes created

Case Study 1 – Truck Restricted Lanes (TTI)

Valid data A=valid test,GPS ok V= first valid sentence after	Latitude (ddmm.mmm) OR (dd.ddddd)	North/South	Longitude (dddmm.mmm) OR (dd.ddddd)	East/West	Time UTC (hhmmss)	Date (ddmmyy)	Speed (mph) (000.0-114.9)	Heading-Degrees (000-259)	Altitude (ff.f) OR (mm.m)	HDOP (00.5-99.9)	Satellites (00-12)
D	31.77808	N	106.4551	W	201014	60808	59.6	90	3707	0.8	12
D	31.77808	N	106.45482	W	201015	60808	59.6	90	3707	0.8	12
D	31.77808	N	106.45453	W	201016	60808	59.7	90	3707	0.8	12
D	31.77807	N	106.45425	W	201017	60808	59.7	90	3707	0.8	12
D	31.77807	N	106.45397	W	201018	60808	59.6	90	3707	0.9	12
D	31.77807	N	106.45368	W	201019	60808	59.3	90	3707	1	12
D	31.77807	N	106.4534	W	201020	60808	58.9	90	3711	0.8	12
D	31.77807	N	106.45313	W	201021	60808	58.4	90	3714	0.8	12
D	31.77807	N	106.45285	W	201022	60808	57.8	90	3714	0.8	12
D	31.77807	N	106.45258	W	201023	60808	57.4	90	3717	0.8	12
D	31.77807	N	106.45232	W	201024	60808	57.1	90	3720	0.8	12
D	31.77807	N	106.45205	W	201025	60808	56.6	90	3720	0.8	12
D	31.77807	N	106.45178	W	201026	60808	56.5	90	3724	0.8	12
D	31.77805	N	106.45152	W	201027	60808	56.8	91	3724	0.8	12
D	31.77805	N	106.45125	W	201028	60808	56.8	92	3727	0.8	12
D	31.77803	N	106.45098	W	201029	60808	56.9	93	3727	0.9	12
D	31.77802	N	106.45072	W	201030	60808	56.9	94	3727	0.9	12
D	31.77798	N	106.45045	W	201031	60808	56.8	95	3727	0.8	12
D	31.77797	N	106.45018	W	201032	60808	57.3	97	3727	1.3	12
D	31.77793	N	106.4499	W	201033	60808	57.3	98	3727	0.8	12
D	31.77788	N	106.44963	W	201034	60808	57.6	99	3724	0.8	12
D	31.77785	N	106.44937	W	201035	60808	58.1	100	3724	0.9	12
D	31.7778	N	106.4491	W	201036	60808	58.2	100	3720	0.8	12
D	31.77777	N	106.44883	W	201037	60808	58.4	100	3720	0.8	12
D	31.77772	N	106.44855	W	201038	60808	58.8	100	3717	0.8	12
D	31.77767	N	106.44828	W	201039	60808	58.9	100	3717	0.9	12
D	31.77763	N	106.448	W	201040	60808	59	100	3717	0.9	12
D	31.7776	N	106.44773	W	201041	60808	59.1	99	3717	0.9	12
D	31.77757	N	106.44745	W	201042	60808	59.5	98	3717	0.9	12
D	31.77753	N	106.44717	W	201043	60808	59.8	96	3714	0.9	12
D	31.7775	N	106.44688	W	201044	60808	60.1	95	3714	0.9	12
D	31.77748	N	106.4466	W	201045	60808	60.4	94	3714	0.9	12
D	31.77748	N	106.44632	W	201046	60808	60.4	92	3714	0.9	12
D	31.77747	N	106.44603	W	201047	60808	60.4	91	3714	0.9	12
D	31.77747	N	106.44575	W	201048	60808	60.5	90	3714	0.9	12
D	31.77747	N	106.44547	W	201049	60808	60.6	90	3714	0.9	12
D	31.77747	N	106.44518	W	201050	60808	60.5	90	3714	0.8	12

Complete I 10 Corridor_EB & WB

GPS unit was used to input freeway grading information

Case Study 1 – Truck Restricted Lanes (TTI)

Typical Vehicle Type	Texas 6 Classification	FHWA Classification
	Class 5: 3 axles, single unit	**Class 6**: 3 axles, single unit
	Class 6: 4 or more axles, single unit	**Class 7**: 4 or more axles, single unit
	Class 7: 3 axles, single trailer	**Class 8**: 3 to 4 axles, single trailer
	Class 8: 4 axles, single trailer	
	Class 9: 5 axles, single trailer	**Class 9**: 5 axles, single trailer
	Class 10: 6 or more axles, single trailer	**Class 10**: 6 or more axles, single trailer
	Class 11: 5 or less axles multi-trailers	**Class 11**: 5 or less axles, multi-trailers
	Class 12: 7 or more axles multi-trailers	**Class 12**: 6 axles, multi-trailers
	Class 13: 6 axles, multi-trailers	**Class 13**: 7 or more axles, multi-trailers

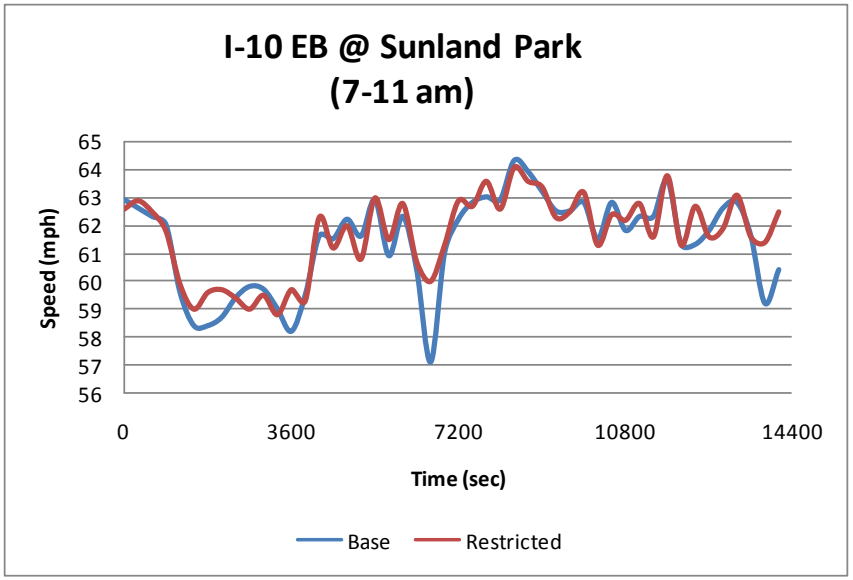
Truck Class	VISSIM Truck/Trailer	Truck Composition	Length (ft)	Shaft Length (ft)	Front Clutch (ft)	Front Axle (ft)	Rear Axle (ft)	Rear Clutch (ft)
5	truckUS_1.v3d	0.5	27.89	1.21	1.21	2.91	23.58	26.07
	truckUS_5.v3d	0.5	27.89	0.56	0.56	2.15	21.28	23.08
6	truckUS_1.v3d	0.5	27.89	1.21	1.21	2.91	23.58	26.07
	truckUS_5.v3d	0.5	27.89	0.56	0.56	2.15	21.28	23.08
7	truck1.v3b	1	18.25	0.00	0.00	5.18	15.39	13.60
	trail3b.v3b		21.66	0.00	4.32	4.33	17.90	21.47
8	truckUS2.v3d	1	16.40	0.85	0.85	2.25	14.06	12.32
	trail4.v3d		28.23	0.00	4.43	4.43	24.51	27.97
9	truckUS.v3d	1	20.67	0.00	0.00	2.27	18.23	16.61
	trailerUS3.v3d		47.57	0.00	3.96	40.85	43.97	46.14
10	truckUS_3.v3d	1	20.67	0.00	0.00	2.27	18.23	16.61
	trailerEuro1.v3d		42.65	0.00	3.87	3.87	32.05	41.41
11	truck1.v3b	1	18.25	0.00	0.00	5.18	15.39	13.60
	trail4.v3d		28.23	0.00	4.43	4.43	24.51	27.97
	trail3a.v3d		12.24	0.33	0.33	9.70	9.73	9.76
	trail4.v3d		28.23	0.00	4.43	4.43	24.51	27.97
12	truckUS3.v3d	1	20.67	0.00	0.00	2.27	18.23	16.61
	trail4.v3d		28.23	0.00	4.43	4.43	24.51	27.97
	trail3a.v3d		12.24	0.33	0.33	9.70	9.73	9.76
	trail3b.v3b		21.66	0.00	4.32	4.33	17.90	21.47
13	truckUS3.v3d	1	20.67	0.00	0.00	2.27	18.23	16.61
	trailerUS_3.v3d		47.57	0.00	3.96	40.85	43.97	46.14
	trail3a.v3d		12.24	0.33	0.33	9.70	9.73	9.76
	trail4.v3d		28.23	0.00	4.43	4.43	24.51	27.97

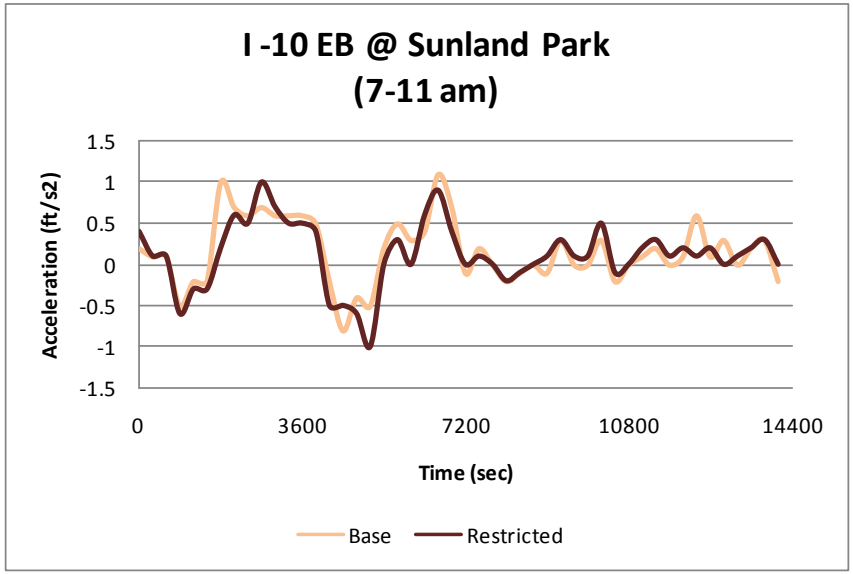
Data provided by TxDOT Automatic Traffic Recorder Stations

Case Study 1 – Truck Restricted Lanes (TTI)

Truck Class	Relative Flow	Length (ft)	Width (ft)	Weight (lb)		Power (hp)	
				Min.	Max.	Min.	Max.
5	0.082	27.89	8	15,000	46,000	220	260
6	0.009	27.89	8	20,000	53,000	220	300
7	0.001	30.94	8	25,000	52,000	250	300
8	0.019	36.13	8	28,000	66,000	315	380
9	0.835	60.22	8	30,000	80,000	380	480
10	0.006	55.39	8	32,000	87,000	415	490
11	0.039	70.69	8	35,000	92,000	440	500
12	0.009	67.24	8	35,000	106,000	505	525
13	0	92.35	8	35,000	120,000	570	580

Case Study 1 – Truck Restricted Lanes (TTI)





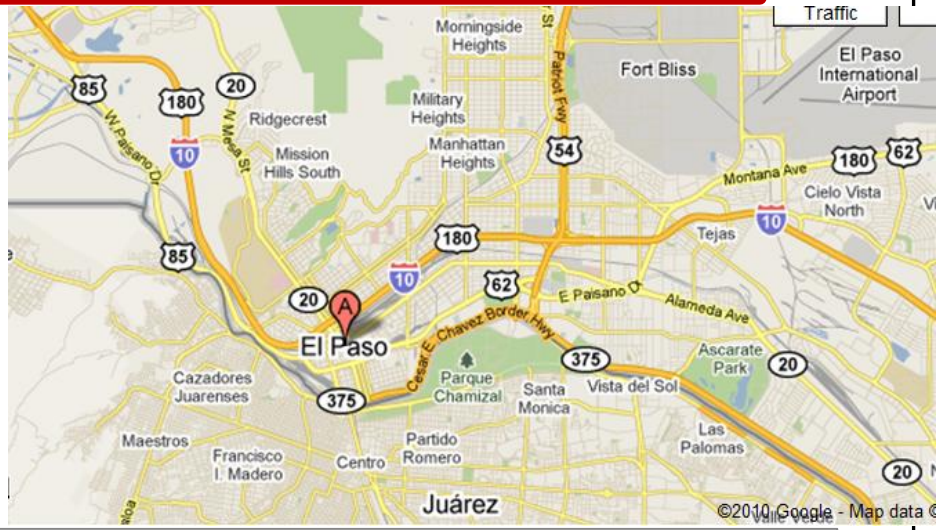
Speed

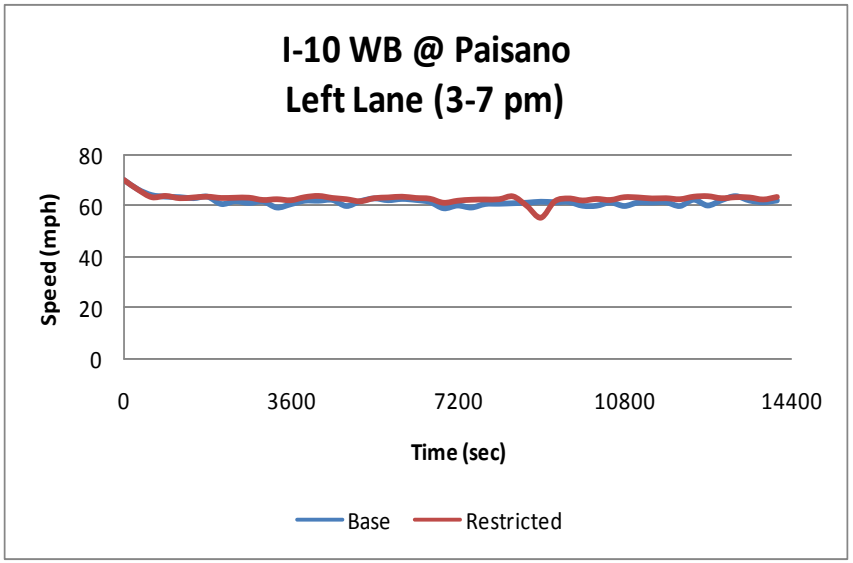
Accel/Decel

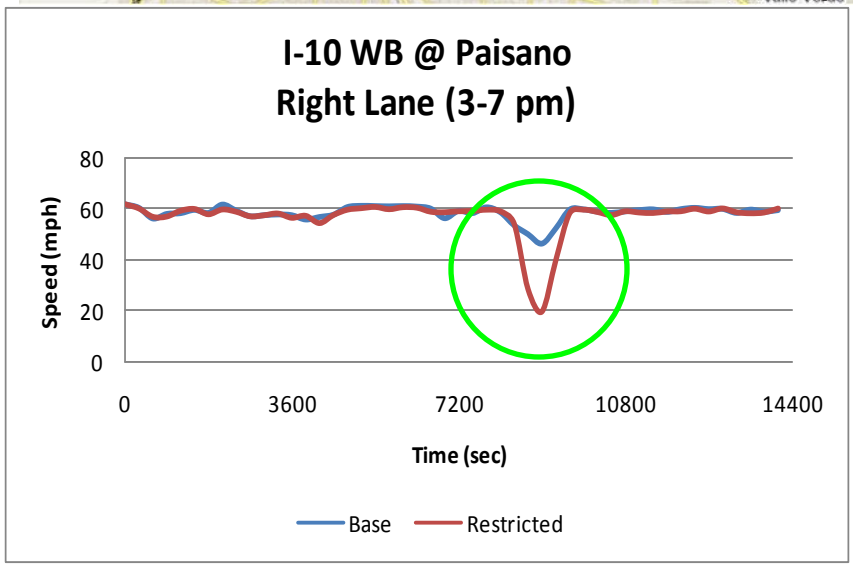
Speed profile calibrated with field data

Case Study 1

- Results showed that restricting trucks from left-most fast lane had slight improvement on speeds.
- Identified section of freeway where restrictions had adverse affect on freeway speeds







Speed – Left vs. Right Lane

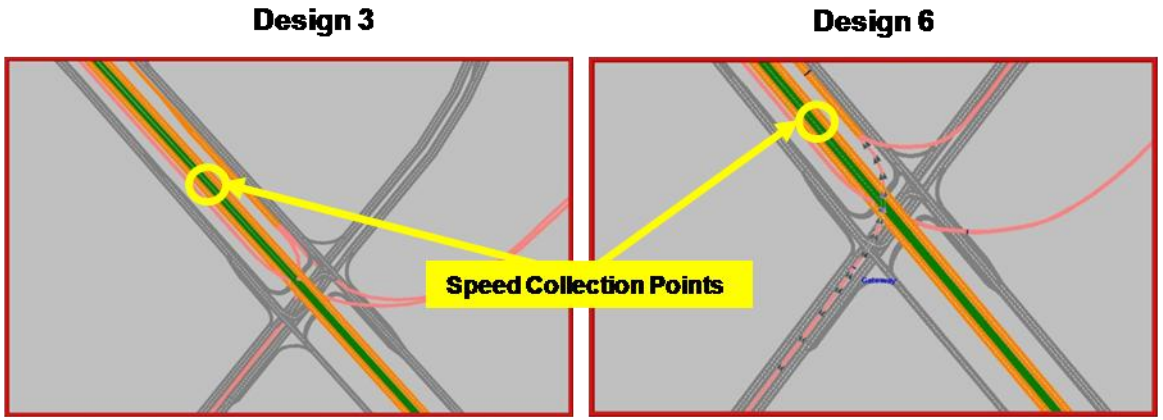
Case Study 2

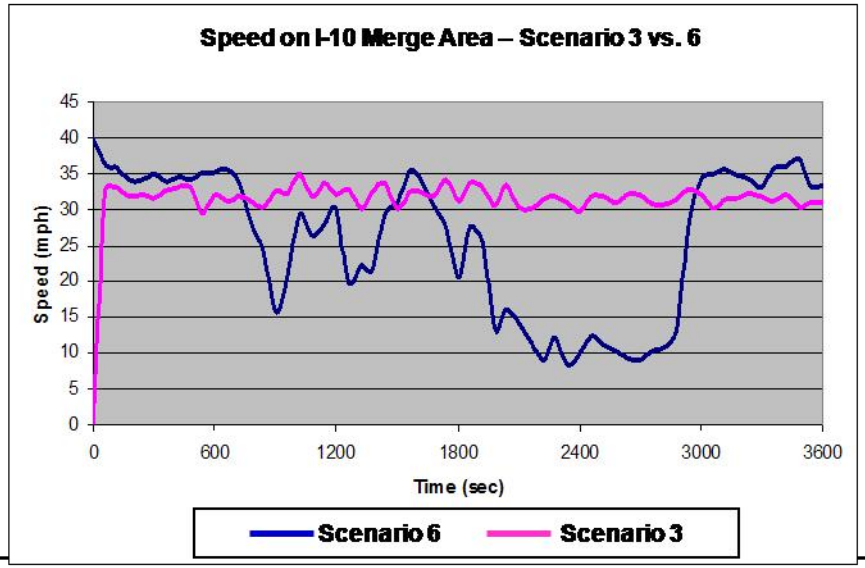
- Texas Department of Transportation looking at alleviating congestion at diamond interchange and surrounding arterials in El Paso, TX.
- Propose 7 different design alternatives for direct connects
- Two sets of designs are identical except for direct connect lane access
- Corridor has heavy truck usage

Case Study 2 – Freeway Improvements (TTI)

- TxDOT wants to know which alternative is most viable option?
- How does weaving at merge areas affect traffic on I-10?
- **How dose improved LOS due to new interchange attract traffic to I-10 in the future?**
- Analyze both the localized traffic impact and regional traffic redistribution
- Which model should we use?
  - Travel demand model?
  - DTA model?
  - Microscopic model?

Case Study 2 – Freeway Improvements (TTI)



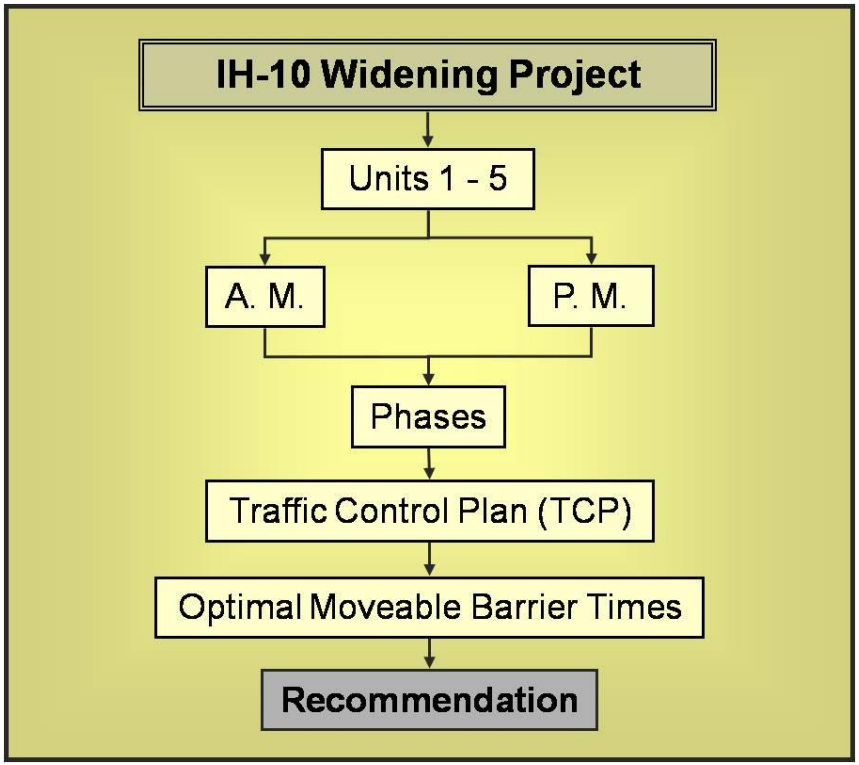


Case Study 2 – Freeway Improvements (TTI)

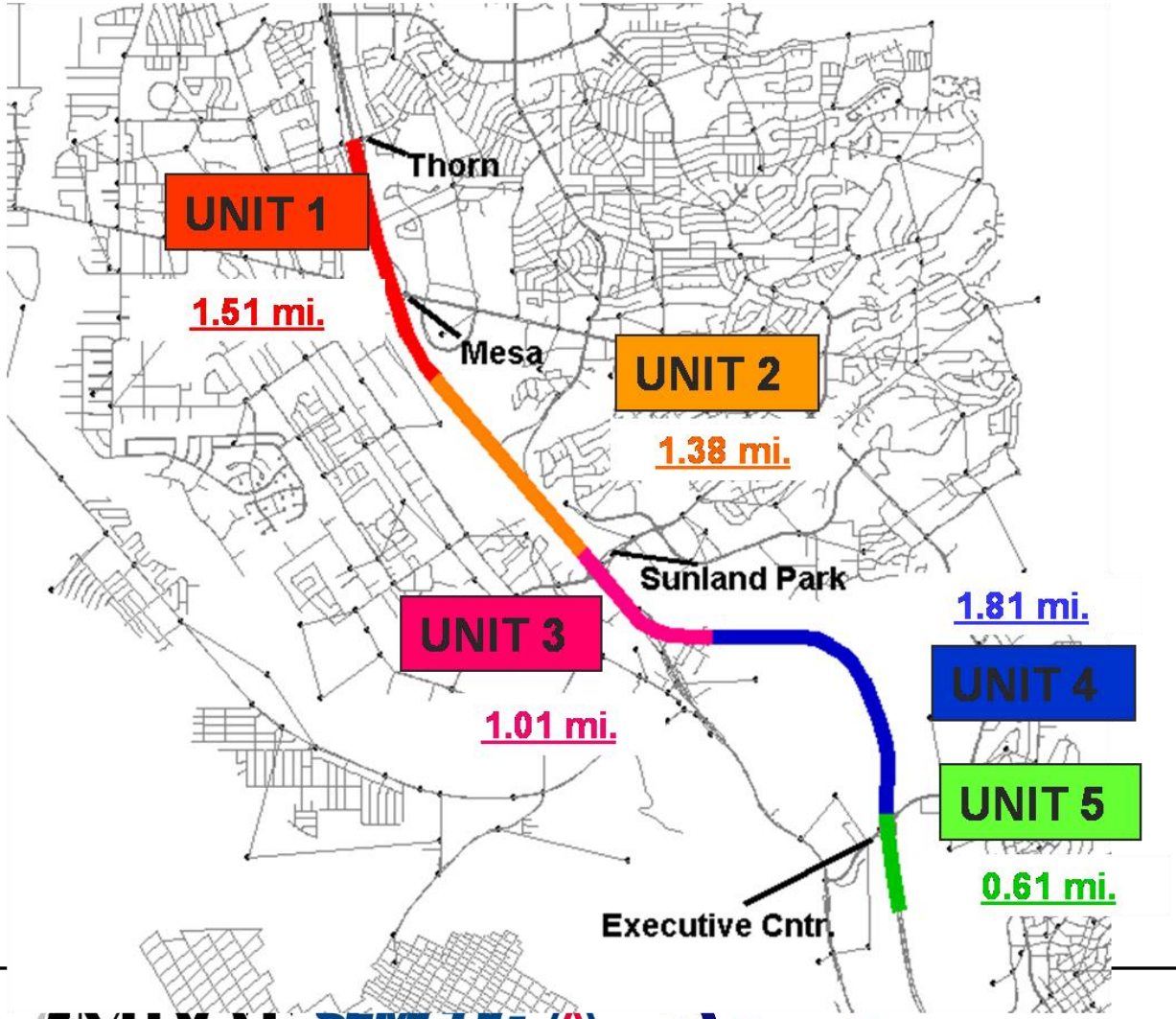
- DTA model was able to show shifts in traffic based upon each design alternative.
  - Queuing on arterials and frontage roads
  - Speed fluctuations during peak hours
- Micro model was able to identify "hot-spot" areas where direct connects merge
- Micro model was used to determine whether or not grade played a major role on trucks entering freeway.

Case Study 3 – Work Zone Mobility

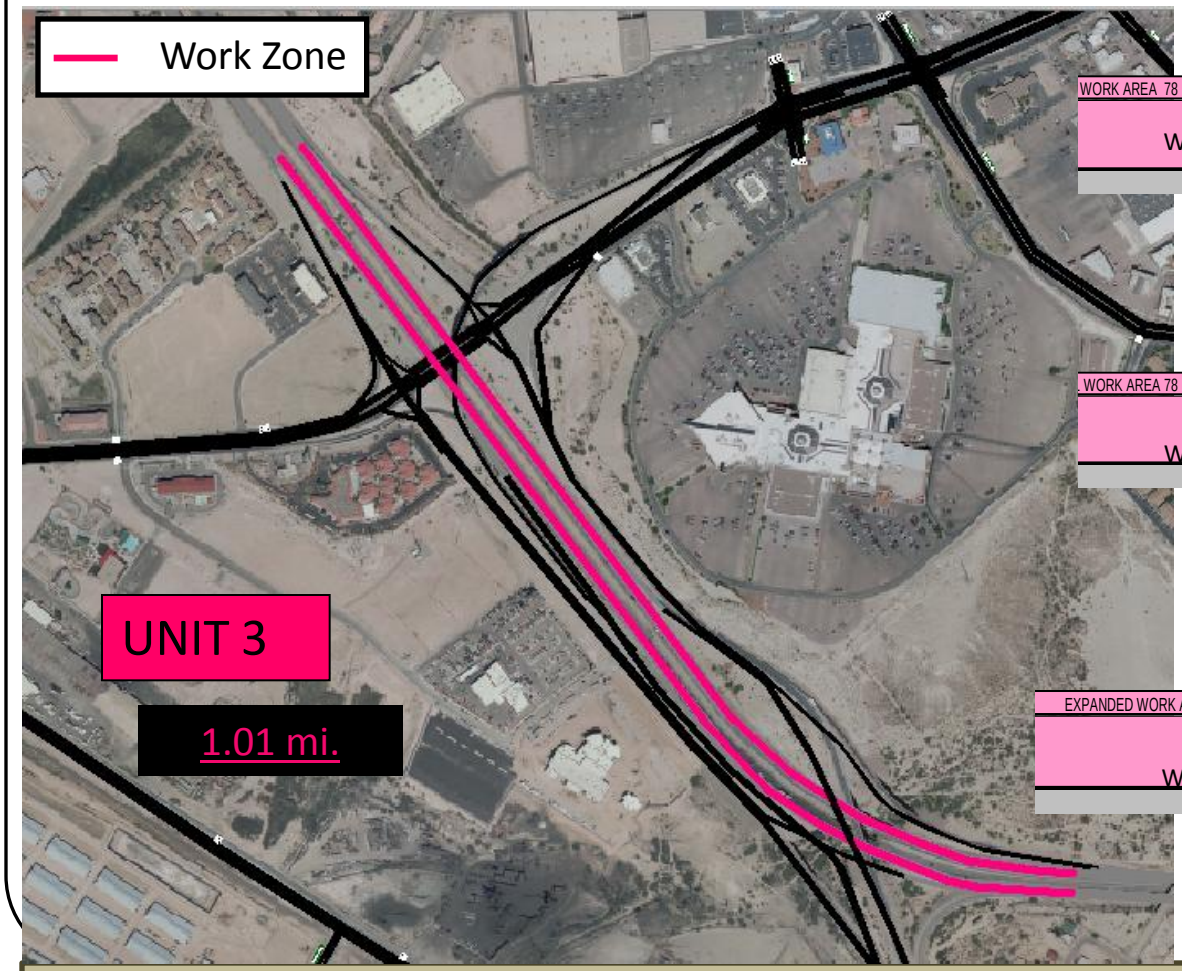
- Construction sequencing for addition of freeway lane
  - TxDOT wants to widen section of I-10 in western portion of El Paso
  - Construction divided into 5 section areas
  - Determine optimal construction sequencing for TCP with moveable barriers

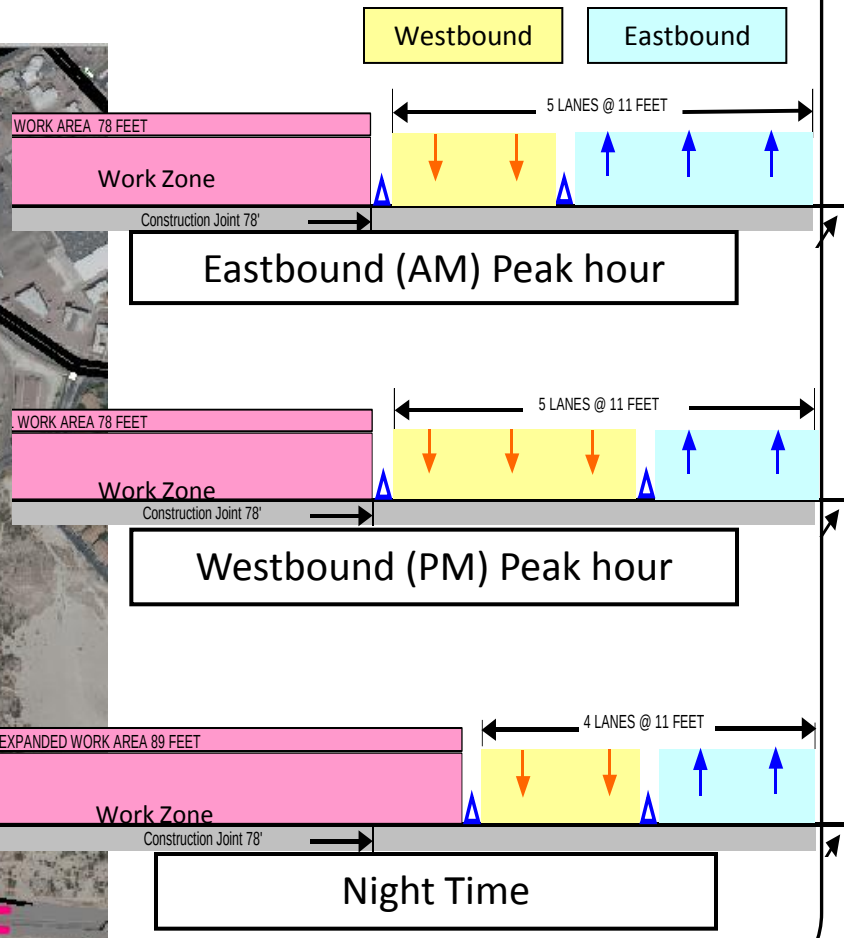


Case Study 3 – Work Zone Mobility



Case Study 3 – Work Zone Mobility

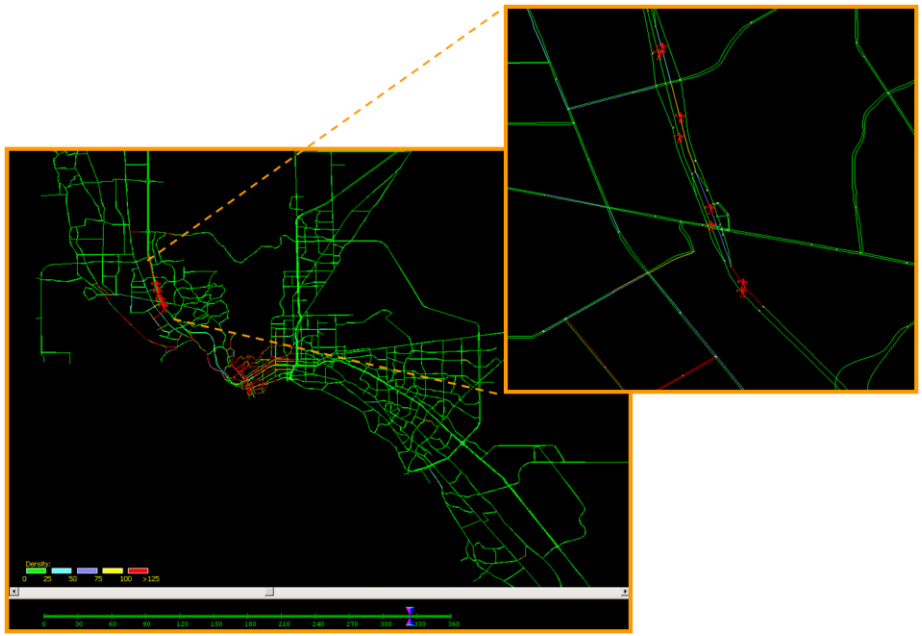




Determine optimal traffic flow in work zone during peak/non-peak hours using movable barriers

Case Study 3 – Work Zone Mobility

- DTA was able to evaluate effectiveness of TCPs
- Identify optimal construction sequencing of phases.
- Identify hotspots during peak and off-peak periods
- Evaluate possible mitigation strategies to help reduce congestion.

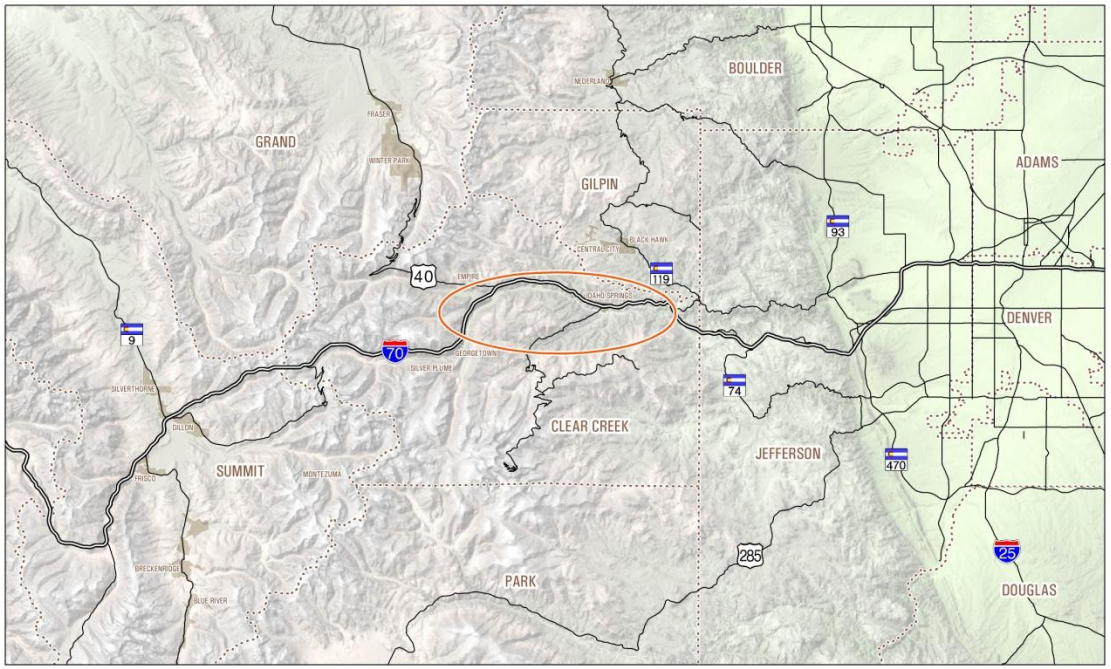


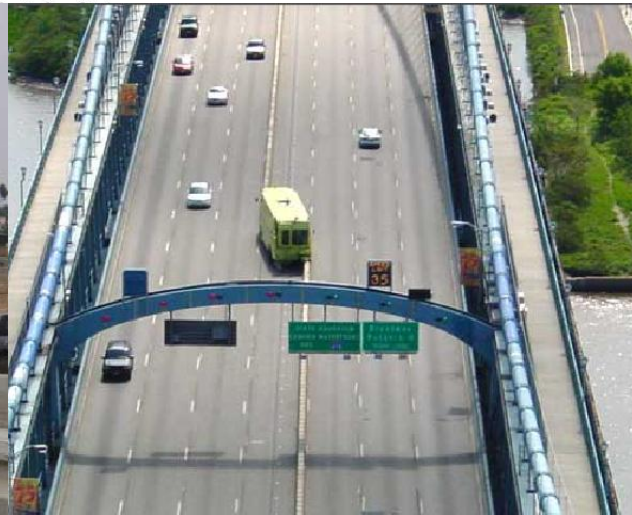
Case Study 3 – Work Zone Mobility

- Microscopic model was used to analyze areas of concern at a higher fidelity of resolution
  - Weave/merge areas
  - Optimize signal timings on adjacent arterials and feedback to DTA model

Case Study 4 - I-70 Zipper Lane Operational Planning

- 15-mile zipper Lane for I-70 EB during Sunday PM in ski season
- $20M capital, $9M O&M



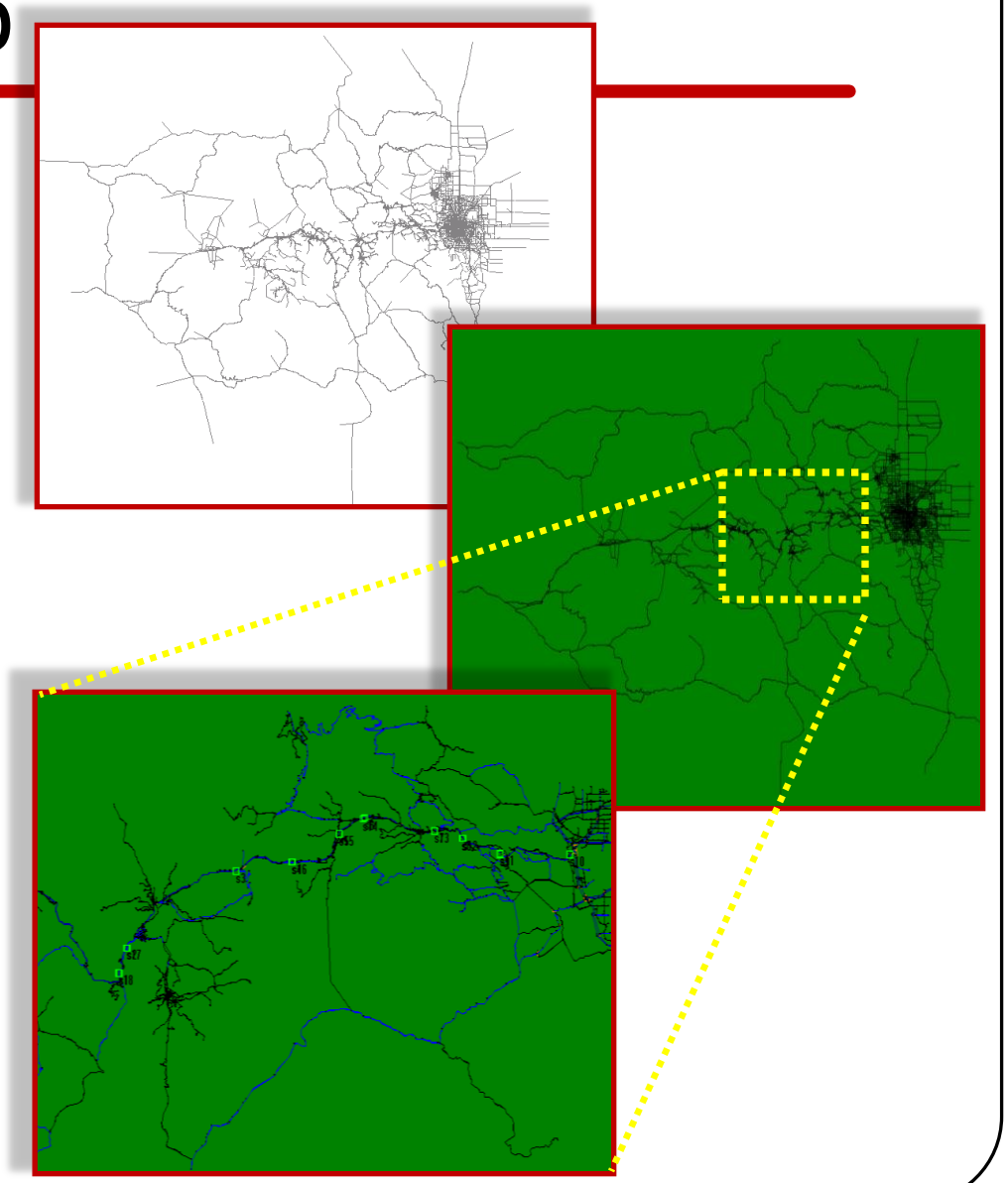


MRM Modeling Process

- Planning decisions
  - Fatal flaw of MBS
  - Tolling traffic and revenue forecast
- Operational Decisions
  - Queue length (WB)
  - East and West terminal configuration
  - Interchange re-design
- Model initial setup
  - Existing I-70 corridor network from a prior study (PEIS)
- Model calibration and validation
  - Traffic data from CDOT
  - Trip origins and destinations

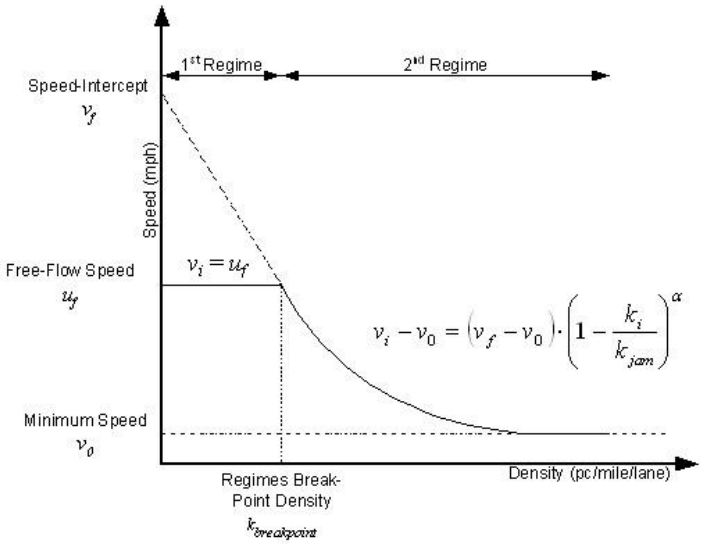
Model Initial Setup

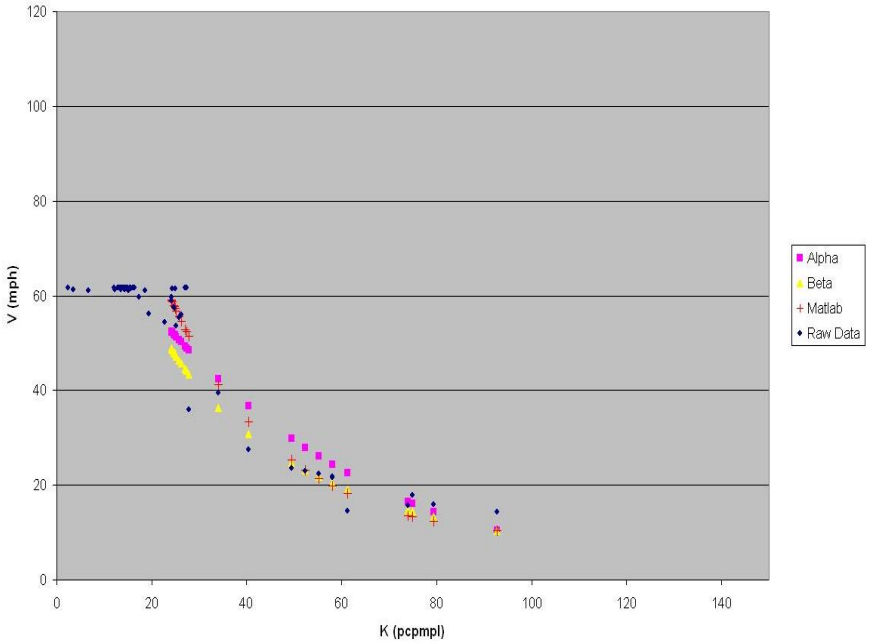
1. Planning model
2. DTA model conversion
3. Subarea model



Model Calibration and Validation

- Calibration of simulation
  - Multiple traffic flow models for categories of grade along corridor

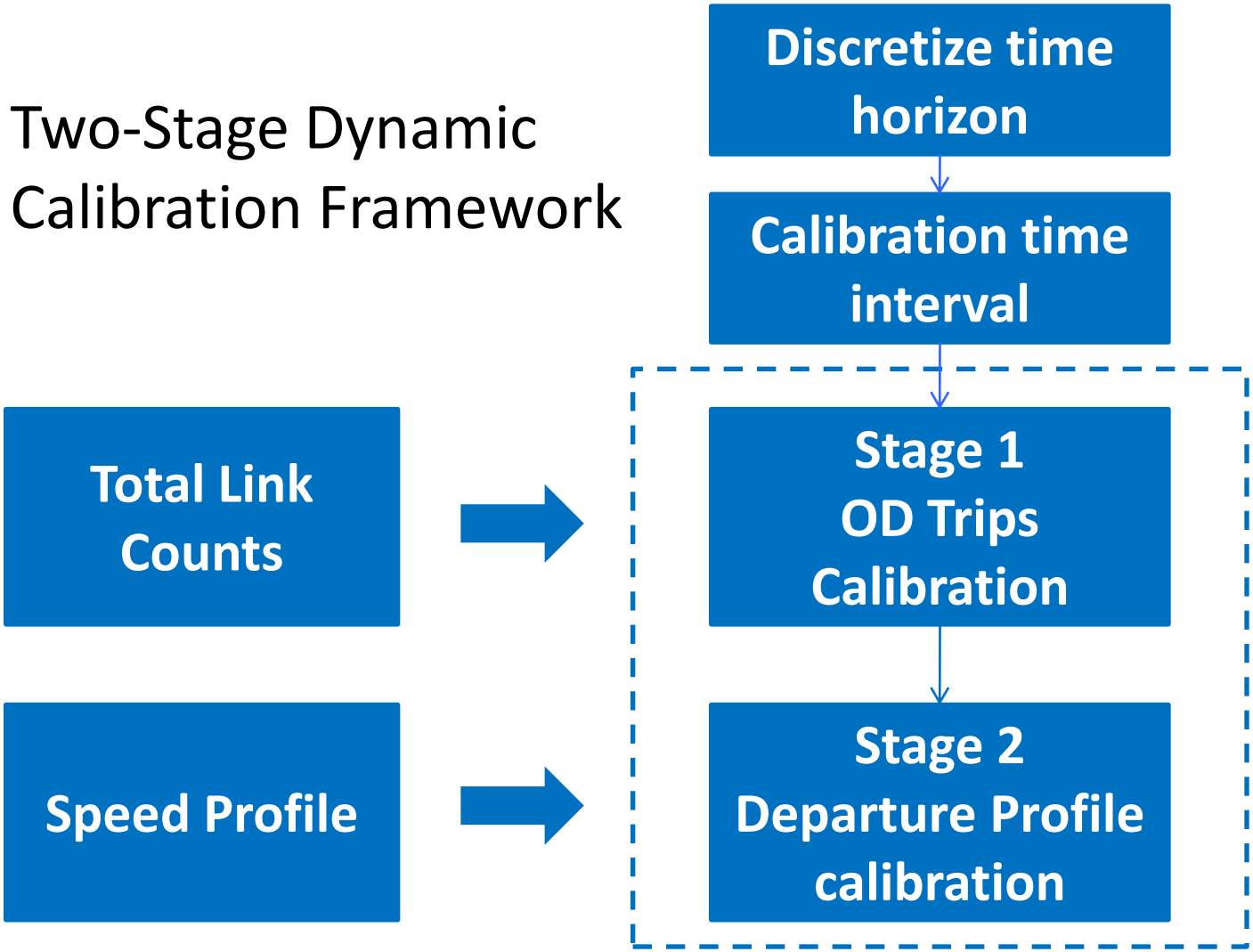




Source:
http://ntl.bts.gov/lib/31000/31400/31419/14497_files/chap_6.htm

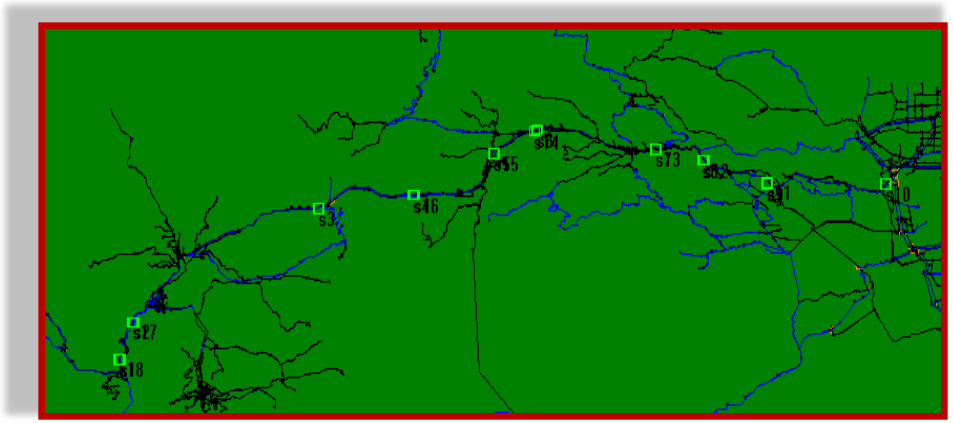
Model Calibration and Validation

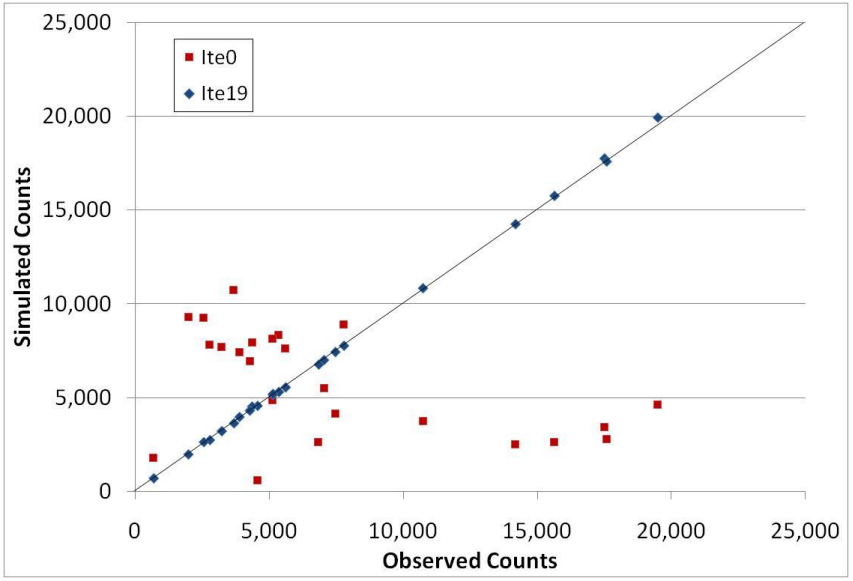
Two-Stage Dynamic Calibration Framework



Model Calibration and Validation

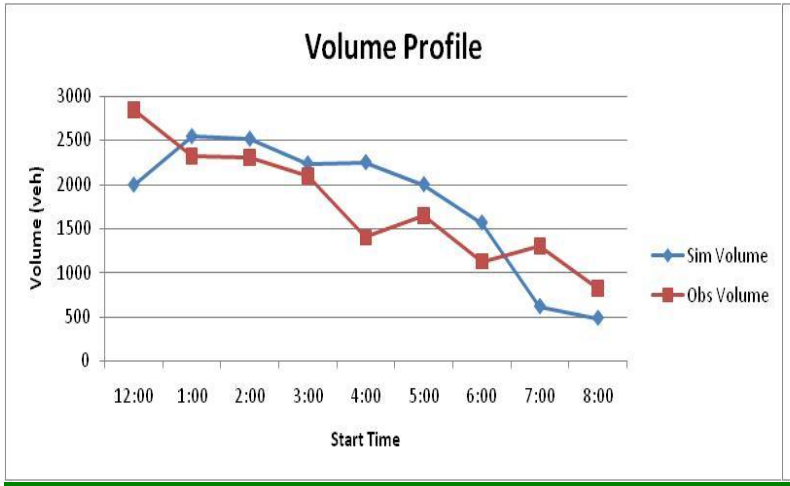
- OD calibration
  - Match total traffic counts within time period at different locations along corridor

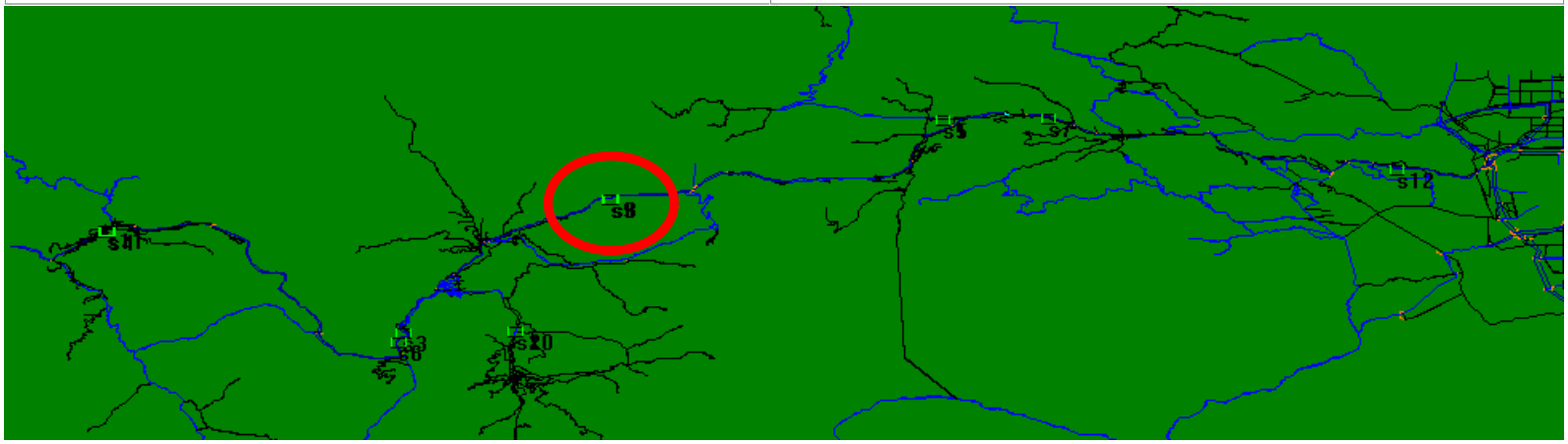




Model Representative of Actual Traffic Condition

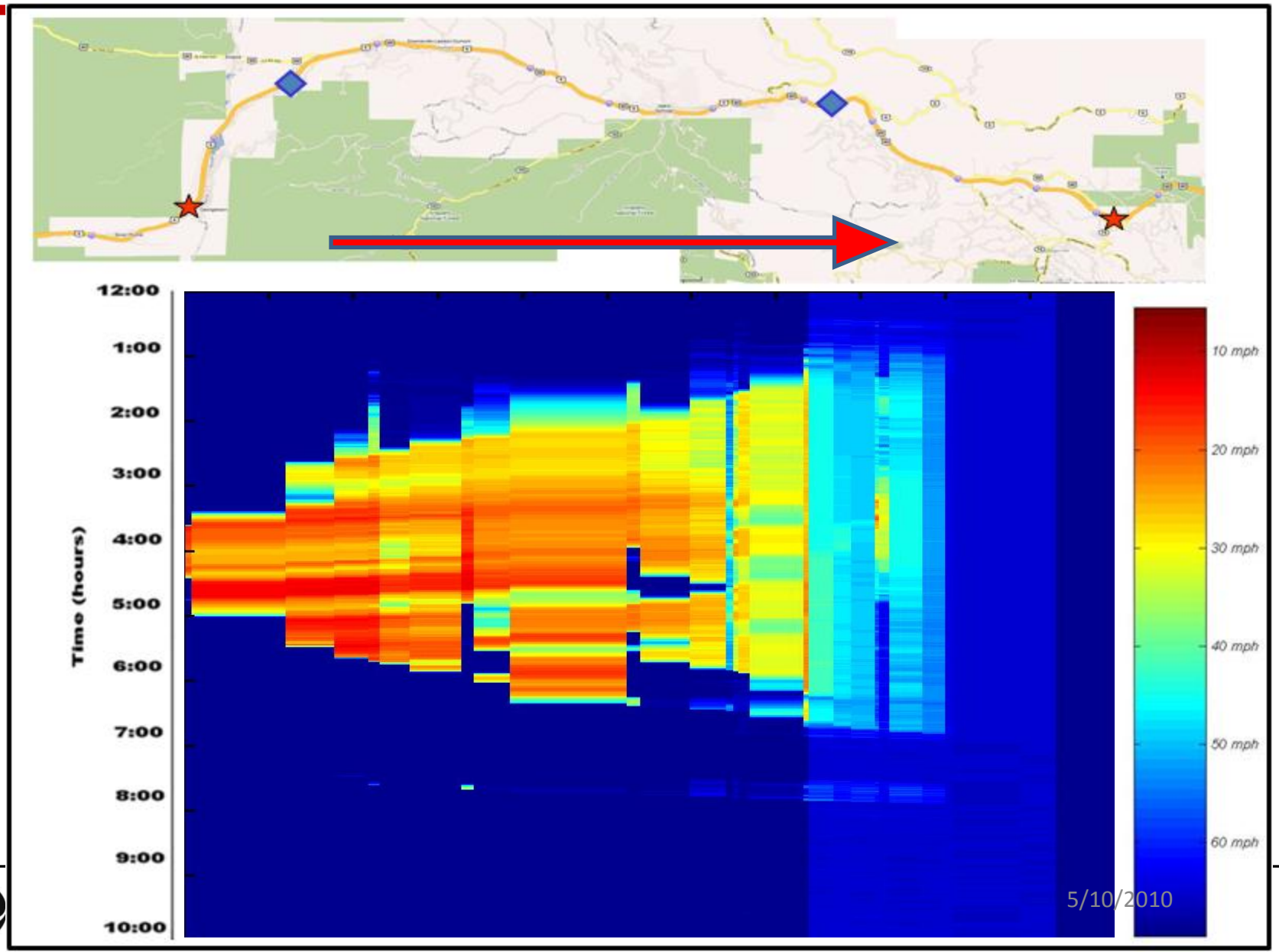
- EB – Eisenhower Tunnel





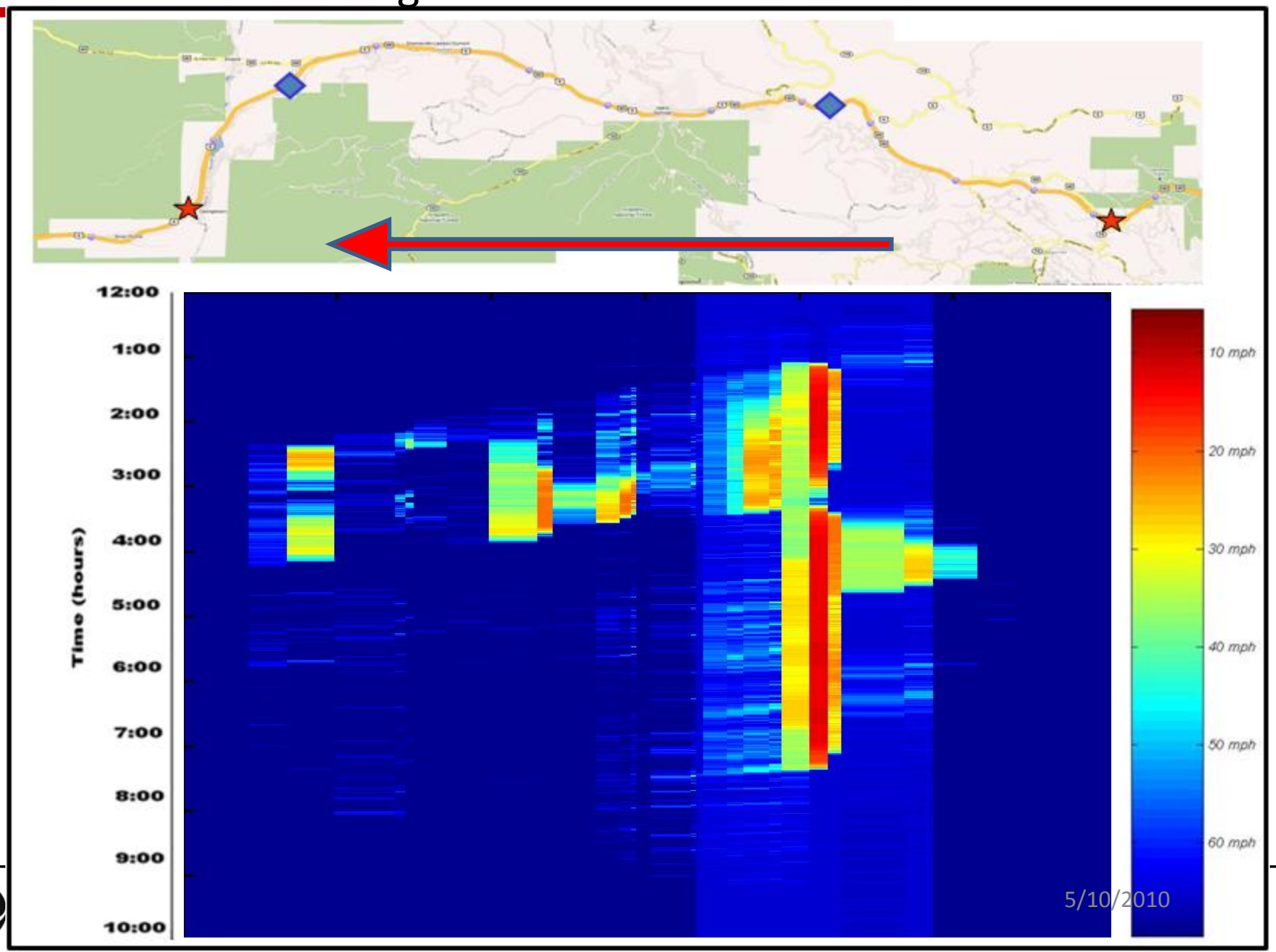
Scenario 1: Baseline (Existing Conditions)

Direction: EB Main Lanes



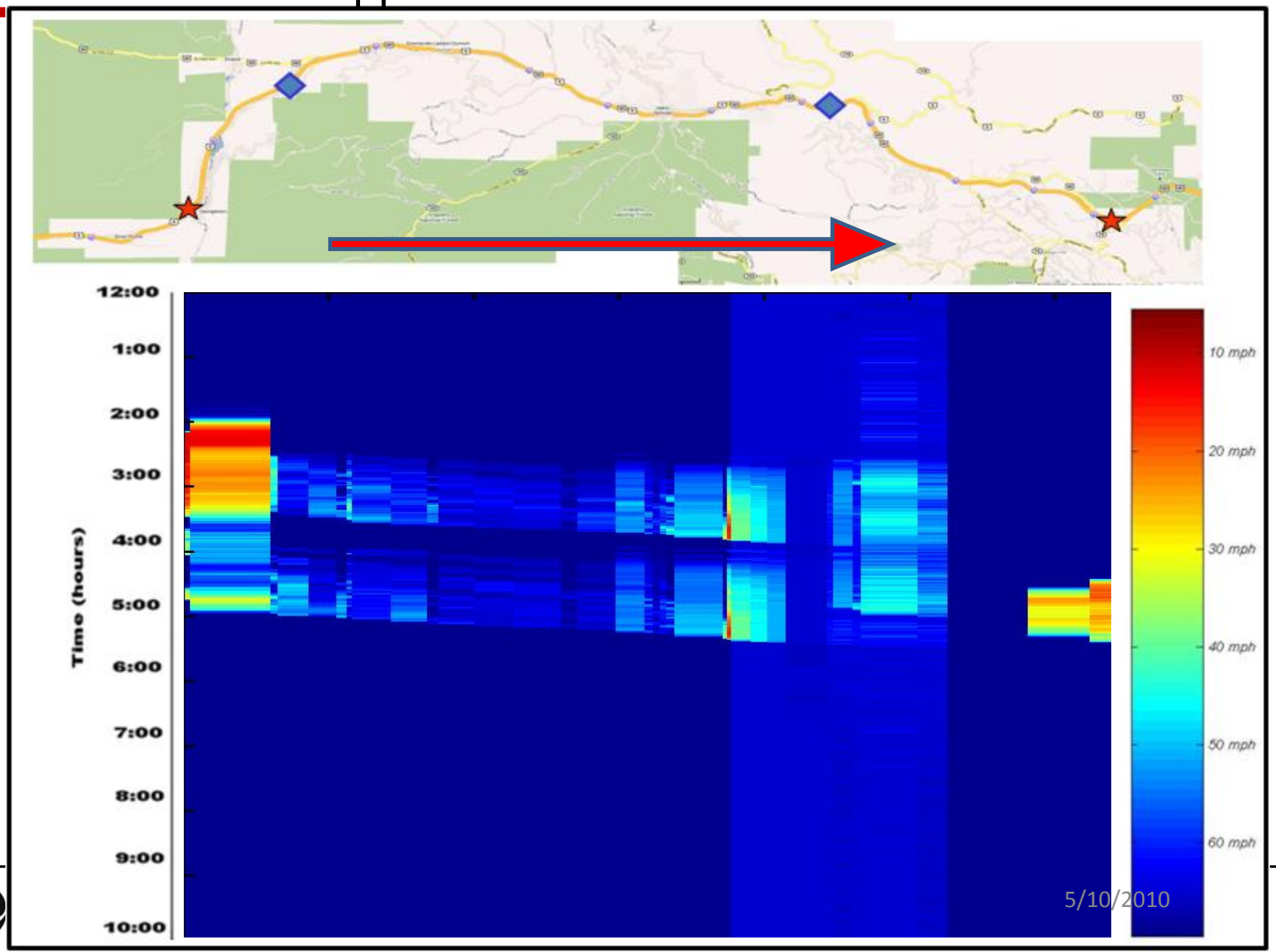
Scenario 2: Truck Allowed in EB Zipper Lane (No Toll)

Direction: WB Single Main Lane



Scenario 3: Truck Restricted from EB Zipper Lane (No Toll)

Direction: EB Zipper Lane



Analysis Scenarios/Strategies

- Scenarios presented
  1. Baseline (existing conditions)
  2. Truck Allowed in EB Zipper Lane – No Toll
  3. Truck Restricted from EB Zipper Lane – No Toll
  4. Truck Restricted from EB Zipper Lane – Congestion Responsive Toll on Zipper Lane
  5. Truck Restricted from EB Zipper Lane – Congestion Responsive Toll on Zipper Lane & WB Truck Diverted

Questions?