Improvements to Default Data for the On-Road Sector of the 2014 NEI

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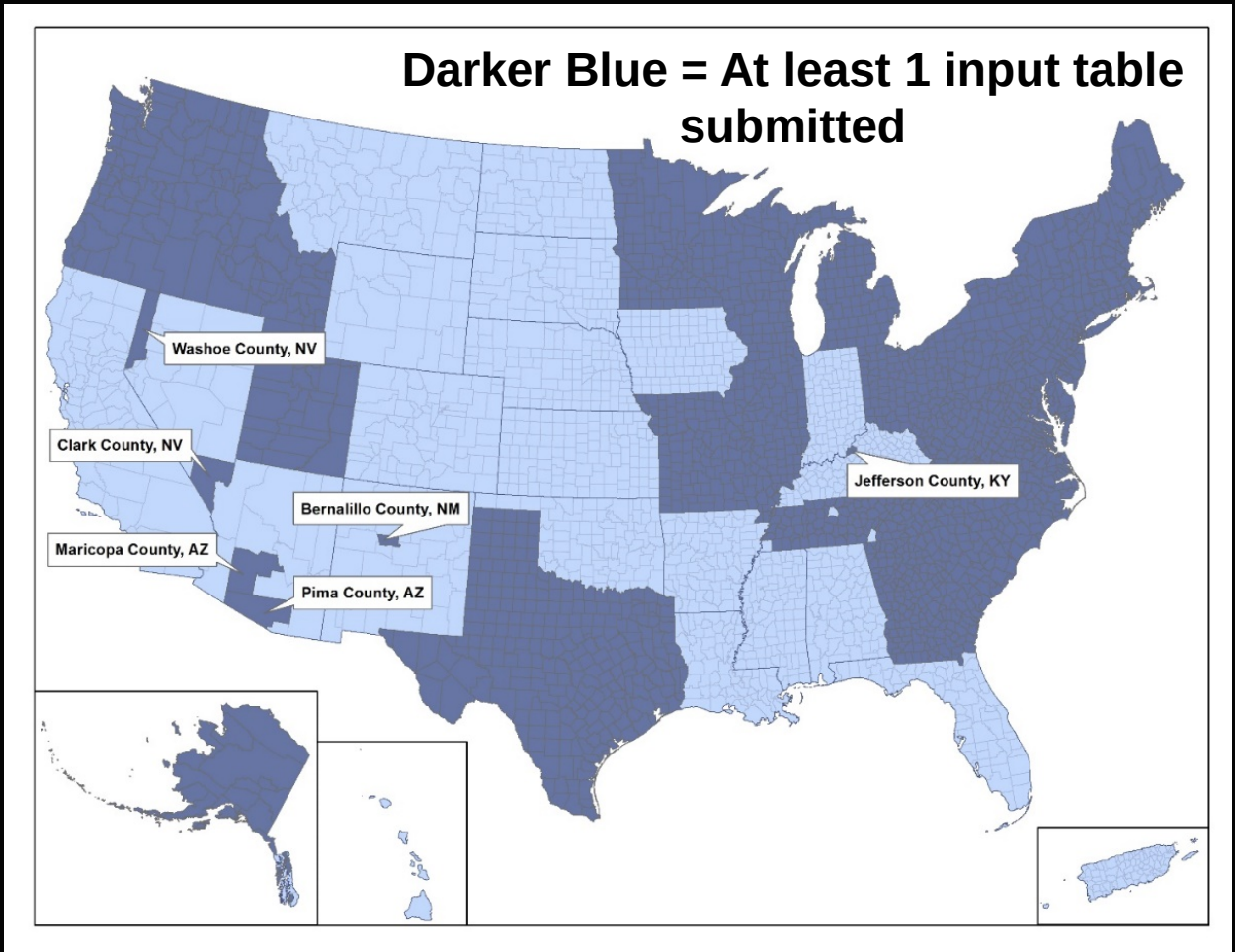
U.S. EPA

NEI Overview

- 3-year cycle
- All pollutants
- All sectors
- All counties
- For on-road, states can submit MOVES input county databases (CDBs)

Who submits data?

- Over 1,800 counties in 33 states provided CDBs



Default Data Improvements

- Vehicle Miles Travelled
- Temperature & Humidity
- **Vehicle Population**
- **Vehicle Age Distribution**
- **Fuel Type Mix (AVFT)**
- Fuel Properties/Market Shares
- **Average Speed Distribution**
- **Road Type Distribution**
- **VMT fractions**
- I/M Compliance/Waiver Rates

Nationally compiled Registration Database

CRC A-100 Study

Purpose

- National compilation of vehicle registration
  - 2014 snapshot
  - Consistent vehicle classifications
- CRC A-100 Study
  - Local data on vehicle speeds

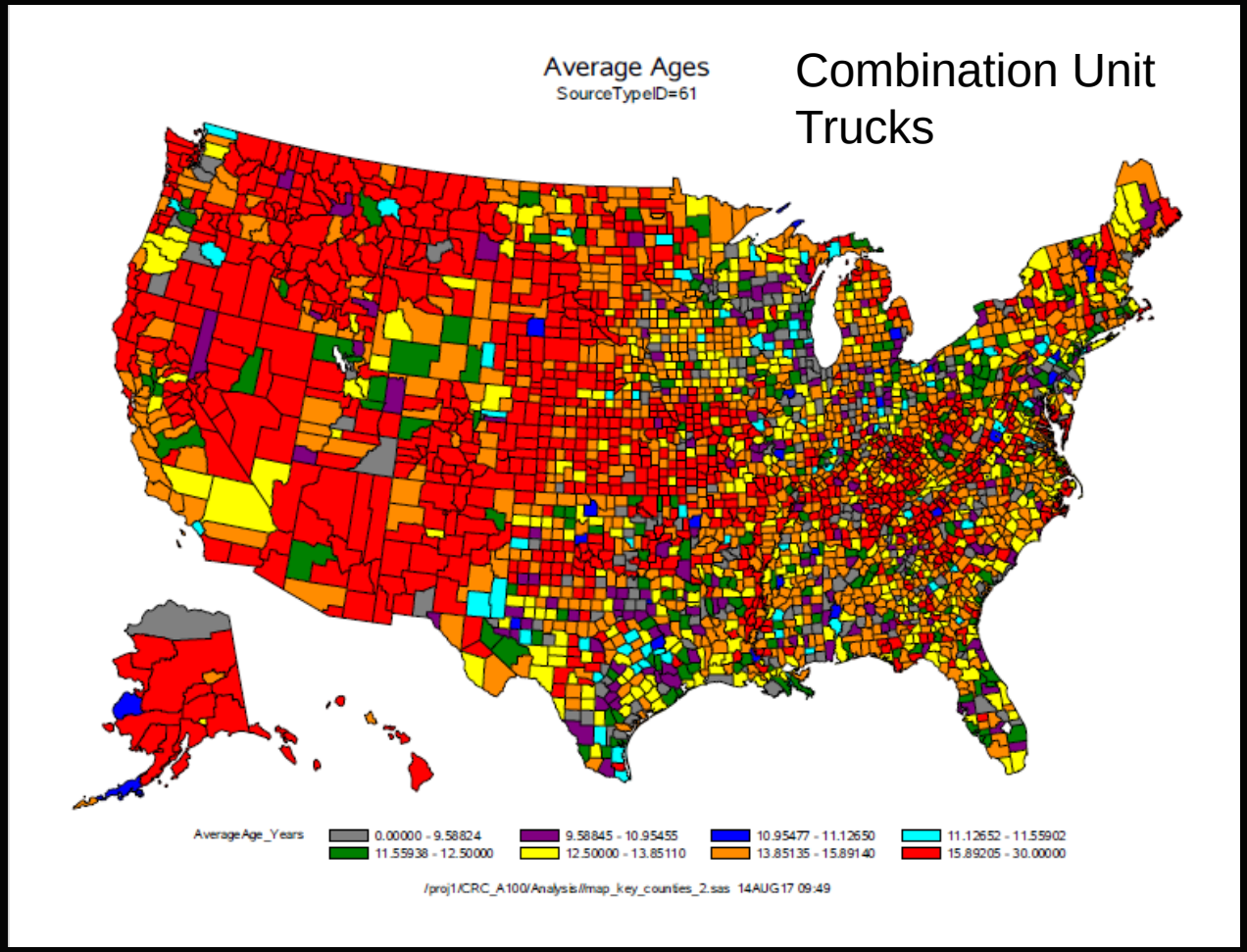
Vehicle Registration Data

- IHS (formerly Polk)
- July 1, 2014 data pull
  - Population by MOVES source type
  - All U.S. counties
  - Model years 1961-2015
  - 268 million light duty, 8.6 million heavy duty vehicles

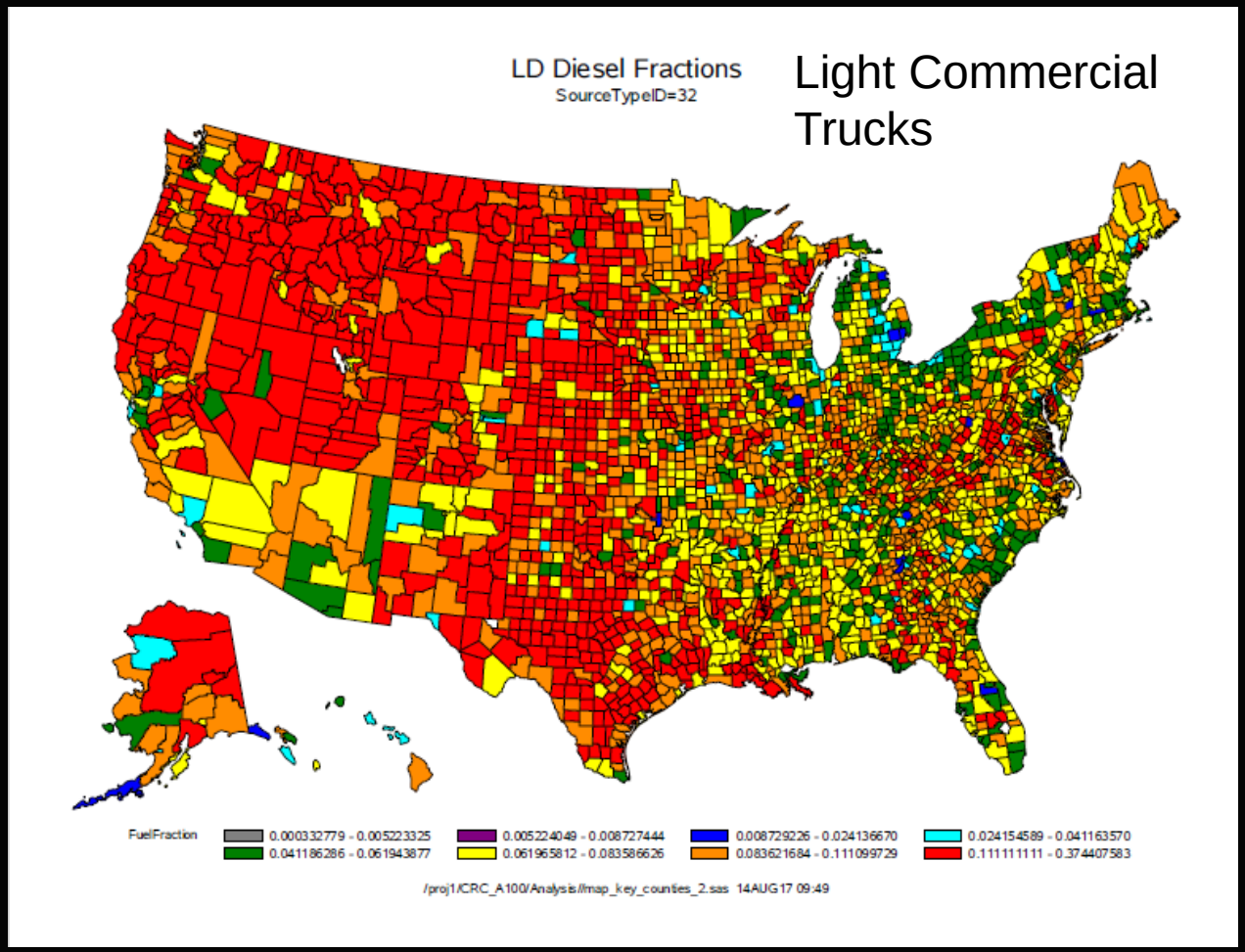
Vehicle Registration Data

- Cleaned up IHS data
  - Reassigned 8 make/models to cars
  - Reassigned Class 3 trucks to heavy-duty
- Calculated MOVES inputs by county
  - Source Type Age Distribution
  - Fuel Type Mix (AVFT)
- U.S. EPA prepared 2014 vehicle population

Vehicle Registration Data: Age



Vehicle Registration Data: Fuel Type Mix



CRC A-100 Study
Vehicle Telematics Data

- Average Speed Distributions
- Relative Fractions of VMT

CRC A-100 Study

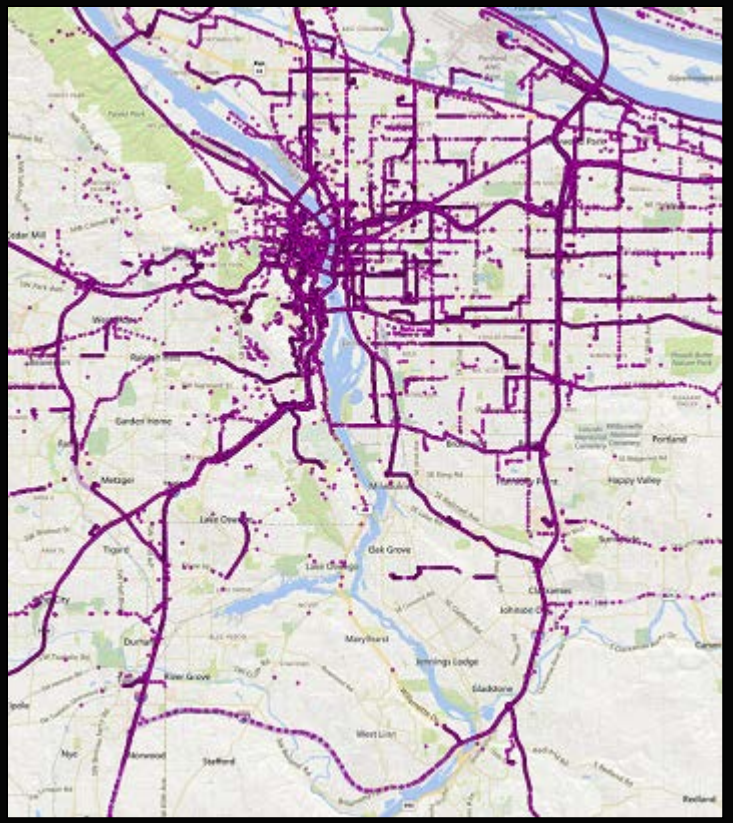
- Big Data source:
  StreetLight Data, Inc.

- Nearly 5 billion observations
- 3,109 counties (continental US)
- 12 consecutive months, 7 days, 24 hours
- 3 vehicle types (LD, MD, and HD)
- 16 MOVES speed bins

StreetLight Data: Navigation-GPS Derived Metrics

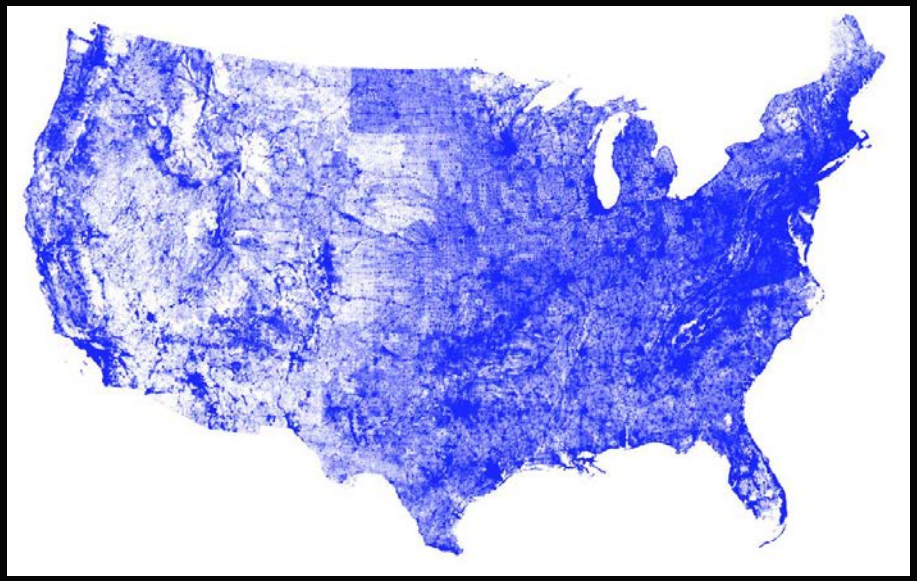
Navigation-GPS Data Characteristics:

- Archival and anonymous
- 5m spatial precision
- Frequent pings
- Vehicle Types: Passenger vehicles "connected cars", Commercial truck fleet management systems (Heavy Duty and Medium Duty Trucks)
- Sourced from StreetLight Data Partner INRIX



STREETLIGHTDATA

CRC A-100: Scale of Analysis



Road Segments
18,644,352 segments across Continental US.

Urban Areas/Clusters
3601 polygons; from the US Census

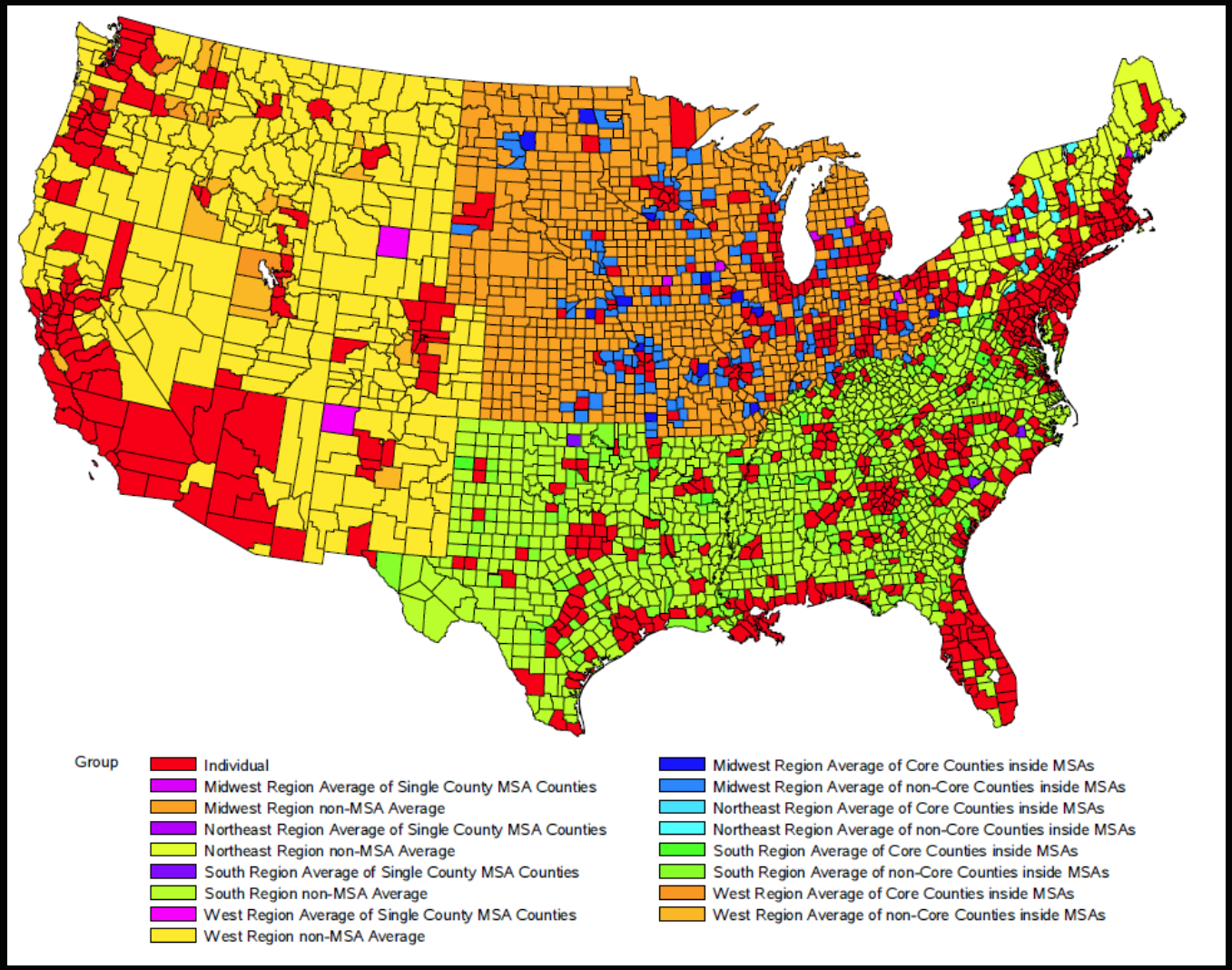
STREETLIGHTDATA

Populating MOVES Average Speed Bins

- Data resolution:
  - LD Pass Vehicle “High Resolution”: 1 “ping” per second (1 Hz)
  - LD Pass Vehicle “Low Resolution”: 1 “ping” every 10 or 30 seconds
  - MD and HD: 1 “ping” every 60 or 180 seconds
- Aggregation done on 1/16th of full dataset for most counties
- Populating all MOVES speed bins by road type, month, day, hour, vehicle type a challenge outside urban areas

Spatial Groups

Example: Urban Unrestricted Roads / Passenger Vehicles



RED = able to populate MOVES inputs for individual county

Others grouped by region, urban/rural…

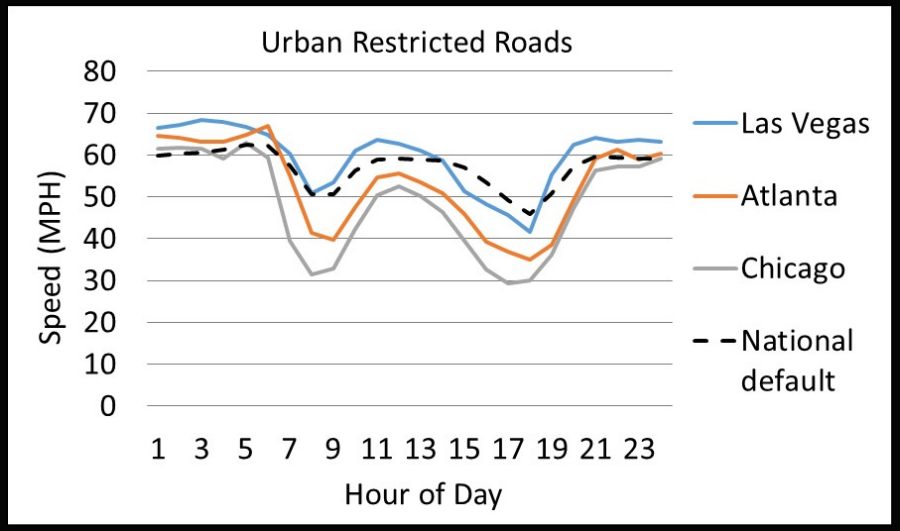
A Tale of Three Cities

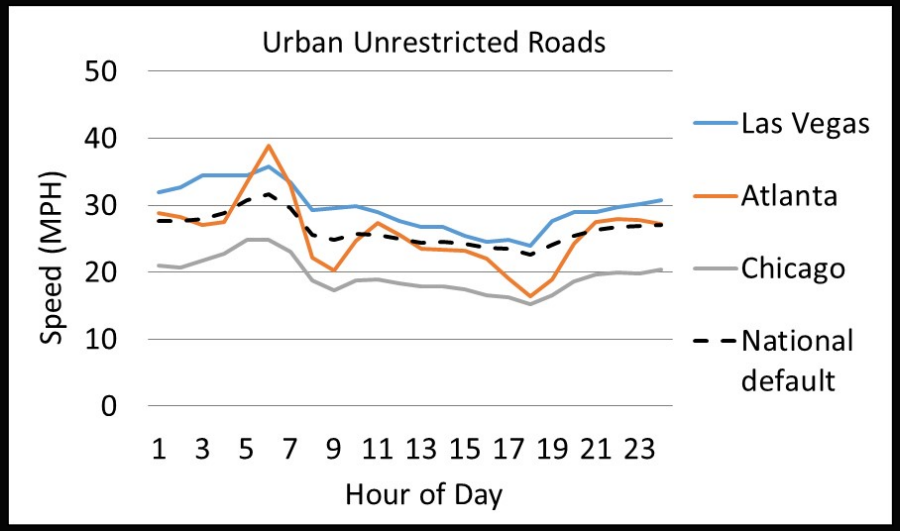
- Case Study:
  - Atlanta (Fulton County, Georgia)
  - Chicago (Cook County, Illinois)
  - Las Vegas (Clark County, Nevada)

- Observations:
  - Differences by city and vs. MOVES default
  - Differences among LD, MD, and HD
  - MD/HD Trucks show higher speeds than LD passenger vehicles in many cases

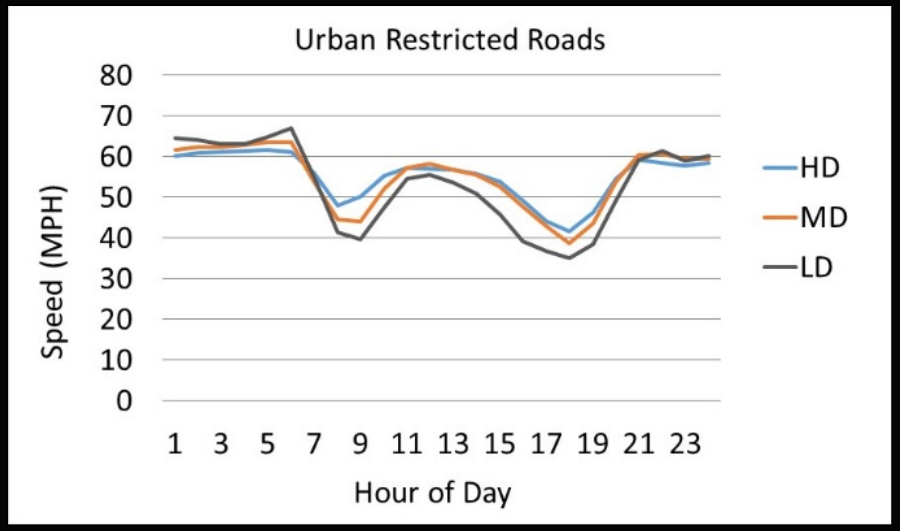
A Tale of Three Cities

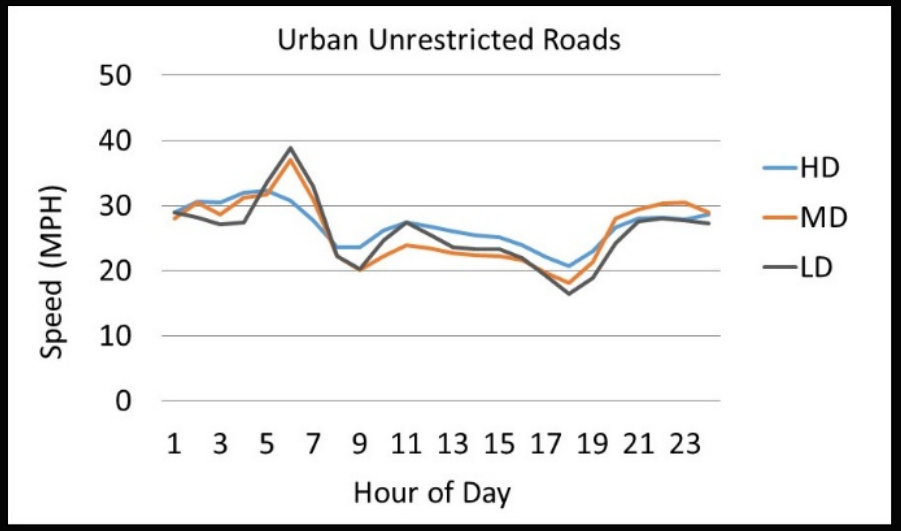
Weekday, LD Passenger Vehicles



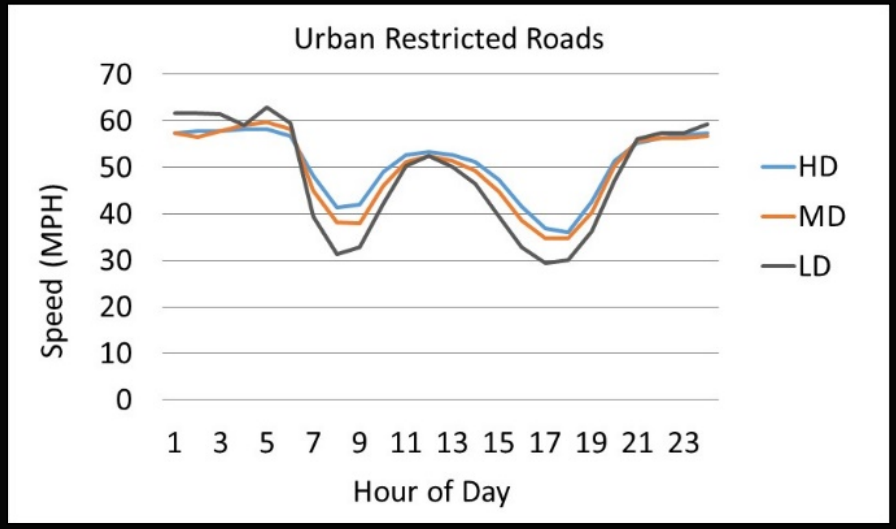


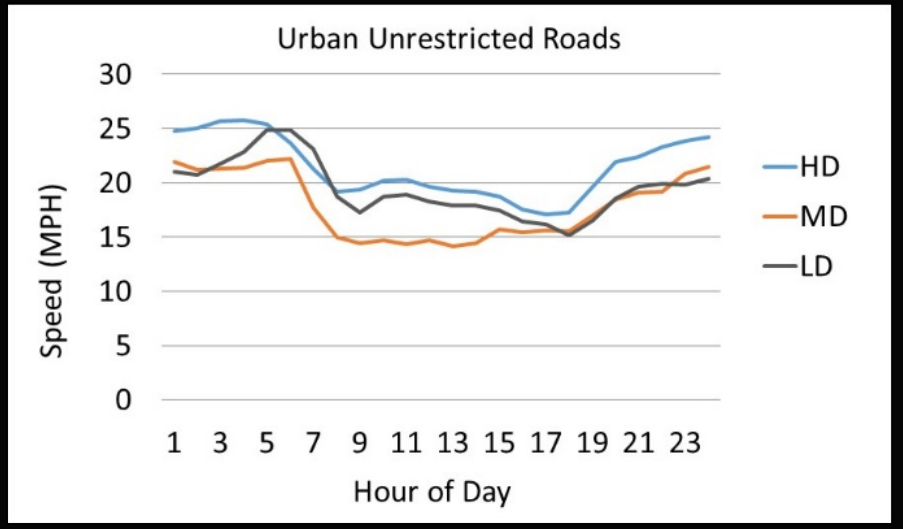
Atlanta (Fulton County, GA) by Vehicle Type



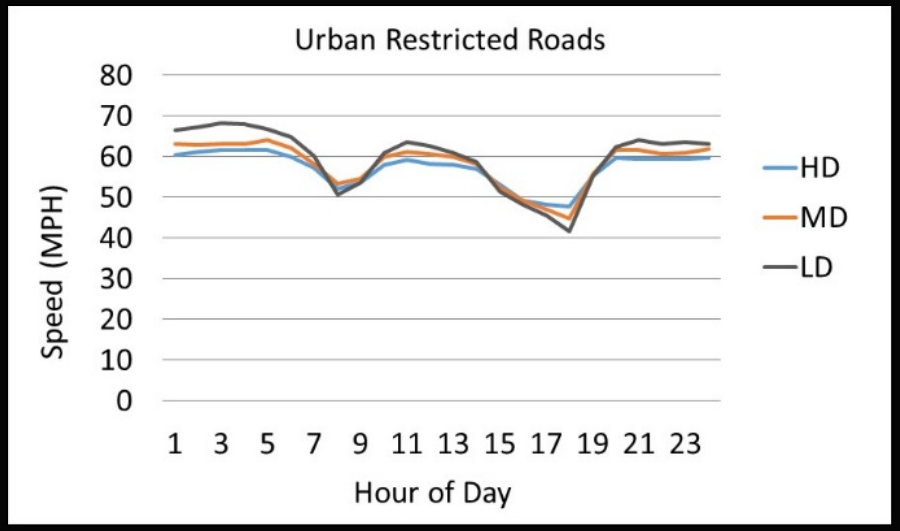


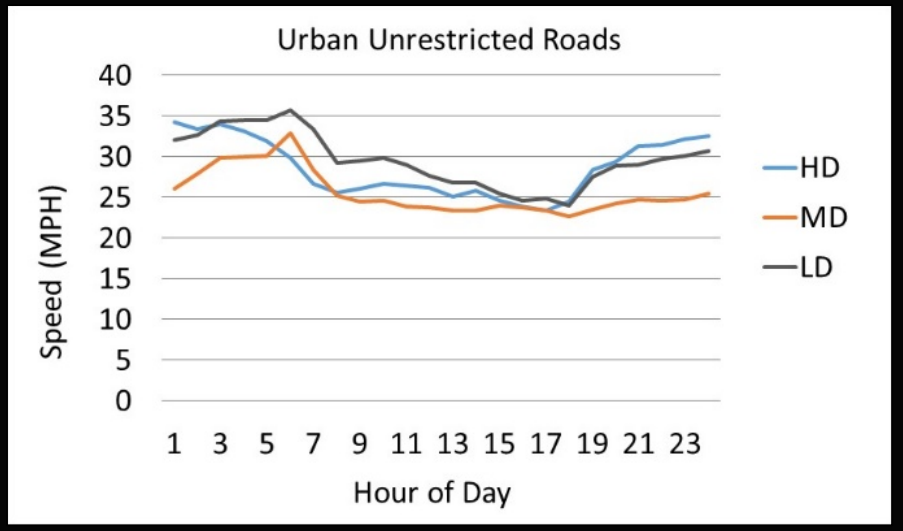
Chicago (Cook County, IL) by Vehicle Type





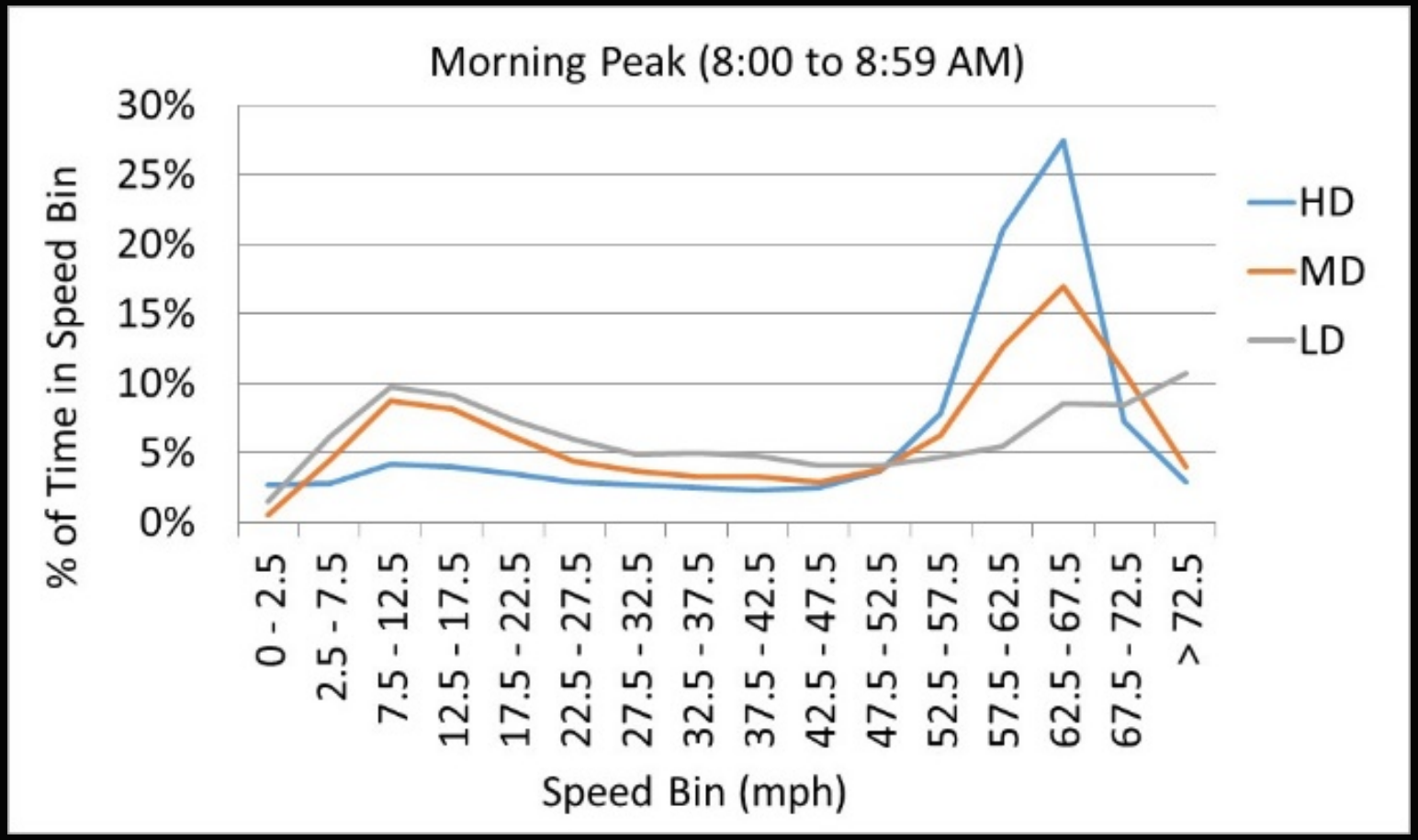
Las Vegas (Clark County, NV) by Vehicle Type





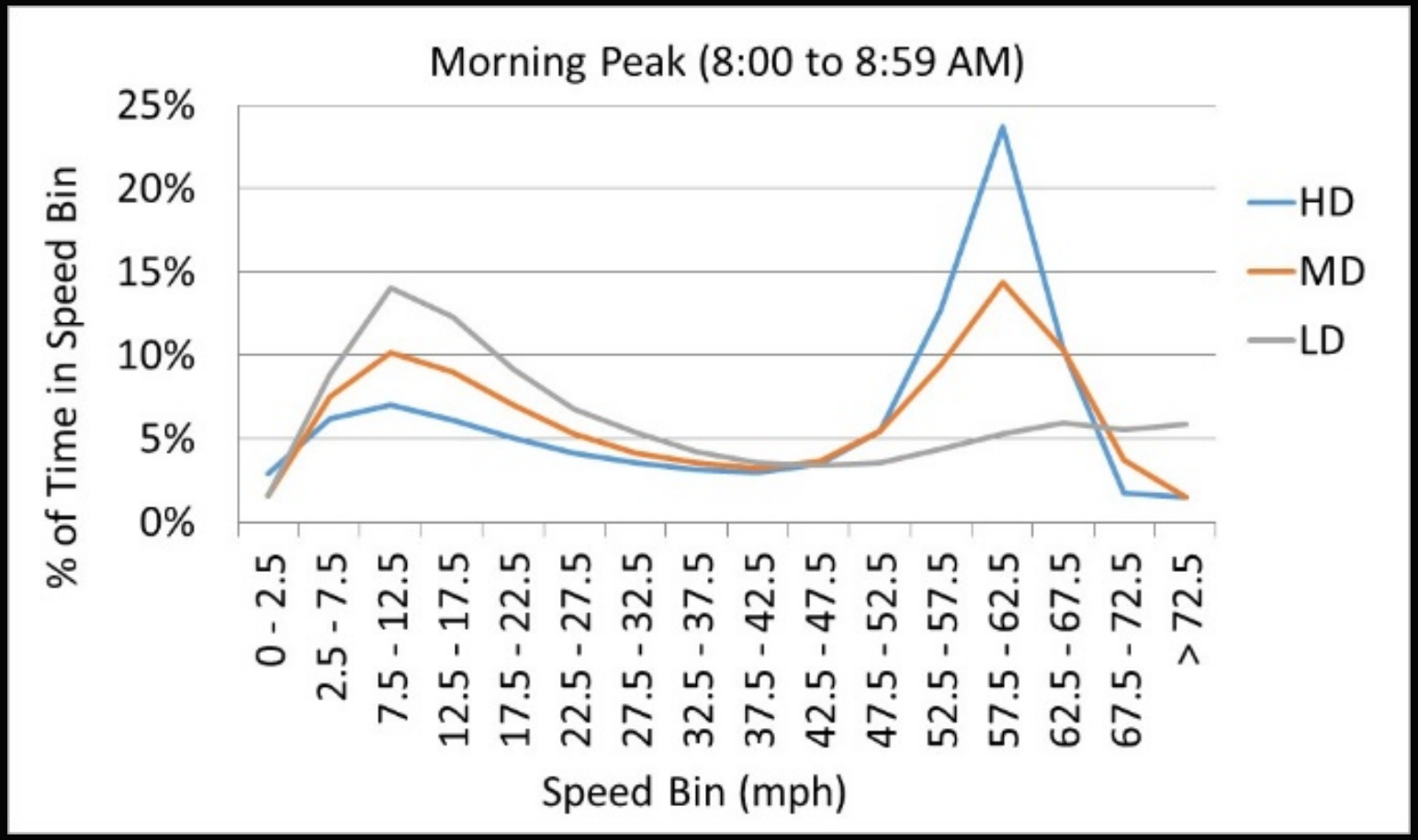
Fulton County Speed Distribution

Weekday 8am on Urban Restricted Access Roads



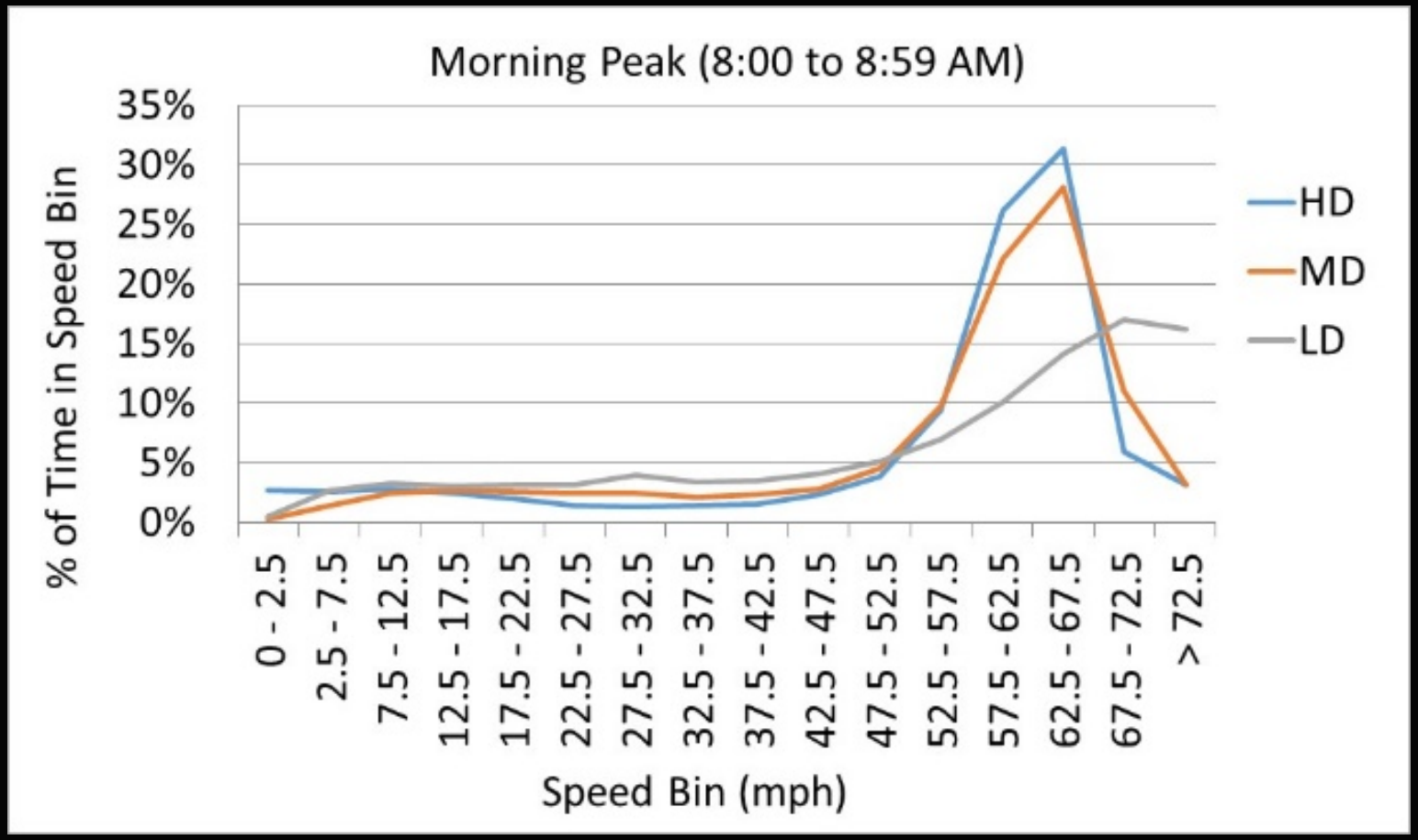
Cook County Speed Distribution

Weekday 8am on Urban Restricted Access Roads



Clark County Speed Distribution

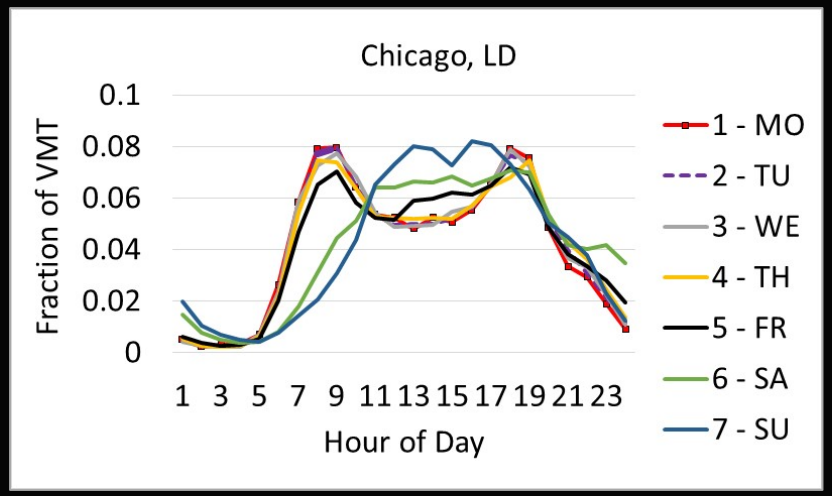
Weekday 8am on Urban Restricted Access Roads

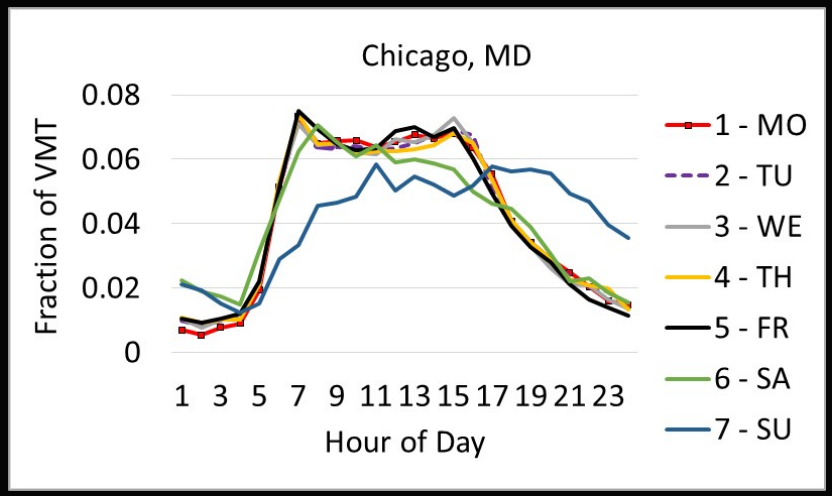


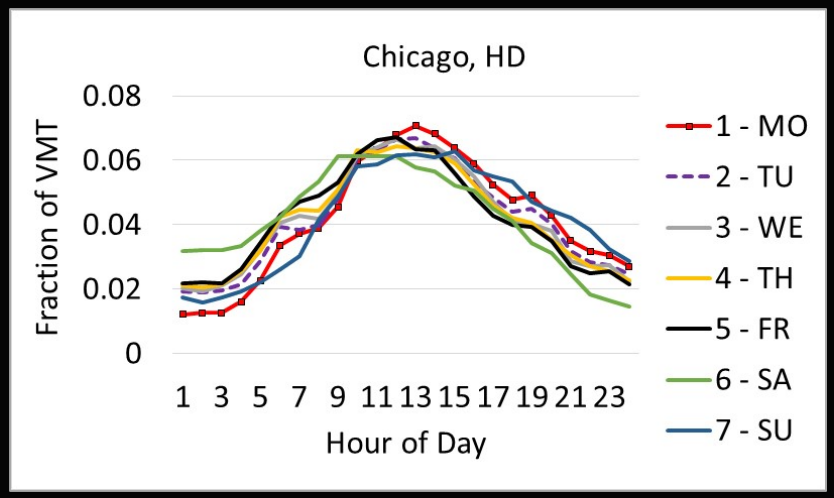
VMT Distribution Data

- Observations:
  - Clear differences among LD passenger vehicles, MD trucks & HD trucks
  - HD truck travel highest off-peak
  - MD truck weekend travel is unique

Chicago, Urban Restricted Access
Hour VMT Distributions by Vehicle







Emissions Impacts

- Ran MOVES to assess emissions sensitivity:
  - 2014 Version 1 Inputs (MOVES default in many cases)
  - A-100 updates for average speed, VMT distribution:

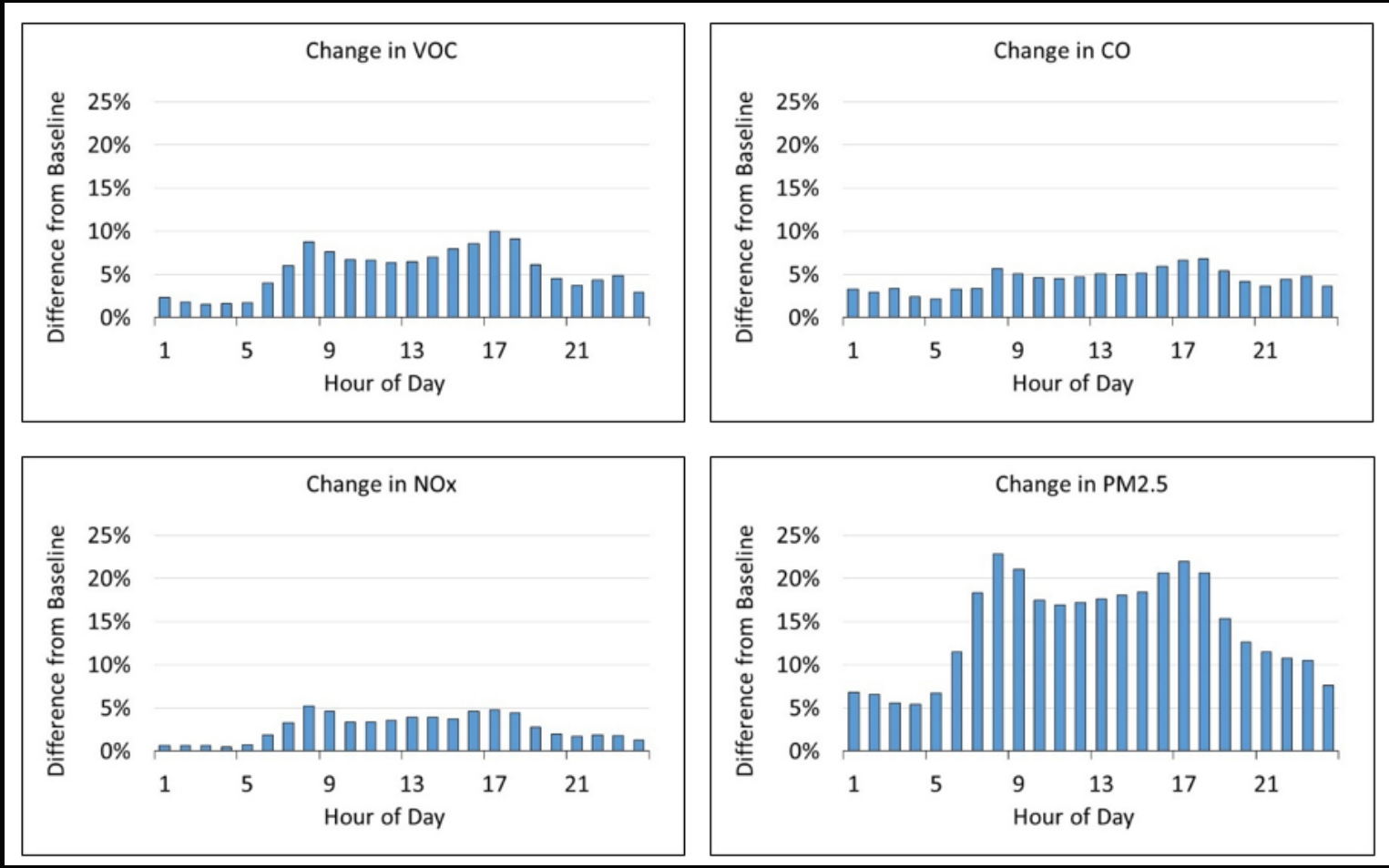
- Chicago (Cook County) Results:

Pollutant	Baseline Emissions (TPD)	CRC A-100 Speeds	
		Emissions (TPD)	Change from Baseline
VOC	68.8	72.5	5%
CO	651.9	677.9	4%
NO_X	135.2	139.4	3%
$PM_{2.5}$	4.6	5.3	14%

Emissions Impacts (Speeds Only)

Cook County, July Weekday

- Hourly differences significant:



Summary

- U.S. National Emissions Inventory (NEI) relies on MOVES inputs at the county level
- EPA and CRC studies provide improved default data
  - Consistent vehicle classification nationwide
  - Observed speeds and VMT distributions
- CRC study fills a huge data gap
- Vehicle telematics data promising source of activity
  - Better spatial/temporal resolution
  - Differences unique to individual cities
  - Truck trends not seen in other datasets

Acknowledgments

- Coordinating Research Council (CRC) Atmospheric Impacts Committee
  - Project Leads: Susan Collet, Mark Janssen, and Dan Baker
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