Sep 7th, 2011

Presenter: **Max Shmaltsuyev**

Overview

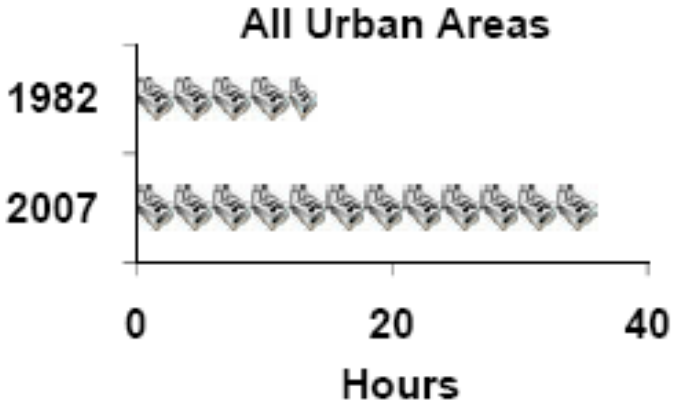
- PART 1 – Texas Transportation Institute (TTI) Methodology Review
- PART 2 – Methodology Adaptation
- PART 3 – Directions for future research

Part 1 – TTI Methodology Review

- TTI Nationwide Cost of Congestion (TTI, 2009)
  - Typical commuter spent 36 hours per year in traffic in 2007
  - Extra gasoline and diesel fuel = 24 gallons in 2007
  - Congestion cost per capita = $757
  - Congestion cost nation = $87.2 Billion
  - Rare break in near-constant growth
    - TTI found that travelers spent one hour less stuck in traffic in 2007 than they did in 2006 and wasted 1 gallon less of gasoline.

TTI Nationwide Cost of Congestion (TTI, 2009)

Exhibit 3. Hours of Travel Delay per Peak-Period Traveler



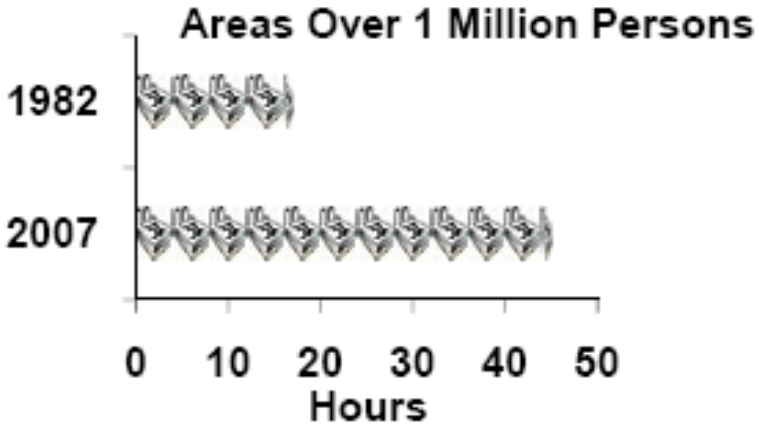
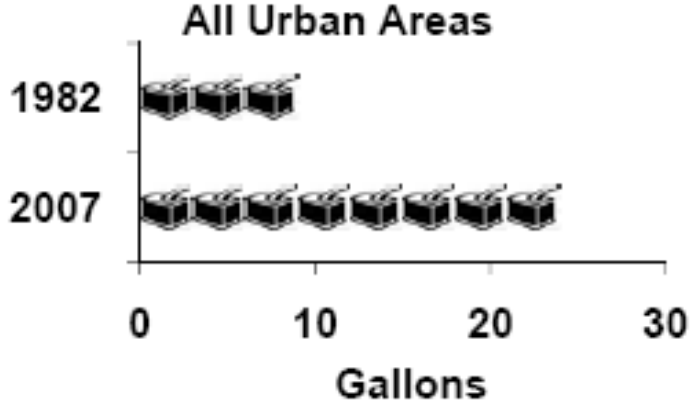
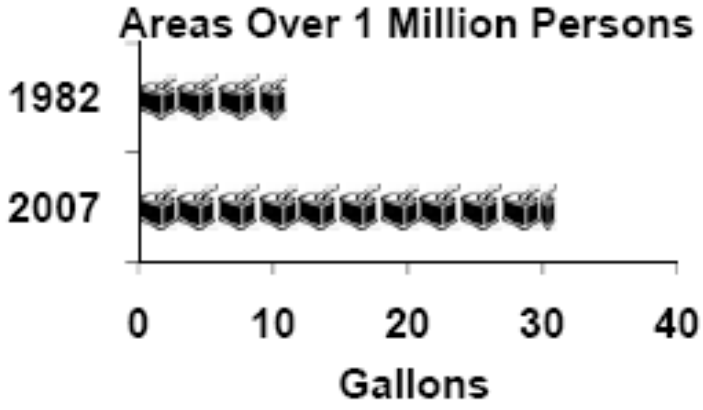


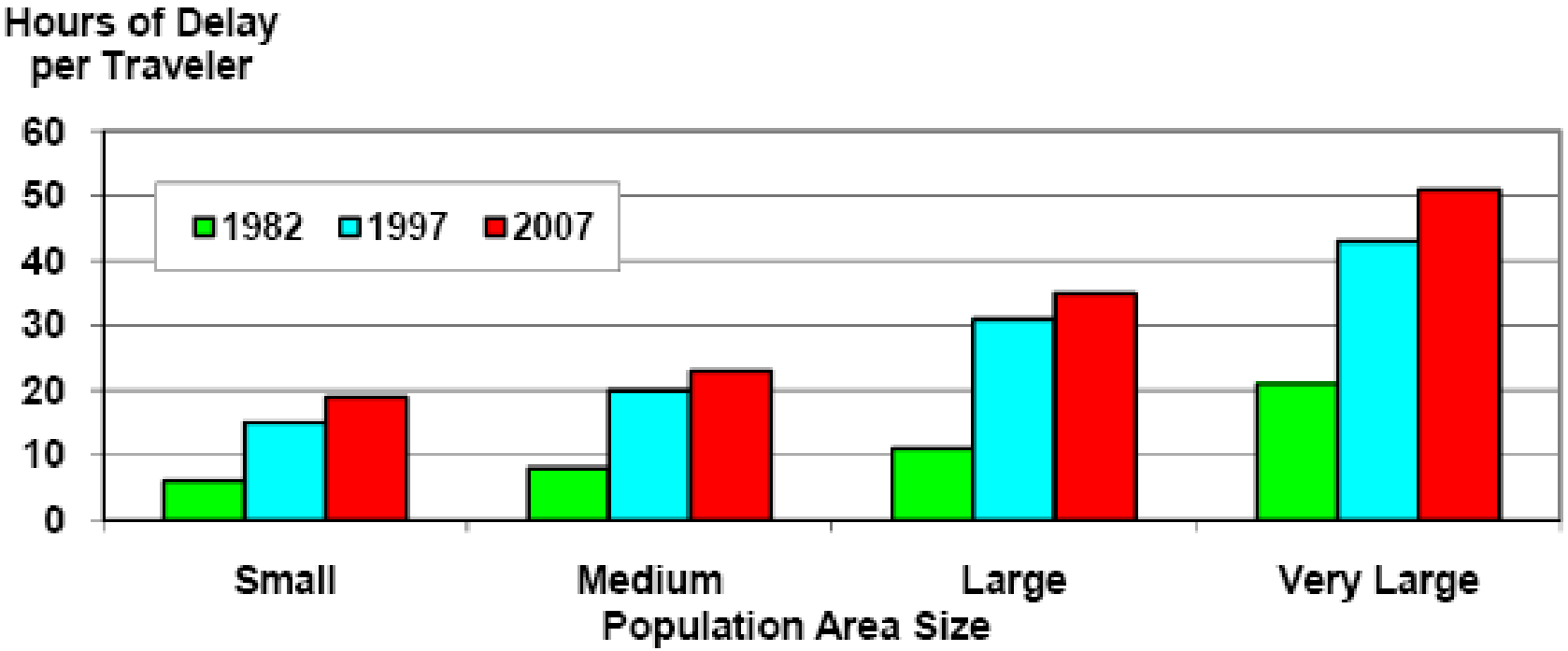
Exhibit 4. Gallons of Fuel Wasted per Peak-Period Traveler





TTI Nationwide Cost of Congestion (TTI, 2009)

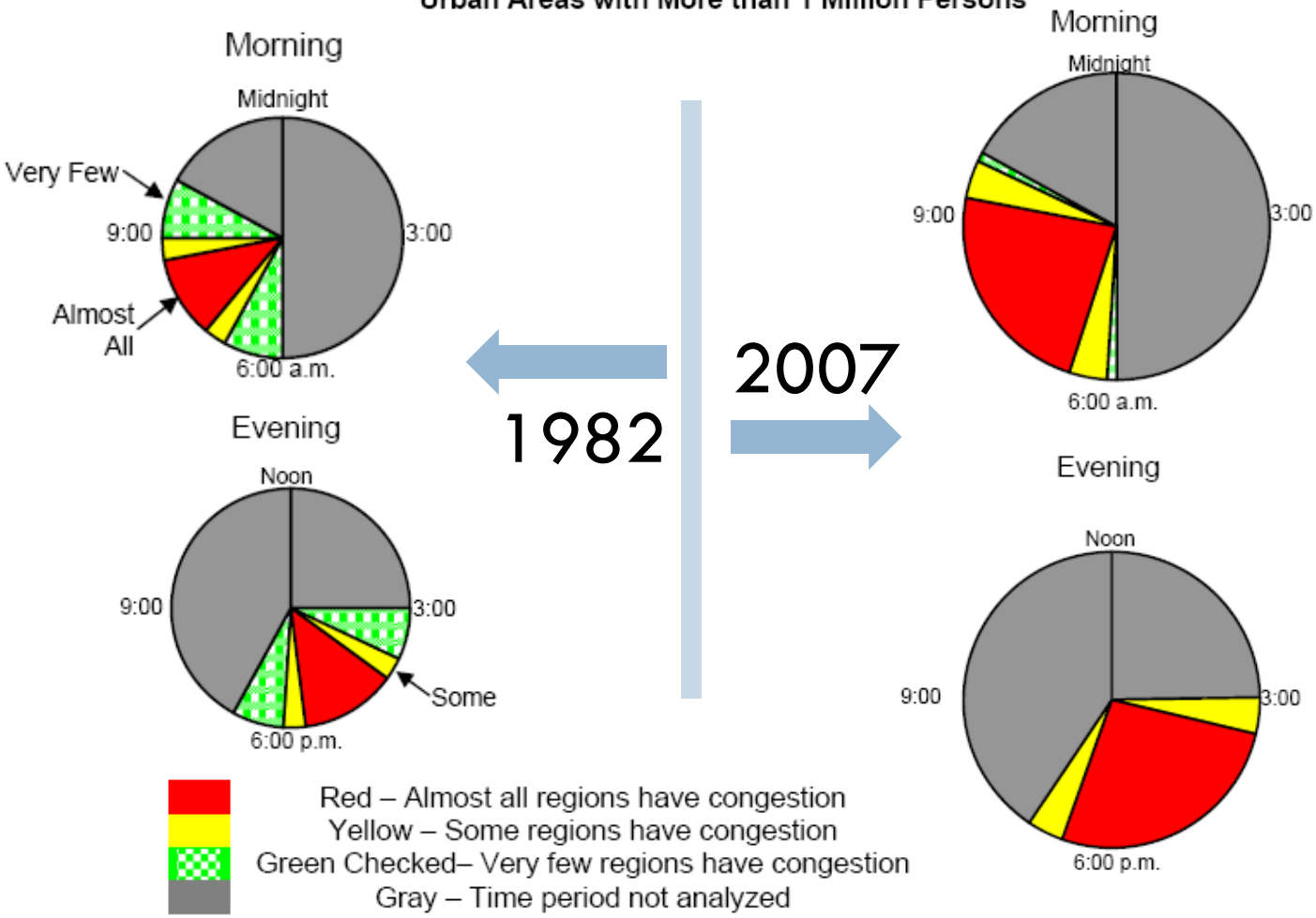
Exhibit 6. Congestion Growth Trend



Small = less than 500,000
Medium = 500,000 to 1 million
Large = 1 million to 3 million
Very Large = more than 3 million

TTI Nationwide Cost of Congestion (TTI, 2009)

Exhibit 8. The Jam Clock Shows That It Is Hard To Avoid Congestion in Urban Areas with More than 1 Million Persons



Note: The *2009 Urban Mobility Report* examined 6 to 10 a.m. and 3 to 7 p.m.

TTI Report – Northeastern Illinois (2007)

	Roadway Congestion Index	Congested Travel (% of Peak VMT)	Travel Time Index	Freeway Speed (mph)	Arterial Street Speed (mph)	Annual Total Cost (Million)
Chicago (MSA)	1.18	46.4	1.43	41	24.7	4,207

Travel Time Index - The ratio of travel time in the peak period to the travel time at free-flow conditions. A value of 1.30 indicates a 20-minute free-flow trip takes 26 minutes in the peak

Roadway Congestion Index – A ratio of daily traffic volume to the number of lane-miles of arterial street and freeway-to estimate the length of the peak period. The resulting ratio indicates an undesirable level of areawide congestion if the index value is greater than or equal to 1.0.

Part 2 – TTI Improvement

The limitations of TTI method:

- TTI just shows individual estimates of urban areas in Illinois;
- TTI does not take into account rural areas;
- TTI does not allow a spatial understanding of congestion; and
- TTI uses national averages of constants and general estimations instead of specific state or local information.

TTI Improvements

- Expand TTI's method to rural and minor urban areas for CMAP's seven county region.
  - Use a comprehensive dataset that includes statewide urban and rural traffic figures from IDOT
    - IRIS (Illinois Roadway Information System)

TTI Improvements

- Include state and local information
  - Chicago MSA Vehicle Occupancy for HBW - 1.03 (National Household Travel Survey, 2009).
  - Direction Distribution Factor for specific interstates. 60/40 if data is not available (IDOT Highway Capacity Manual).
    - Hourly volumes from highway sensors where used to calculate a ratio of inbound peak hourly volumes and total peak hourly volumes (inbound + outbound).
  - Truck Factor for links with truck counts. If data is not available than 16/12/6.5 (IDOT Highway Capacity Manual).

Calculation Procedures

- Data Collection
- Percent of Delay Travel in Congested Conditions (≤50%)
- Average Peak-Period Speed
- Average Travel Times
- Travel Delay = Average Travel times – Travel Times at Free Flow Speed
- Delay Related Indices

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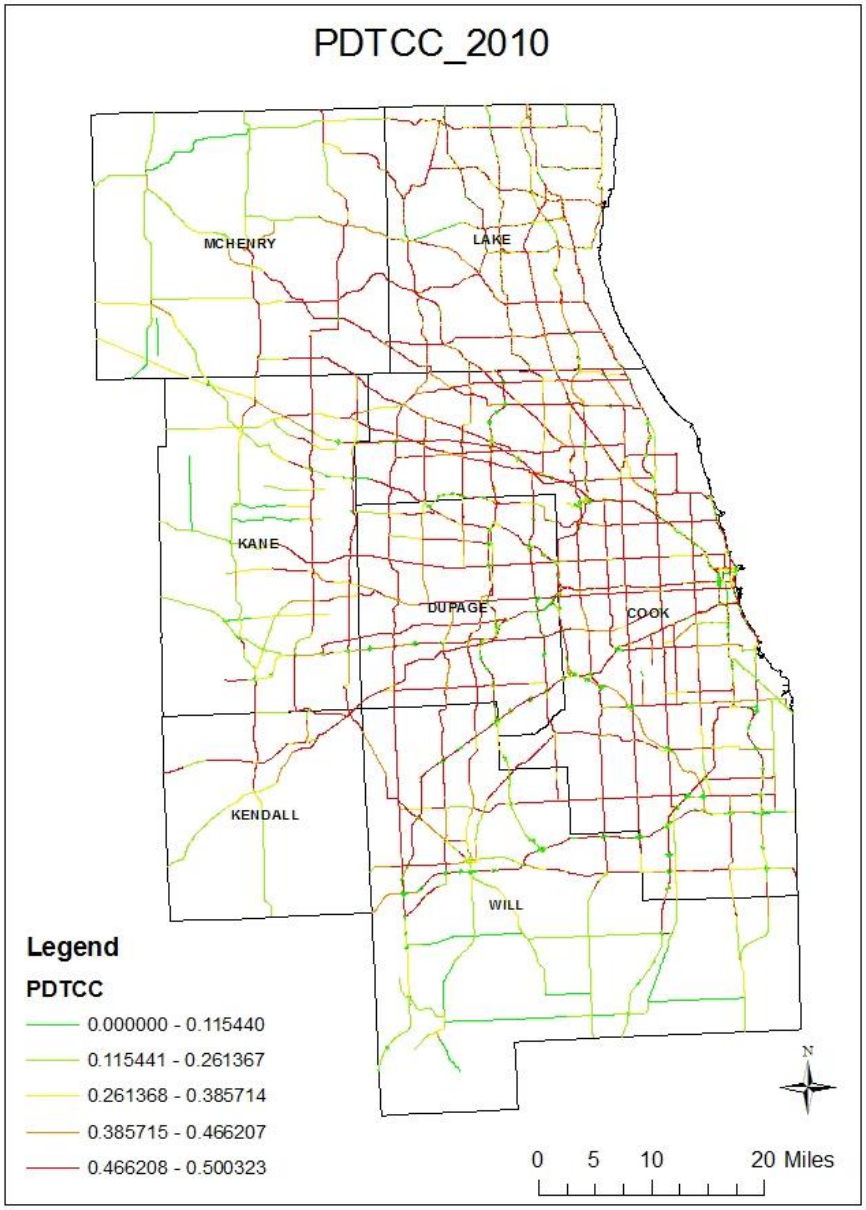
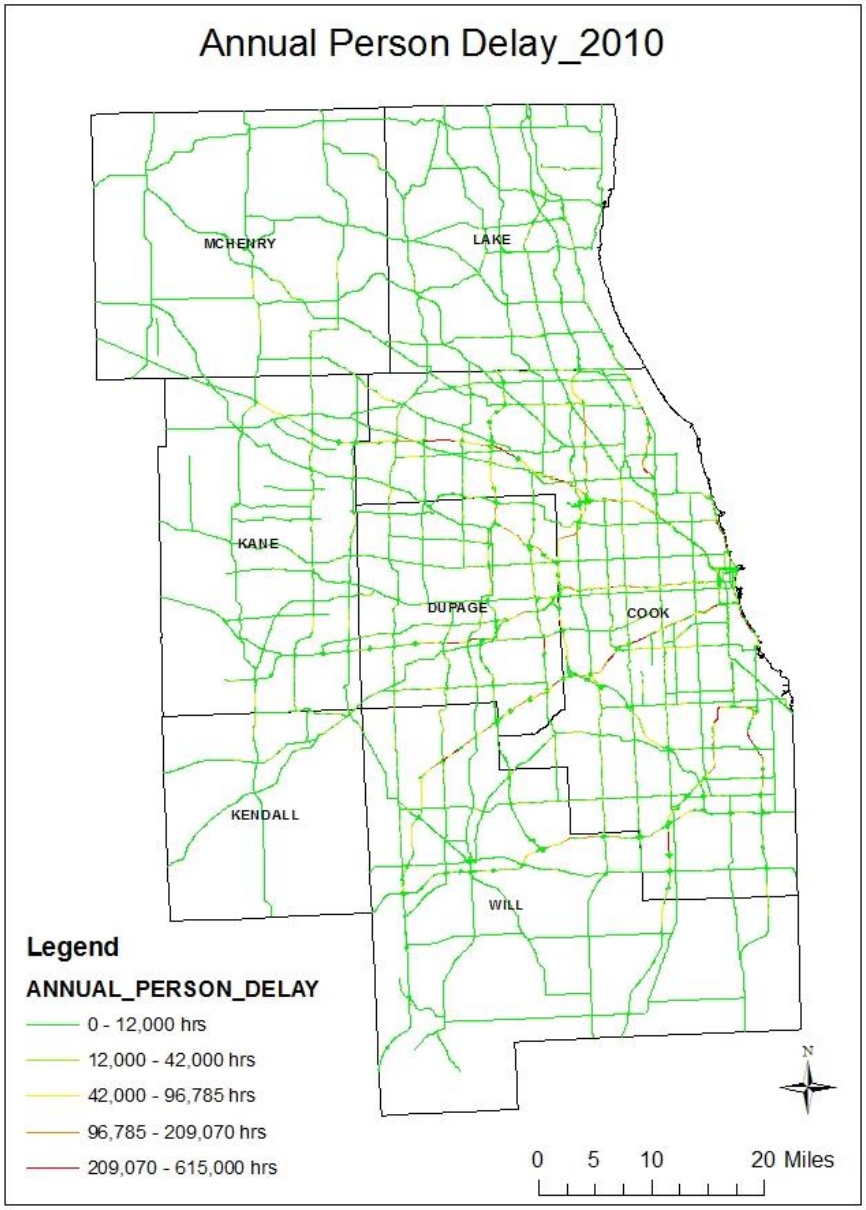
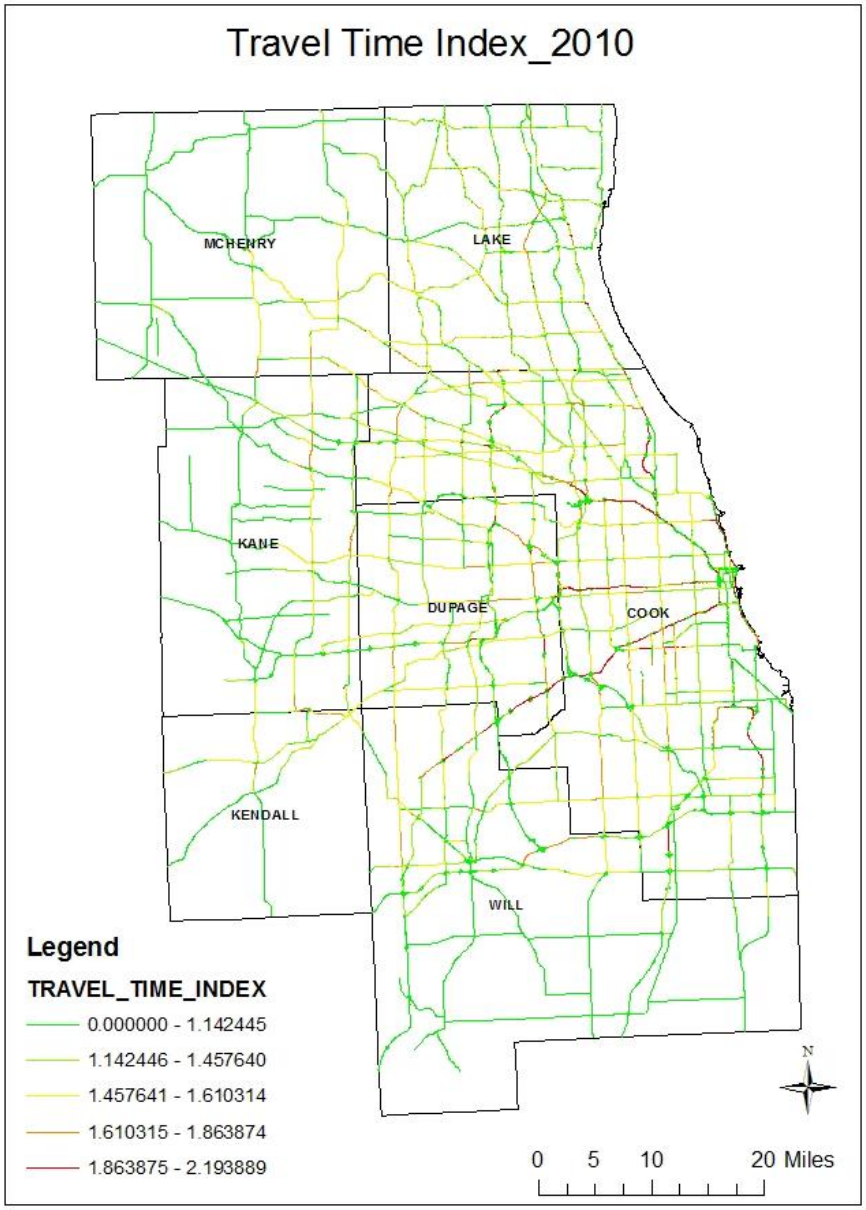
Visual Representation of Modeling Results

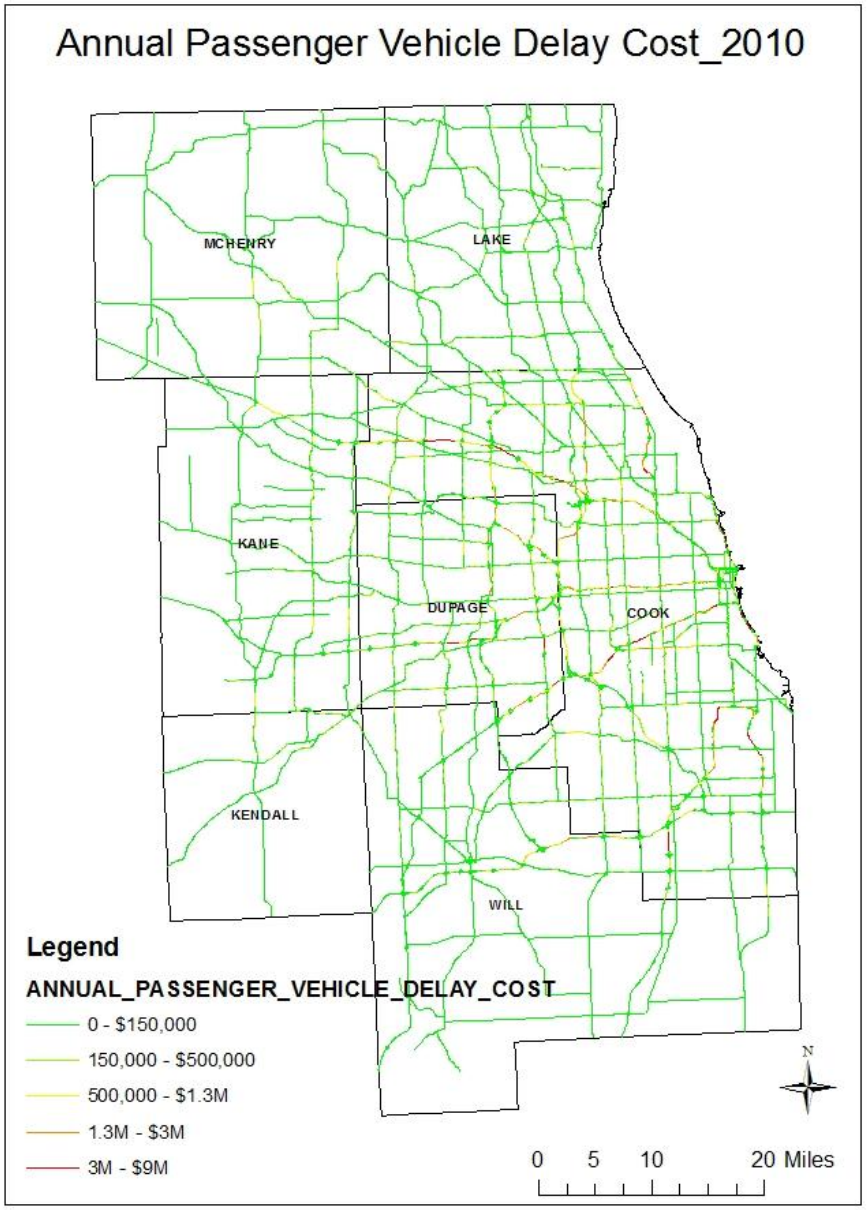

PDTCC_2010
MCHENRY
LAKE
KANE
DUPAGE
COOK
KENDALL
WILL
Legend
PDTCC
0.000000 - 0.115440
0.115441 - 0.261367
0.261368 - 0.385714
0.385715 - 0.466207
0.466208 - 0.500323
N
0 5 10 20 Miles



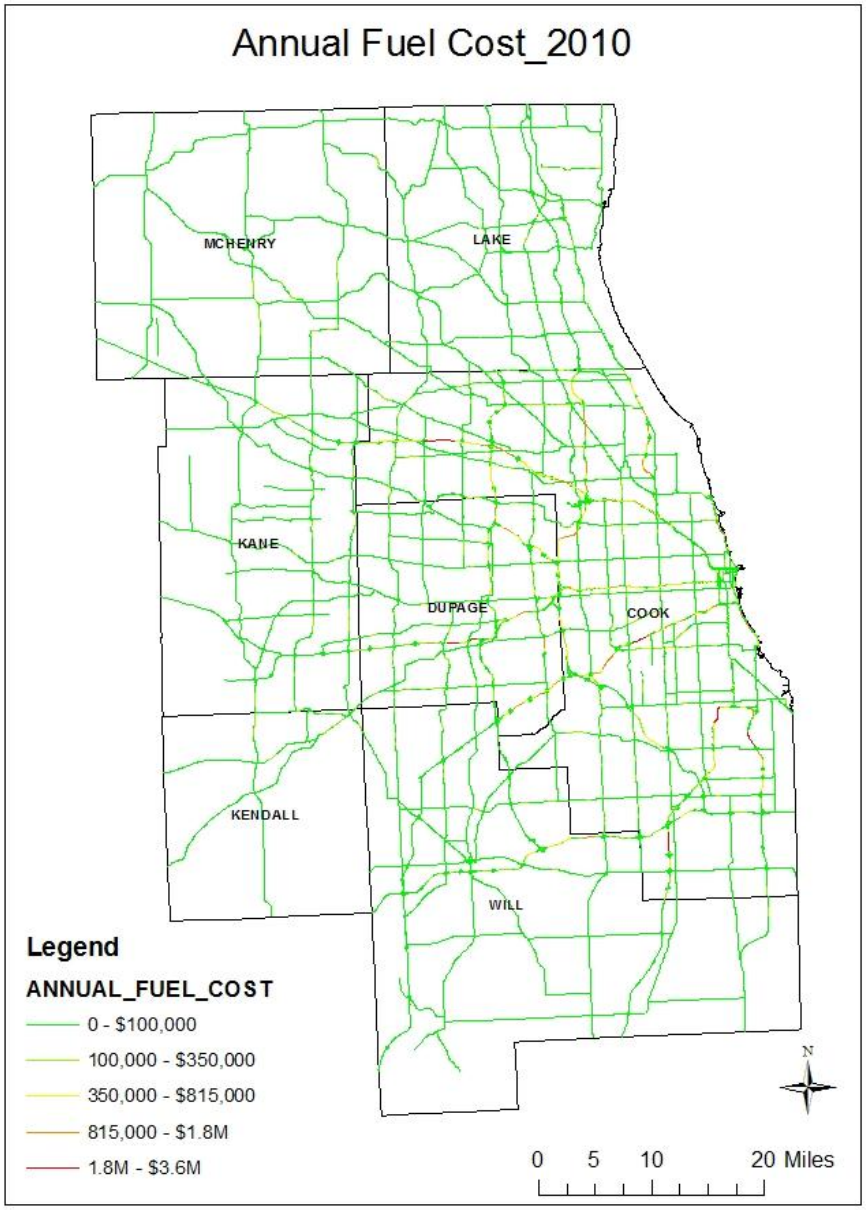
Annual Persons – Hours Of Delay = Daily Vehicle-Hours of Incident and Recurring Delay on Freeways and Arterial Streets * 250 Working Days per Year * Vehicle Occupancy



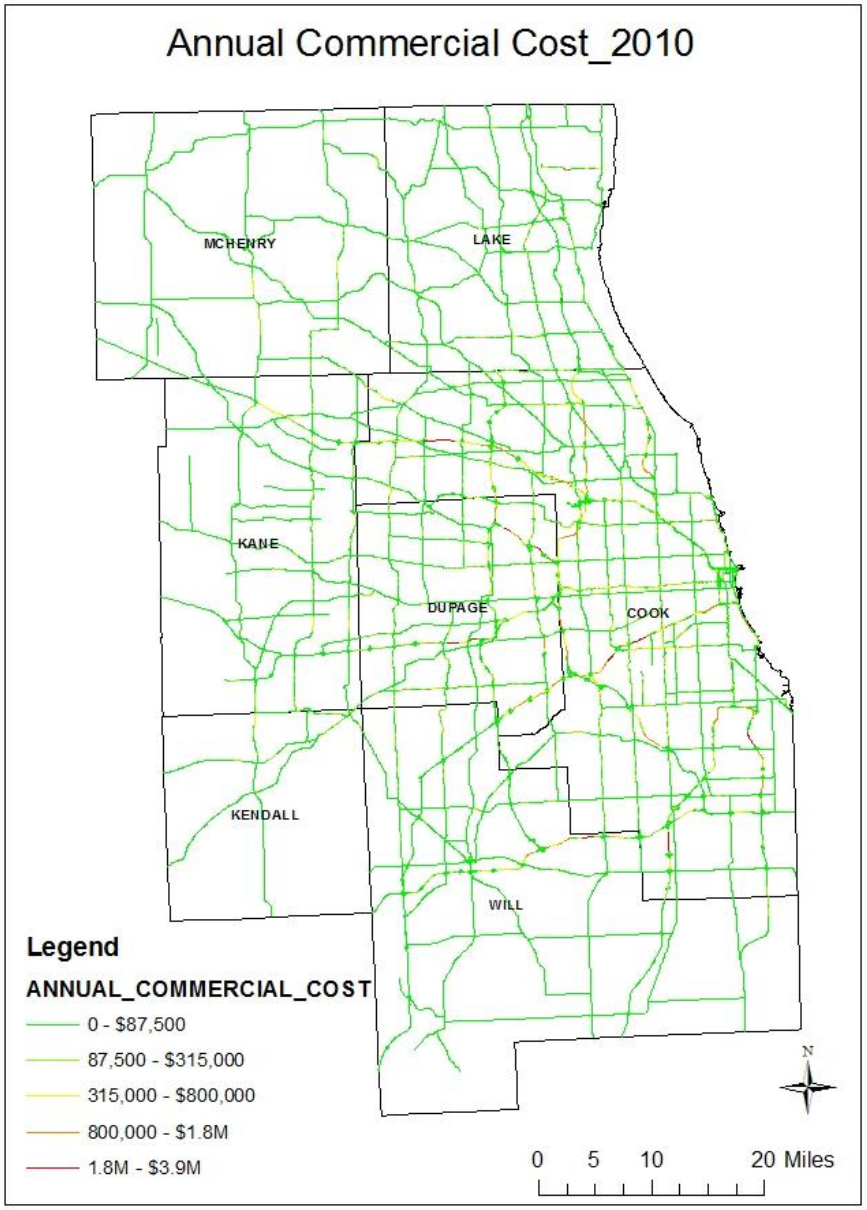
$$\text{Travel Time Index} = \frac{Peak\ Travel\ Time}{Free{-}Flow\ Travel\ Time}$$



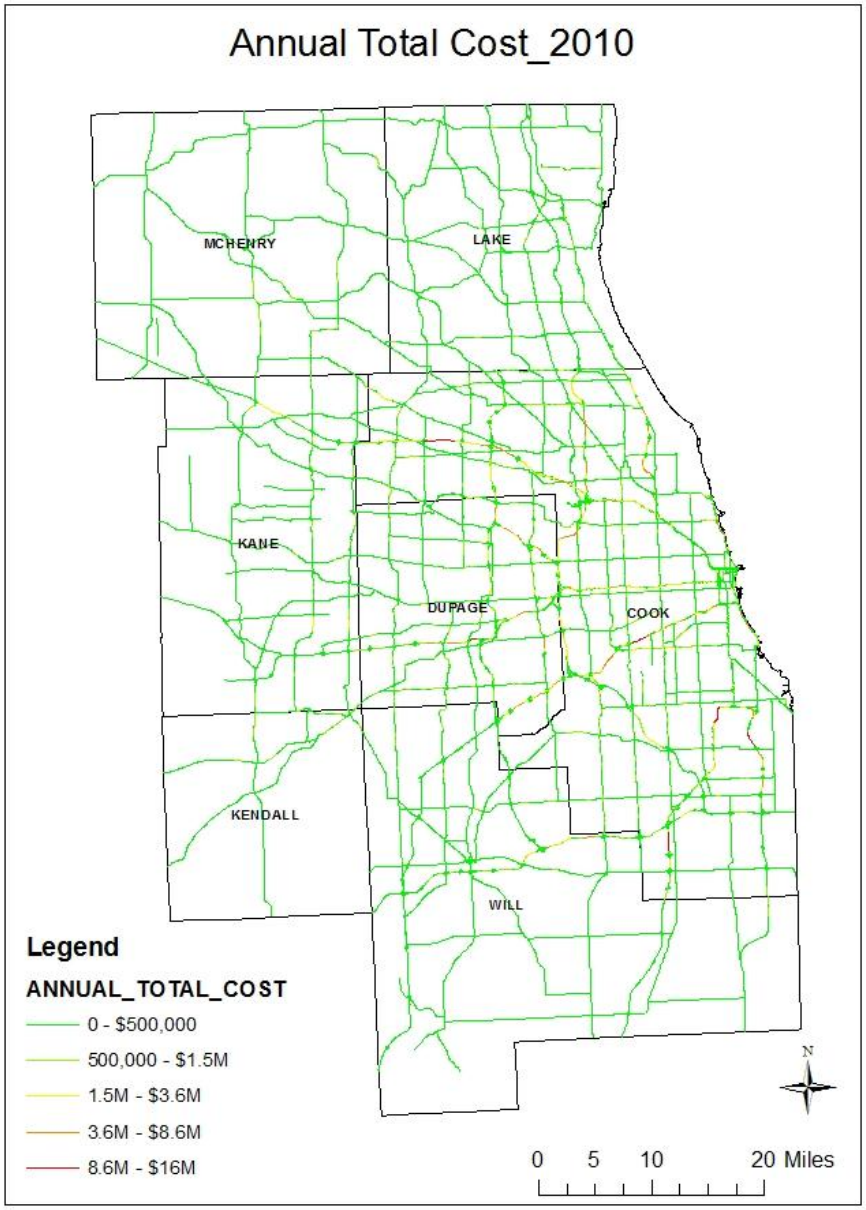
Annual Passenger Vehicle Delay Cost = Annual Persons-Hours of Delay * Yearly Avg. cost of time per person hour ($15.47, $2007) * (1 – percent of commercial vehicles)



Annual Fuel Cost = [Average Speed in Peak Period / Fuel Economy] * Daily Vehicle-Hours of Incident and Recurring Delay on FW and AT * Yearly Fuel Cost ($2.94, 2010) * 250 Working Days per year



 Annual Commercial Vehicle Cost = Daily Vehicle-Hours of Incident and Recurring Delay on FW and AT * Percent of Commercial Vehicles * Yearly Commercial Vehicle Operating Cost per Vehicle Hour ($102.12, $2007) * 250 Working Days per year



Annual Cost Due to Congestion = Annual Passenger Vehicle Delay Cost + Annual Passenger Fuel Cost + Annual Commercial Vehicle Cost

Congestion Measurements Comparison

TTI Report 2007

MSA	Roadway Congestion Index (RCI)	Congested Travel (% of peak VMT)	Travel Time Index (TTI)	Freeway Speed (mph)	Arterial Street Speed (mph)	Annual Total Cost (Million)
Chicago	1.18	46.4	1.43	41	24.7	$4,207

Chicago-Naperville-Joliet, IL, Lake County-Kenosha, IL-WI and Gary, IN

Disaggregated Model 2010

Cook	1.34	41.39	1.34	48.9	29.2	2,048
DuPage	1.35	41.03	1.31	48.8	27.1	554.4
Kane	1.17	37.75	1.22	51.0	30.9	125.2
Kendall	1.26	41.63	1.30		31.0	30.7
Lake	1.23	40.09	1.25	52.4	29.0	263.6
McHenry	1.16	38.13	1.25	60.0	31.4	75.4
Will	1.02	34.02	1.19	48.9	31.8	133.1
Ave. / Total	**1.26**	**39.83**	**1.29**	**49.4**	**29.7**	**$3,231**

Part 3 - Directions for future research

- Historical Trend Analysis
  - IRIS (Illinois Roadway Information System) 2001-2010
- GO TO 2040 Regional Mobility Projects
  - Projected VMT reduction vs. Dollars saved

Presented by: Max Shmaltsuyev
Email: mshmalt@gmail.com
Cell: 224-715-4958

Questions?

- Functional Class (Interstate, Freeway and Expressway, Other Principal Arterial)
- VMT (Daily Vehicle-miles of Travel)
- NOLANES (Number of Lanes)
- LANEMILES (Lane-miles)
- ADT (Average Daily Traffic per Section of Road)
- AVGDFACT (Average Directional Factor per Section of Road)
- AVGTFACT (Average Truck Factor per Section of Road)

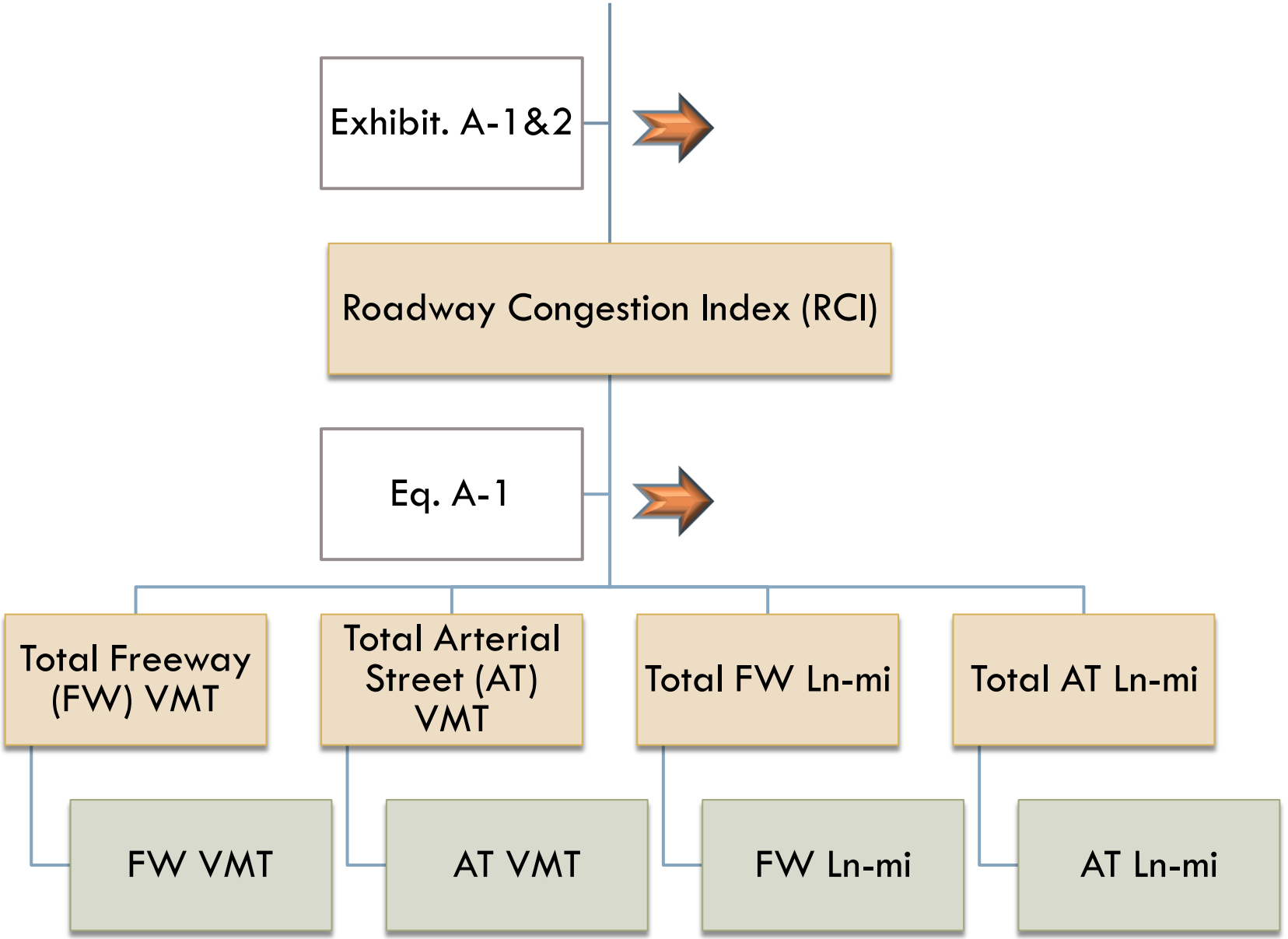
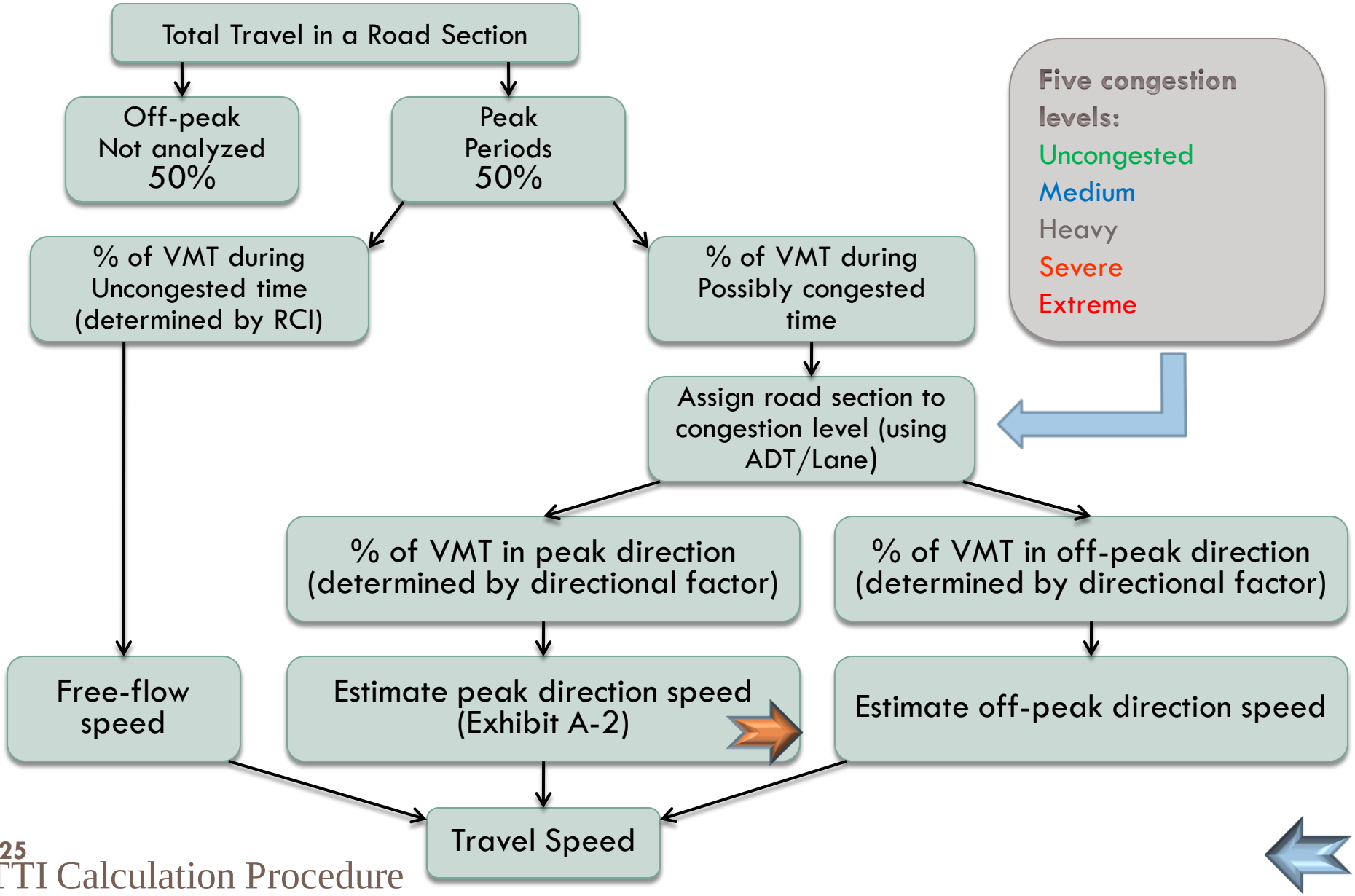
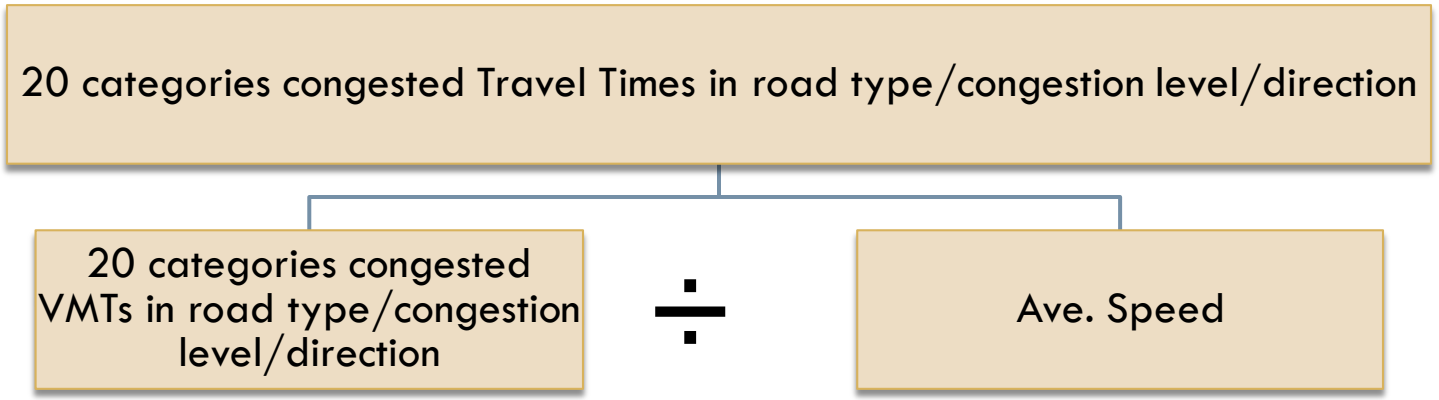


Exhibit. A-1&2
Roadway Congestion Index (RCI)
Eq. A-1
Total Freeway (FW) VMT
Total Arterial Street (AT) VMT
Total FW Ln-mi
Total AT Ln-mi
FW VMT
AT VMT
FW Ln-mi
AT Ln-mi


Total Travel in a Road Section
Off-peak
Not analyzed
50%
Peak
Periods
50%
% of VMT during Uncongested time (determined by RCI)
% of VMT during Possibly congested time
Five congestion levels:
Uncongested
Medium
Heavy
Severe
Extreme
Assign road section to congestion level (using ADT/Lane)
% of VMT in peak direction (determined by directional factor)
% of VMT in off-peak direction (determined by directional factor)
Free-flow speed
Estimate peak direction speed (Exhibit A-2)
Estimate off-peak direction speed
Travel Speed



TTI Calculation Procedure

TTI Calculation Procedure

1. Incident-Related Travel Delay — Eq. A-3
2. Annual Person Delay — Eq. A-4
3. Travel Time Index — Eq. A-5,6
4. Fuel Economy — Eq. A-7
5. Wasted Fuel — Eq. A-8
6. Congestion Cost — Eq. A-9~12

(Eq. A-1)

Roadway Congestion Index $= \frac{Freeway\ VMT\ per\ Ln.Mi. * Freeway\ VMT + Prin\ Art\ Str\ VMT\ per\ Ln.Mi. * Prin\ Art\ Str\ VMT}{14{,}000 * Freeway\ VMT + 5{,}000 * Prin\ Art\ Str\ VMT}$

Exhibit A-2. Percent of Daily Travel in Congested Conditions

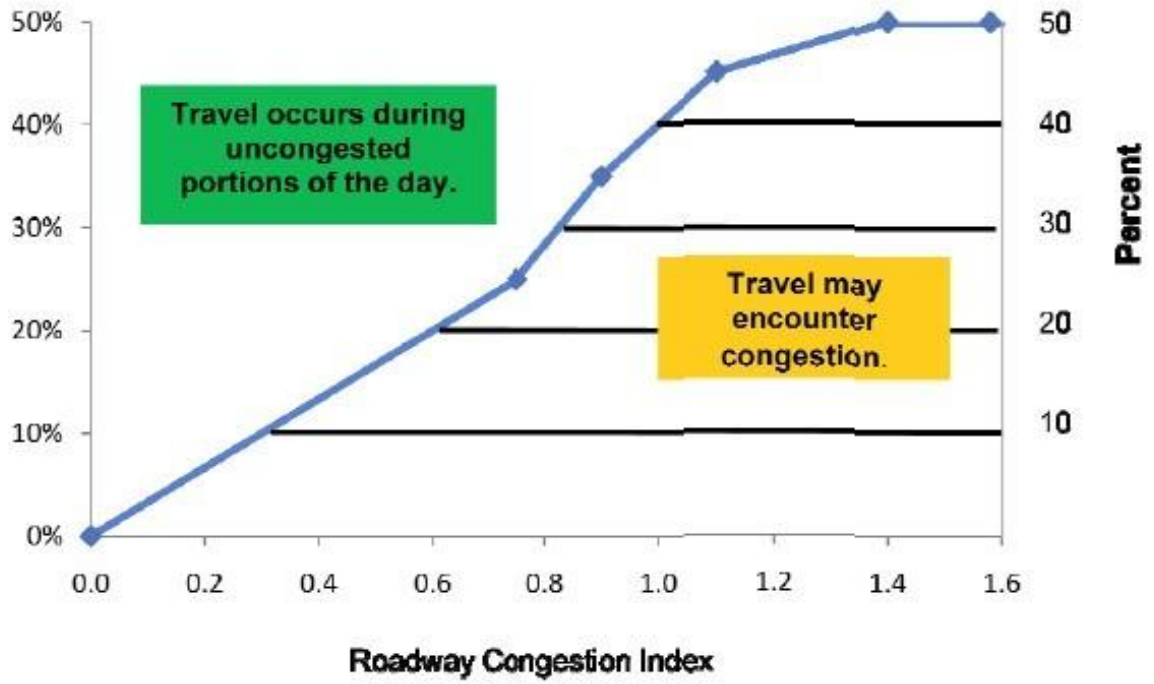


Exhibit A-1. Percent of Daily Travel in Congested Conditions

Roadway Congestion Index	PDTCC Estimation Equation
$0 < RCI < 0.75$	$0.333 \times RCI$
$0.75 \leq RCI < 0.9$	$0.667 \times RCI - 0.25$
$0.9 \leq RCI < 1.1$	$0.5 \times RCI - 0.1$
$1.1 \leq RCI < 1.4$	$0.167 \times RCI + 0.267$
$1.4 \leq RCI < 1.6$	0.5

Exhibit A-4. 2009 Urban Mobility Report – Freeway Speed Estimates

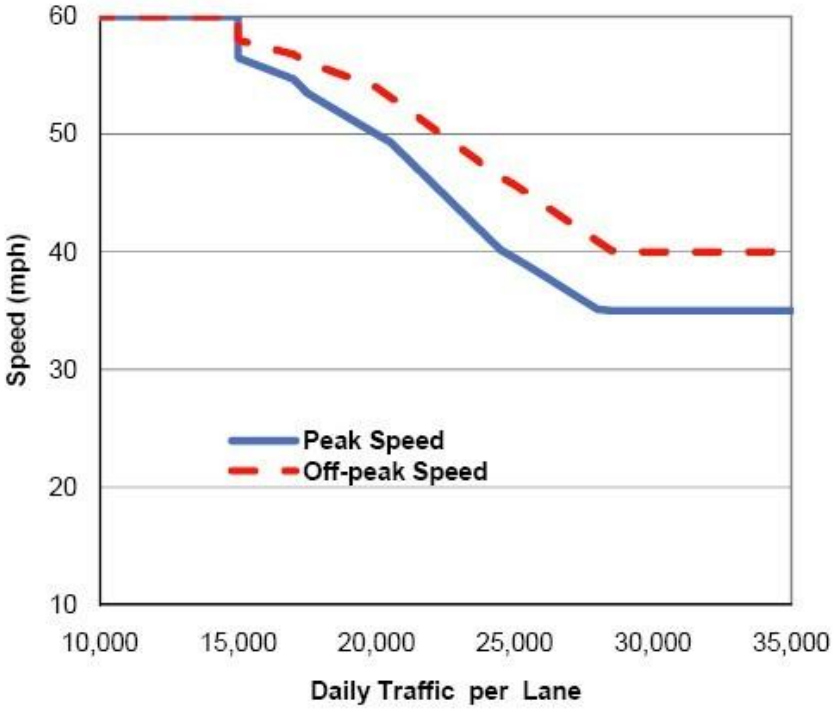


Exhibit A-5. 2009 Urban Mobility Report – Arterial Speed Estimates

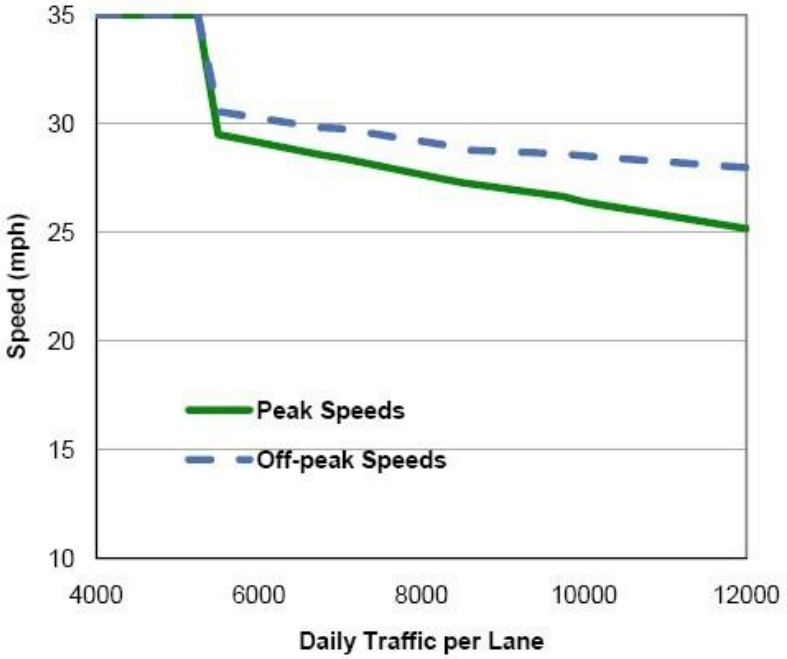


Exhibit A-2. Daily Traffic Volume per Lane and Speed Estimating Used in Delay Calculation

Facility and Congestion Level	Daily Traffic Volume per Lane	Speed Estimate Equation[1]	
		Peak Direction	Off-Peak Direction
Freeway			
Uncongested	Under 15,000	60	60
Medium	15,001 - 17,500	70-(0.9* ADT/Lane)	67-(0.6* ADT/Lane)
Heavy	17,501 - 20,000	78-(1.4* ADT/Lane)	71-(0.85* ADT/Lane)
Severe	20,001 - 25,000	96-(2.3* ADT/Lane)	88-(1.7* ADT/Lane)
Extreme	Over 25,000	76-(1.46* ADT/Lane)	85.7-(1.6*ADT/Lane)
		Lowest speed is 35 mph	Lowest Speed is 40 mph
Arterial Street			
Uncongested	Under 5,500	35	35
Medium	5,501 - 7,000	33.58-(0.74* ADT/Lane)	33.82-(0.59* ADT/Lane
Heavy	7,001 - 8,500	33.80-(0.77* ADT/Lane)	33.90-(0.59* ADT/Lane
Severe	8,501 - 10,000	31.65-(0.51* ADT/Lane)	30.10-(0.15* ADT/Lane
Extreme	Over 10,000	32.57-(0.62* ADT/Lane)	31.23-(0.27*ADT/Lane)
		Lowest speed is 20 mph	Lowest Speed is 27 mph
Note: [1]ADT/Lane in thousands