

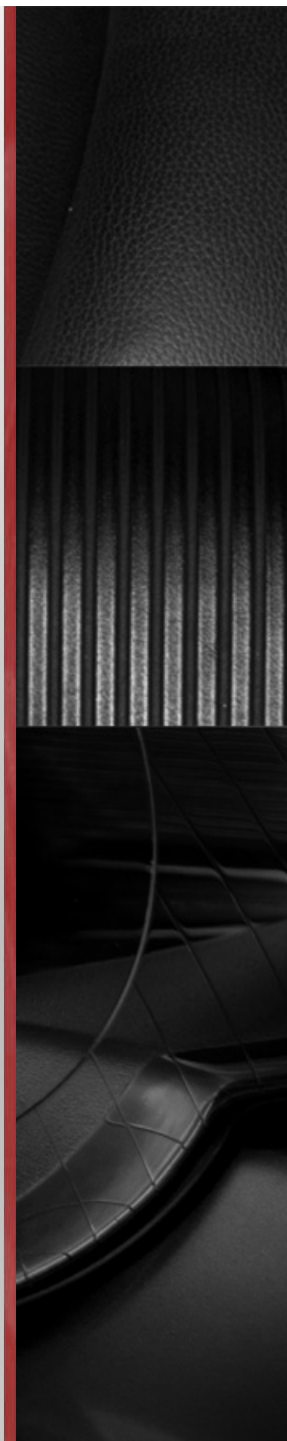
Dynameq: The Next Generation in Traffic Forecasting and Analysis

I-70 STEIS in Kansas City Case Study

February 28, 2014

Joe Blasi, PE, PTOE – HNTB

Derek Vap, PE – HNTB





Presentation Overview

1. Project Background
2. What is Dynameq? Why Did We Use It?
3. Using Dynameq
4. Reasonable and Preferred Alternatives
5. Results and Conclusions
6. Future Possibilities

Purpose and Need

- **Improve Safety** - From 2008 to 2012, there were:
 - 2,017 crashes
 - 10 fatal and 28 disabling injuries crashes
 - Majority of the corridor exceeds the statewide average crash rates for urban interstates by more than 100 percent.

Section	Section Name	Length	Average 2008-2012 Crash Rate Versus Statewide Average Crash Rate (109.61)	
			Eastbound	Westbound
Section 1	Paseo Interchange	0.87	101%	124%
Section 2	Benton Curve	1.20	168%	140%
Section 3	23rd Street Interchange	0.67	88%	123%
Section 4	Jackson Curve	0.90	203%	100%
Section 5	Van Brunt	0.73	174%	125%
Section 6	US-40	0.59	146%	163%
Section 7	Manchester	0.57	208%	178%
Section 8	I-435	0.96	247%	201%
Section 9	Blue Ridge Cutoff	1.28	144%	112%

Purpose and Need

- **Reduce Congestion**

- Congestion is not directly linked to traffic volumes (current AADT between 75,000 and 115,000)
- Congestion occurs at spot locations where there are substandard merge, diverge, and weave areas.



Purpose and Need

- **Restore and Maintain Existing Infrastructure**
 - I-70 is more than 50 years old
 - Deteriorating pavement and bridges
 - Geometric issues (Benton and Jackson Curves)
 - Closely spaced interchanges (15 partial or full interchanges in 6.8 miles)
 - Ramp issues (short and/or steep on- and off-ramps)



Purpose and Need

- **Improve Accessibility**

- There are 19 street crossings and 2 pedestrian bridges to enable non-motorized access across I-70
- To assist non-motorized travel across I-70, there are currently 9 bus routes that cross I-70
- There are 4 bus routes that travel on I-70



Purpose and Need

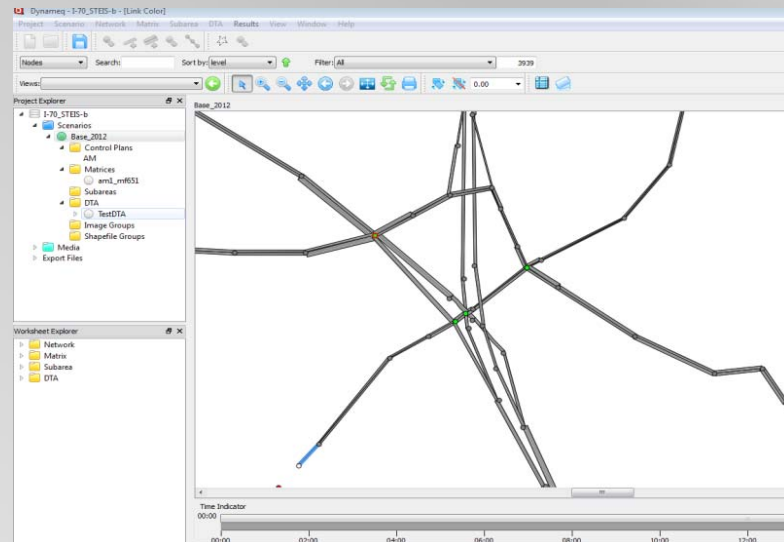
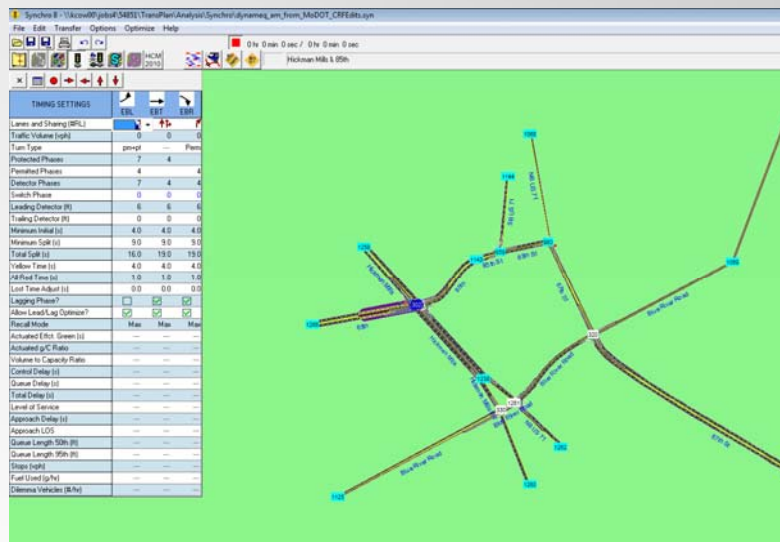
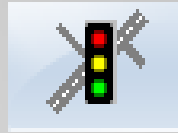
- **Improve Goods Movement**

- Trucks are 11% of the daily volume
- I-70 provides access to several major truck facilities along the corridor and region.

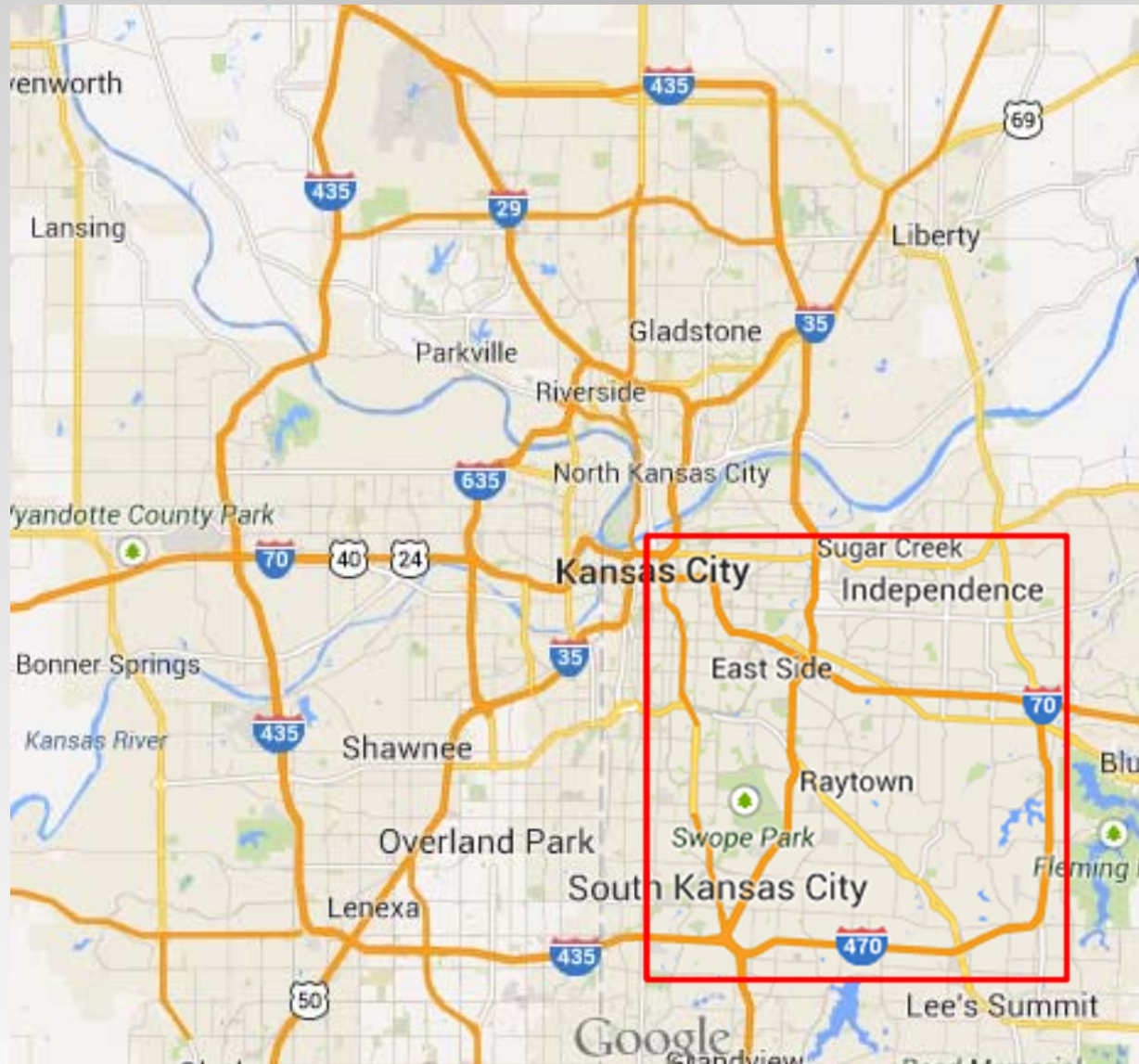


What Is Dynameq and Why Use It?

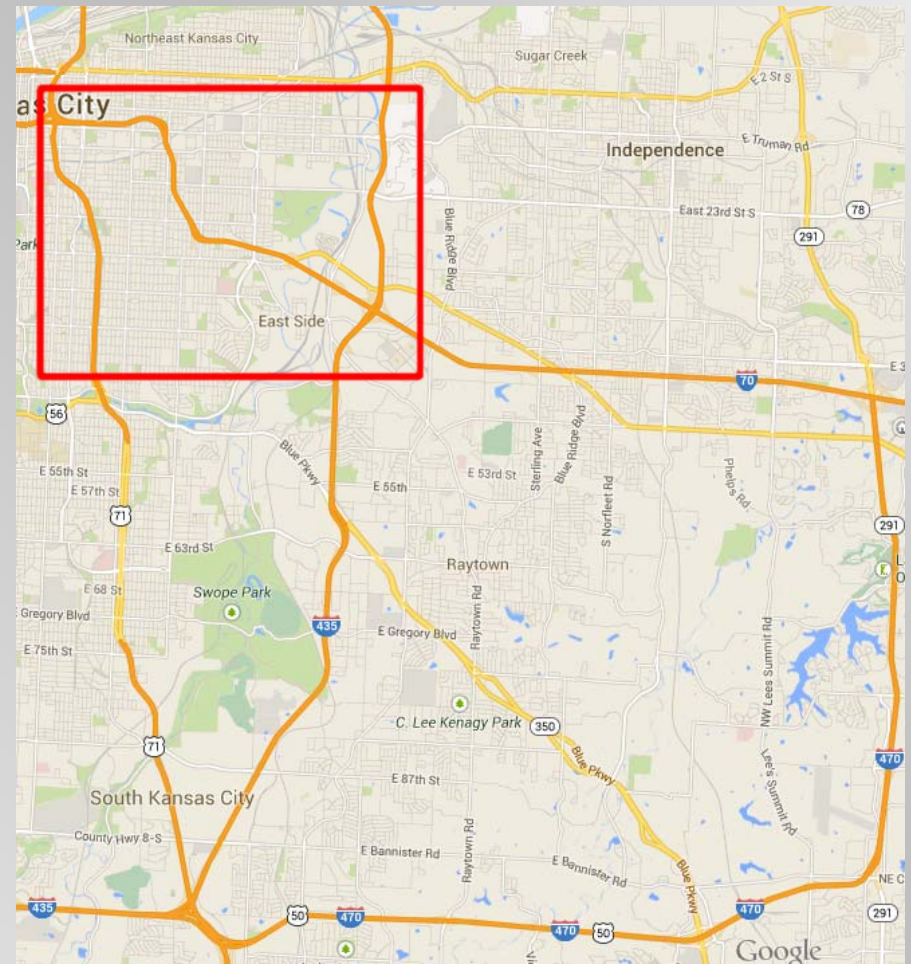
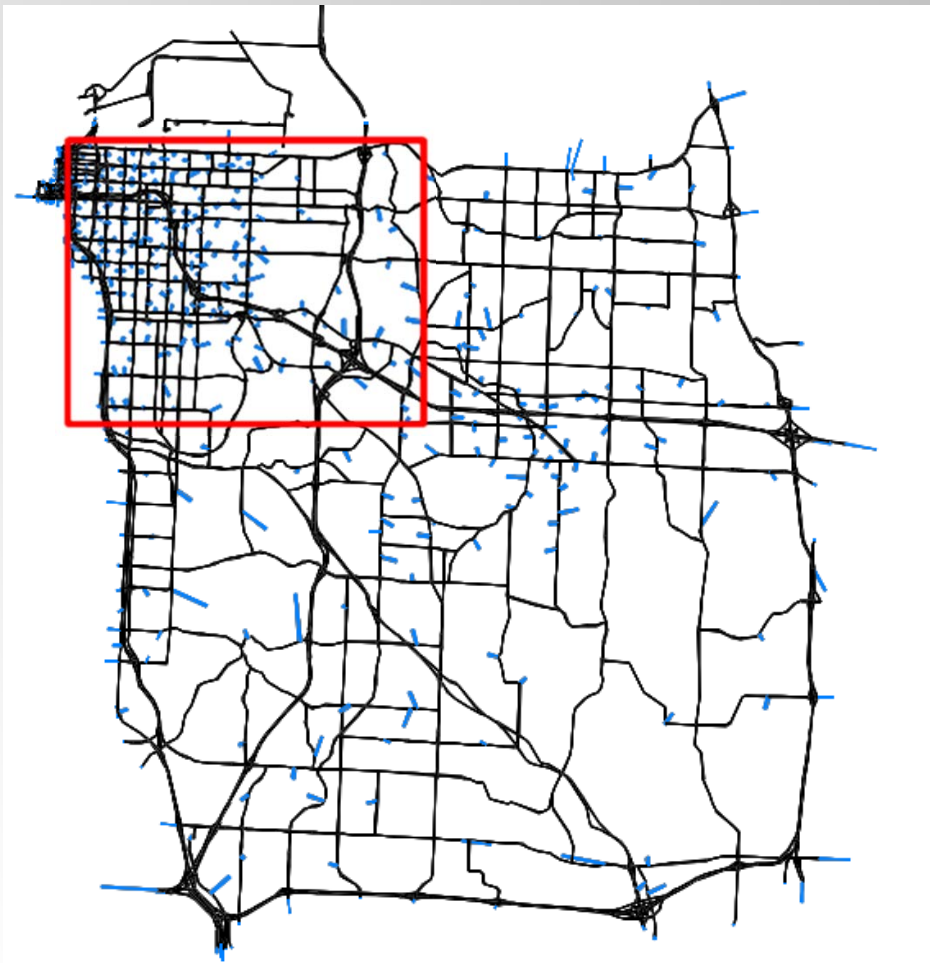
- Dynamic Traffic Assignment (DTA)
- Benefits of Macro- and Micro-Simulation
- Medium-sized network
- Time Component
- Integration with MARC Model



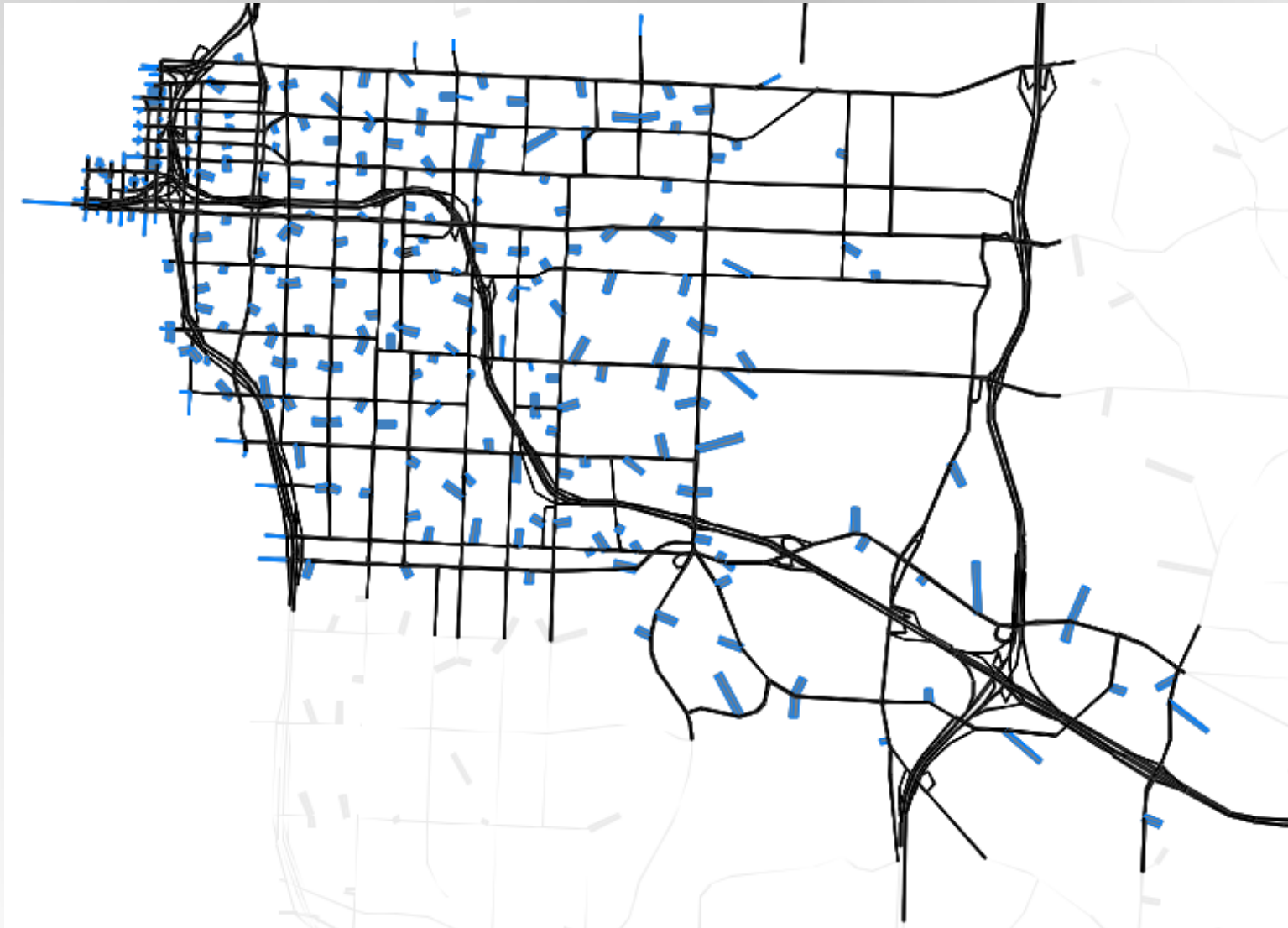
The Region



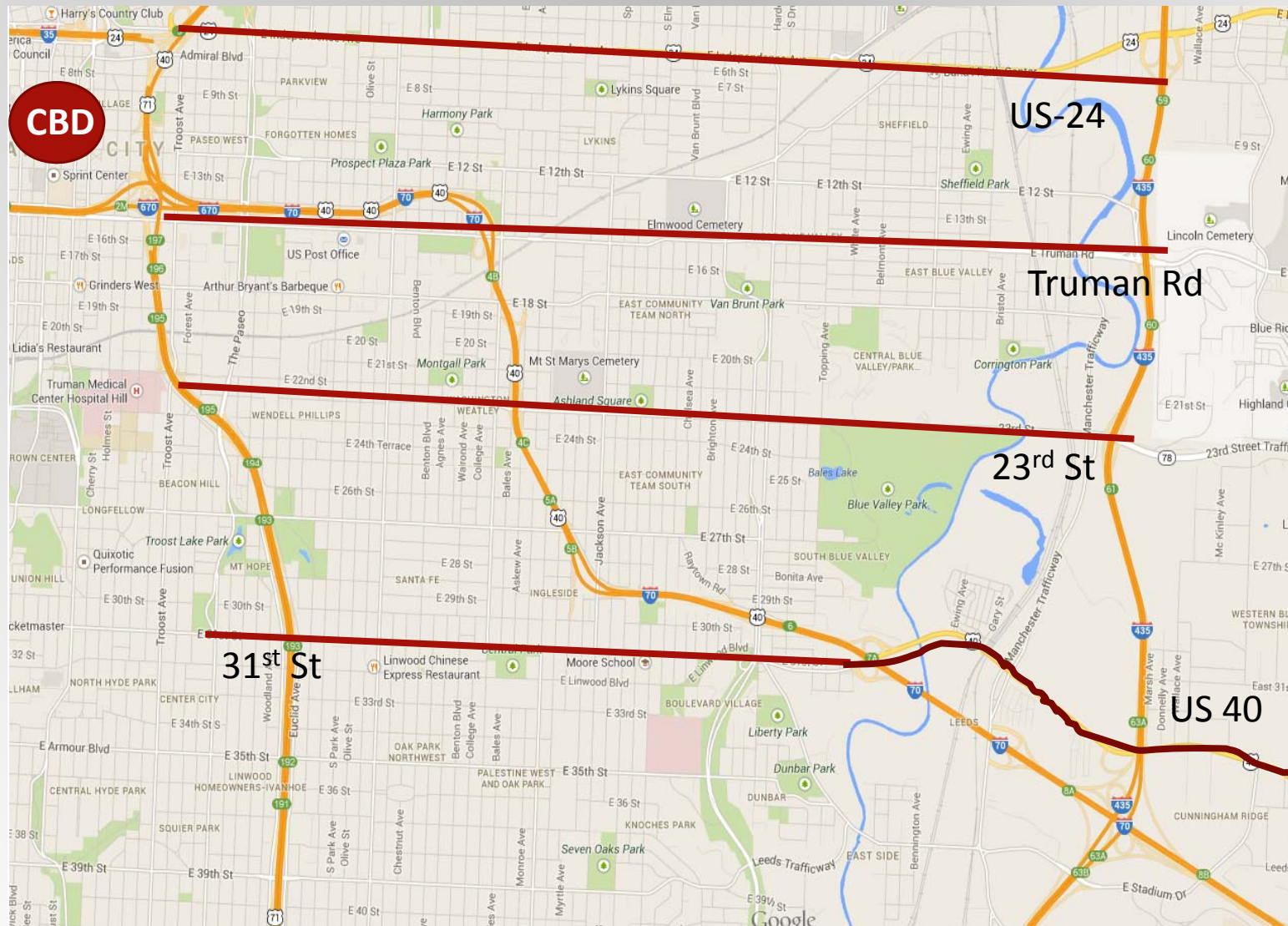
The Model Area



The Subarea



The Subarea



Steps to Get Network into Dynameq



Updating Geometry in Synchro

8981 Swope Pkwy & Blue Pkwy & Benton Blvd												
LANE SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)	1	3	1	1	3	1	1	3	1	1	3	1
Traffic Volume (vph)	23	365	26	39	1506	48	74	115	15	35	80	44
Street Name	Swope Pkwy			Blue Pkwy			Swope Pkwy			Benton Blvd		
Link Distance (ft)	—	381	—	—	436	—	—	1170	—	—	826	—
Link Speed (mph)	—	40	—	—	40	—	—	35	—	—	35	—
Set Arterial Name and Speed	—	EB	—	—	WB	—	—	NB	—	—	SB	—
Travel Time (s)	—	6.5	—	—	7.4	—	—	22.8	—	—	16.1	—
Ideal Satd. Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	—	-4	—	—	0	—	—	0	—	—	—	—
Area Type CBD	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—
Storage Length (ft)	125	—	200	350	—	0	100	—	150	—	—	—
Storage Lanes (#)	1	—	1	1	—	—	1	—	1	—	—	—
Right Turn Channelized	—	—	Yield	—	—	None	—	—	Yield	—	—	—
Curb Radius (ft)	—	—	250	—	—	—	—	—	50	—	—	—
Add Lanes (#)	—	—	0	—	—	—	—	—	0	—	—	—
Lane Utilization Factor	1.00	0.91	1.00	1.00	0.91	0.91	1.00	0.95	1.00	—	—	—
Right Turn Factor	1.000	1.000	0.850	1.000	0.994	—	1.000	1.000	0.850	—	—	—
Left Turn Factor (prot)	0.950	1.000	1.000	0.950	1.000	—	0.950	1.000	1.000	—	—	—
Saturated Flow Rate (prot)	1805	5187	1615	1770	5052	—	1770	3539	1583	—	—	—
Left Turn Factor (perm)	0.111	1.000	1.000	0.509	1.000	—	0.651	1.000	1.000	—	—	—
Right Ped Bike Factor	1.000	1.000	0.987	1.000	0.999	—	1.000	1.000	1.000	—	—	—
Left Ped Factor	1.000	1.000	1.000	0.999	1.000	—	1.000	1.000	1.000	—	—	—
Saturated Flow Rate (perm)	211	5187	1593	947	5052	—	1213	3539	1583	—	—	—
Right Turn on Red?	—	—	<input checked="" type="checkbox"/>	—	—	<input checked="" type="checkbox"/>	—	—	<input checked="" type="checkbox"/>	—	—	—
Saturated Flow Rate (RTOR)	0	0	145	0	8	—	0	0	145	—	—	—
Link Is Hidden	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—
Hide Name in Node Title	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—	—	<input type="checkbox"/>	—

- Lanes and Sharing
- Storage Length
- Storage Lanes
- Right Turn Channelized
- Curb Radius
- Add Lanes
- Right Turn on Red?



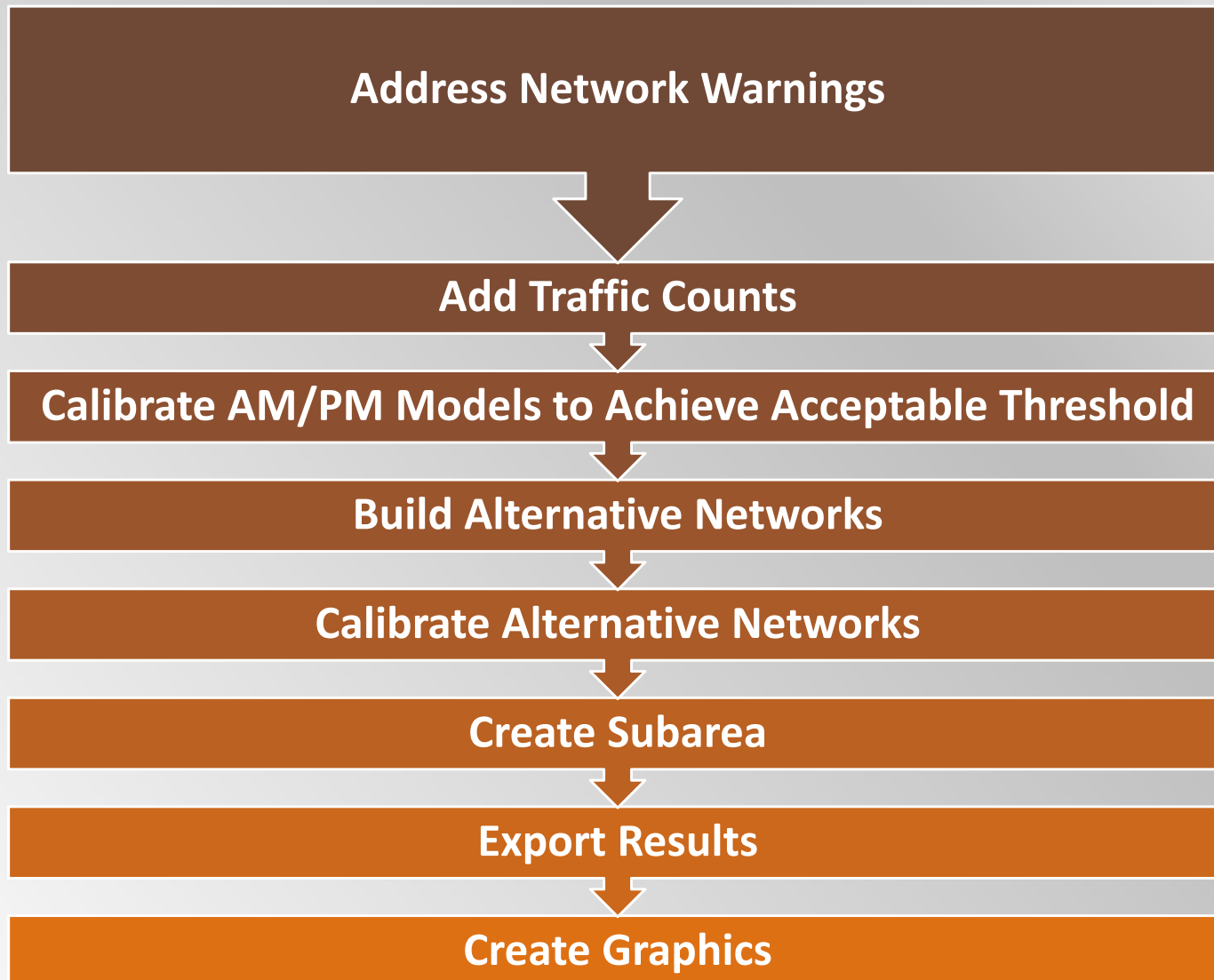
An aerial photograph of a complex highway interchange. The main road runs vertically through the center, with several lanes in each direction. To the left, a multi-lane ramp curves around a large, rectangular building with a flat roof. Below this building is a large parking lot filled with many cars. To the right, another ramp curves around a smaller building with a gabled roof. Further right, a road branches off to the right, leading to a large, circular, landscaped area with a central green space and surrounding walkways. The surrounding area includes various trees, grassy fields, and some smaller structures. The overall scene depicts a well-developed transportation hub in an urban or suburban setting.

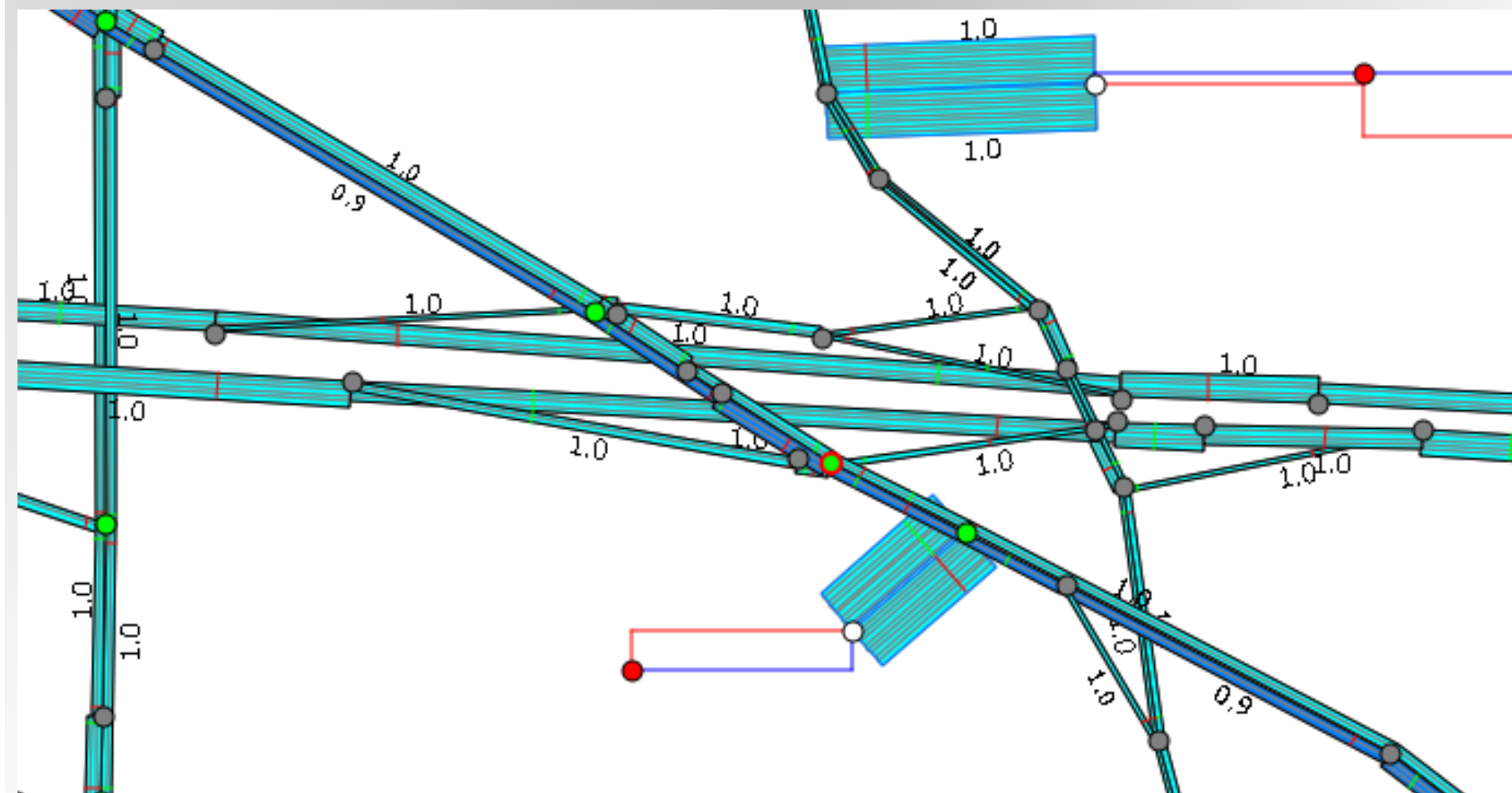
-
- Diagram illustrating traffic flow at the intersection of Benton Blvd, Blue, and Wopole Pkwy. The diagram shows traffic volumes for various approaches.
- Approaches and Traffic Volumes:**
- Benton Blvd (Top):** 44, 80, 35
 - Blue (Right):** 48, 1506, 39
 - Wopole Pkwy (Left):** 23, 365, 26
 - Bottom Approach:** 15, 115, 74
- The intersection area is labeled with 8981 and 8983. A central area is labeled 8981. A bottom approach has 8983. The diagram includes lane markings, traffic signals, and a central intersection area with a grid of yellow lines.

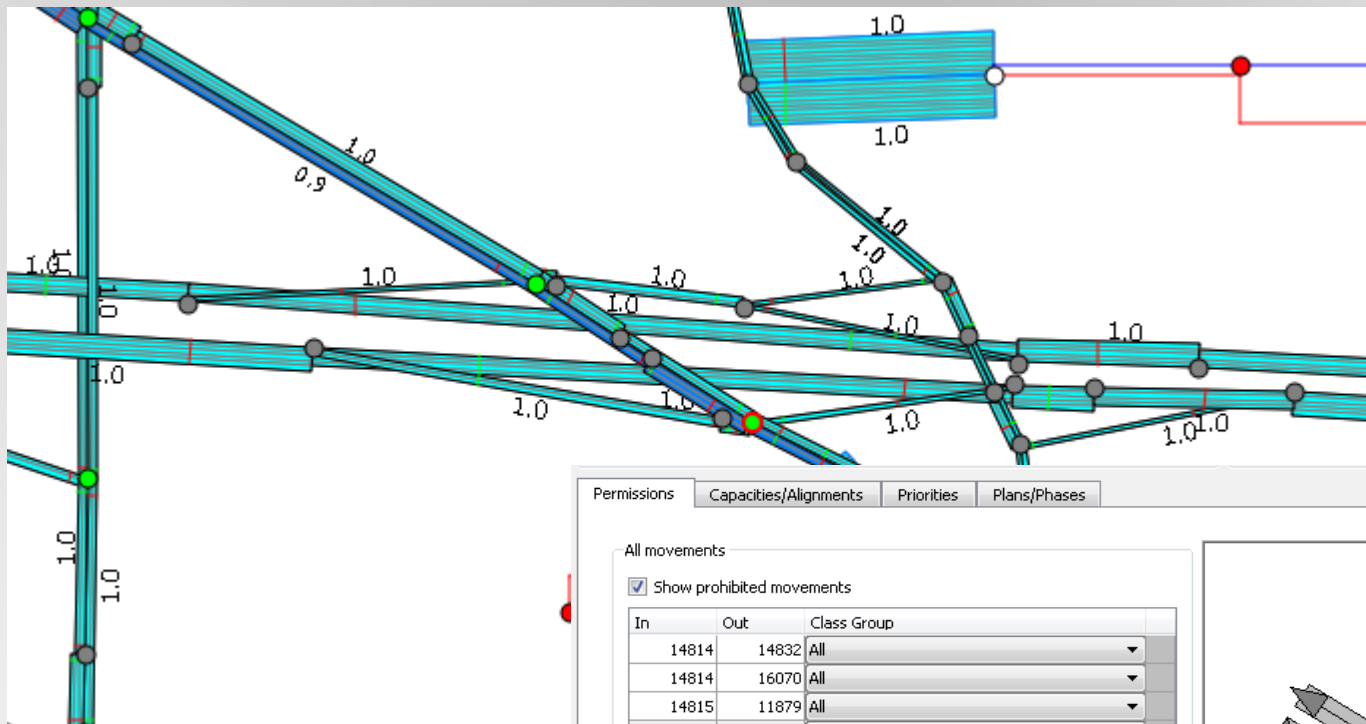
Steps to Get Network into Dynamaq



Steps Taken once our network was in Dynameq







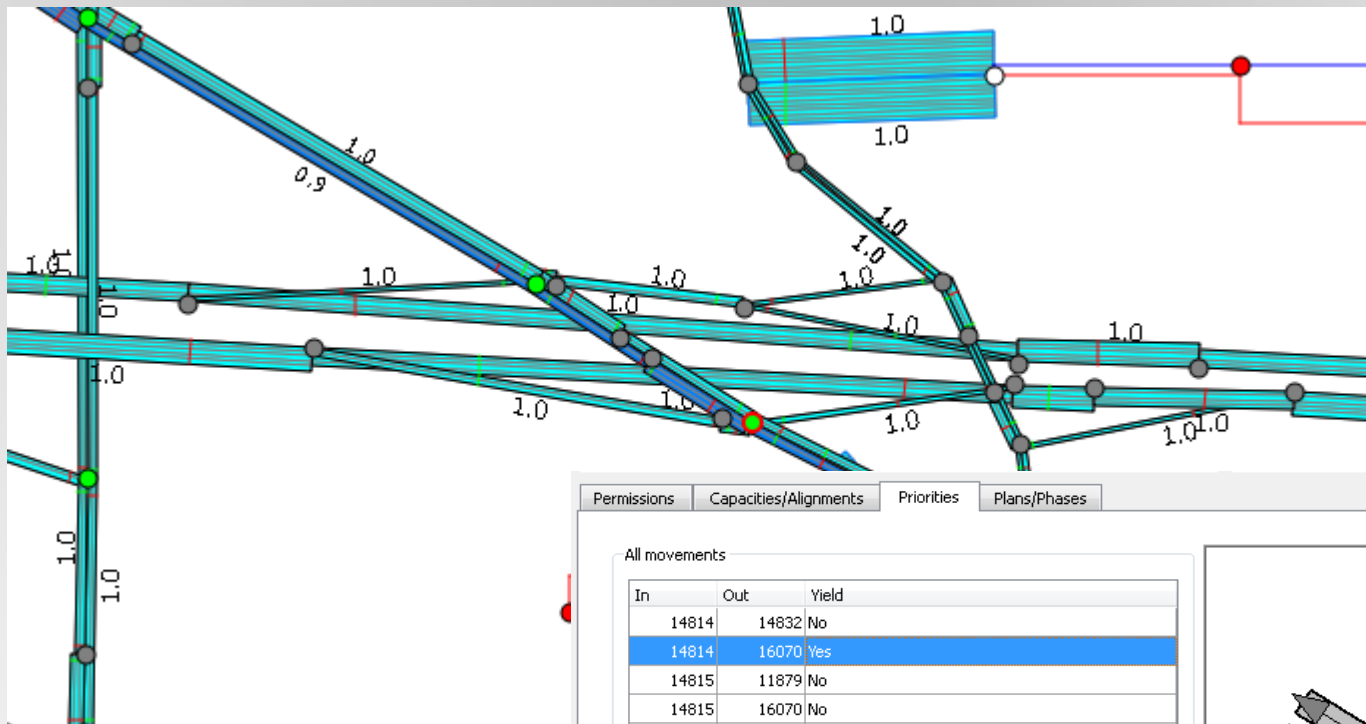
Permissions
Capacities/Alignments
Priorities
Plans/Phases

All movements
☒ Show prohibited movements

In	Out	Class Group
14814	14832	All
14814	16070	All
14815	11879	All
14815	16070	All
14816	11879	All
14816	14832	All
14814	11879	Prohibited
14815	14832	Prohibited
14816	16070	Prohibited

View options

- Prohibited
- All
- Transit
- Default_Transit
- Default



Permissions
Capacities/Alignments
Priorities
Plans/Phases

All movements

In	Out	Yield
14814	14832	No
14814	16070	Yes
14815	11879	No
14815	16070	No
14816	11879	No
14816	14832	No

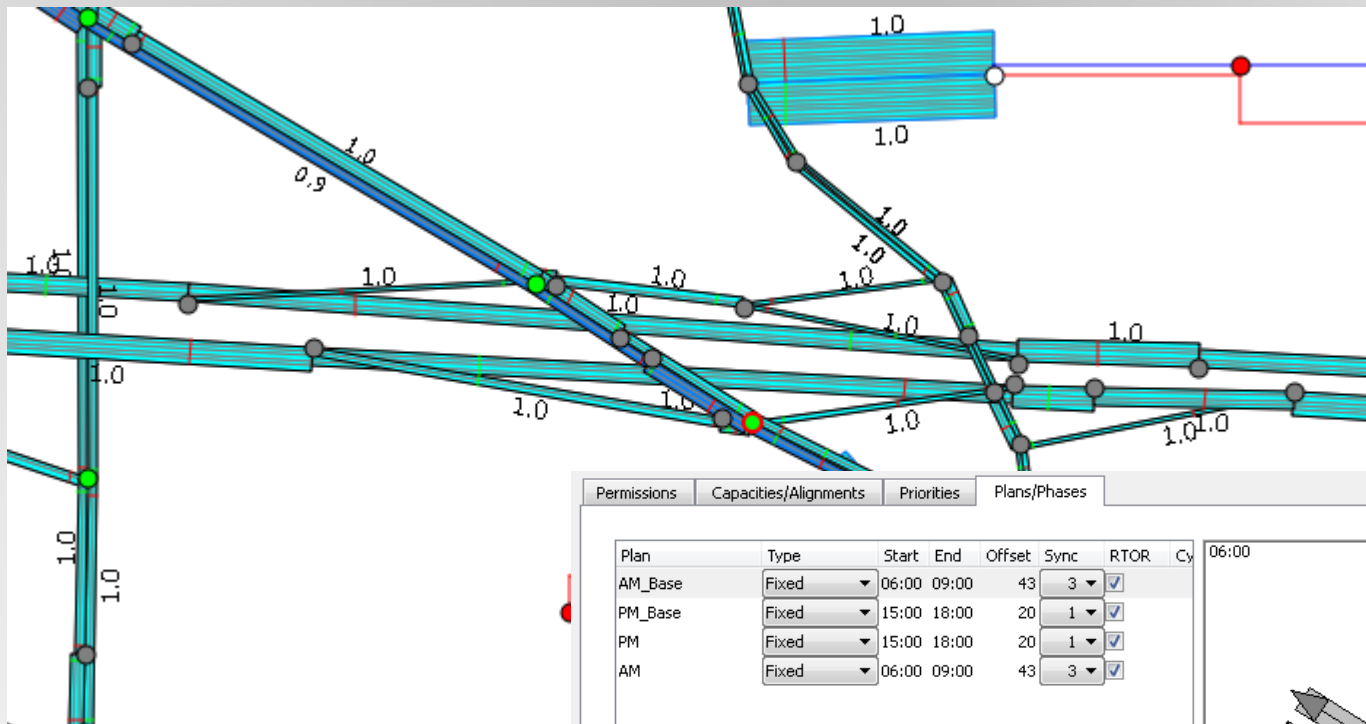
Higher priority movements

Add
Delete

In	Out	Critical Gap	Critical Wait
14816	11879	4.50	60.00
14816	14832	4.50	60.00
14815	16070	6.50	60.00

View options ▾

- Higher priority movement
- Lower priority movement



Permissions
Capacities/Alignments
Priorities
Plans/Phases

Plan	Type	Start	End	Offset	Sync	RTOR	Cy
AM_Base	Fixed	06:00	09:00	43	3	<input checked="" type="checkbox"/>	
PM_Base	Fixed	15:00	18:00	20	1	<input checked="" type="checkbox"/>	
PM	Fixed	15:00	18:00	20	1	<input checked="" type="checkbox"/>	
AM	Fixed	06:00	09:00	43	3	<input checked="" type="checkbox"/>	

Phases:
Add
Delete
Copy
<<
>>

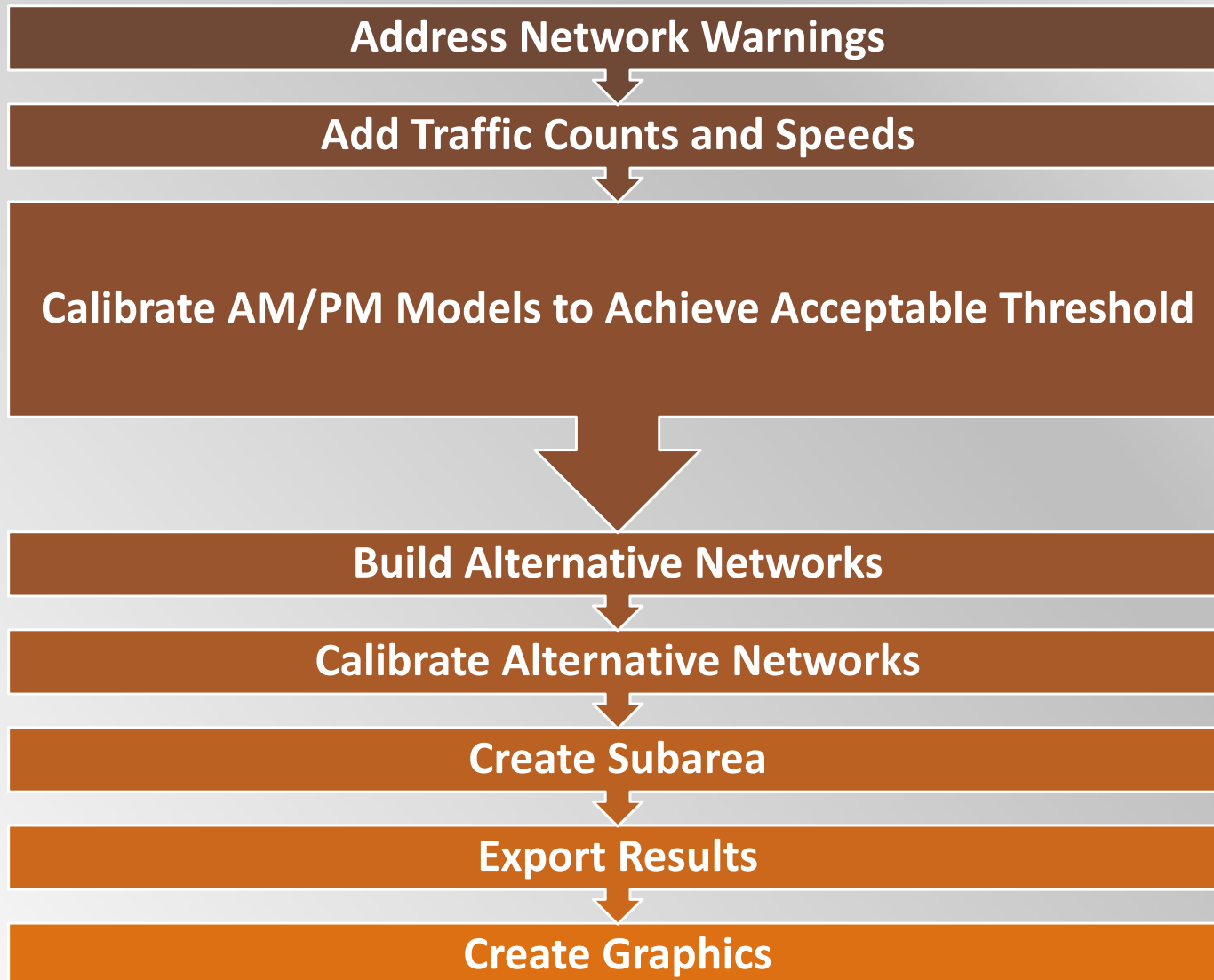
	1	2	3	4
Green	33.2	7.8	5.2	8.2
Yellow	4.1	3.5	4.1	4.1
All Red	3.7	3.7	3.7	3.7
Type	Standard	Standard	Standard	Standard

06:00

View options

- Protected capacity
- Permitted capacity
- Right turn on red
- Movement not in phase

Steps Taken once our network was in Dynameq



Dynameq: Network Scatterplot

File

AM_Counts *

Data Source Options

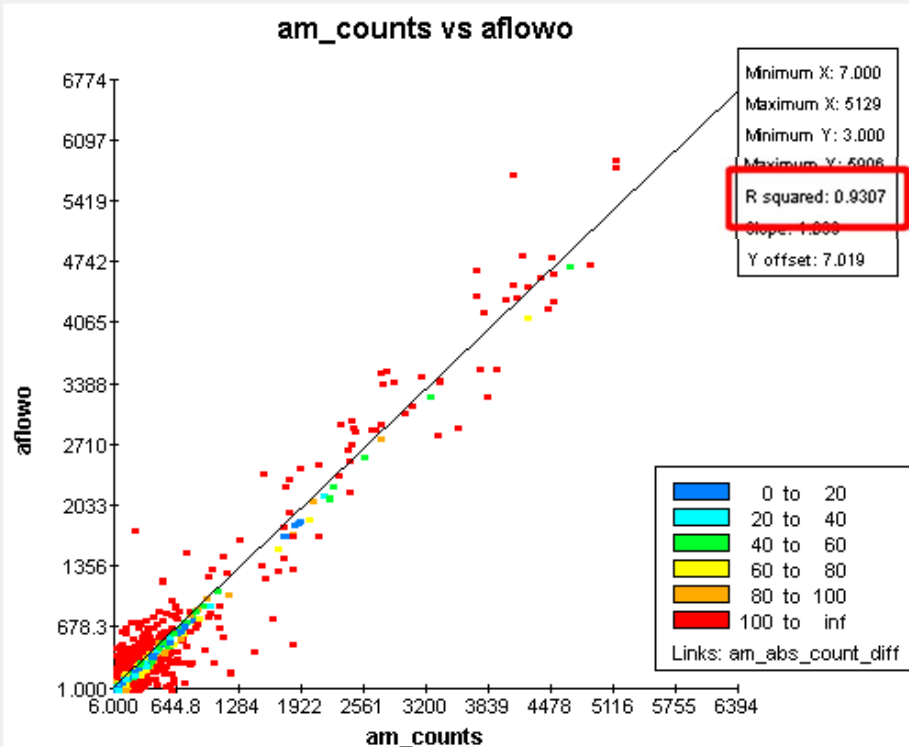
Domain: Links

X Value: am_counts

Y Value: aflowo

Filter: All

6576



Maximum: 6774

Number of intervals: 10

Intervals between labels: 1

Interval size: 677.3

Display Options

Color Control

Use default color

Color by attribute

am_abs_count_diff

Show Legend

Edit...

Show Point Outlines

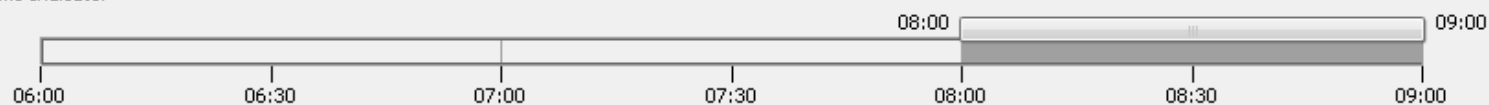
Point Size

2

Statistics Font Size

7

Time Indicator



Potential Improvements

Short-Term Action Items

- Mowing
- Maintenance
- Bridge Replacement



Horizontal Curves



Low Clearance Bridge (14'3")

Rebuild I-70 to last 30 years

Support Lanes and Roads

- Auxiliary Lanes
- Collector Distributor Lanes
- Frontage/Parallel Roads
- Reversible Lanes

Improve Bike
and
Pedestrian
Crossings



Short Merge/Diverge Areas



Short Weave Areas

Add Park
and Ride lot



Bus on Shoulder

Dave Gonzalez, Mn/DOT

Flexible
Work
Hours

Ramp
Metering

Interchange Options

- Consolidation
- Modification
- Elimination



Second Tier Alternatives

- Three Second Tier Alternatives
 - No-Build Alternative
 - Geometric Improvements Alternative
 - Interchange Consolidations Alternative

- Second Tier Screening
 - Purpose and Need
 - Social and Natural Environmental Issues
 - Engineering Issues
 - Public Comment

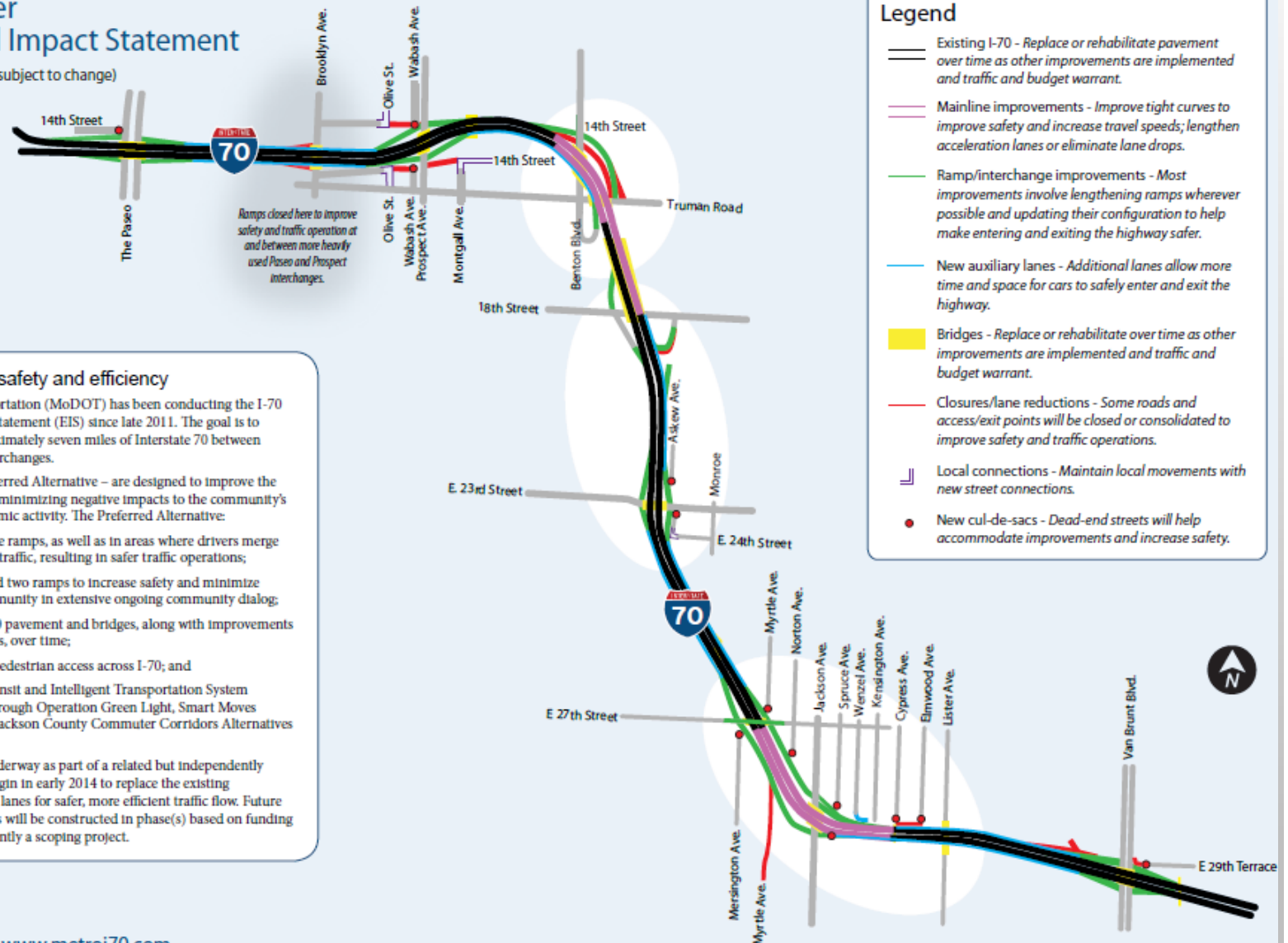
Preferred Alternative



I-70 Second Tier Environmental Impact Statement

Preferred Alternative (draft - subject to change)

The Paseo to Van Brunt Blvd.



Improving safety and efficiency

The Missouri Department of Transportation (MoDOT) has been conducting the I-70 Second Tier Environmental Impact Statement (EIS) since late 2011. The goal is to develop recommendations for approximately seven miles of Interstate 70 between The Paseo and Blue Ridge Cutoff interchanges.

The EIS recommendations – the Preferred Alternative – are designed to improve the highway's safety and efficiency while minimizing negative impacts to the community's current and future vitality and economic activity. The Preferred Alternative:

- Makes improvements to interstate ramps, as well as in areas where drivers merge with or maneuver through other traffic, resulting in safer traffic operations;
- Consolidates one interchange and two ramps to increase safety and minimize impacts as requested by the community in extensive ongoing community dialog;
- Rebuilds and/or rehabilitates I-70 pavement and bridges, along with improvements to the Benton and Jackson Curves, over time;
- Includes improving bicycle and pedestrian access across I-70; and
- Calls for MoDOT to continue transit and Intelligent Transportation System coordination in the study area through Operation Green Light, Smart Moves Regional Transit Vision and the Jackson County Commuter Corridors Alternatives Analysis.

Other corridor improvements are underway as part of a related but independently funded project. Construction will begin in early 2014 to replace the existing Manchester Bridge and add auxiliary lanes for safer, more efficient traffic flow. Future I-70/I-435 interchange improvements will be constructed in phase(s) based on funding availability. This interchange is currently a scoping project.

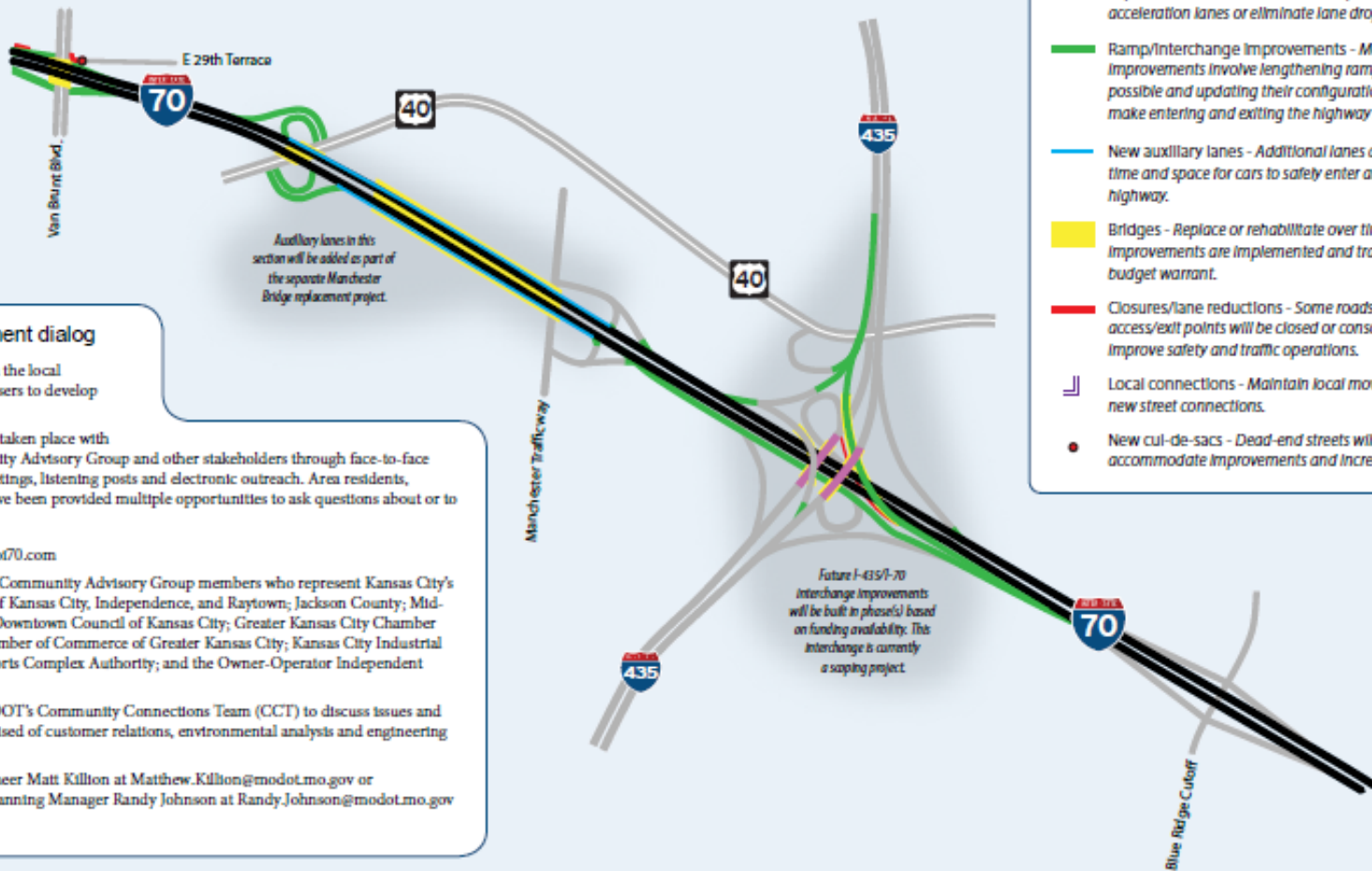


1-888-ASK-MODOT | www.metroi70.com

Preferred Alternative

I-70 Second Tier Environmental Impact Statement Preferred Alternative (draft - subject to change)

Van Brunt Blvd. to Blue Ridge Cutoff



Legend

-  Existing I-70 - Replace or rehabilitate pavement over time as other improvements are implemented and traffic and budget warrant.
-  Mainline Improvements - Improve tight curves to improve safety and increase travel speeds; lengthen acceleration lanes or eliminate lane drops.
-  Ramp/Interchange Improvements - Most improvements involve lengthening ramps wherever possible and updating their configuration to help make entering and exiting the highway safer.
-  New auxiliary lanes - Additional lanes allow more time and space for cars to safely enter and exit the highway.
-  Bridges - Replace or rehabilitate over time as other improvements are implemented and traffic and budget warrant.
-  Closures/lane reductions - Some roads and access/exit points will be closed or consolidated to improve safety and traffic operations.
-  Local connections - Maintain local movements with new street connections.
-  New cul-de-sacs - Dead-end streets will help accommodate improvements and increase safety.

The I-70 improvement dialog

MoDOT has worked closely with the local community and other highway users to develop potential I-70 solutions.

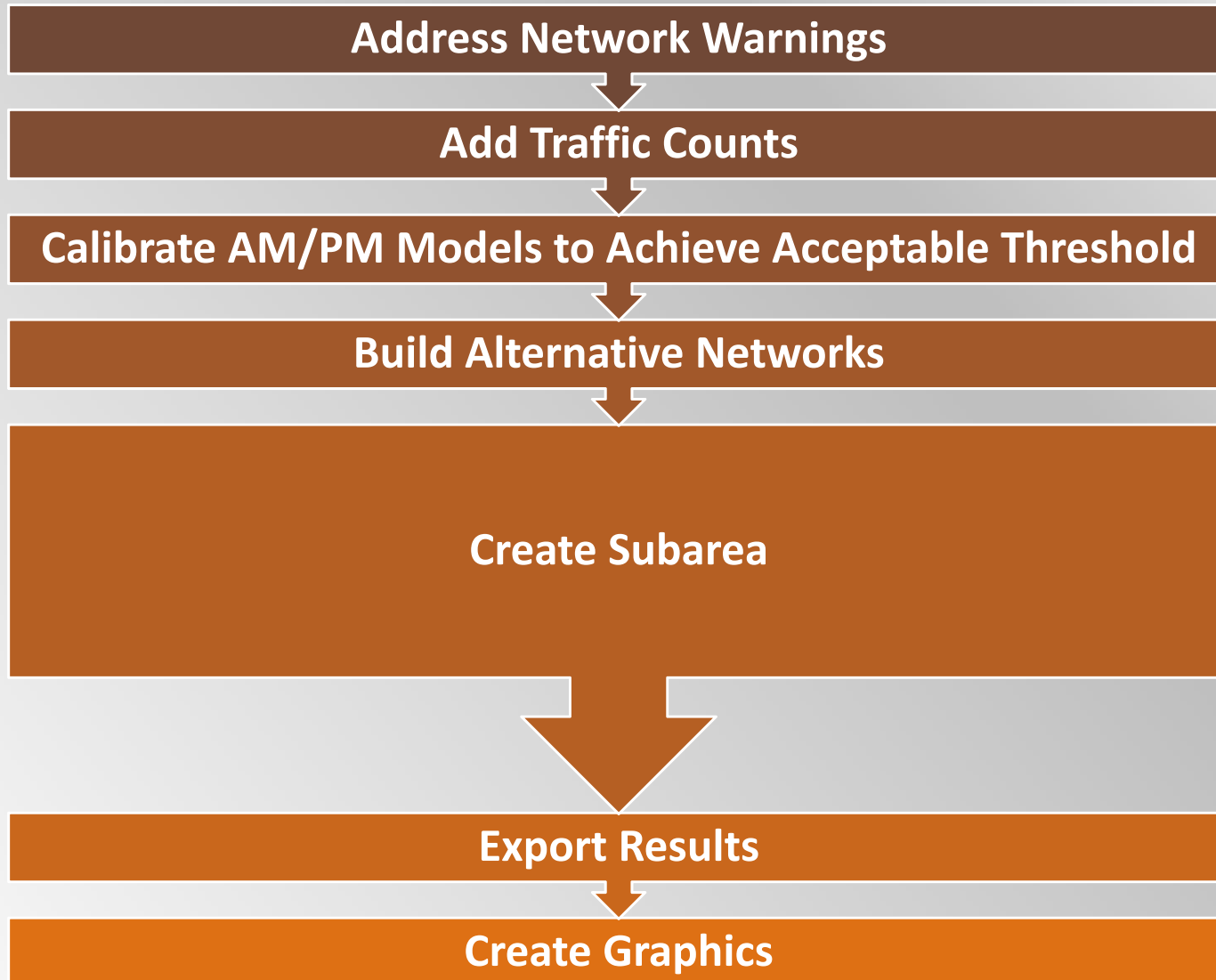
Extensive stakeholder dialog has taken place with the study's 14-member Community Advisory Group and other stakeholders through face-to-face meetings, community group meetings, listening posts and electronic outreach. Area residents, business owners and travelers have been provided multiple opportunities to ask questions about or to comment on the EIS. They can:

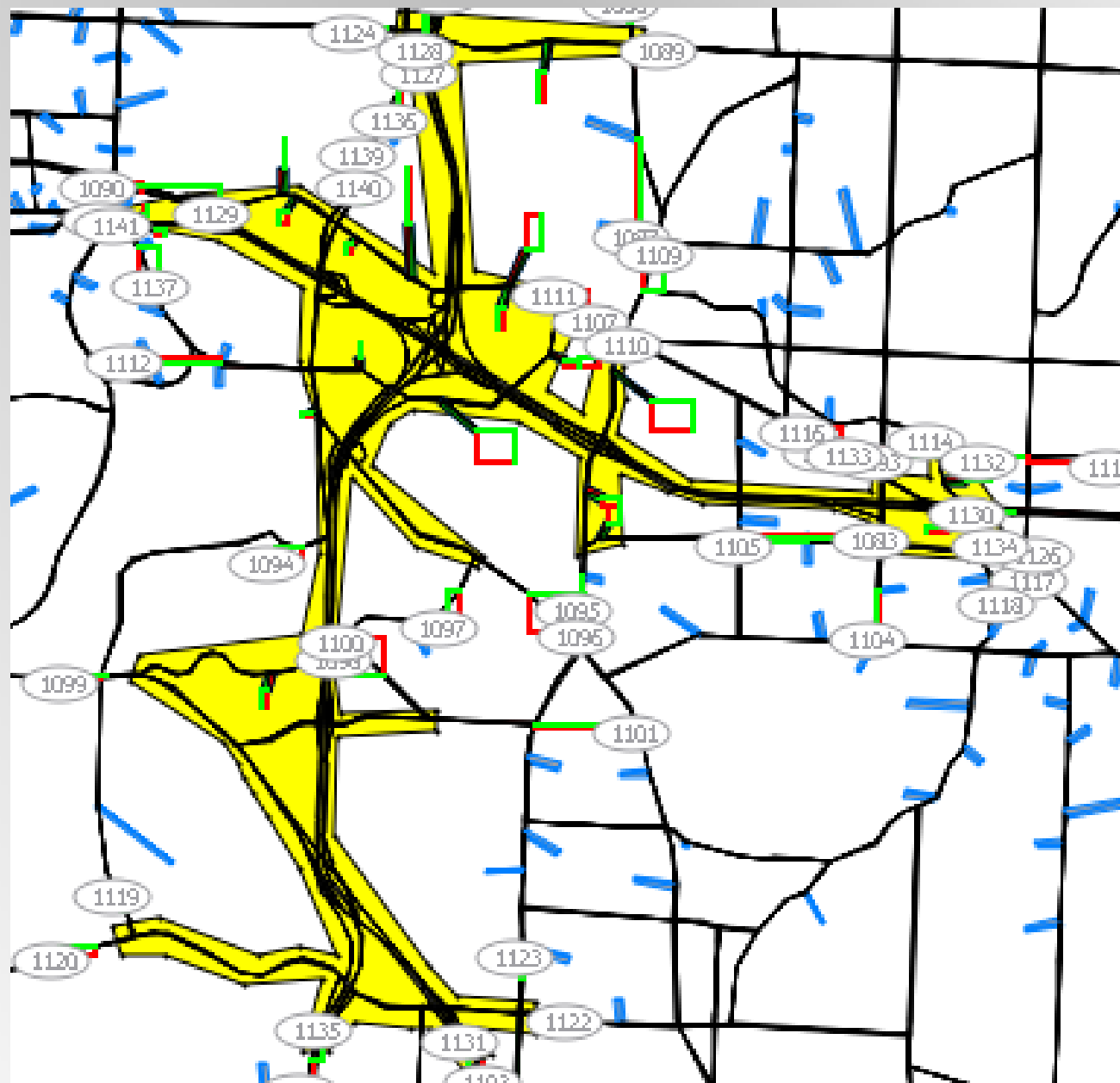
- Find out more at www.metroi70.com
- Learn more from the study's Community Advisory Group members who represent Kansas City's 3rd Council District; Cities of Kansas City, Independence, and Raytown; Jackson County; Mid-America Regional Council; Downtown Council of Kansas City; Greater Kansas City Chamber of Commerce; Hispanic Chamber of Commerce of Greater Kansas City; Kansas City Industrial Council; Jackson County Sports Complex Authority; and the Owner-Operator Independent Drivers Association;
- Meet with a member of MoDOT's Community Connections Team (CCT) to discuss issues and concerns. The CCT is comprised of customer relations, environmental analysts and engineering specialists;
- Contact MoDOT Area Engineer Matt Killion at Matthew.Killion@modot.mo.gov or 816-622-0500 or MoDOT Planning Manager Randy Johnson at Randy.Johnson@modot.mo.gov or 816-607-2265.



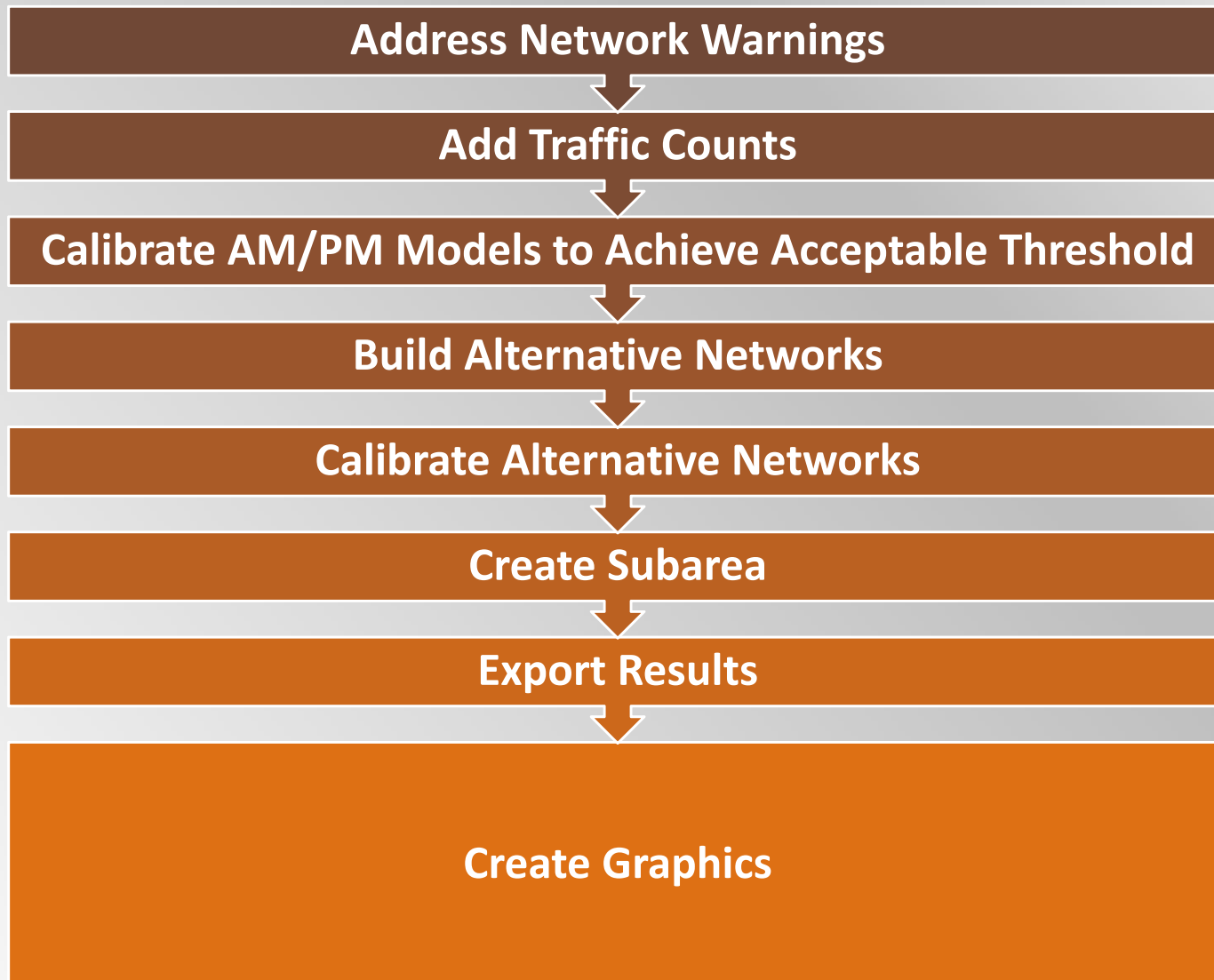
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Steps Taken once our network was in Dynameq

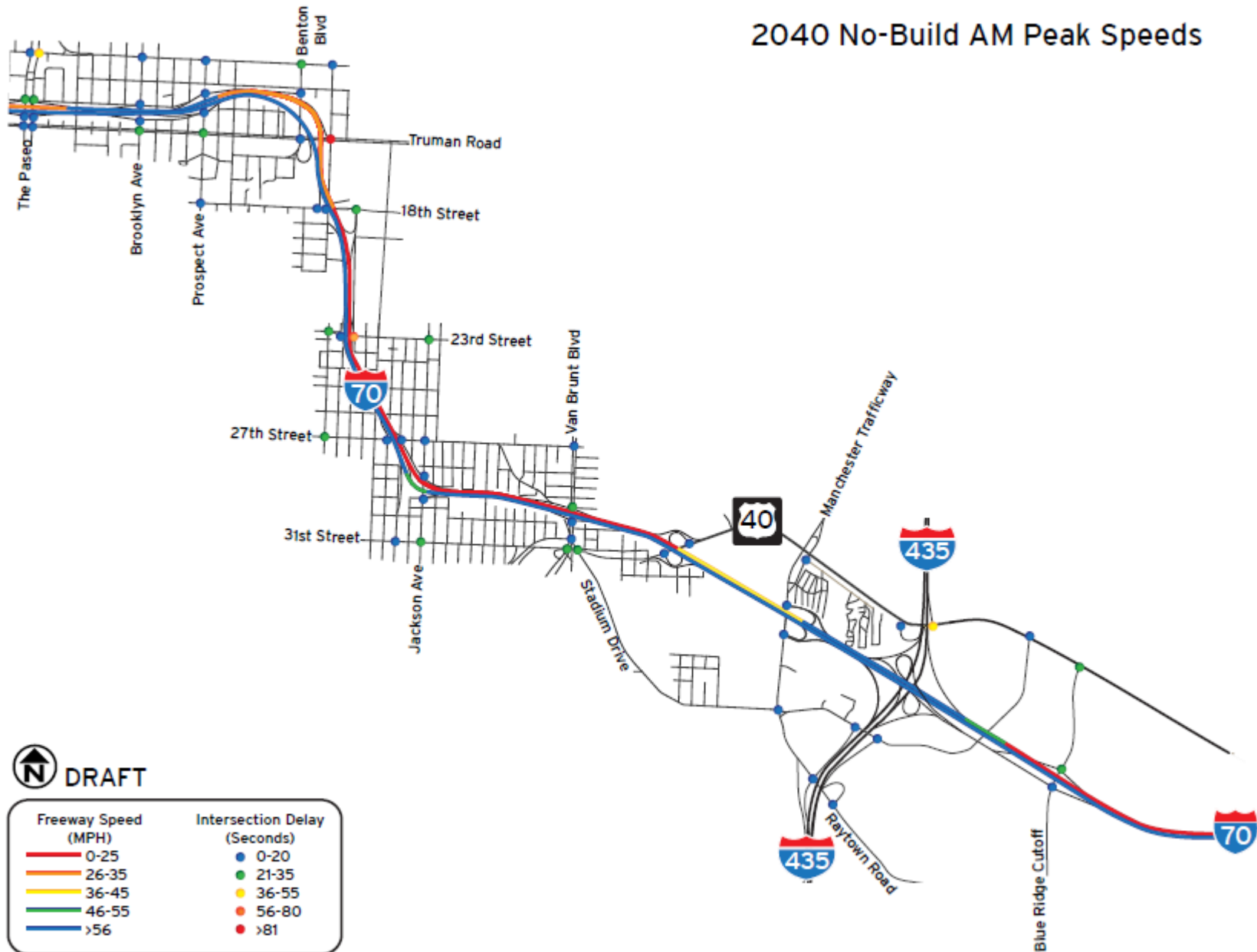




Steps Taken once our network was in Dynameq



2040 No-Build AM Peak Speeds



July 2013

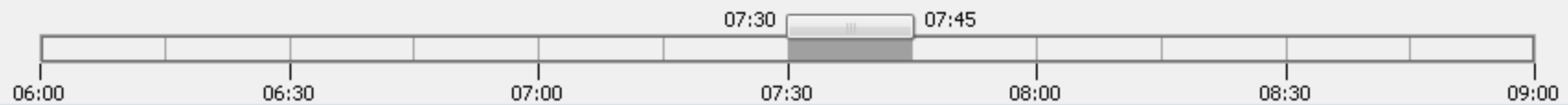


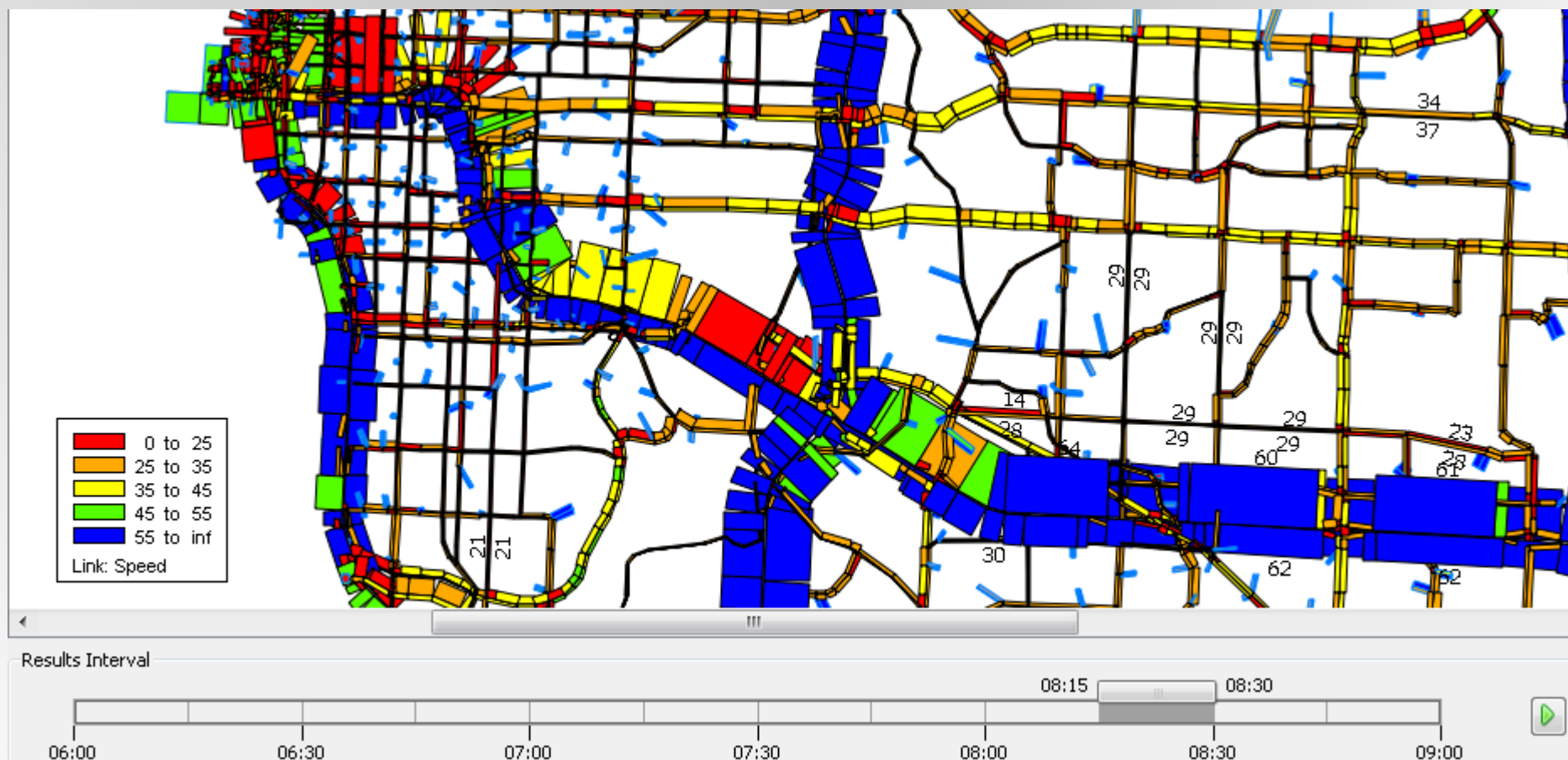
Features We Liked

- **Network Warnings**
- **Scatterplot for R-Square**
- **Time Slide Bar**
- Graphical Capabilities Make Calibration Easy
- DTA
 - Creating user defined attributes → Displaying them in simulation results
 - Filters
 - Creating Select Links
- Creating Subareas → Exporting results



Results Interval







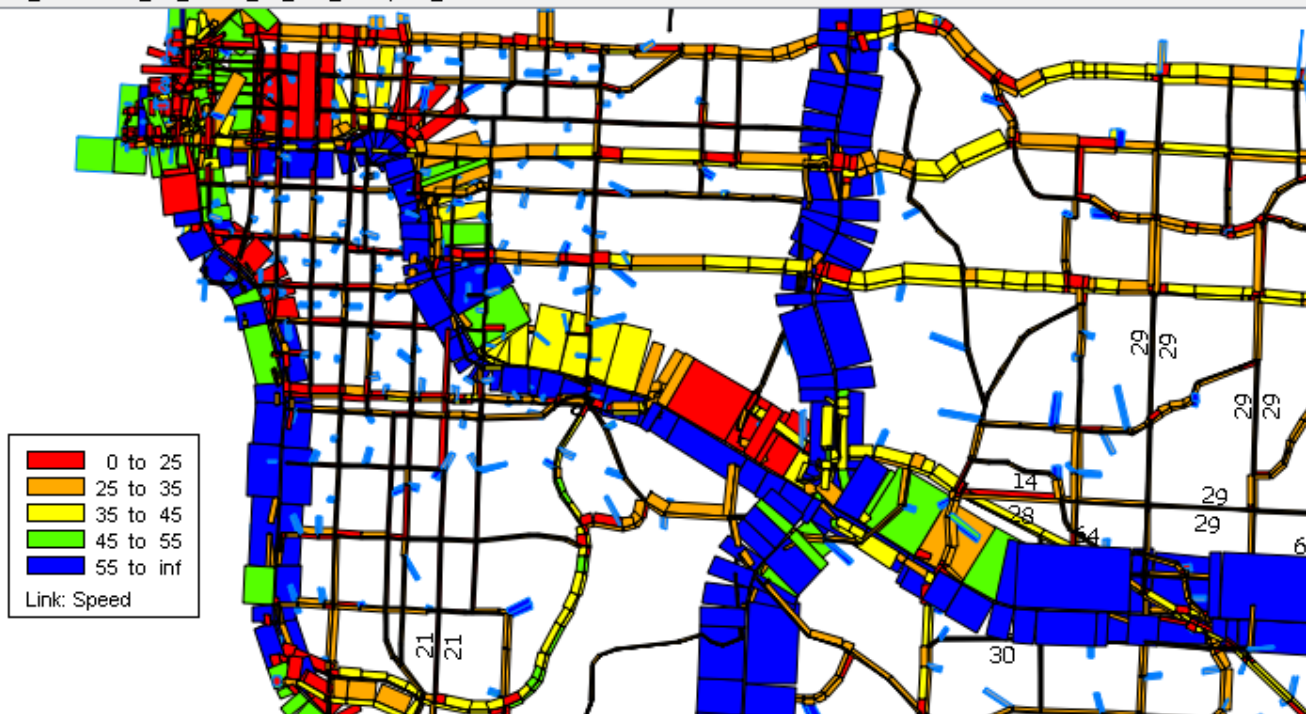
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 - Creating Select Links
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level  Filter: All 6593





_Preferred_Alternative_8In_Manch_DT_Plus_Edits / AM_Peak



speed2  


Centroids 

Links 



☒ Color legend 

☐ Bar legend


☒ Color

Speed 



☒ Numeric values

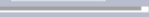
Decimals: 0  


Width:

Outflow 

☐ Numeric values

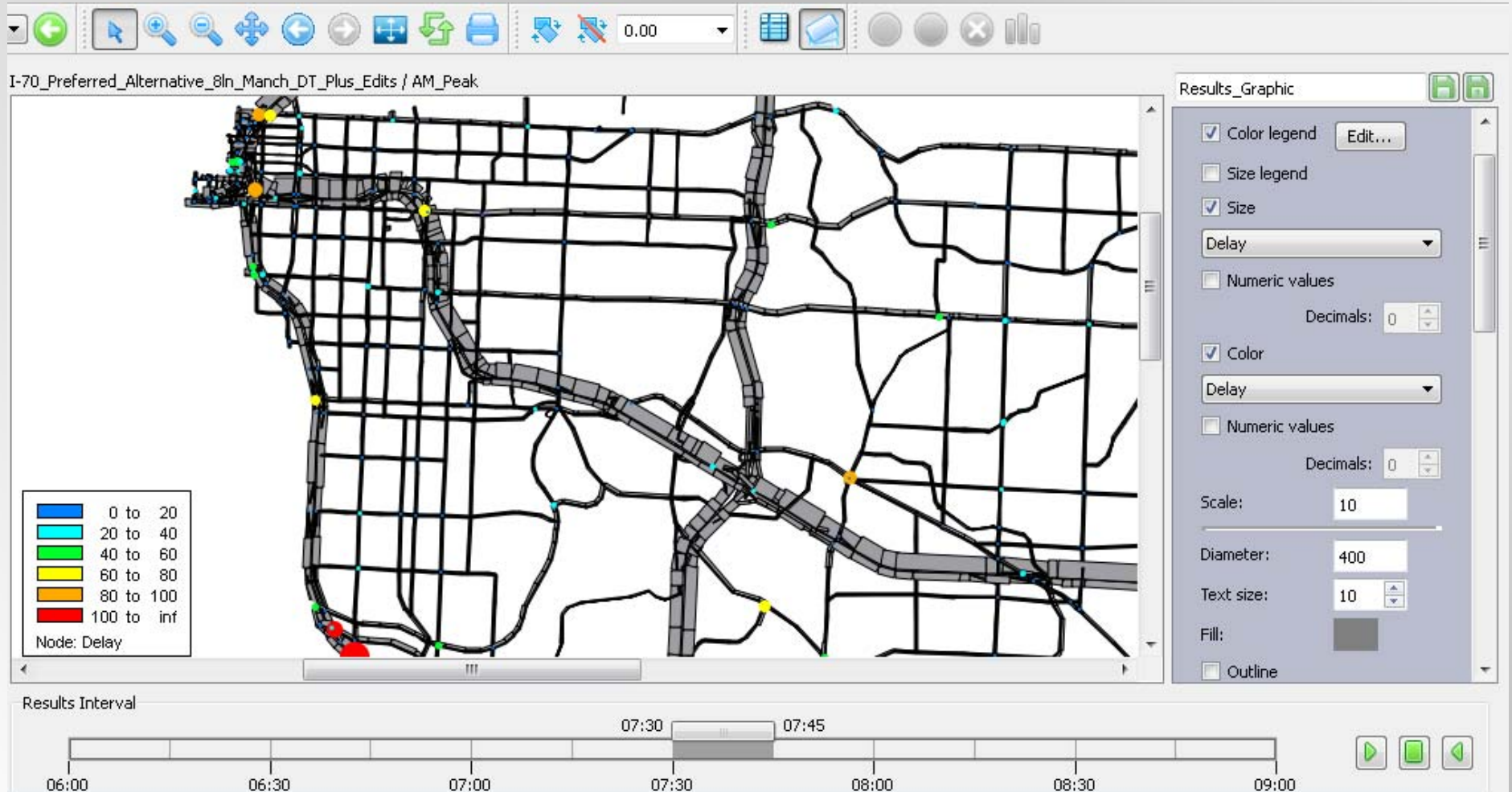
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Scale: 200 

Offset: 1.00 

Results Interval

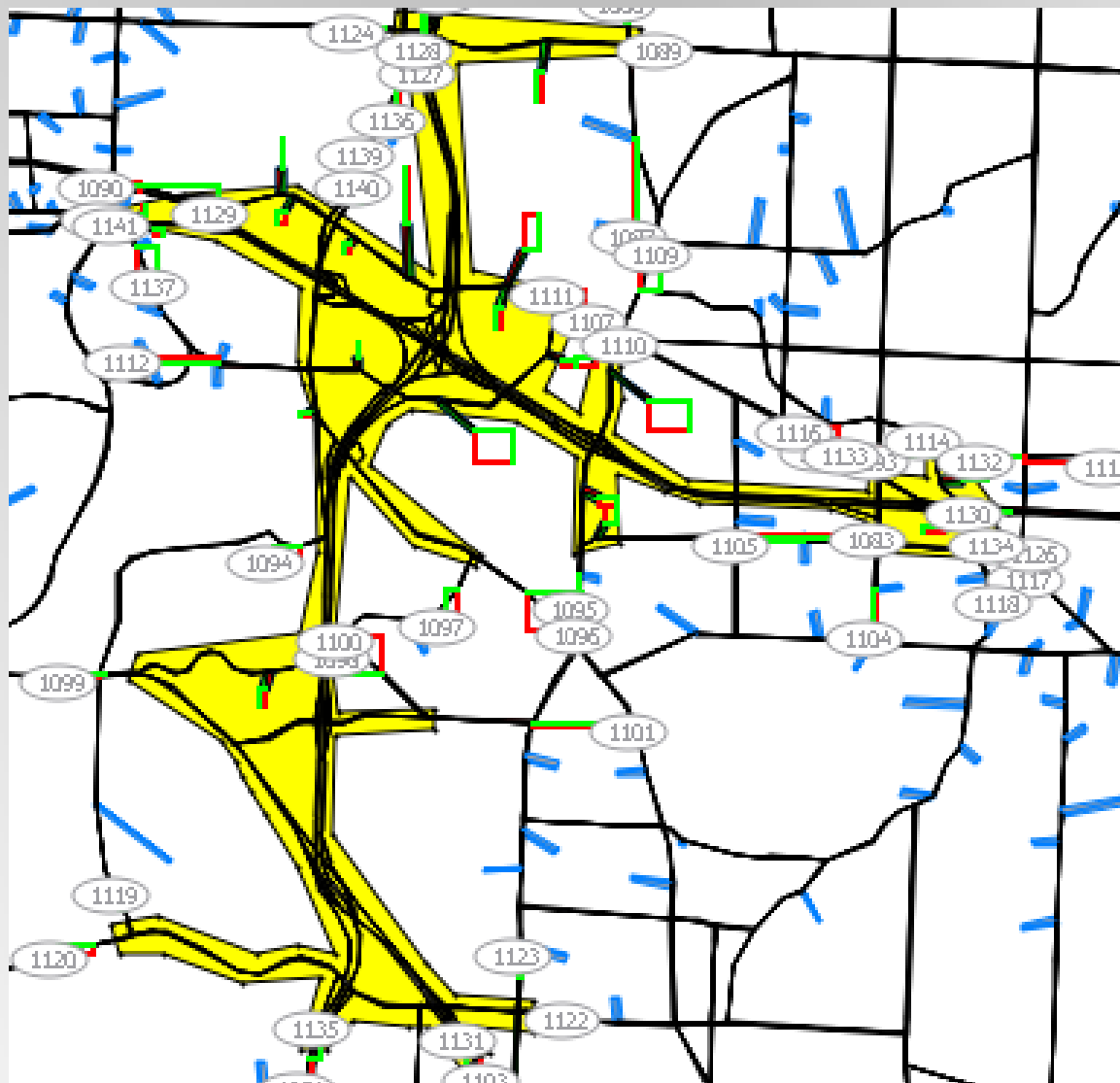




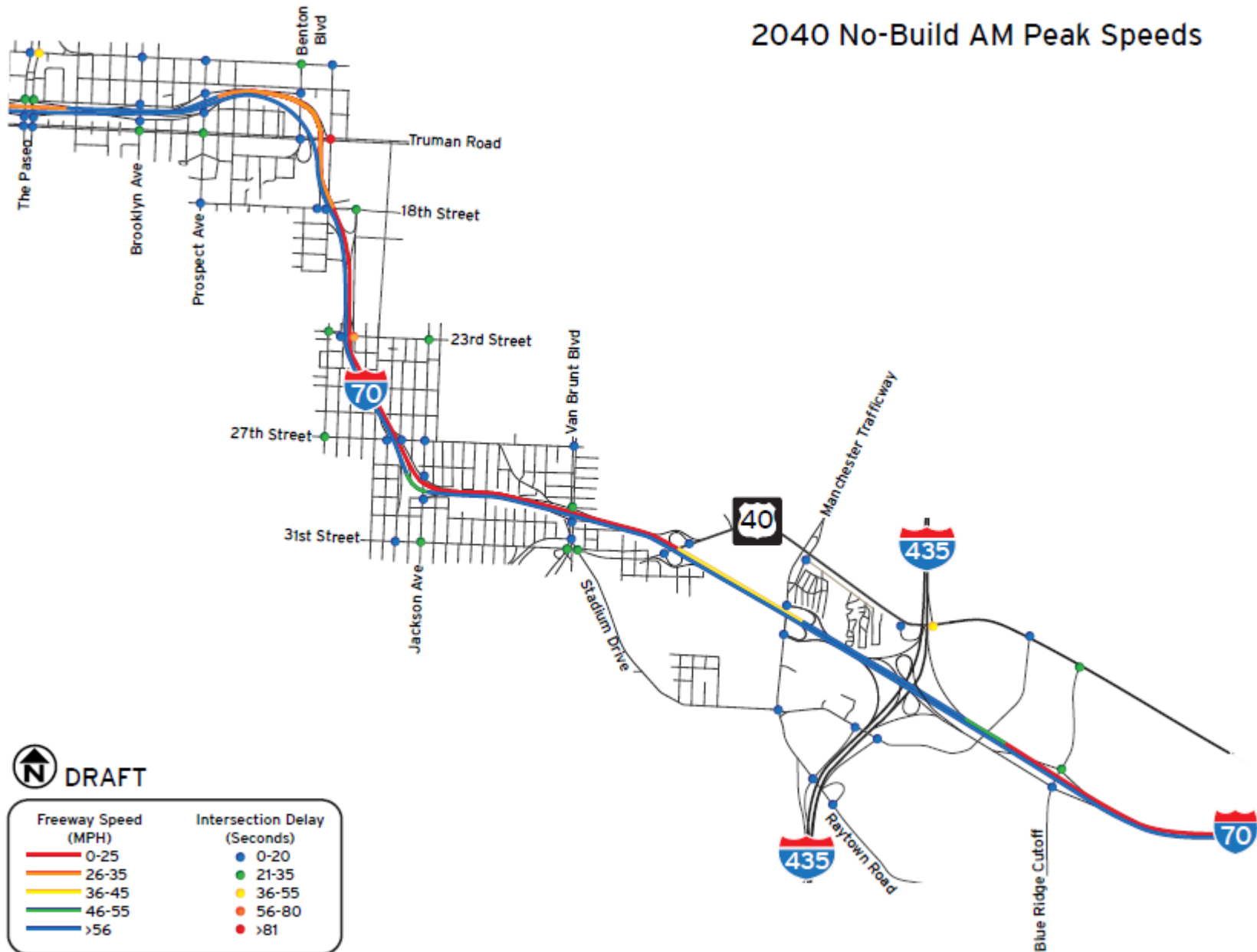



Features We Liked

- Network Warnings When Loading a Project
- Scatterplot for R-Square
- Time Slide Bar
- Graphical Capabilities Make Calibration Easy
- **DTA**
 - Creating user defined attributes → Displaying them in simulation results
 - Filters
 - Creating Select Links
- Creating Subareas → Exporting results



2040 No-Build AM Peak Speeds




 DRAFT

July 2013

2040 Preferred AM Peak Speeds



 DRAFT

Freeway Speed (MPH)	Intersection Delay (Seconds)
0-25	0-20
26-35	21-35
36-45	36-55
46-55	56-80
>56	>81

July 2013

Deliverable

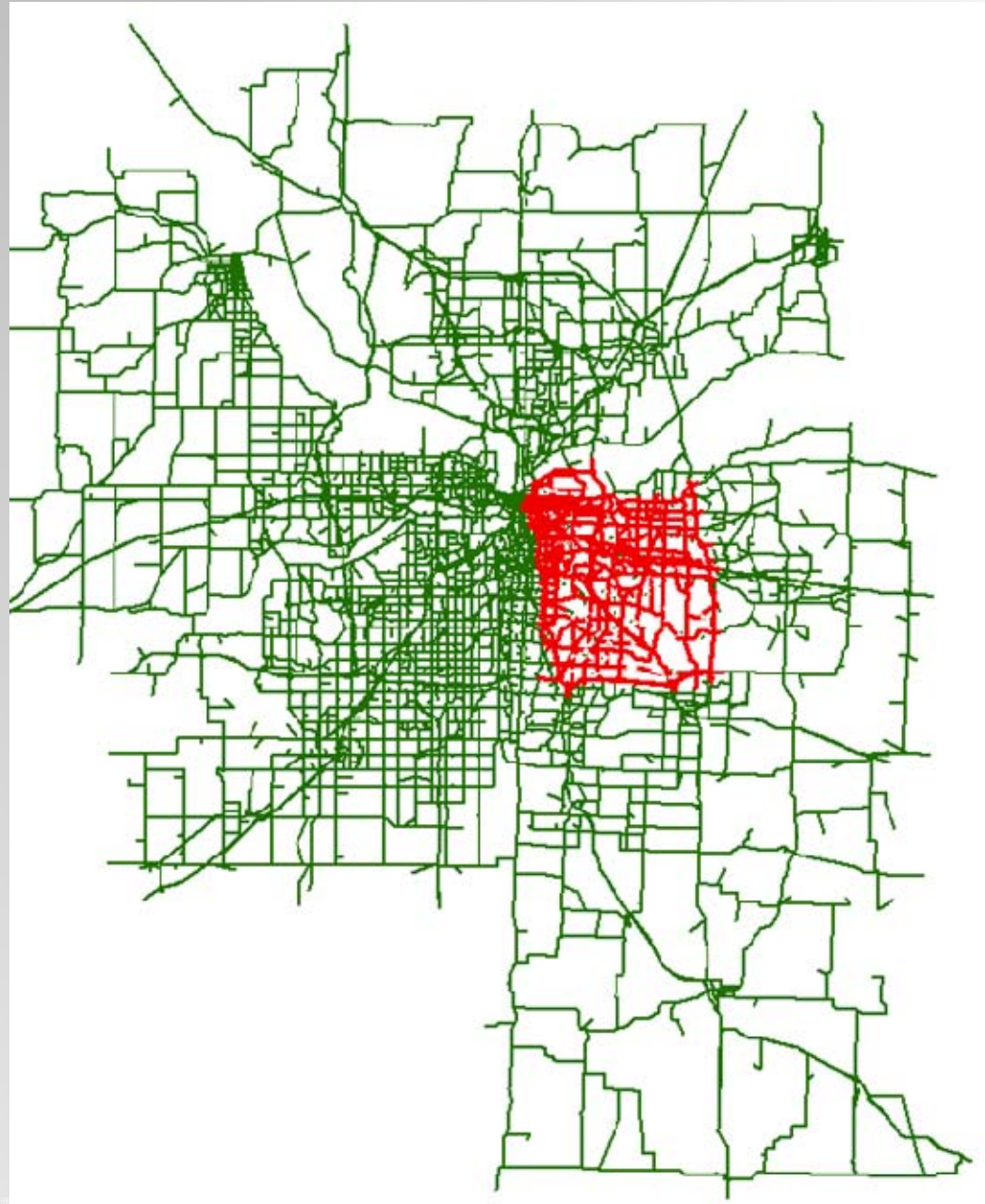
		Existing (2012)	No-Build (2040)	Improve Geometrics (2040)	Interchange Consolidation (2040)	Preferred (2040)
AM Peak / Westbound	Vehicle Miles Traveled	442,887.89	549,038.60	554,409.45	554,373.83	555,511.82
	Vehicle Hours Traveled	10,650.77	15,623.16	15,834.69	15,849.85	15,025.01
	Vehicle Hours of Delay	1,788.45	4,342.64	4,477.04	4,375.54	3,732.77
	Average Speed (MPH)	41.58	35.14	35.01	34.98	36.97
PM Peak / Eastbound	Vehicle Miles Traveled	482,803.52	615,721.30	616,211.00	621,499.91	619,783.86
	Vehicle Hours Traveled	12,113.33	17,878.10	18,057.09	17,912.19	17,937.81
	Vehicle Hours of Delay	2,187.52	5,078.87	5,258.78	4,900.66	5,047.88
	Average Speed (MPH)	39.86	34.44	34.13	34.70	34.55



Conclusions about Dynameq

- Strengths of the program
 - Graphics
 - Time Dimension
- Challenges
 - Editing network
 - Detailed operations (e.g. merging/weaving)
 - Subarea extraction could be improved
- Opportunities
 - Maintenance of Traffic Analysis
 - Expand model to regional level?

Future Steps





Thank You. Questions?

HNTB Corporation

Joe Blasi, PE, PTOE

Squad Leader, Integrated Planning Solutions Group

Jblasi@hntb.com

Derek Vap, PE

Project Engineer, Transportation Group

DVap@hntb.com