Alternative Methods for Conducting Speed Studies - Equipment and Insights from MSU Research

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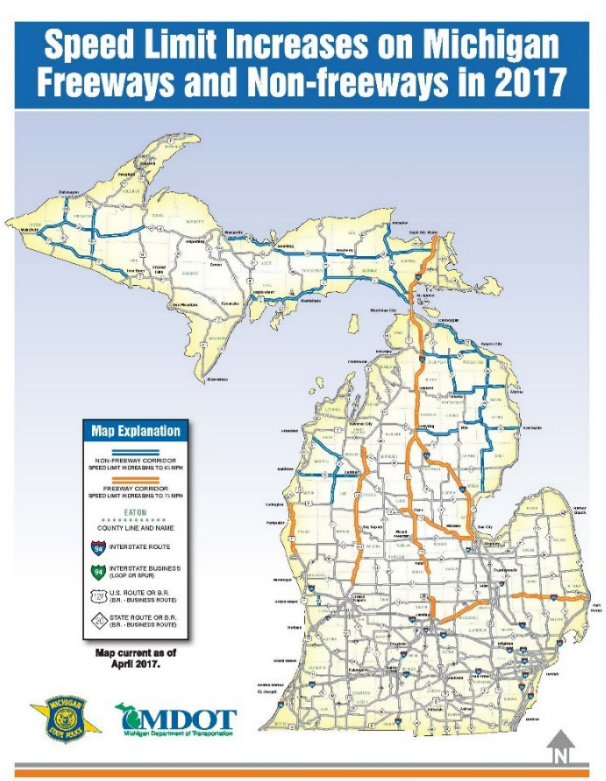


Engineering Speed Studies

- What do they provide?
  - Engineering speed studies provide a sample distribution of vehicular speeds within the traffic stream at a highway location
- How are they used?
  - Establish speed limits
    - Determine if complaints about speeding are valid
  - Set traffic signal timings
  - Evaluated engineering designs and TCDs
  - Determine mandatory federal reporting
  - Analyze crash locations or support investigations
  - Speed trends for engineering study

Speed Study Considerations

- Time of day
  - Off Peak vs. Peak
- Day of week
  - Weekday vs. Weekend
- Duration
  - Typically >1 hour and >30 vehicles per direction
- Vehicle classes
  - Passenger vehicles vs. trucks
- Headways
  - At least 4-5 second headways
- Equipment

Common Speed Collection Equipment

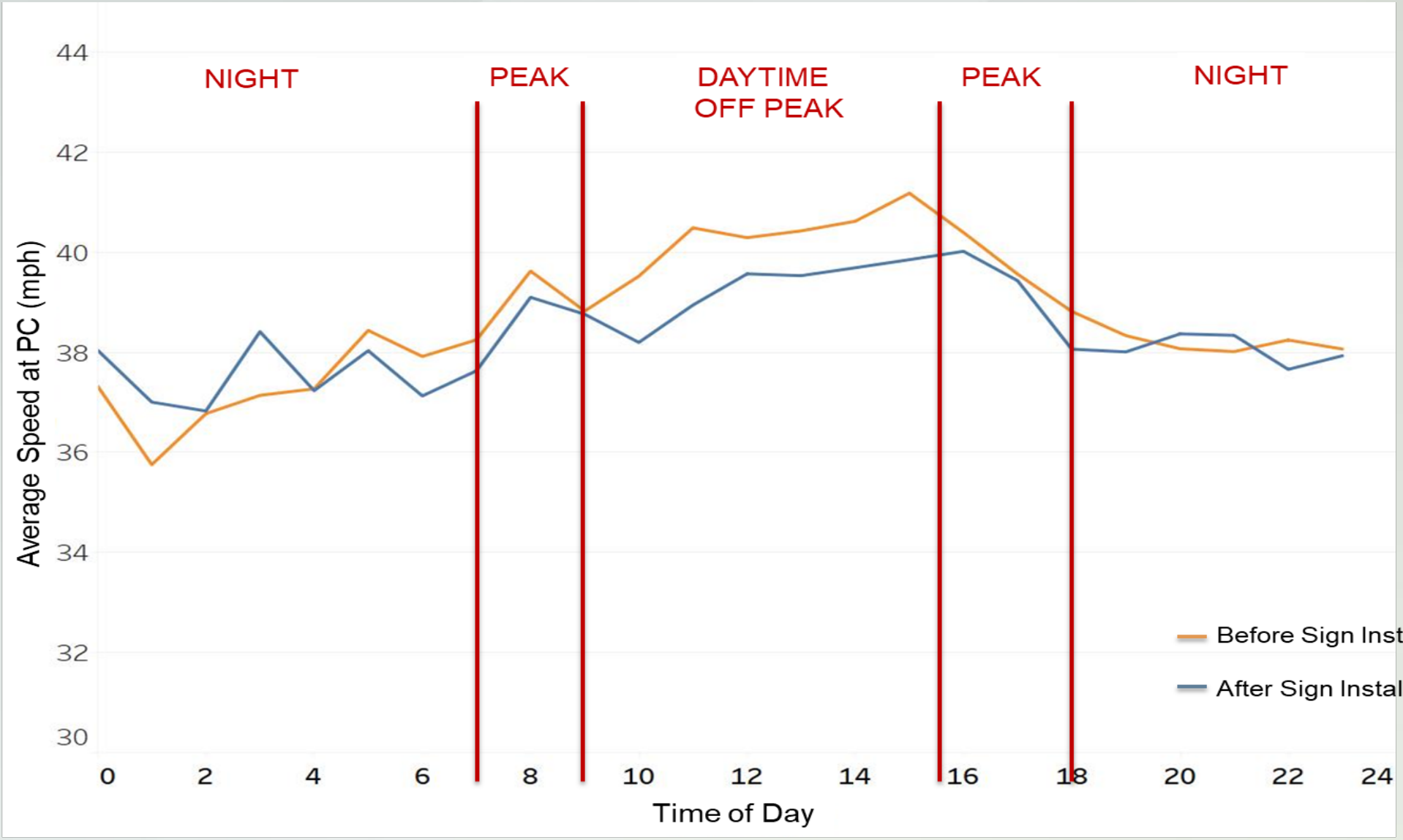
- Road Tubes
  - Pros: cheap, common, can be left unmonitored
  - Cons: worker safety, tubes come undone
  - **Best for long term speed studies on low volume roads and streets**
- Radar Gun
  - Pros: cheap, fast
  - Cons: difficult to isolate specific vehicles, requires safe/covert position to park vehicle
  - **Best for quick speed studies where selection of specific vehicles is not needed**

Advanced Speed Collection Equipment

- Permanent traffic recorders (PTR)
  - Pros: 24/7/365 collection, can typically get day-by-day or hour-by-hour
  - Cons: Expensive, lacks granularity (combines all vehicle types and congestion levels)
  - **Best for assessing general trends in travel speeds for federal reporting requirements**
- Automated radar traffic recorders (ATR)
  - Pros: 24/7 collection at point locations
  - Cons: Sensitive to site geometry and setup
  - **Best for assessing general trends in travel speeds for speed studies on straight roadways**

ATR Speed Trailer

ATR Speed Trailer Data



Pole Mounted Radar ATR

- Vehicle speed, length, gap, and volume
- Provides data for each vehicle
- Can be used on two lane roads, bidirectional or unidirectional

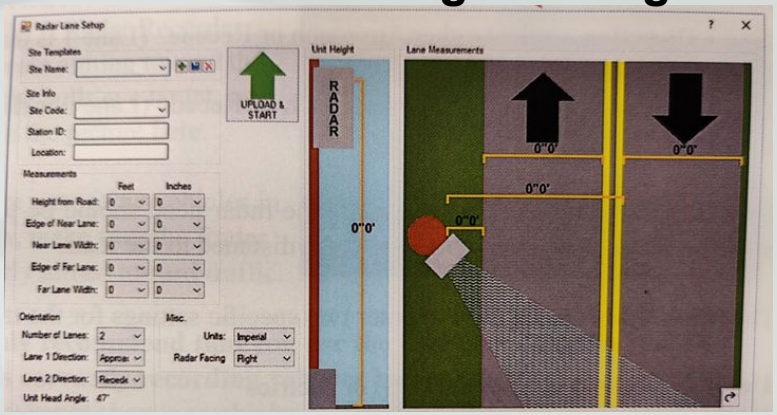
Jamar "Black Cat II"

Installation and Programming

Installation details:

- 6-10 feet offset from the travel lane
- At least 6 feet above the ground
- 45 degree angle to the traffic flow
- Where the far side lane is within 50 feet
- Where the traffic is free flow

Bluetooth Programming



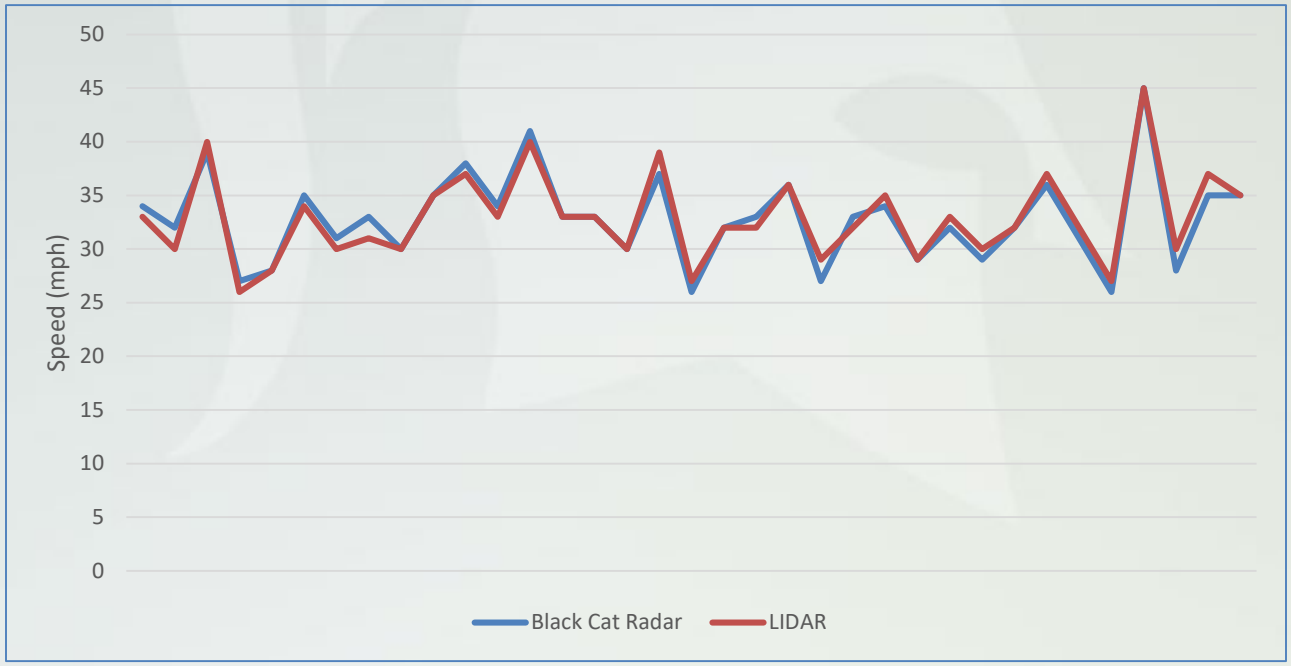
Example Installation

Field Testing by MSU

- Black Cat II (Jamar) and TrafficSTAT Traffic Data Collection System (MPH Industries)
  - Tested in **tangent & curve** sections
- Test vehicles: Sedan, SUV, & pick-up
- Daytime in clear weather
- Cruise control speed set and verified by LIDAR gun

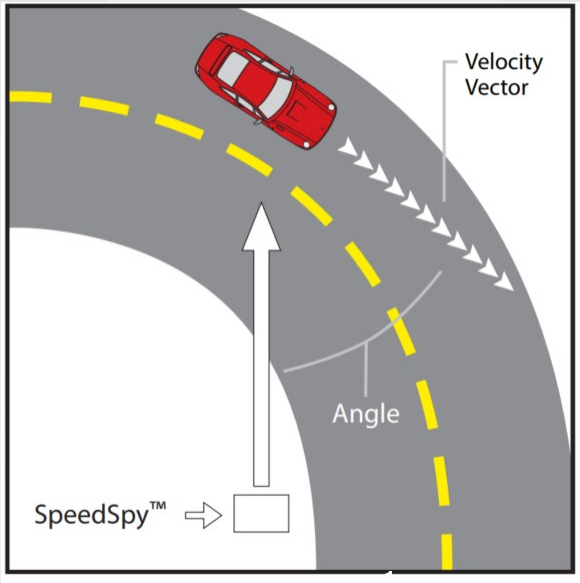
Results - Tangent Section

- ATR speed was within ±1 mph of LIDAR
- ATR did not miss any vehicle
- Vehicle length data was acceptable



Results - Curve Section

- Speed difference on curves of **up to 8 mph** between the ATR and LIDAR
- ATR would occasionally miss the vehicle entirely
- **Speed measurement is very sensitive to the angle the radar is aimed, which makes it difficult to setup on curve sections**



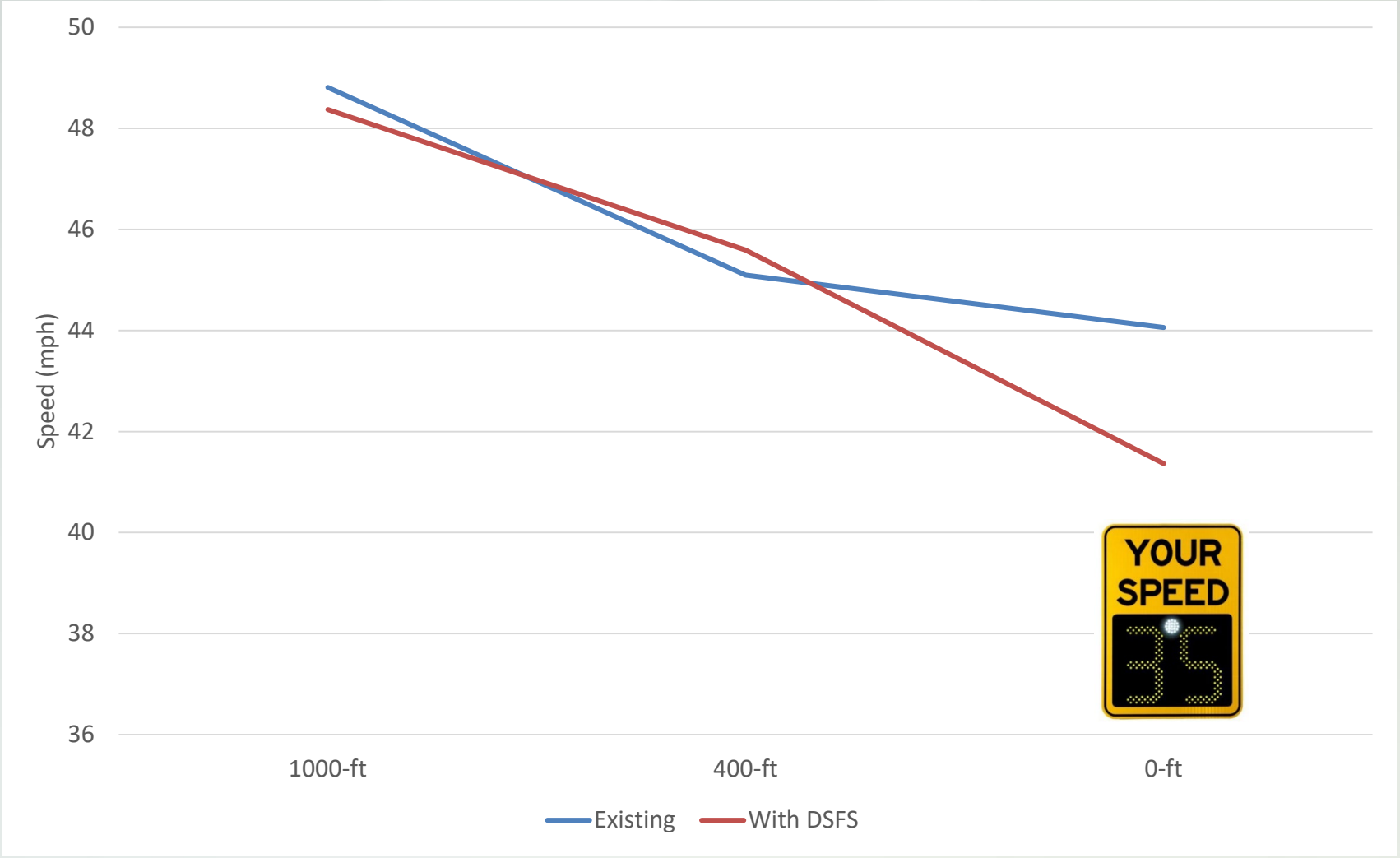
Advanced Speed Collection Equipment

- LIDAR
  - Pros: Precise vehicle speed measurement
  - Cons: Requires line-of-sight, safe shoulder/roadside, weather
  - **Preferred for tracking individual vehicles**

- Cameras
  - Pros: Direct observation, vehicle classes
  - Cons: Labor intensive, weather, battery life
  - **Preferred when assessing various aspects of behavior and when vehicle type is important**
  - **OK for tracking speeds (LIDAR is better)**

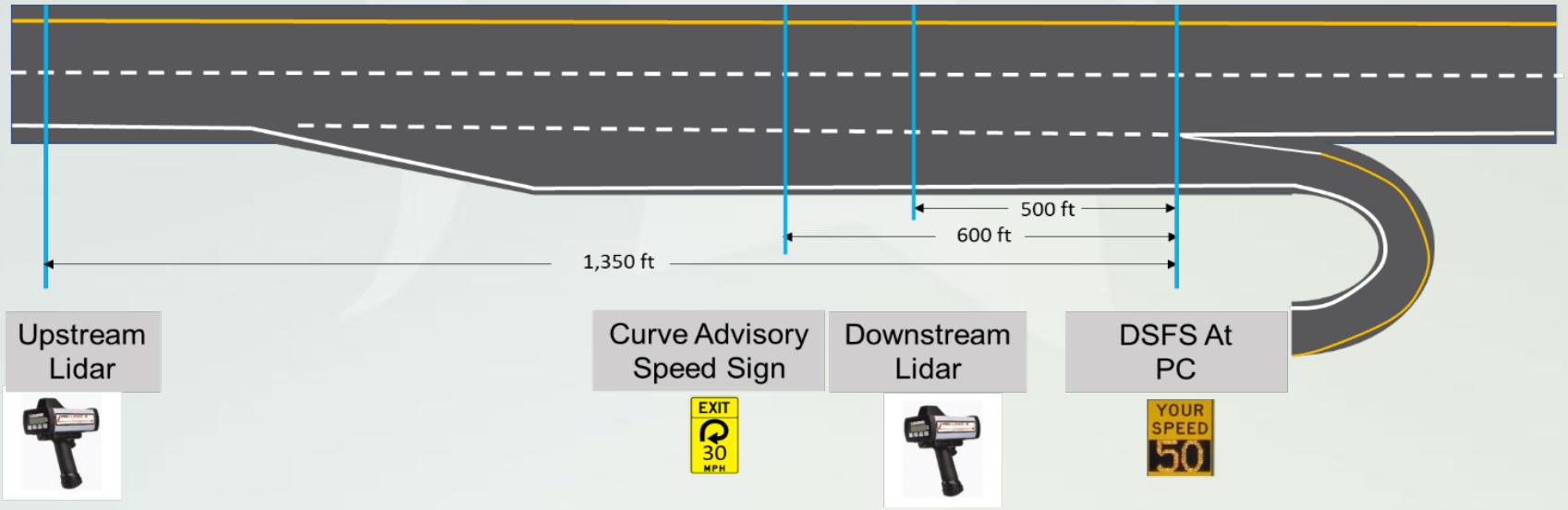
Camera Views (series of 3 cameras)

Speed Data from 3 Cameras

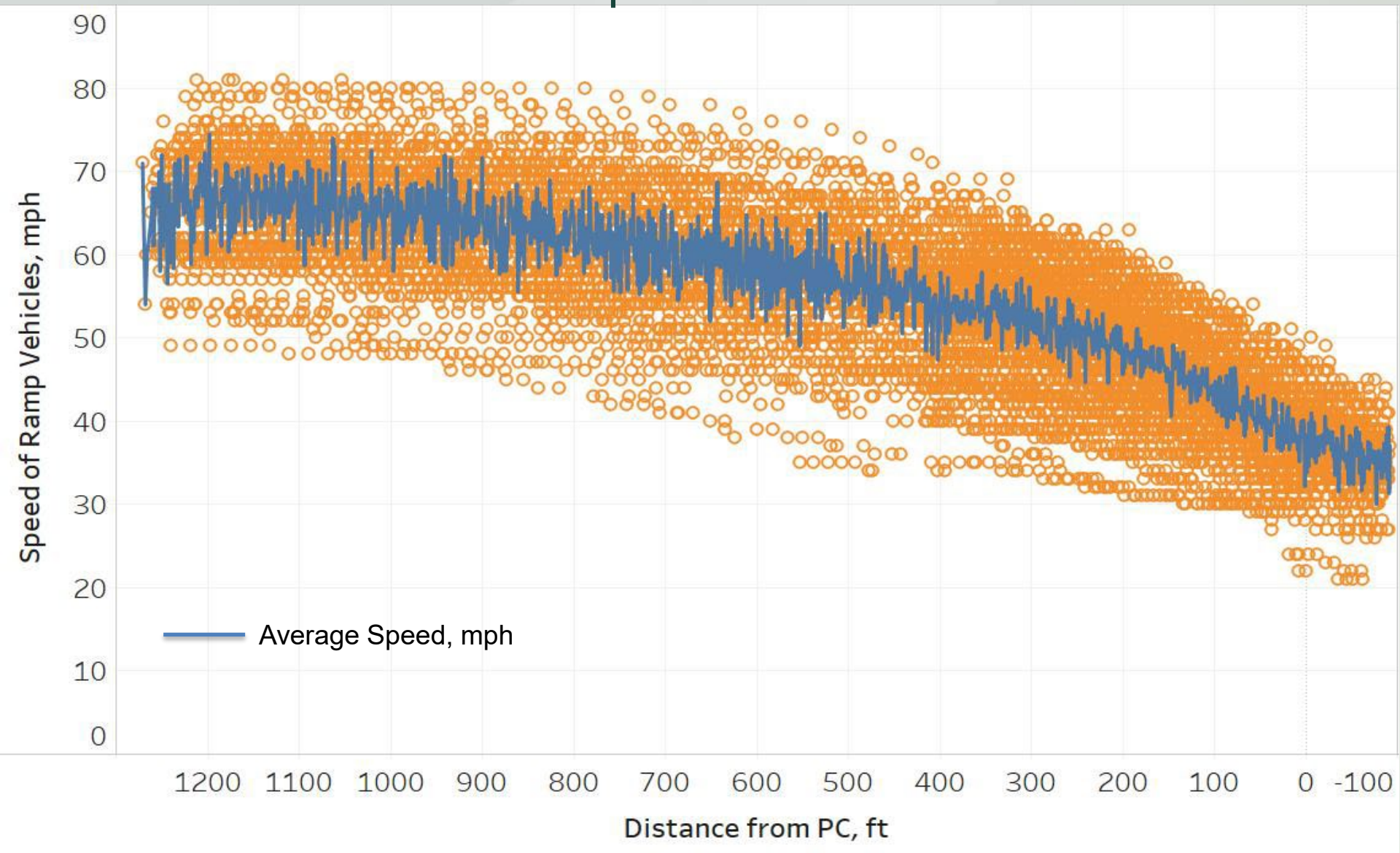


LIDAR Data Collection Setup

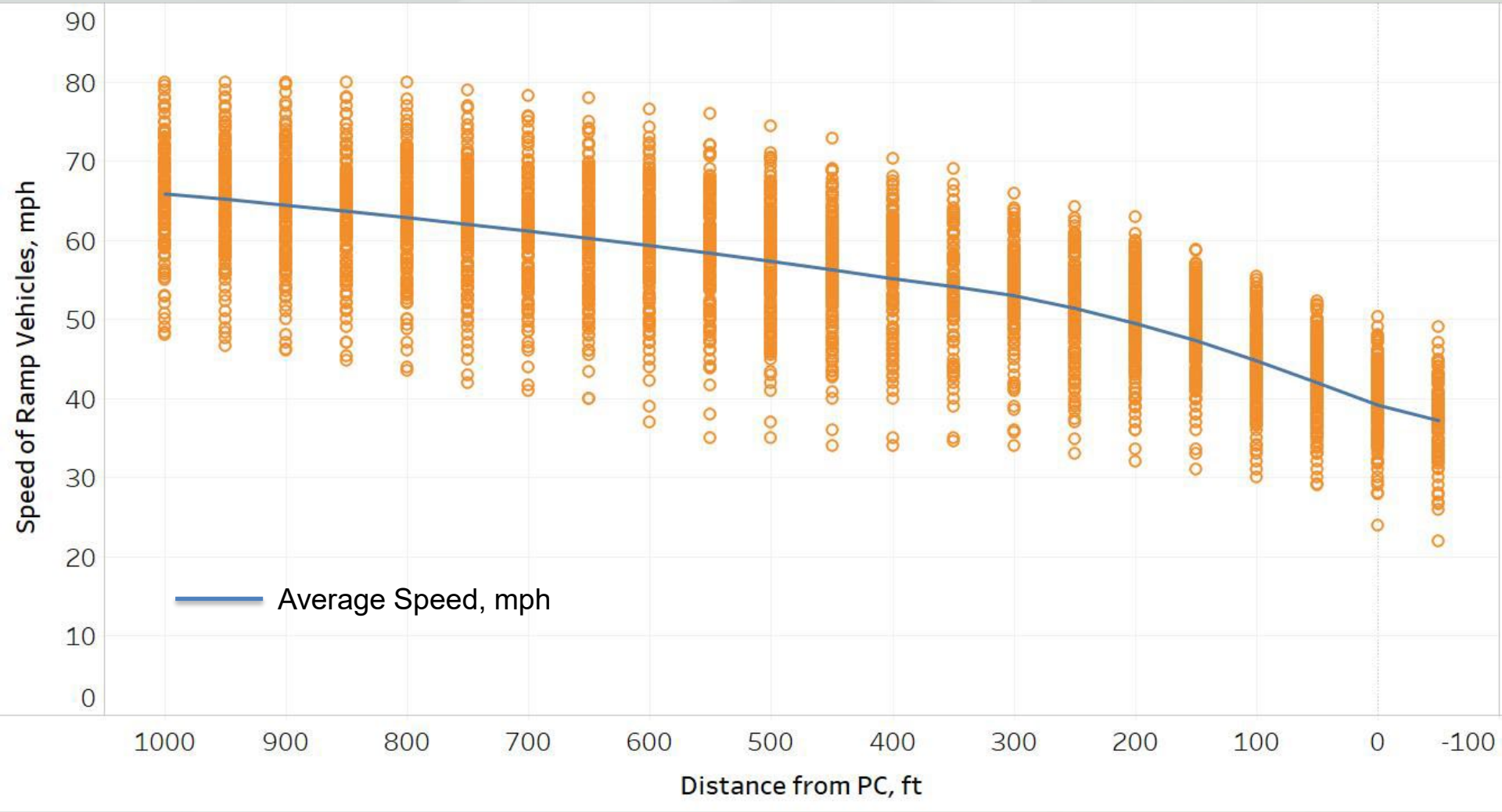
- LIDAR "hand-off" method for speed tracking
  - Upstream Data Collector 1,350 ft from PC
  - Downstream Data Collector 500 ft from PC



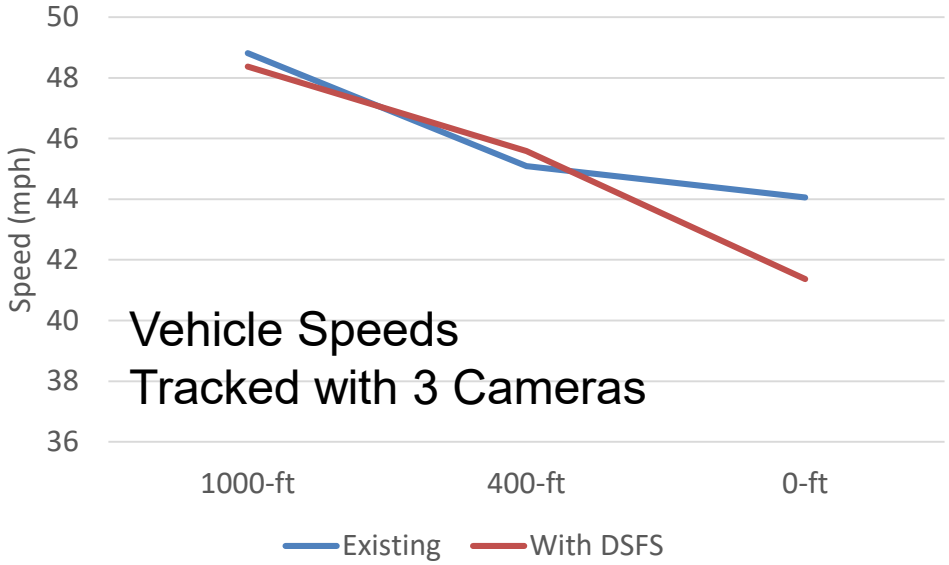
Lidar Tracking Data: Raw Speed Profiles

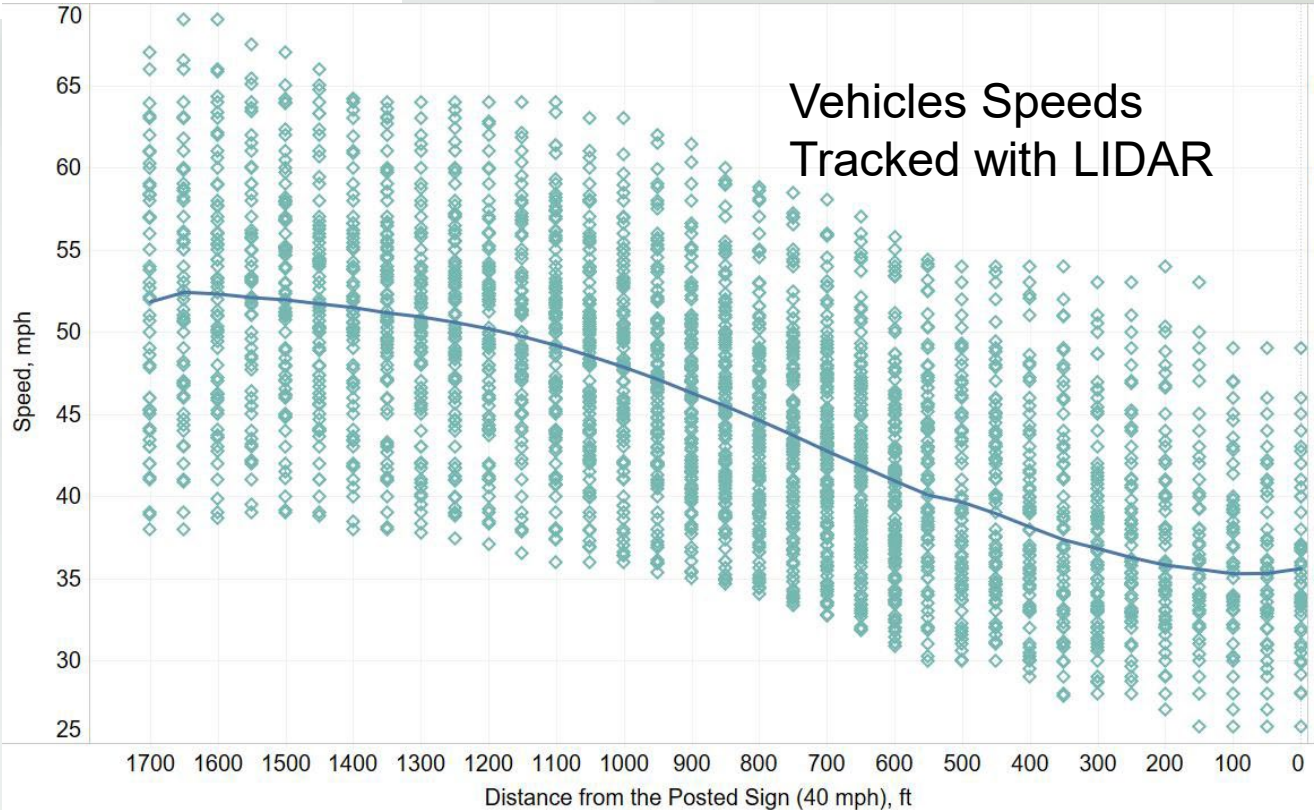


Lidar Tracking Data: Processed at 50 ft Intervals



Speed Profile Comparison: Camera Tracking vs. LIDAR Tracking





Nationwide Speed Limit Trends

Policy Debate

Home » News

Menu Set Weather

316

Speed limits highways

5.6k shares

Oregon speed limit signs changed

Oregon Department of Transportation crews Idaho border around 5:30 a.m. March 1, the freeway.

By Elliot Njus | The Oregonian/Ore
Email the author | Follow on Twitte
on February 29, 2016 at 8:21 AM, u

Speed limits on much of Interstat as several rural Oregon highways Tuesday as a law passed last year

386

75-mph speed limits officially coming to Michigan

42.8k shares

Speed limits on some rural, limited-access Michigan highways could rise to 75 miles per hour after speed and safety studies. *(Gillian Van Stratt | MLive)*

By Emily Lawler | elawler@mlive.com
on January 05, 2017 at 11:47 AM, updated January 05, 2017 at 2:18 PM

Print
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LANSING, MI -- Gov. Rick Snyder on Thursday signed bills allowing speed limits on some Michigan highways to 75 miles per hour.

"Ensuring that all Michiganders are safe while operating vehicles on our state's roadways is critically important, and these bills allow for appropriately increased speed limits on certain roadways after safety studies are conducted," Snyder said.

The main bill requires the Michigan Department of Transportation and Department of State Police to raise speed limits to 75 miles per hour on 600 miles of rural, limited-access freeways if a safety and engineering study deems it safe.

The bills require safety and engineering studies before speed limits are raised.

The House initially approved the package in June, but both chambers passed the latest version in December. The Senate changed the bills from what the House had passed. Sen. Tom Casperson, R-Escanaba, said the Senate-passed bills went back toward using the 85th percentile -- that is, the speed that 85 percent of drivers on a stretch of road do not exceed -- to help set speed limits.

Speed limit increase to 75 squeezes through House, heads to governor
Some highway speeds could increase to 75 miles-per-hour.

Rep. Bradford Jacobsen, R-Oxford, led the package. The bills were HBs 4423-4427, and are now Public Acts 445-449 of 2016.

The bills also allow for speed limit changes in other areas, including:

- Speed limits on gravel roads in counties with populations over 1 million would decrease to 45 miles per hour.
- Up to 900 miles of rural state trunk line highways would see hikes to 65 miles per hour.

Note: This story has been edited to reflect the speed limit of state trunk line highways.

DETROIT AUTO SHOW

Rundown of vehicle unveilings

- Early peek at the auto show floor
- Ram 1500 special edition to debut at auto show

Complete coverage »

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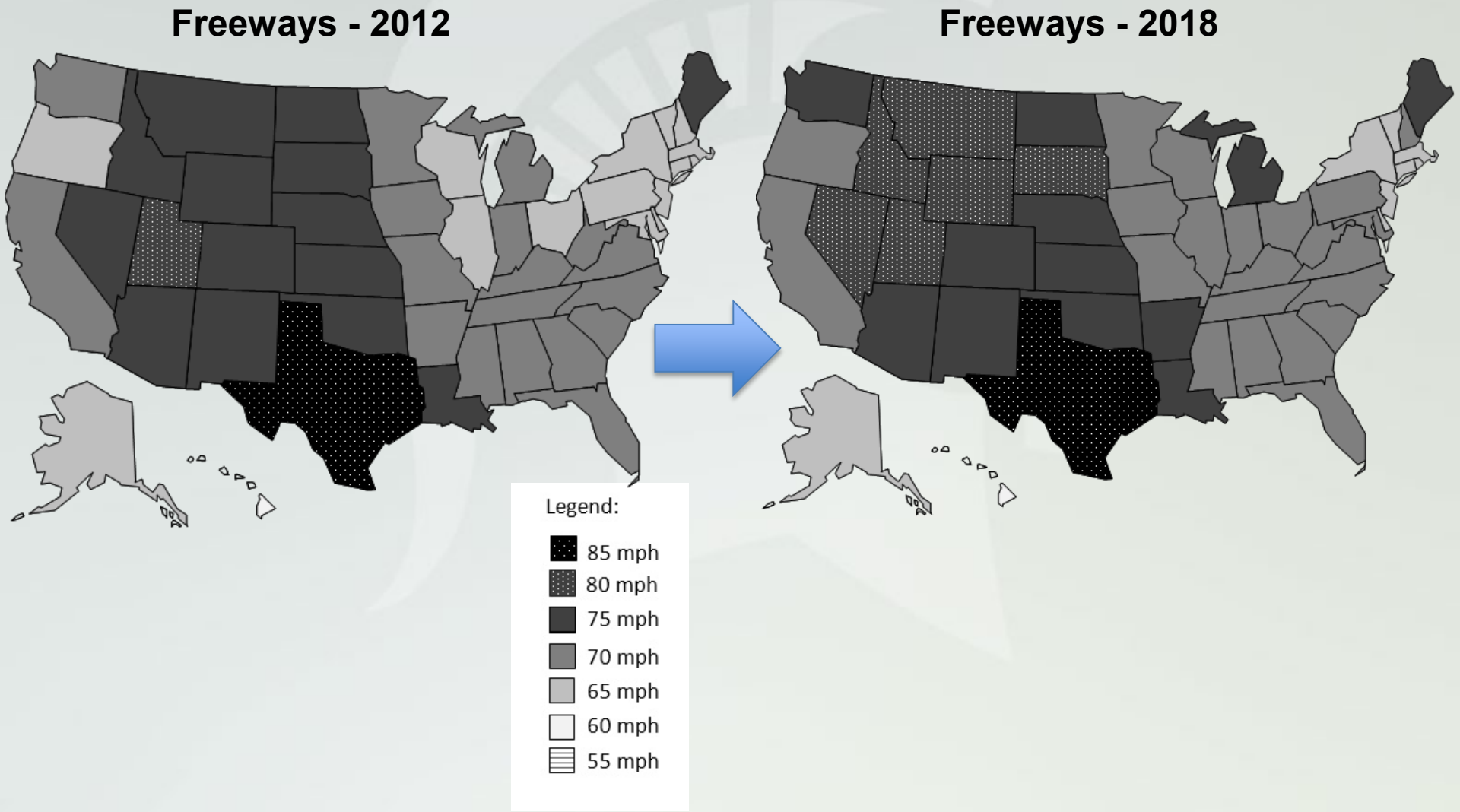
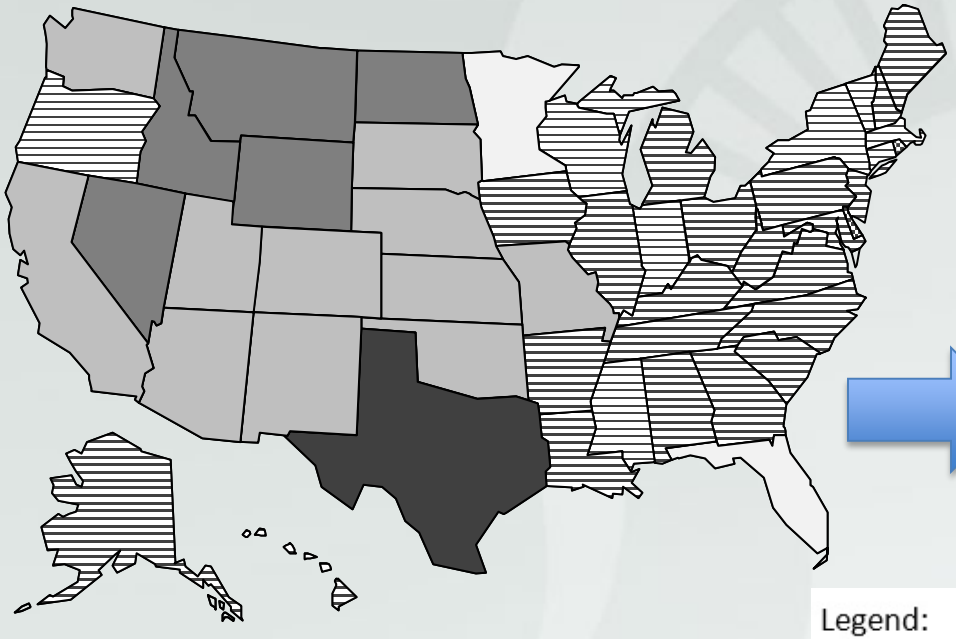
Maximum Limits - Freeways

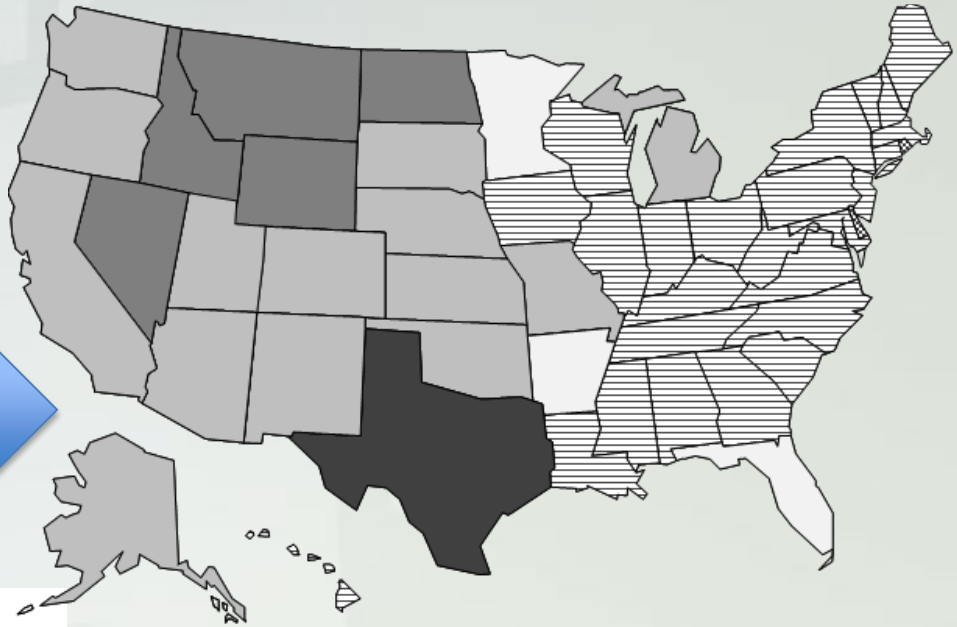


Maximum Limits - Undivided Highways

Undivided - 2012



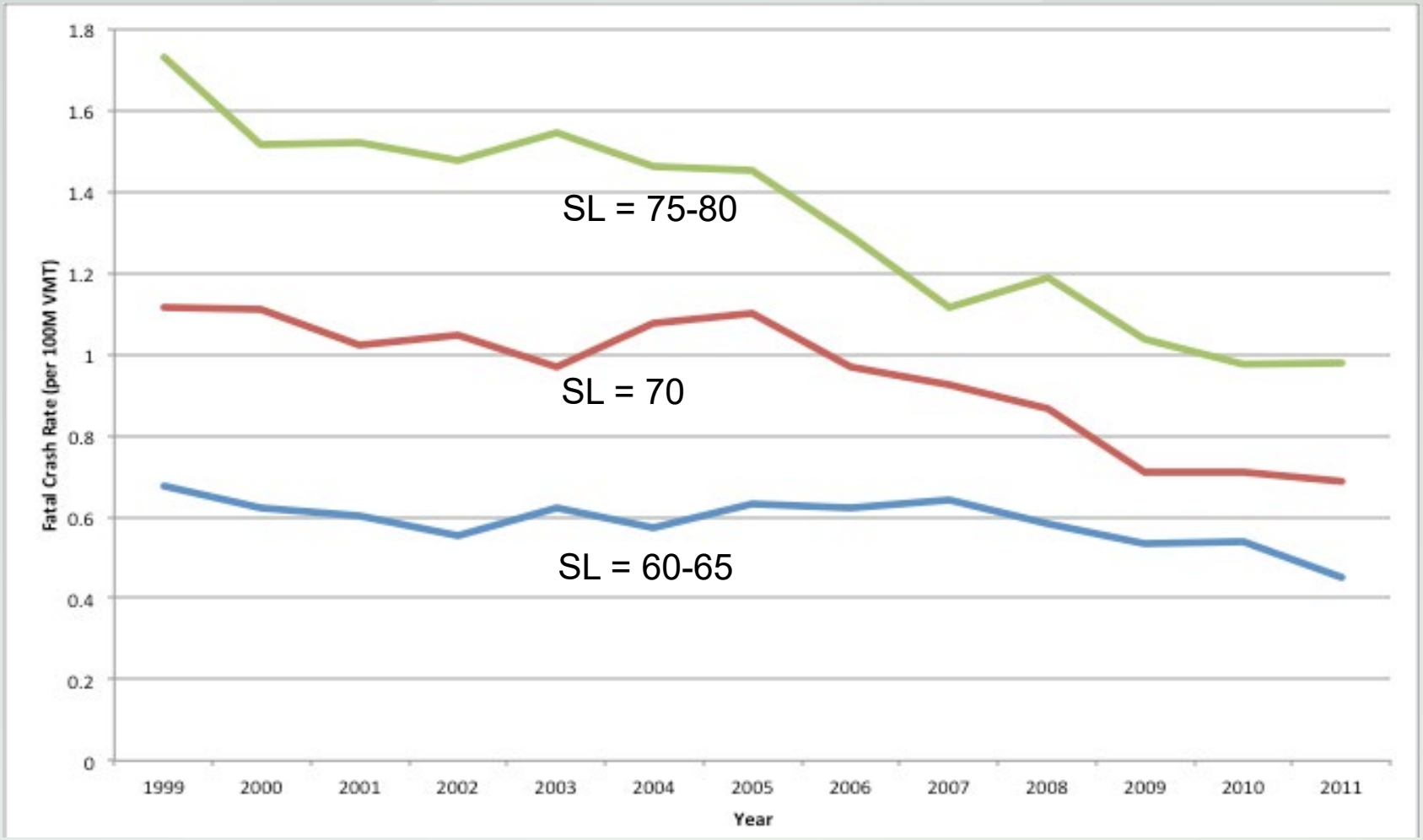
Undivided - 2018



Legend:

- 75 mph
- 70 mph
- 65 mph
- 60 mph
- 55 mph
- 50 mph

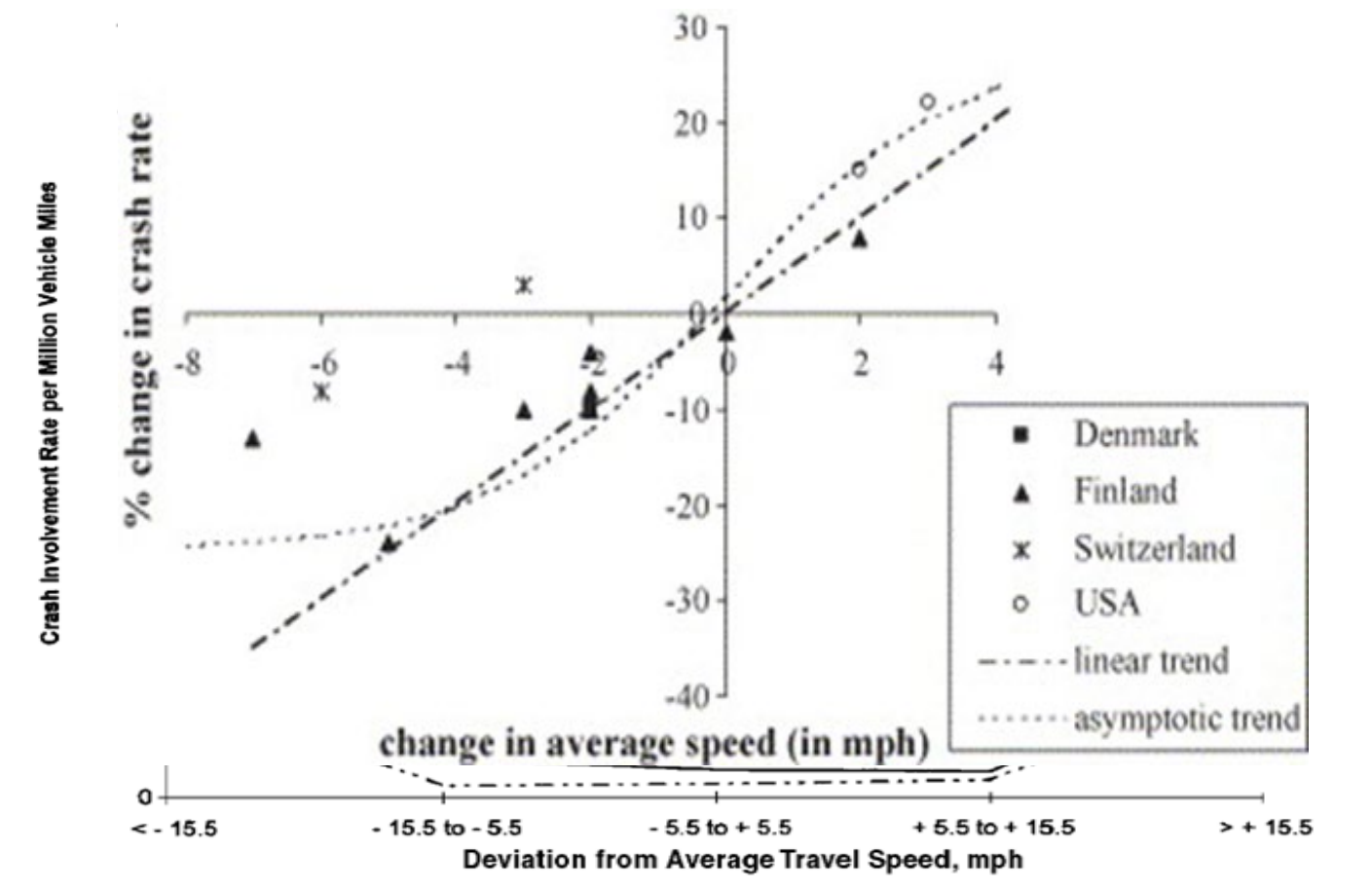
Why Is Speed Important?
US Interstate Fatality Trends



Why Is Speed Important? Speed vs. Crashes

Wennet al. (1971)

Finch et al. (1994)

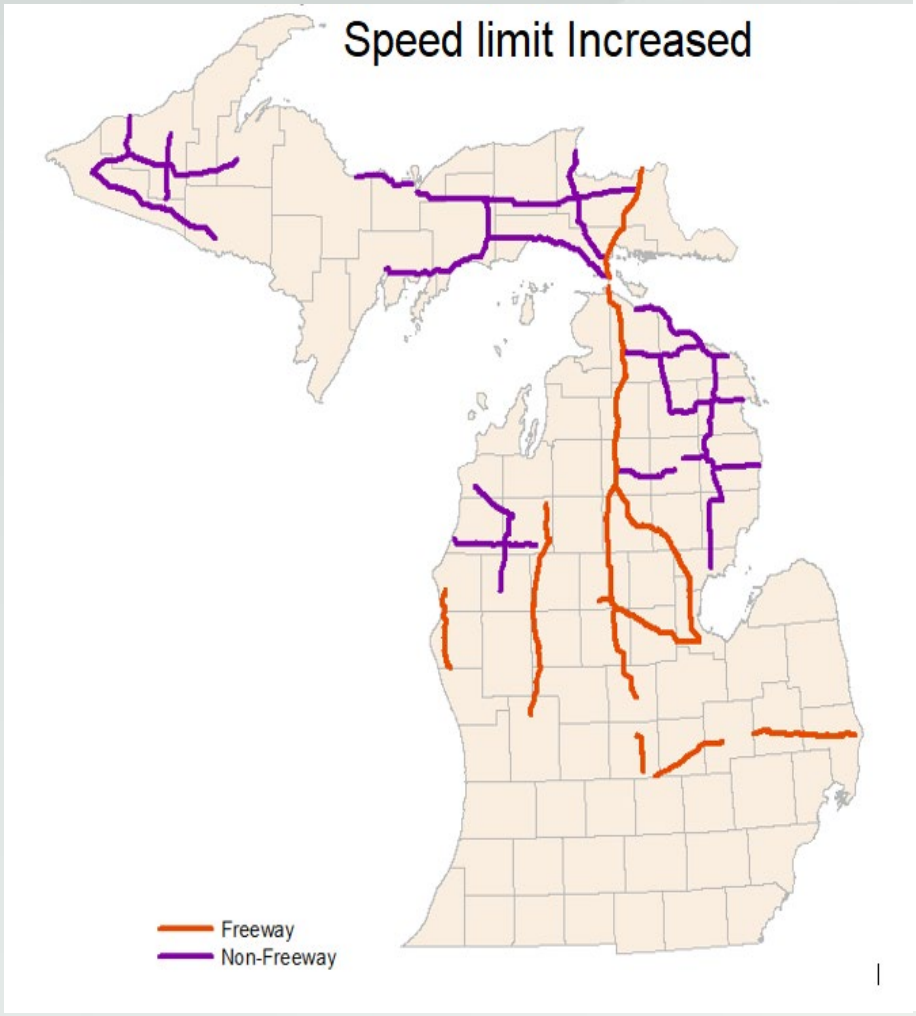


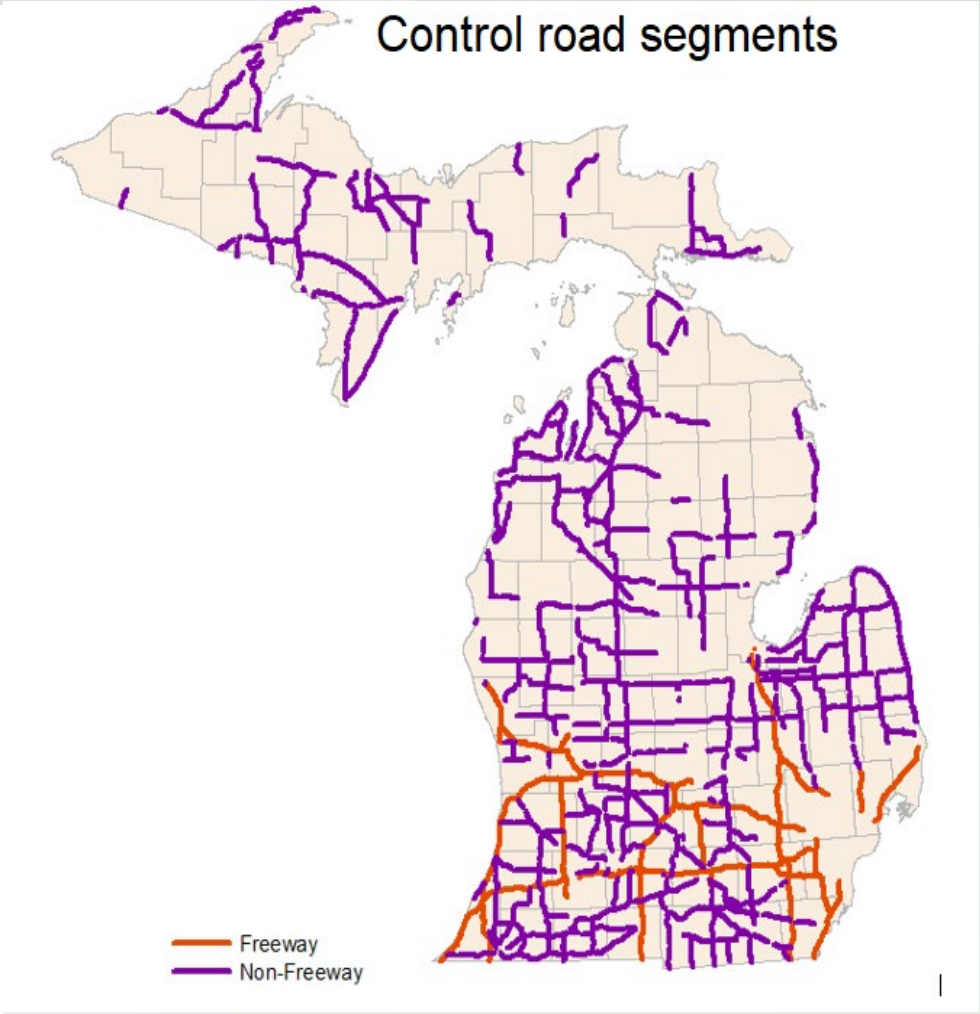
Evaluation of the 2017 Speed Limit Increases in Michigan

2017 Changes to Michigan Speed Limit Policy

- In early January 2017, Governor Rick Snyder signed Public Act 445 into law which mandated an increase in the speed limit
  - from 70 to 75 mph on 600 mi of rural freeways
  - from 55 to 65 mph on 900 mi of rural trunklines
  - where supported by an **"engineering and safety study and the 85th percentile speed of free-flowing traffic under idea conditions"**
  - truck limit raised to 65 mph on all freeways
- Implementation began on May 1, 2017 and continued through November 2017

Map of Increase and Non-Increase Routes



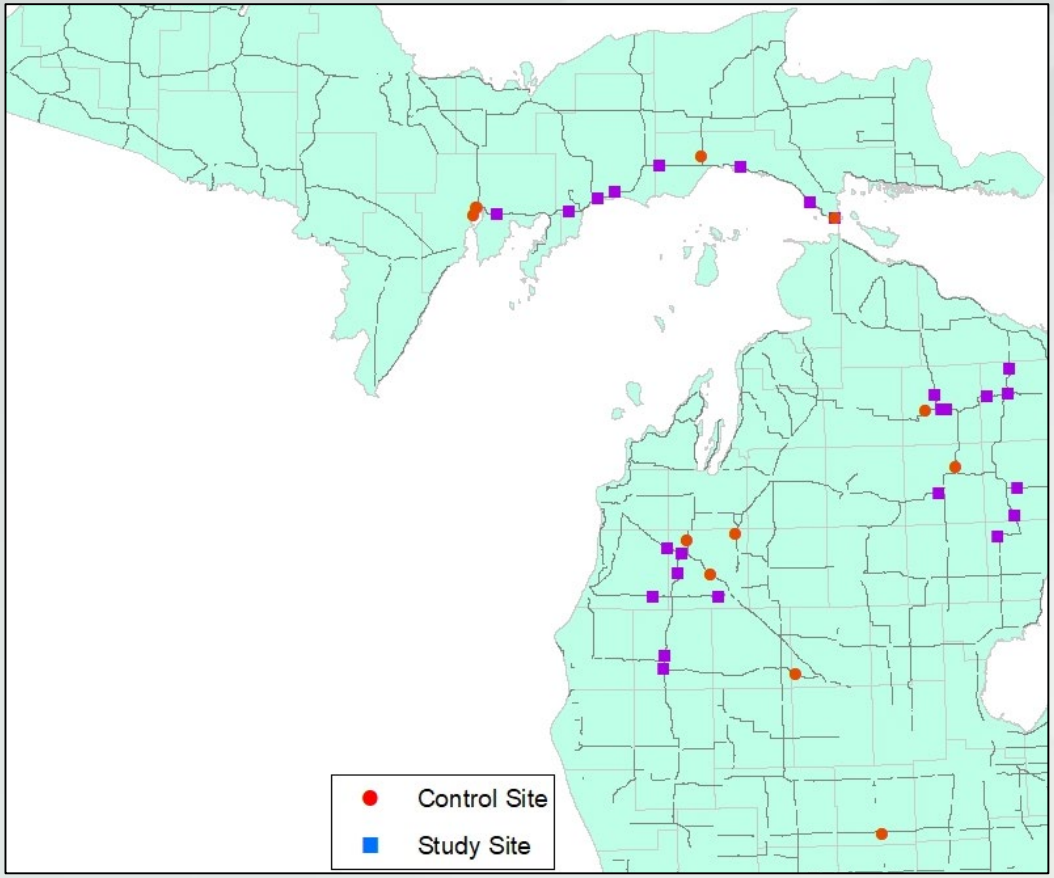


Preliminary Evaluation of Changes in Operating Speed

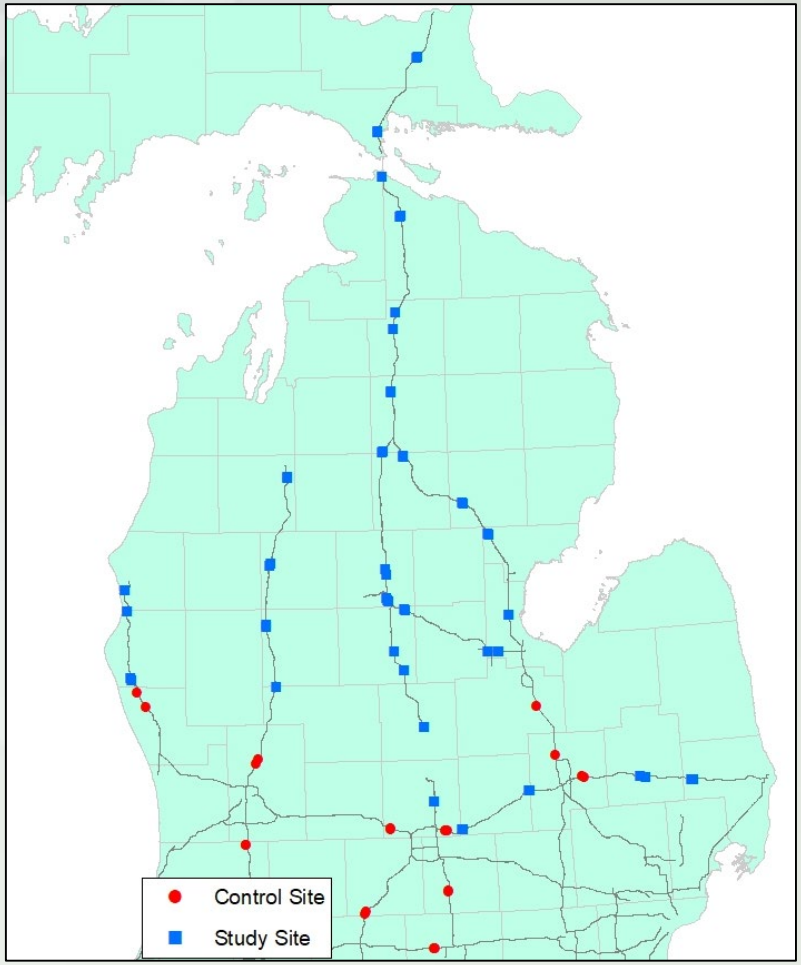
- LIDAR/Cameras
  - Random sample of 100 directional vehicles
  - Cars/Trucks separately
  - Freeflow conditions only
  - **Good for assessing free flow speeds**
- MDOT permanent traffic recorders (PTR)
  - 24/7/365
  - All vehicles aggregated together
  - All levels of congestion
  - **Good for assessing general speed trends**

LIDAR Collection Locations

Non-Freeway – LIDAR Locations

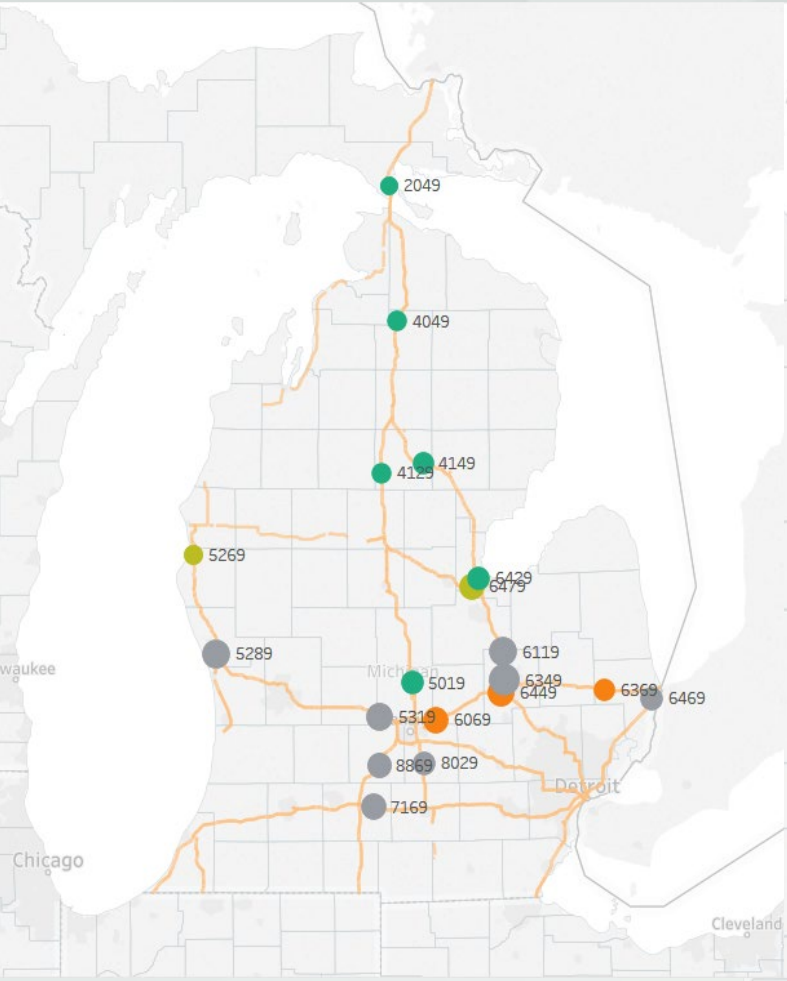


Freeway – LIDAR Locations

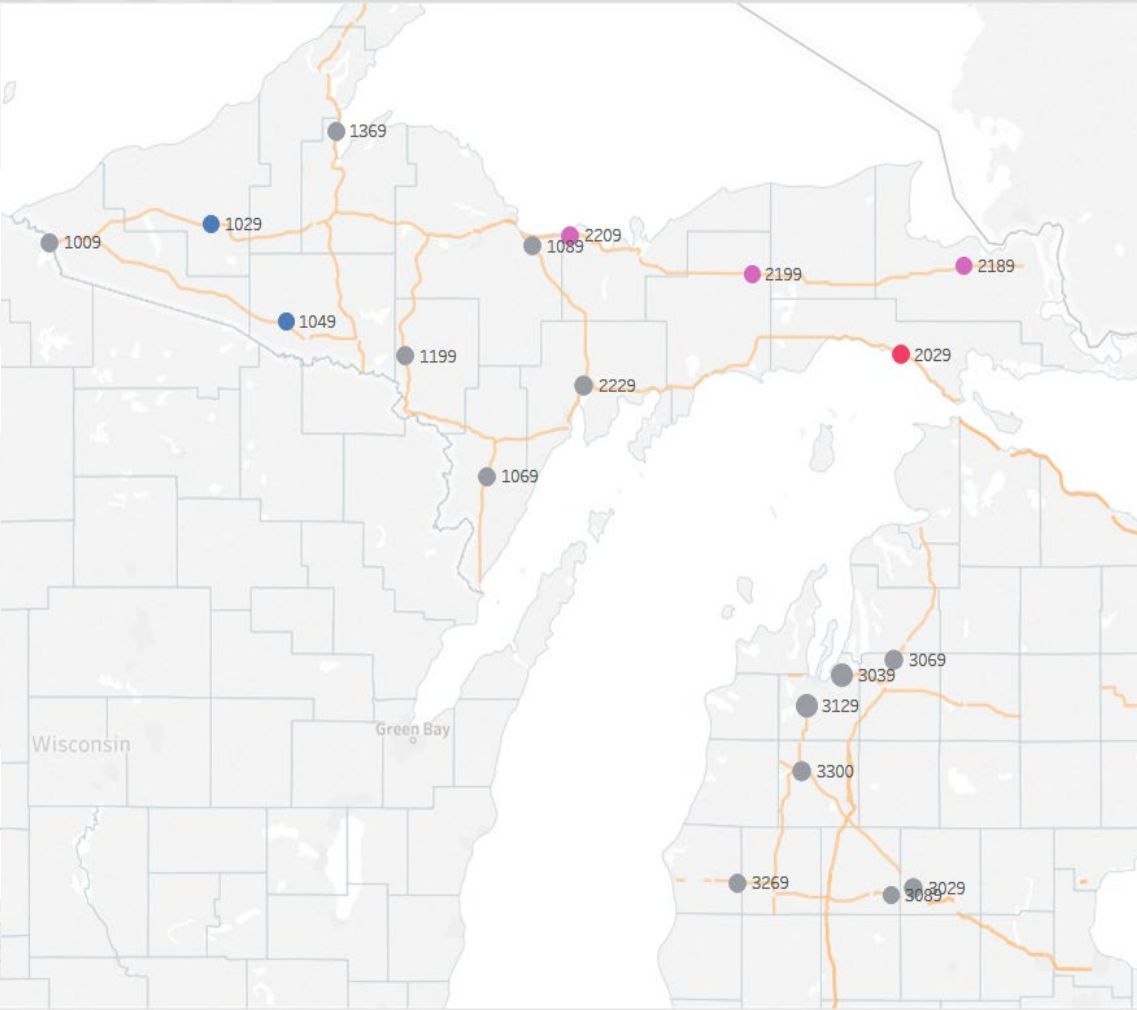


PTR Station Map

Freeway



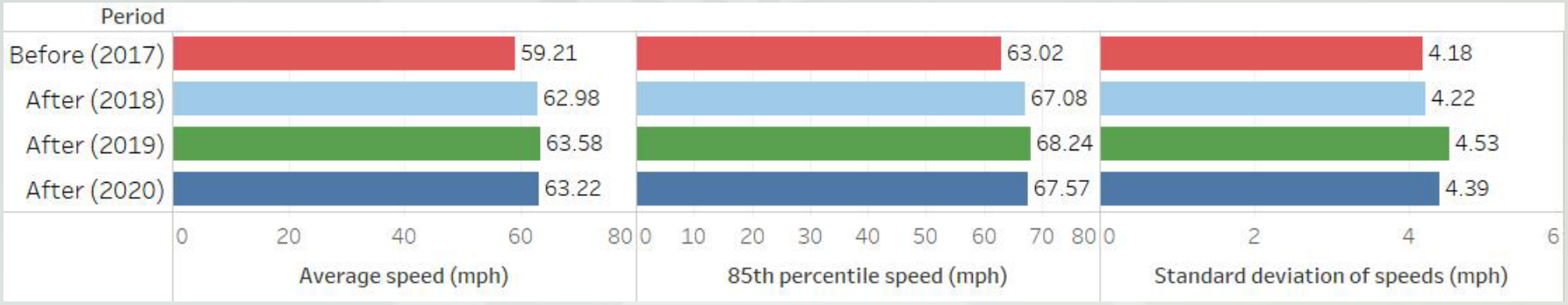
Non-Freeway



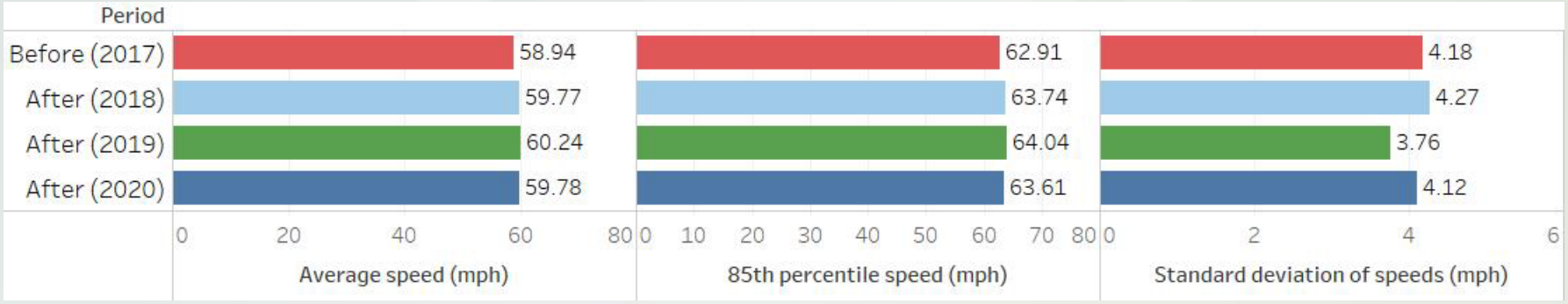
LIDAR Data Summary (Free-Flow Speeds)

Preliminary LIDAR Results **Non-Freeways** (Passenger Vehicles)

Study Sites (n=33)

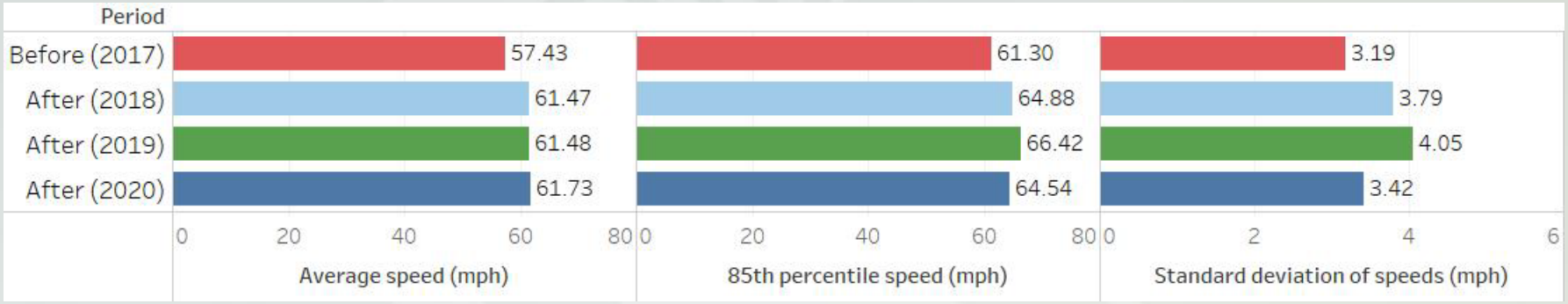


Control Sites (n=9)

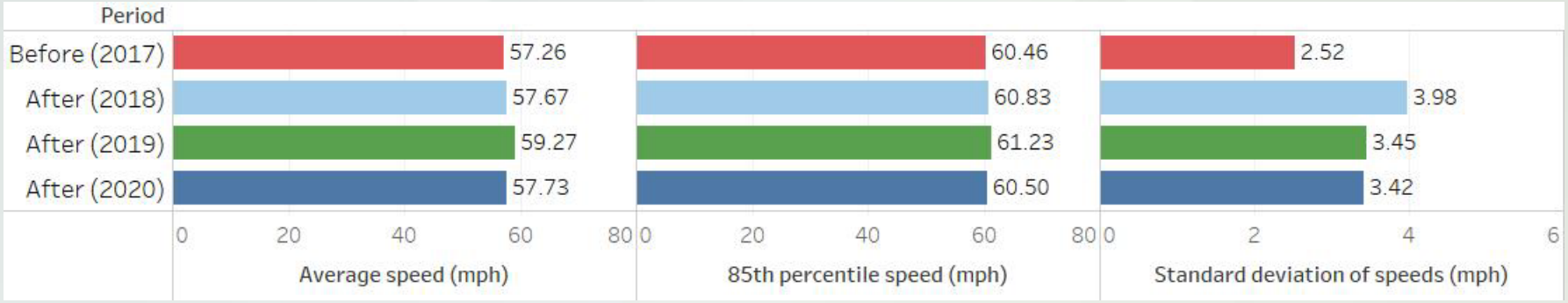


Preliminary LIDAR Results **Non-Freeways** (Trucks)

Study Sites (n=33)

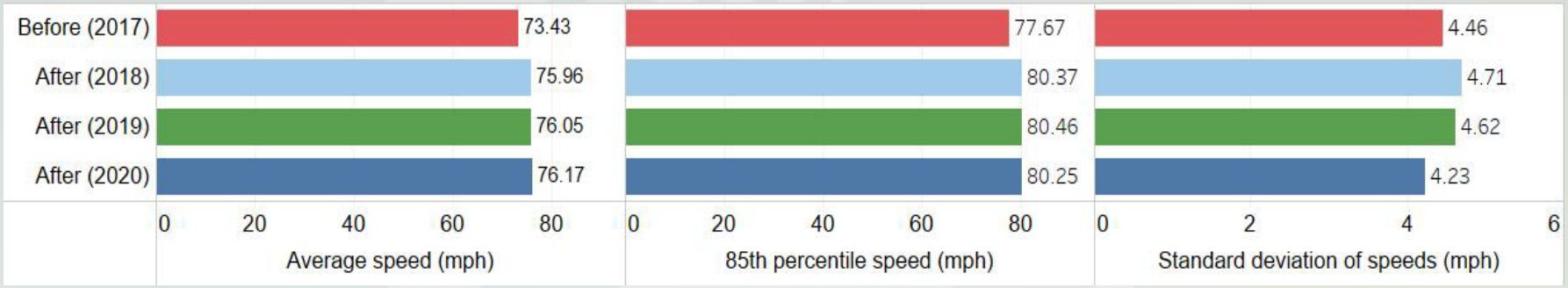


Control Sites (n=9)



Preliminary LIDAR Results **Freeways** (Passenger Vehicles)

Study Sites (n=55)



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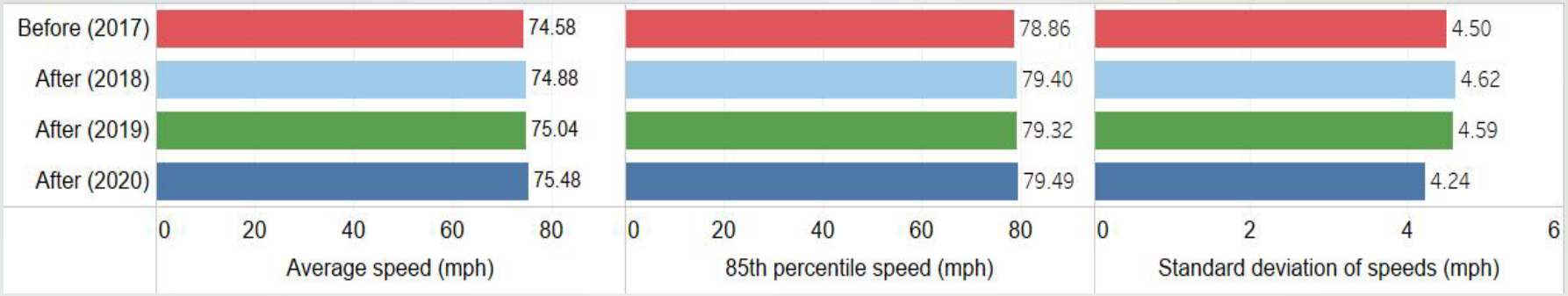
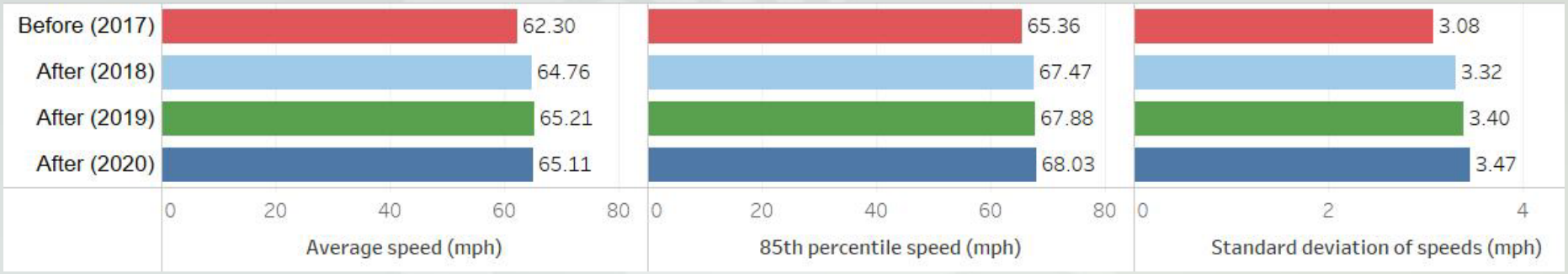


Preliminary LIDAR Results **Freeways** (Trucks)

Study Sites (n=55)



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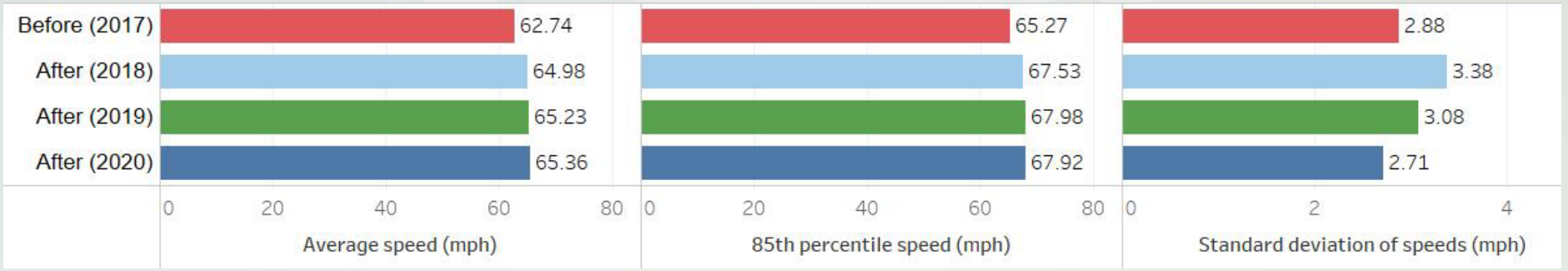
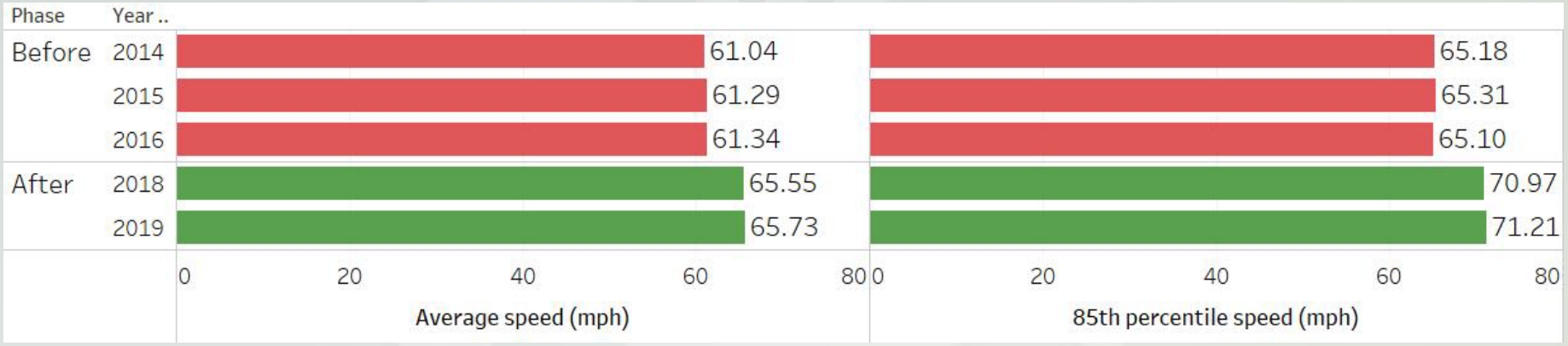


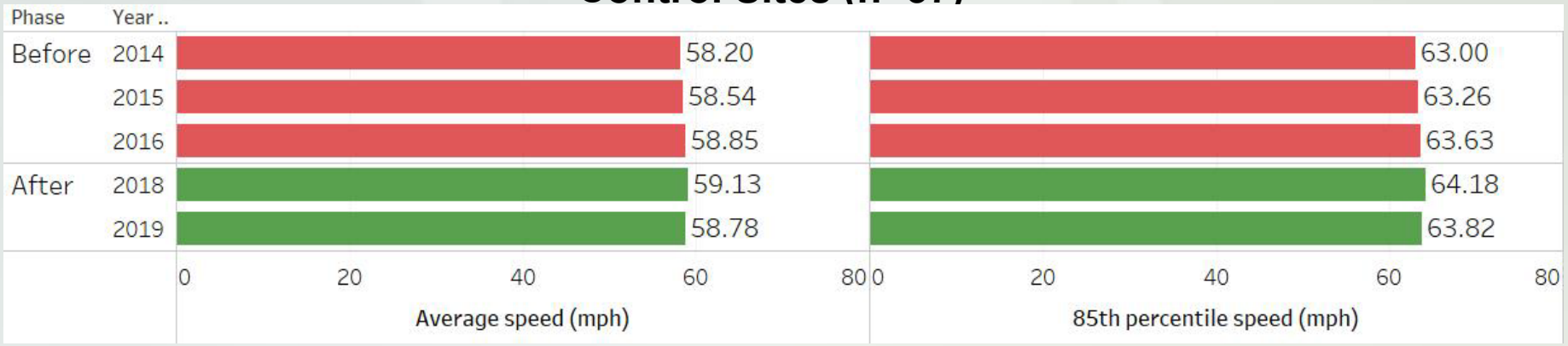
PTR Speed Data Summary (General Travel Speeds)

Aggregate Speed Trends (PTR)
Non-freeways

Study Sites (n=6)

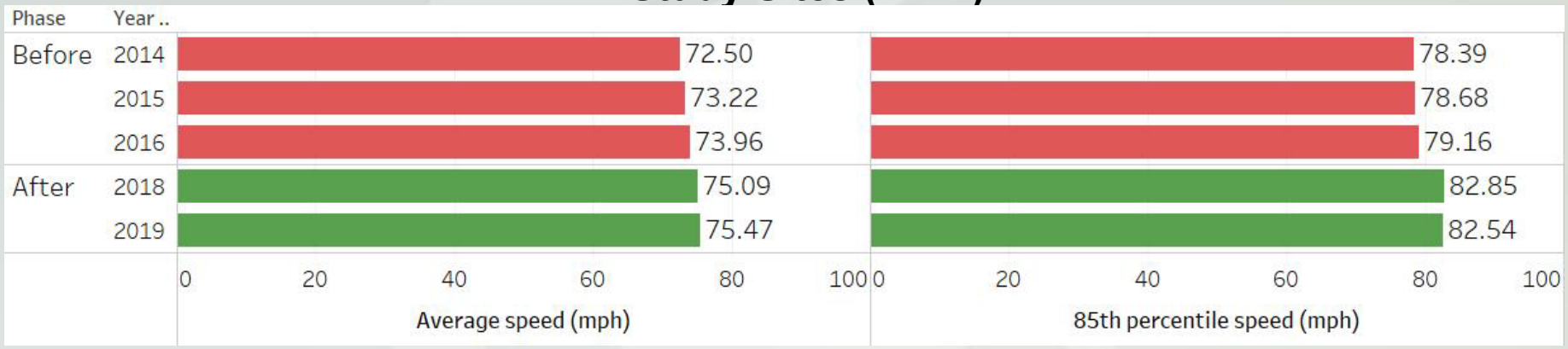


Control Sites (n=37)

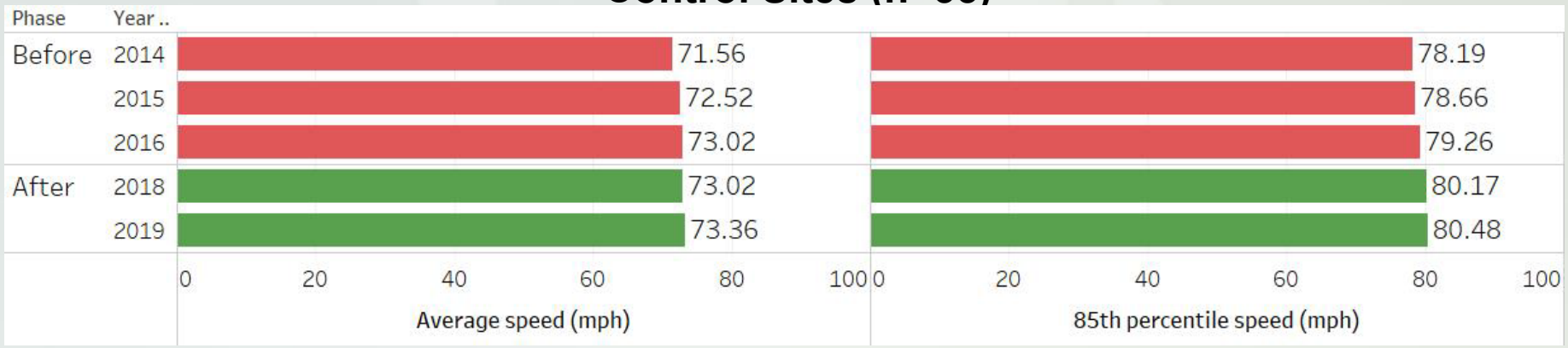


Aggregate Speed Trends (PTR)- **Freeways**

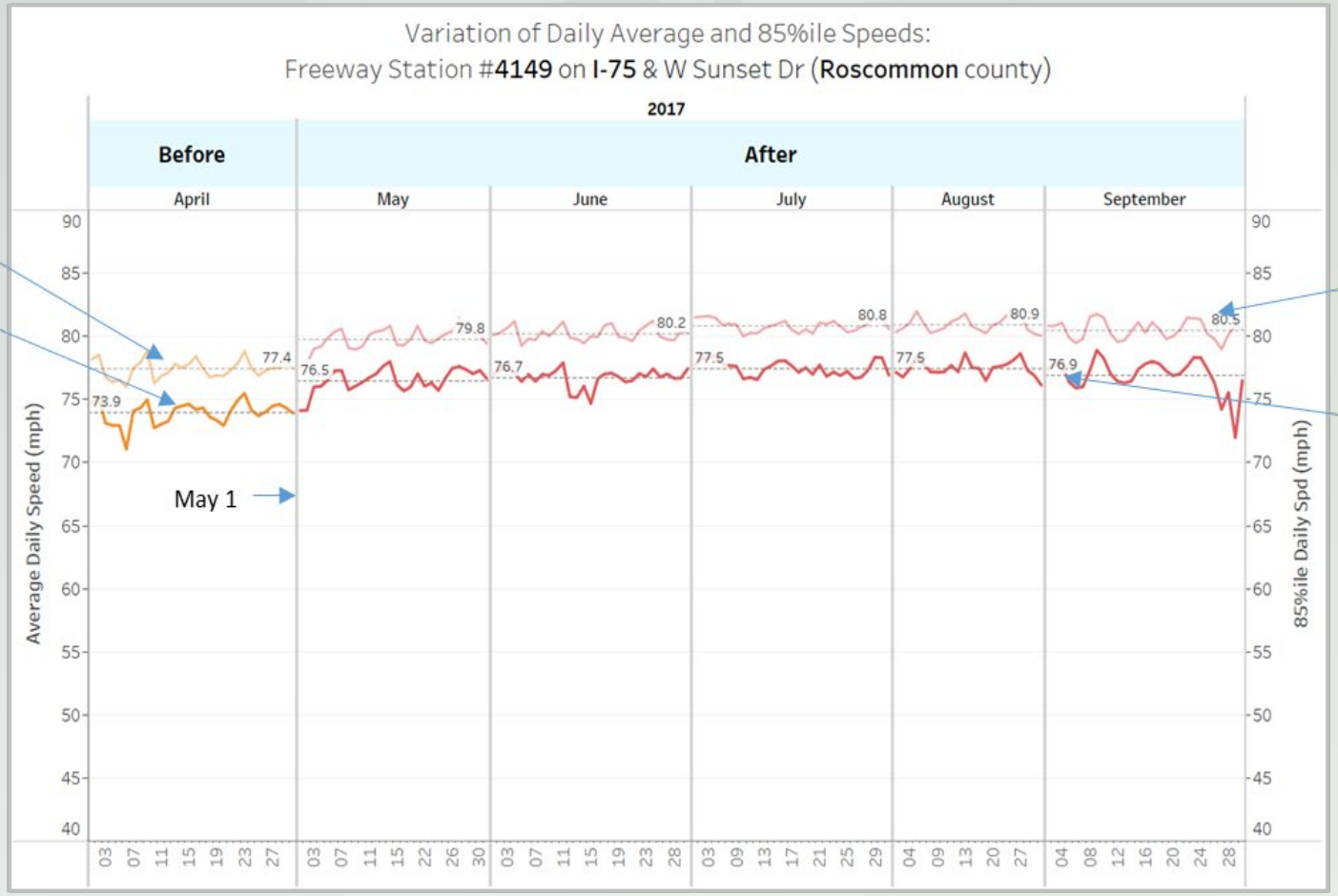
Study Sites (n=12)



Control Sites (n=35)



Speed Trends over Time - Freeway **Increase** Site



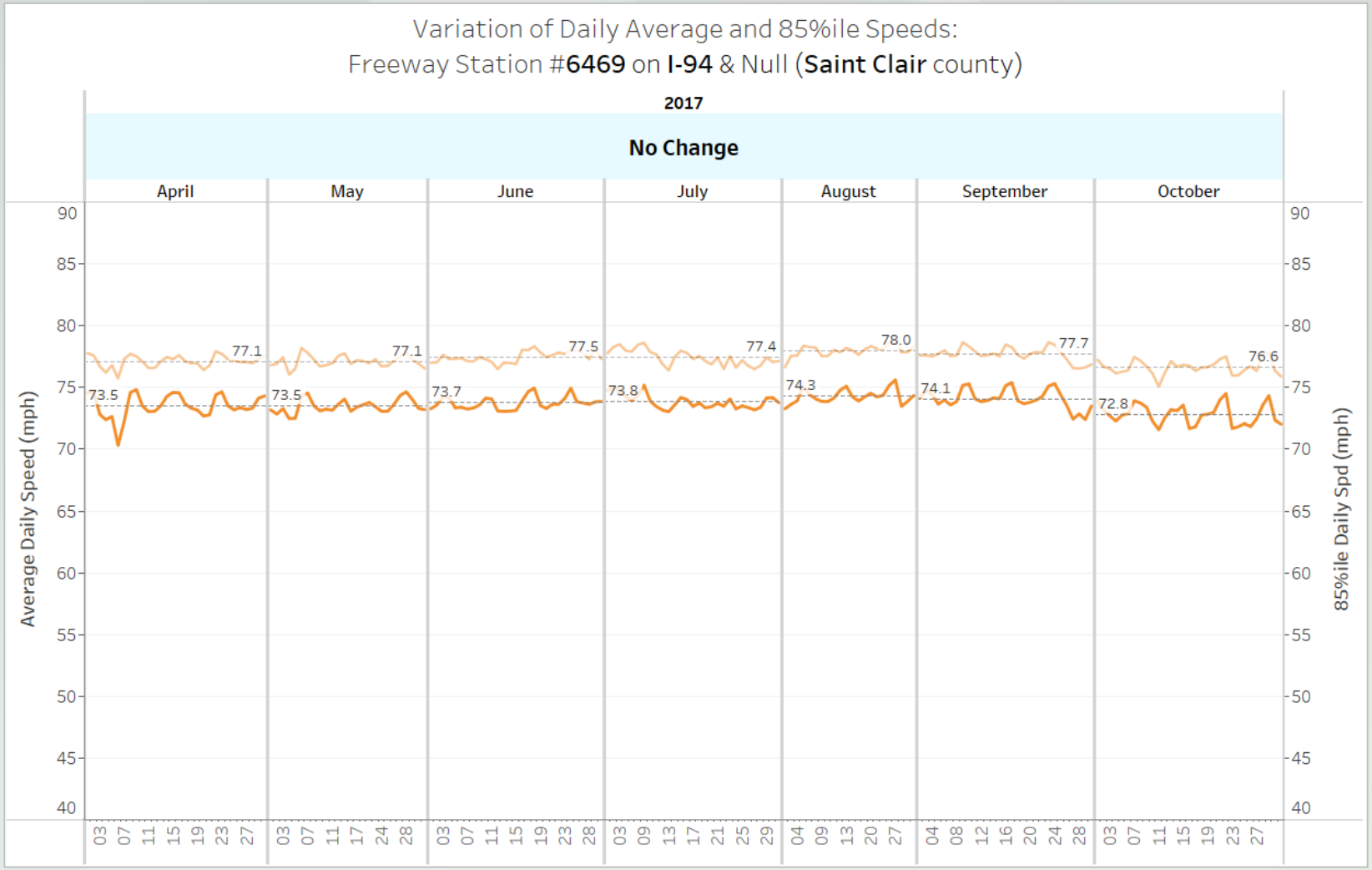
Daily 85th percentile

Daily Mean

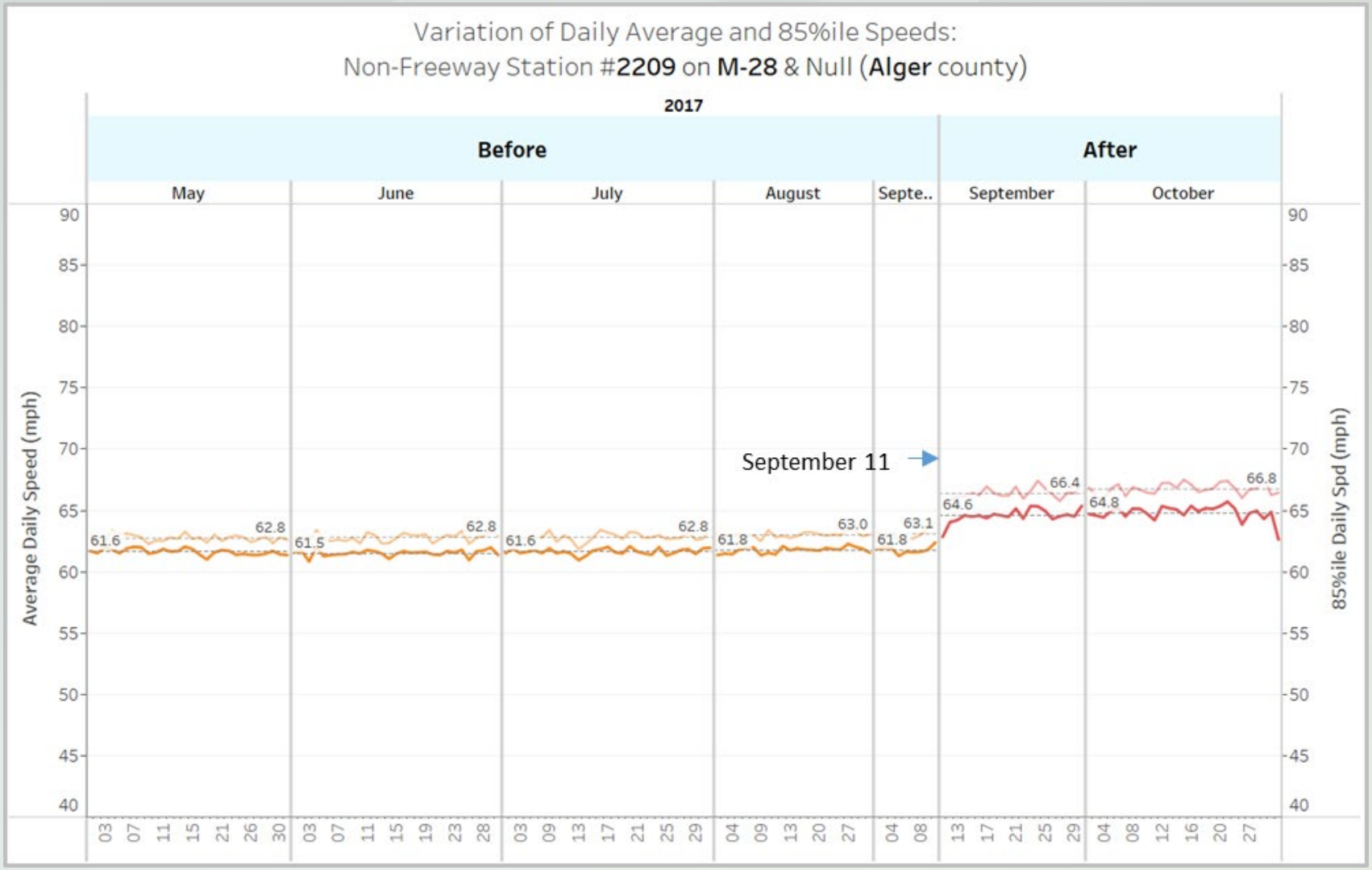
Monthly Mean of Daily 85th percentile

Monthly Mean of Daily Mean

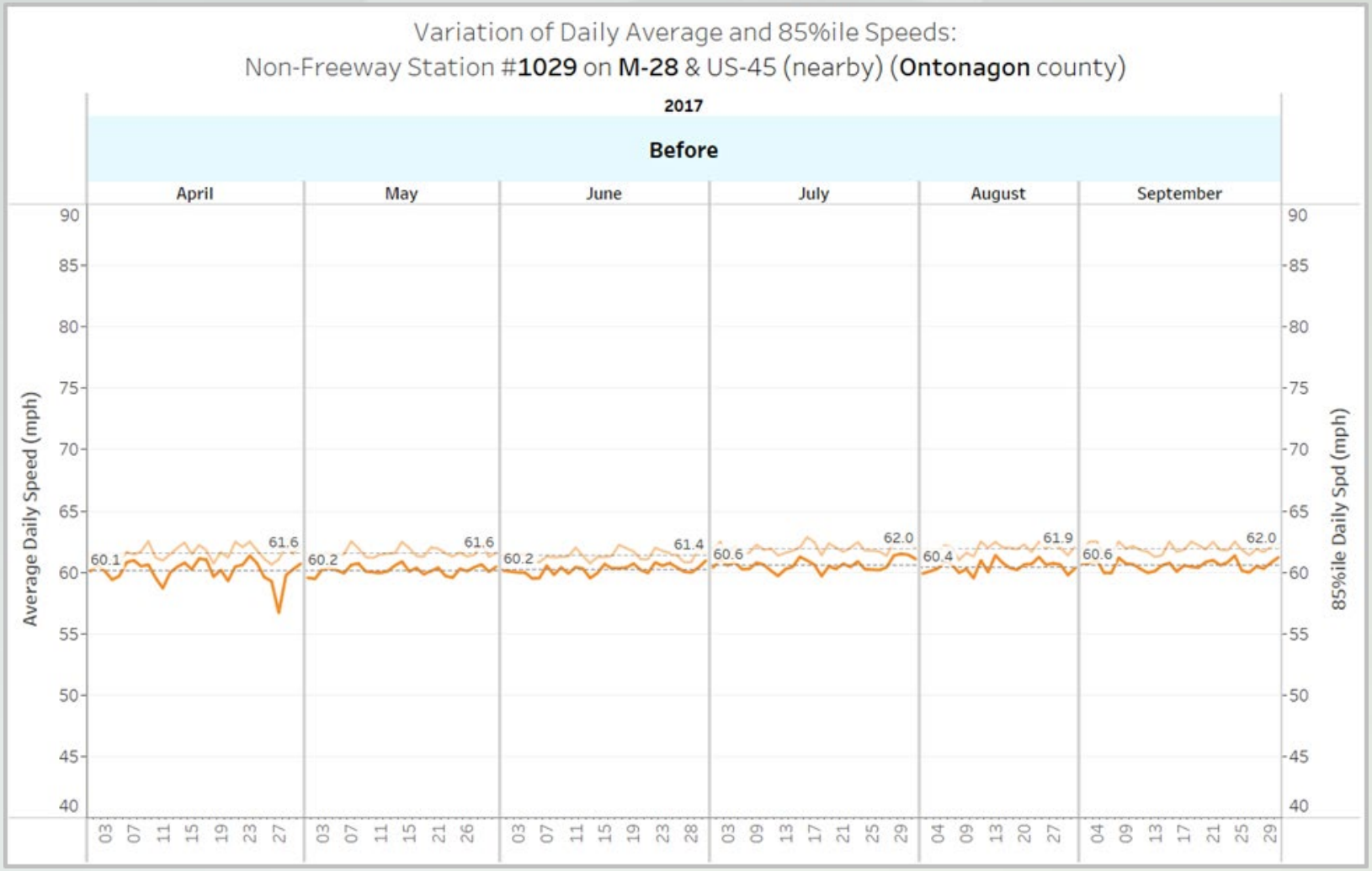
Speed Trends over Time - Freeway **Control** Site



Speed Trends over Time - Non-Freeway **Increase** Site



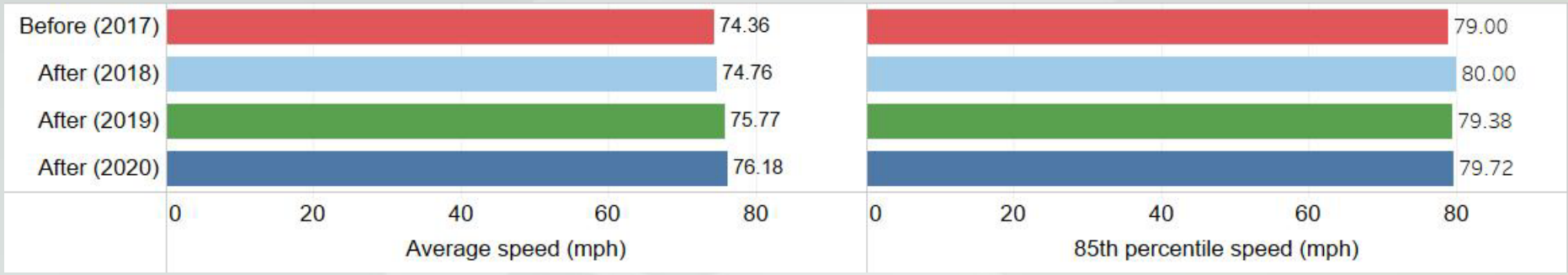
Speed Trends over Time - Non-Freeway **Control** Site



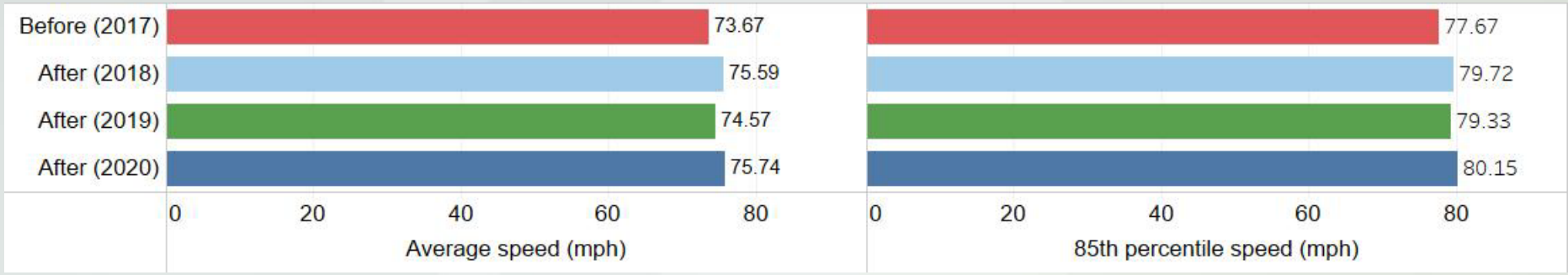
Other Speed Trends

Spill Over Effects on Freeway Control Sites (Outbound)

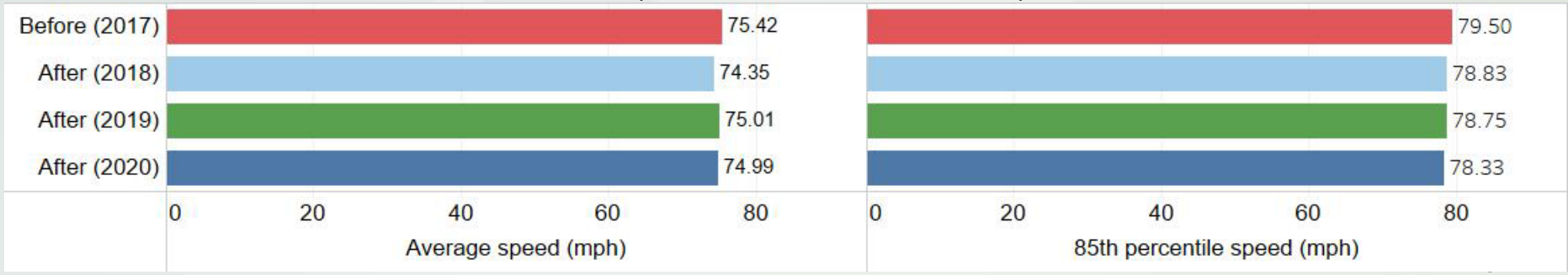
Within 10 mi of speed limit increase segment (Sites, n=3)



Beyond10 mi of speed limit increase segment (Sites, n=3)

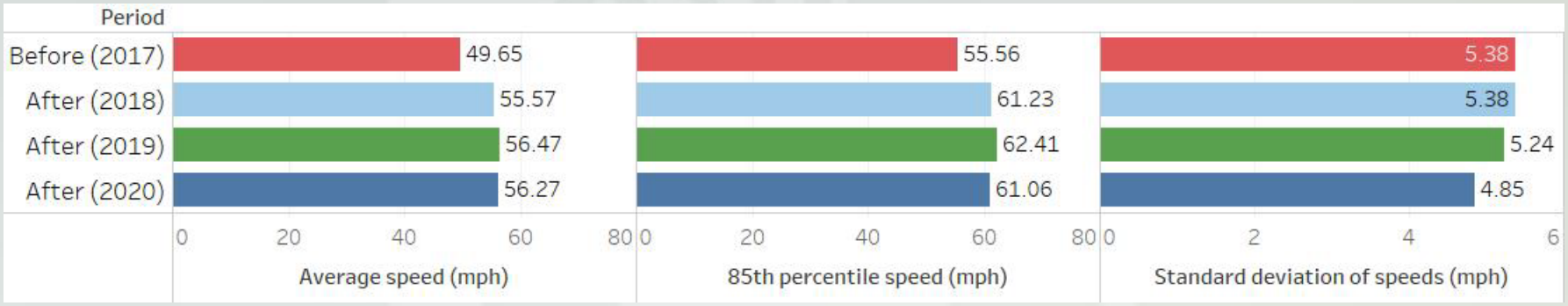


Distinct (Sites, n=4, on I-94 & I-96)

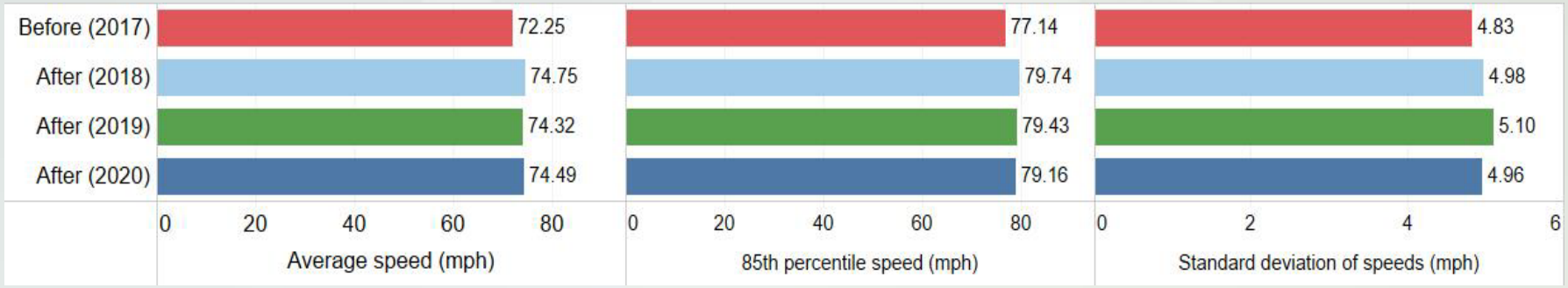


Speeds at Curve Entry

Non-Freeway - Passenger Vehicle (Sites, n=4)

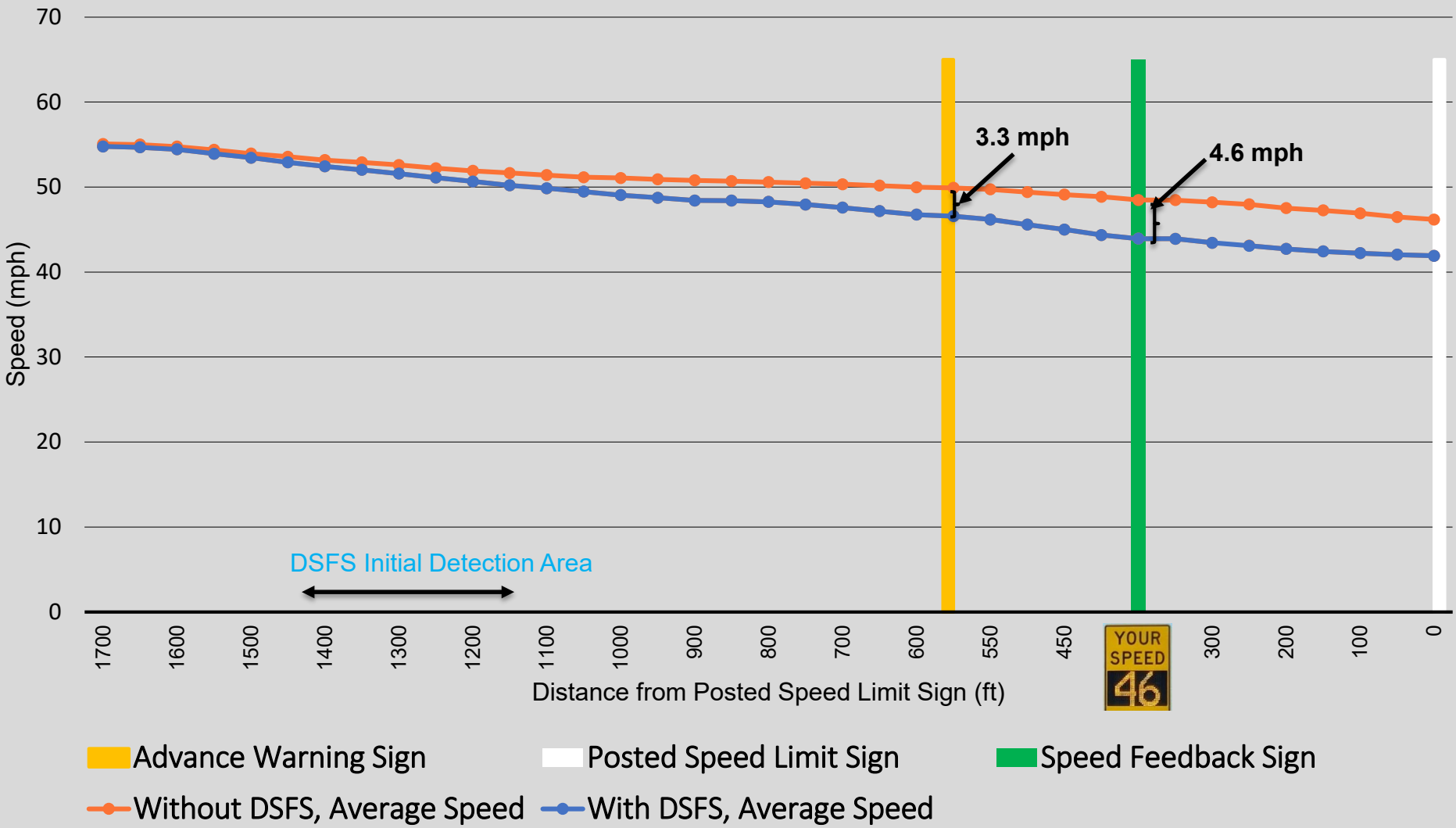


Freeway - Passenger Vehicles (Sites, n=7)



Speed Management Strategies

Speeds Approaching Speed Reduction Zone with and without Feedback Sign



Speeds Approaching Exit Ramp with and without Feedback Sign

Speed of Ramp Vehicles, mph

75
70
65
60
55
50
45
40
35
30

EXIT
30
MPH

Typical Activation Range

YOUR SPEED
46

1100 1050 1000 950 900 850 800 750 700 650 600 550 500 450 400 350 300 250 200 150 100 50 0 -50

Distance from PC, ft

- Without DSFS -No speed trailer at site (N=193)
- Without DSFS -Speed trailer at site (N=137)
- Side Mounted 15-in TrafficCalm sign (N=192)
- Side Mounted 18-in TrafficCalm sign (N=170)
- Side Mounted 18-in ATS Sign (N=172)
- Side Mounted 18-in ATS Sign (only slow down message above 65mph) (N=151)

We Need Your Assistance!!!

- NCHRP 15-75 – Developing New Expert Speed Limit Setting System
- **We are recruiting professionals to help review speed limit case studies**
  - Rural and urban
  - All speed ranges
  - All functional classes
  - ~4-8 cases to review per person
- Please contact me at **gatestim@msu.edu**

Questions?

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