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Speed Management and Speed Reduction in Portland, OR

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Speed Management and Speed Reduction in Portland, OR

Friday Transportation Seminar
Friday, October 7, 2022

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Outline

- Vision Zero and speed management in Portland, OR
- Speed limit reduction on residential streets
- Speed limit reduction on:
  - Arterials
  - Collectors

Vision Zero and Speed Management

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Vision Zero and Speed Management

VISION ZERO

SAFE SYSTEM

APPROACH

Zero is our goal. A Safe System is how we get there.

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Safe System Elements

- **Safe Streets**

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Safe System Elements

- Safe Streets
- **Safe Speeds**

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Safe System Elements

- Safe Streets
- Safe Speeds
- **Safe Vehicles**

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Safe System Elements

- Safe Streets
- Safe Speeds
- Safe Vehicles
- **Safe People**

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Vision Zero and Speed Management

Safe Speeds: PBOT's Speed Management Approach

- Set safe speed limits
- Redesign dangerous streets to encourage safe speeds
- Enforce the speed limit through automated enforcement
- Educate Portlanders about the impact of speed

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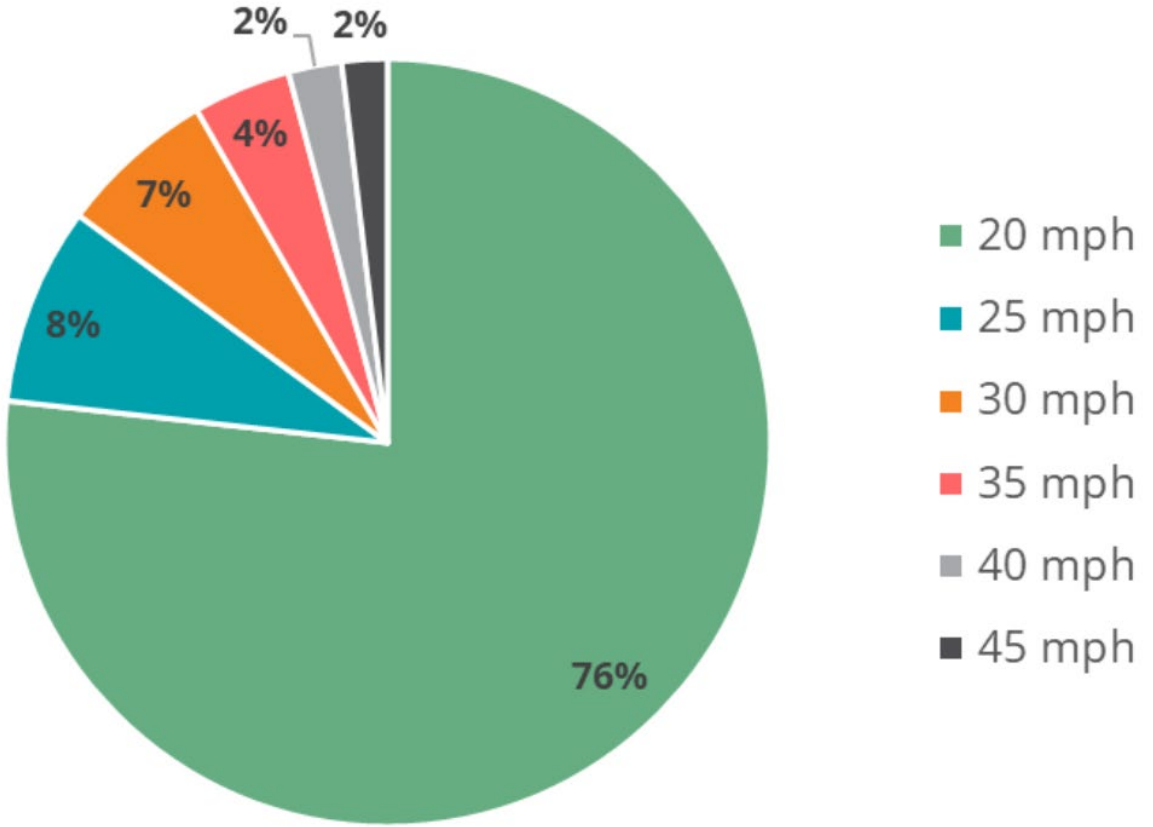
Set Safe Speed Limits



Most of the approximately 2,100 miles of streets in Portland have a 20 mph speed limit. (Graph excludes freeways and the less than 1% of streets that are 15 or 50 mph.)

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Vision Zero and Speed Management

Set Safe Speed Limits: New ODOT Speed Limit Setting Methodology

Federal Functional Street Classification[2]	Land Use Context			
	Urban Core / Central Business District	Urban Mix	Suburban Commercial & Residential	Suburban Fringe
Arterial	20-25	25-30	30-35	35-45
Collector	20-25	25-30	25-35	30-40
Local	20-25	20-25	25-35	25-35

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Speed Limit Reduction on Residential Streets

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Speed Reduction on Residential Streets

- January 2018 – Portland City Council approved reducing the speed limit on all residential streets

25 mi/h → **20 mi/h**

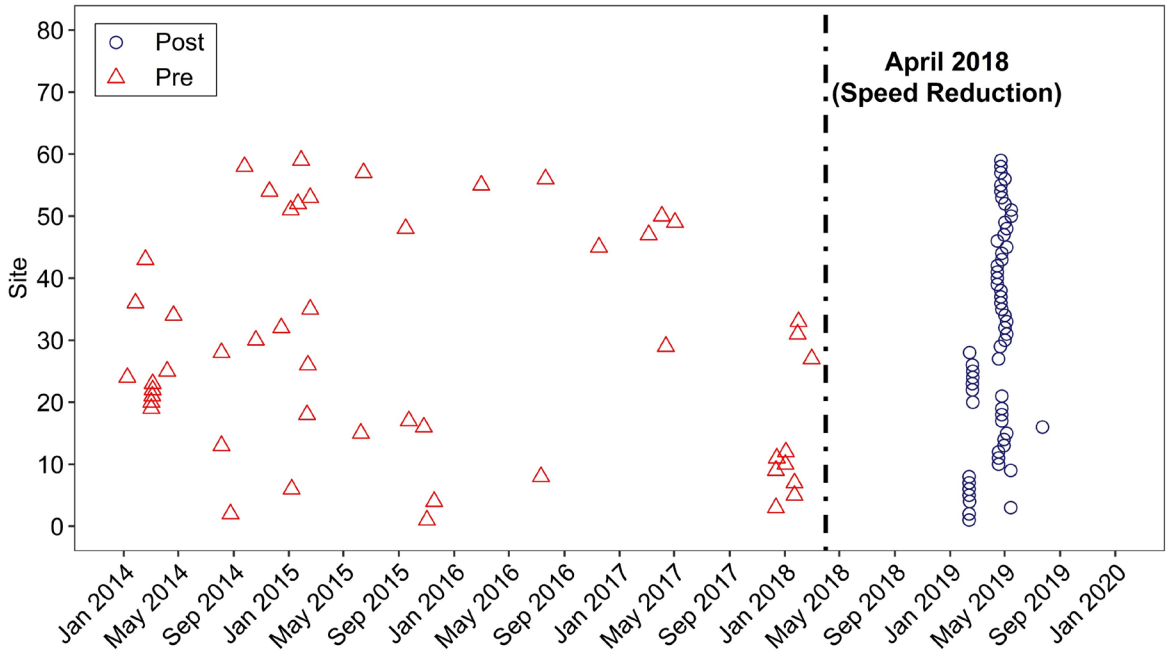
- Residential street = street in a residence district according to ORS 801.430
  - Federally classified arterials and collectors excluded
- 20 mi/h speed limit went into effect April 1, 2018

Speed Reduction on Residential Streets

- New speed limit signs and updated existing signs installed from Feb. 2018 to May 2019
  - Increased number of residential speed limit signs to more than 2,000
- Educational and awareness campaign “20 is Plenty”
  - ≈ 7,000 yard signs distributed

Speed Data

- Before and after data analyzed at 58 locations
- All speed data collected using pneumatic tube counters
- Before and after data collected during weekdays and a few weekends
  - Duration ranged between 24-97 hours



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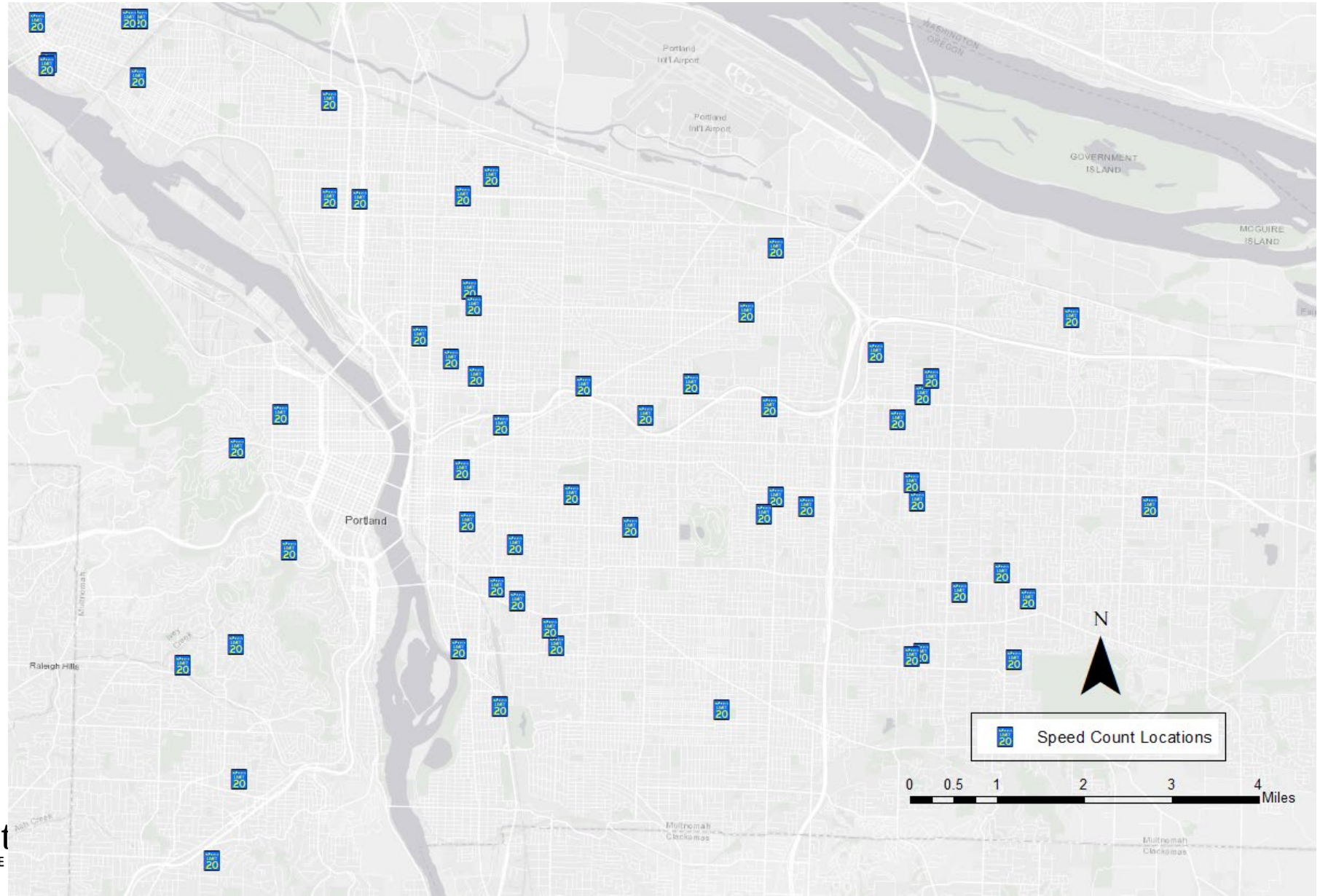
Speed Data



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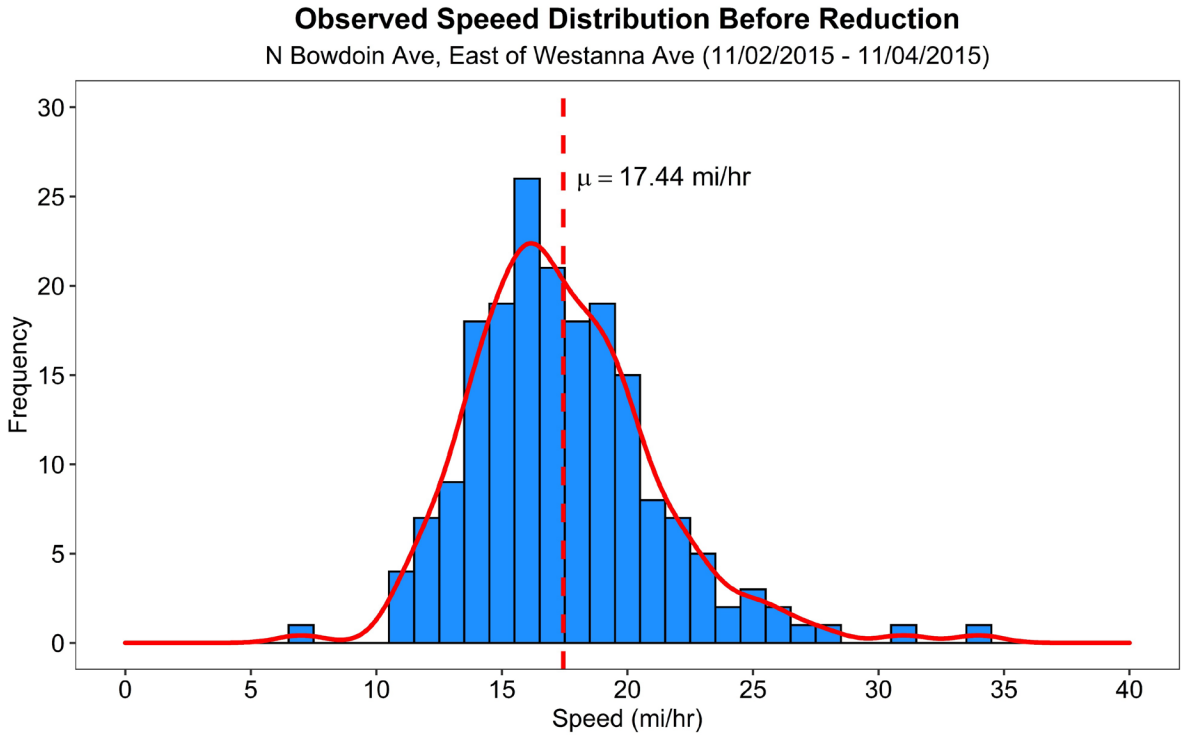
Speed Data

- Quality control
  - Speed = 0 mi/h and speed > 100 mi/h
  - Visual inspection of speed distributions

Summary of Analyzed Speed Data			
Period	All Observations	Observations Not Removed from Data	% Difference (Relative to All Observations)
Before	142,389	131,452	-7.99%
After	90,075	82,768	-8.46%
Total	**232,464**	**214,220**	**-8.17%**



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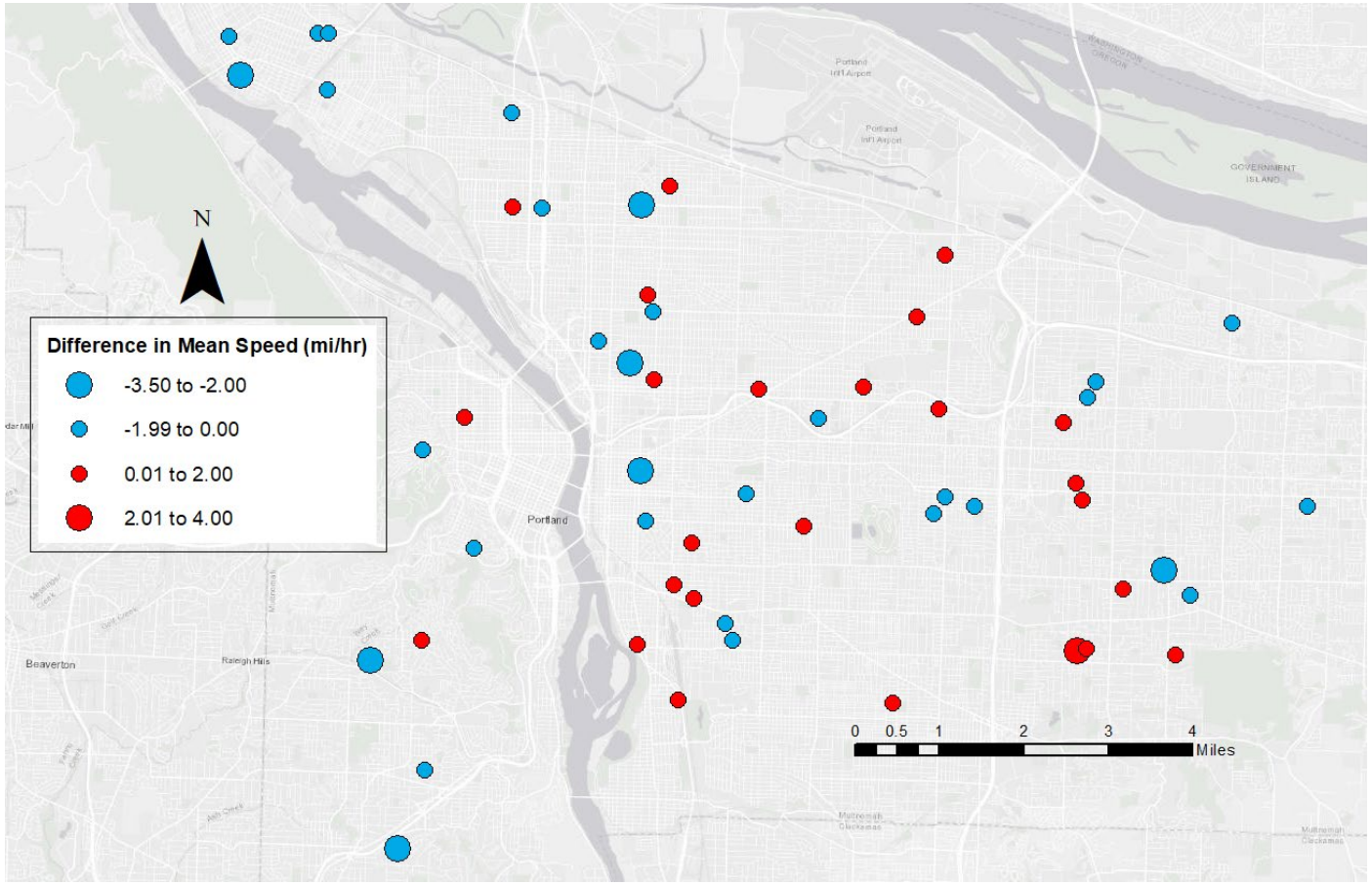
Methods

- **Descriptive Analysis**
  - Mean speed
  - Median speed
  - 85th percentile speed
  - Percent vehicles exceeding 25 mi/h
  - Percent vehicles exceeding 30 mi/h
  - Percent vehicles exceeding 35 mi/h



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Methods

- **Log-Linear Regression Model**
  - Determine effect of speed reduction on observed speeds
- **Binary Logit Model**
  - Likelihood/odds of observing speeds above a given threshold
  - 5 mi/h over posted speed
  - 10 mi/h over posted speed
  - 15 mi/h over posted speed

Descriptive Statistics Results

Summary Statistics of Observed Vehicle Speeds						
Period	Mean	Median	85th Percentile	Greater Than 25 mi/h	Greater Than 30 mi/h	Greater Than 35 mi/h
Before (n = 131,452)	21.66	22	27	24.13%	6.49%	1.11%
After (n = 82,768)	21.70	22	27	23.60%	4.83%	0.59%
Number of Sites with Decrease Observed	33	43	50	43	40	42
Percentage of Sites with Decrease Observed	56.9%	74.1%	86.2%	74.1%	69.0%	72.4%

Modeling Results

Log-Linear Regression Model Specifications for Observed Speed			
Variable	Coefficient	Std. Error	p-value
Constant	2.341	0.020	0.000
Before/After Period			
1 if After Speed Reduction, 0 if Before	-0.010	0.001	0.000
Time-of-Day			
1 if 6:00 a.m. to 10:00 a.m., 0 Otherwise	-0.007	0.001	0.000
1 if 4:00 p.m. to 8:00 p.m., 0 Otherwise	0.028	0.005	0.000
Day-of-Week			
1 if Wednesday, 0 Otherwise	0.056	0.002	0.000
1 if Thursday, 0 Otherwise	0.025	0.002	0.000
1 if Friday, 0 Otherwise	0.016	0.002	0.000
1 if Weekend, 0 Otherwise	-0.081	0.003	0.000
Roadway Characteristics			
Natural Logarithm of Surface Width	0.088	0.005	0.000
Natural Logarithm of Pavement Condition Index	0.107	0.002	0.000
Curb Height	-0.011	0.000	0.000

Indicates a decrease in observed speed of approximately 1.0%, on average

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Modeling Results

Estimated Change in Odds of Observing Speed Thresholds	
Speed Threshold	Estimated Change in Odds
Greater Than 25 mi/h	-15.9%
Greater Than 30 mi/h	-33.6%
Greater Than 35 mi/h	-49.6%

- **15.9% reduction in odds of observing speeds > 25 mi/h**
- **33.6% reduction in odds of observing speeds > 30 mi/h**
- **49.6% reduction in odds of observing speeds > 35 mi/h**

Residential Streets Summary

- Models confirmed descriptive analysis while controlling for site-specific variations
- Analysis suggests that the speed limit reduction has resulted in lower observed speeds and fewer vehicles traveling at higher speeds
- Largest change observed in reduction > 30 mi/h and > 35 mi/h
- Models suggest the role roadway characteristics have on vehicle operating speeds

Speed Limit Reduction on Arterials and Collectors

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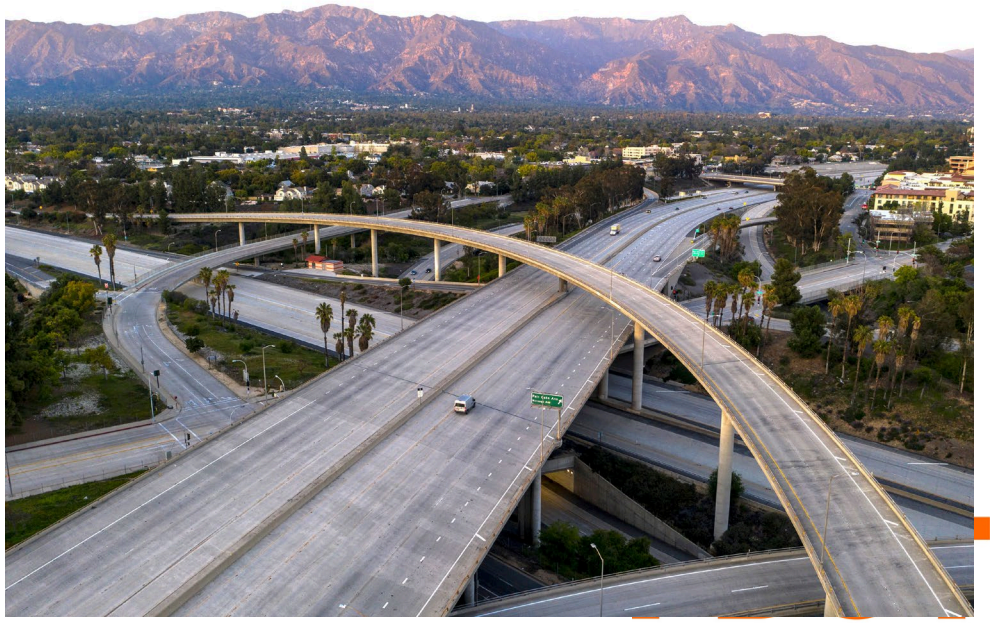
Speed Data

- Speed data collected using pneumatic tubes
- Duration of data collection at all sites consisted of at least 24 hours
- One arterial location and 23 collector locations had after data collected in 2020
  - This was the height of the COVID-19 pandemic

Traffic Data and COVID-19

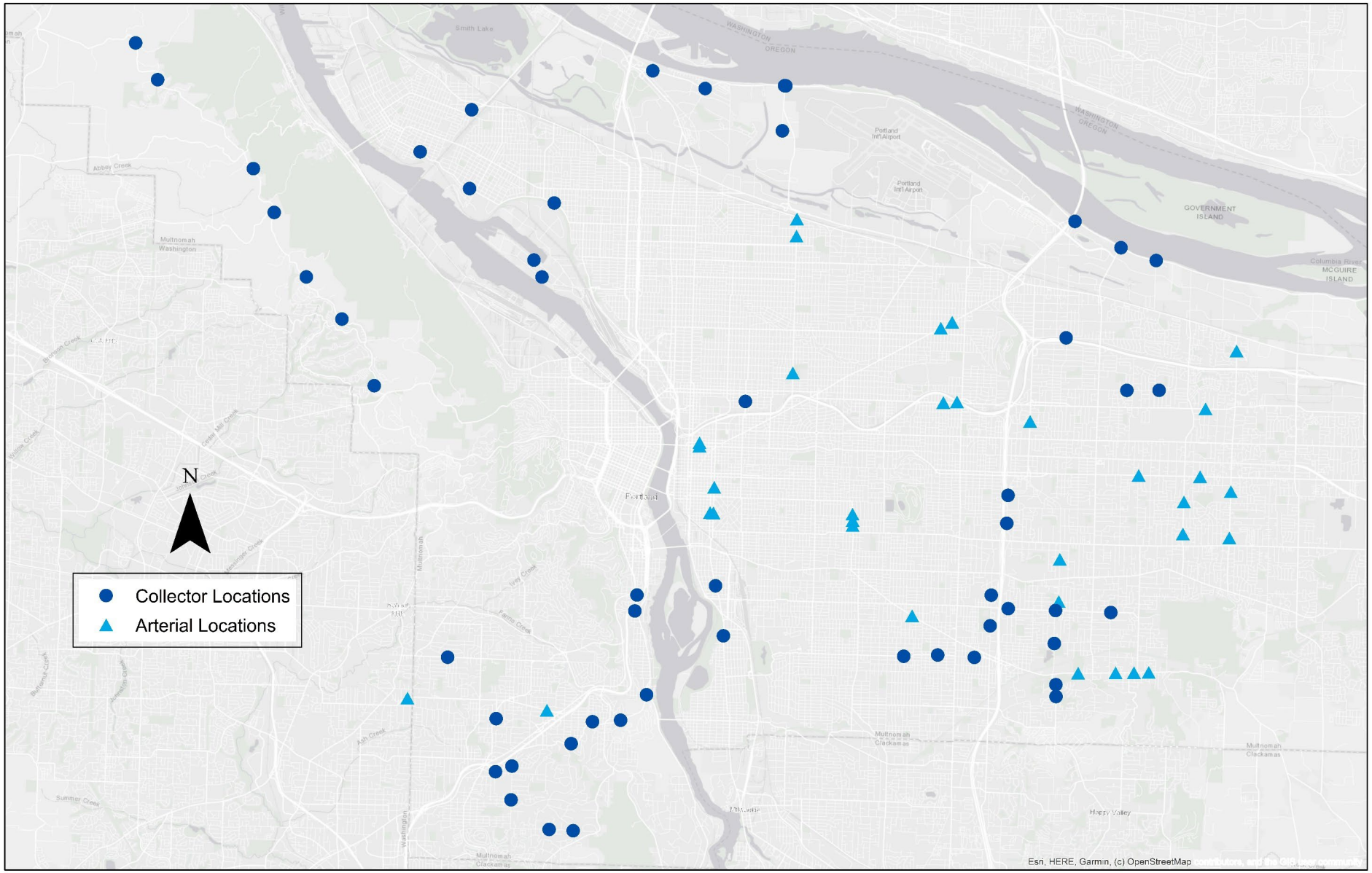
- Stay-at-home orders led to significant changes in travel trends and driving patterns nationwide (*1-3*)
  - Reduction in traffic volume and congestion (*4,5*)
  - This remained until ≈ Feb. 2021, in which VMT began approaching pre-COVID levels (*6*)



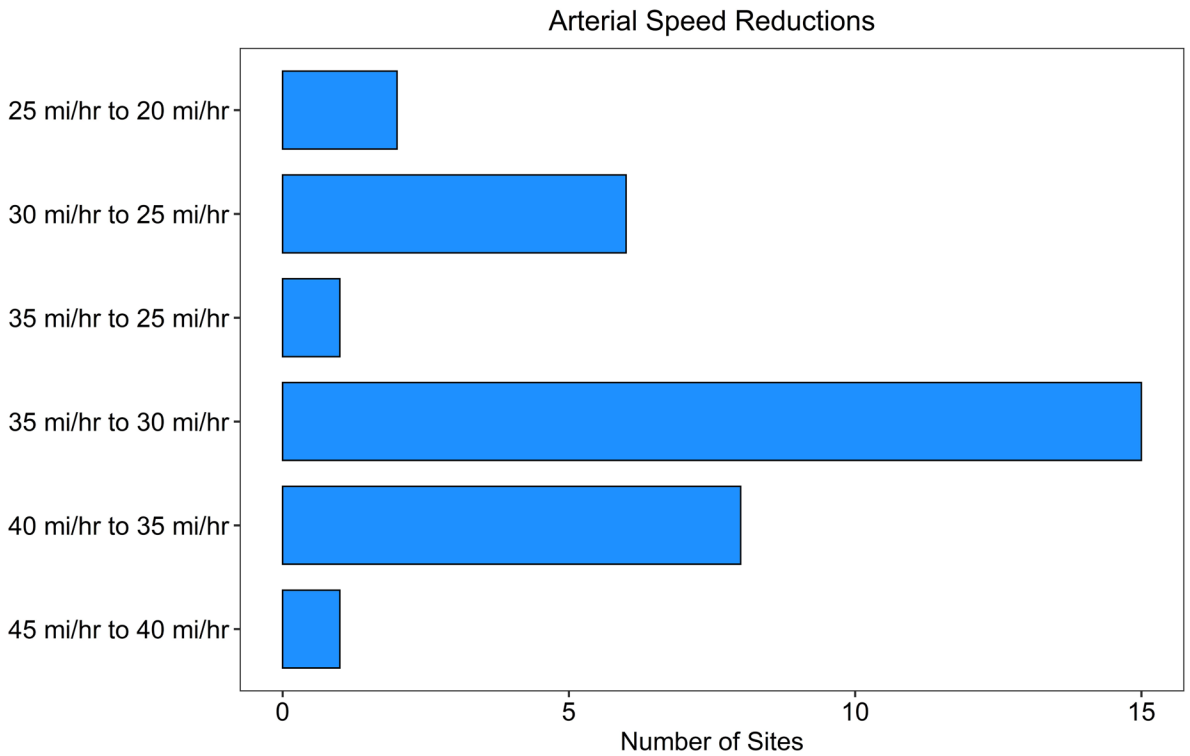
Traffic Data and COVID-19

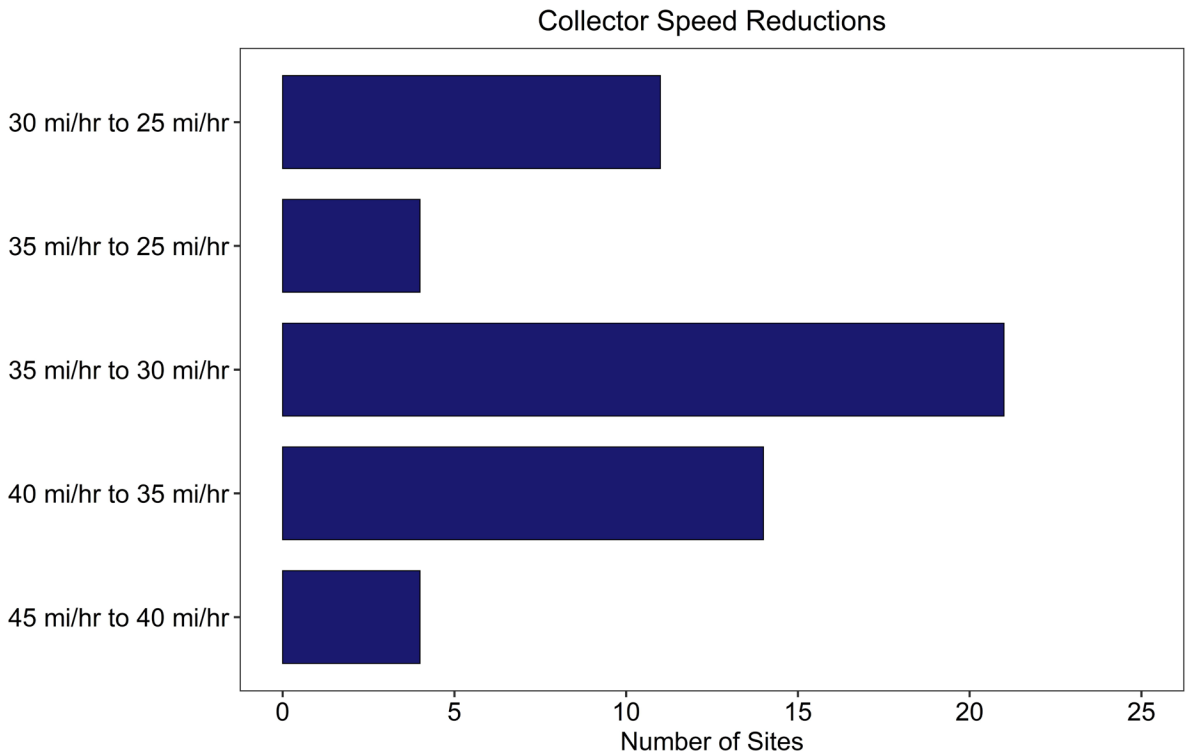
- Fewer vehicles on roadway → riskier behavior
  - Speeding among the most common (*3*)
  - Average speeds increased during last three quarters of 2020 (*3*)
  - Speeds greater than 20 mi/h over speed limit more prevalent (*3*)
- Despite decreases in VMT, speeding-involved crashes increased (*3*)
- Similar trends experienced in Oregon during this period (*7,8*)
- 2020 after data analyzed separately

Speed Reduction Locations



Speed Reduction Groups by Classification





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Speed Reduction Groups by Treatment

- **Collectors**
  - Three 35 mi/h to 30 mi/h locations had speed bumps installed
  - Three 40 mi/h to 35 mi/h locations had fixed speed safety cameras activated
  - Four 45 mi/h to 40 mi/h locations had fixed speed safety cameras activated (all locations in this group)
  - Consistent changes across all metrics observed

Results of Descriptive Analysis

Summary of Reductions on Arterials and Collectors						
Arterials						
Data Collection Period	Number of Sites	Sites with Decrease in Mean Speed	Sites with Decrease in 85th Percentile Speed	Sites With Decrease in > 5 mi/hr Over the Speed Limit	Sites With Decrease in > 10 mi/hr Over the Speed Limit	Sites With Decrease in > 15 mi/hr Over the Speed Limit
2020 After Data	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
2021 After Data	32	22 (69%)	17 (53%)	25 (78%)	20 (63%)	13 (41%)
Collectors						
Data Collection Period	Number of Sites	Sites with Decrease in Mean Speed	Sites with Decrease in 85th Percentile Speed	Sites With Decrease in > 5 mi/hr Over the Speed Limit	Sites With Decrease in > 10 mi/hr Over the Speed Limit	Sites With Decrease in > 15 mi/hr Over the Speed Limit
2020 After Data	14	7 (50%)	8 (57%)	11 (79%)	11 (79%)	9 (64%)
2021 After Data	30	18 (60%)	16 (53%)	21 (70%)	20 (67%)	16 (53%)
2020 After Data and Traffic Calming Device	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
2021 After Data and Traffic Calming Device	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
2020 After Data and Fixed Speed Safety Cameras	7	7 (100%)	6 (86%)	7 (100%)	7 (100%)	6 (86%)

Results of Regression Model

Pooled Log-Linear Regression Model Specifications for Arterials			
Variable	Coefficient	Std. Error	p-value
Constant	2.900	0.001	<0.0001
Before/After Period			
1 if after reduction, 0 if before	-0.020	0.000	<0.0001
Time-of-Day			
1 if 6:00 a.m. to 10:00 a.m., 0 otherwise	-0.041	0.000	<0.0001
1 if 10:00 a.m. to 4:00 p.m., 0 otherwise	0.005	0.000	<0.0001
1 if 4:00 p.m. to 10:00 p.m., 0 otherwise	0.068	0.001	<0.0001
Day-of-Week			
1 if weekend, 0 otherwise	-0.025	0.001	<0.0001
Vehicle Type			
1 if bus, 0 otherwise	-0.126	0.002	<0.0001
Change Group			
1 if 30 mi/hr to 25 mi/hr, 0 otherwise	0.395	0.001	<0.0001
1 if 35 mi/hr to 25 mi/hr, 0 otherwise	0.533	0.001	<0.0001
1 if 35 mi/hr to 30 mi/hr, 0 otherwise	0.565	0.001	<0.0001
1 if 40 mi/hr to 35 mi/hr, 0 otherwise	0.681	0.001	<0.0001
1 if 45 mi/hr to 40 mi/hr, 0 otherwise	0.804	0.001	<0.0001
Data Collection Period			
1 if 2020, 0 otherwise	0.092	0.002	<0.0001

Results of Regression Model

Pooled Log-Linear Regression Model Specifications for Collectors			
Variable	Coefficient	Std. Error	p-value
Constant	3.254	0.000	<0.0001
Before/After Period			
1 if after reduction, 0 if before	-0.027	0.000	<0.0001
Time-of-Day			
1 if 6:00 a.m. to 10:00 a.m., 0 otherwise	-0.028	0.000	<0.0001
1 if 10:00 a.m. to 4:00 p.m., 0 otherwise	0.003	0.000	<0.0001
1 if 4:00 p.m. to 10:00 p.m., 0 otherwise	0.048	0.001	<0.0001
Day-of-Week			
1 if weekend, 0 otherwise	-0.053	0.001	<0.0001
Vehicle Type			
1 if bus, 0 otherwise	-0.027	0.002	<0.0001
Change Group			
1 if 35 mi/hr to 25 mi/hr, 0 otherwise	0.119	0.001	<0.0001
1 if 35 mi/hr to 30 mi/hr, 0 otherwise	0.197	0.000	<0.0001
1 if 40 mi/hr to 35 mi/hr, 0 otherwise	0.353	0.001	<0.0001
1 if 45 mi/hr to 40 mi/hr, 0 otherwise	0.491	0.001	<0.0001
After Data Collection Period			
1 if 2020, 0 otherwise	0.007	0.001	<0.0001
Speed Countermeasures			
1 if speed bumps installed, 0 otherwise	-0.040	0.001	<0.0001
1 if fixed speed safety cameras present, 0 otherwise	0.009	0.001	<0.0001

Arterials/Collector Summary

- Models (pooled and disaggregate) confirmed descriptive analysis while controlling for site-specific variations
- Expected decrease of ≈ 2.0% across all **arterials**, on average
- Expected decrease of ≈ 2.7% across all **collectors**, on average
- Some variables may have heterogeneous effects and require an alternate estimation approach

Summary and Conclusions

Summary and Conclusions

- The effectiveness of lowering speed limits
  - Data suggests that, on average, observed vehicle speeds are lower
  - Most effective was lowering speed limit and implementing a treatment (speed bumps, speed cameras)
  - Roadway characteristics play an important role
- Future Work
  - Apply more advanced models to consider data limitations and unobservables
  - Collect another round of after data for arterials/collectors and compare to the 2020 and 2021 results
    - Are trends trending back to pre-pandemic norms, or is this the new norm?

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Questions

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Journal Article (Residential Streets)

Anderson, J.C., Kothuri, S., Monsere, C., 2022. Effect of Residential Speed Limit Reduction on Driving Speeds in Portland, Oregon. Transport Findings. https://doi.org/10.32866/001c.31956

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