Washington State Driving Behavior Analysis

CAMBRIDGE MOBILE TELEMATICS

WA TRAFFIC SAFETY COMMISSION

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Executive Summary

In 2024, the Washington Traffic Safety Commission contracted with Cambridge Mobile Telematics in a data collaboration to pilot the use of telematics data to document driver behavior and supplement current roadside observation surveys.

Telematics data uses smartphone sensors to collect anonymized and aggregated driver behavior including speeding, handheld phone use, and hard-braking. The data can be combined with traditional traffic safety data sources, such as crash reports and driver citations, to better understand driver behavior and high-risk crash areas on public roads.

The analysis had four goals:

1. Document the coverage of CMT's data across Washington's counties in terms of unique drivers and trips taken, in particular for the months of June 2022 and June 2023 for comparison with roadside observation surveys
2. Compare risky behavior (phone motion distraction, phone call distraction, speeding and hard-braking) between counties and the two timeframes
3. Understand patterns of compound risky behavior such as speeding and distraction
4. Investigate rates of risky behavior for three cities (Seattle, Spokane, and Vancouver, WA) and make comparisons between them and their encompassing counties

In addition, an example hotspot analysis was conducted for a disadvantaged neighborhood of Seattle to show how these types of analyses can provide data to influence the funding of traffic safety interventions.

Coverage per county was demonstrated to be statistically appropriate, with 6.1 million trips and 84 thousand unique drivers for June 2023. This equated to almost 1.5 million hours of driving (~171 years of data) and the equivalent of half a billion roadside observations. Volumes have increased further since 2023.

County rates of phone distraction (phone motion and calls), speeding and hard-braking varied considerably by county, as would be expected by the variety of road types, traffic volume, and commuting volume. The change in phone distraction in the year studied was different between counties, with some improving and others getting considerably worse. Over the course of the year, both phone call usage and instances of hard-braking generally increased.

Distraction occurs more commonly at speeds and on functional class roads where it's highly likely that vulnerable road users are present. Phone calls were common on both these roads and highways. Speeding rates were common on all classes of roads except for residential-type roads.

The results show that about 1 in 4 (25%) of full trips had any distraction as measured by phone motion. This is much higher than the 9% rate measured by the Washington roadside observation survey of distracted driving that also measures other forms of distraction.

The city analyses showed that phone motion, phone call, and speeding rates were lower than the encompassing county, while hard braking was higher. There were considerable differences between the cities, likely reflecting the size of the city, road types, and traffic volumes.

The report shows that CMT telematics data is substantial in Washington, and that it could supplement roadside observation surveys. The county-to-county and city-to-city comparisons offer the opportunity to target law enforcement and public-safety campaign spending.

About CMT and this Report

Cambridge Mobile Telematics (CMT) is the world's leading telematics service provider for drivers who opt-in to the program through their auto insurer. Its mission is to make the world's roads and drivers safer. Since its founding in 2010 (formerly the CarTel project at MIT), CMT's technology has gathered anonymized data on hundreds-of-billions of miles driven in the United State and globally. Its telematics platform DriveWell® provides an accurate view of driver, vehicle, and policy-level risk by fusing phone, IoT device, and connected car data into a single system. Every day, CMT's technology measures and protects 12 million drivers. The information gathered provides novel insights about drivers' reaction to new legislation and road interventions.

Washington State is using telematics data to provide insights on trends, county-to-county differences, and to identify areas of particular concern. This would supplement and perhaps replace roadside observation surveys that are in use today[1,2].

The Insurance Institute for Highway Safety (IIHS) published research in 2024 that "compared the telematics measures with the National Highway Traffic Safety Administration's roadside observations of driver electronic device use. Logistic regression tested relationships between regional, legislative, and temporal factors and the odds of cellphone behaviors occurring on a trip or at a given point in time". They found that the "...correspondence between trends in cellphone distractions across regional, legislative, and temporal factors suggest telematics data have considerable utility and appear to complement existing data sets"[3].

In the IIHS study, data manually collected from roadside locations over various time periods were compared to the distraction rates of drivers participating in CMT's telematics programs. These drivers were operating in the same areas and during the same periods as the roadside studies.

The chart below shows the strong and significant correlation between the National Occupant Protection Use Survey (NOPUS) roadside measured distraction value (percentage of trips with distraction) and an equivalent measure using CMT's data.

[1] Seat Belt Use in Washington State, 2023, Washington Traffic Safety Commission. February 2024
[2] Distracted Driving Observation Survey Results, Washington Traffic Safety Commission. Brief No. 10 April 2024
[3] The utility of telematics data for estimating the prevalence of driver handheld cellphone use, 2019–2022 Reagan, Ian J. / Cicchino, Jessica B. / Teoh, Eric R. Journal of Safety Research. Volume 89, June 2024

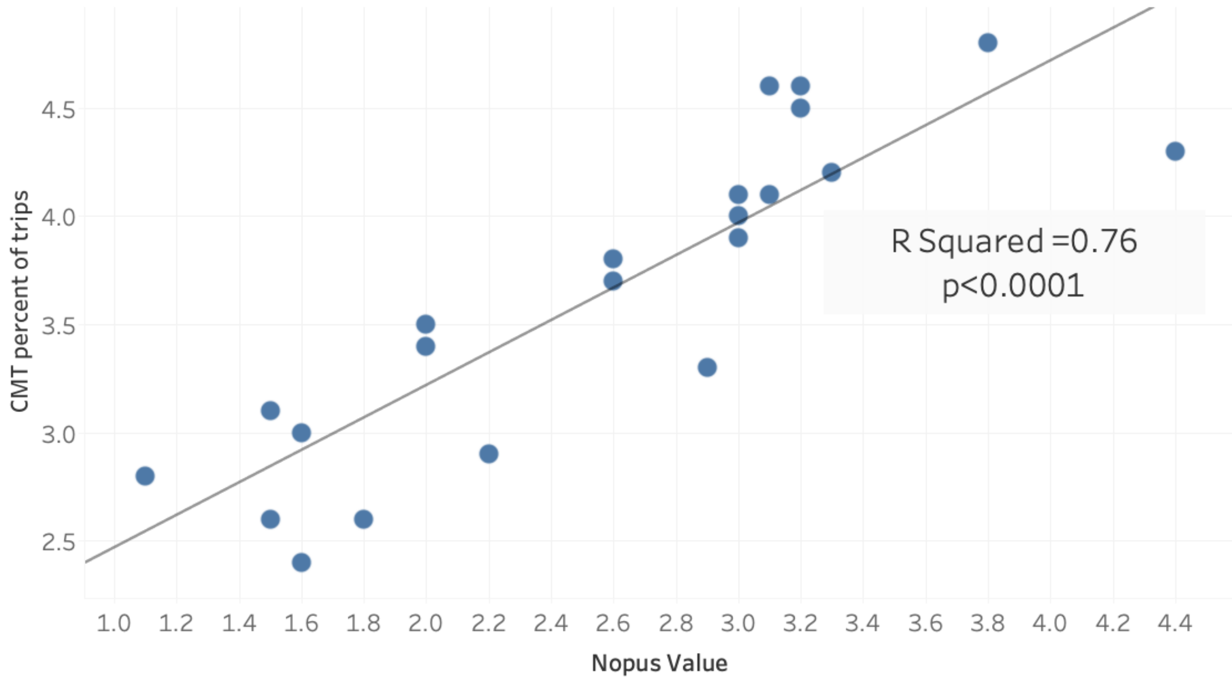


Figure 1. The significant and high correlation between NOPUS measures of distraction and telematics data from drivers in the same area and time of the roadside study. Each mark is a location at a point in time.

Given the results from the IIHS research, it behooves states to compare their roadside observation survey data to CMT data to ensure a correlation exists and investigate discrepancies if not. As such, Washington State requested CMT's rates of risky driving behaviors per county for the months of June 2022 and June 2023.

Telematics Risk Factors

CMT extracts risk factors from raw telematics data. These risk factors are known to be predictive of crashes, as evidenced by almost every state's acceptance of telematics factors in pricing insurance[4].

The telematics data used in this report is aggregated with respect to location, which anonymizes the data by removing personal identifiers and discarding route information at an individual trip level. By creating aggregates from many trips recorded by many distinct drivers, it is not possible to reverse the process and determine the actions of an individual.

The analysis in this report is derived from telematics data for June 2022 and June 2023, recorded by tens of thousands of unique drivers.

[4] California is the only state as of September 2024 that does not allow telematics to be used to price insurance.

Hard-braking based events

An hard-braking deceleration event is flagged when longitudinal acceleration with respect to the car frame of reference exceeds a certain threshold, over a sufficiently long period. Through actuarial studies, CMT has selected a threshold of > 3.2 m/s^2 to maximize the correlation between a pattern of hard-braking and the likelihood of a crash.

Events at or above this threshold are considered abrupt and not a typical part of safe driving aside from isolated incidents. The minimum duration of an event to be counted must be 0.6s.

While these events take place over a minimum time of 0.6 and could be a number of seconds long, they are considered to be singular events caused by a decision made at one point on the road. The count of these events are normalized by distance traveled on the trip to give a “count of hard-brakes per 100km”.

Speeding

A speeding risk event is normally defined as a driver exceeding the posted speed limit by 9.3mph (15kph) for 5 seconds or more. The threshold is increased to 12.4mph (20kph) over the limit when the posted speed limit is between 55 mph and 65 mph.

Posted Speed Limit (mph)	Speeding Risk Event Threshold (mph)
60	72
65	77
70	79

Speeding events don’t occur at a single point in time, at a minimum they are 5 seconds long, but could of course last tens of minutes. Therefore, we count the length of total time spent speeding and divide it by the total trip time, and express it as minutes of speeding per hour of driving.

Speed limits are obtained through our use of various mapping solutions. Inevitably there are errors in these, either due to speed limit changes or bad data. Via feedback from drivers, CMT maintains corrections to the speed limit database. Not every segment of road has a speed limit recorded in our sources, but the vast majority of non-residential roads do.

Distraction

Phone use is a large and growing source of driver distraction. For the purposes of this study, CMT’s platform records two different phone-related events.

1. **Phone motion** is captured when the driver reaches for the phone and picks it up. Once the driver picks up the phone and the screen activates, the phone motion event begins. Phone motion is typically the movement of the driver bringing the phone to them and then putting it down.
2. **Phone calls** are the period when a phone call is in progress, whether the audio is routed via the phone, Bluetooth, or the car's infotainment solution.

These event types are not mutually exclusive. When a driver picks up a phone to dial a call, it is likely that there will be phone motion, screen interaction, and phone call events recorded at the same time, though not necessarily for the same duration. CMT records these events only when the vehicle is traveling 9.3mph (15 kph) or faster to better correlate phone usage with risk of a crash. Only events lasting 3s or more are counted to reduce false positives

Similar to speeding, distraction events don't occur at a single point in time, at a minimum they are 3 seconds long, but again could last tens of minutes. Therefore, we count the length of total time spent distracted and divide it by the total trip time, and express it as minutes of distraction per hour of driving. In this report we consider phone motion and phone calls as the primary measures of distraction.

Trips Without Events

Many trips are taken without a risky event occurring. The time and distance of these trips are included in the denominators for the aggregate statistics described in this document.

Methodology

Event Rates

For this analysis a methodology was used that measures the drive time, drive distance, and risky events as defined above for counties in Washington (regardless of whether the trip started or ended in Washington; this is especially important for counties that border other states and have a well-used road connection to them).

Driving distance and time were apportioned in a straight-line fashion to the county they occurred in rather than just allocating them to the start or end county of the trip. This method is not as precise as analyzing every road segment traversed but offers considerable time and cost benefits to the analysis. A comparison between this apportioning method and a full road segment analysis revealed a mean error of approximately 0.3%. Events were geolocated to the county they occurred in.

Coverage

When considering telematics data as an alternative or supplement to roadside observation surveys, it's important to understand the coverage that is available. The following map shows the number of unique trips recorded in each county for June 2023. Unsurprisingly the highest number of trips can be found in the more populated counties.

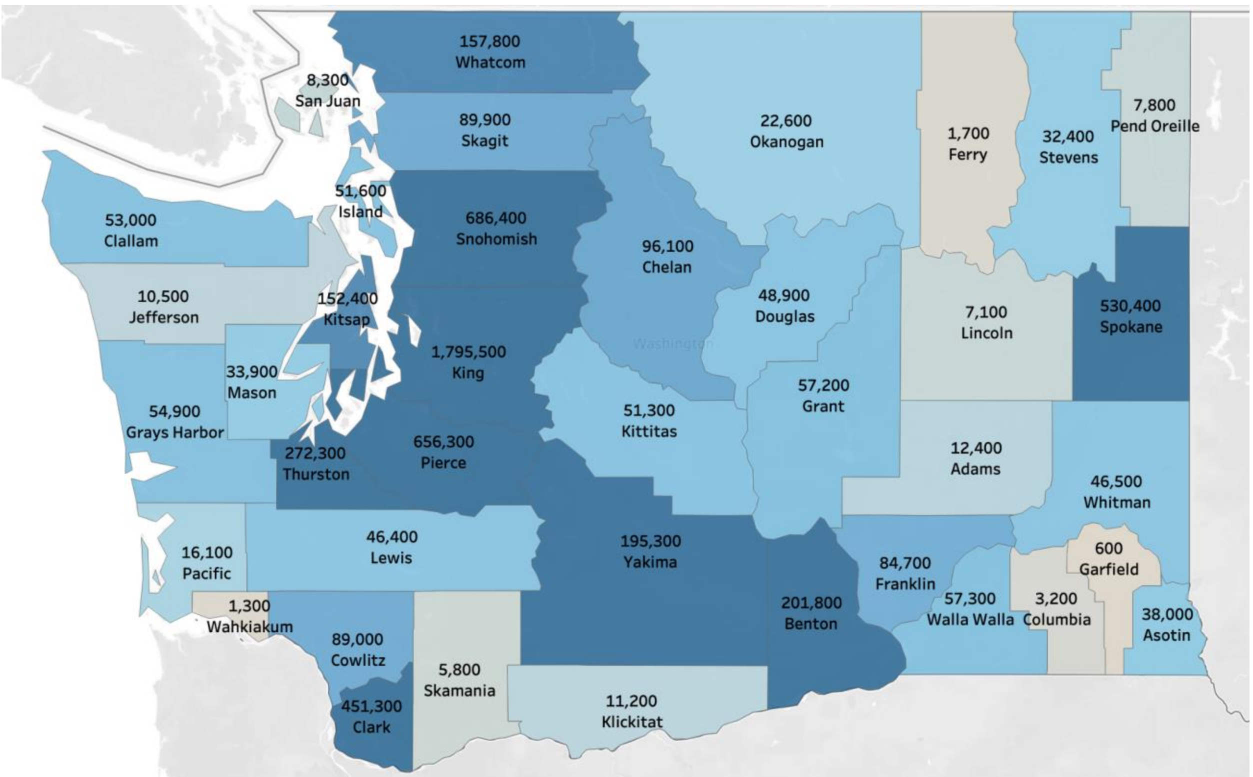


Figure 2. Trips recorded in each county in for the June 2023 corpus (rounded to the nearest 100)

For unique drivers, we can express the count per county as a percent of that county's population. This isn't a perfect normalization as the same proportion of residents will not drive in each county, and many drivers seen in a county will not live in the county; however, it's helpful to understand that even rural counties have reasonable coverage.

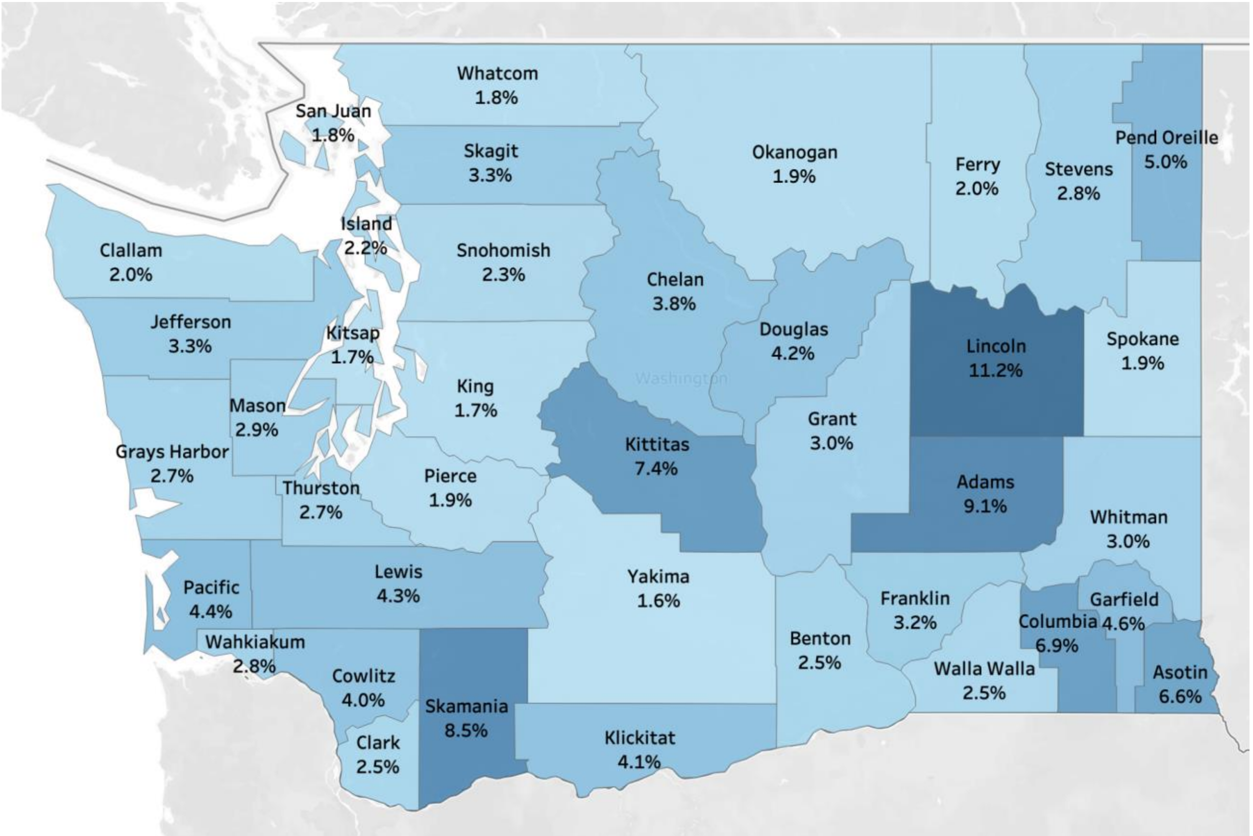


Figure 3. Unique drivers as a percent of county population in each county in for the June 2023 corpus. Rural counties are well represented when normalized this way.

State-wide the number of drivers available for the analysis increased from 67,300 to 83,900 over the gap of a year, while the total trips analyzed went from 4.6 million to 6.1 million. The total number of unique drivers at the state level is lower than the unique drivers summed per county from the chart above, as most drivers will cross county lines at least once in the course of a month (so will be counted in two or more counties).

For June of 2023, a total of 1.47 million hours of driving were analyzed. A typical roadside observation may last 10 seconds at most, meaning that these drives represent over half a billion roadside observations. Arguably, the full drives paint a more accurate picture of road risk in Washington, as driver behavior away from stop/go traffic and intersections is also captured by telematics data.

Similarly, speed capture devices, either temporary pneumatic road tubes or fixed speed cameras, only capture data at a minimal number of discrete locations, and don't capture compound events such as phone use in combination with speeding[5].

[5] Some newer vision systems can observe both, but their deployment is very limited in the US

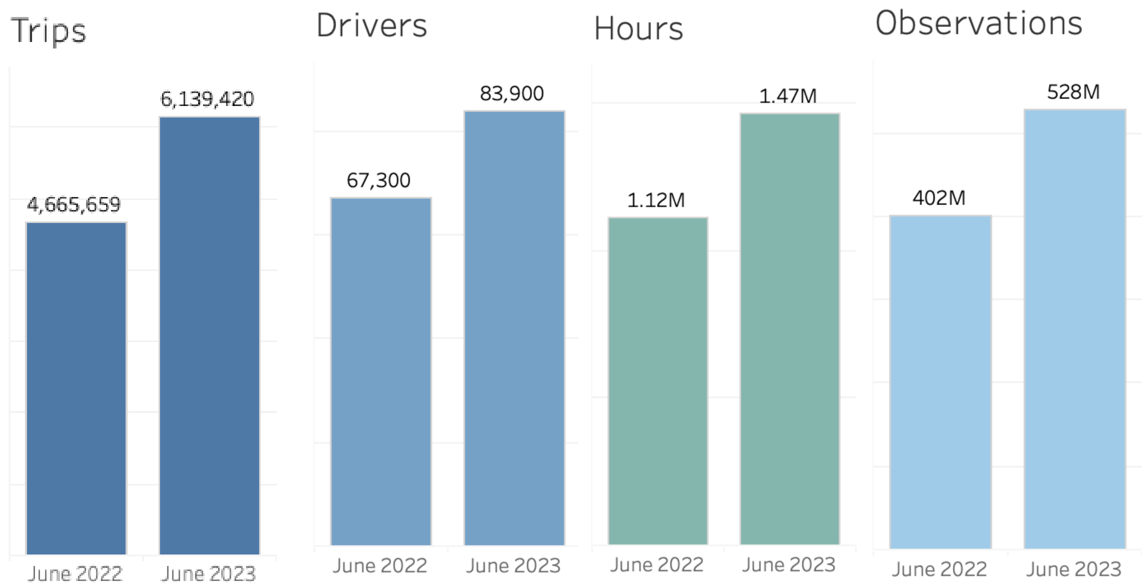
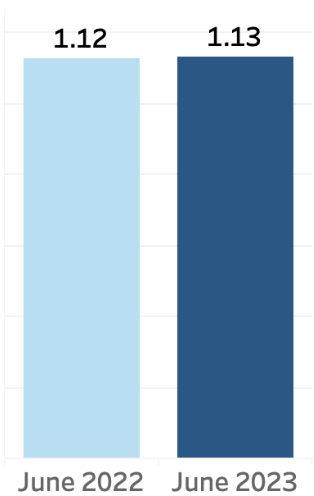


Figure 4. Trips, drivers, total trip hours, and effective roadside observations for Washington State for the two periods of study.

Results

Distracted driving - Phone Motion



Phone motion statewide didn't change significantly over the year while it varied considerably by county. There isn't a good correlation with population by county; CMT's annual road risk study showed that more rural *states* typically have higher distraction rates, but that isn't reflected on a county level in Washington[6].

There's a swath of connected counties (Douglas, Grant, Adams, and Franklin) that have higher distraction rates. It's possible that the road types, traffic volume, and speeds in those counties lend themselves to higher distraction.

Figure 5. Statewide phone motion rate

[6] The State of US Road Risk in 2024. Cambridge Mobile Telematics.

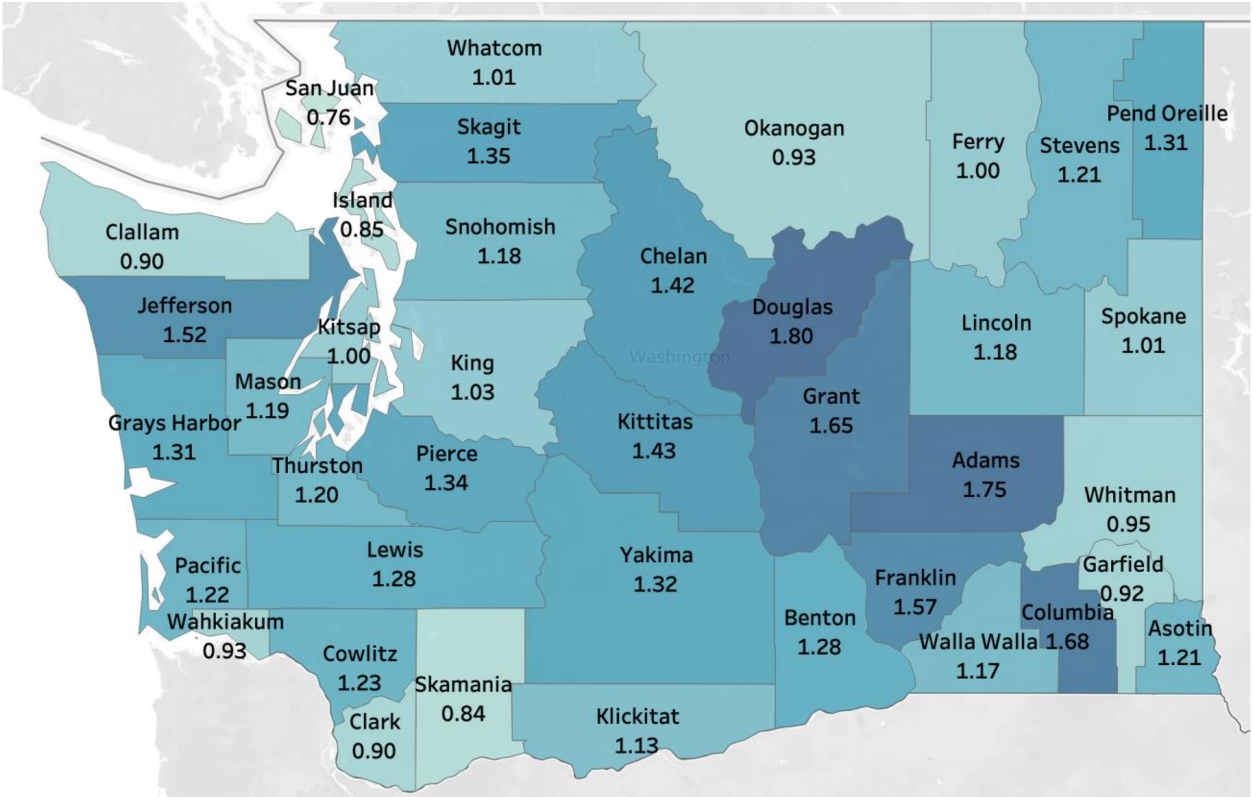


Figure 6. Phone Motion distraction rates by county for June 2023 (minutes of phone motion per hour of driving)

The rates also vary considerably over the year gap, with some counties getting considerably worse, while others improved. The counties that exhibited the largest distraction increases are those with fewer drivers, making them more susceptible to statistical noise. This includes Ferry, Garfield, San Juan, and Wahkiakum counties. As the number of drivers increases each year (and has considerably increased in late 2023 through mid-2024) the noise will reduce, and we can be more confident about trends in these less populous counties.

> ***“About 1 in 4 (25%) of trips had phone distraction. This is much higher than the 9% rate measured by the Washington roadside observation survey”***

Roadside studies typically use a percent of drives (observations) with distraction metric. For both months in the study, the data shows that about 1 in 4 (25%) of full trips had any distraction as measured by phone motion. This is much higher than the 9% rate measured by the Washington roadside observation survey of distracted driving, which also includes distraction from sources other than cell phones[7]. In addition, the distracted driving observation survey is only conducted in 26 of 39 counties at 375 total locations.

[7] Distracted Driving Observation Survey Results, Washington Traffic Safety Commission. Brief No. 10 April 2024

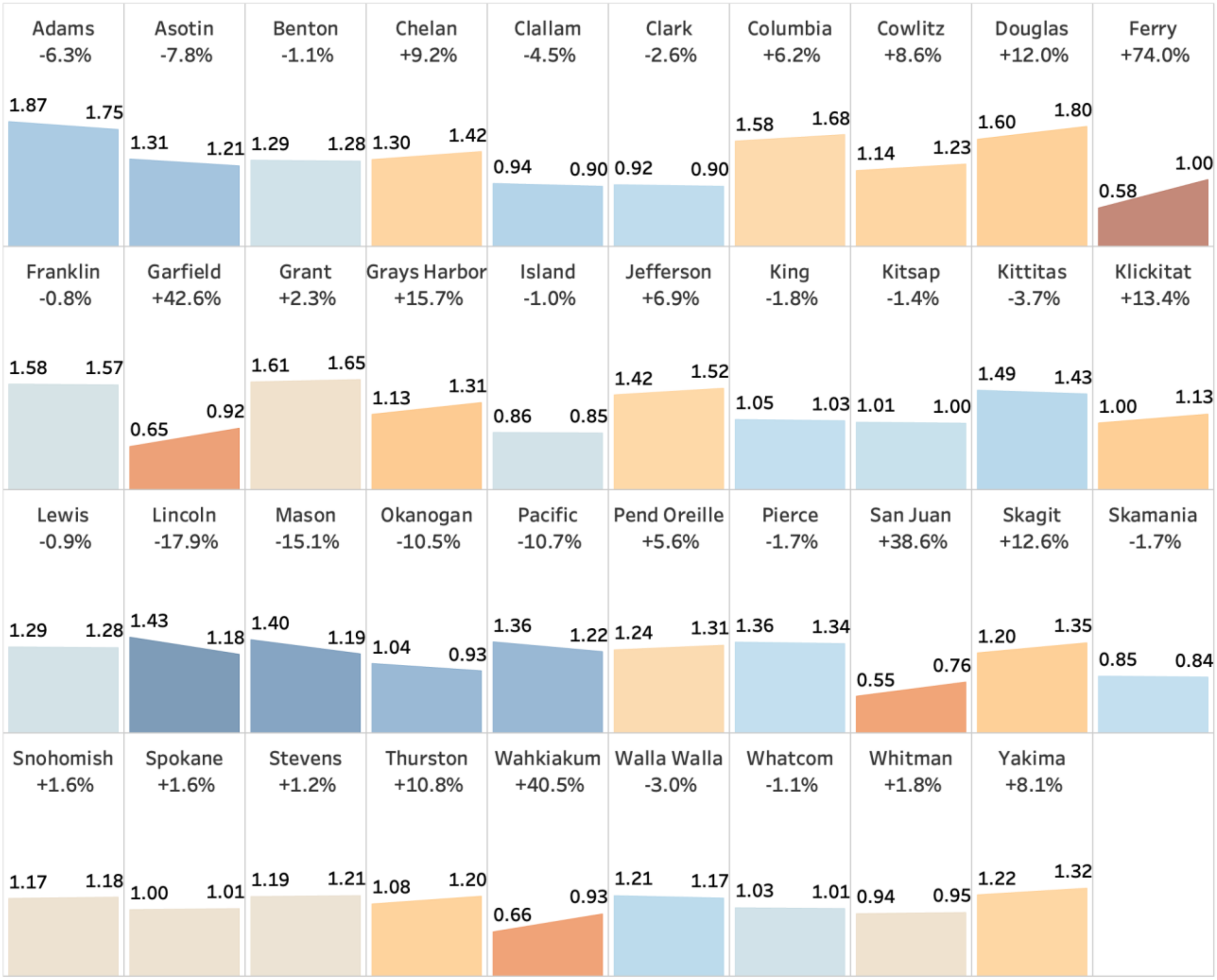


Figure 7. Change in phone distraction minutes per hour of driving from June 2022 to June 2023 by county. The charts are colored by the percent change from 2022 to 2023 with orange showing an increase in distraction and blue a decrease. ***Statewide distracted driving was effectively flat at 1.12 minutes per hour in June 2022 to 1.13 minutes per hour in June 2023.***

Distracted driving - Phone Calls

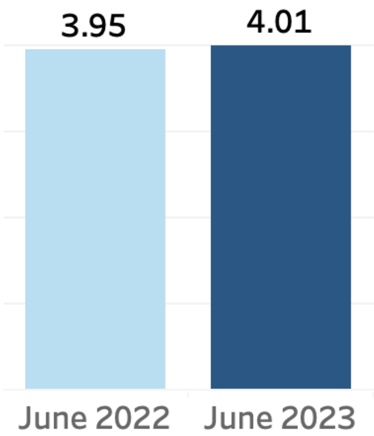


Figure 8. Statewide phone call rate

Phone calls show different spatial and temporal patterns than phone motion. In this study we do not differentiate between hands-free and hand-held calls. The general consensus in the scientific literature is that there is limited, if any, difference in cognitive impairment between the two types [8,9]. Actuarial data combined with CMT's data implies the same. If the driver uses the phone to dial, there will be accompanying distraction involved with looking away from the road.

The swath of rural counties with high phone motion also tend to have high phone call use, but notably King County with Seattle and the surrounding commuter counties are high as well.

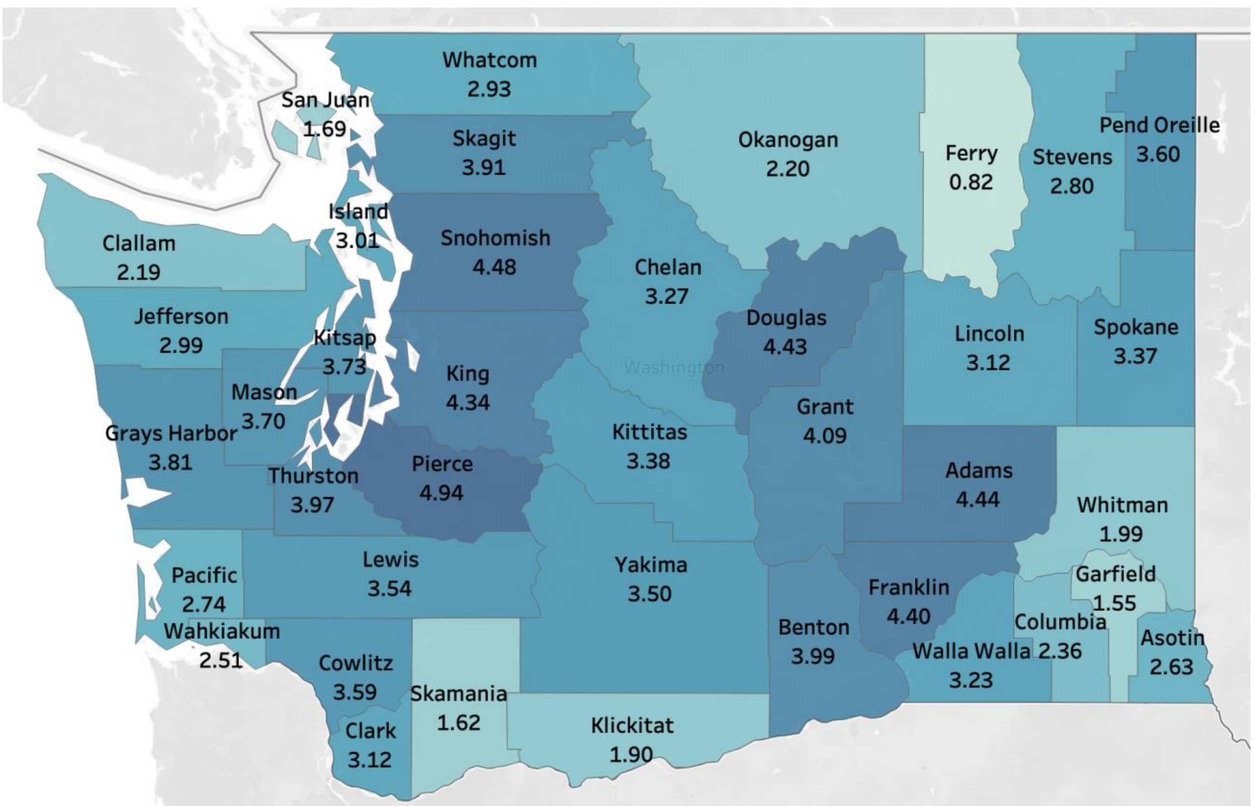


Figure 9. Phone call distraction rates by county for June 2023 (minutes of phone calls per hour of driving)

8 Yoko Ishigami, Raymond M. Klein, Is a hands-free phone safer than a handheld phone, Journal of Safety Research, Volume 40, Issue 2, 2009

9 Agathe Backer-Grøndahl, Fridulv Sagberg, Driving and telephoning: Relative accident risk when using hand-held and hands-free mobile phones, Safety Science, Volume 49, Issue 2, 2011

Many counties showed an increase in phone call minutes over this time frame.

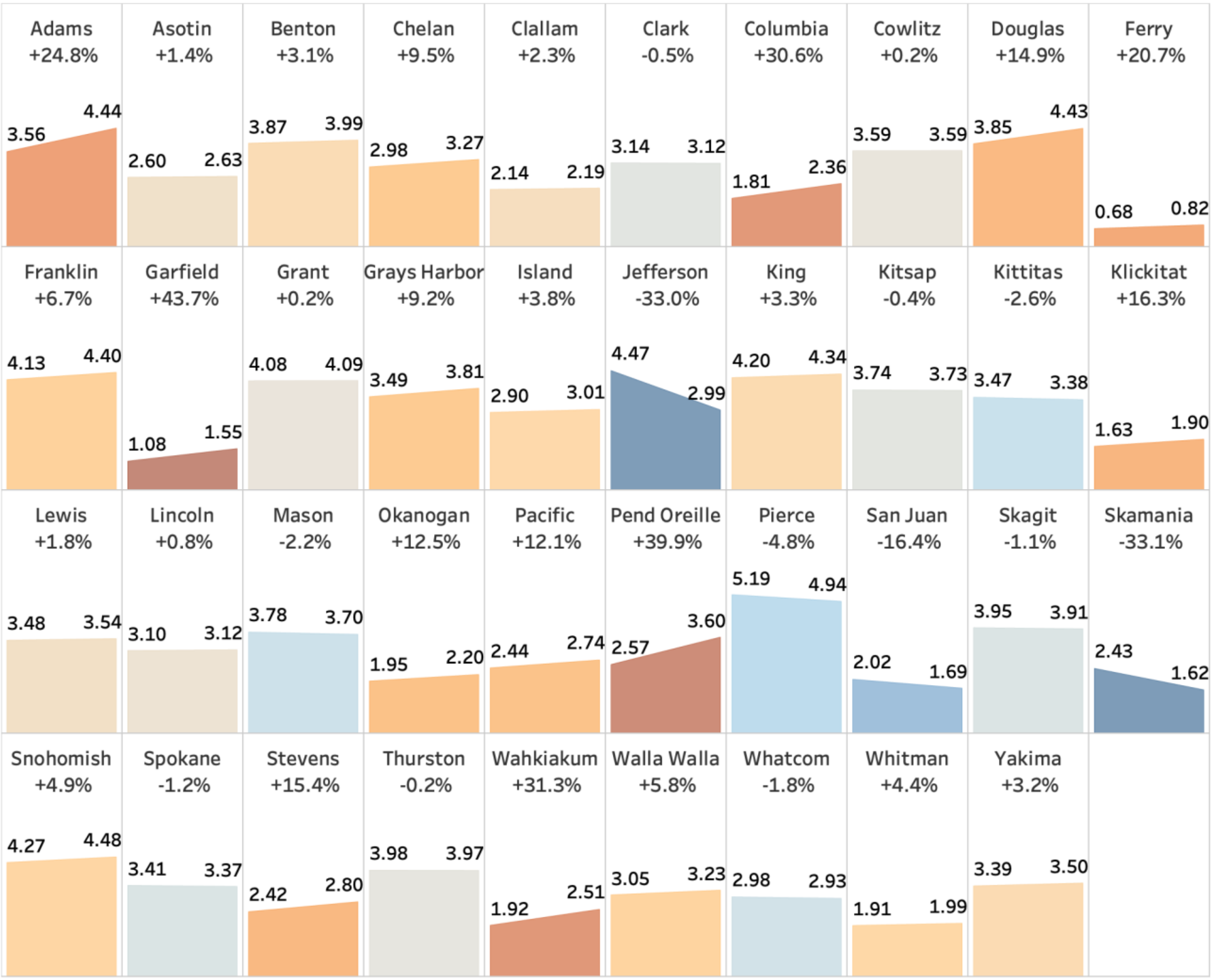


Figure 10. Change in phone call minutes per hour of driving from June 2022 to June 2023 by county. The charts are colored by the percent change from 2022 to 2023. ***Statewide phone calls driving showed a slight increase from 3.95 minutes per hour to 4.01 minutes per hour.***

Phone call rates are statistically correlated with the rank of each county's population (from the most populous King County at number 1 to Garfield at 39, see Figure 11). On first consideration this shouldn't be the case as we are normalizing to the miles of driving that occurs. However, it could be speculated that commuters are more likely to be engaged in phone call use and that is correlated with county population and proximity to a city.

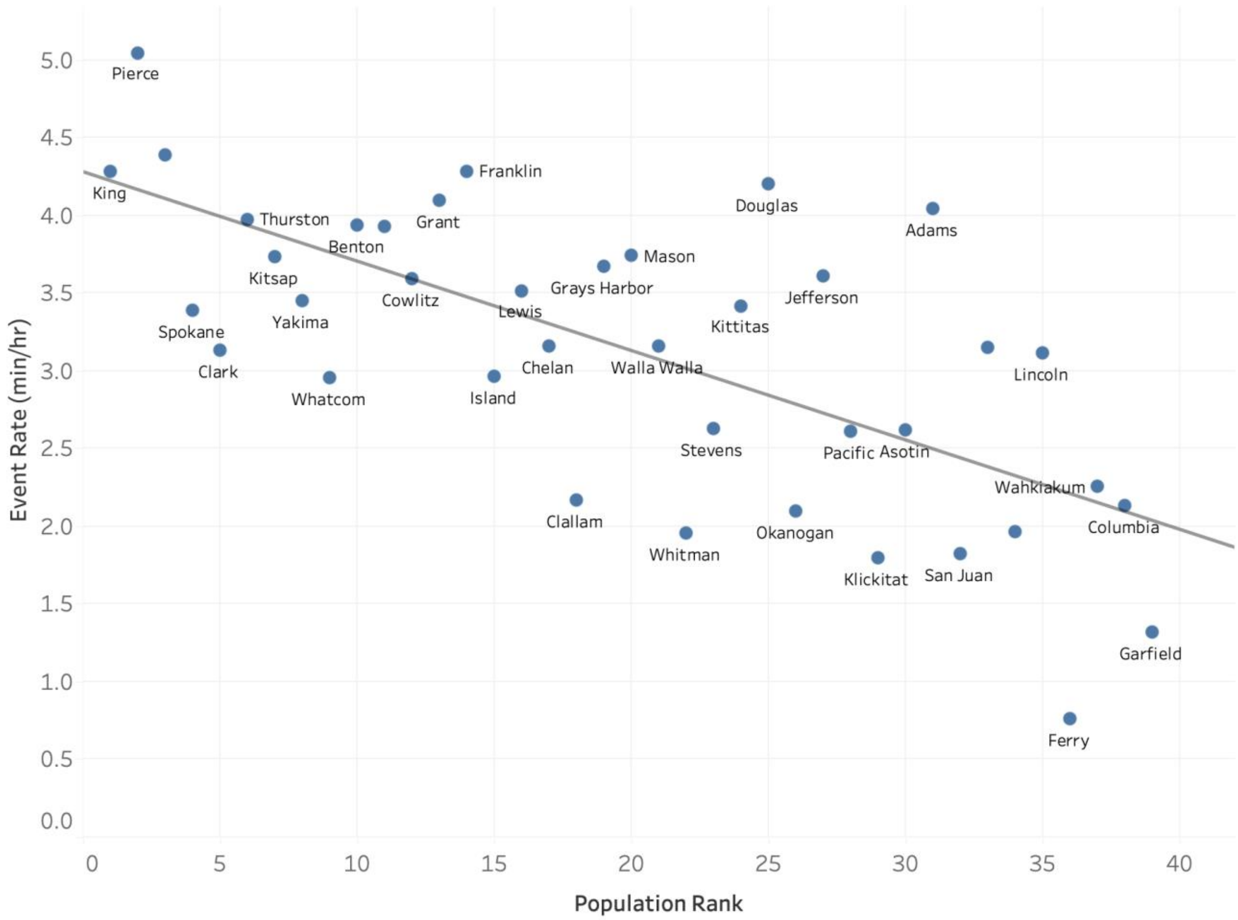
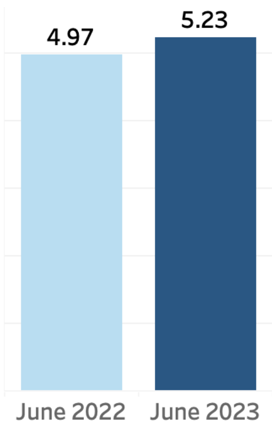


Figure 11. Phone call rates vs. the population rank (1st = King, 39th=Garfield) showing a statistically significant relationship (R^2 = 0.47, p<0.001)

Hard Braking



High frequency of hard braking (>3.2m/s^2) is one of the leading indicators of crash risk, both from an individual driver perspective[10,11], and by extension, road segments, and counties. Hard brake count per 100 miles traveled increased slightly over the course of the year.

The nature of the roads in the county (fewer hard brakes occur per mile on a highway than on a road with intersections) and the volume of cars in a county (as other drivers, traffic, and the presence of pedestrians/cyclists are often the cause of hard brakes) drastically affect hard braking rates.

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[10] Dingus, T. A., F. Guo, S. Lee, J. F. Antin, M. Perez, M. Buchanan-King, and J. Hankey, Driver crash risk factors and prevalence evaluation using naturalistic driving data. Proceedings of the National Academy of Sciences, Vol. 113, No. 10, 2016, pp. 2636–2641.

[11] Palat, B., G. S. Pierre, and P. Delhomme, Evaluating individual risk proneness with vehicle dynamics and self-report data: toward the efficient detection of At-risk drivers. Accident Analysis and Prevention, Vol. 123, 2019, pp. 140–149.

Figure 12. Statewide hard brake rate

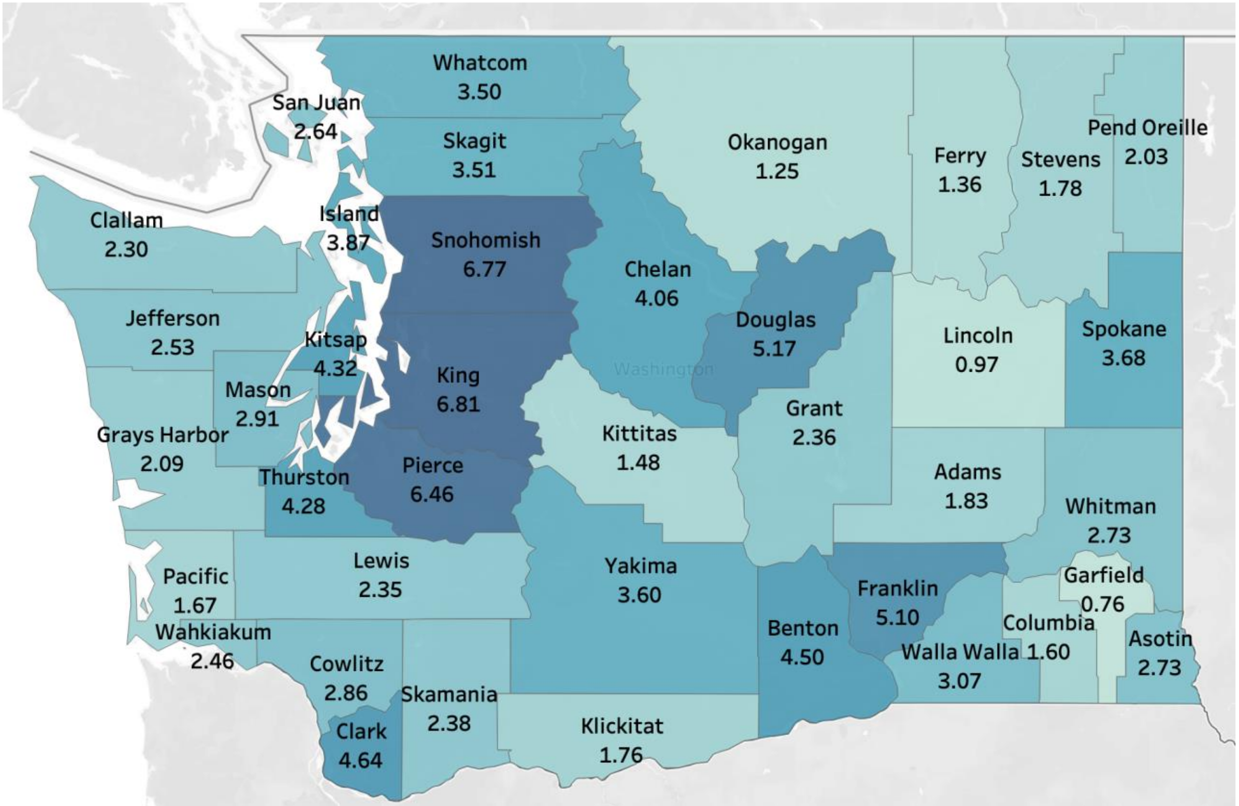


Figure 13. Hard brake rates by county for June 2023 (hard brakes per 100 miles of driving)

Unsurprisingly, rates are much higher in the more populated counties especially King, Snohomish, and Pierce. Like phone calls, hard brake rates are well correlated with the population rank of the county, despite the fact that there is normalization (Figure 14).

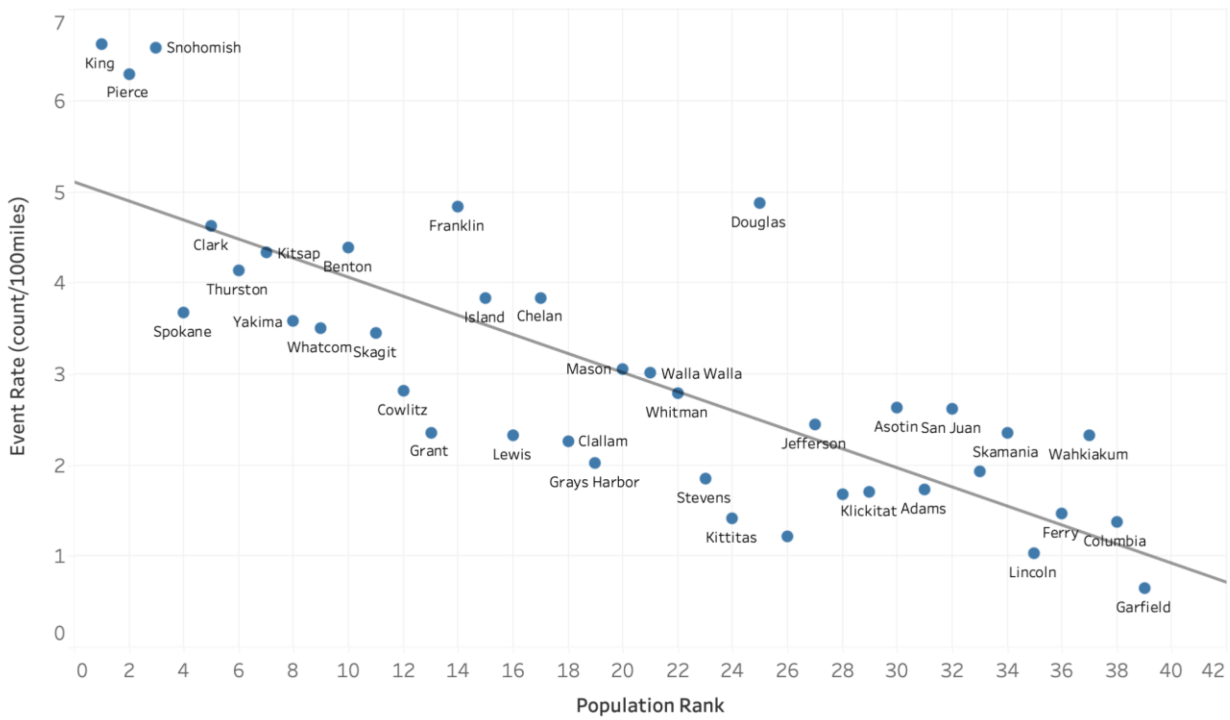


Figure 14. Hard brake rates vs. the population rank (1st = King, 39th=Garfield) showing a statistically significant relationship (R^2 = 0.62, p<0.001)

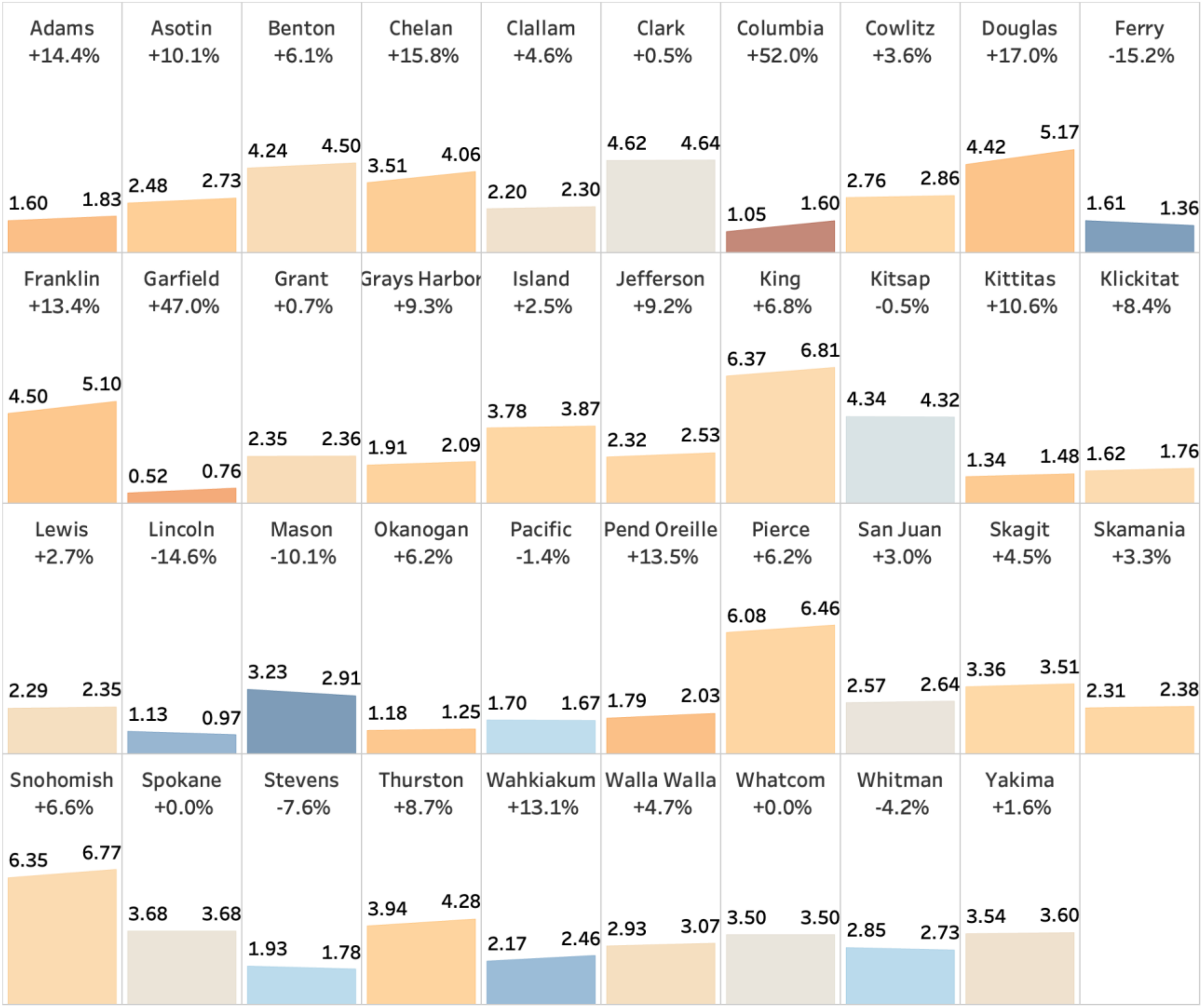


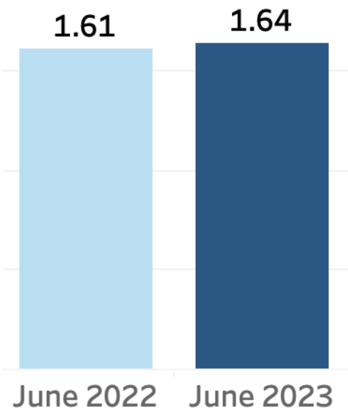
Figure 15. Change in hard brakes per 100 miles of driving from June 2022 to June 2023 by county. The charts are colored by the percent change from 2022 to 2023. ***Statewide hard braking showed an increase from 4.97 hard-brakes per 100 miles to 5.23.***

Rates of hard braking have gone up in the majority of counties. Columbia increased the most with a 52% increase. While Columbia is a less populated county, it still had over 600 telematics drivers in 2022 and 1,600 in 2023, suggesting that while susceptible to noise, there was still likely a large increase in rates.

One possible explanation for the increase in rates, especially in counties with heavy commuting, could be reflective of more people returning to the office for more days per week. This is supported by data from other sources.[12]

[12] *Seattle traffic slowed a whole lot in 2023*. The Seattle Times, June 2024. https://www.seattletimes.com/seattle-news/transportation/seattle-traffic-slowed-a-whole-lot-in-2023/

Speeding



Speeding is similar to phone distraction and calls in that the event can take place over a number of miles or minutes; therefore, it's expressed as minutes of speeding per hour of driving (where a speeding event is a certain number of mph over limit as described previously). For example, 1.64 minutes of speeding (June 2023 speeding rate) at 55 mph or more in a 45 mph zone is equivalent to traveling at least one and a half miles at a high rate of speed.

Speeding, somewhat obviously, is a function of being able to speed on free-flowing roads. So again, the nature of the roads and traffic volume will play into county-to-county differences. Equally the presence of a highly traveled road where almost every driver is speeding can greatly influence county values.

Figure 16. Statewide speeding rate

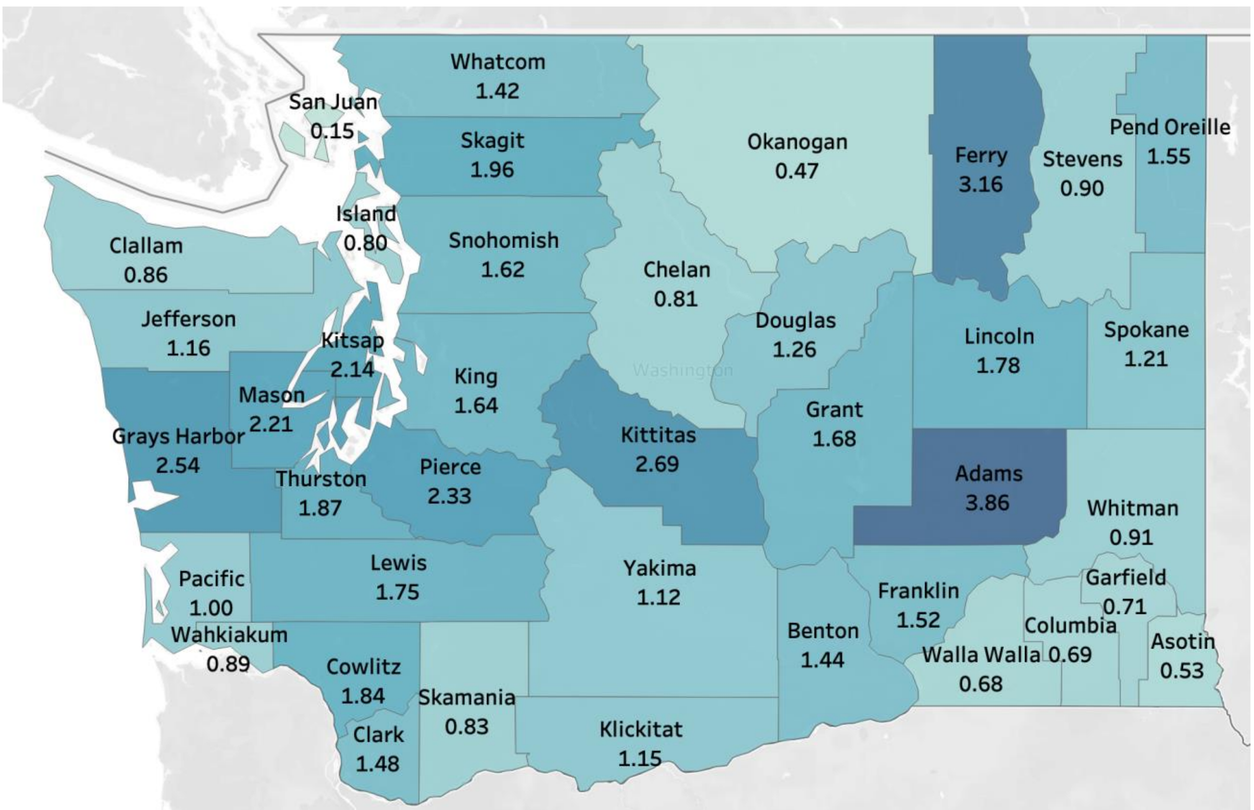


Figure 17. Speeding rates by county for June 2023 (minutes of speeding per hour of driving)

There was no correlation seen between speeding rate and county population. This may seem counterintuitive where counties with more rural roads lend themselves to more speeding as there's less traffic preventing it, but these counties also typically have less miles of limited access highways where speeding is ubiquitous.

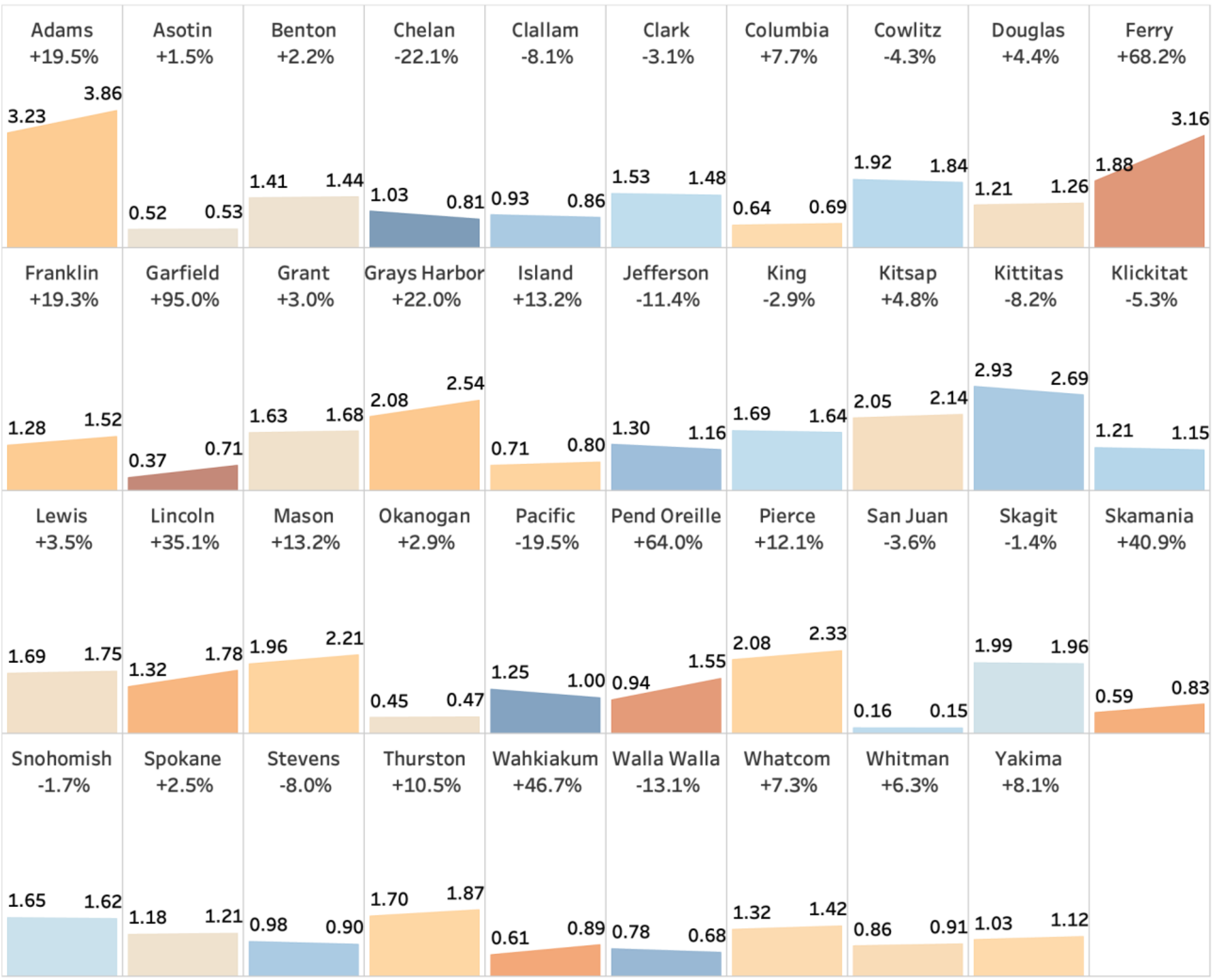


Figure 18. Change in speeding per hour of driving from June 2022 to June 2023 by county. The charts are colored by the percent change from 2022 to 2023. ***Statewide speeding showed a slight increase from 1.61 minutes per hour to 1.64 minutes per hour.***

Adams and Ferry counties are outliers here. While Adams has a fairly low population, I-90 will have a significant amount of traffic that speeds. Equally the few other roads in the county lend themselves to speeding as shown below.

Figure 19. WA-26, one of the few main roads in Adams County, likely lends itself to speeding.

Ferry county has remarkably few roads, with State Route 21 running N/S and State Route 20 running E/W. The volume on these roads is likely low, with ample opportunity for speeding, though that doesn't explain the reason for the increase from 2022 to 2023.

Figure 20. WA-20, one of the two main roads in Ferry County, is likely a low volume road lending itself to speeding, though more hilly than the counterpart shown in Adams county.

Compound Events and Other Breakdowns

In this section we will look at the events broken down by other pieces of information we have about the risky behavior. In some cases, event counts or total minutes are shown instead of rates. The type of analysis in this study (at the county level rather than individual road segments) does not provide the denominators needed (for example, the total number of hours of the parts of trips spent at 30mph vs. 45 mph) to provide rates in every case.

Distraction (Phone Motion) vs. Speed and Functional Class

The implications of distraction are different at different speeds. Below 15 mph it's likely any crash would be a minor fender bender. At 20 mph to 35 mph a distraction related crash could cause serious injury to vulnerable road users and vehicle occupants. At 35 mph to 55 mph the distraction could still be on roads with vulnerable road users, and the crash is much more likely to result in death or permanently debilitating injury. Above 55 mph the distraction is more likely to be on a highway.

Obviously, the distance traveled while looking away from the road increases at these higher speeds, but equally the energy of any crash is the square of velocity, making crashes at this speed very dangerous to the occupant and any third-parties.

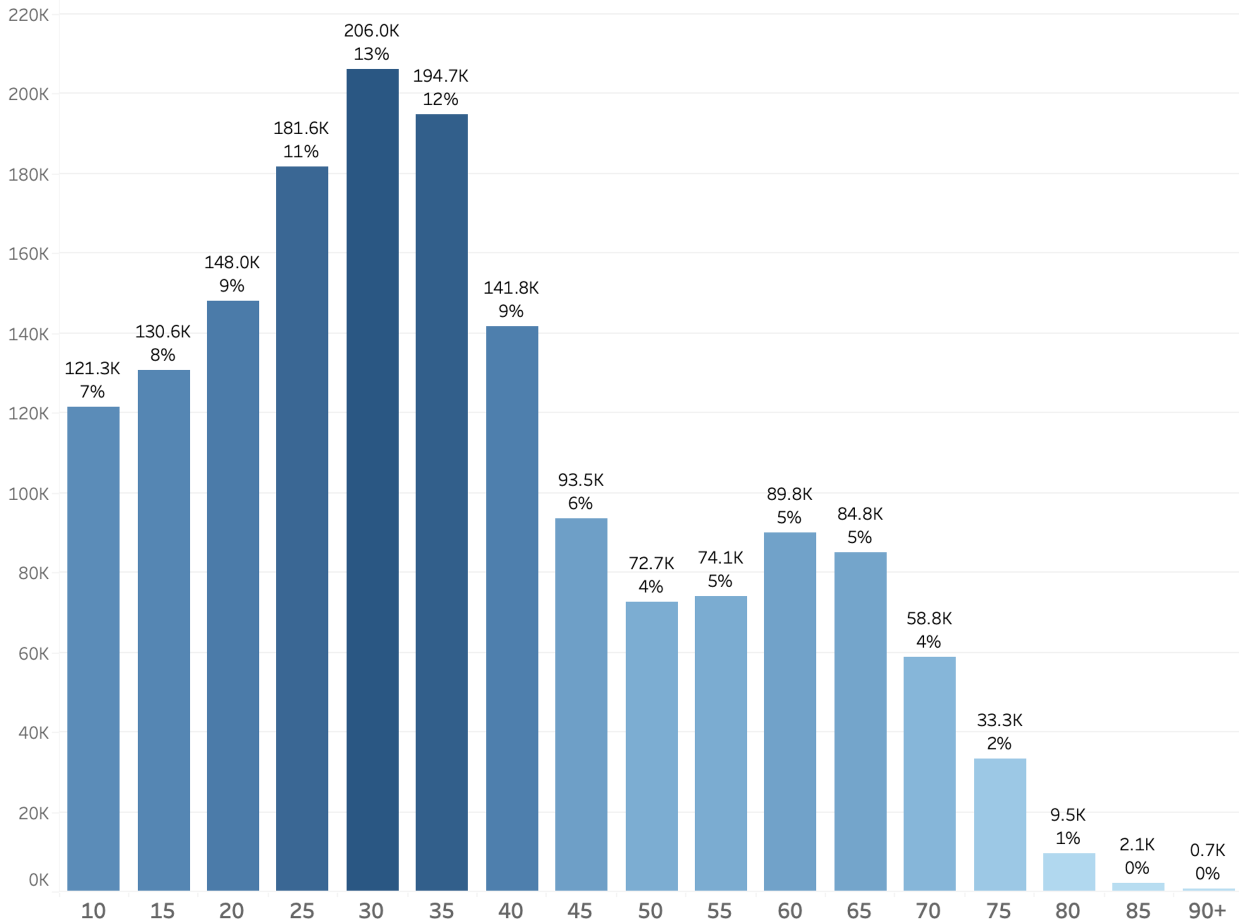


Figure 21. The minutes of phone motion distraction seen in Washington State in June 2023, broken out by the speed band (mph) at the time of the distraction. The percentages show minutes of distraction at this speed divided by the total distraction minutes.

"There were 670 minutes of distraction with the driver exceeding 90 mph"

The chart above shows peaks between 25 mph and 35 mph (where pedestrians and cyclists are almost definitely present), and another at highway speeds of 60 mph and 65 mph, Concerningly there's a number of events occurring at even higher speeds; there were 670 minutes of distraction with the driver exceeding 90 mph. There were 3 minutes of distraction at 115 mph (grouped in the 90+ bucket in the chart above).

The definition of functional class of a road can vary by map provider or organization, but typically they follow this general pattern:

- Highway (FC1): High speed, high volume roads like highways (usually, but not always access-restricted)
- Trunk (FC2): Roads used to channel drivers onto FC1 roads, or major roads that are not highways. Sometimes called trunk roads

- Primary (FC3): Roads that intersect FC2 roads and can still be important thoroughfares. Often called primary roads
- Secondary (FC4): Roads that intersect FC3 roads and can be neighborhood feeders to Primary roads. Often called secondary roads
- Residential (FC5): Smaller roads like, but not limited to, residential and access roads

Firstly, we can consider time spent on each of these road types.

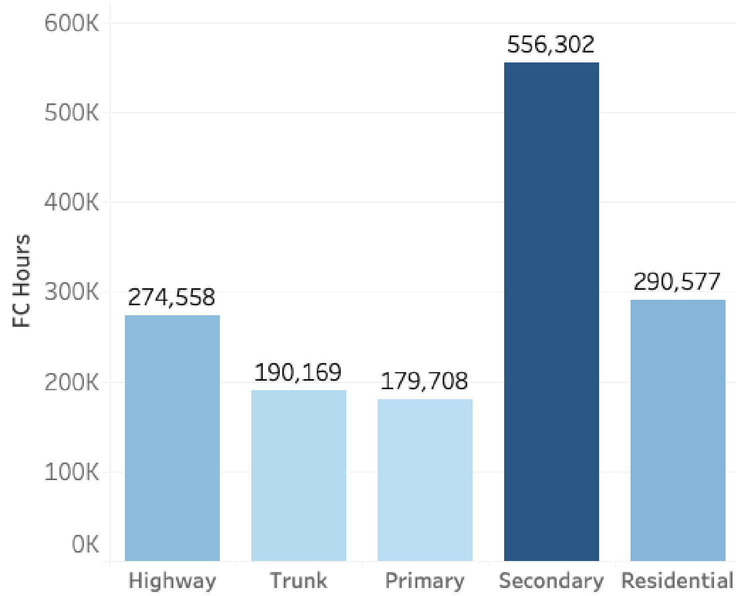


Figure 22. Hours spent on each type of road in June 2023 across the state. The total hours exceeds the hours reported earlier in the document as this includes hours of driving time spent outside of Washington state (but started or ended in state)

It can be seen that more time is spent on secondary roads in Washington state than the other functional classes. However, as seen in Figure 23, phone motion distraction is highest on residential (FC5) roads, followed by secondary roads.

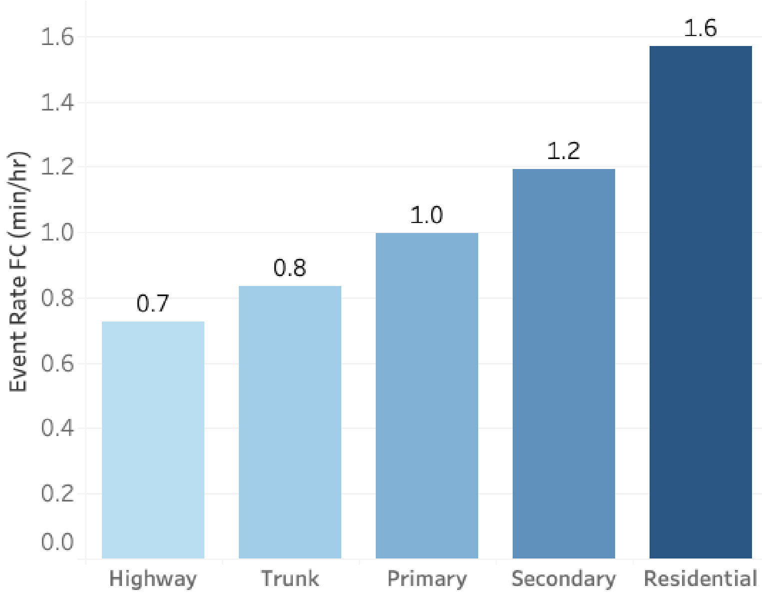


Figure 23. The rate of phone motion distraction in June 2023 across the state. The rates (minutes of distraction per hour of driving) increase as the functional class drops.

It's of considerable concern that the distraction rate increases on the classes of roads that are as the likelihood of vulnerable users being present in the roadway increases (i.e. there are few pedestrians in highways and trunk roads hopefully, but they are common on secondary and residential roads).

Distraction (Phone Calls) vs. Speed and Functional Class

Given that phone calls are more common than phone motion distraction we can also look at phone calls by travel speed band and functional class (the type of analysis used for this study does not allow rates of speeding to be calculated by the individual speed bands).

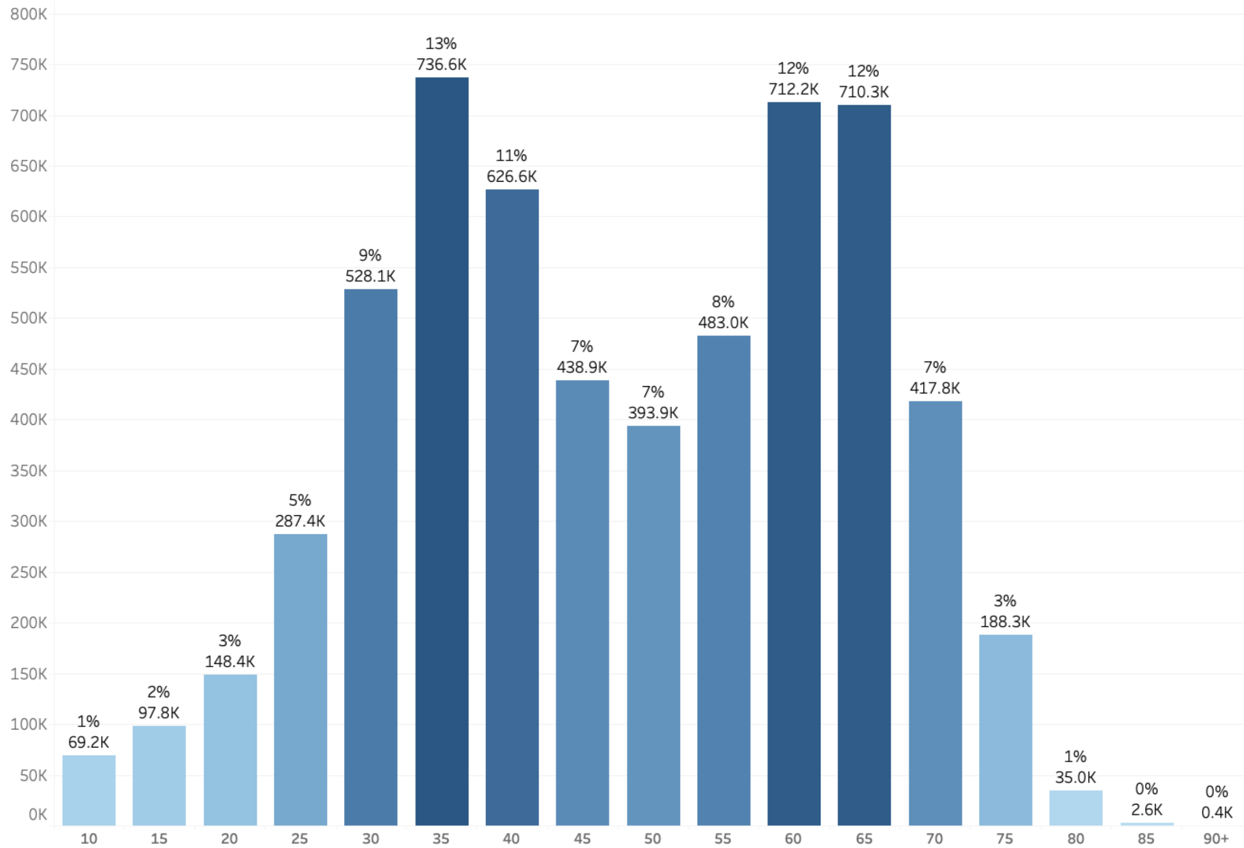


Figure 24. The minutes of phone call distraction seen in Washington State in June 2023, broken out by the speed band (mph) at the time of the distraction. The percentages show minutes of distraction at this speed divided by the total distraction minutes.

Unsurprisingly, more pronounced peaks are observed at highway speeds, aligning with the tendency to perhaps say, 'I'll call you when I'm on the highway. This is reflected in the rate of phone calls (minutes per hour of driving) per functional class being much more even than phone motion as shown in Figure 25 below. However, there is still a peak at 35mph, a common speed on lower functional classes.

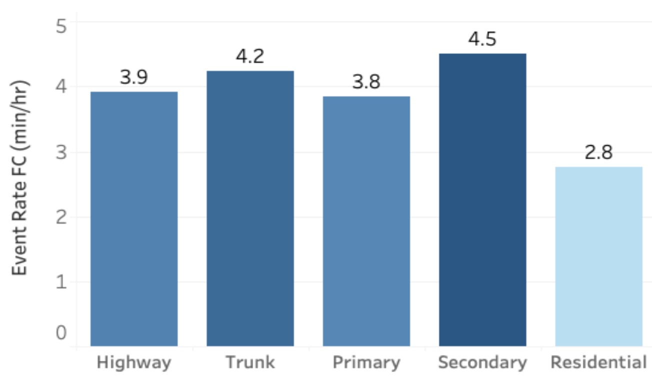


Figure 25. The rate of phone call distraction in June 2023 across the state. The rates (minutes of distraction per hour of driving) are fairly consistent except for residential roads.

Hard Brake vs. Speed and Functional Class

Similarly, we can look at what speeds hard brakes start at. Most occur under 30mph, synonymous with high traffic volumes, encountering vehicles turning, and the presence of vulnerable road users on lower functional class roads.

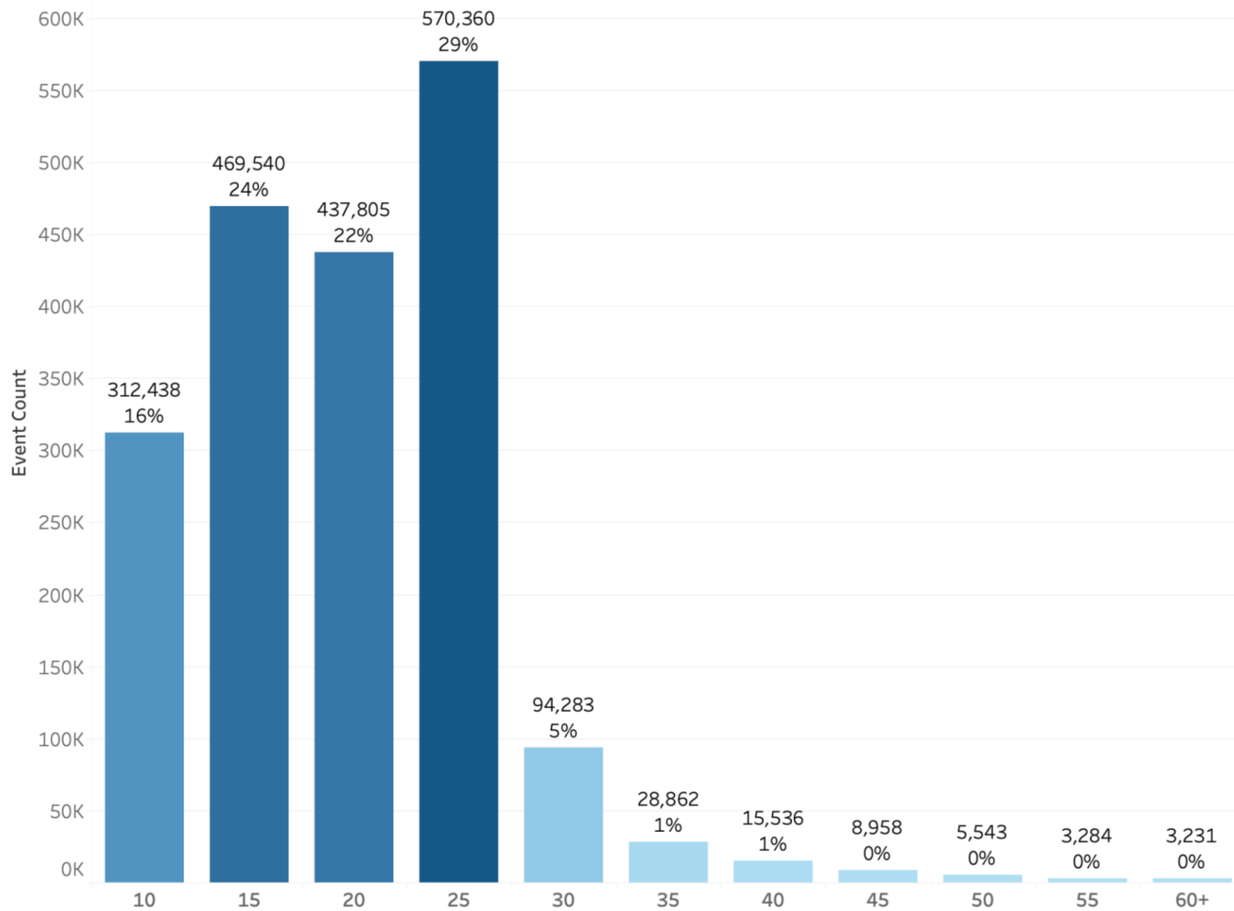


Figure 26. The count of hard brake events seen in Washington State in June 2023, broken out by the speed band (mph) at the start of braking.

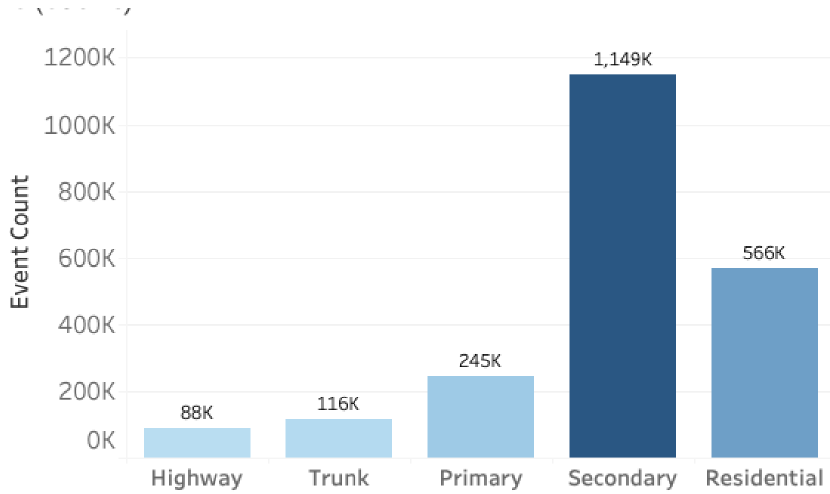


Figure 27. The count of braking events in June 2023 across the state. Lower functional class roads see higher braking amounts.

Speeding vs. Speed and Functional Class

"On highways with a 60 mph limit, about half exceeded that limit by more than 15 mph"

The amount by which a driver exceeds the speed limit is important as it indicates the increased risk to drivers that may be observing the limit, or trying to pull out onto a road, and expecting adherence to the limit, as well as the increased risk of death to vulnerable road users. The chart below is both a function of the distance of roads in Washington state with the respective limit, and how inclined people are to speed on them. On highways with a 60 mph limit, about half exceeded that limit by more than 15 mph.

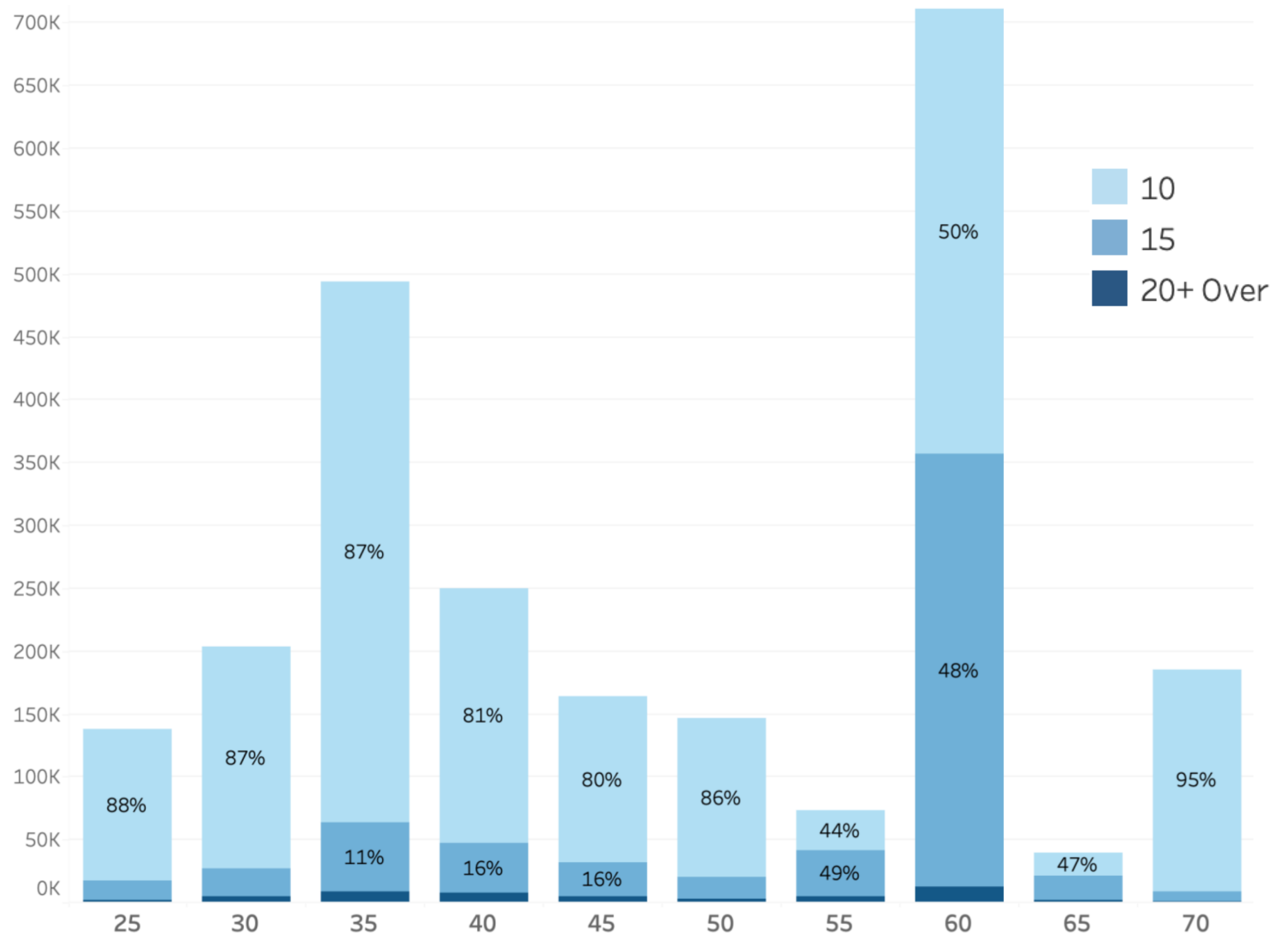


Figure 28. The count of speeding events by speed limit, and the amount that the limit was exceeded by (darker colors indicate greater amounts above the limit) for June 2023. The percent in each excess speed band are also shown in the table below.

Speed Limit	10 to 15 mph over	15 to 20 mph over	20+ Over
25	88%	11%	2%
30	87%	11%	2%
35	87%	11%	2%
40	81%	16%	3%
45	80%	16%	3%
50	86%	12%	2%
55	44%	49%	7%
60	50%	48%	2%
65	47%	47%	5%
70	95%	5%	<0.5%

Table 1: The percent of speeders in each excess speed band by speed limit.

If we normalize the speeding vehicles by total time spent on a functional class by all cars in the dataset, speeding rate is similar across all but residential roads, with highways not surprisingly showing the most.

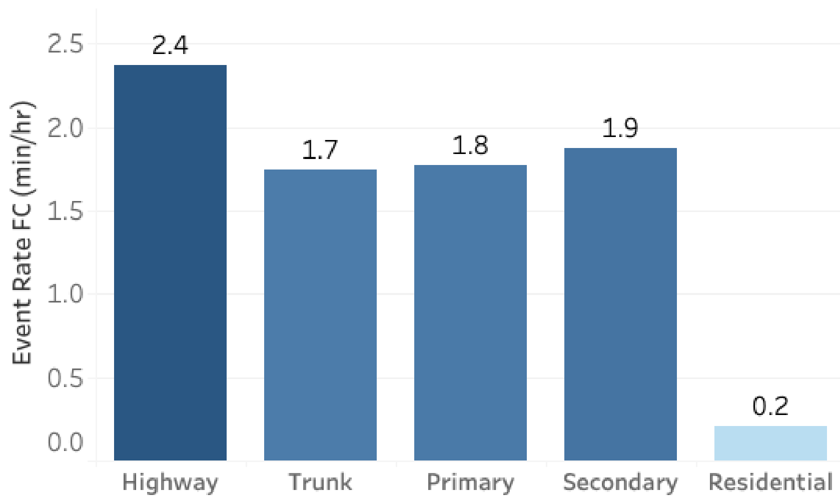


Figure 29. Speeding rate (minutes per hour of driving) per functional class shows speeding is ubiquitous on all but residential roads.

City Analyses

In addition to the county-to-county analyses, three cities were chosen for comparison: Seattle, Spokane on the eastern border with Idaho, and Vancouver, across the river from Portland, Oregon.

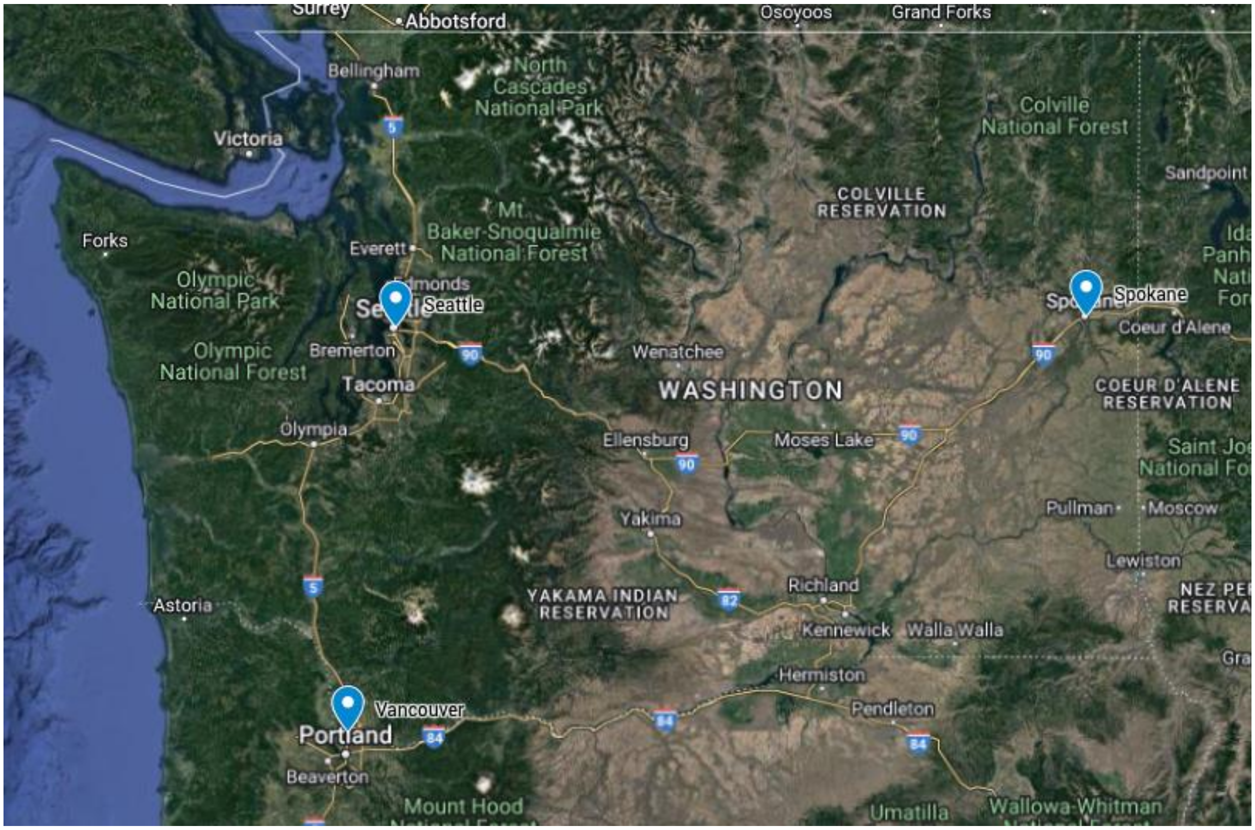


Figure 30. The three cities chosen for comparison.

Seattle has by far the largest population at around 760k in the city itself and 4m in the metro areas. Visitors must arrive from the north or south or are funneled in over two major bridges.

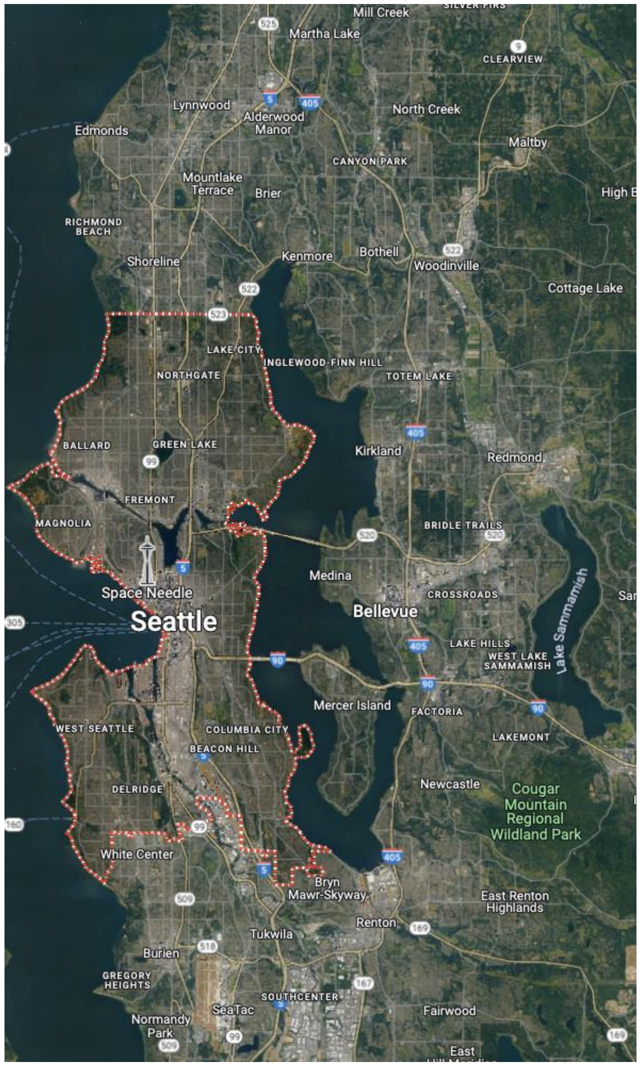


Figure 31. Google's satellite view of Seattle, showing the major routes in and out of the city, and some of the surrounding commuter towns. The red outline shows the city limit.

Spokane isn't geographically constrained by the coastline like Seattle, has a lower population of about 230k with 600k in the surrounding area. I-90 passes through, and Spokane could be considered the gateway to Idaho and beyond.

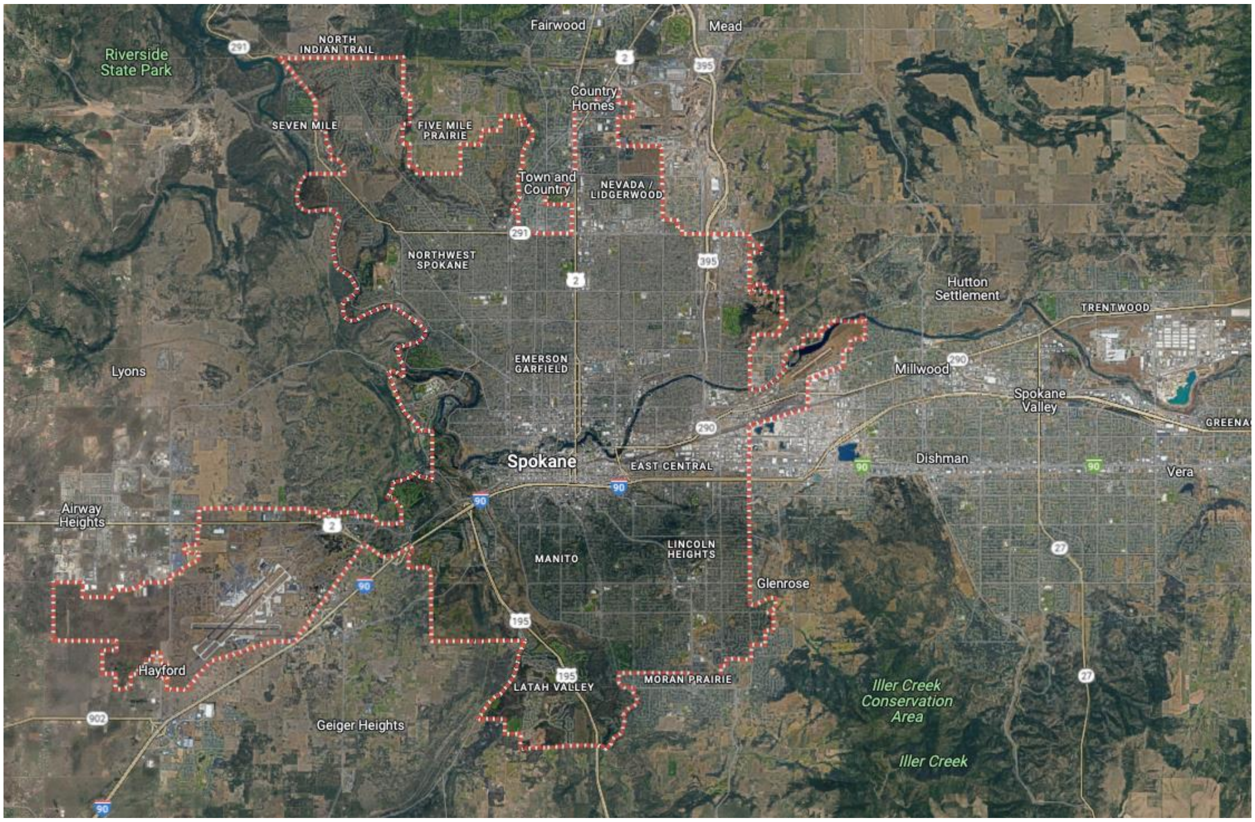


Figure 32. Google's satellite view of Spokane. There are fewer surrounding cities and is generally more rural than Seattle.

Vancouver is on the southern border of Washington and is considered part of the greater Portland (OR) metropolitan area. It has a population of around 190k, with the Portland-Vancouver-Hillsboro Metro Area having about 2.5m (though most commuter traffic would be in and out of Portland). All traffic heading south must go over the two bridges.

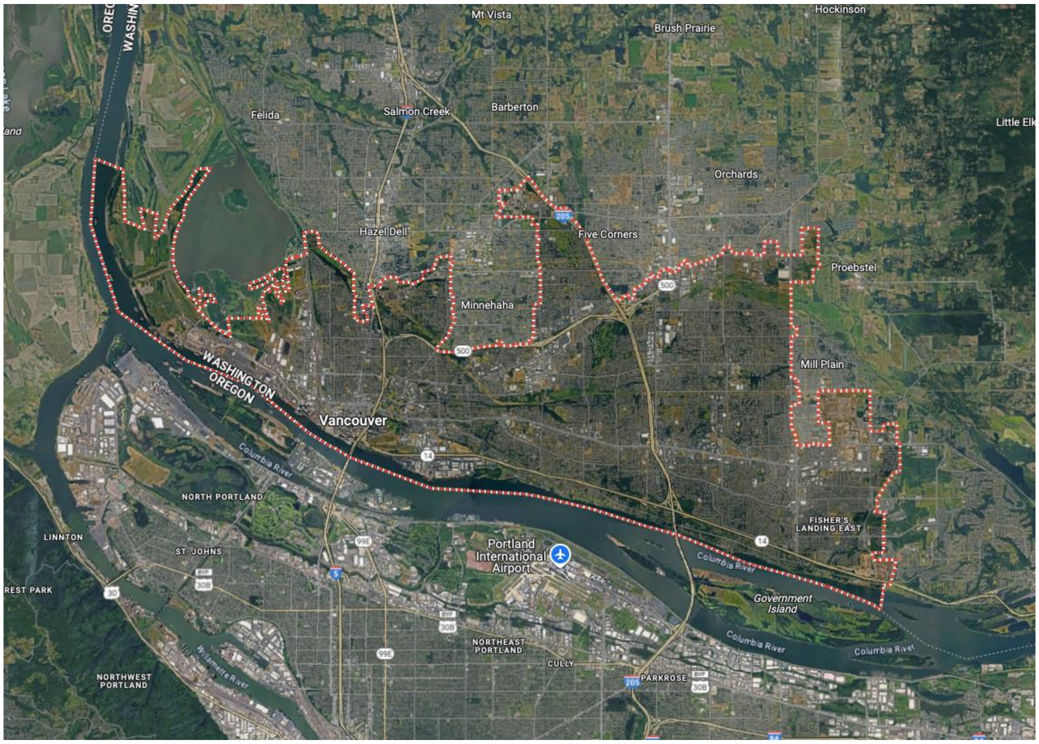


Figure 33. Google's satellite view of Vancouver.

The methodology for comparing the cities was the same as the county analyses, with trip time and distance apportioned to the part of the trip within the cities, and events geolocated. The city geometries chosen were those used by the 2020 United States census.

Distracted Driving - Phone Motion

When looking at the city rates, the phone motion distraction rates are higher than the encompassing county.

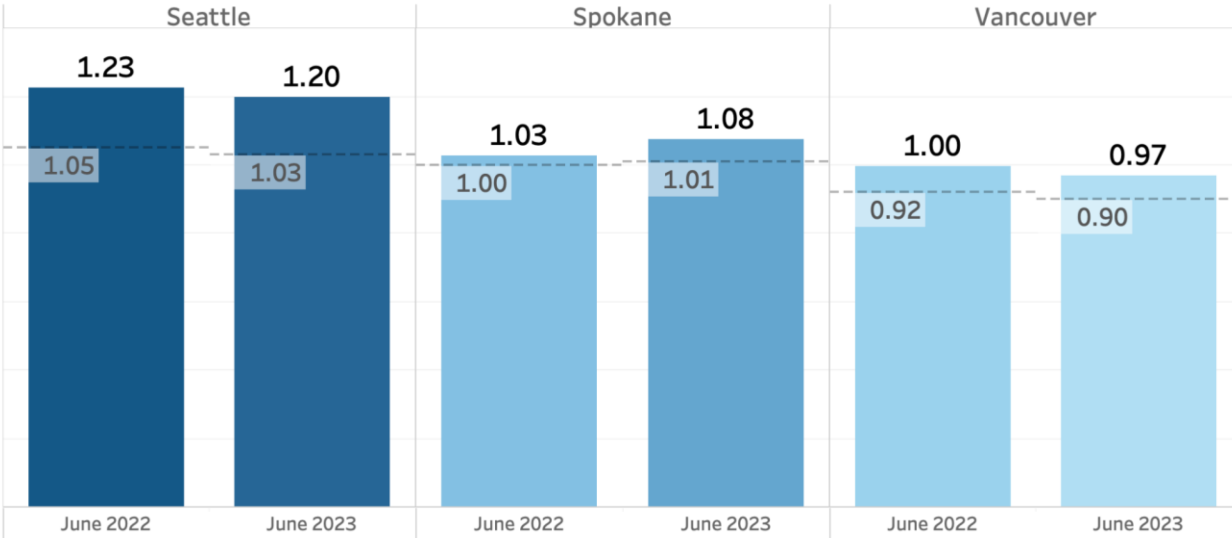


Figure 34. Phone motion distraction rates for the three cities. The rate for the county they are part of is shown as the hashed reference line.

Distracted driving - Phone Calls

A similar pattern emerged for phone calls, with the city rates exceeding the county rates.

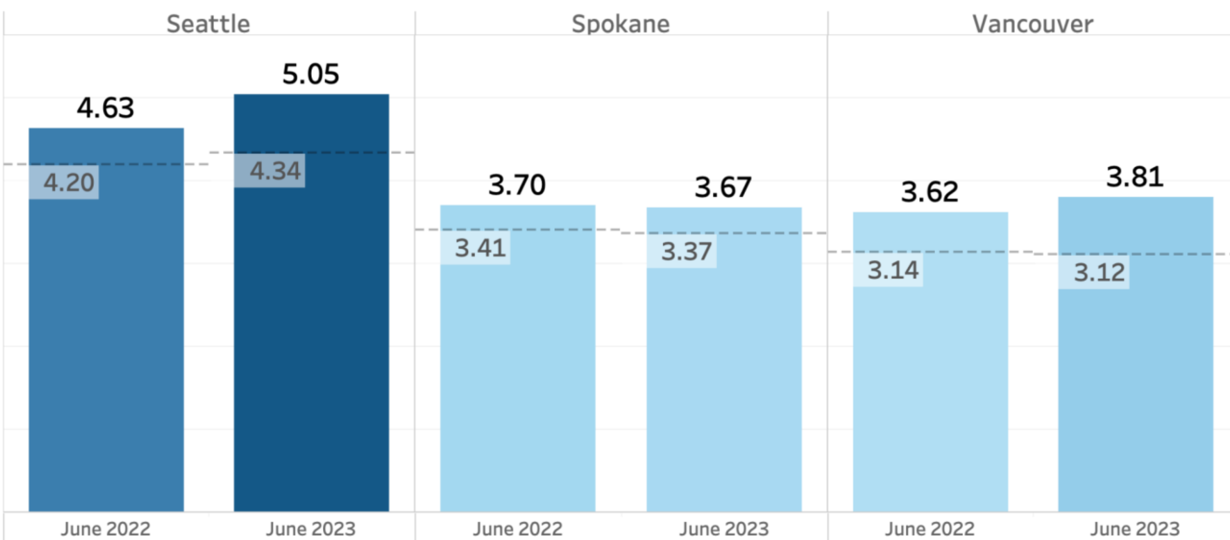


Figure 35. Phone call distraction rates for the three cities. The rate for the county they are part of is shown as the hashed reference line.

Hard Braking

Rates were considerably higher for Spokane and Vancouver cities compared to their accompanying counties while Seattle had similar rates to the county they are in. This is possibly due to the higher amount of traffic in all of King County, compared to the cities of Spokane and Vancouver's lower influence on county wide traffic.

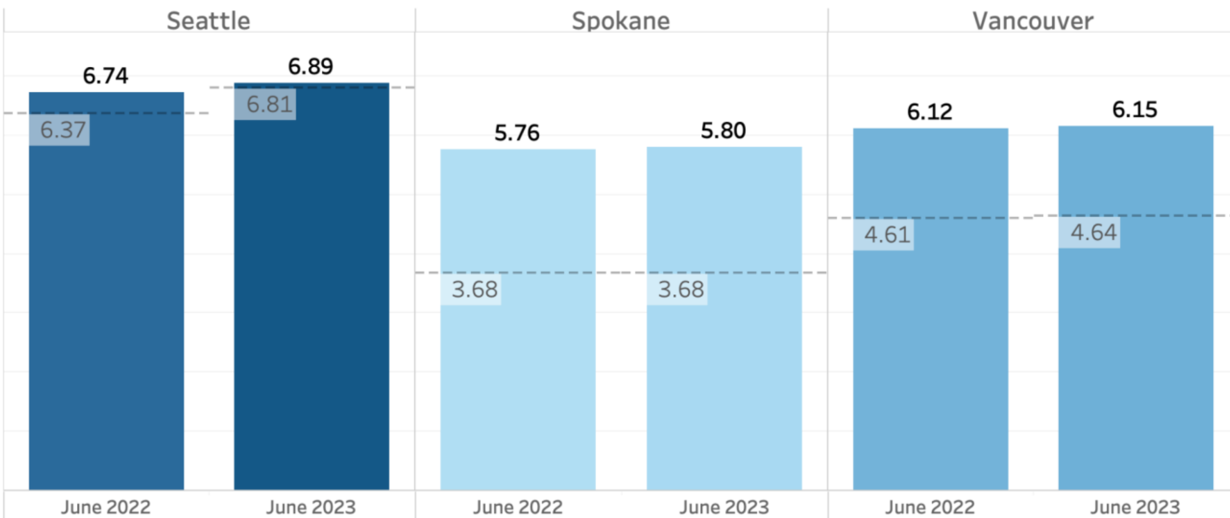


Figure 36. Hard braking rates for the three cities. The rate for the county they are part of is shown as the hashed reference line

Speeding

Speeding was lower for the cities compared to the county they are in. This is likely a reflection of the ability to speed being reduced on more congested roads.

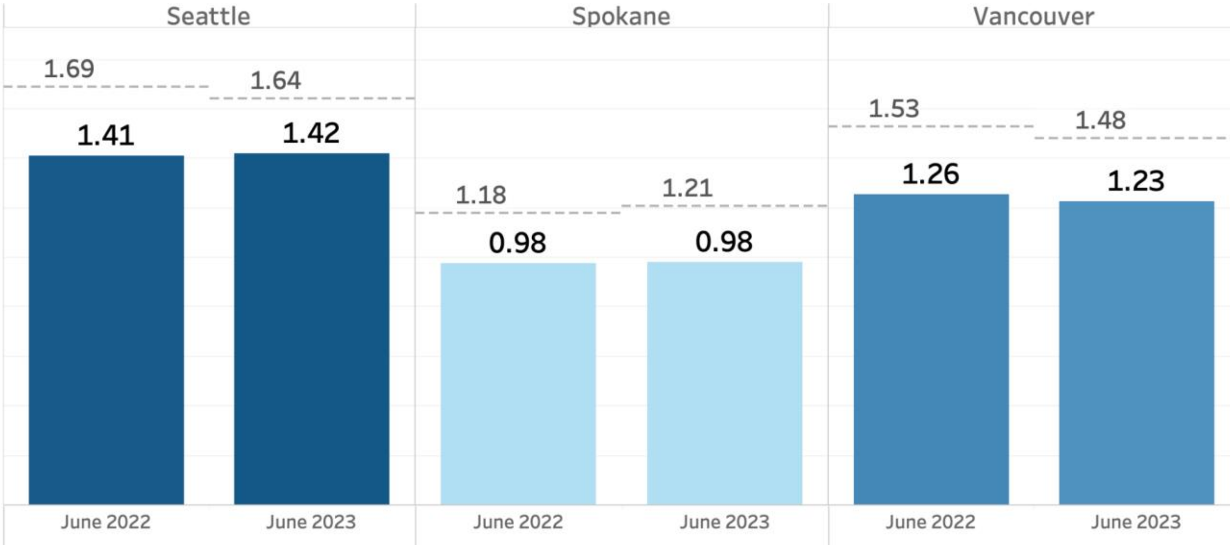


Figure 37. Speeding rates for the three cities. The rate for the county they are part of is shown as the hashed reference line.

Disadvantaged Neighborhood Example

An example of a road hotspot analysis is presented in this section. It demonstrates the ability to identify parts of the road system that are of particular concern. CMT looked at 41k trips with 45k events from June 2023 to present that occurred in a neighborhood of Seattle labeled as 'persistently poor' by The Neighborhood Poverty Project[13].

Neighborhoods like this typically have a lower reported crash rate as incidents are less likely to be reported or recorded[14], and have less influence in local politics to ask for change[15,16]. This can lead to a disparity in road safety spending compared to more affluent neighborhoods, and a resultant increase in risk to vulnerable road users.

[13] https://eig.org/neighborhood-poverty-project/interactive-map/

[14] Lombardi LR, Pfeiffer MR, Metzger KB, Myers RK, Curry AE. Improving identification of crash injuries: Statewide integration of hospital discharge and crash report data. Traffic Inj Prev. 2022;23(sup1):S130-S136.

[15] Elder EM, Enos RD, Mendelberg T. The Long-Term Effects of Neighborhood Disadvantage on Voting Behavior: The "Moving to Opportunity" Experiment. American Political Science Review. 2024;118(2):988-1004

[16] Matthew J. Parlow, Revolutions in Local Democracy? Neighborhood Councils and Broadening Inclusion in the Local Political Process, 16 MICH. J. RACE & L. 81 (2010).

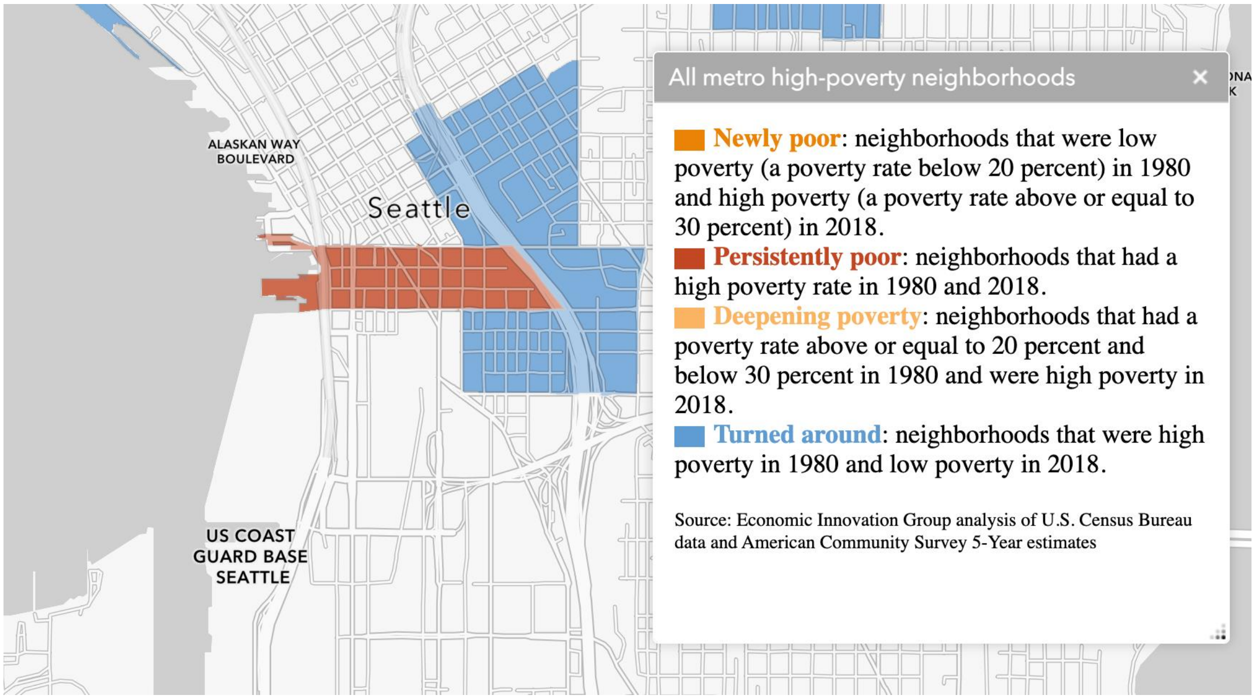


Figure 38. The location of the disadvantaged neighborhood in Seattle as described by the The Neighborhood Poverty Project.

Phone distraction, hard braking, and speeding events were extracted. Hotspot and trend visualizations were created to identify areas and times of increased risk in this neighborhood.

The map below shows the density of phone use (motion) events. They are very common on these roads as is typical elsewhere.

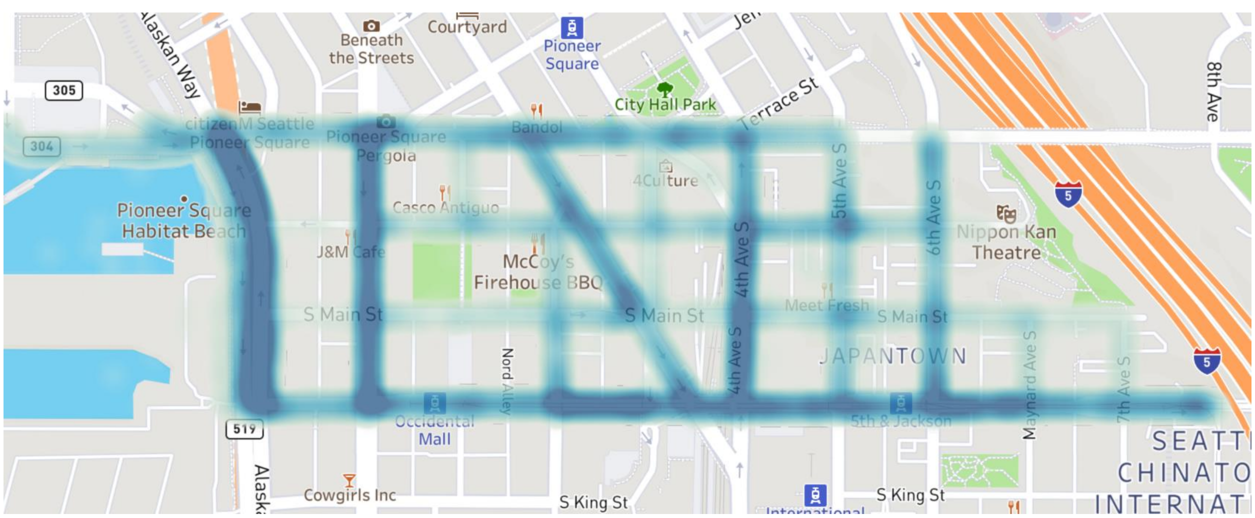


Figure 39. A density map of phone motion events where higher intensity of colors demonstrate areas of higher risk.

The hour of day and day of week pattern of phone use follows patterns seen commonly across other parts of the country, with afternoon commutes seeing more phone use than the morning (presumably to organize evening events, picking up children, etc.). The pattern is persistent throughout the day on the weekend.

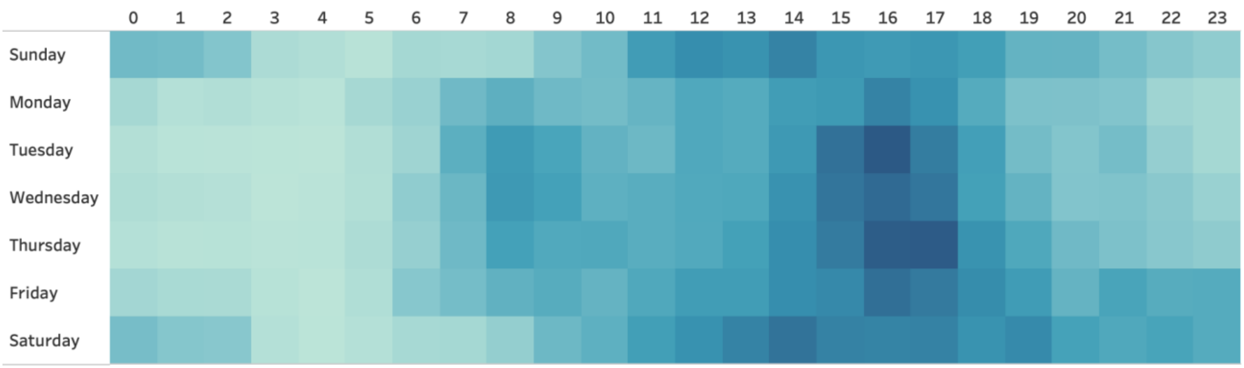


Figure 40. Phone motion hour of day and day of week volume. Cells are a darker blue when more phone use occurs.

The map below shows the density of hard braking events (these are significant deceleration events greater than 3.2 m/s^2, that are highly correlated with crash likelihood) in the neighborhood.

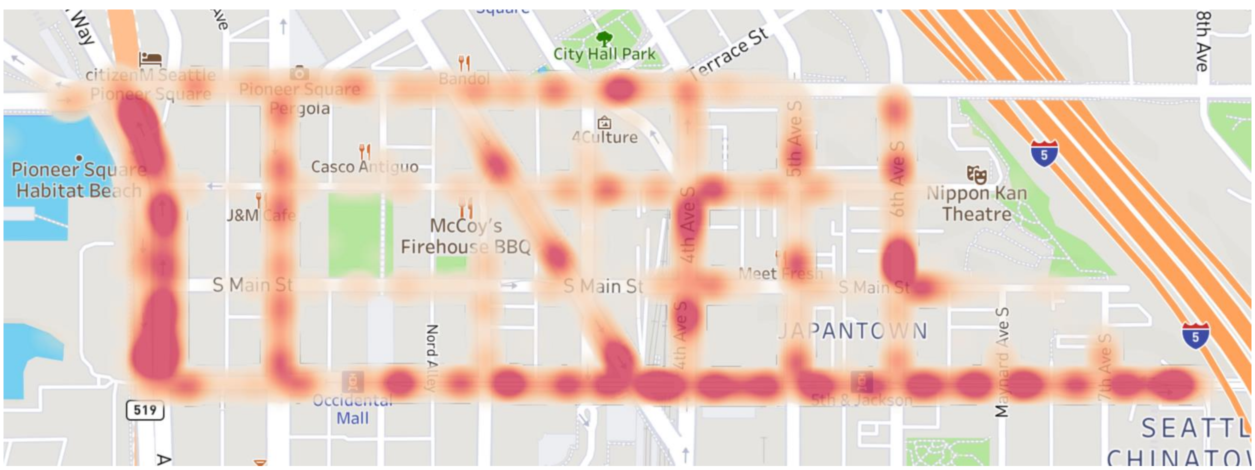


Figure 41. A density map of hard braking events where higher intensity of colors demonstrate areas of higher risk.

There's considerable hard braking on Alaskan Way to the west, likely due to high traffic volume and frequent building and road construction, especially during commute times. While a major road, it's not a highway and there are vulnerable users present, as shown by crosswalks and a separated bike lane on the bay side.

Jackson Street is another road with extensive hard-braking, and again there will be many vulnerable users present. Hard braking at the various intersections is common, especially in the middle of this stretch where Jackson meets 4th and the 2nd Ave Extension.

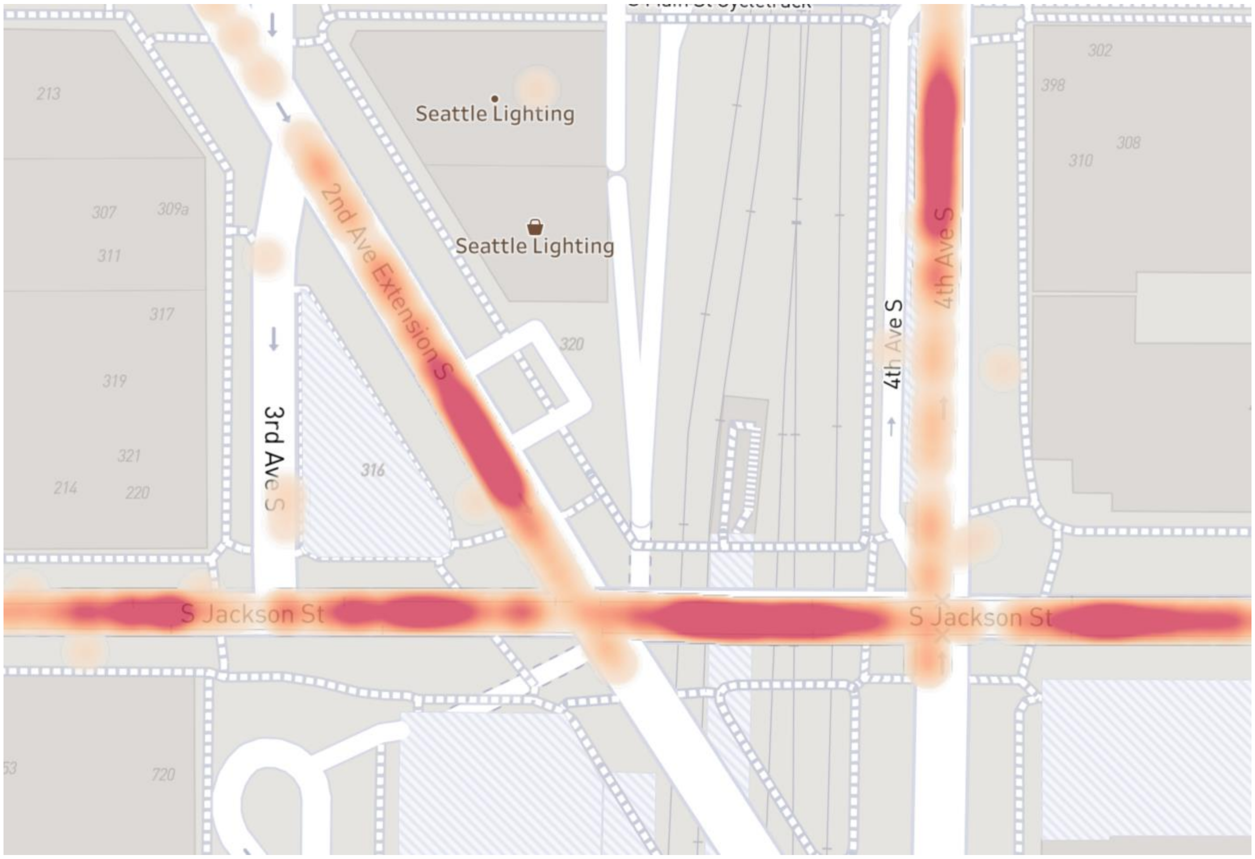


Figure 42. A density map of hard braking events on Jackson Street, 4th, and the 2nd Ave extension shows considerable levels of risky behavior.

An aerial view shows the complexity of this junction, with multiple roads, one at an angle, one-way and multi-direction roads, bike lanes, and two types of transit stops. Apparent from Google Street view there are a number of vulnerable road users in this area.

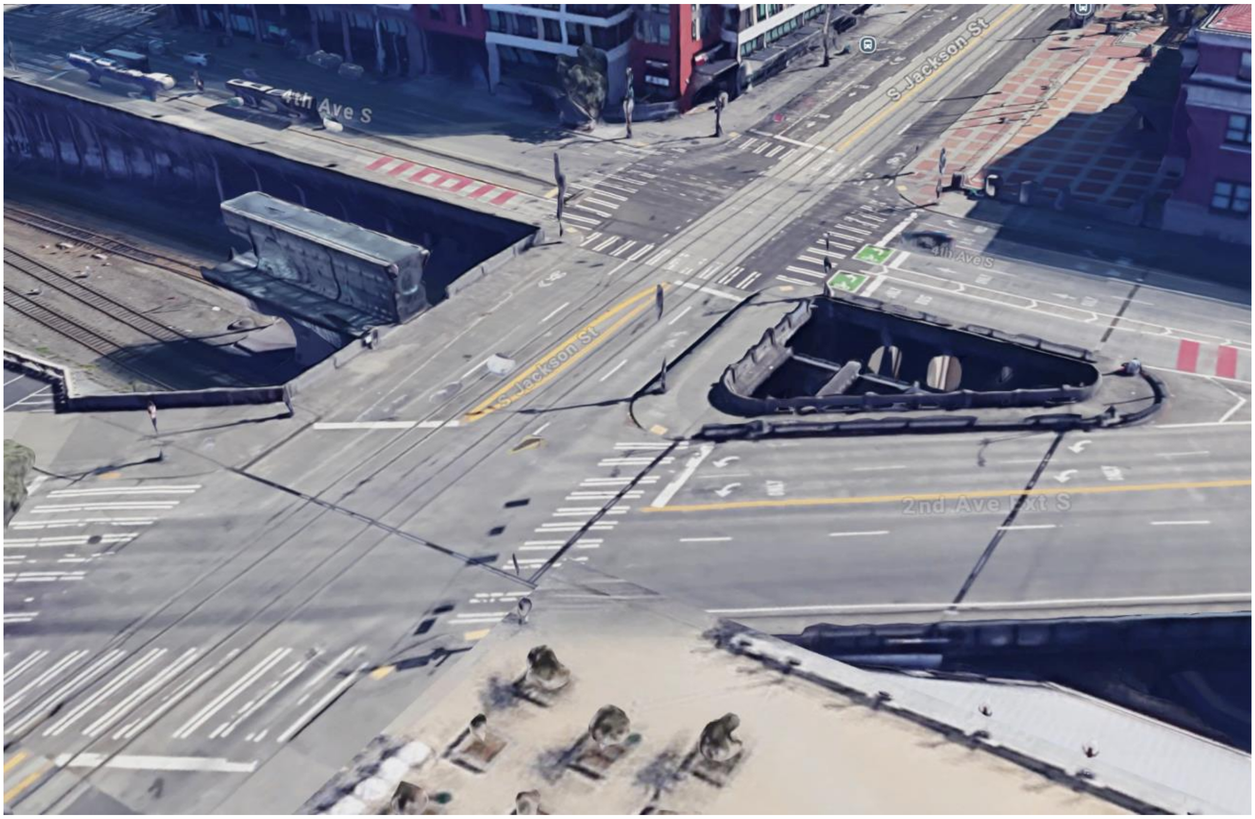


Figure 43. A Google Street View of an intersection on Jackson Street showing the complexity for drivers and pedestrians alike.

The hard-braking seen on Jackson Street is unfortunately but explicably linked to injuries seen on this stretch of road. For every year that data is available from WSDOT, there is a pedestrian or bicyclist injury in the vicinity of this junction.

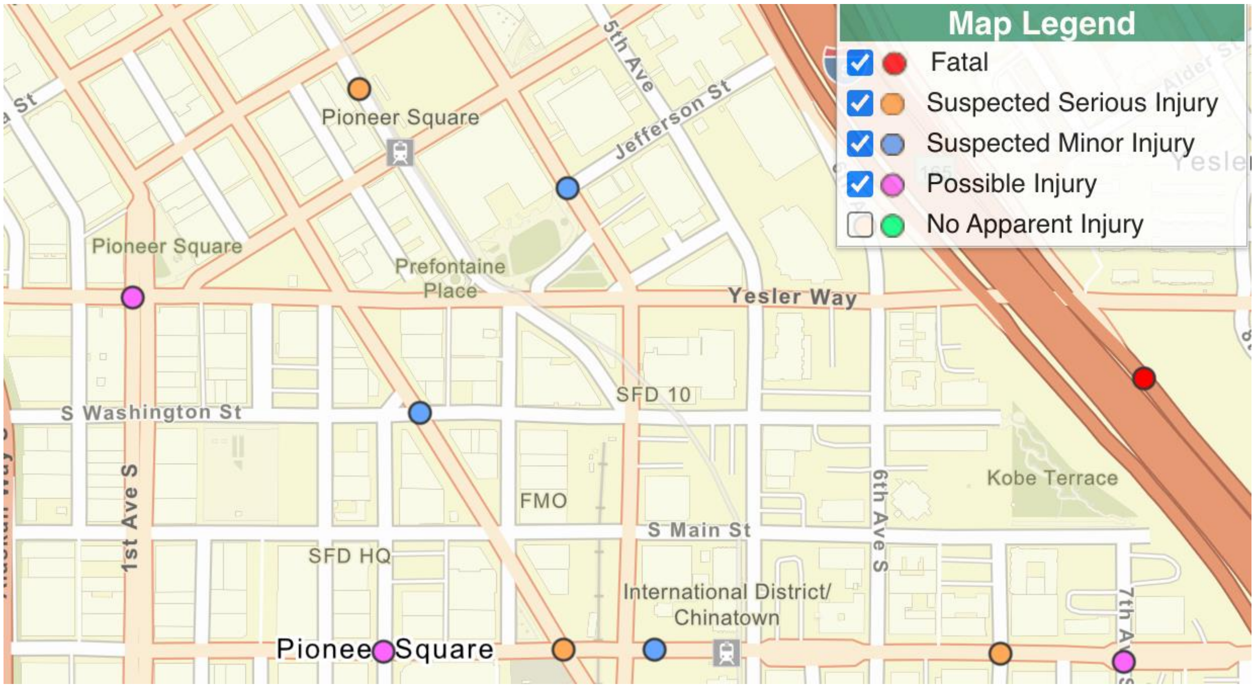


Figure 44. Vulnerable Road User (pedestrian and cyclist) Injuries seen in 2023 in this area (reported) according to WSDOT.[17]

The hour of day and day of week pattern of hard braking follows commute patterns mostly. Saturday and Sunday show increases around noon.

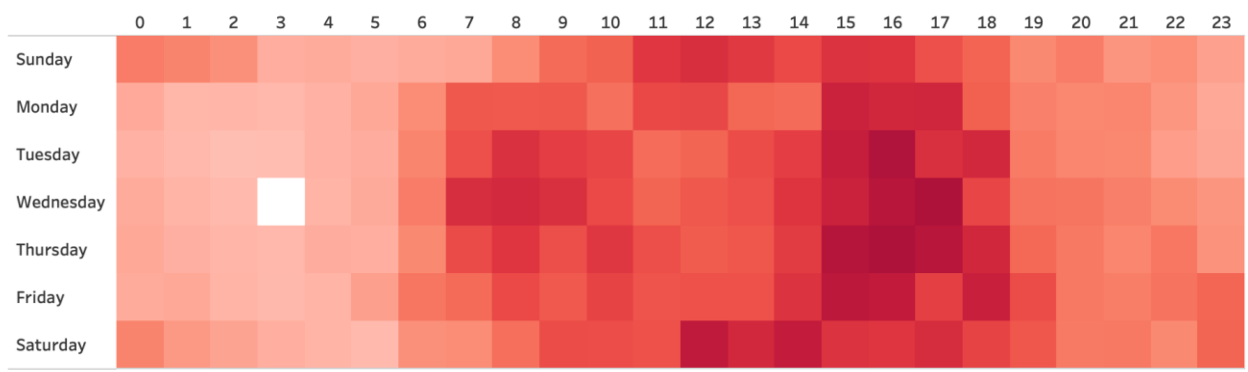


Figure 45. Hard braking hour of day and day of week volume. Cells are a darker red when more braking occurs

Speeding is a function of free-moving traffic. It's common on 2nd Ave extension, 4th Ave, Jackson Street and Alaskan Way.

[17] *https://remoteapps.wsdot.wa.gov/highwaysafety/collision/data/portal/public/*

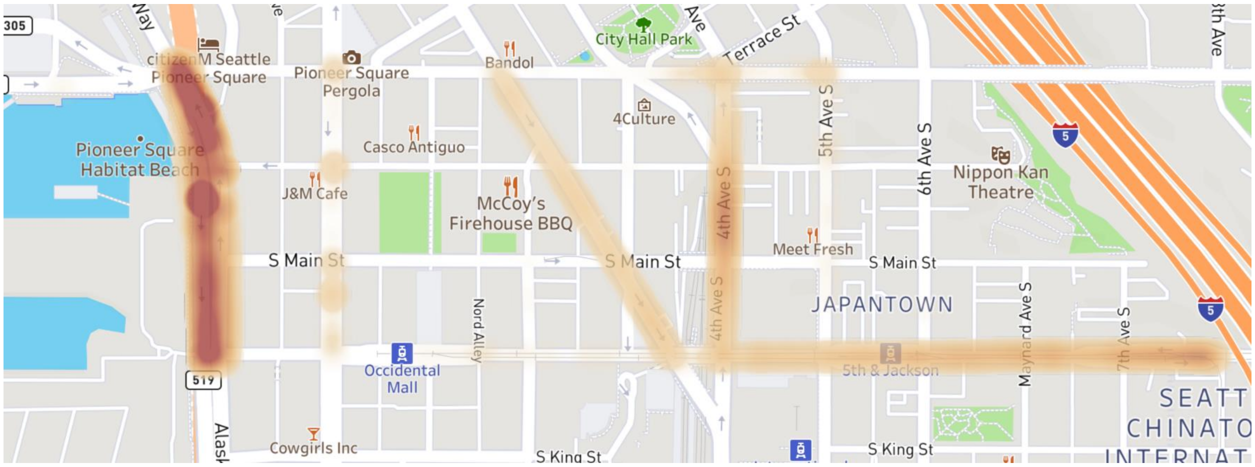


Figure 46. A density map of speeding events where higher intensity of colors demonstrate areas of higher risk.

Finally speeding occurs more commonly in the early hours of the commute, when roads are free enough to get up to speed.

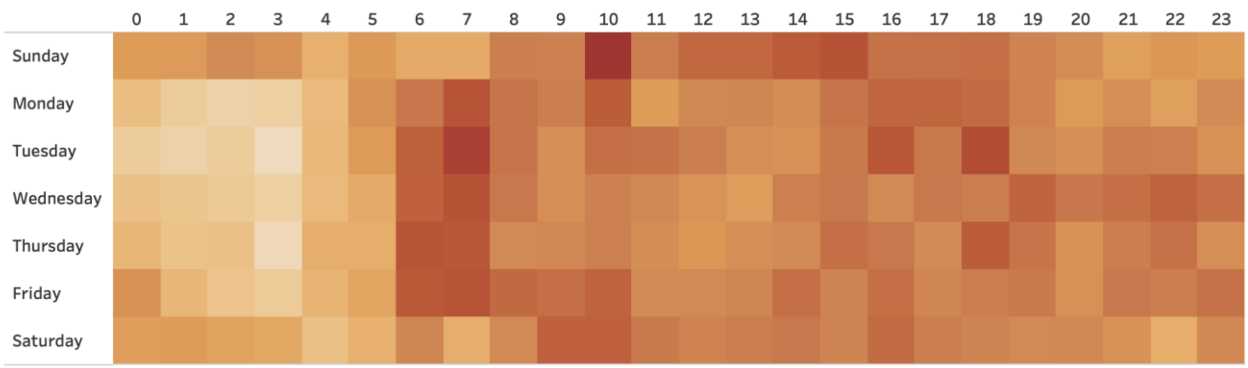


Figure 47. Speeding hour of day and day of week volume. Cells are a darker orange when more speeding occurs

These data show how fine-grained telematics events can provide further insights into the road safety situation in a city and state.

Conclusion

This report has shown that CMT's telematics data is substantial in Washington and can provide insights on driving trends and county-to-county differences. This information can be utilized to identify and address areas of concern. The report also suggests that telematics data could supplement or replace current roadside observation surveys in understanding driver behavior and risky driving areas. For example, telematics data provides a larger sample size and captures a more complete picture of driving habits compared to traditional methods like roadside observations or speed capture devices. This comprehensive view can aid in developing more effective traffic safety interventions.

The analysis of the three cities – Seattle, Spokane, and Vancouver – revealed that city driving often involves higher rates of phone distraction and hard braking compared to their respective counties, while speeding rates are lower. This highlights the varying traffic conditions and driver behaviors across different geographical areas. The report also demonstrated the potential of telematics data in identifying road safety issues within specific locations, as exemplified by the analysis of a disadvantaged neighborhood in Seattle. This granular data can be leveraged to inform targeted interventions and improve road safety for all.