

The background features a blue-tinted image of a multi-lane highway with traffic, viewed from an elevated perspective. Overlaid on this are various data visualization elements such as bar charts, line graphs, and circular gauges, suggesting a focus on traffic intelligence and data analysis.

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SAFER ROADS

Washington GHSA Grant Project

***WASHINGTON TRAFFIC
SAFETY COMMISSION***

August 29, 2024





Washington Traffic Safety Commission (WTSC) and Michelin Mobility Intelligence will leverage driving behavior insights to:

- Gain insight into and understand South King and Yakima County
- Learn about high-risk areas in South King and Yakima County
- Use insights gained to educate the community

DATA TIME FRAME

October 2023 - March 2024

WASHINGTON STUDY

- 1 Overall Analysis of Yakima and South King County:
 - Key Definitions
 - Key Numbers

- 2 Focus area analysis with :
 - Speed bucket analysis
 - Atypical event analysis
 - Specific analysis of the point of interest



- When analyzing and combining crash data and driving behavior insights for the 22 intersections within the city of Yakima, **1ST STREET AND LINCOLN**, **32ND AVE & NOB HILL BLVD**, and **FAIR AVE & NOB HILL BLVD** pose the **HIGHEST RISK**
- For all kinds of roads in Yakima County, the crash risk is **SIGNIFICANTLY HIGHER** from **MIDNIGHT TO 6 AM** and **HIGHER** for **RURAL ROADS**
- The intersection at **MCDONALD AND SOUTH WAPATO ROAD** within the Yakama Reservation is a **HIGH-RISK INTERSECTION**
- The **NORTHERN CORRIDOR** between 140th Ave and 132nd is the **MOST HIGH-RISK** in the 11-mile stretch within South King County
- **SE SUMMIT LANDSBURG & 253RD ST SE** poses a **HIGH RISK** due to **HIGH SPEEDS** and the **ROAD DESIGN** at this intersection



ATYPICAL DRIVING BEHAVIOR EVENTS



A **HARSH BRAKING** event is a decrease in accelerometry above a certain threshold for a certain time. Detected when decelerations falls below -7.1 mph/s



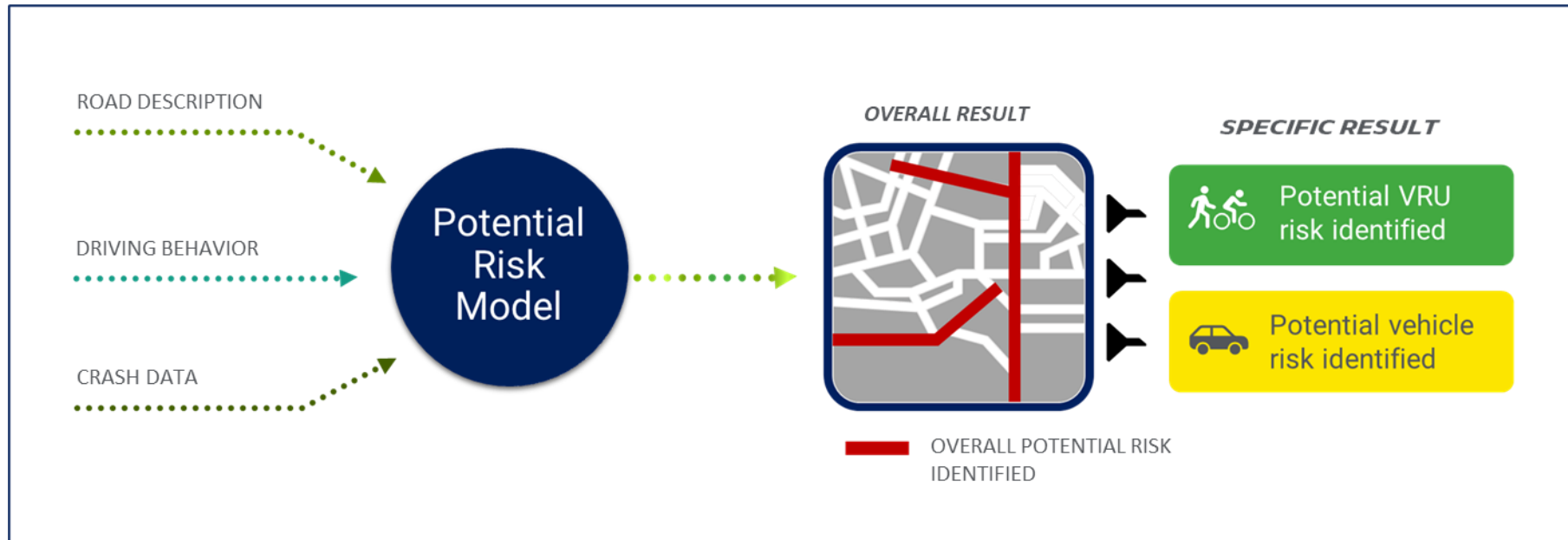
A **HARSH ACCELERATION** event is a sudden increase in speed beyond a certain threshold for a certain time. Detected when acceleration exceeds 7.1 mph/s



V85 SPEED is the speed at or below which 85 percent of the drivers travel on a road segment



Systemic approach to assess the probability of areas which could be risky using road features and historical crash data



Vulnerable Road Users (VRU) risk analysis provides insights into the risks to Pedestrians & Cyclists. It provides an understanding of road segments where there is a high probability of VRU presence and where they might be at risk.

Michelin Mobility Intelligence uses the systemic approach to road safety to highlight the road segments where there is high probability of VRU presence and where there is high probability of interaction between VRUs and motorized vehicles. The road segments are identified using Michelin's proprietary machine learning model, which creates a location signature based on (road infrastructure, points of interest, traffic volumes and speeds, past VRU crash data, etc.) and applies this signature to other matching road segments within the area of focus.

When combined with driving behavior insights, these VRU insights assist in identification of VRU risk hotspots where VRUs might be at a greater risk of a near-miss or crash with a motorized vehicle.

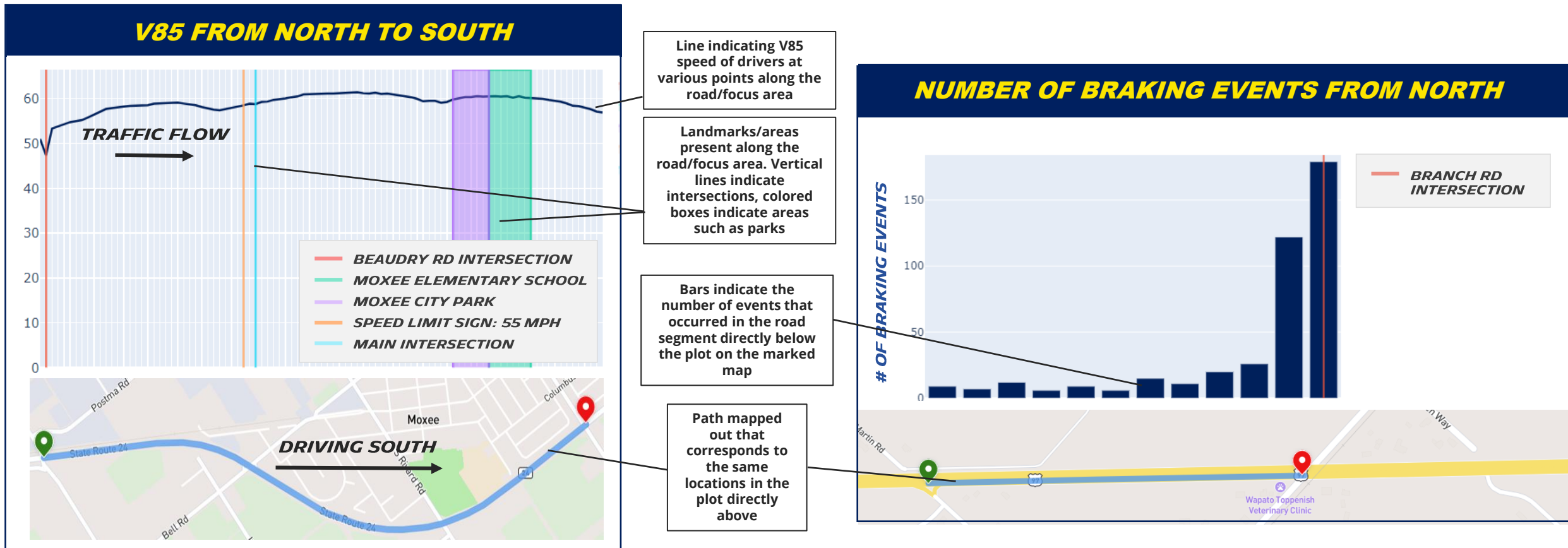


INTERPRETATION OF V85 SPEED & EVENT PLOTS

EXAMPLES:

Below are two types of plots, a V85 speed plot and a braking event plot, similar to those used to show driving behavior in certain focus areas.

The V85 plot shows the V85 speed for each section of road as drivers travel along the path that is highlighted on the map below the plot, and the braking event plot shows the number of harsh braking events that happen in each section of road, again highlighted below the plot.



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01 *OVERALL ANALYSIS*



KEY NUMBERS

DATA USED IN THE STUDY

YAKIMA



Miles of Road



GPS Points Collected



Total Driving Hours



Braking Events



Acceleration Events

SOUTH KING



Miles of Road



GPS Points Collected



Total Driving Hours



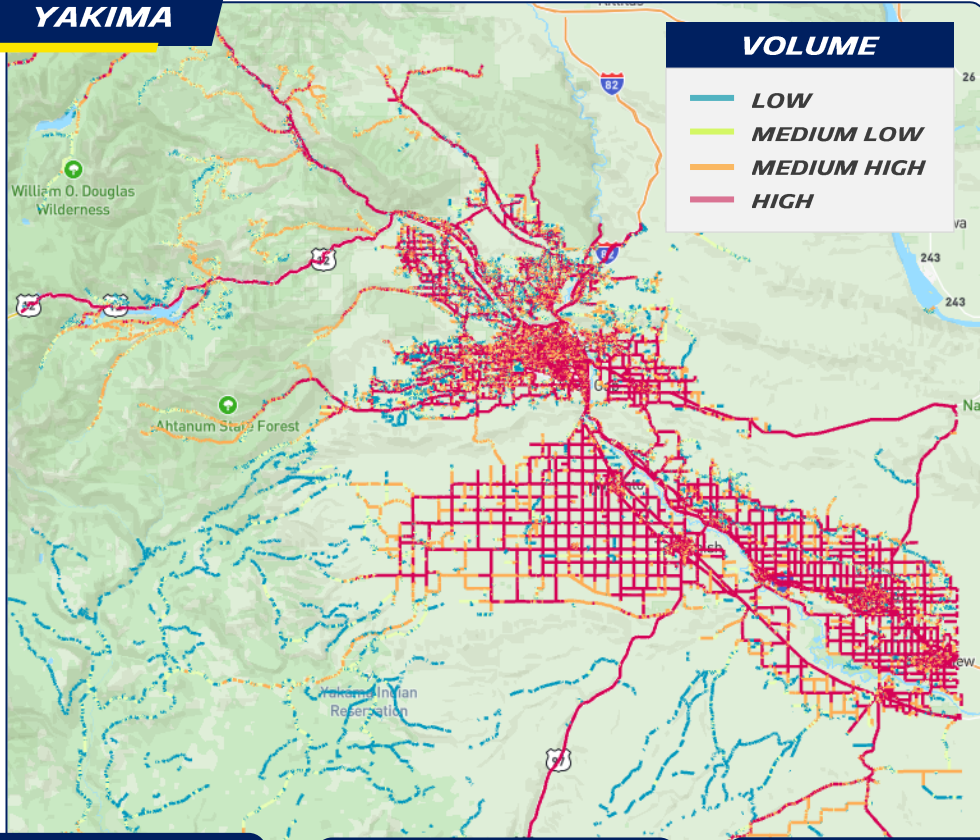
Braking Events



Acceleration Events

DATA VOLUME ACROSS ROAD NETWORKS

YAKIMA



TRIP POINTS

85 Million Trips per Month

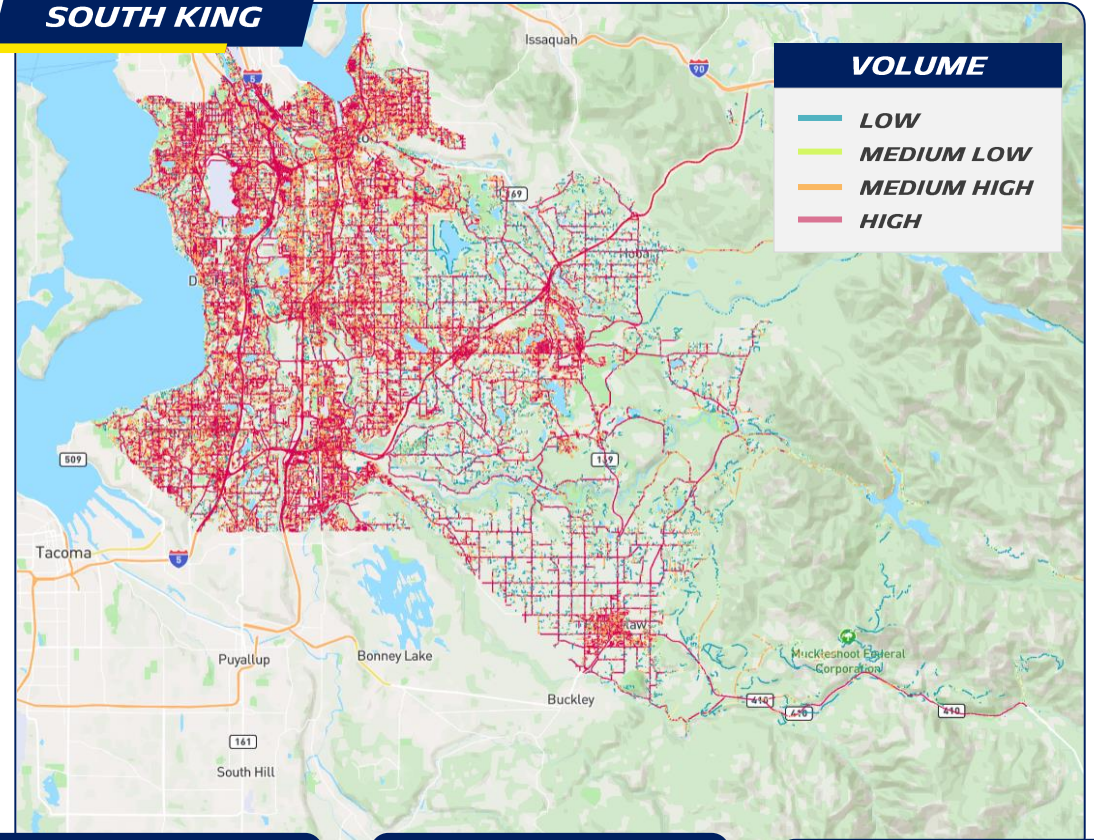
ATYPICAL EVENTS

234 Million per Month

2020 POPULATION

257,000 Residents

SOUTH KING



TRIP POINTS

234 Million Trips per Month

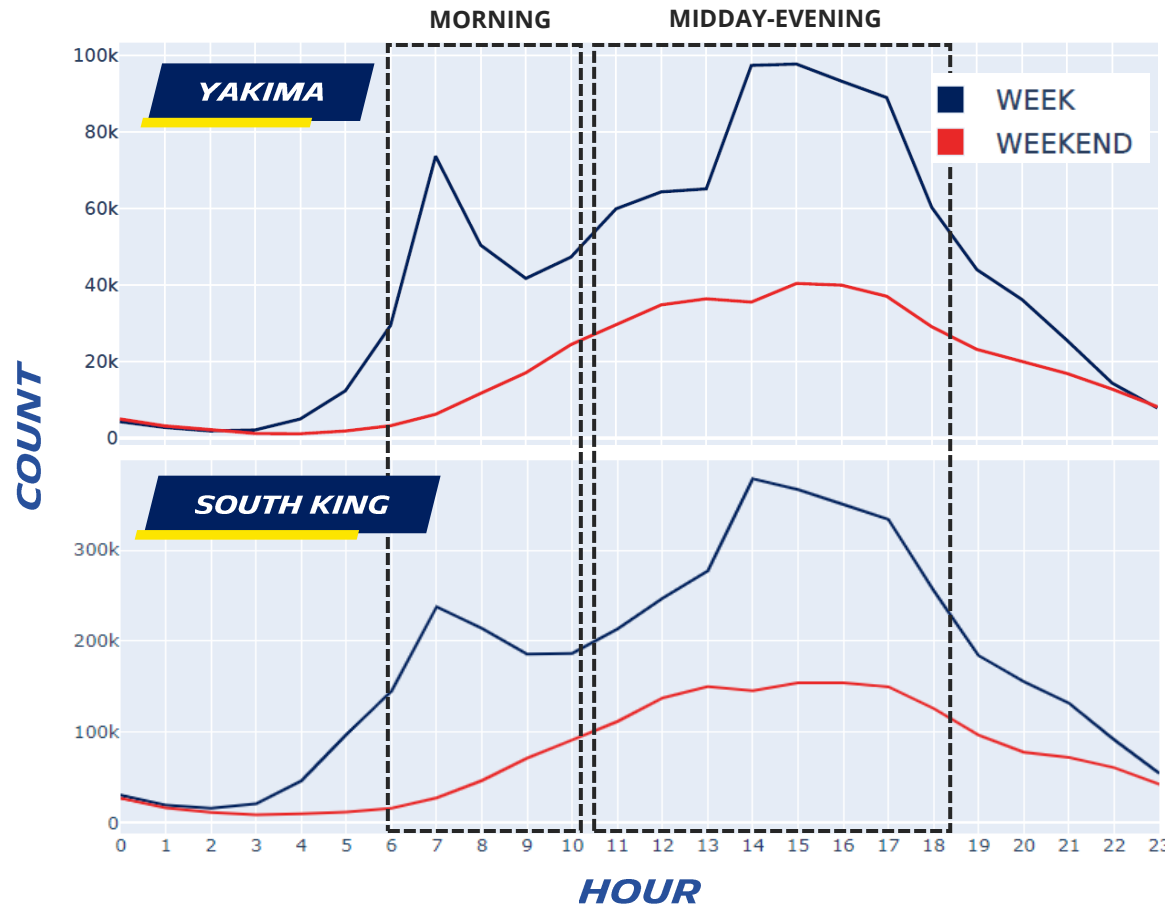
ATYPICAL EVENTS

1 Million per Month

2023 POPULATION

664,000 Residents

EVOLUTION OF ATYPICAL EVENTS



SUMMARY OF ATYPICAL EVENTS

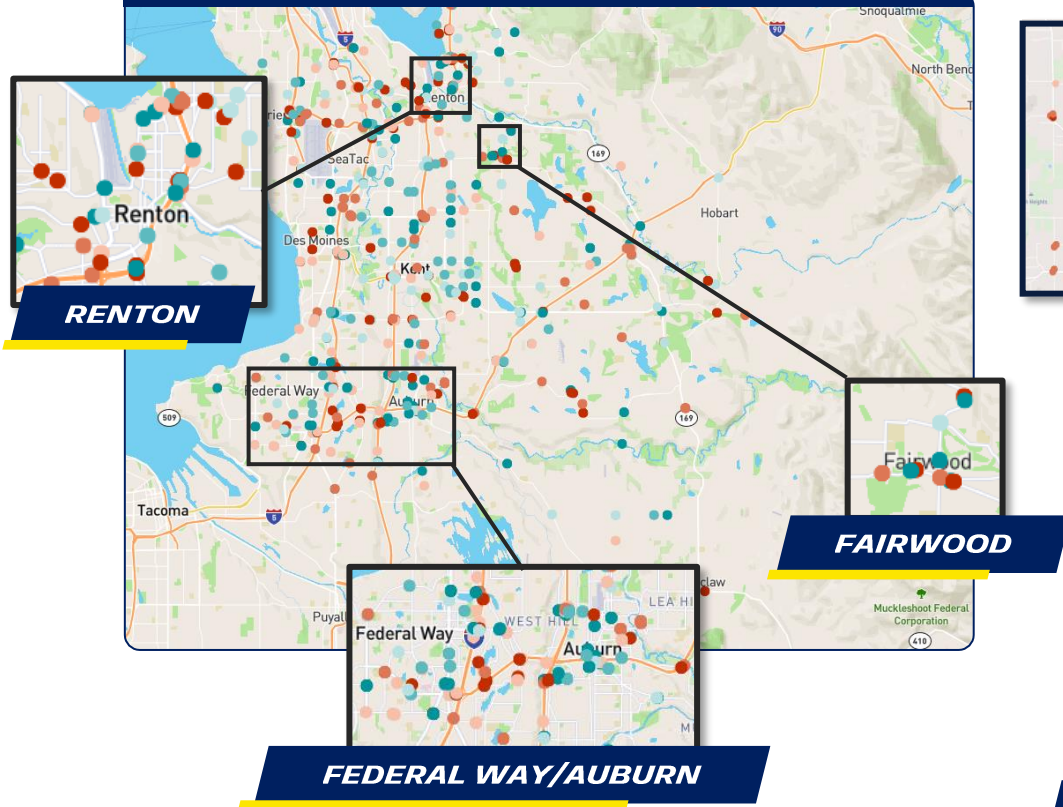
	Yakima	South King
Harsh Braking	1.2M	5M
Harsh Acceleration	242K	1M
Peak Hour (Week)	2:00 pm	2:00 pm
Peak Hour (Weekend)	3:00 pm	3:00 pm

OBSERVATIONS:

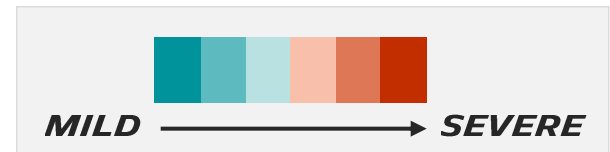
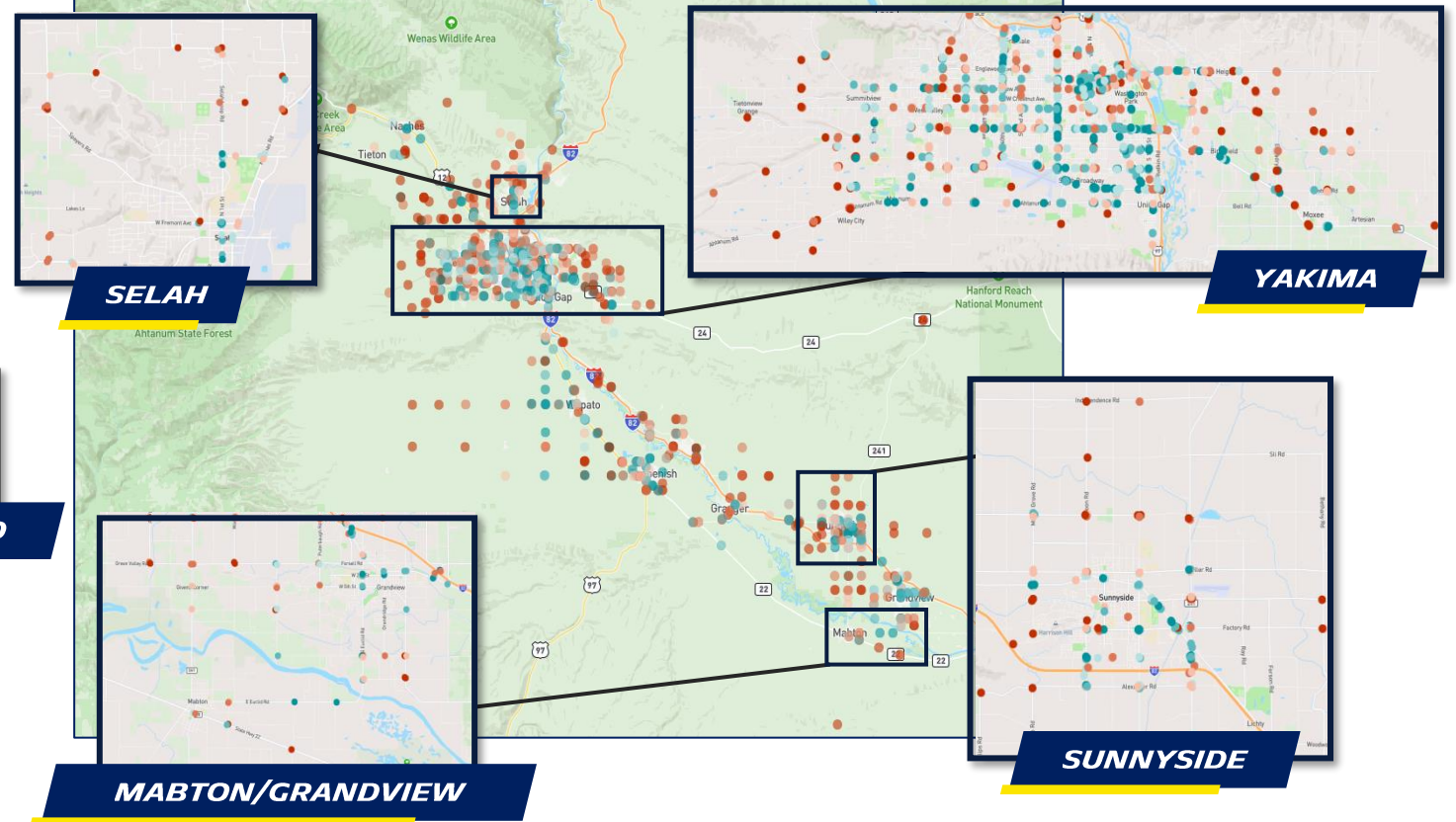
- Braking events are 4-5 times more likely than harsh acceleration (regardless of the week's context)
- Atypical events peak at 7 am and during the evening rush hour on weekdays
- Atypical events are more spread out on weekends, with a plateau from 1 pm to 5 pm

RISK HOTSPOTS FOR KING COUNTY AND YAKIMA COUNTY

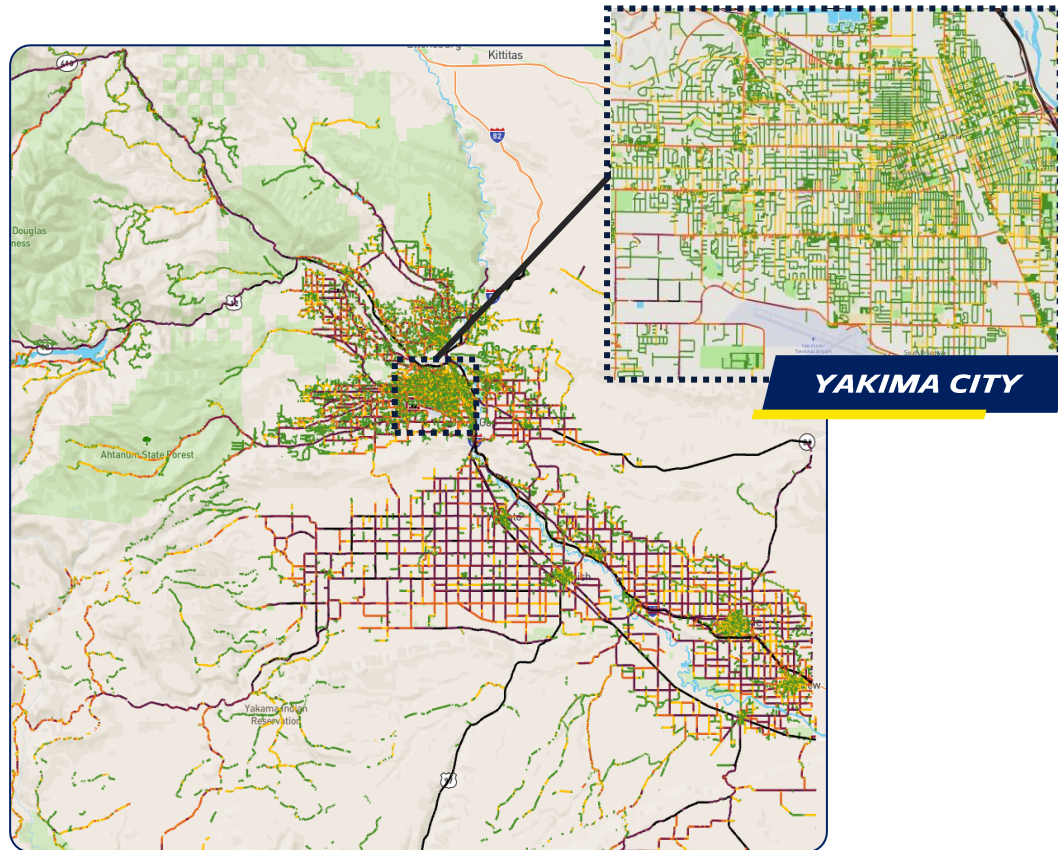
KING COUNTY: ~2.7k hotspots



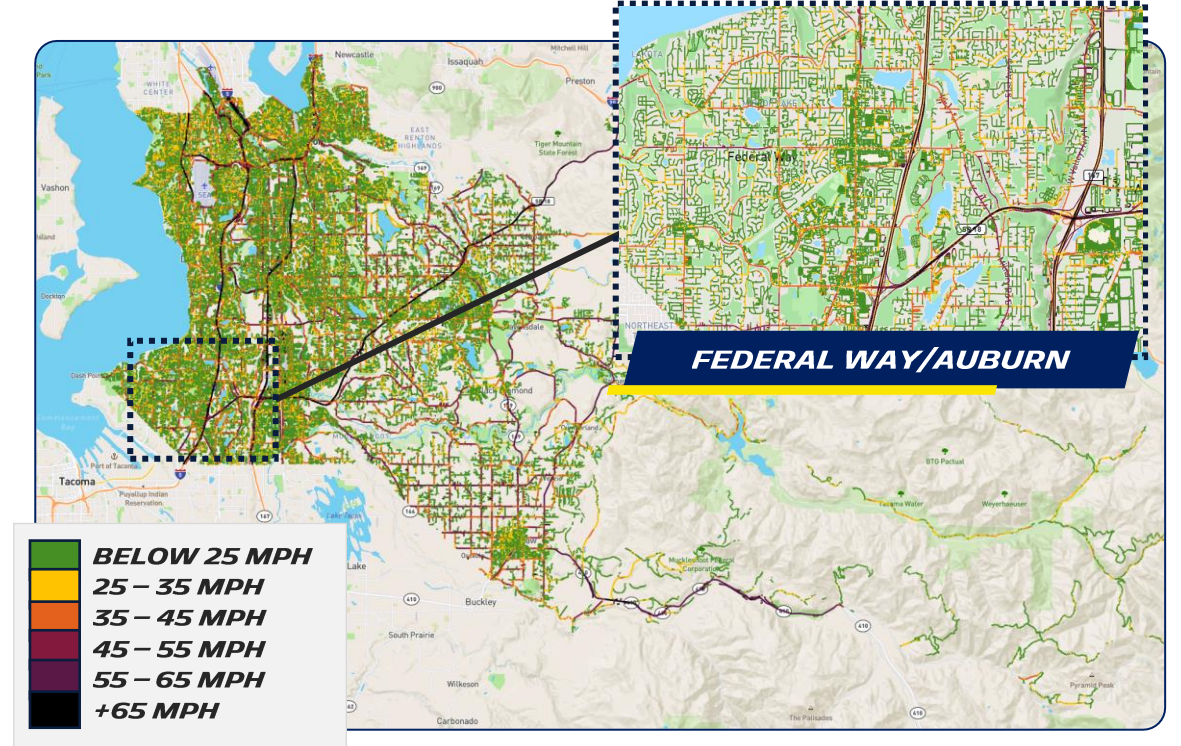
YAKIMA COUNTY: ~1.4k hotspots



V85 – YAKIMA COUNTY



V85 – SOUTH KING COUNTY

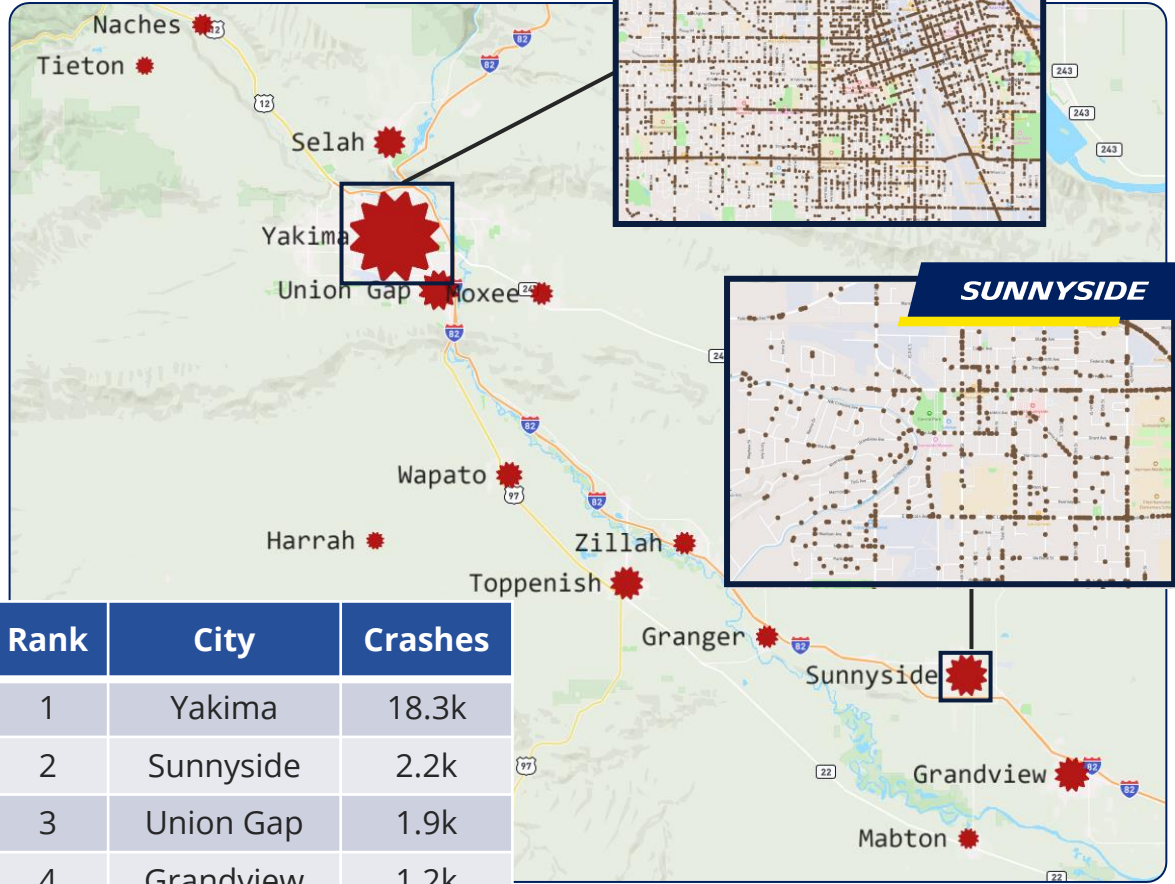


OBSERVATIONS:

- The V85 is lower in urban settings and may be attributed to increased traffic congestion, lower speed limits and/or enforced speed limits.
- Despite the overall slower V85, higher-speed corridors are still prevalent in urban areas, particularly in South King County.

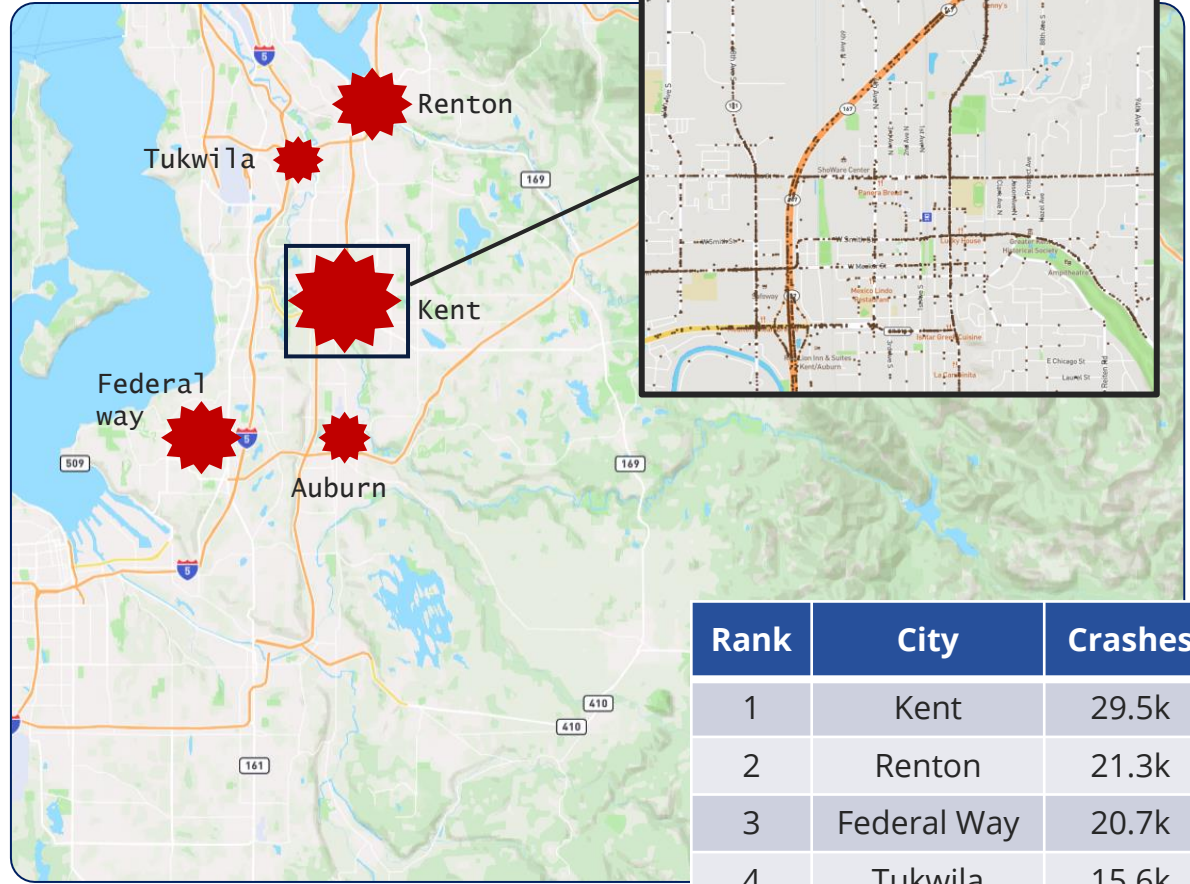
CRASH DISTRIBUTION MAP

YAKIMA COUNTY



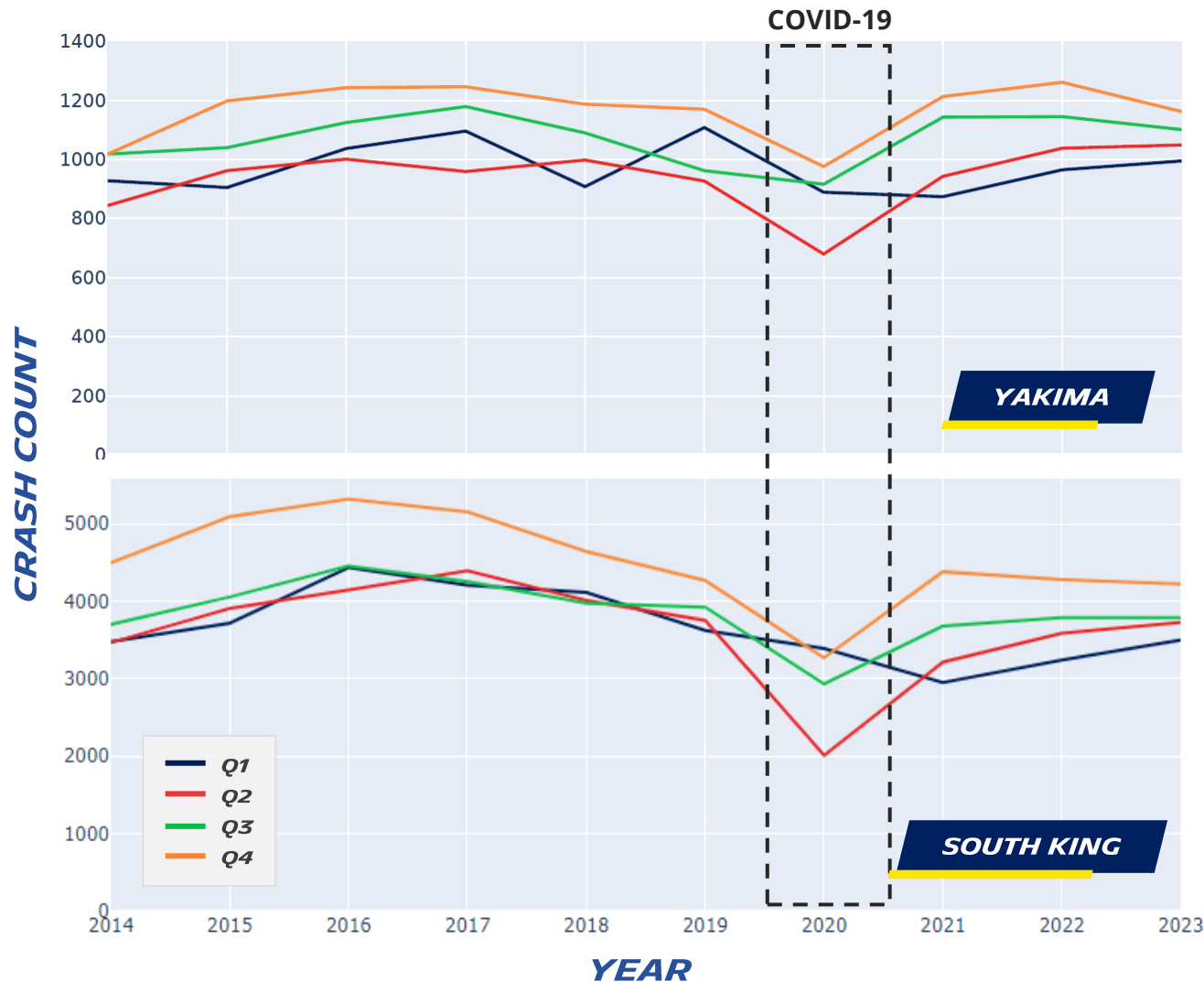
Rank	City	Crashes
1	Yakima	18.3k
2	Sunnyside	2.2k
3	Union Gap	1.9k
4	Grandview	1.2k
5	Toppenish	.9k

SOUTH KING COUNTY



Rank	City	Crashes
1	Kent	29.5k
2	Renton	21.3k
3	Federal Way	20.7k
4	Tukwila	15.6k
5	Auburn	14.9k

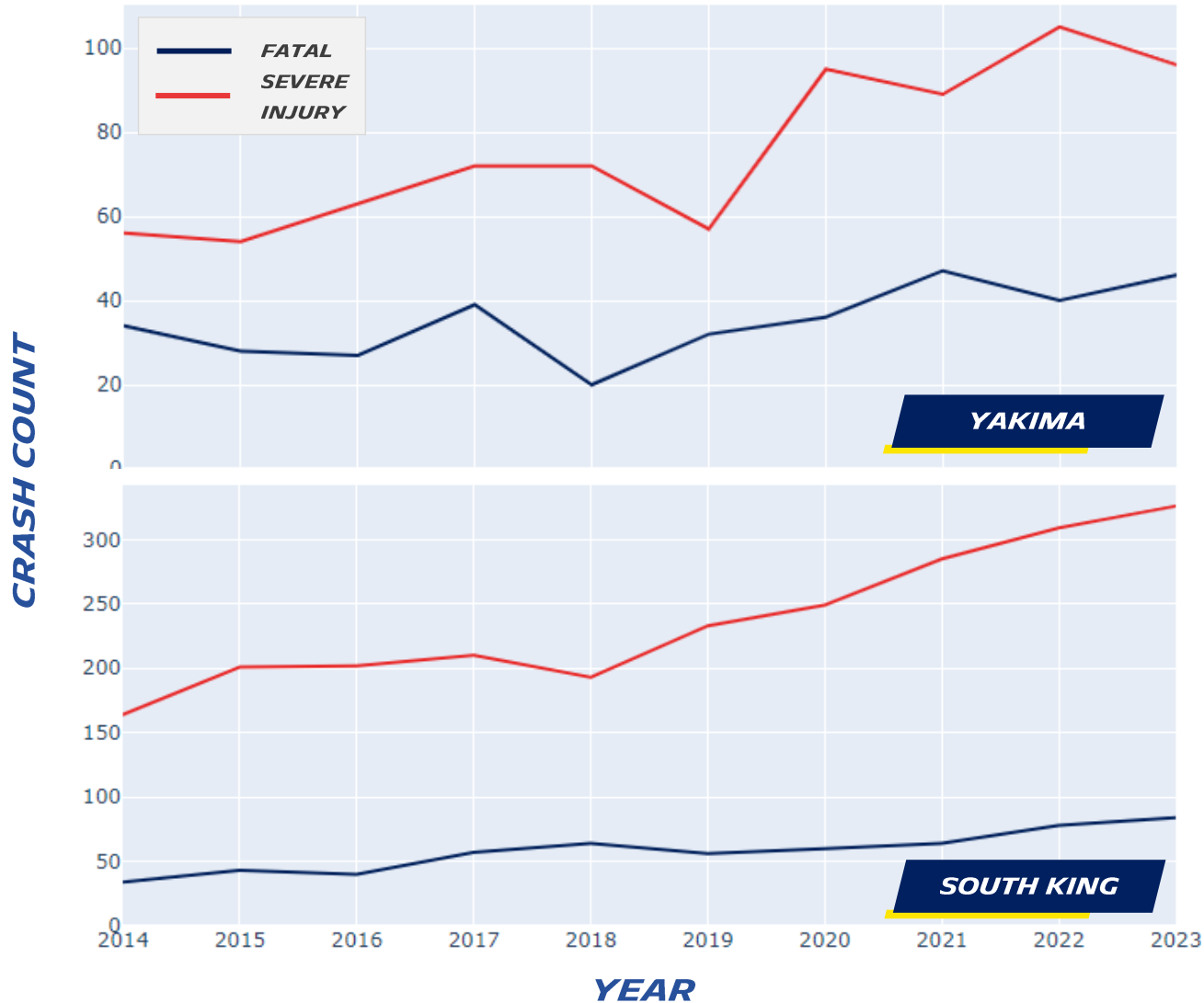
TEMPORAL EVOLUTION OF CRASH COUNTS



OBSERVATIONS:

- Total of 41.5k and 175k crashes recorded in Yakima and South King counties, respectively, over the past 10 years
- South King has seen a decline in total yearly crashes since a 2016 peak, stabilizing post-2021; Yakima's trend remains steady.
- In South King, 10% reduction in annual crashes since 2014-2016, despite a 17.5% population increase (2010-2020)
- Notable dip in crashes during the COVID-19 pandemic due to reduced traffic
- Crashes are more frequent in Q4 across both counties

TEMPORAL EVOLUTION OF SEVERE CRASH COUNTS



CRASH SEVERITY DEFINITION

All crashes in the dataset are assigned 1 of 5 severity levels (Fatal, Severe Injury, Minor Injury, Possible Injury, Property Damage Only/No Injury) based on the most severe outcome present in the crash.

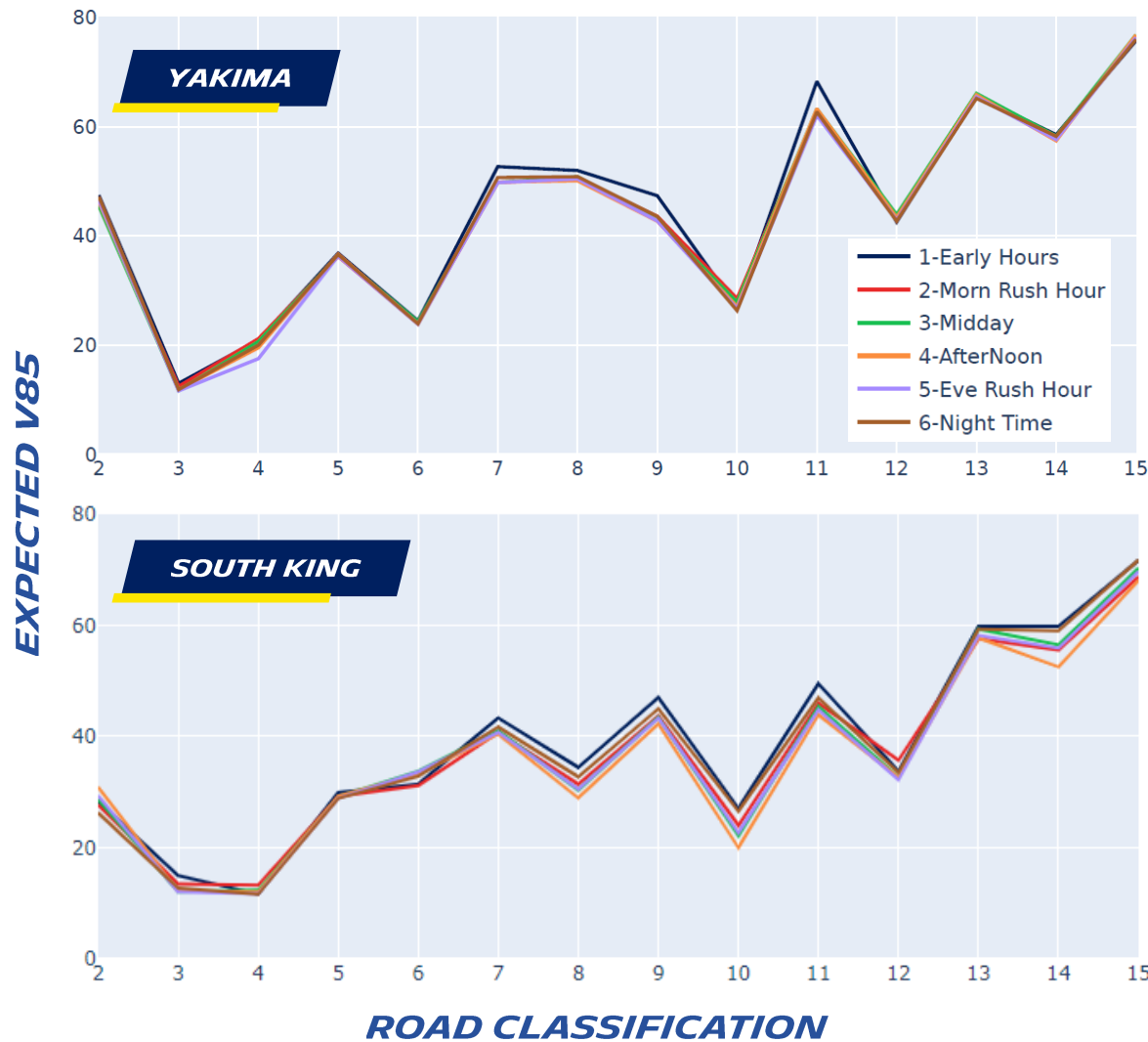
For example, if two people are injured in a crash, one severely and one lightly, the crash will be labeled a severe injury crash.

OBSERVATIONS:

- 349 fatal and 759 severe injury crashes were recorded in Yakima County between 2014-2023
- 580 fatal and 2372 severe injury crashes were recorded in south King County between 2014-2023

	2014 - 2016 Yearly Avg. Yakima S. King	2021 - 2023 Yearly Avg. Yakima S. King	% Change Yearly Avg. Yakima S. King
Total	4106 15450	4296 13717	+4.6% -11.2%
Fatal	30 39	44 75	+46.7% +92.3%
Severe Injury	58 189	97 307	+67.2% +62.4%
Minor Injury	266 965	376 1425	+41.4% +47.7%
Possible Injury	890 3838	698 2573	-21.6% -33.0%
PDO	2863 10419	3081 9336	+7.6% -10.4%

V85 BY ROAD TYPE



OSM ROAD CLASSIFICATION

- | | |
|-------------------|-------------------|
| 2. Unclassified | 9. Secondary |
| 3. Service | 10. Primary Link |
| 4. Living Street | 11. Primary |
| 5. Residential | 12. Trunk Link |
| 6. Tertiary Link | 13. Trunk |
| 7. Tertiary | 14. Motorway Link |
| 8. Secondary Link | 15. Motorway |

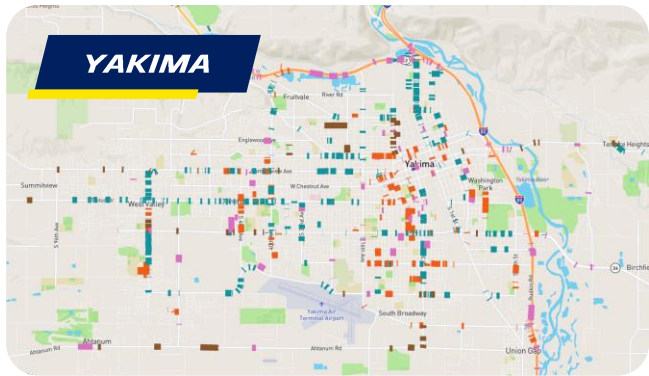
OBSERVATIONS:

- The time-of-day impact on V85 values is minimal, with differences typically ranging within 5 – 10 mph for both counties, irrespective of road type.
- Road type is a key determinant of V85, with higher-priority roads showing higher speeds due to higher speed limits, and reduced congestion.
- Roads in Yakima see higher speeds than the same road types in South King, and the roads in South King see more variation in V85 speed across time of day than most road types in Yakima. This is likely partially explained by the higher traffic density of South King.

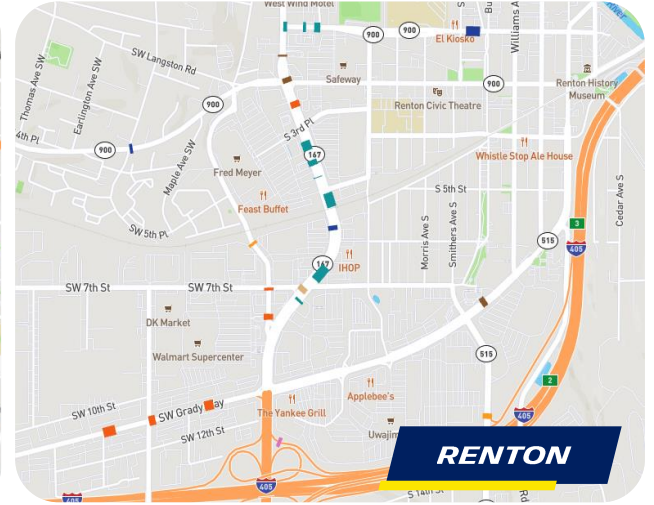
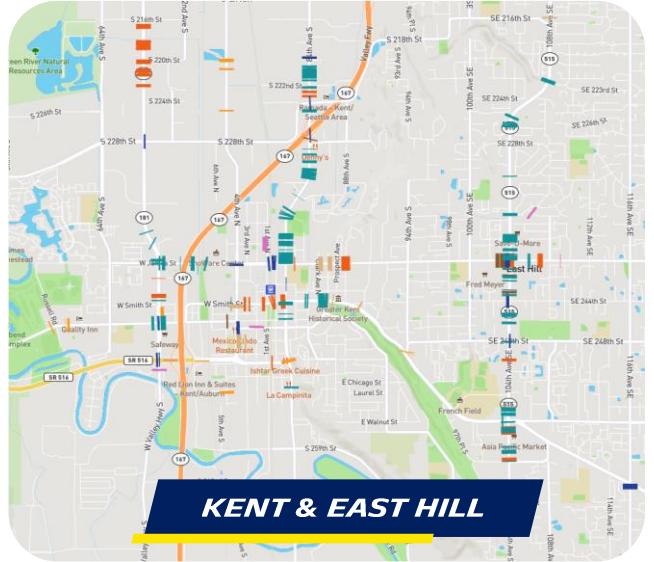
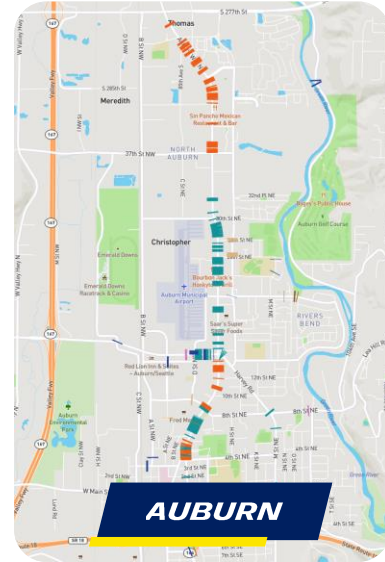
RISK HOTSPOTS FOR VULNERABLE ROAD USERS

HIGH-RISK AREAS FOR PEDESTRIANS AND CYCLISTS

YAKIMA



SOUTH KING



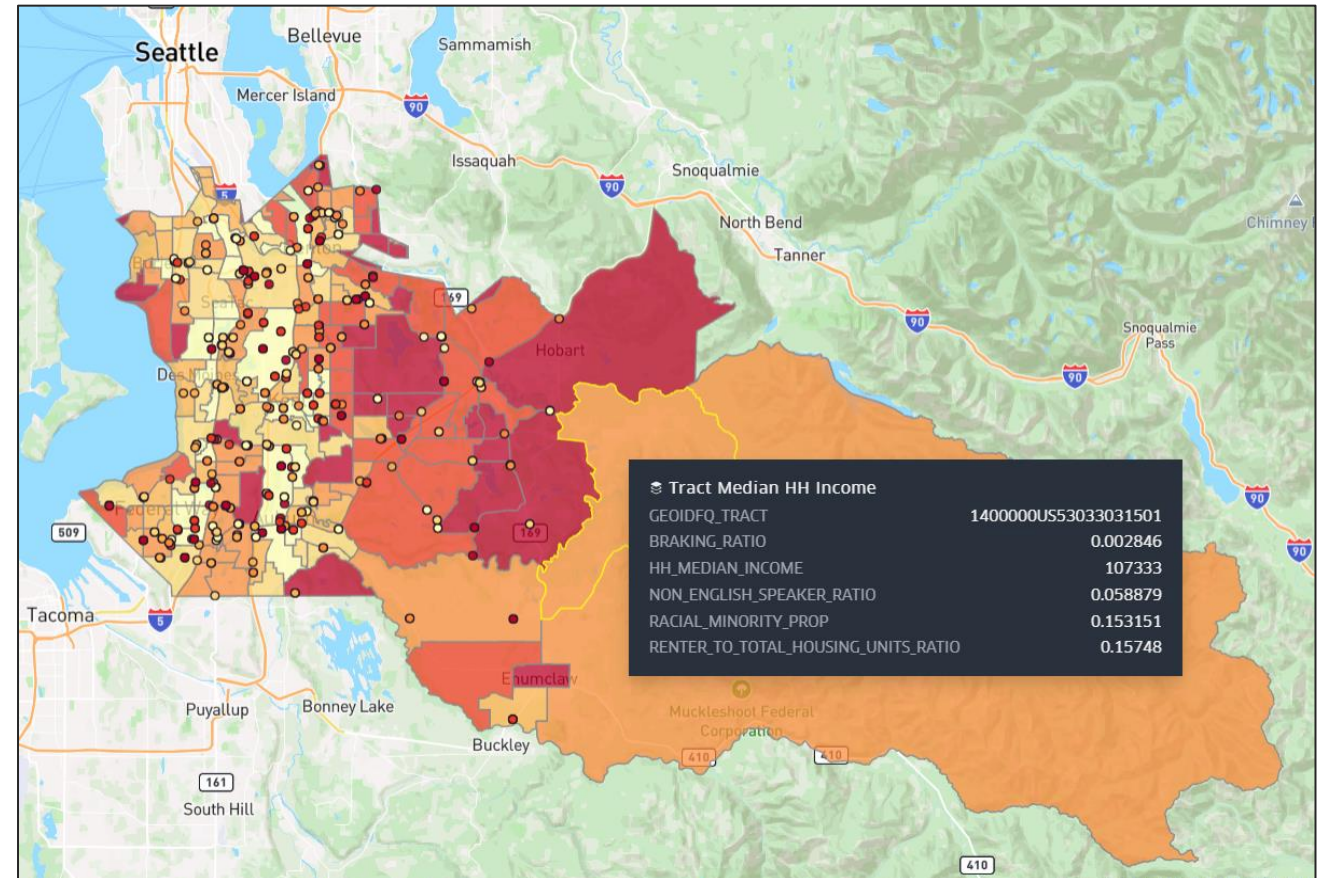
- CYCLISTS, PEDESTRIANS, VEHICLES
- CYCLISTS, PEDESTRIANS
- CYCLISTS, VEHICLES
- CYCLISTS
- PEDESTRIANS, VEHICLES
- PEDESTRIANS
- VEHICLES

DELIVERABLE HIGHLIGHT:

The Kepler maps with socioeconomic and demographic data will provide a better understanding of the relationships between socioeconomic/demographic factors and driving risk factors.

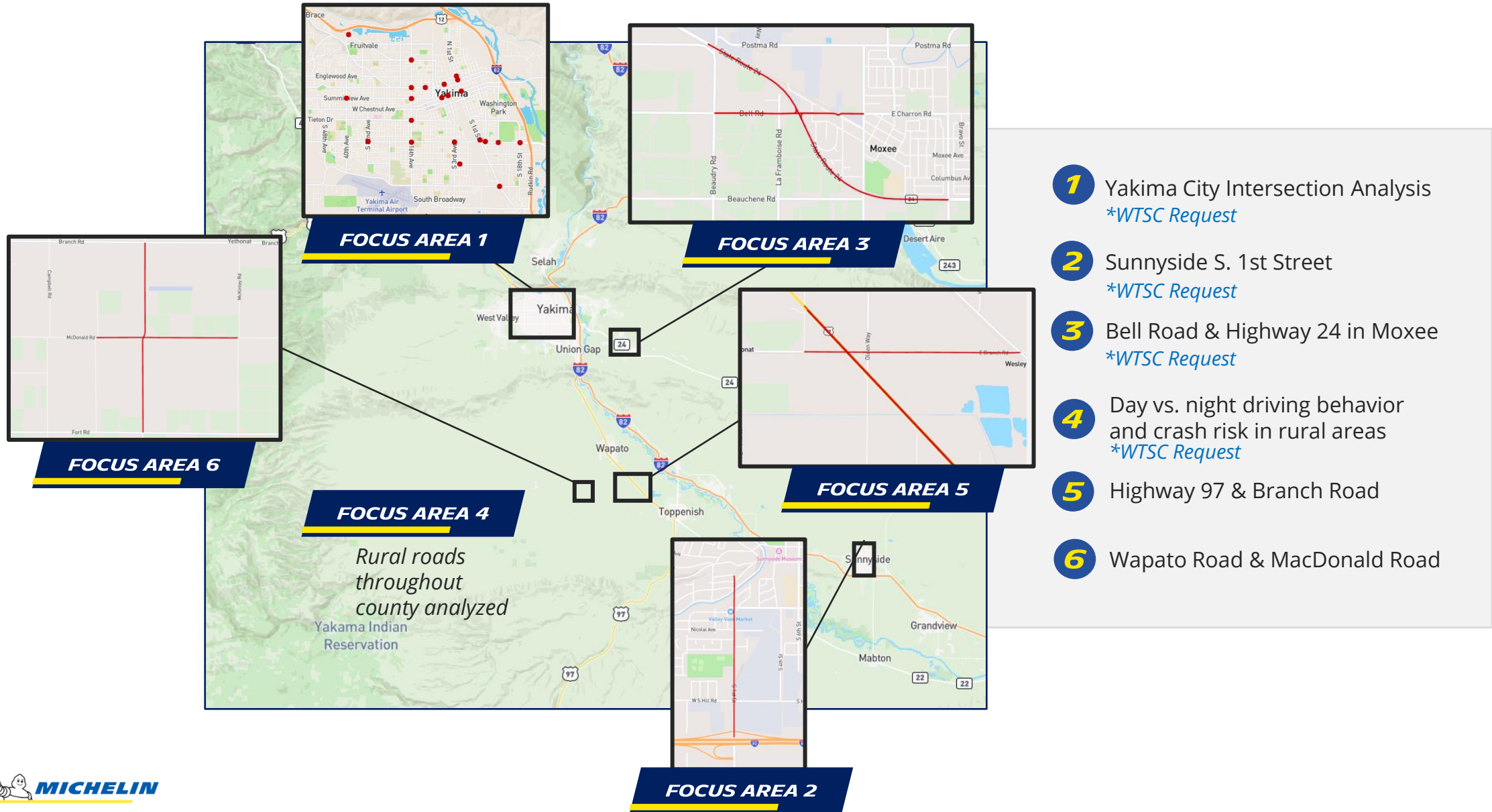
EXAMPLE:

This image shows a view from a Kepler map, included among the deliverables, that indicates the location of braking severity hotspots overlaid on median tract household income.



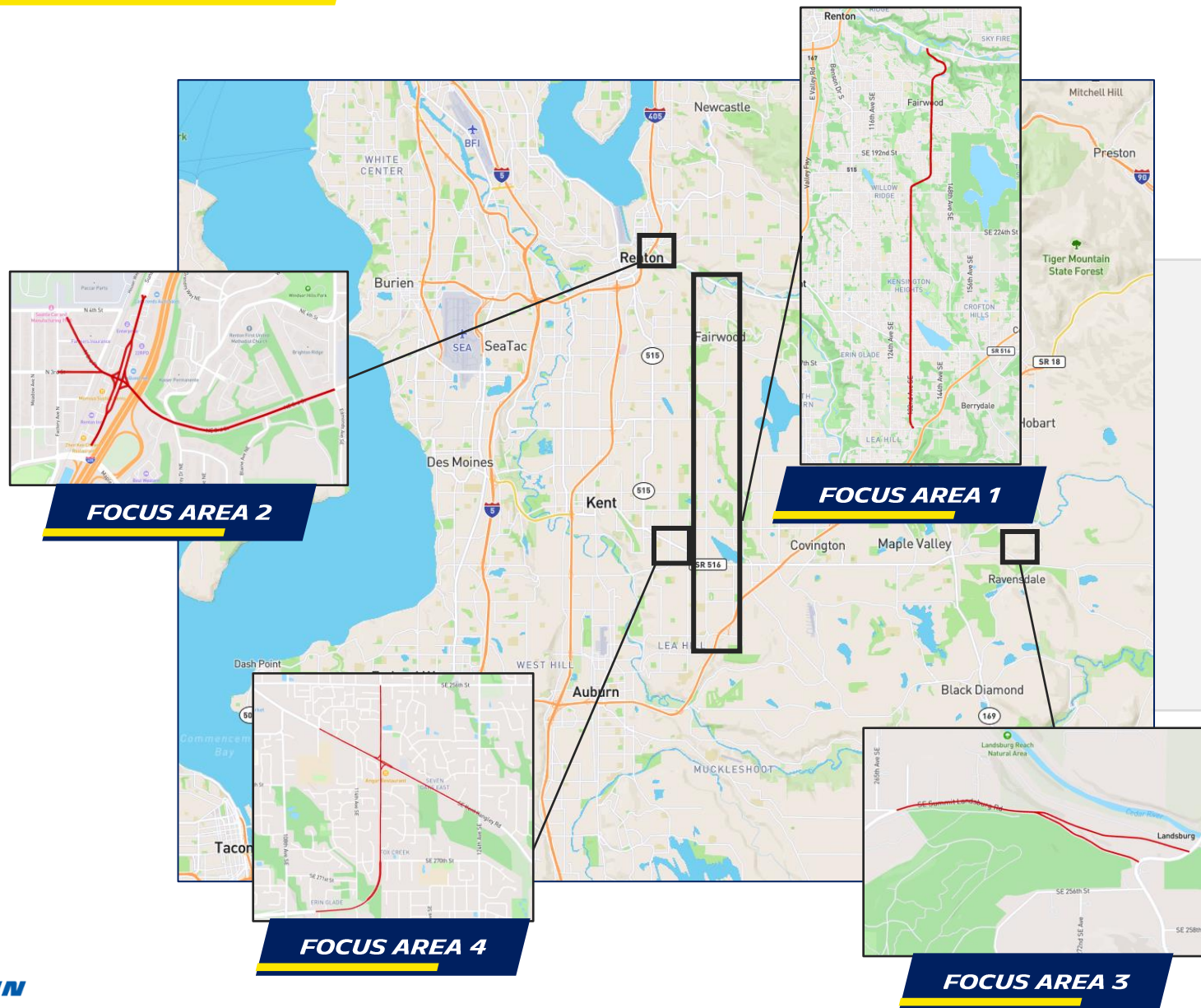
SOUTH KING COUNTY BRAKING HOTSPOTS OVERLAID ON TRACT HH INCOME

YAKIMA FOCUS AREA OVERVIEW



- 1** Yakima City Intersection Analysis
**WTSC Request*
- 2** Sunnyside S. 1st Street
**WTSC Request*
- 3** Bell Road & Highway 24 in Moxee
**WTSC Request*
- 4** Day vs. night driving behavior and crash risk in rural areas
**WTSC Request*
- 5** Highway 97 & Branch Road
- 6** Wapato Road & MacDonald Road

SOUTH KING FOCUS AREA OVERVIEW



- 1** 140th Avenue Corridor
**WTSC Request*
- 2** Sunset Boulevard turn from N. 3rd Street
- 3** SE Summit Landsburg & 253rd Street
- 4** Kent-Kangley Road & 116th Avenue SE



YAKIMA FOCUS AREAS

- Six focus areas (*4 selected by WTSC, 2 identified for deeper dives via driving behavior analysis*)
 - 22 Yakima city intersection analyses
 - 2 corridor analyses
 - Day/Night Crash Risk analysis
 - 2 intersection analyses

SOUTH KING FOCUS AREAS

- 4 focus areas (*1 selected by WTSC, 3 identified for deeper dives via driving behavior analysis*)
 - 1 corridor
 - 3 intersections

Area	Location	County	Origin	Focus Area Type	Top Behavior/Risk Type(s)	Area Crash History
1.	City of Yakima Intersections	Yakima	WTSC	Area	Multiple	High
2.	Sunnyside – S. 1st St.	Yakima	WTSC	Corridor	Speed, VRU	High
3.	Moxee – Bell Rd. & Hwy 24	Yakima	WTSC	Corridor	Accel. & Braking Severity	Moderate
4.	Rural crash risk – Day vs. Night	Yakima	WTSC	Area	Multiple	-
5.	Toppenish – US-97 & Branch Rd.	Yakima	MMI	Intersection	Speed, Accel. Severity	High
6.	Toppenish – Wapato Rd. & McDonald Rd.	Yakima	MMI	Intersection	Speed, Braking Severity	Moderate
7.	140th/132nd Ave Corridor	South King	WTSC	Corridor	Multiple	High
8.	Renton – Sunset Blvd. & 3rd St.	South King	MMI	Intersection	Accel. Severity	High
9.	Ravensdale – 253rd & Summit-Landsburg	South King	MMI	Intersection	Speed, Braking Severity	Low
10.	Kent - 116th Ave. & Kent-Kangley Rd.	South King	MMI	Intersection	Speed, Accel Severity	High

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YAKIMA CITY INTERSECTION ANALYSIS

Initial Crash-based risk ranking

Intersection Name	Crashes
16 TH AVE & NOB HILL BLVD	46
40 TH AVE & SUMMITVIEW AVE	26
1 ST ST & NOB HILL BLVD	26
FAIR AVE & NOB HILL BLVD	24
16 TH AVE & LINCOLN AVE	24
3 RD AVE & NOB HILL BLVD	23
5 TH AVE & YAKIMA AVE	23
1 ST ST & MEAD AVE	23
1 ST ST & LINCOLN AVE	20
16 TH AVE & FRUITVALE BLVD	20
40 TH AVE & FRUITVALE BLVD	20
1 ST ST & D ST	19
3 RD AVE & LINCOLN AVE	19
3 RD AVE & YAKIMA AVE	18
1 ST ST & YAKIMA AVE	18
32 ND AVE & NOB HILL BLVD	17
6 TH ST & NOB HILL BLVD	17
CUSTER AVE & LINCOLN AVE	16
16 TH AVE & TIETON DR	16
1 ST ST & WASHINGTON AVE	15
18 TH ST & NOB HILL BLVD	15
16 TH AVE & SUMMITVIEW AVE	15

RISK DIAGNOSIS

Each of the 22 intersections were evaluated using MMI’s Driving Behavior Severity Ranking (DBSR) and Vulnerable Road User (VRU) risk assessment to determine overall risk at a given intersection.

Diagnostic Factors:

- DBSR (Harsh Braking, Harsh Acceleration) – Severity
- DBSR (Harsh Braking, Harsh Acceleration) – Hotspot count
- VRU – Number of high-risk road sections

Approach:

- Each intersection was assigned an overall risk level based on:
 - Number of DBSR hotspots present
 - Severity of those hotspots
 - Presence of VRU risk
- For reference, a hypothetical “high risk” intersection with multiple lanes and dedicated turn lanes could easily have 4 or more hotspots, as hotspots can be entering or leaving the intersection and can be either harsh braking or acceleration hotspots.

Note on Crash Ranking:

- This initial ranking only considered crash totals, not severity. Crash severity will be layered into this analysis to provide more context. Injury types considered were Fatal, Severe, and Minor.

*Note: these crash counts, provided by the City of Yakima task force, generally align with the 4-year crash counts from 2020-2023 in the larger crash dataset provided by the WTSC. There are slight discrepancies due to differences in where the exact boundaries of the intersections are set.

RISK LEVEL ASSIGNMENT BY DRIVING BEHAVIOR

RISK LEVEL ASSIGNMENT

After factoring in DBSR and VRU outputs, the 22 intersections were assigned one of five risk levels.

Risk Level Classifications

- 5: 3+ AND very severe driving behavior hotspots present
- 4: Either 2+ moderate OR 1 very severe hotspot present
- 3: Either 2 moderate hotspots OR 1 severe hotspot present
- 2: 1 moderate hotspot present
- 1: 0 hotspots present

Key Takeaways

- Most of these intersections exhibit patterns of risky driving behavior to varying degrees.
 - 14 of the 22 intersections (Groups 5 & 4) would be classified as notably risky intersections based only on behavior
 - 8 of the 22 (Groups 3-1) would not be classified as especially risky intersections based only on behavior, although some risky behavior is still present
- Other intersections in Yakima City outside these 22 are as risky or riskier.

Crash total-based risk ranking

(Injury severity is not considered in this ranking, provided only for context)

Intersection Name	Crashes	Crashes with Injury	Proportion of Crashes with Injury
16 TH AVE & NOB HILL BLVD	46	5	0.11
40 TH AVE & SUMMITVIEW AVE	26	1	0.04
1 ST ST & NOB HILL BLVD	26	3	0.12
FAIR AVE & NOB HILL BLVD	24	3	0.13
16 TH AVE & LINCOLN AVE	24	3	0.13
3 RD AVE & NOB HILL BLVD	23	3	0.13
5 TH AVE & YAKIMA AVE	23	3	0.13
1 ST ST & MEAD AVE	23	1	0.04
1 ST ST & LINCOLN AVE	20	2	0.10
16 TH AVE & FRUITVALE BLVD	20	4	0.20
40 TH AVE & FRUITVALE BLVD	20	2	0.10
1 ST ST & D ST	19	1	0.05
3 RD AVE & LINCOLN AVE	19	2	0.11
3 RD AVE & YAKIMA AVE	18	4	0.22
1 ST ST & YAKIMA AVE	18	2	0.11
32 ND AVE & NOB HILL BLVD	17	1	0.06
6 TH ST & NOB HILL BLVD	17	3	0.18
CUSTER AVE & LINCOLN AVE	16	4	0.25
16 TH AVE & TIETON DR	16	1	0.06
1 ST ST & WASHINGTON AVE	15	1	0.07
18 TH ST & NOB HILL BLVD	15	2	0.13
16 TH AVE & SUMMITVIEW AVE	15	2	0.13

Behavior-based risk ranking

(MMI ranking comes only from evaluation of driving behavior severity)

Intersection Name	Crashes	Crashes with Injury	Proportion of Crashes with Injury	Risk Group
16 TH AVE & FRUITVALE BLVD	20	4	0.20	5
6 TH ST & NOB HILL BLVD	17	3	0.18	5
3 RD AVE & NOB HILL BLVD	23	3	0.13	5
FAIR AVE & NOB HILL BLVD	24	3	0.13	5
16 TH AVE & LINCOLN AVE	24	3	0.13	5
1 ST ST & LINCOLN AVE	20	2	0.10	5
32 ND AVE & NOB HILL BLVD	17	1	0.06	5
CUSTER AVE & LINCOLN AVE	16	4	0.25	4
3 RD AVE & YAKIMA AVE	18	4	0.22	4
5 TH AVE & YAKIMA AVE	23	3	0.13	4
16 TH AVE & NOB HILL BLVD	46	5	0.11	4
1 ST ST & WASHINGTON AVE	15	1	0.07	4
1 ST ST & D ST	19	1	0.05	4
40 TH AVE & SUMMITVIEW AVE	26	1	0.04	4
18 TH ST & NOB HILL BLVD	15	2	0.13	3
1 ST ST & YAKIMA AVE	18	2	0.11	3
3 RD AVE & LINCOLN AVE	19	2	0.11	3
40 TH AVE & FRUITVALE BLVD	20	2	0.10	3
16 TH AVE & TIETON DR	16	1	0.06	3
16 TH AVE & SUMMITVIEW AVE	15	2	0.13	2
1 ST ST & NOB HILL BLVD	26	3	0.12	2
1 ST ST & MEAD AVE	23	1	0.04	1

RANKING FACTOR DEEP DIVE

Many of the high-crash intersections meet the criteria for higher-risk driving behavior, although there are notable exceptions.

Hotspot Count and Severity

- 13 intersections had 3+ DBSR hotspots – often indicating issues coming from multiple traffic directions
- 13 intersections had at least one DBSR hotspot ranked in the top 100 most severe hotspots in Yakima city (braking or acceleration)
- 17 intersections with VRU risk
- 2 intersections had only one outside-top-100 DBSR hotspot, and 1 had no DBSR hotspots

Intersection Name	Crashes	Total Hotspots	Rank of Most Severe Hotspot	Average Severity Rank of Hotspots	VRU Present	Risk Group
FAIR AVE & NOB HILL BLVD	24	4	26	189.3	Yes	5
16 TH AVE & LINCOLN AVE	24	3	65	140.7	Yes	5
3 RD AVE & NOB HILL BLVD	23	4	42	137.3	Yes	5
1 ST ST & LINCOLN AVE	20	6	46	202.2	Yes	5
16 TH AVE & FRUITVALE BLVD	20	3	57	87	Yes	5
32 ND AVE & NOB HILL BLVD	17	5	7	232.6	Yes	5
6 TH ST & NOB HILL BLVD	17	4	48	119.3	Yes	5
16 TH AVE & NOB HILL BLVD	46	2	39	213.5	Yes	4
40 TH AVE & SUMMITVIEW AVE	26	2	32	144.5	No	4
5 TH AVE & YAKIMA AVE	23	3	94	155	No	4
1 ST ST & D ST	19	3	151	246	Yes	4
3 RD AVE & YAKIMA AVE	18	4	107	225	Yes	4
CUSTER AVE & LINCOLN AVE	16	3	127	347.7	Yes	4
1 ST ST & WASHINGTON AVE	15	3	97	165.3	Yes	4
40 TH AVE & FRUITVALE BLVD	20	2	82	134.5	No	3
3 RD AVE & LINCOLN AVE	19	2	235	237	Yes	3
1 ST ST & YAKIMA AVE	18	2	244	253.5	Yes	3
16 TH AVE & TIETON DR	16	1	91	91	No	3
18 TH ST & NOB HILL BLVD	15	3	185	299	No	3
1 ST ST & NOB HILL BLVD	26	1	225	225	Yes	2
16 TH AVE & SUMMITVIEW AVE	15	1	112	112	Yes	2
1 ST ST & MEAD AVE	23	0	-	-	Yes	1

DEEP DIVE INTO CRASH INJURY SEVERITY

CRASH INJURY SEVERITY

The 4 intersections where the highest proportion of crashes were injury crashes were all in the top 2 risk groups.

The relationship between driving behavior severity and crash outcomes becomes even stronger when injury severity is included.

Injury Overview

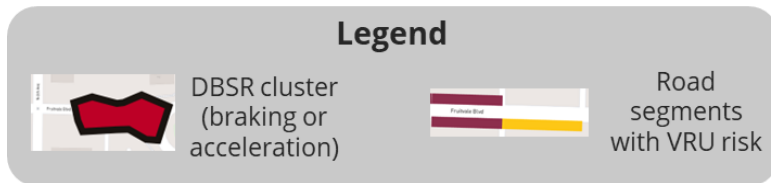
- Of all 460 crashes in these 22 intersections, 53 crashes had at least 1 confirmed minor or more severe injury.
- Of these 53 injury crashes, 13 had at least 1 severe injury or worse.
- Behavior Risk Group 5 had the highest rate of crashes that led to a severe injury at 4.1%, followed by Risk Group 4 at 3.7%.

All but one severe or fatal injury crash happened in the intersections classified in the highest two risk groups, although the one fatal crash happened at a Risk Group 3 intersection.

Crashes lead to severe injury much more frequently at intersections in the two highest driving behavior risk groups than at other intersections.

Intersection Name	Crash Count	Crash with Any Confirmed Injury Count	Proportion of All Crashes With Any Confirmed Injury	Severe and Fatal Crash Count	Proportion of All Injury Crashes With Severe or Fatal Injury	Proportion of All Crashes with Severe or Fatal Injury	Risk Group
16 TH AVE & FRUITVALE BLVD	20	4	0.20	1	0.25	0.050	5
6 TH ST & NOB HILL BLVD	17	3	0.18	1	0.33	0.059	5
3 RD AVE & NOB HILL BLVD	23	3	0.13	0	0.00	0.000	5
FAIR AVE & NOB HILL BLVD	24	3	0.13	1	0.33	0.042	5
16 TH AVE & LINCOLN AVE	24	3	0.13	2	0.67	0.083	5
1 ST ST & LINCOLN AVE	20	2	0.10	1	0.50	0.050	5
32 ND AVE & NOB HILL BLVD	17	1	0.06	0	0.00	0.000	5
CUSTER AVE & LINCOLN AVE	16	4	0.25	3	0.75	0.188	4
3 RD AVE & YAKIMA AVE	18	4	0.22	1	0.25	0.056	4
5 TH AVE & YAKIMA AVE	23	3	0.13	0	0.00	0.000	4
16 TH AVE & NOB HILL BLVD	46	5	0.11	2	0.40	0.043	4
1 ST ST & WASHINGTON AVE	15	1	0.07	0	0.00	0.000	4
1 ST ST & D ST	19	1	0.05	0	0.00	0.000	4
40 TH AVE & SUMMITVIEW AVE	26	1	0.04	0	0.00	0.000	4
18 TH ST & NOB HILL BLVD	15	2	0.13	0	0.00	0.000	3
1 ST ST & YAKIMA AVE	18	2	0.11	0	0.00	0.000	3
3 RD AVE & LINCOLN AVE	19	2	0.11	1	0.50	0.053	3
40 TH AVE & FRUITVALE BLVD	20	2	0.10	0	0.00	0.000	3
16 TH AVE & TIETON DR	16	1	0.06	0	0.00	0.000	3
16 TH AVE & SUMMITVIEW AVE	15	2	0.13	0	0.00	0.000	2
1 ST ST & NOB HILL BLVD	26	3	0.12	0	0.00	0.000	2
1 ST ST & MEAD AVE	23	1	0.04	0	0.00	0.000	1

Driving Behavior-based Risk Group	Total Crashes	Total Injury Crashes	Proportion of Crashes with Injury	Total Severe+ Injury Crashes	Proportion of Total Crashes with Severe or Fatal Injury
5	145	19	0.131	6	0.041
4	163	19	0.117	6	0.037
3	88	9	0.102	1	0.011
2	41	5	0.122	0	0.000
1	23	1	0.043	0	0.000

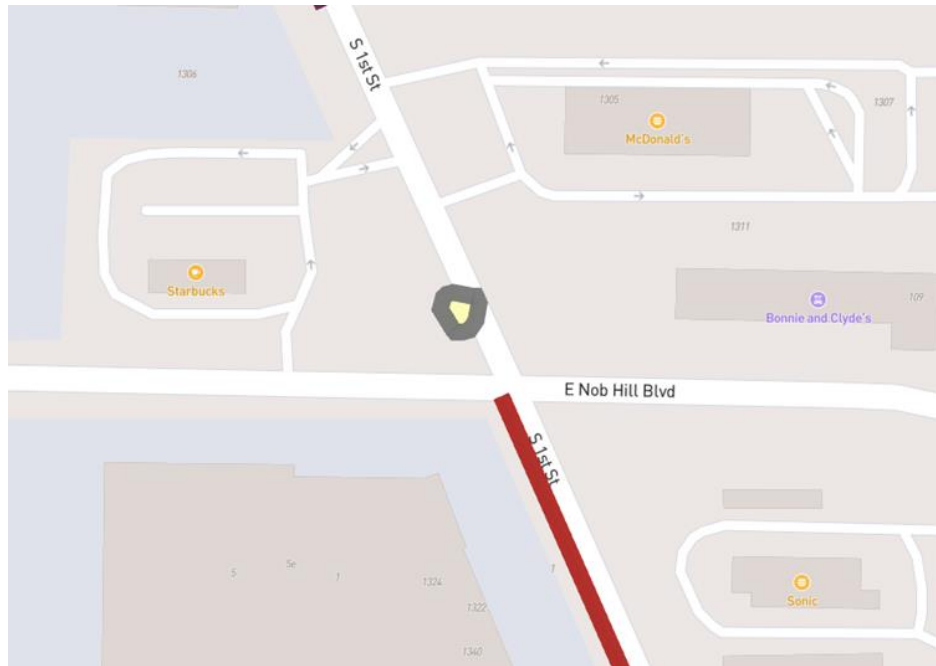


QUANTITY AND SEVERITY OF DBSR HOTSPOTS CLASSIFY THIS INTERSECTION AS HAVING VERY ABNORMAL DRIVING BEHAVIOR

Intersection Name	Crashes	Total Hotspots	Rank of Most Severe Hotspot	Average Severity Rank of Hotspots	VRU Present	Risk Group
1 ST ST & LINCOLN AVE	20	6	46	202.2	Yes	5

Overview

- Acceleration hotspot in all four directions of traffic flow
- Braking hotspot approaching intersection from east on Lincoln, and approaching right turn from north N. 1st St.
- At least four road segments identified as risky for pedestrians or cyclists



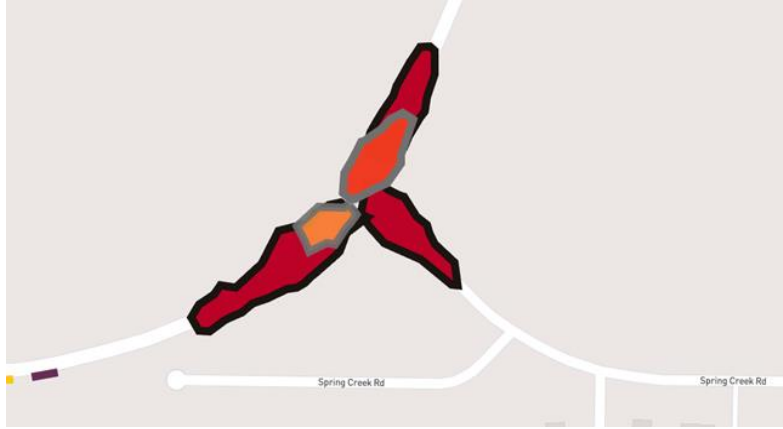
QUANTITY AND SEVERITY OF DBSR HOTSPOTS CLASSIFY THIS INTERSECTION AS HAVING MINIMAL ABNORMAL BEHAVIOR

Intersection Name	Crashes	Total Hotspots	Rank of Most Severe Hotspot	Average Severity Rank of Hotspots	VRU Present	Risk Group
1 ST ST & NOB HILL BLVD	26	1	225	225	Yes	2

Overview

- Only one DBSR hotspot (acceleration)
- One road segment with risk to VRU

RISKY INTERSECTIONS IN YAKIMA CITY NOT INCLUDED IN LIST PROVIDED

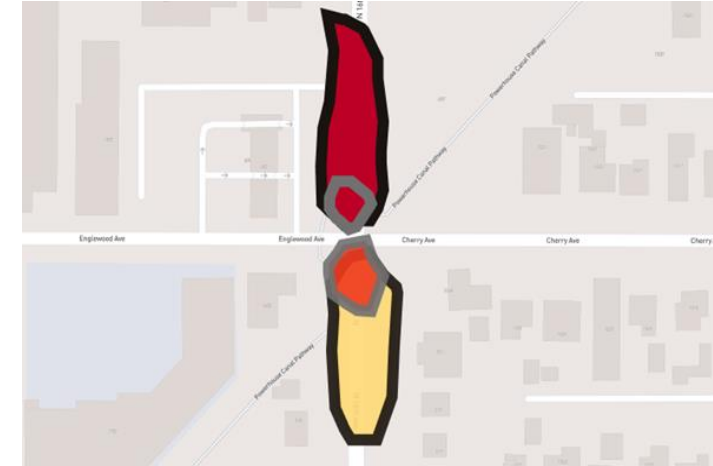


S 48th Ave. & W. Washington Ave. **Risk Group 5**

- 3 top-50 braking DBSR hotspots
- 1 top-100 & 1 top-150 DBSR hotspot

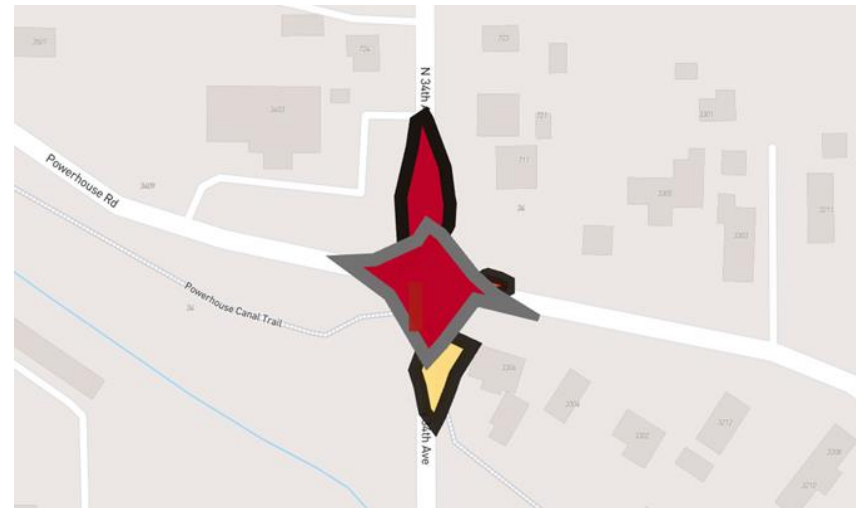
Englewood/Cherry Ave. & N. 16th Ave. **Risk Group 5**

- Top-25 and top-100 accel DBSR hotspots
- 2 top-100 braking DBSR hotspots



Pacific Ave. & S. 2nd St. **Risk Group 5**

- The #1, #10, and #155 most severe braking DBSR hotspots



Powerhouse Rd. & N 34th Ave **Risk Group 5**

- 3 braking DBSR hotspots, including 2 top-100
- Top 25 acceleration DBSR hotspot
- 1 road segment with VRU

PUTTING EVERYTHING TOGETHER:

- 14 of the 22 high-crash intersections requested for analysis exhibit severe patterns of risky driving behavior.
- For the 8 intersections with high crash counts but lower-severity driving behavior, other factors may explain the high crash numbers, such as high traffic volume or suboptimal infrastructure design.
- The intersections with the most severe driving behavior have some overlap with the 22 high-crash intersections, but other intersections outside of these 22 were also identified as risky due to severe driving behavior.
- Severity of driving behavior correlates strongly with the likelihood of crashes leading to severe injury, and less strongly with the likelihood of crashes leading to injury in general.
- Analysis of driver behavior, combined with crash history data, tells a more complete picture in identifying areas for safety improvements than either approach alone.



S. Fair Ave & E. Nob Hill Blvd.
(4th-ranked in crashes, categorized in Risk Group 5 by driving behavior)

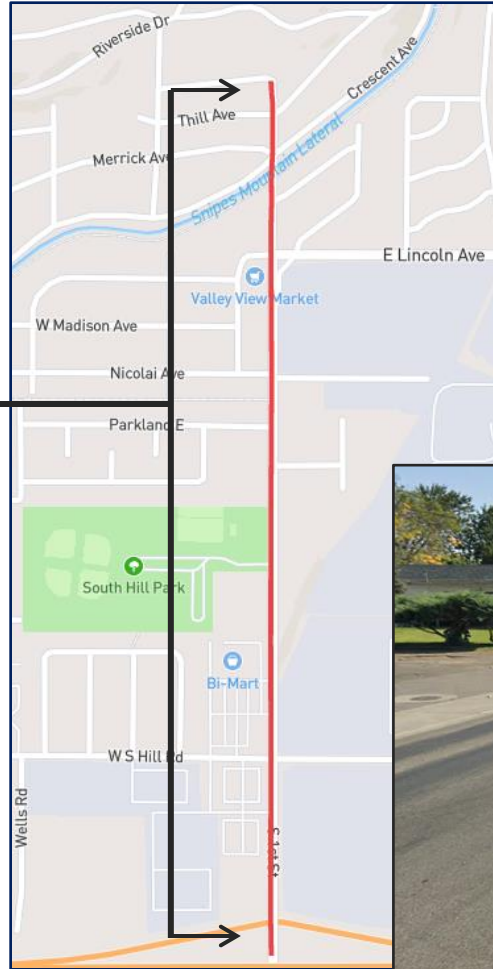
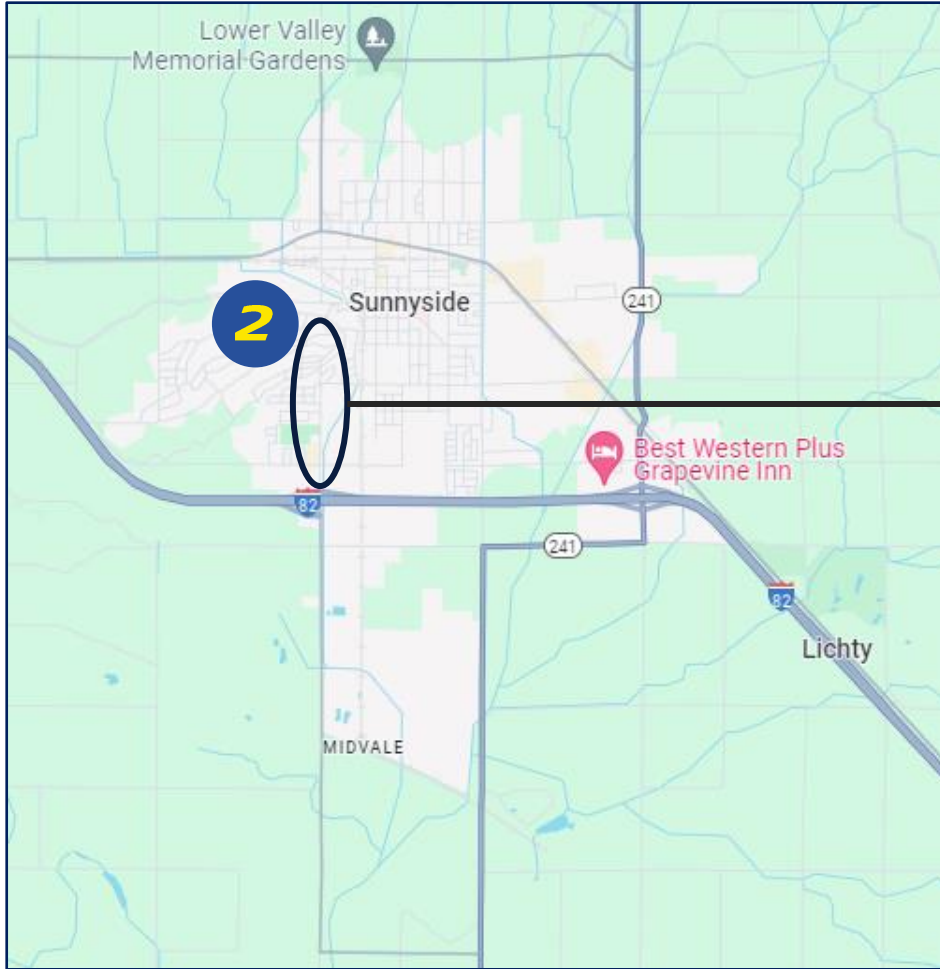
MICHELIN

MOBILITY INTELLIGENCE

Y2

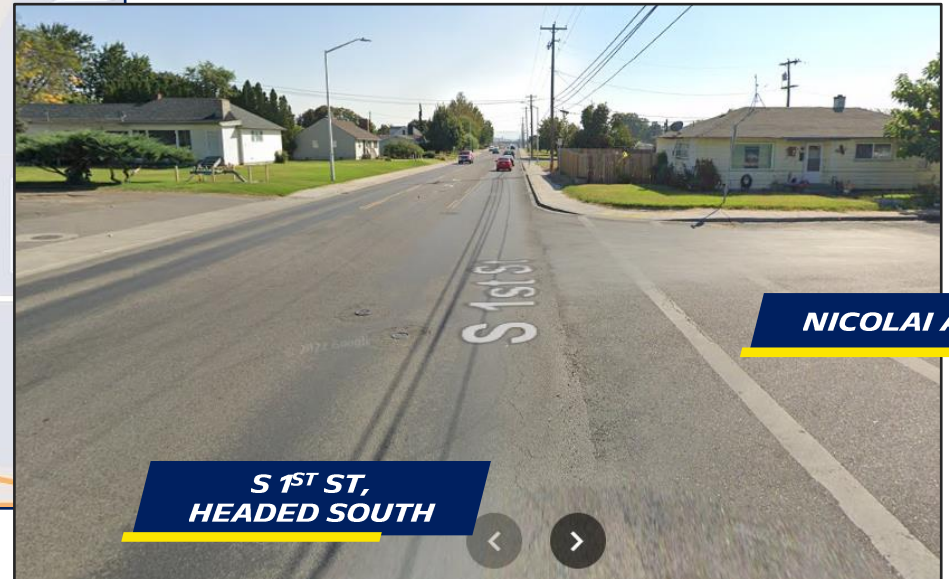
***SUNNYSIDE
SOUTH 1ST STREET***

SUNNYSIDE SOUTH 1ST STREET: FOCUS AREA

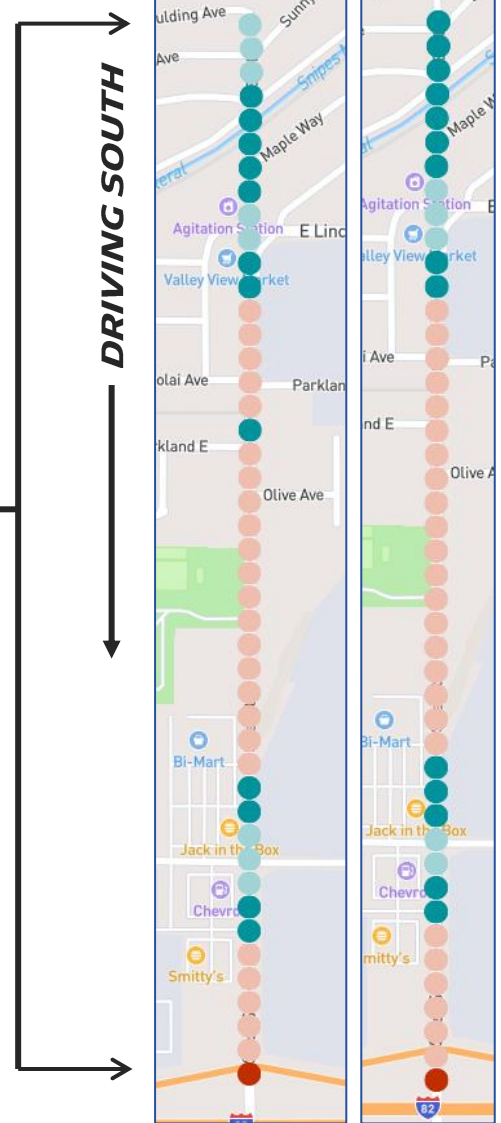


FOCUS AREA:

- Located in Sunnyside, Yakima, with a length of 1 mile.
- Total of 250k trips over a 6-month time span



SUNNYSIDE SOUTH 1ST STREET: V85 SPEED



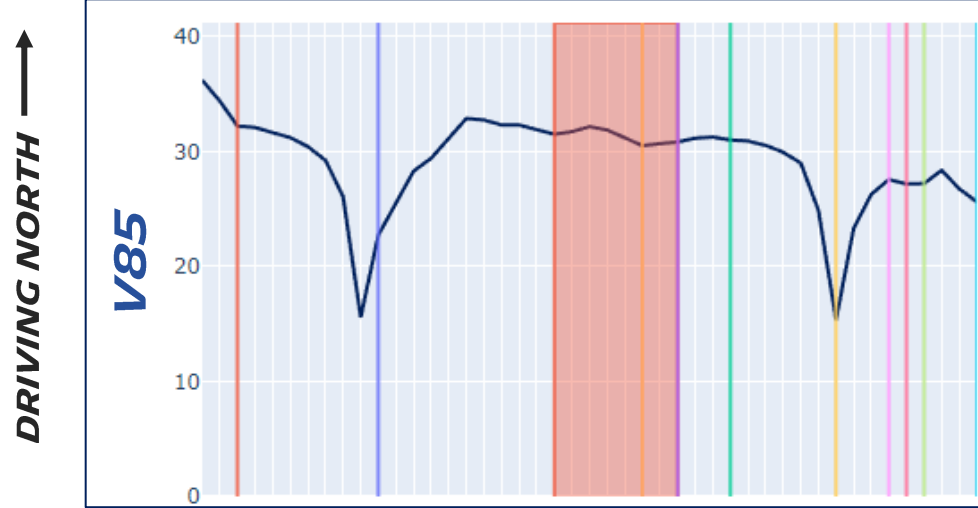
V85 IS AROUND 32 MPH.

This means that most vehicles (85%) drive at a speed of 32 miles per hour or less. Given the 25-mph speed limit, this level of speed is higher than expected.

TAKEAWAYS:

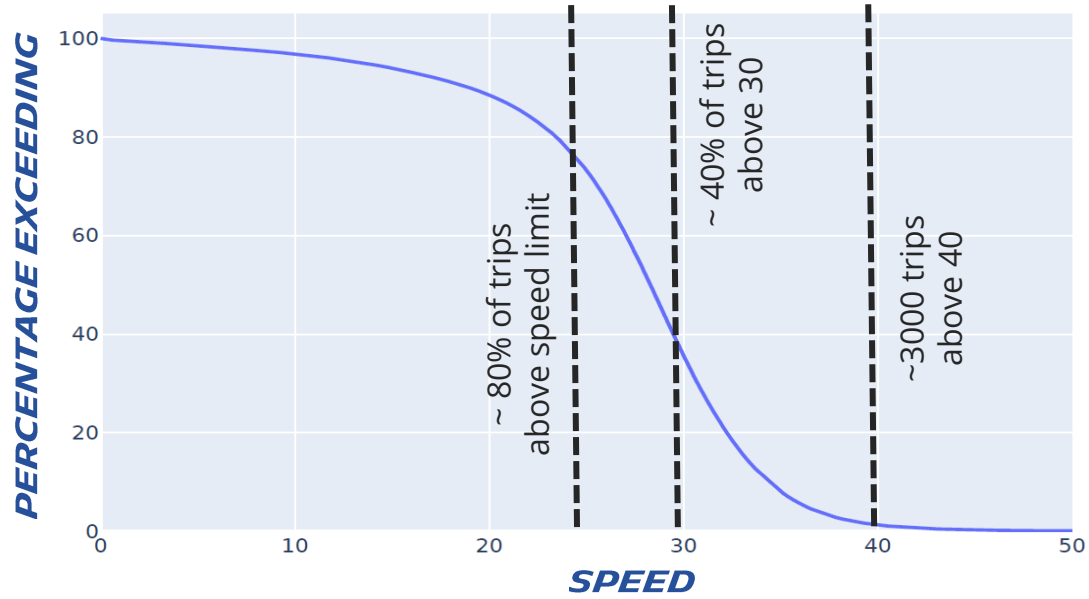
- The V85 data indicates a similar pattern for both northbound and southbound traffic, suggesting that both directions are equally fast
- There is a notable reduction in speed around the intersections, e.g., Hill Road and Lincoln Ave.
- Otherwise, the V85 remains nearly constant, even around the park and other intersections

SUNNYSIDE SOUTH 1ST STREET: SPEED DISTRIBUTION



- SOUTH HILL PARK
- NICOLAI AVE & PARKLAND E INTERSECTION
- E PARKLAND DRIVE INTERSECTION
- OLIVE AVE INTERSECTION
- THILL AVE & SUNNYSIDE AVE INTERSECTION
- MERRICK AVE & CRESCENT AVE INTERSECTION
- SW CRESCENT AVE INTERSECTION
- E MAPLE WAY INTERSECTION
- E LINCOLN AVE INTERSECTION
- E S HILL RD
- SPEED LIMIT SIGN: 25 MPH

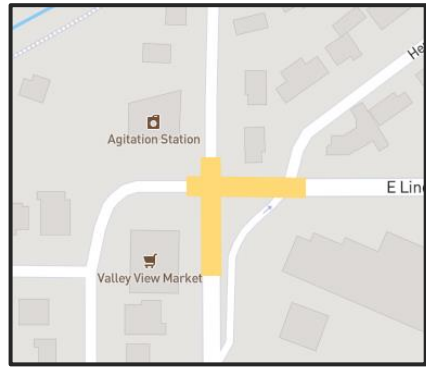
DISTRIBUTION OF MAX SPEED



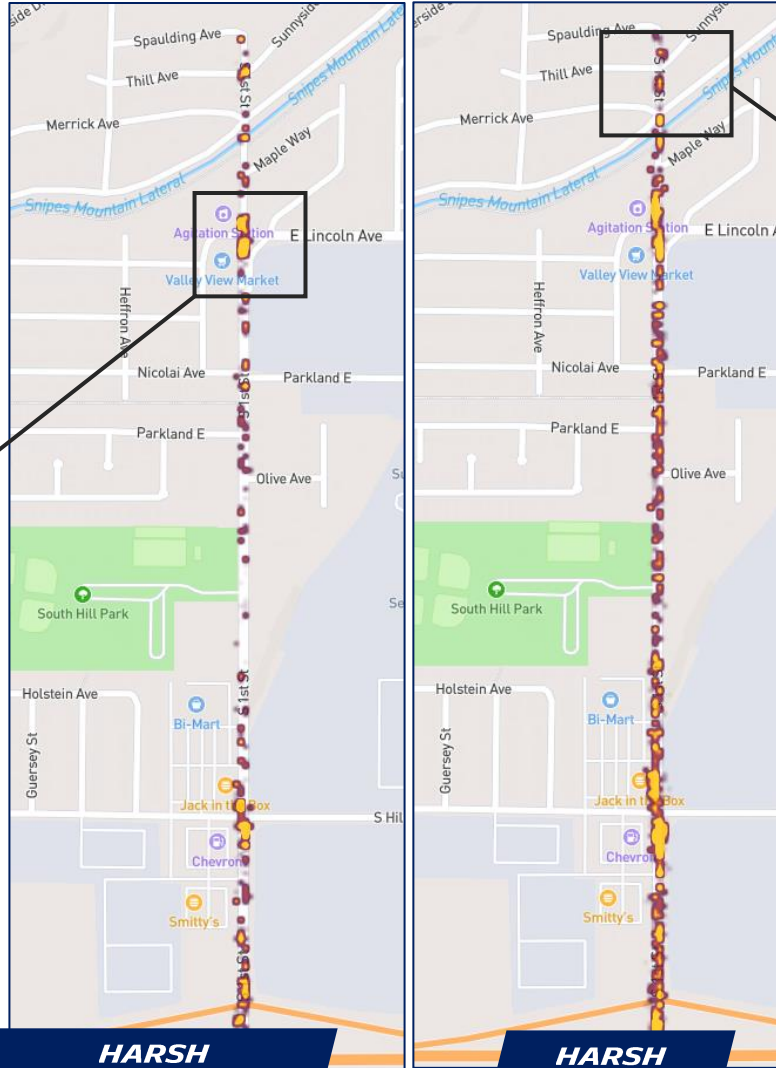
TAKEAWAYS:

- The data shows a trend of high speeds throughout but slowing at the Hill Road and Lincoln Ave. intersections.
- Over 80% of trips exceed the speed limit, with more than 40% surpassing it by over 20%.
- More than 3000 trips are recorded at extremely high speeds.

SUNNYSIDE SOUTH 1ST STREET: ATYPICAL EVENTS



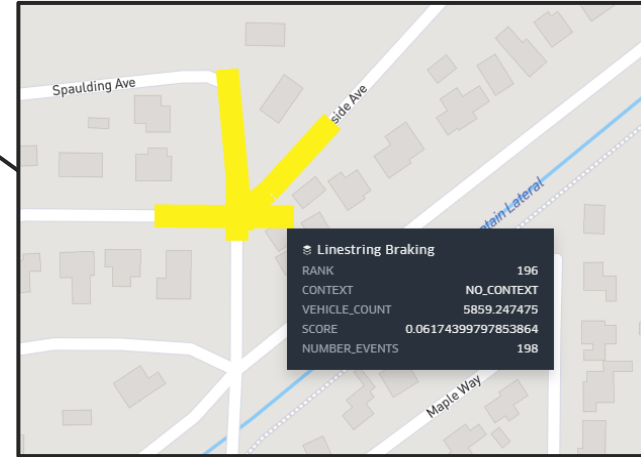
**ACCELERATION SEVERITY
RANK: 336/488**



**HARSH
ACCELERATION**

**HARSH
BRAKING**

**BRAKING SEVERITY RANK:
196/1665**

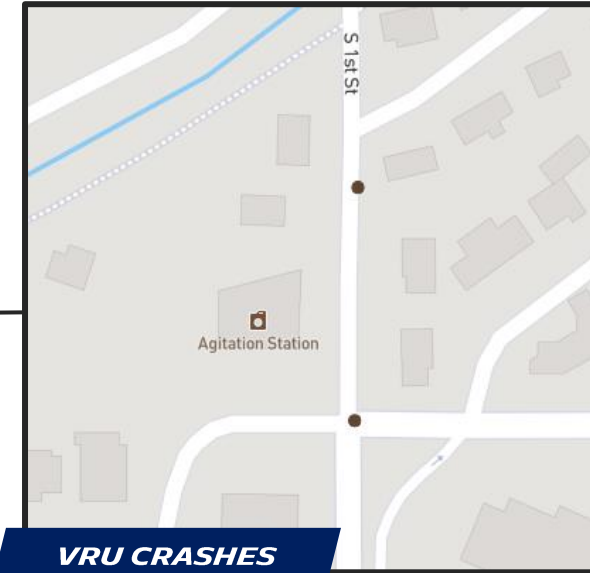


TAKEAWAYS:

- Although not as severe as some other severe behavior hotspots in Yakima County, we observed a pattern of harsh braking and accelerations in the northern part of the road.
- Given the residential nature of the area, as well as its proximity to the park, such atypical behaviors could pose serious risks.

TAKEAWAYS

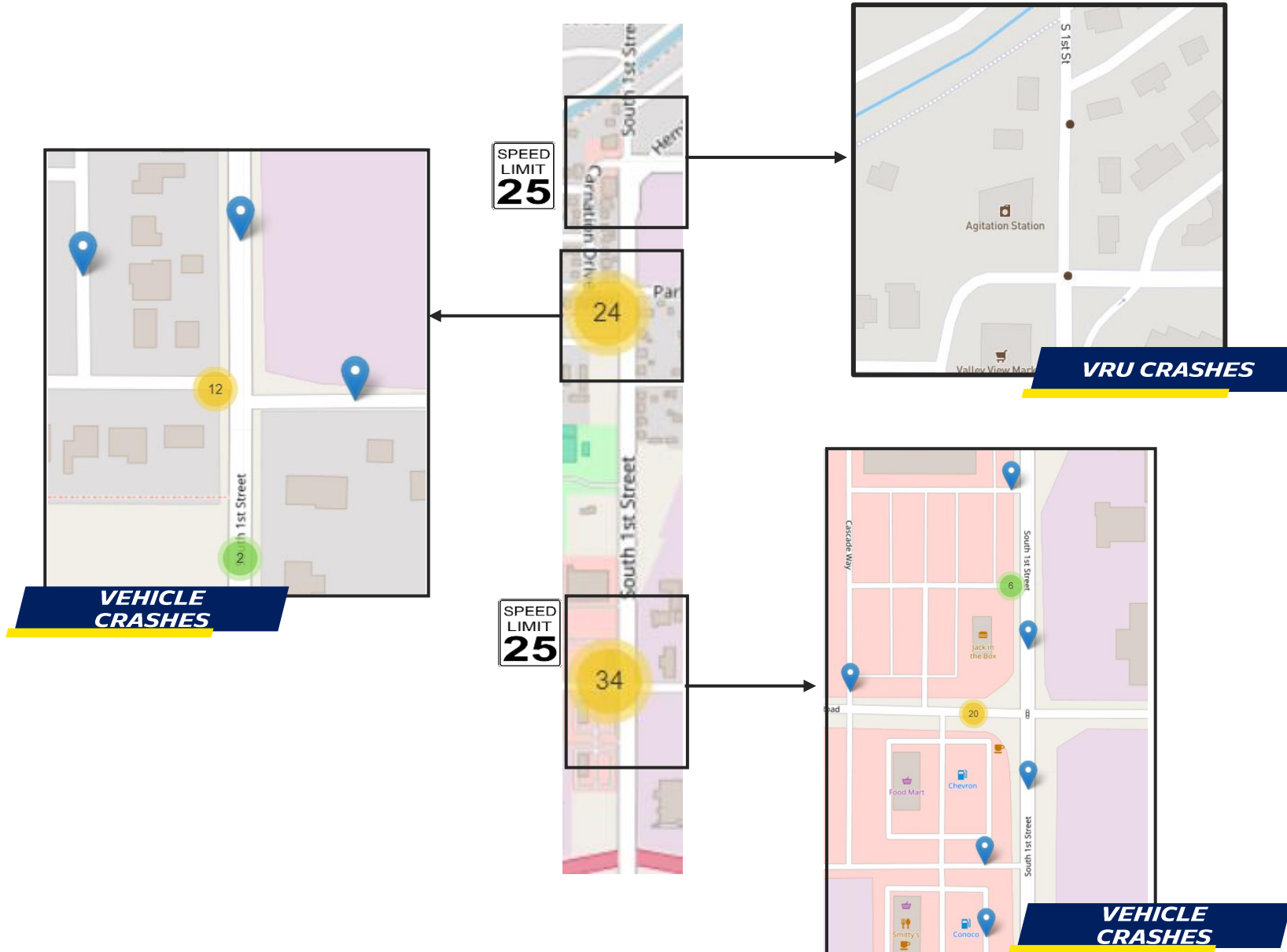
- The intersection at Lincoln Ave has a history of crashes involving vulnerable road users (VRUs).
- Additionally, the area surrounding this intersection with Hill Road has a record of vehicle-to-vehicle collisions.
- Overall, this section of the South 1st. St. corridor is one of the riskiest parts of the corridor.



SUNNYSIDE SOUTH 1ST STREET: CRASHES

TAKEAWAYS

- The intersection at Lincoln Ave has a history of crashes involving vulnerable road users (VRUs).
- Additionally, the areas surrounding this intersection with Hill Road and Nicolai Avenue have a record of vehicle-to-vehicle collisions.
- Overall, this section of the South 1st St. corridor is one of the riskiest parts of the corridor.

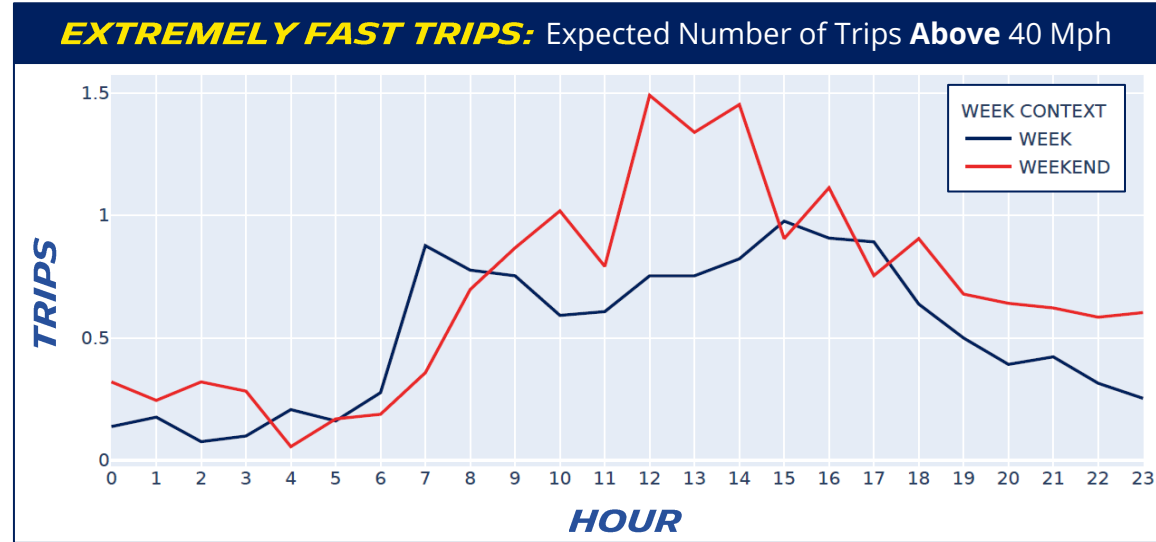
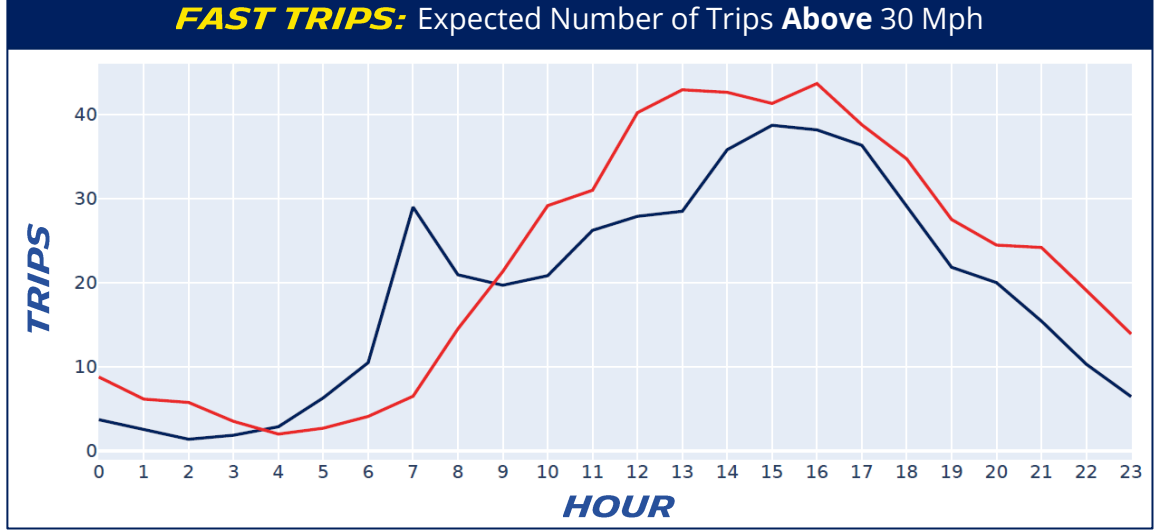


SUNNYSIDE SOUTH 1ST STREET: EXTREME SPEEDING

RESIDENTIAL AREAS



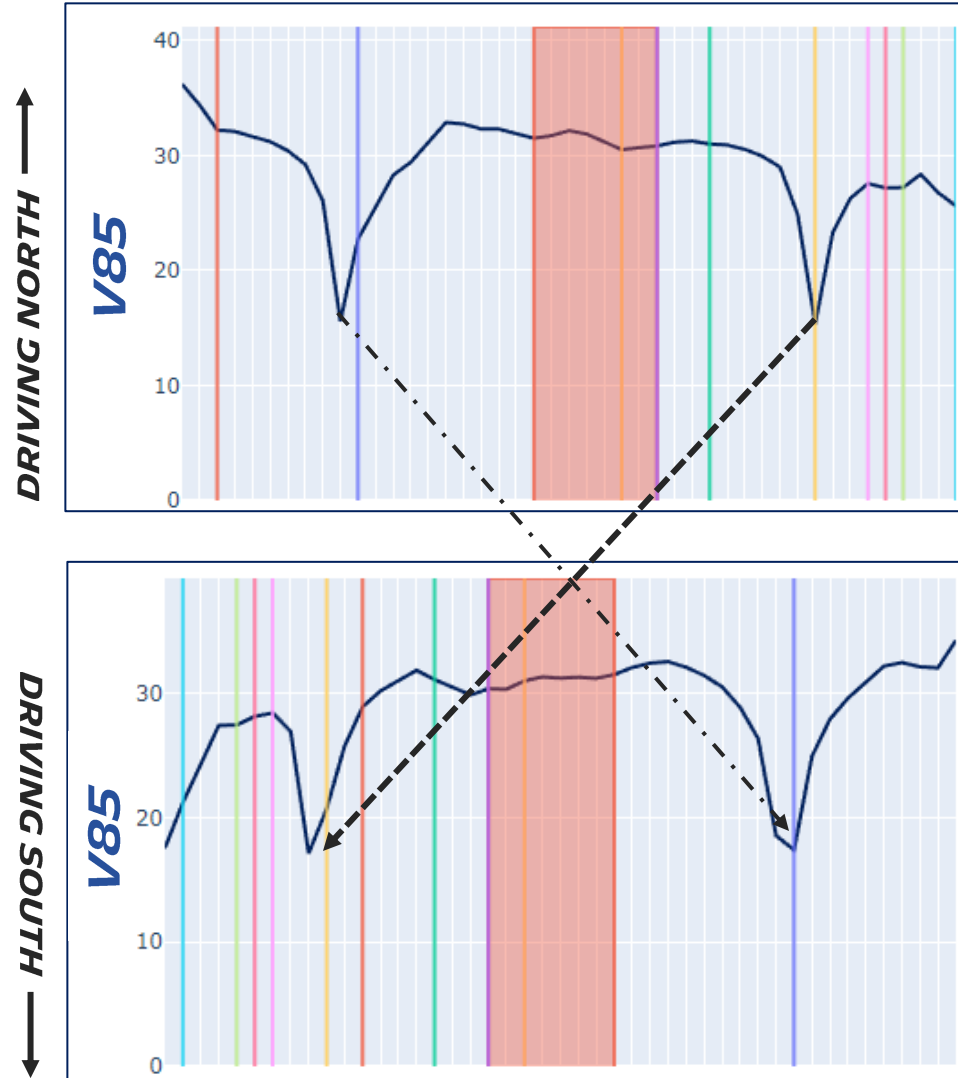
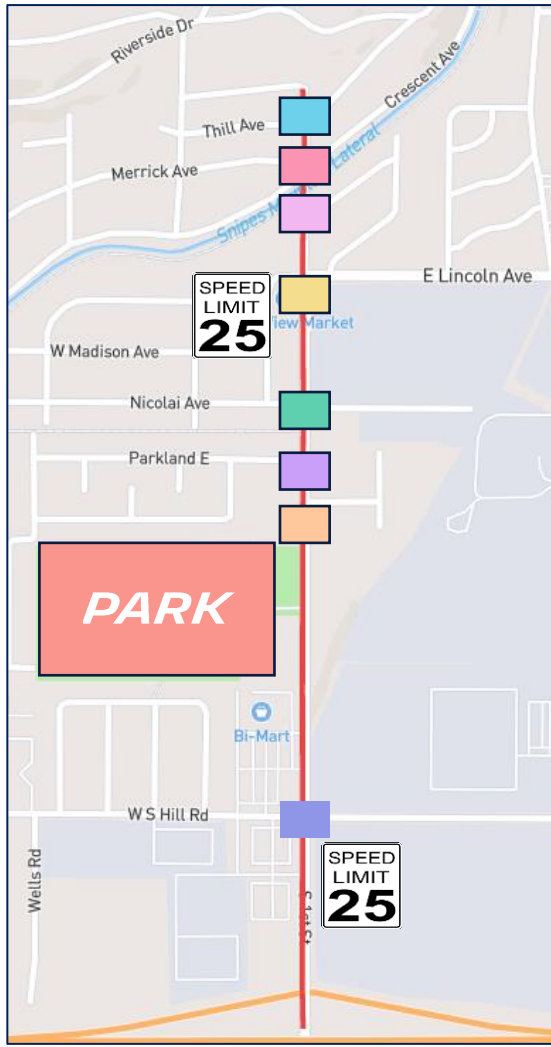
0.1 MILE



TAKEAWAYS:

- Over 20 trips per hour exceed the speed limit by more than 20% from 7 am to 8 pm, peaking at nearly 40 trips weekly. On weekends, more trips exceed the speed limit by over 20% from 9 am to 10 pm.
- During weekdays from 7 am to 6 pm, 2 trips exceeding 40 mph occur every 3 hours (0.66 per hour). On weekends from 10 am to 5 pm, 3 trips exceeding 40 mph occur every 3 hours (1 per hour).
- Harsh braking (-7.1 mph/s) from 40mph to a stop, considering a 0.75-second reaction time, takes about 6.4 seconds and 210 feet, posing a **high risk** to vulnerable road users.

SUNNYSIDE SOUTH 1ST STREET: V85 ALONG THE ROUTE



TAKEAWAYS:

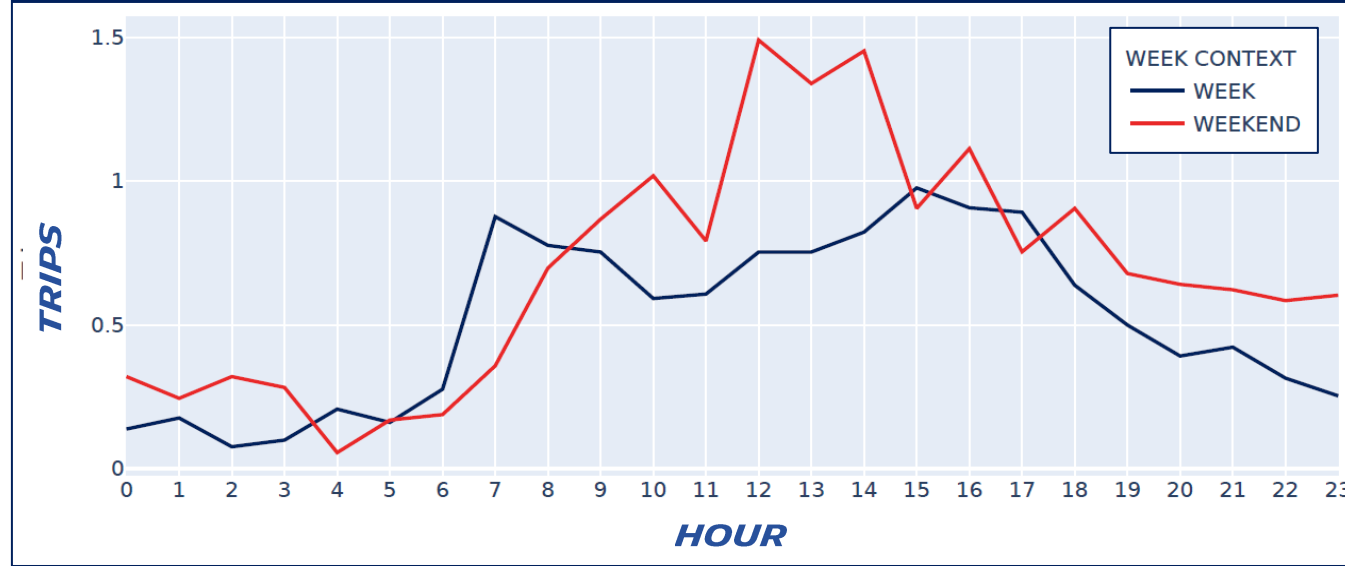
- The V85 data indicates a similar pattern for both northbound and southbound traffic, suggesting that both directions are equally fast
- There is a notable reduction in velocity around the intersections with Hill Road and Lincoln Ave.
- Otherwise, the V85 remains nearly constant, even around the park and other intersections

RESIDENTIAL AREAS



0.1 MILE

EXTREMELY FAST TRIPS: Expected Number of Trips Above 40 Mph

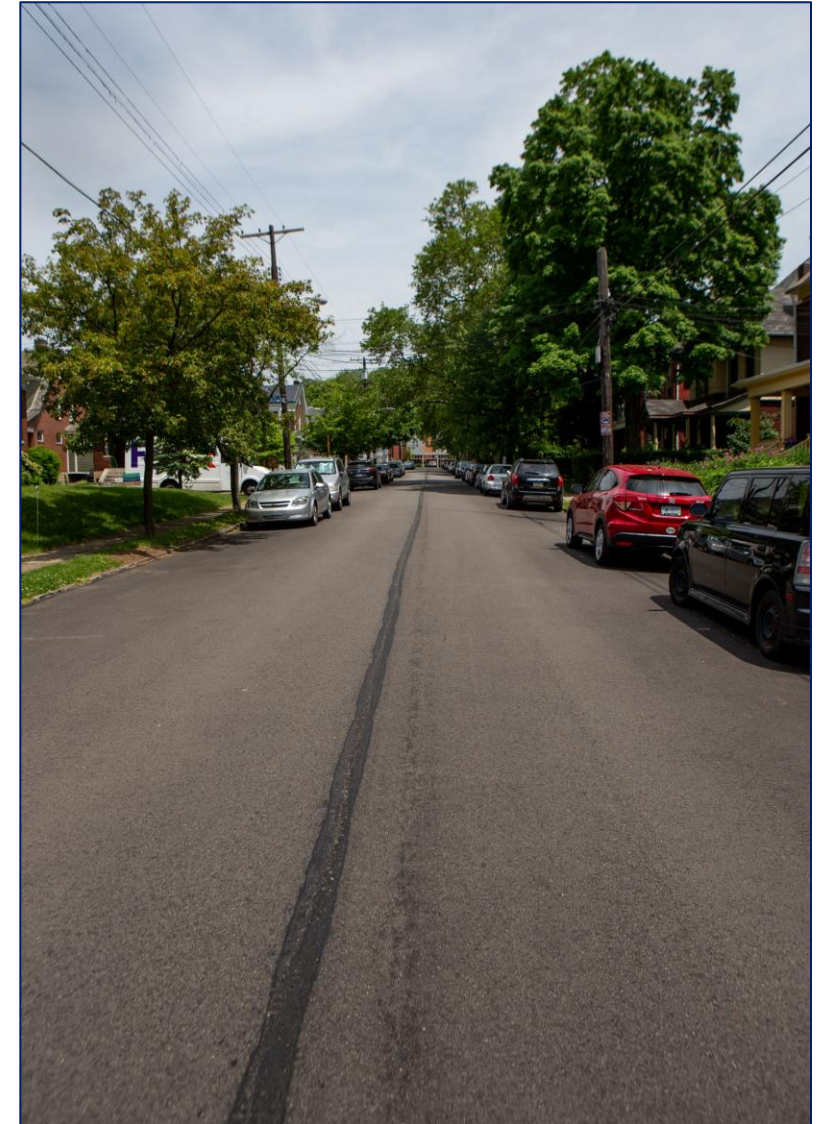


TAKEAWAYS:

- During weekdays from 7 am to 6 pm, 2 trips exceeding 40 mph occur every 3 hours (0.66 per hour).
- On weekends from 10 am to 5 pm, 3 trips exceeding 40 mph occur every 3 hours (1 per hour).
- Harsh braking from 40mph to a stop, considering a 0.75-second reaction time, takes about 4.35 seconds and 150 feet.
- Due to the dense residential area (about 1,700 households), this speed poses a high risk to vulnerable road users (VRUs).

PUTTING EVERYTHING TOGETHER:

- Sunnyside South 1st Street has two areas that are particularly vulnerable to crashes: (1) The intersection with **Lincoln Ave**, (2) The intersection with **Hill Road**.
- 80% of drivers exceed the speed limit, with over 40% exceeding it by more than 20%.
- Both intersections have a history of crashes, involving both Vulnerable Road Users (VRU) and Vehicle-to-Vehicle (V2V) collisions.
 - **Potential Safety Factors:**
 - *Poor lighting and signage*
 - *Heavy residential area*
 - *High vehicle velocity*
 - *Numerous intersections*



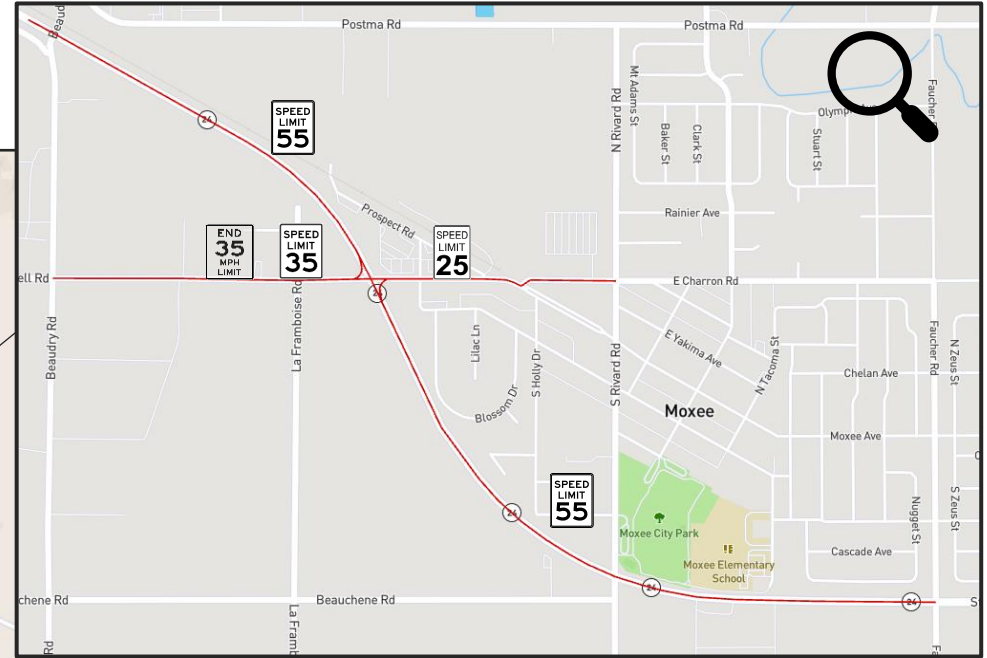
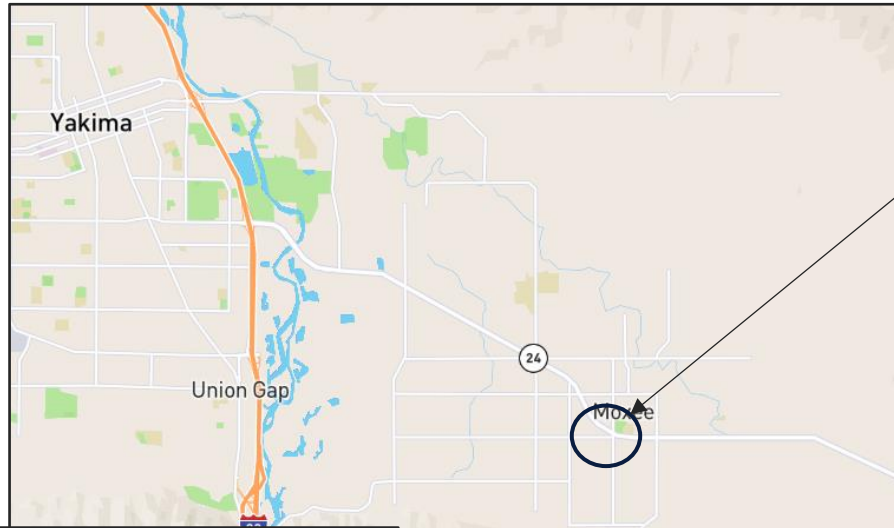
MICHELIN

MOBILITY INTELLIGENCE

Y3

***US-24 & BELL RD. IN
MOXEE***

ANALYZING DRIVING BEHAVIOR ON MOXEE HIGHWAY



Bell Road - Google Maps



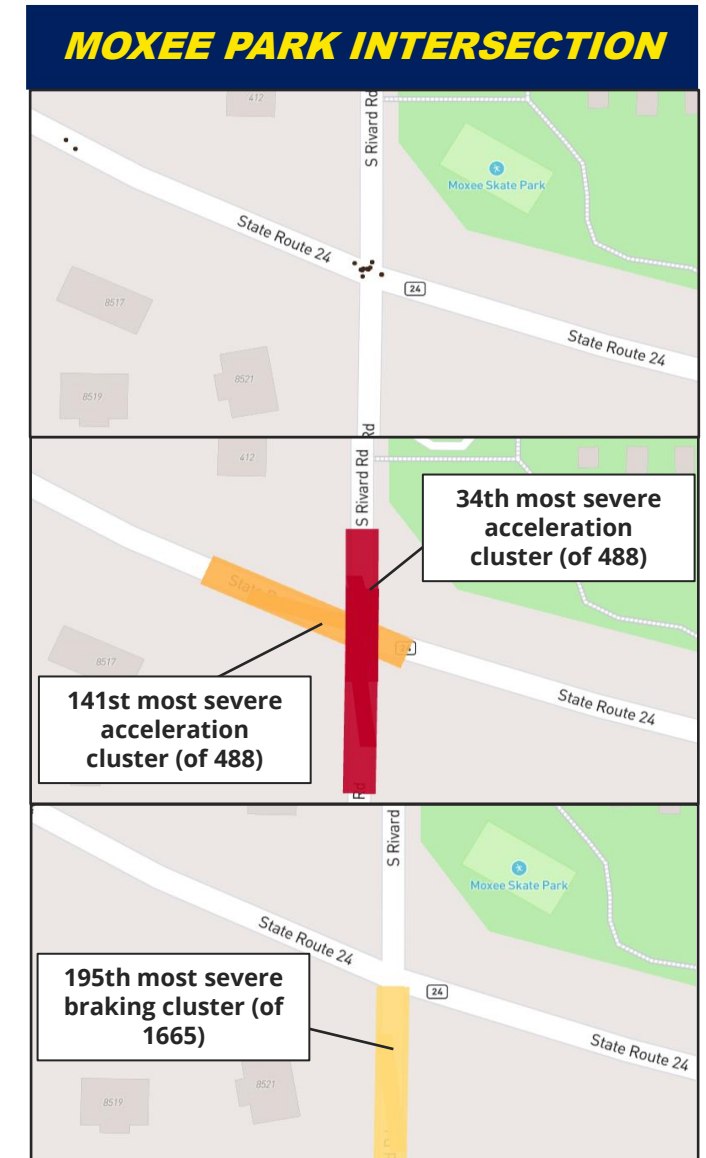
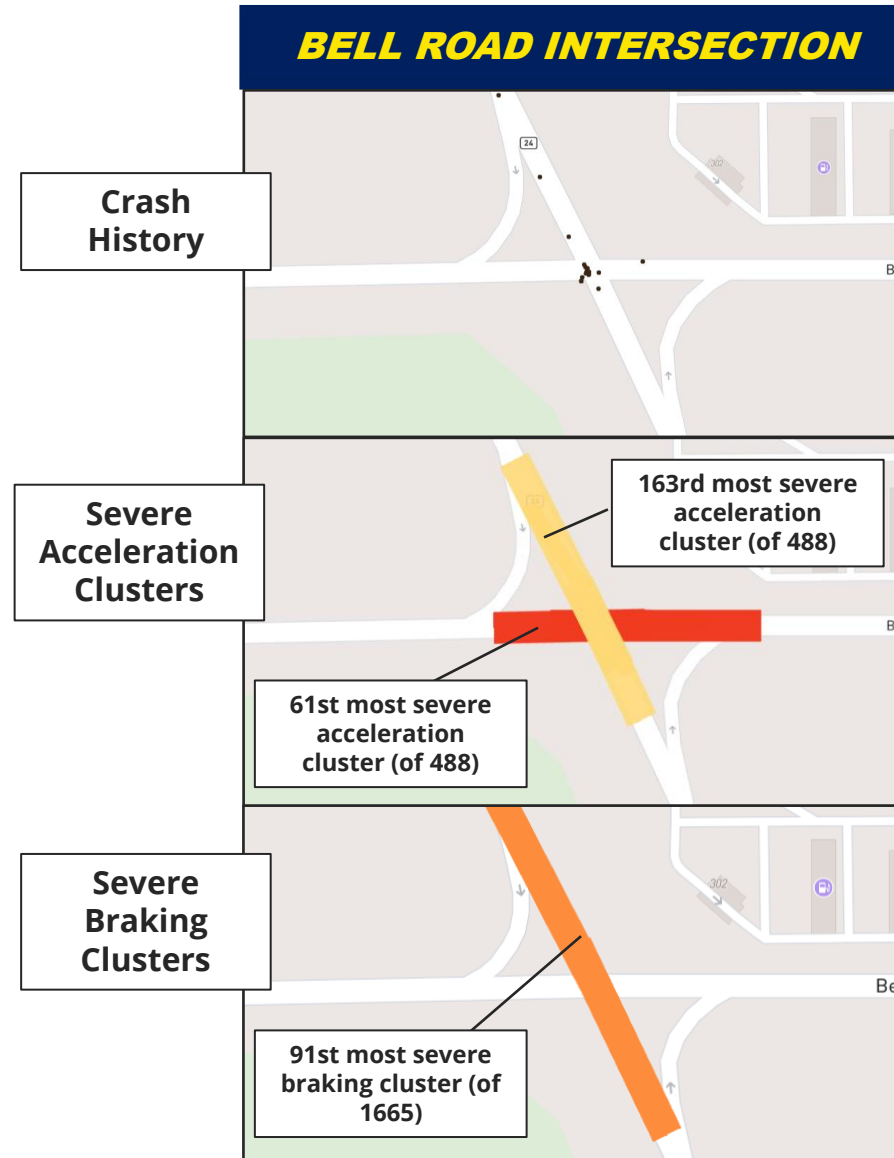
INTERSECTION BETWEEN HIGHWAY 24 AND BELL ROAD

- Intersection between high-speed road (55 mph) and low speed road (35 mph).
- This type of intersection often sees dangerous acceleration from drivers turning onto the higher speed road, and severe braking from drivers traveling on the higher speed road.

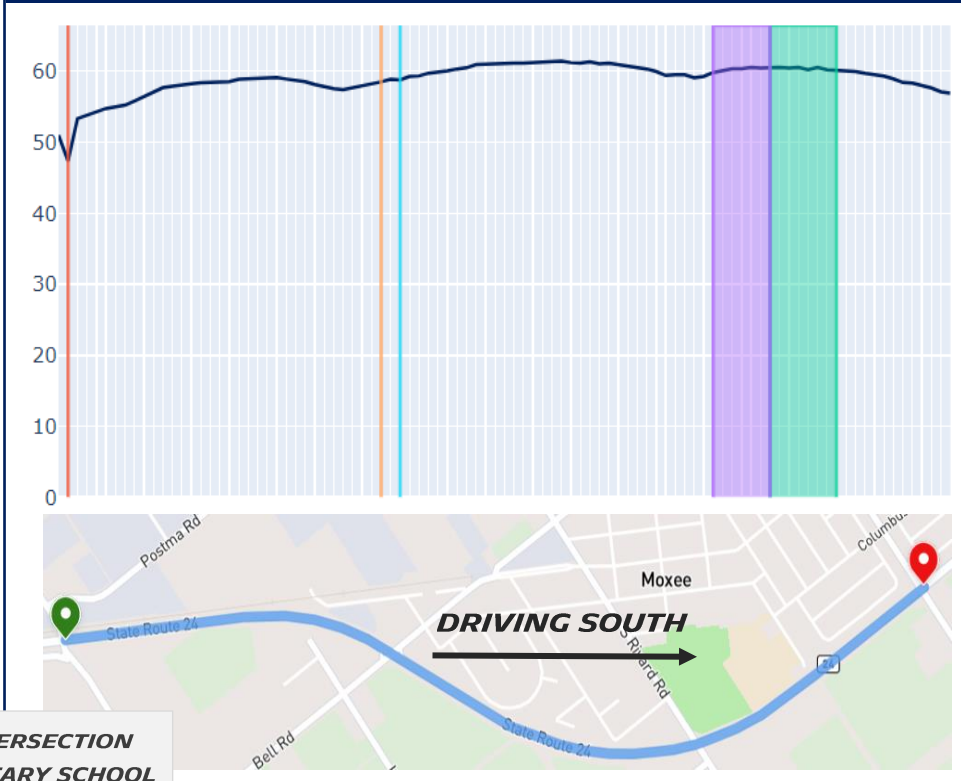
MOXEE HIGHWAY (OVERALL RESULTS)

OBSERVATIONS

- Significant recent crash history, although no pedestrian/cyclist crashes and no fatal crashes
- Severe driving behavior clusters are present at both intersections in this corridor
- VRU risk model did not flag any road segments in this corridor
- No significant speed difference from weekdays to weekend days



V85 FROM NORTH TO SOUTH

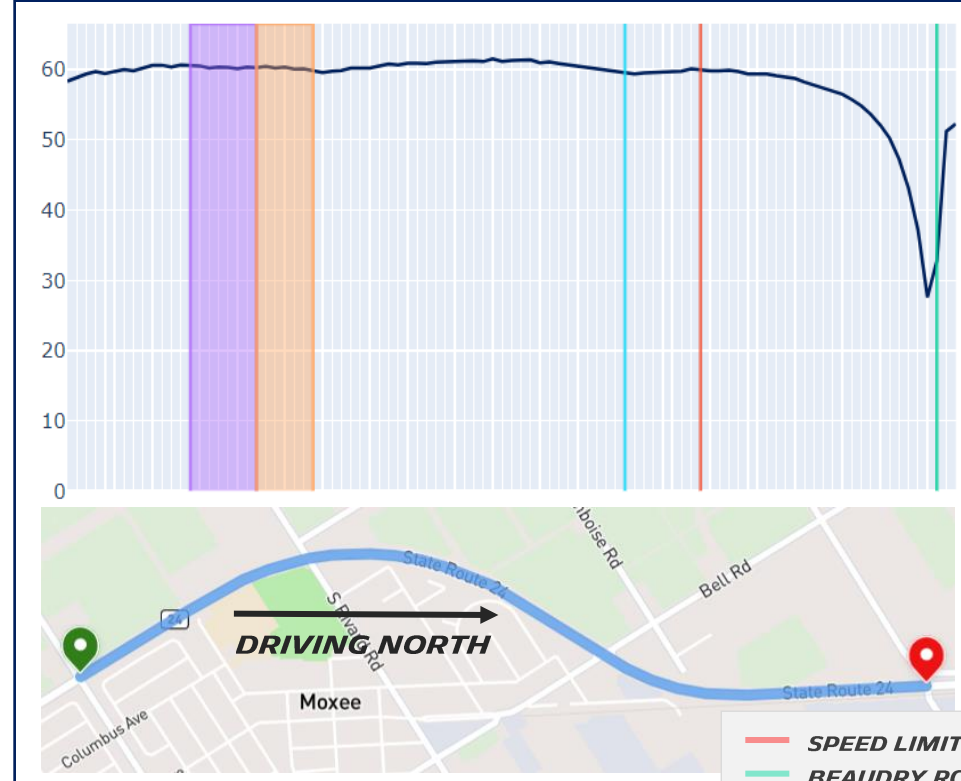


- BEAUDRY RD INTERSECTION
- MOXEE ELEMENTARY SCHOOL
- MOXEE CITY PARK
- SPEED LIMIT SIGN: 55 MPH
- MAIN INTERSECTION

OBSERVATIONS

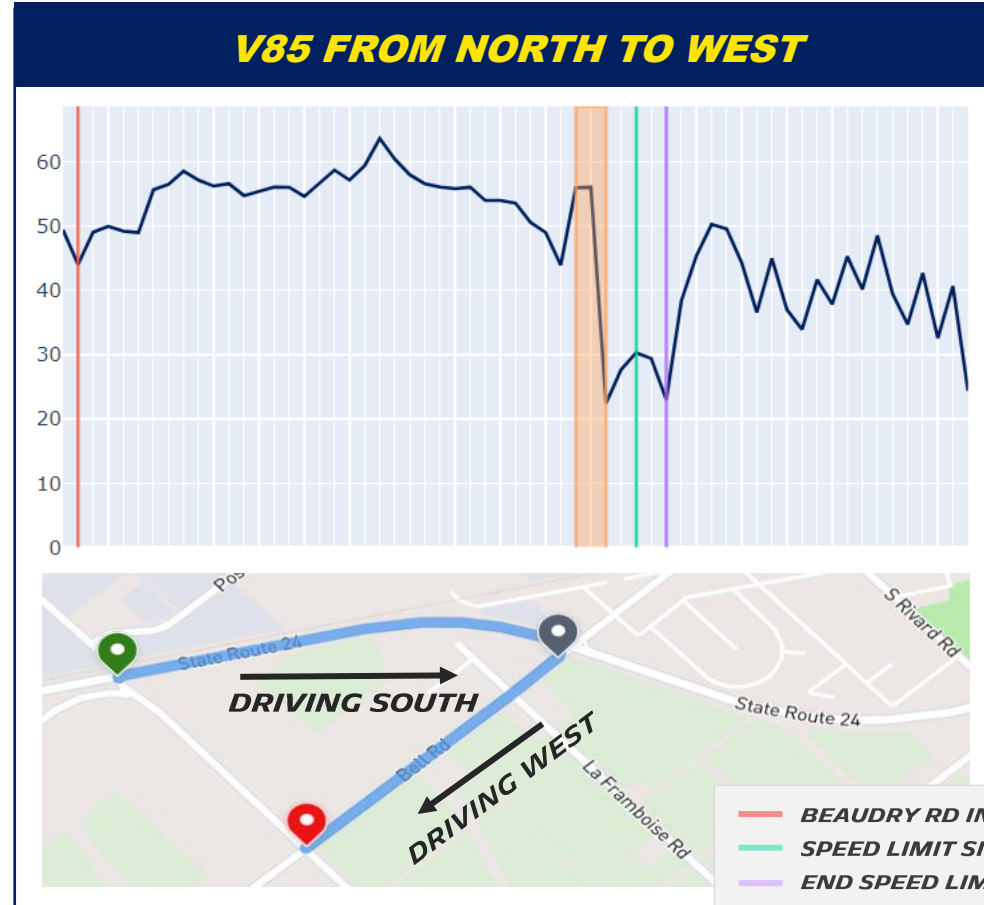
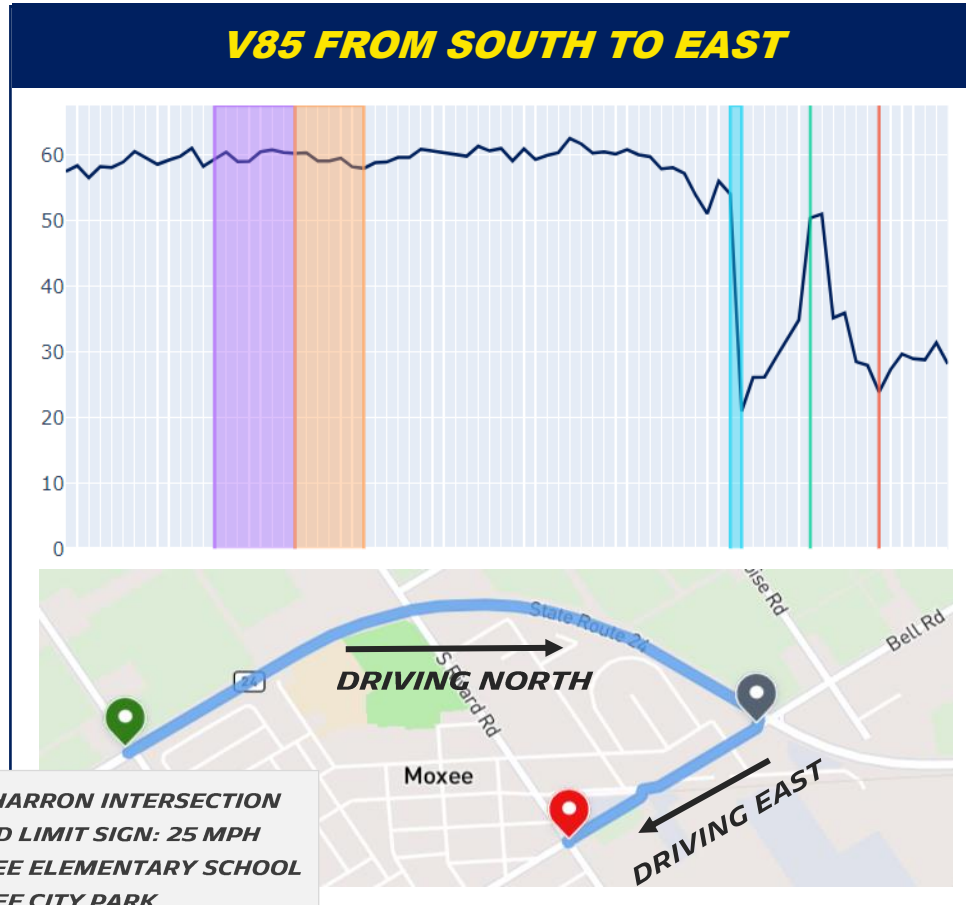
- Drivers going in either direction on US-24 generally do not decrease their speed around the Bell Rd. Intersection or driving past the elementary school or the park.

V85 FROM SOUTH TO NORTH



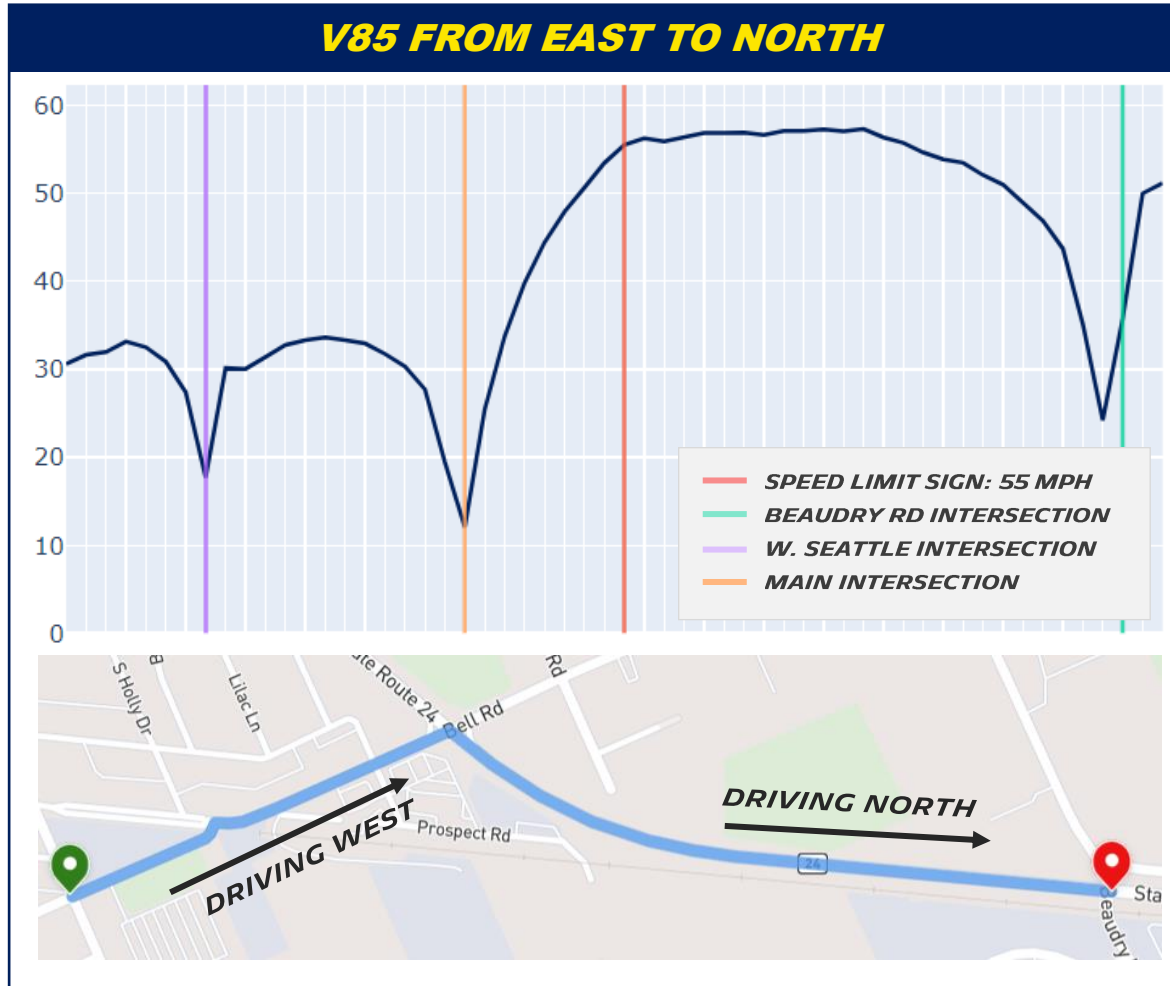
- SPEED LIMIT SIGN: 55 MPH
- BEAUDRY ROAD INTERSECTION
- MOXEE ELEMENTARY SCHOOL
- MOXEE CITY PARK
- MAIN INTERSECTION

- The V85 speed on US-24 is consistently around 60mph, about 5mph (10%) over the speed limit.



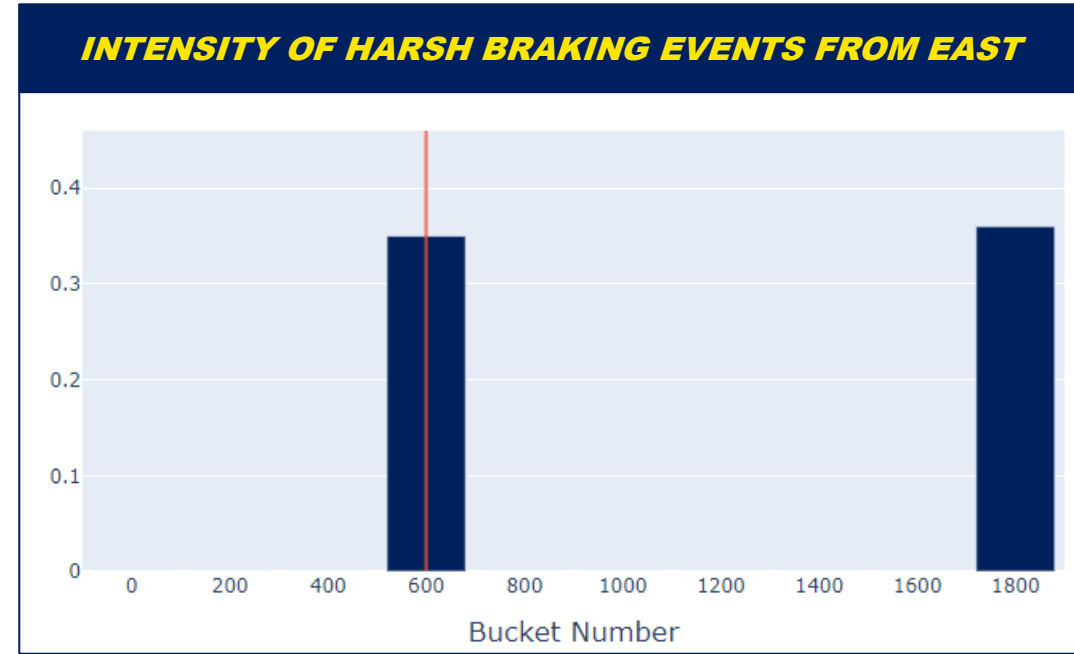
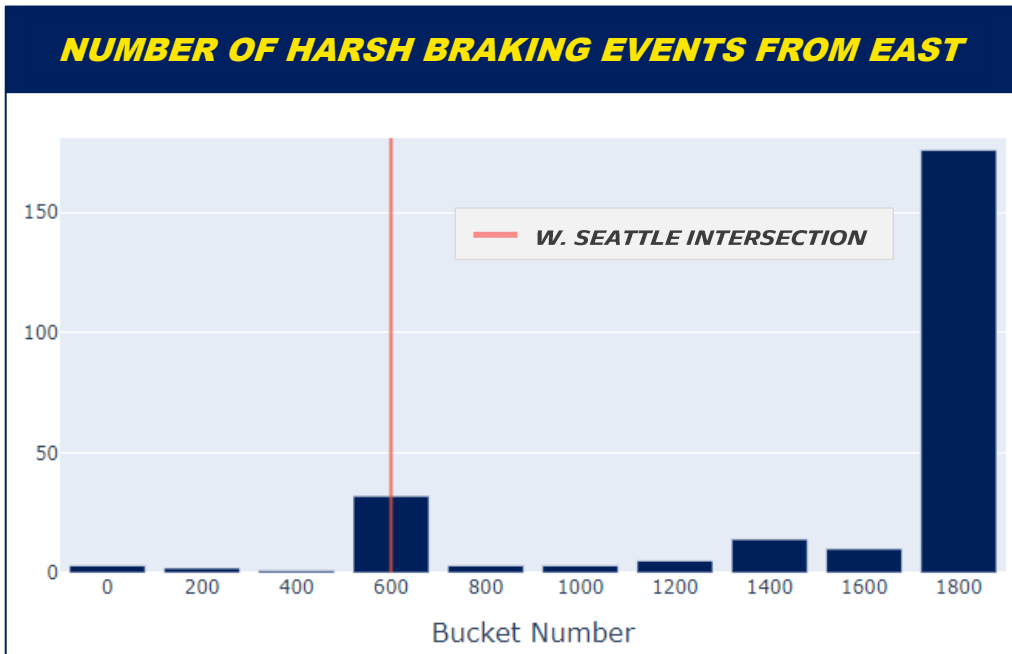
OBSERVATIONS

- Drivers decrease their speed significantly entering the turn lanes.
- Drivers from the South turning to head East accelerate after the turn lane and start decreasing their speed at the 25mph speed limit sign.



OBSERVATIONS

- Drivers heading west on Bell Road turning north onto US-24 slow down significantly at the intersection and start accelerating up to 60mph, consistent with normal driving behavior



* Average intensity calculated for 200ft road segments with > 20 events

FOR REFERENCE:

BRAKING INTENSITY DISTRIBUTION

- 25th percentile: 0.333
- 50th percentile: 0.348
- 75th percentile: 0.374

OBSERVATIONS

- There is an elevated number of harsh braking events at this intersection, especially from Bell Road from the east.
- However, these events are very close to the intersection, indicating a pattern of late braking behavior.
- The intensity of these braking events is consistent with the Yakima County average harsh braking intensity.

BRAKING INTENSITY FROM WEST



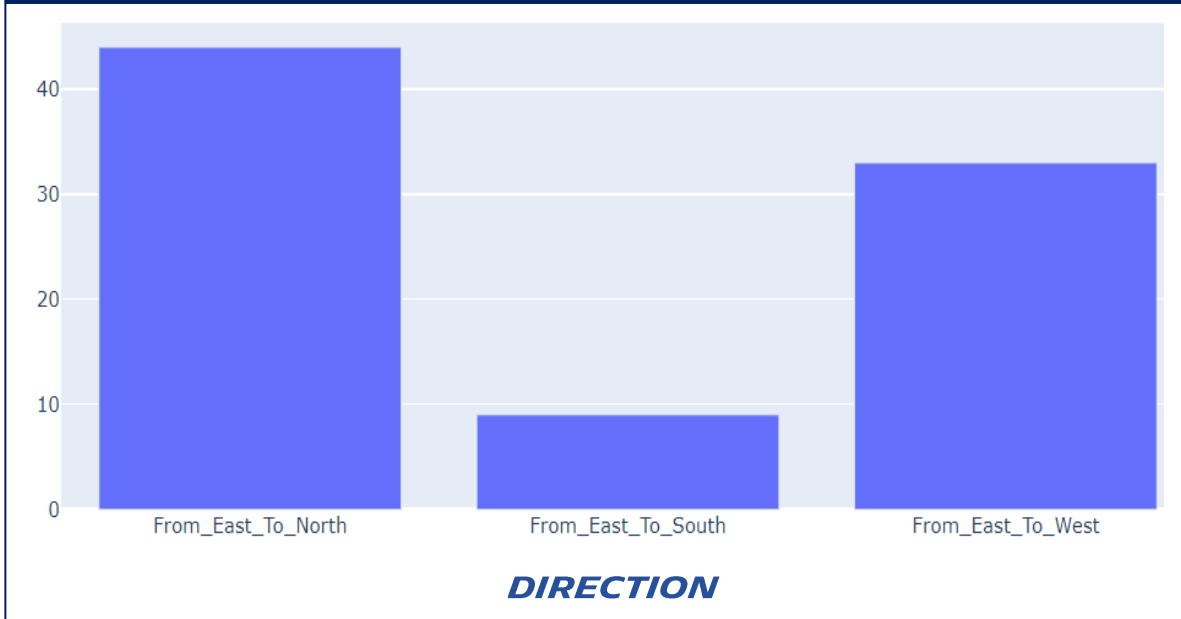
BRAKING INTENSITY FROM EAST

* Points represent average braking intensity for each 20ft road segment with at least 5 harsh braking events

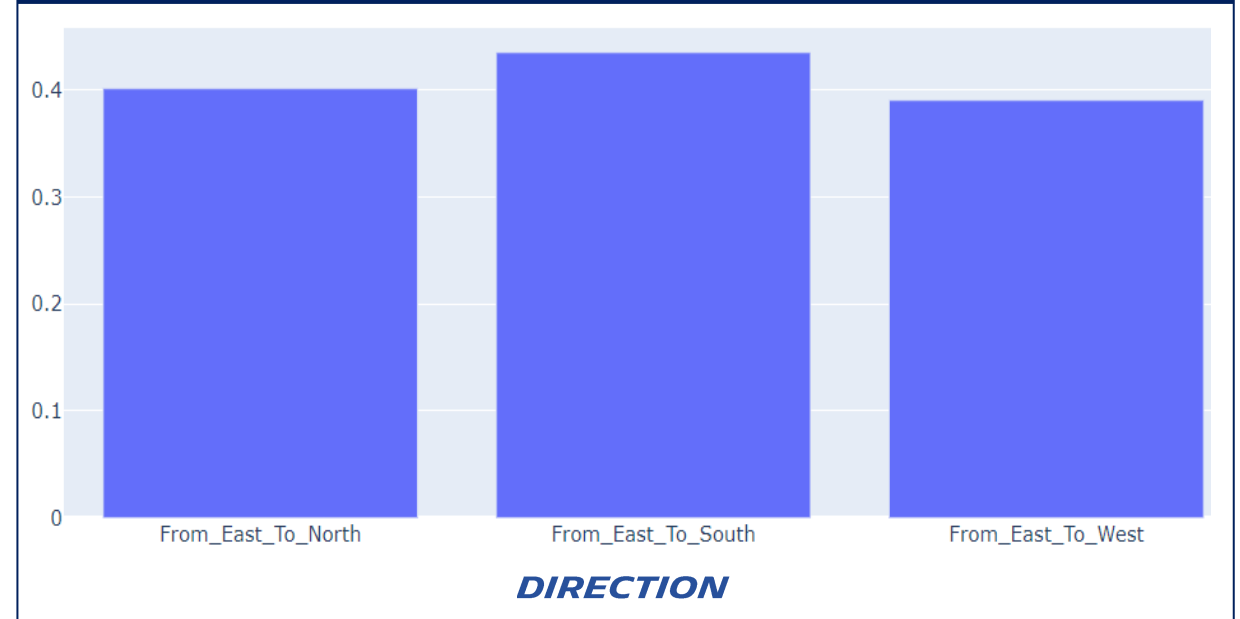
OBSERVATIONS

- Drivers from both east and west tend to brake more harshly the nearer they are to the stop sign at the intersection with US-24
- Drivers on Bell Road/W. Moxee Ave from the east also tend to brake frequently and harshly before the intersection with W. Seattle Ave, which as of September 2023 did not have a stop sign but did have a pedestrian crosswalk

NUMBER OF ACCELERATION EVENTS FROM EAST



MEDIAN INTENSITY OF ACCELERATION FROM EAST



OBSERVATIONS

- The pattern of acceleration behavior among drivers coming from the east on Bell Road indicates that drivers accelerate frequently and harshly, both to get directly across the intersection, as well as to get up to speed and out of the way of oncoming traffic when turning onto US-24.
- On a per-trip basis, harsh acceleration happens most frequently when drivers are going directly across the intersection.

CONCLUSIONS:

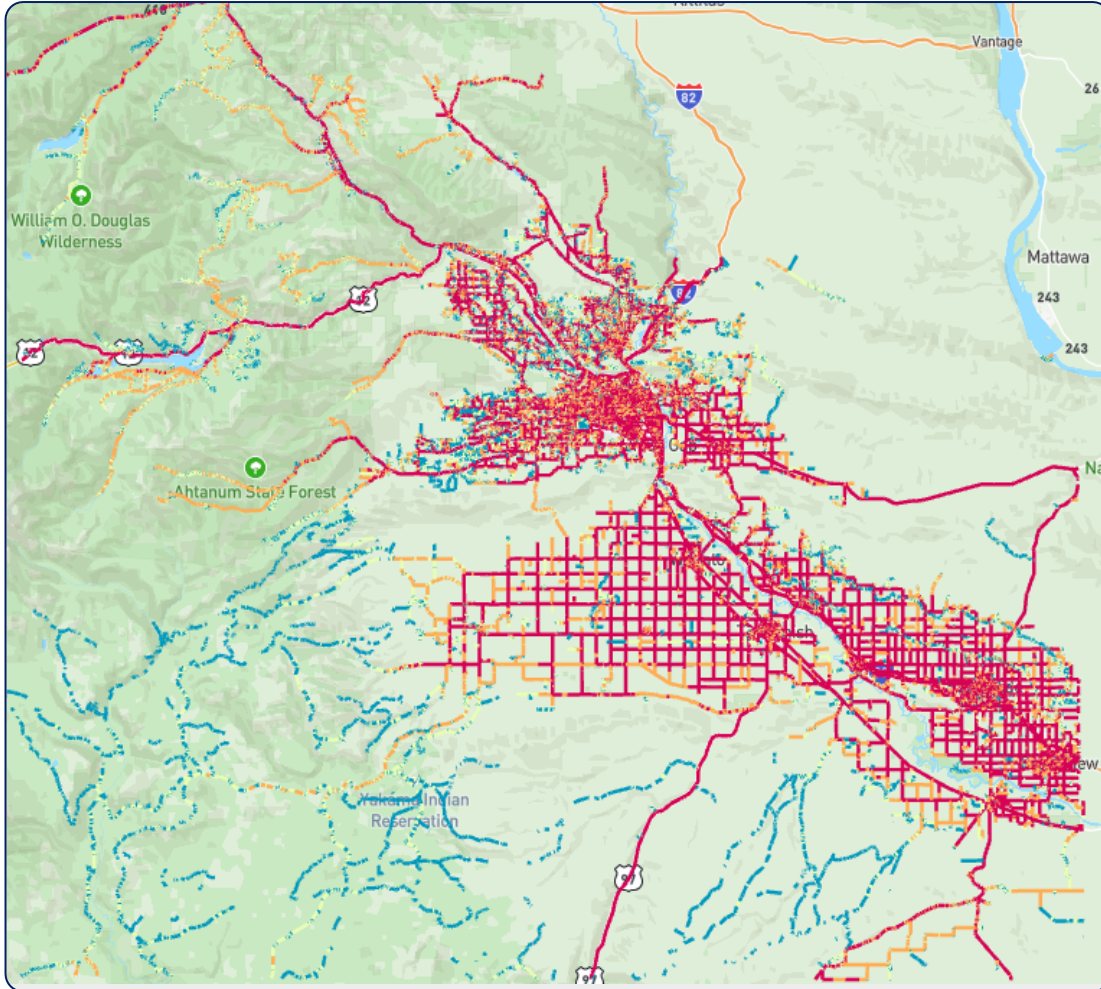
- There are some areas of risk, especially among drivers looking to cross or turn onto US-24 from Bell Road, specifically from the east.
- Although no areas were flagged as high VRU risk, in at least one area, speed and braking analysis indicated impact of pedestrian crosswalk on driving behavior.
- Our analysis did not identify major differences in behavior across different contexts, such as day vs. night, or weekday vs. weekend.
- V85 speed on US-24 in this corridor (generally about 5mph over the speed limit) does not indicate major problems with risk from speeding in this area.
- In conclusion: There are some specific risky driving behavior patterns, but generally, this corridor does not have as much abnormal driving behavior as some other, riskier areas.

MICHELIN

MOBILITY INTELLIGENCE

Y4

***YAKIMA CRASH RISK: DAY VS.
NIGHT***



SUMMARY OF COLLISION

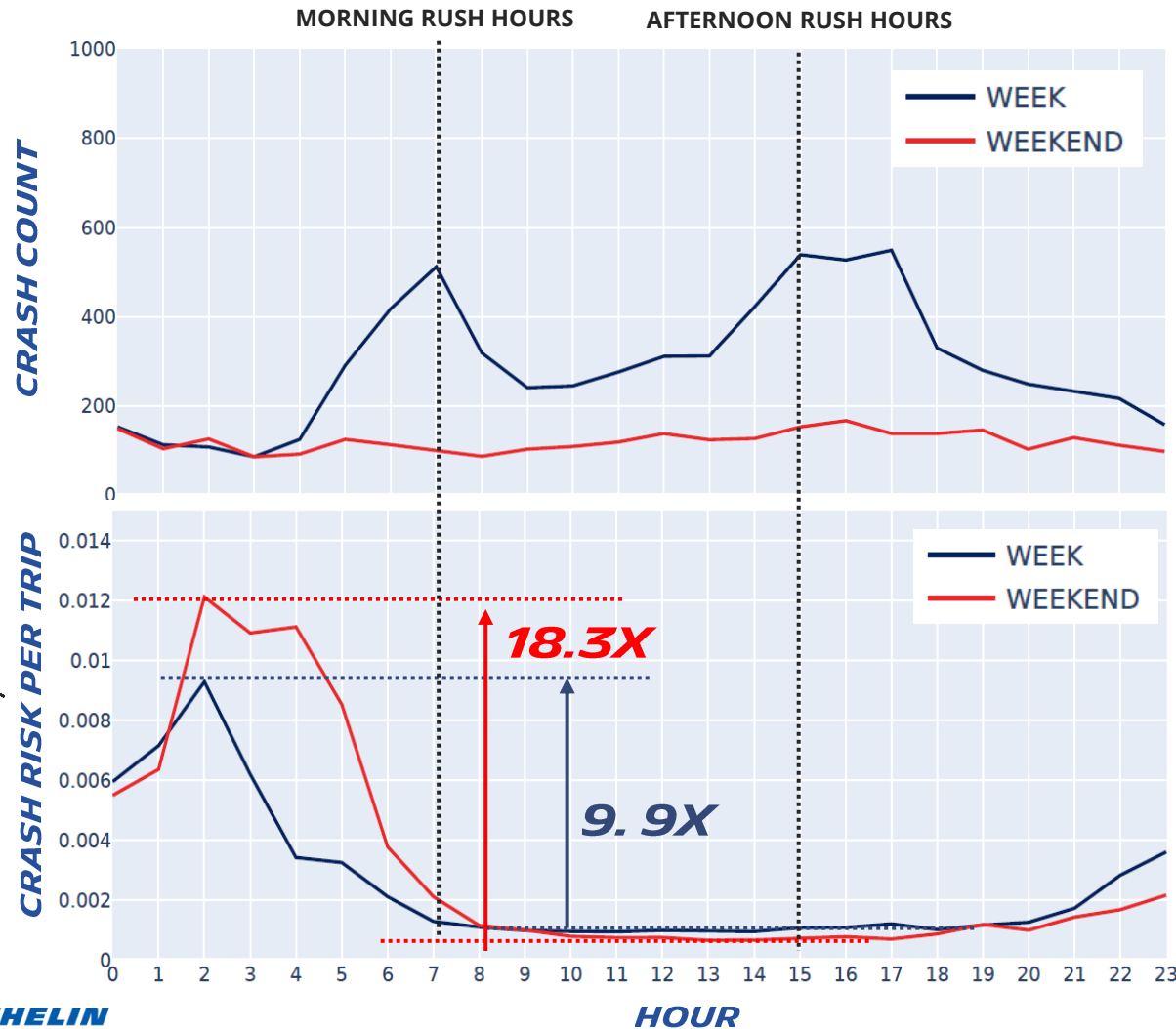
Type	Context	Collisions
Urban	Week	22424
Rural	Week	7076
Highway	Week	1882
Urban	Weekend	6592
Rural	Weekend	2886
Highway	Weekend	699



How do traffic safety dynamics shift throughout the day?

Are there specific times of day when the road network becomes a high-risk zone for crashes, and if so, where?

ADJUSTING FOR TRAFFIC VOLUME



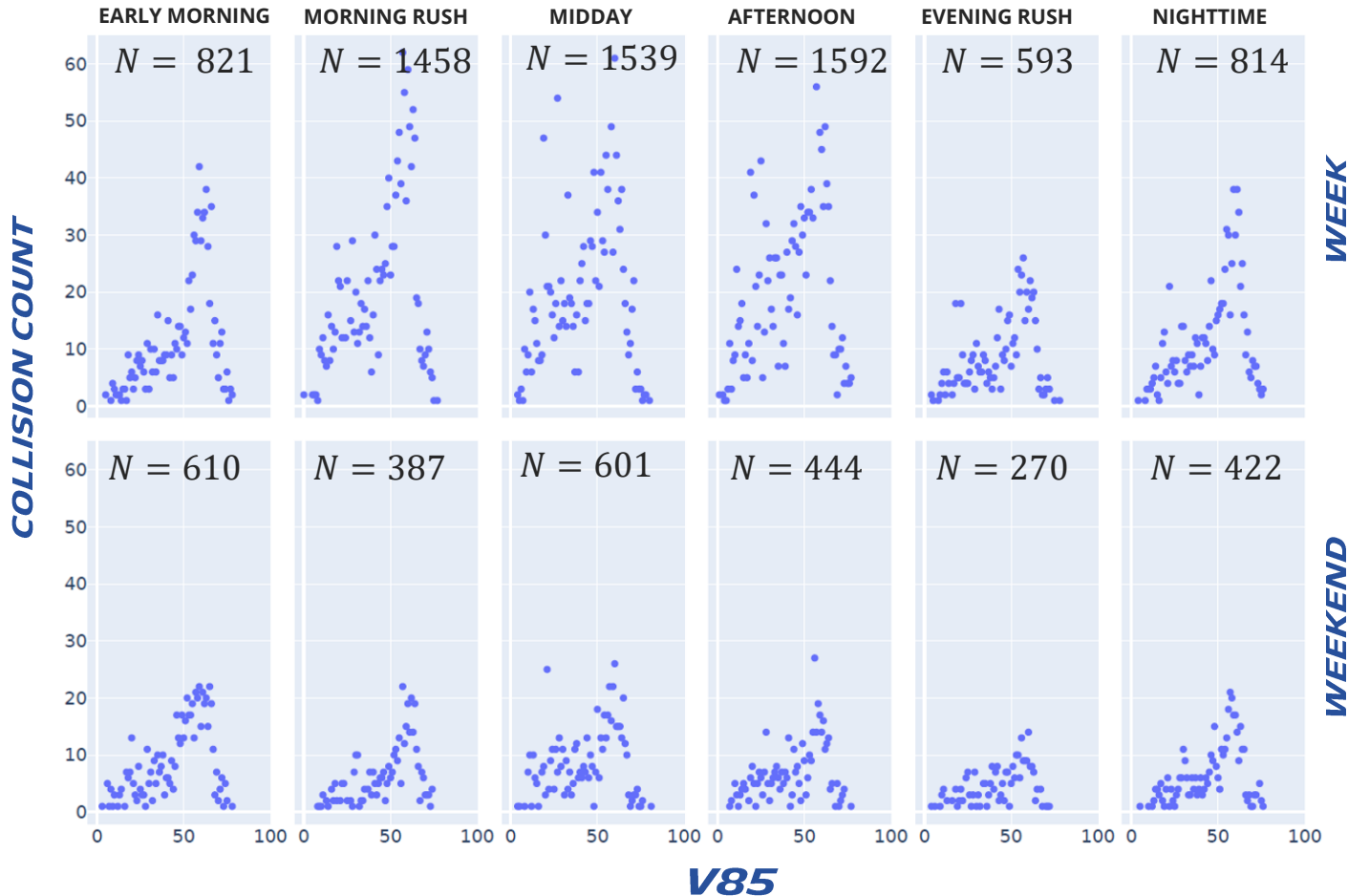
TAKEAWAYS:

- Crashes peak during weekday morning and afternoon rush hours, and around 2 pm on weekends.
- After 6 am, the crash risk drops to a minimum value and remains there. This implies that the risk of a trip experiencing a crash will be constant and the number of crashes remains proportional to traffic volume.
- For all kinds of roads, the crash risk is significantly higher from midnight to 6 am.

SUMMARY OF ANALYSIS

Type	Context	Risk Difference (Peak to Minimum)
Urban	Week	5.9x
Rural	Week	9.9x
Highway	Week	8.9x
Urban	Weekend	16.2x
Rural	Weekend	18.3x
Highway	Weekend	25.1x

YAKIMA COUNTY: COLLISIONS AND V85

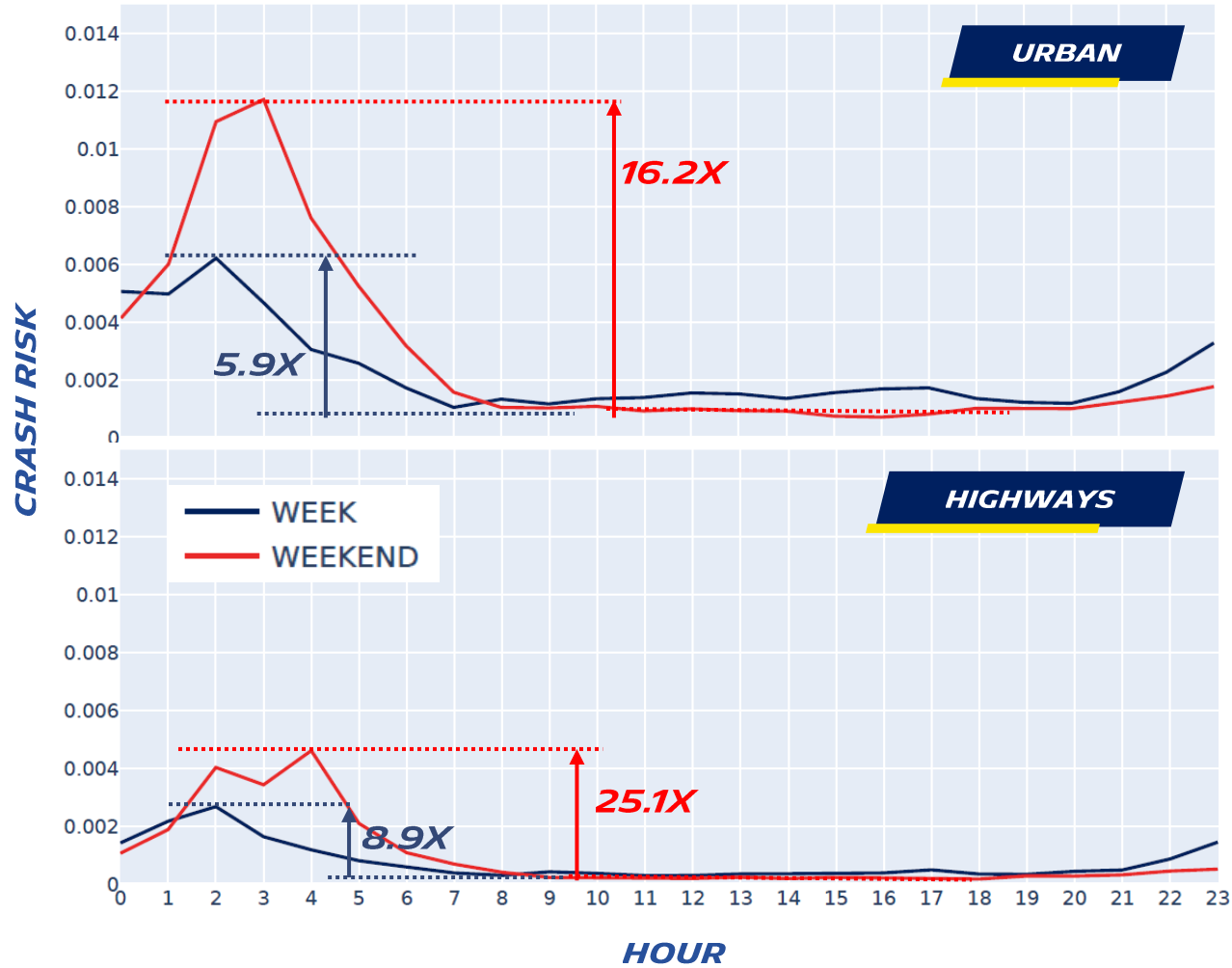


Early Morning: midnight - 6 am
Morning Rush: 6 am - 10 am
Midday: 10 am - 3 pm
Afternoon: 3 pm - 6pm
Evening Rush: 6 pm - 8 pm
Nighttime: 8 pm - midnight

Time	Context	50<V85<60
Early Morning	Week	27%
Early Morning	Weekend	27%
Morning Rush	Week	26%
Morning Rush	Weekend	27%
Midday	Week	23%
Midday	Weekend	23%
Afternoon	Week	25%
Afternoon	Weekend	27%
Evening Rush	Week	27%
Evening Rush	Weekend	29%
Nighttime	Week	27%
Nighttime	Weekend	30%

CRITICAL VELOCITY:

The data indicates that road segments with a V85 around 55 mph experience the highest number of collisions.



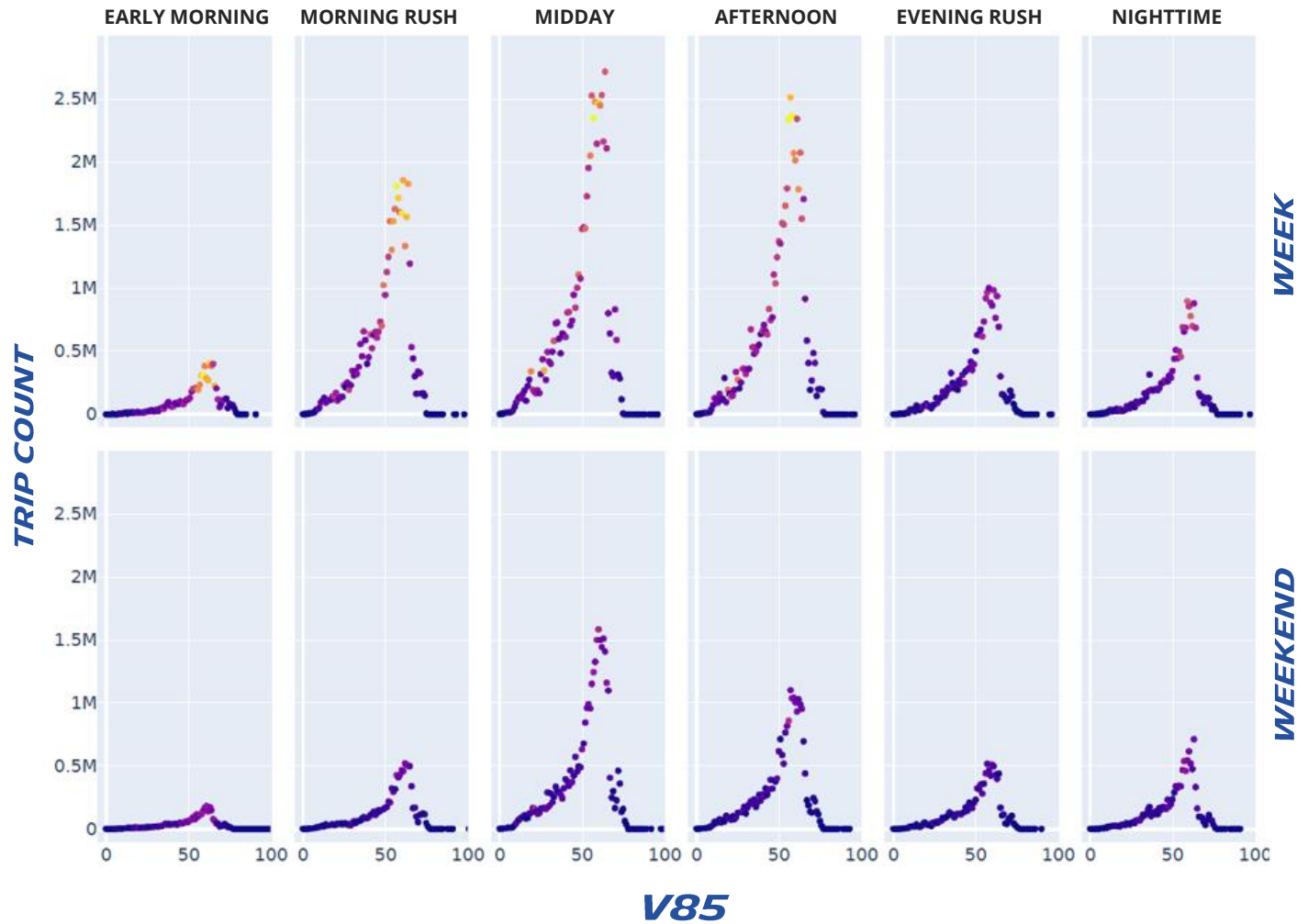
TAKEAWAYS:

- For all kinds of roads, the crash risk is significantly higher from midnight to 6 am.
- After 6 am, the crash risk drops to a minimum value and remains there. This implies that the risk of a trip experiencing a crash will be constant and the number of crashes remains proportional to traffic volume.
- Given the size of each network, highways show the highest risk of crash per mile traveled, followed by rural and urban roads.

SUMMARY OF ANALYSIS

Type	Context	Risk Difference (Peak to Minimum)
Urban	Week	5.9x
Rural	Week	9.9x
Highway	Week	8.9x
Urban	Weekend	16.2x
Rural	Weekend	18.3x
Highway	Weekend	25.1x

YAKIMA COUNTY: CRITICAL SPEED FOR RURAL ROADS



TAKEAWAYS:

- Of the rural roads, the highest number of trips occur on road segments with a V85 around 55 mph.
- The network experiences the highest volume of traffic at midday, followed by afternoon and morning rush hours. There is a similar pattern at higher magnitude during the week.
- **For rural roads, the risk of collision per trip is highest on roads where the V85 is around 55 mph, which is around the speed of the most heavily traveled roads.**

Early Morning: midnight – 6 am

Morning Rush: 6 am - 10 am

Midday: 10 am – 3 pm

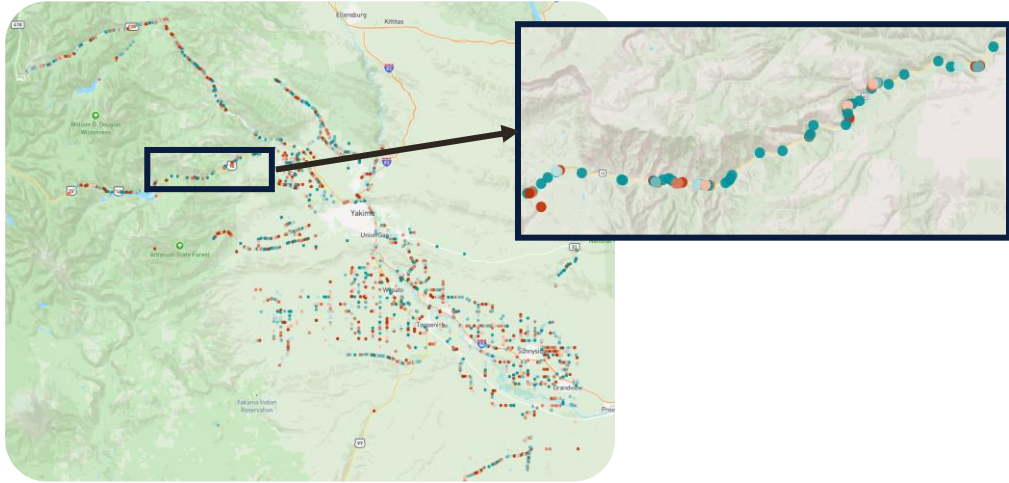
Afternoon: 3 pm – 6pm

Evening Rush: 6 pm – 8 pm

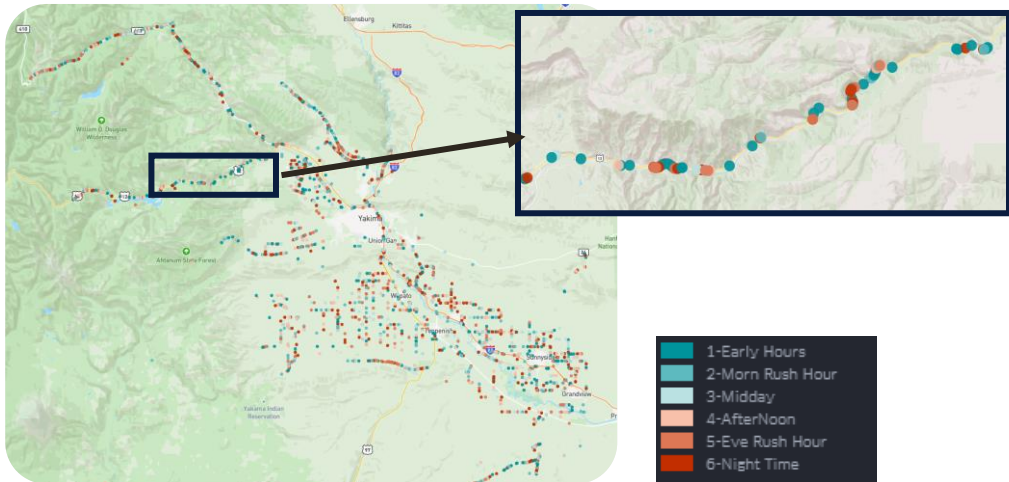
Nighttime: 8 pm - midnight

ROADS WITH CRITICAL V85

WEEK



WEEKEND



PUTTING EVERYTHING TOGETHER:

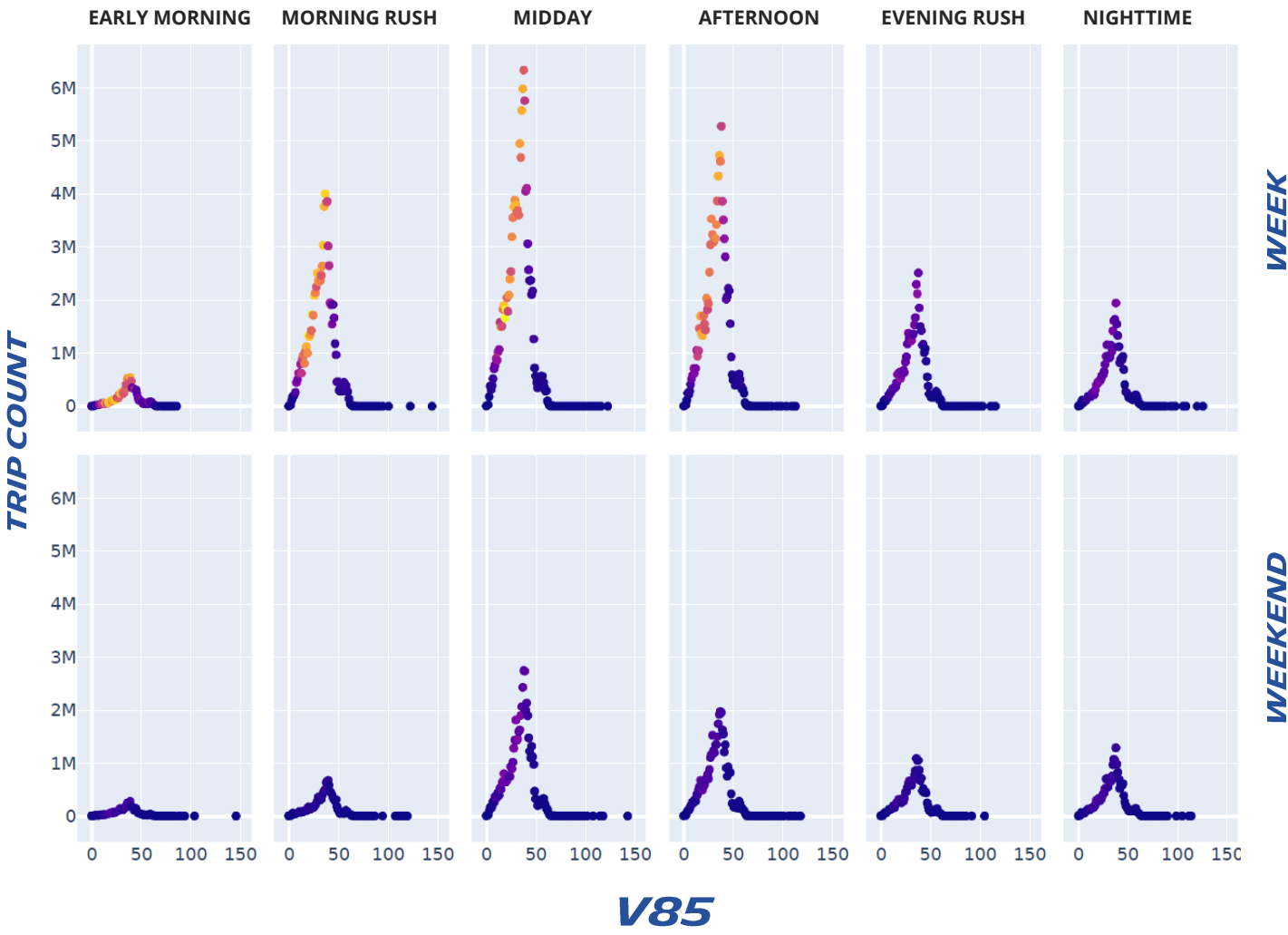
- During weekdays, the highest number of crashes occurs during the morning and evening rush hours. On weekends, these events peak around 2 pm.
- In terms of crash risk per trip, the highest risk is observed between midnight and 6 am, with the risk being as high as 25x higher than in daytime.
- The highest risk of crashes occurs on road segments where V85 is around 55 mph for rural.
- A number of factors could drive these periods of increased risk, such as poor lighting, higher speeds at night, driver fatigue, and possibly impaired driving.

PUTTING EVERYTHING TOGETHER:

- During weekdays, the highest number of crashes and atypical driving events occur during the morning and evening rush hours. On weekends, these events peak around 2 pm.
- In terms of crash risk per trip, the highest risk is observed between midnight and 6 am, with the risk being as high as 25x higher than in daytime.
- The highest risk of crashes occurs on road segments where V85 is around 55 mph for rural roads, 30 mph for urban roads, and 70 mph for highways.
- A number of factors could drive these periods of increased risk, such as poor lighting, higher speeds at night, driver fatigue, and possibly impaired driving.



YAKIMA COUNTY: CRITICAL SPEED FOR URBAN ROADS



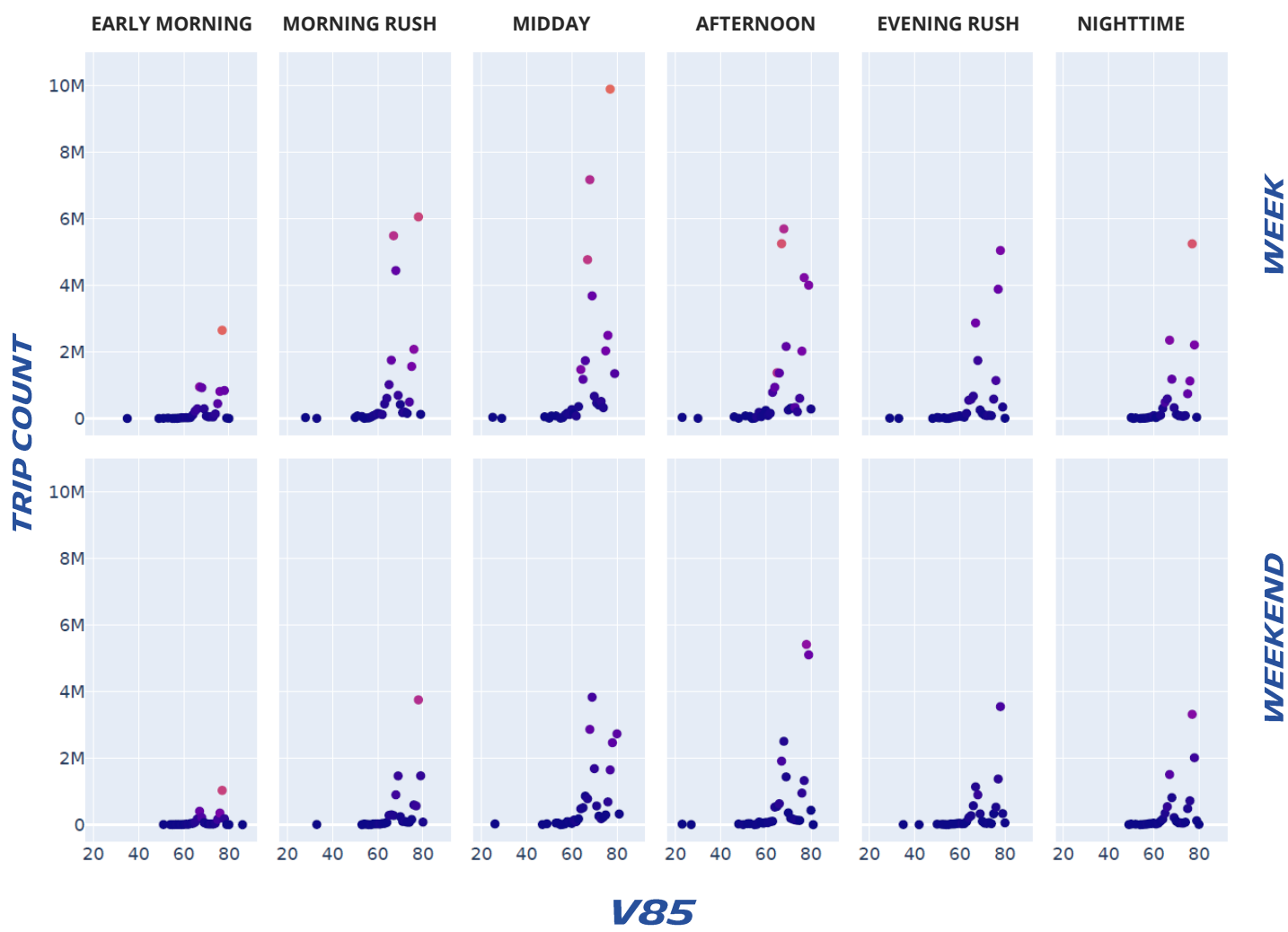
TAKEAWAYS:

- Out of all the road segments in the urban road network, the highest number of trips occur on road segments with a V85 of 40 mph.
- Similar traffic patterns as rural roads are observed for urban roads, both during the week and on weekends.
- **For urban roads, the risk of collision per trip is highest on roads where the V85 is around 30 mph, which is below the speed of the most heavily traveled roads.**

YAKIMA COUNTY: CRITICAL SPEED FOR FREEWAYS

MICHELIN

MOBILITY INTELLIGENCE



TAKEAWAYS:

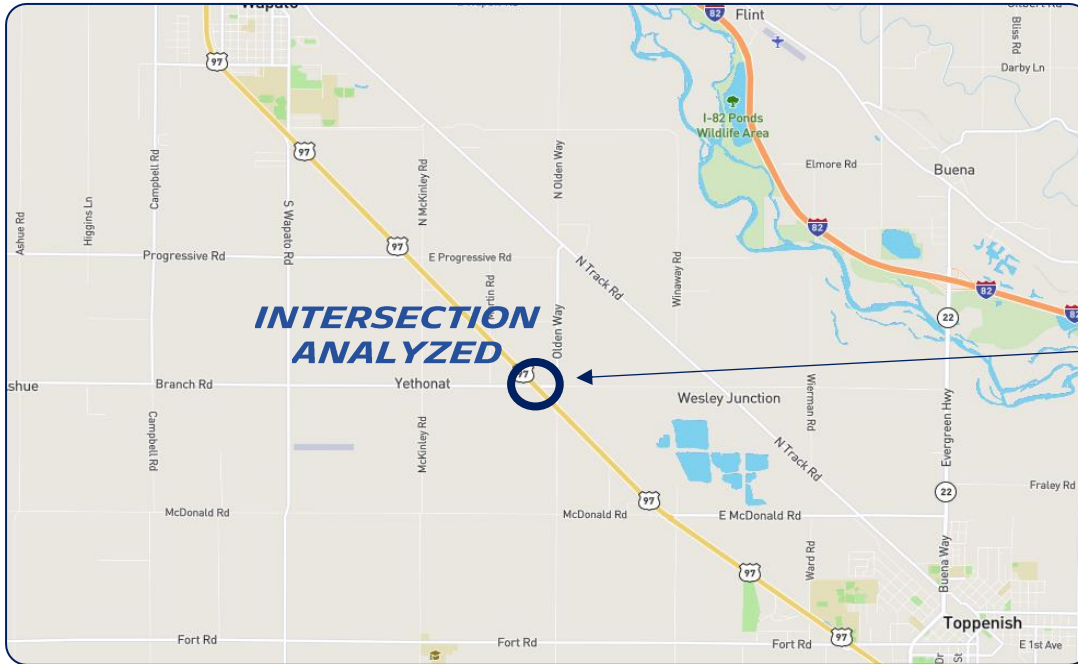
- Out of all the road segments in the highway road network, the highest number of trips occur on road segments with a V85 of between 60 and 80 mph.
- Similar traffic patterns as rural and urban roads are observed for highways, both during the week and on weekends.
- **The risk of collision per trip over the network of highways roads is highest on roads where the majority of the traffic tends to be driving.**

MICHELIN

MOBILITY INTELLIGENCE

Y5

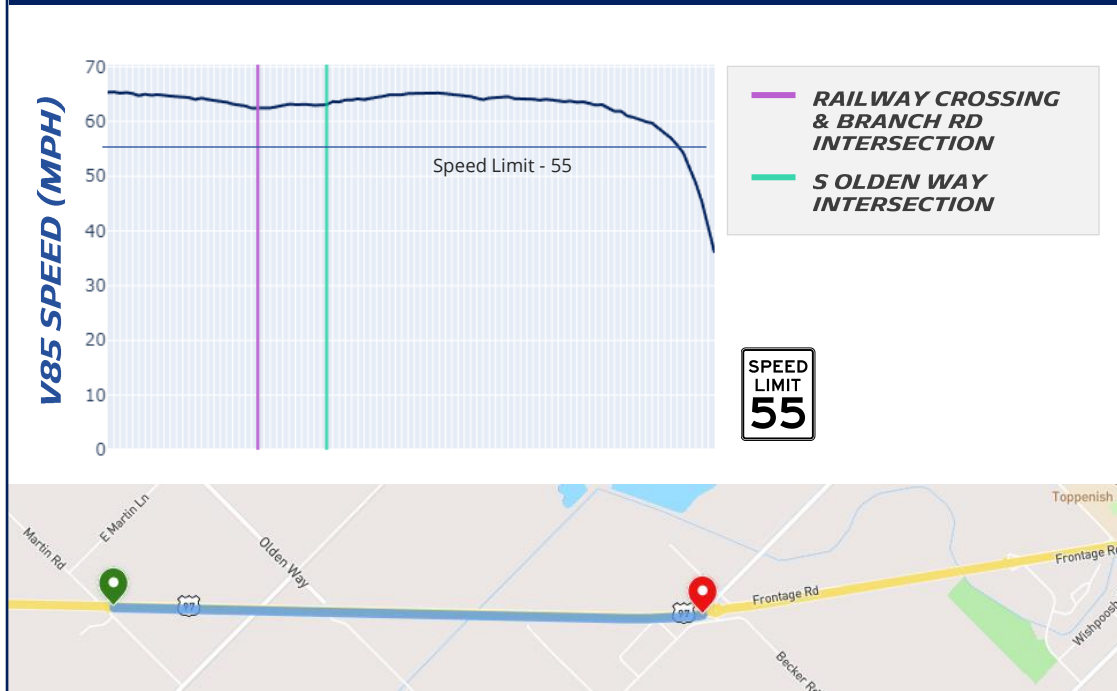
***INTERSECTION BETWEEN
HIGHWAY 97 AND BRANCH RD***



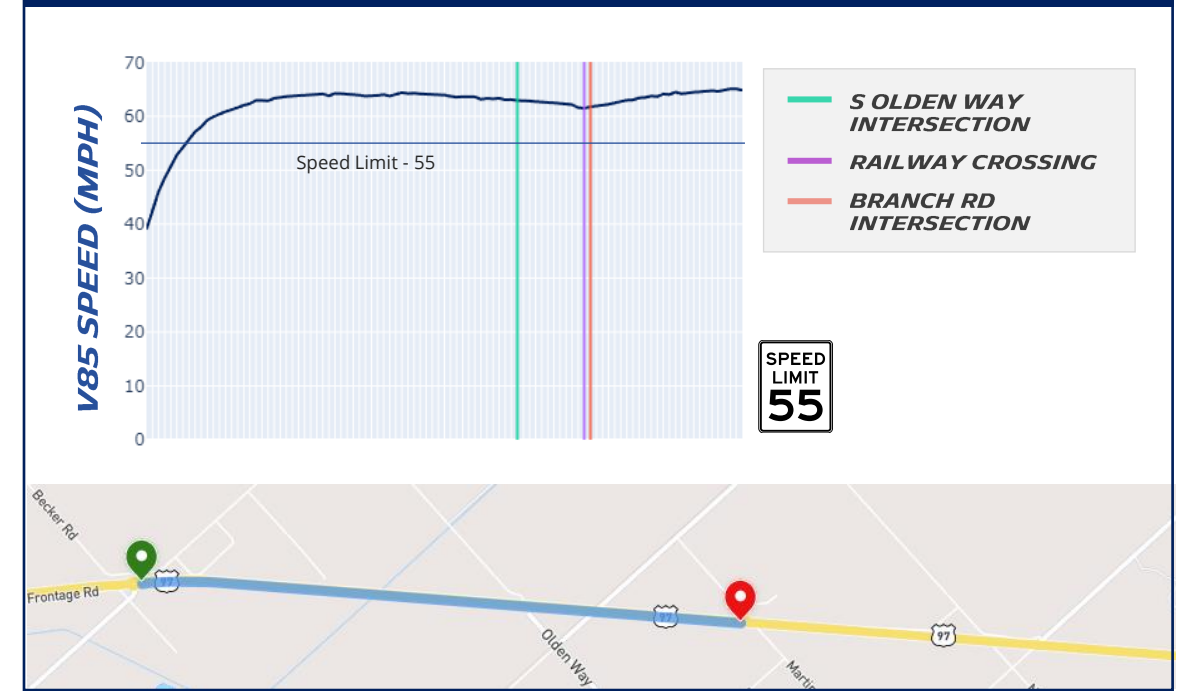
FOCUS AREA OVERVIEW

- 55 mph speed limit on US-97
- 50 mph speed limit on Branch Rd.
- Train tracks are present, parallel to Branch Rd
- Branch Rd has stop signs at the intersection with US-97, traffic on US-97 does not stop

V85 FROM NORTH TO SOUTH



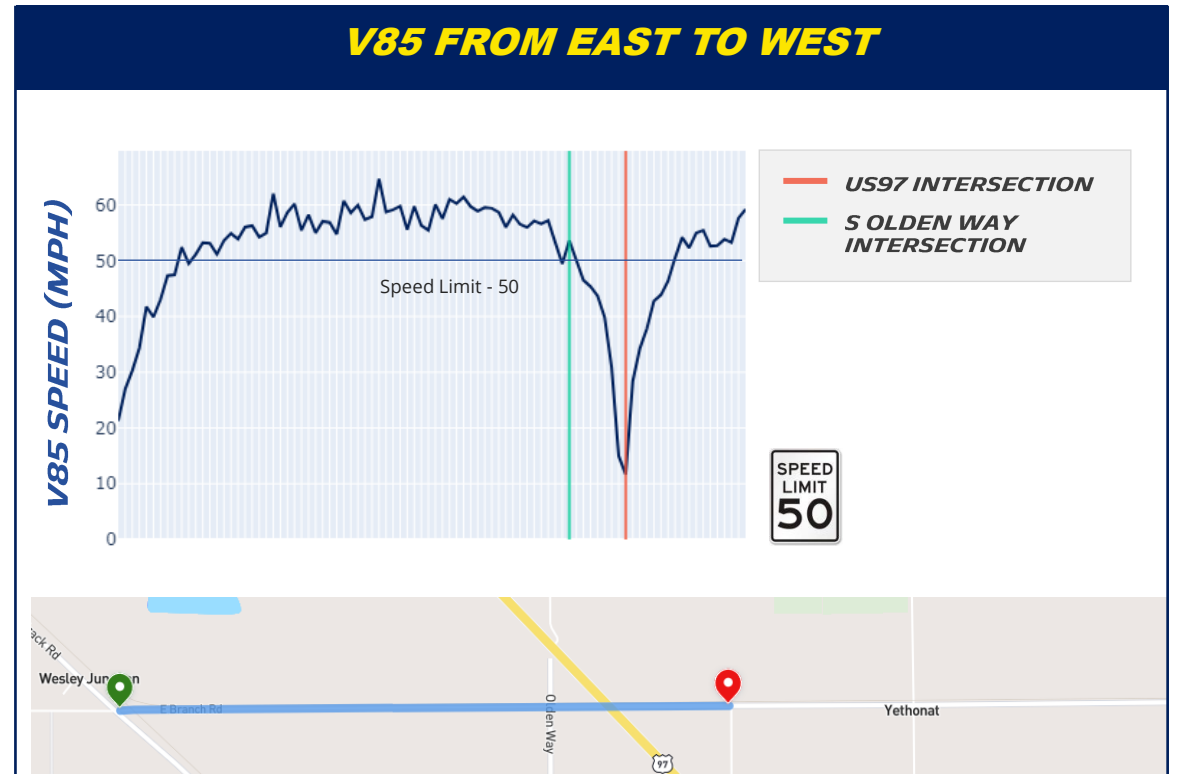
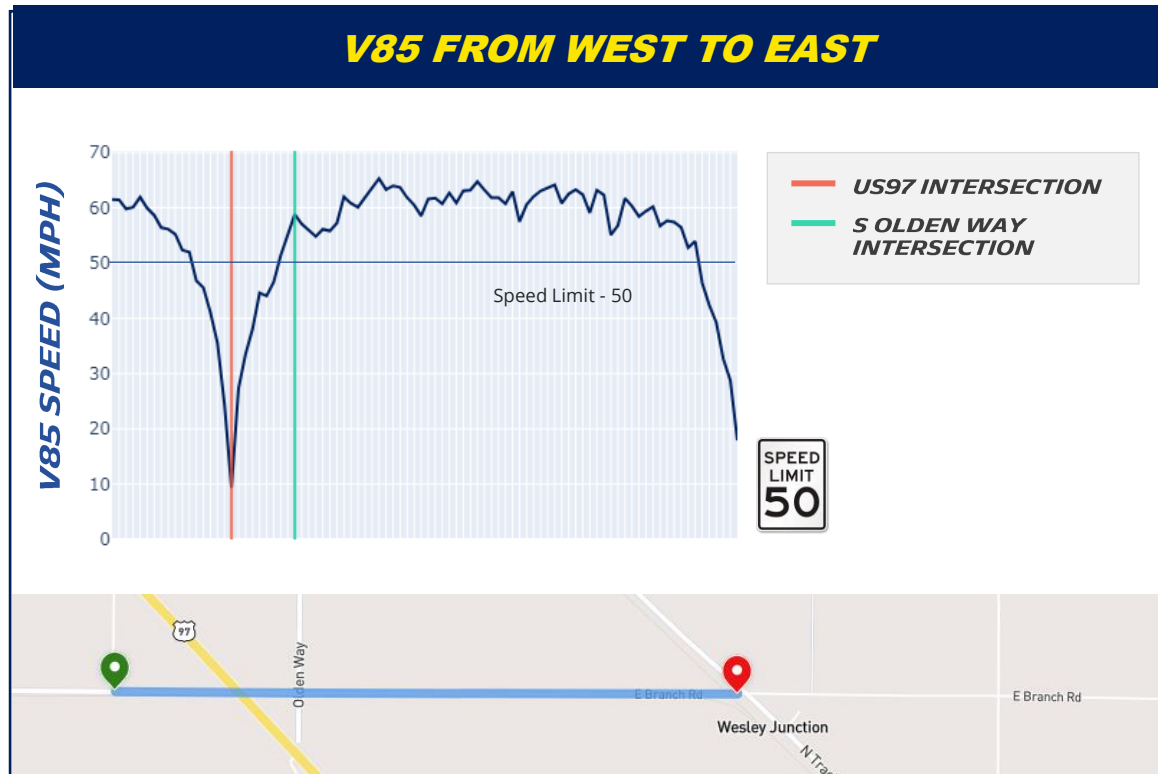
V85 FROM SOUTH TO NORTH



OBSERVATIONS

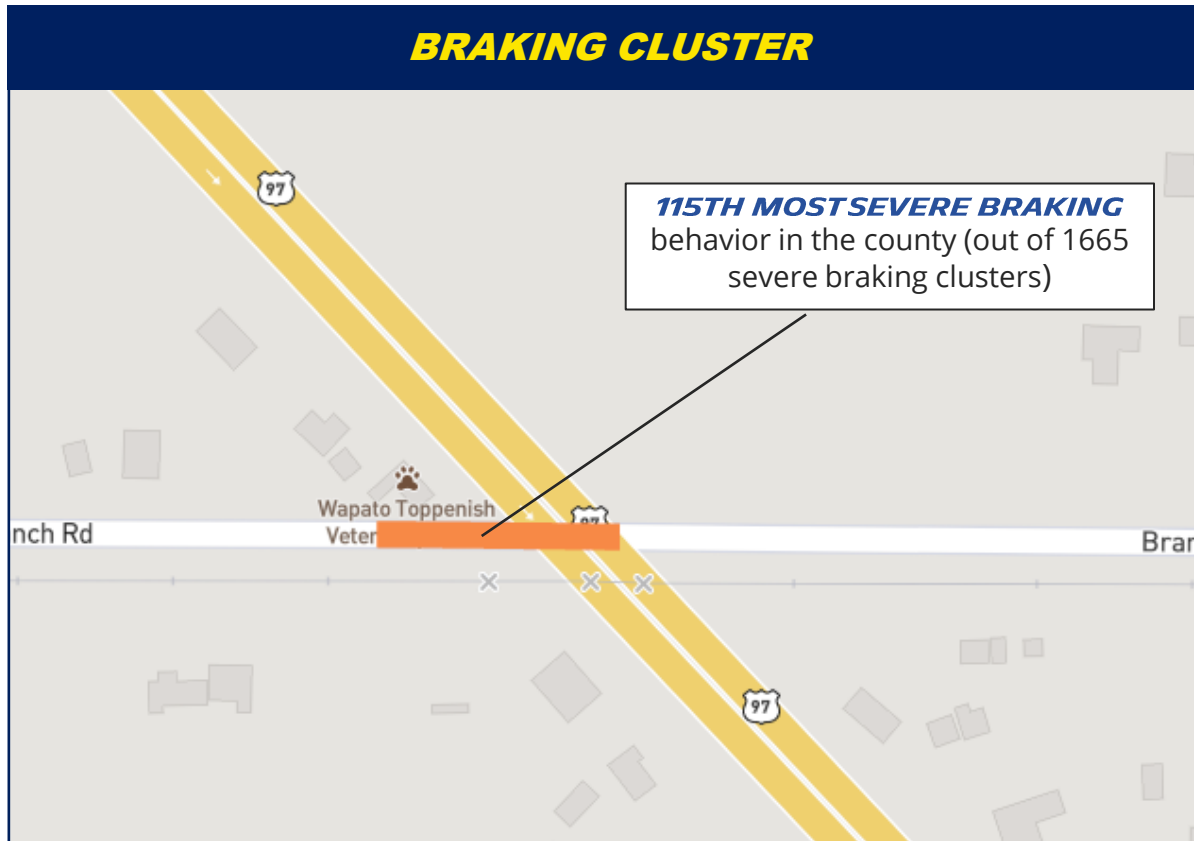
- Drivers speed decrease before roundabout near McDonald Rd
- We notice speeding: V85 speed is close to 10 mph above the speed limit for both directions
- There was a very slight drop in speed at the intersection. This shows that very few drivers stop when passing over the railroad.

YAKIMA 5 : V85 SPEED (BRANCH RD)



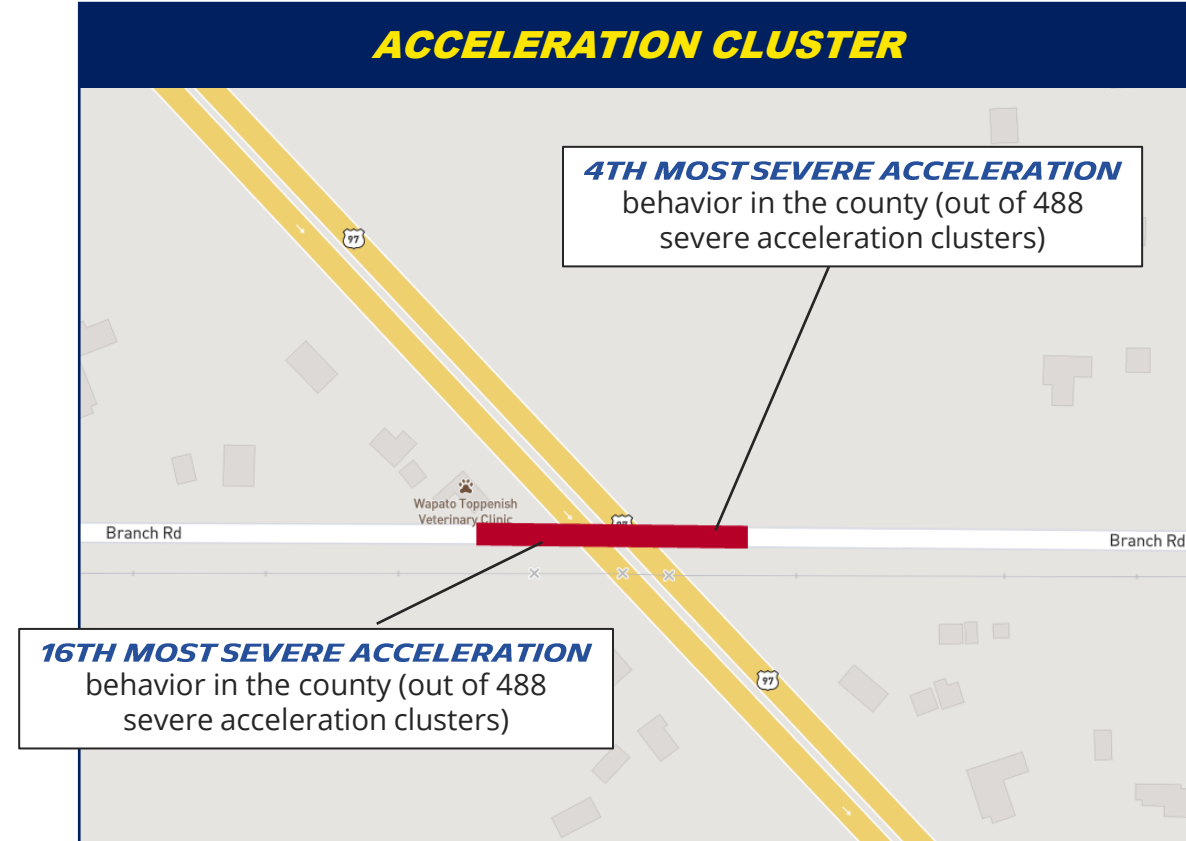
OBSERVATIONS

- Significant speeding : 15% of drivers are going more than 10 mph over the speed limit
- Speed is reduced even more abruptly ahead of stop signs than other areas we studied



OBSERVATIONS

- Somewhat abnormal harsh braking behavior coming from West to East on Branch Road

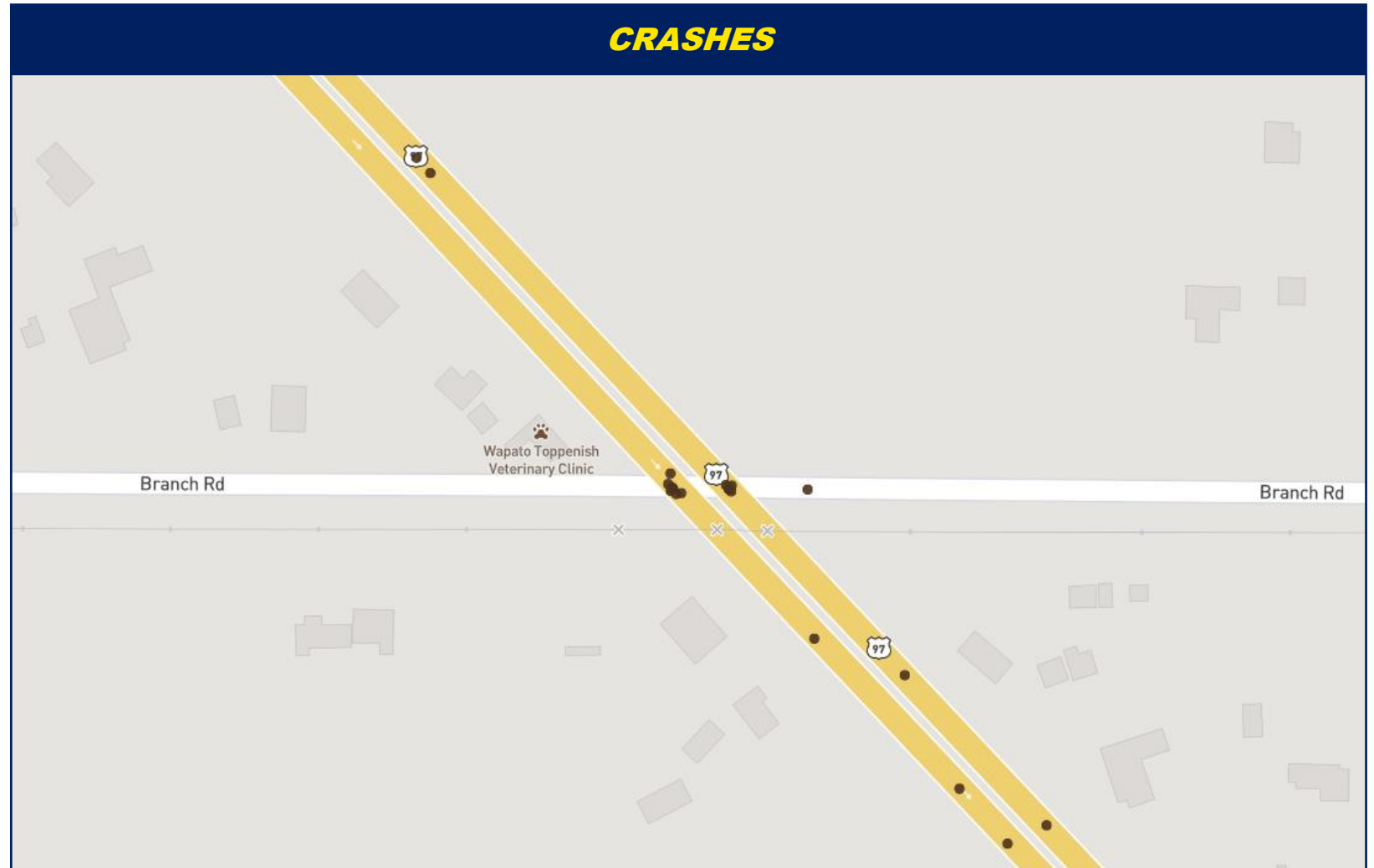


OBSERVATIONS

- Extremely abnormal harsh acceleration behavior detected coming from Branch Road from both directions

OBSERVATIONS

- Fairly dense crash history (11 crashes at the intersection between 2020 and 2023)
- All V2V crashes, no pedestrian nor bicycles involved
- Additional crashes on US-97 within several hundred yards of the intersection



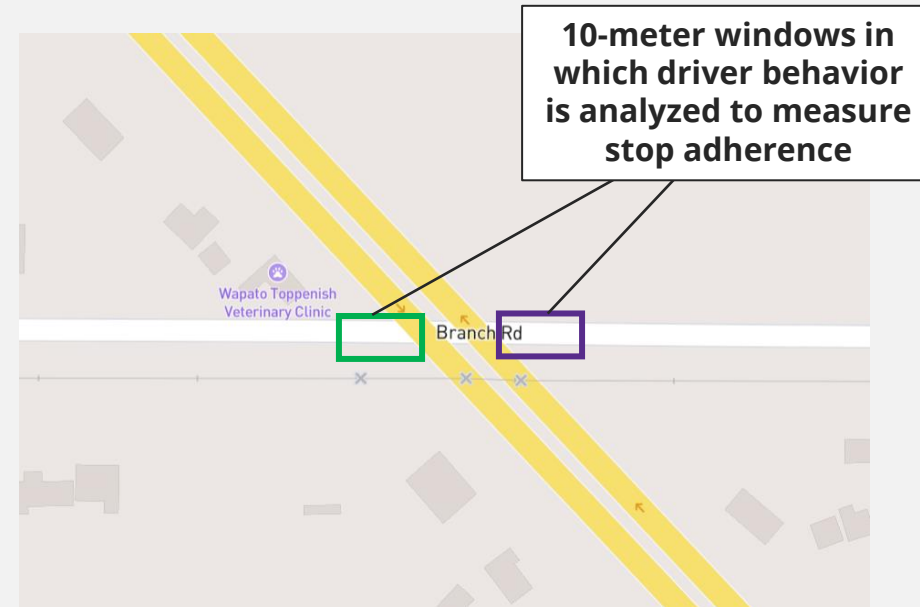
OBJECTIVE

Identify driver behavior at stop signs, specifically how commonly we see full stop adherence and how commonly we see failure to stop.

Approach:

- Identify where the most low/zero-speed data points are clustered, and define a 10-meter window around the center of this cluster as the "correct stopping window"
- The size of this window acknowledges the fact that not everyone who stops at a stop sign stops in exactly the same place.
- Once this window is identified, we can determine how many drivers in this window are going at speeds that indicate they did not stop fully, or at all, at the stop sign.

STEP 1: DEFINING THE STOPPING WINDOW



STEP 2: ESTABLISHING BEHAVIOR BASELINE AT 6 NEARBY 4-WAY STOP INTERSECTIONS

Baseline Comparison:

- Analyzing 6 nearby 4-way stop intersections determined that a baseline for full stop sign adherence is **83.9% at 4-way stops**
- This means 83.9% of trip points in the stopping window for those intersections were under 10 MPH
- We would expect to see significantly higher adherence at this Branch Rd. intersection because traffic on US-97 does not stop

Findings:

- Both approaches show much higher adherence than the baseline, as expected.
- Between 0.5% and 0.7% of trip points in these stopping windows are above 20mph, indicating failure to stop risk.

STEP 3: EVALUATING BEHAVIOR AT INTERSECTION IN FOCUS

Intersection Name	% of data points in stopping window within 0-10 MPH	% of data points in stopping window within 10-20 MPH	% of data points in stopping window within 20-30 MPH	% of data points in stopping window above 30 MPH
	"Adherence"	"Possible Adherence"	"Violation Risk"	"High Violation Risk"
Branch/US97 (from West) 2149 trip points	91.4%	7.9%	0.6%	0.1%
Branch/US97 (from East) 2072 trip points	92.0%	7.4%	0.3%	0.2%

*Note: This analysis was updated on 9/6/24 after initial delivery to include additional data filters, to account for the fact that this intersection is a 2-way stop and differs from the first intersections analyzed, which were all 4-way stops. These updated results are more robust and show higher stop adherence than the initial results did.

US 97 - NORTH TO SOUTH

Speed Category	Trip Points	% of Trip Points
55-60mph	208,619	32.33
60-65mph	152,784	23.68
65-70mph	49,666	7.70
70-75mph	10,975	1.70
75-80mph	2,493	0.39
80-90mph	984	0.15
90-100mph	180	0.03
Above 100mph	97	0.02

US 97 – SOUTH TO NORTH

Speed Category	Trip Points	% of Trip Points
55-60mph	212,085	34.27
60-65mph	143,630	23.21
65-70mph	41,348	6.68
70-75mph	8,781	1.42
75-80mph	1,920	0.31
80-90mph	793	0.13
90-100mph	158	0.03
Above 100mph	79	0.01

OBSERVATIONS

- 2.3% of drivers going south and 1.9% of drivers going north on US-97 were speeding by more than 15mph
- Although relatively rare, extremely high-speed trips were present on this stretch of road going in both directions

BRANCH ROAD - WEST TO EAST

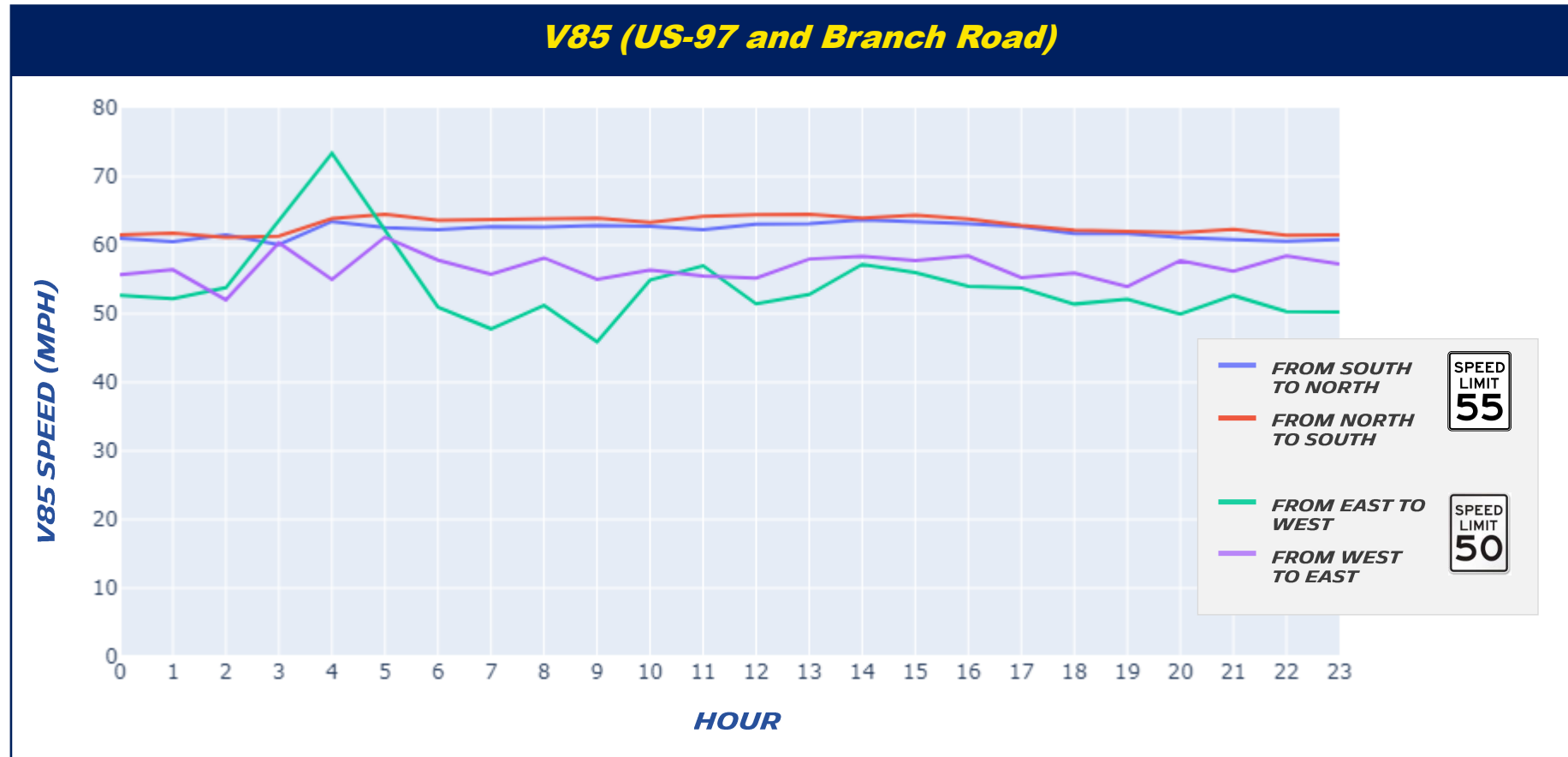
Speed Category	Trip Points	% of Trip Points
50-55mph	856	14.01
55-60mph	799	13.08
60-65mph	447	7.32
65-70mph	124	2.03
70-75mph	36	0.59
75-80mph	14	0.23
80-90mph	5	0.08
90-100mph	1	0.02
100mph +	0	0

BRANCH ROAD - EAST TO WEST

Speed Category	Trip Points	% of Trip Points
50-55mph	548	12.43
55-60mph	329	7.46
60-65mph	146	3.31
65-70mph	54	1.22
70-75mph	15	0.34
75-80mph	7	0.16
80-90mph	4	0.09
90-100mph	2	0.05
100mph +	1	0.02

OBSERVATIONS

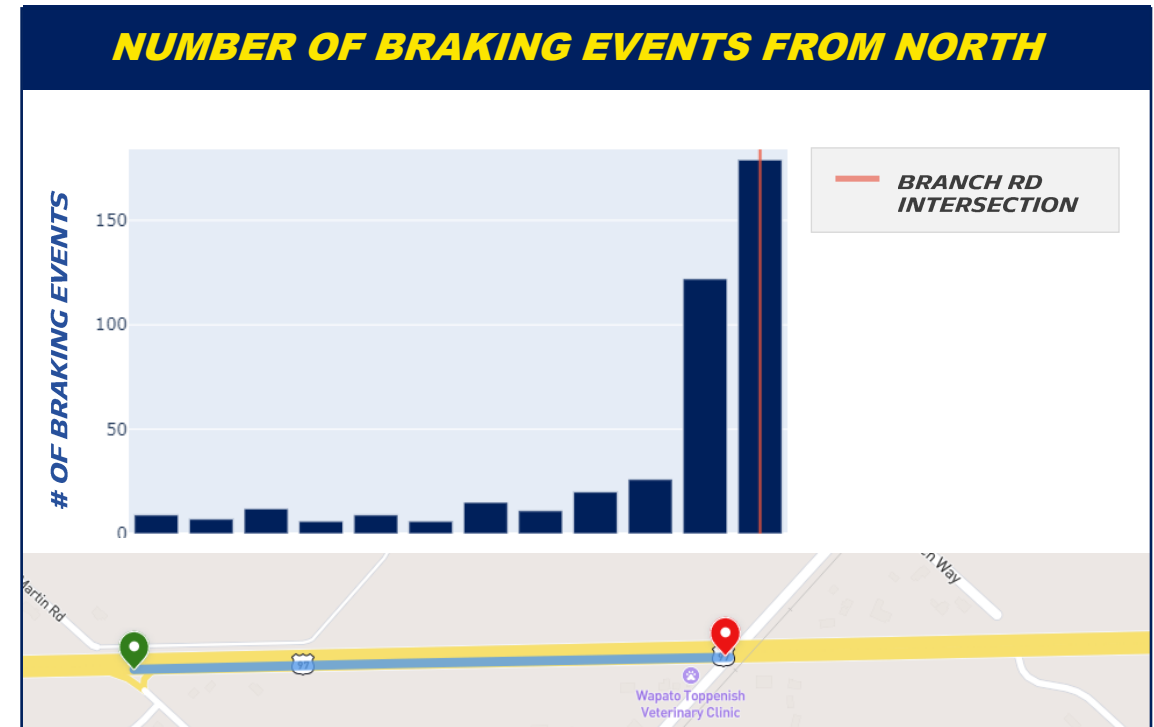
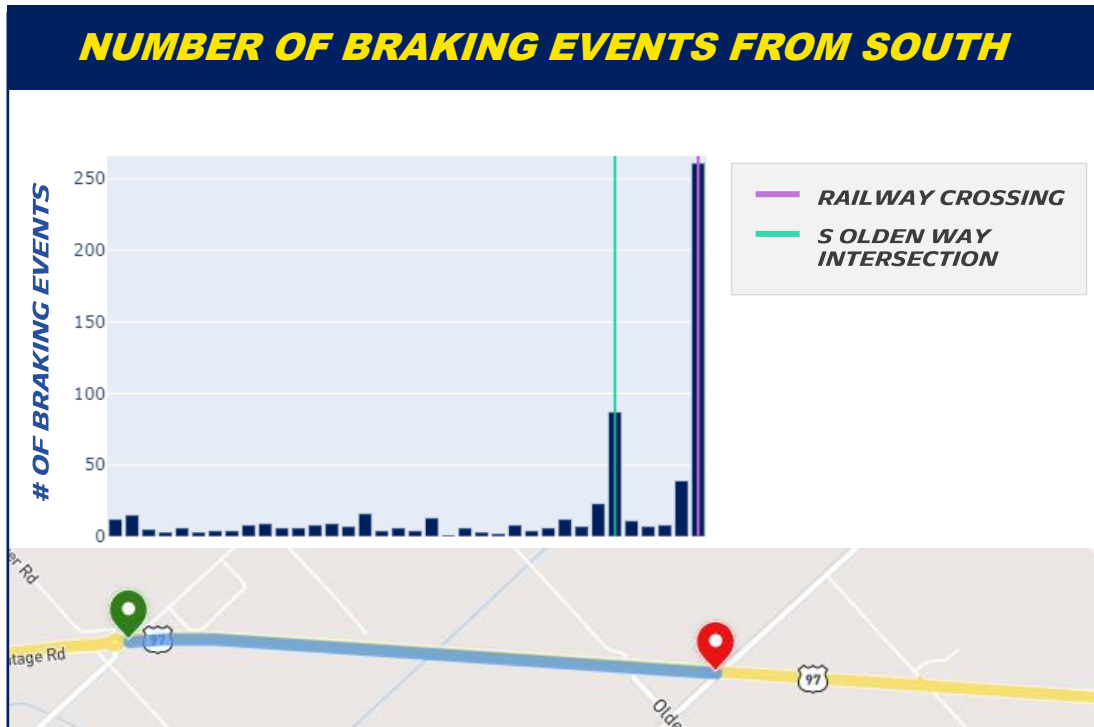
- 3.0% of drivers going east and 1.9% of drivers going west on Branch Rd. were speeding by more than 15mph
- Although speed is lower than US-97, this road is narrow with small shoulders and has stretches of trees and structures very near the road, creating a risk of a serious crash, especially when visibility is low.



OBSERVATIONS

- As expected, V85 on US-97 is generally above that of Branch Road, although the difference is smaller at night and in the early morning.
- V85 spike on Branch Rd. in early morning may be due to small sample size.

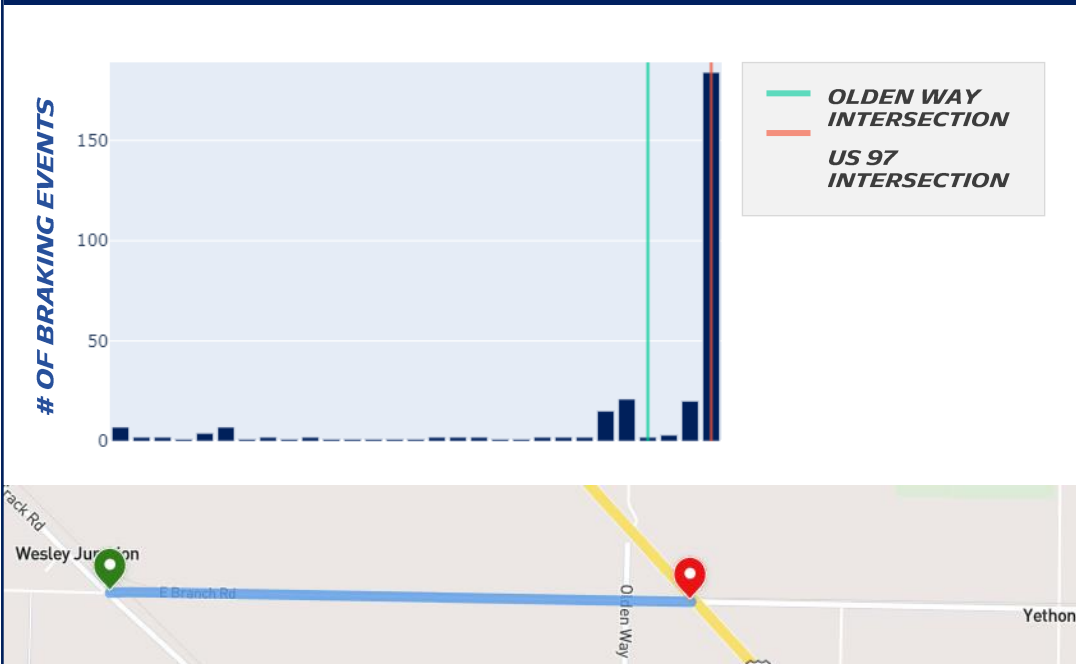
YAKIMA 4 : BRAKING EVENTS (US 97)



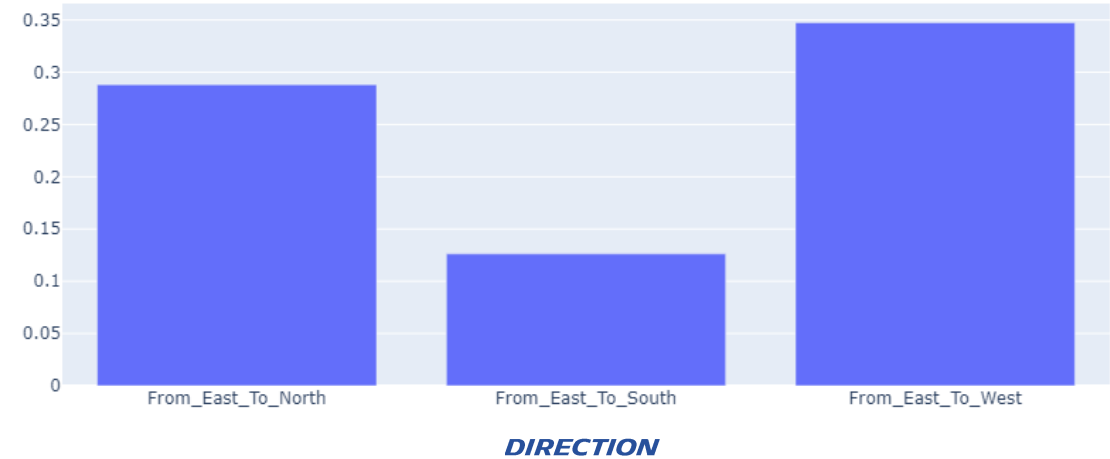
OBSERVATIONS

- Harsh braking is minimally present before intersection with Branch Road and the train tracks in both directions
- Relative to the hundreds of thousands of trips on US-97, the few hundred harsh braking events tell us that braking is not frequent at all where traffic crosses this intersection
- This is consistent with our V85 speed analysis

NUMBER OF BRAKING EVENTS FROM EAST



NUMBER OF ACCELERATION EVENTS FROM EAST



OBSERVATIONS

- Harsh braking occurs relatively frequently as drivers on Branch Road approach US-97 from the east
- When drivers on Branch Road approach US-97 from the east, they accelerate harshly when going straight across the intersection or when turning right to go north. However, they do not accelerate aggressively as often when turning left and crossing traffic to go south.

KEY TAKEAWAYS

- Severe driving behavior is present, both acceleration and braking, for drivers on Branch Rd. approaching US-97. In part, the severe acceleration behavior is likely influenced by the large distance across 4 lanes that drivers on Branch Rd. need to cross to get across the highway.
- V85 speed is close to 10mph above speed limit on both Branch Road and US-97, and V85 speed on US-97 does not reduce significantly at the intersection.
- These factors, combined with the area's recent crash history, indicate elevated risk levels, including of high-speed serious collisions

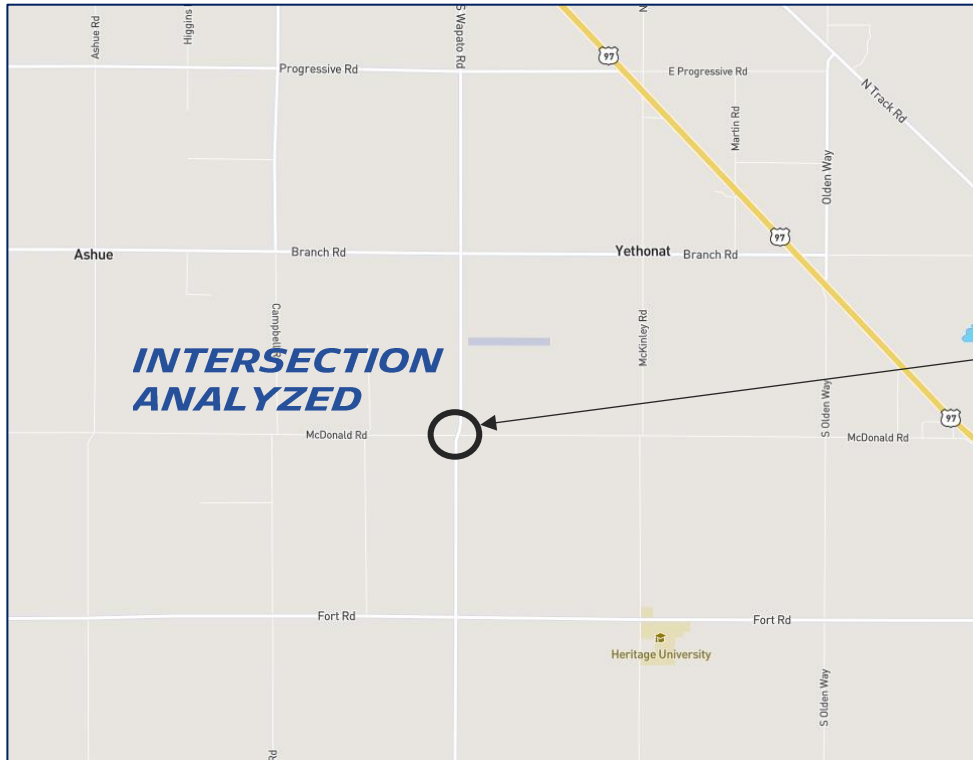
MICHELIN

MOBILITY INTELLIGENCE

Y6

**MCDONALD/SOUTH WAPATO
ROAD INTERSECTION**

MCDONALD/SOUTH WAPATO ROAD INTERSECTION



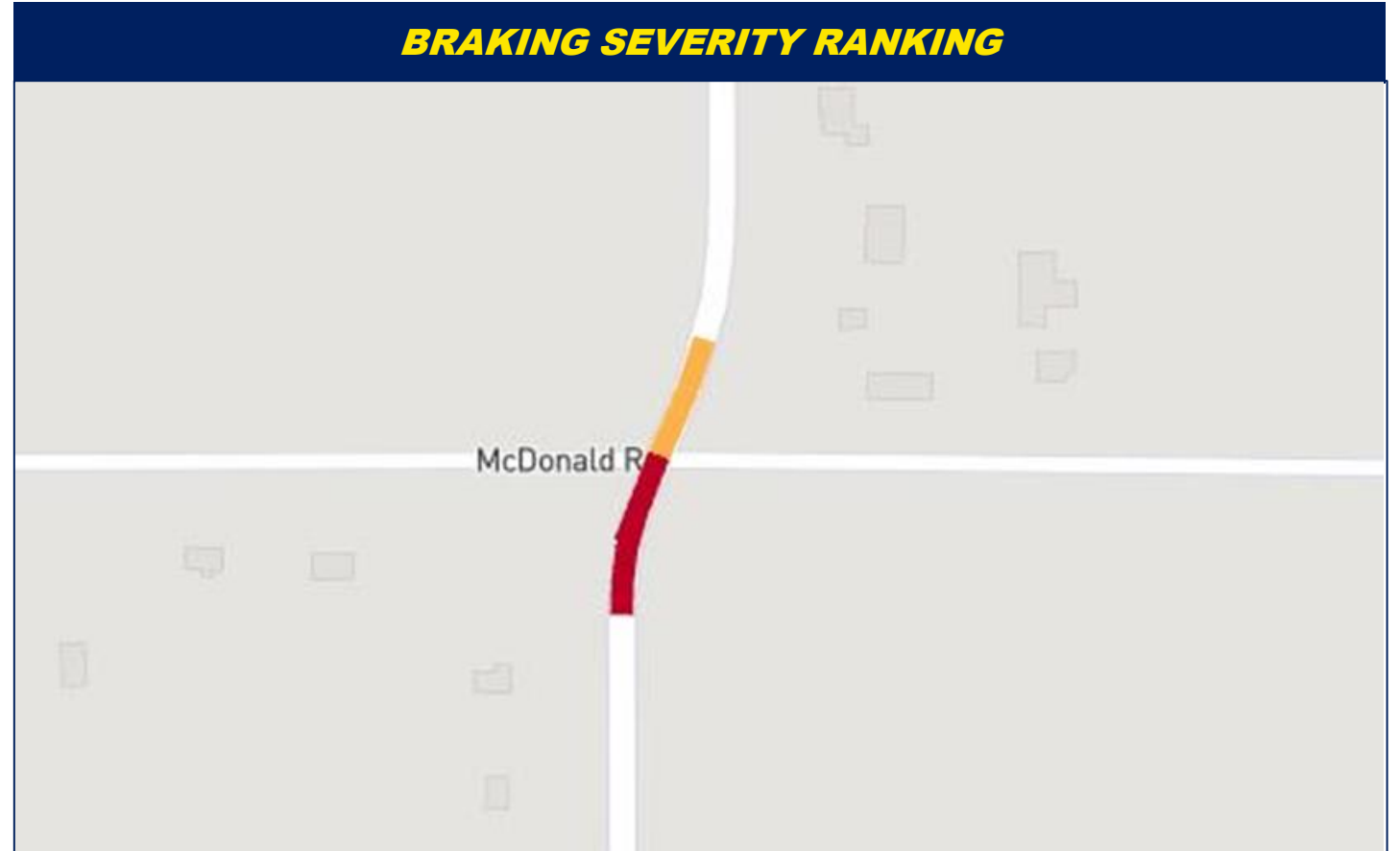
OBSERVATIONS

- Intersection with a 4-way stop, to the west of US-97 in Yakama Reservation
- Within the last few years, this intersection was converted from a 2-way stop into a 4-way stop.

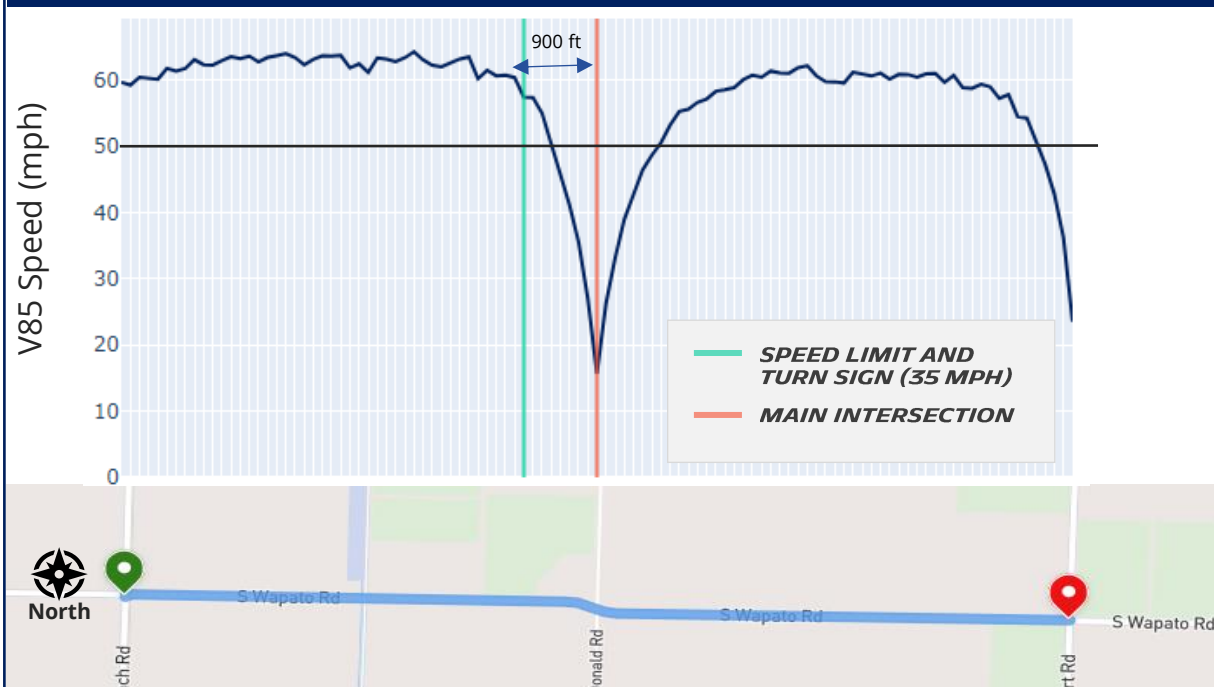
2901 McDonald Rd - Google Maps

OBSERVATIONS

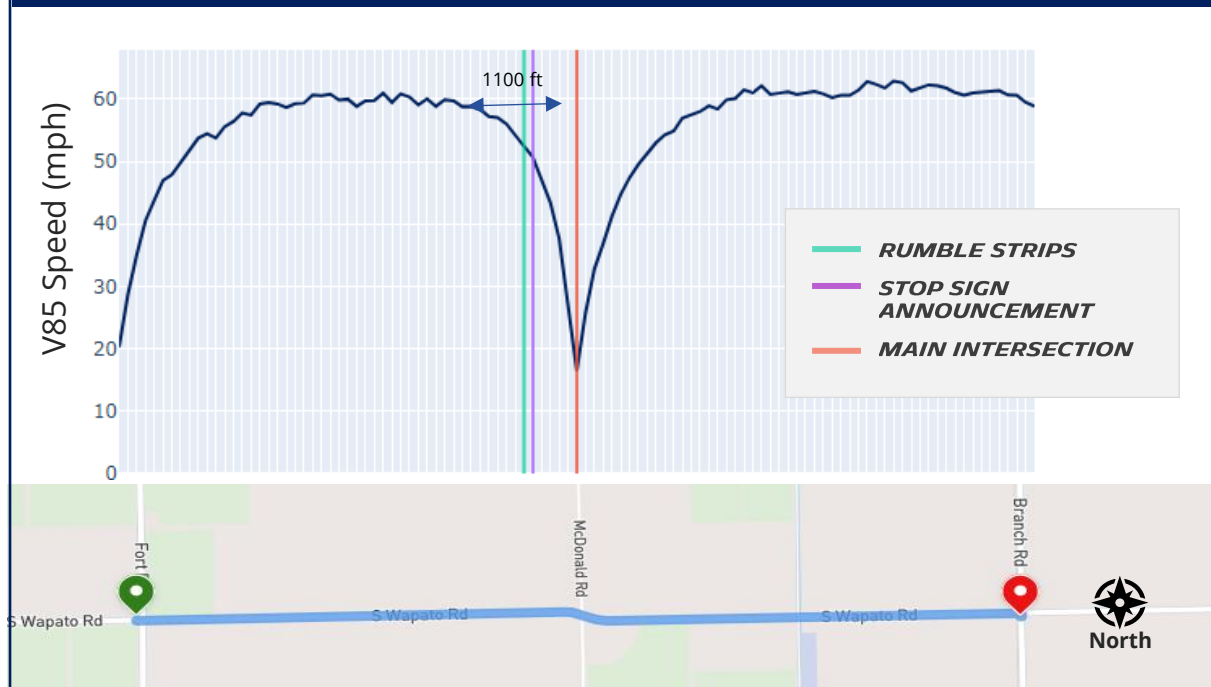
- There are 2 severe harsh braking clusters present:
 - 4th-most severe coming from the South
 - 122nd-most severe coming from the North



V85 FROM NORTH TO SOUTH



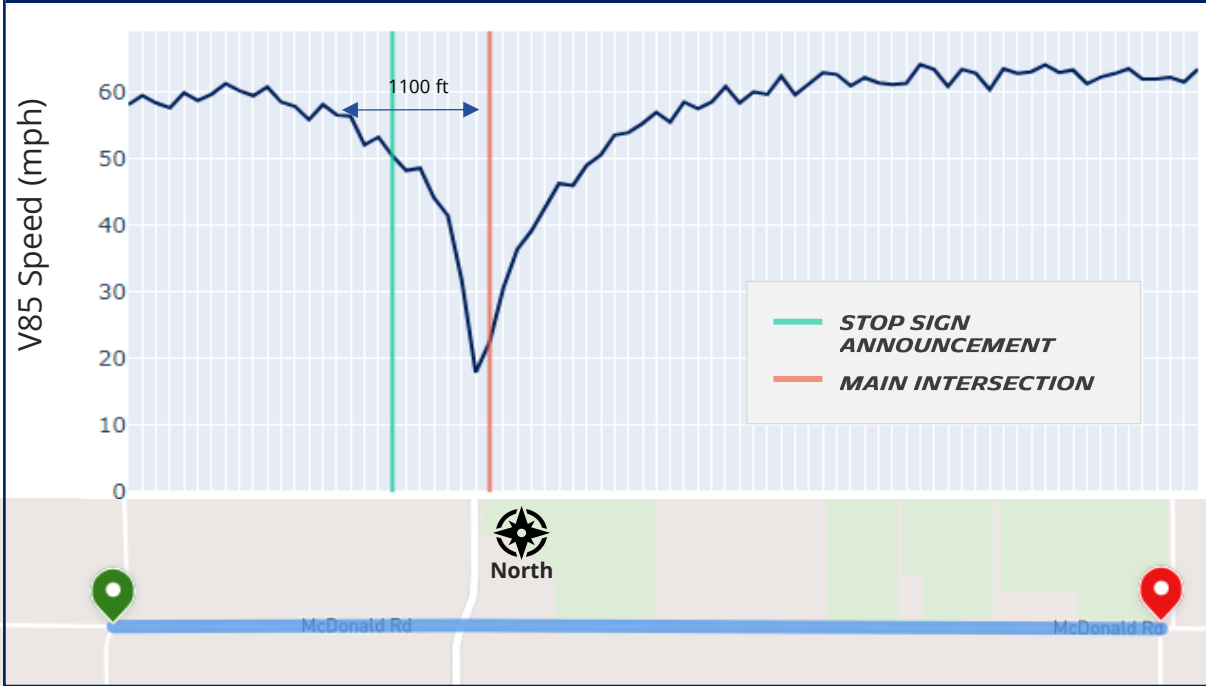
V85 FROM SOUTH TO NORTH



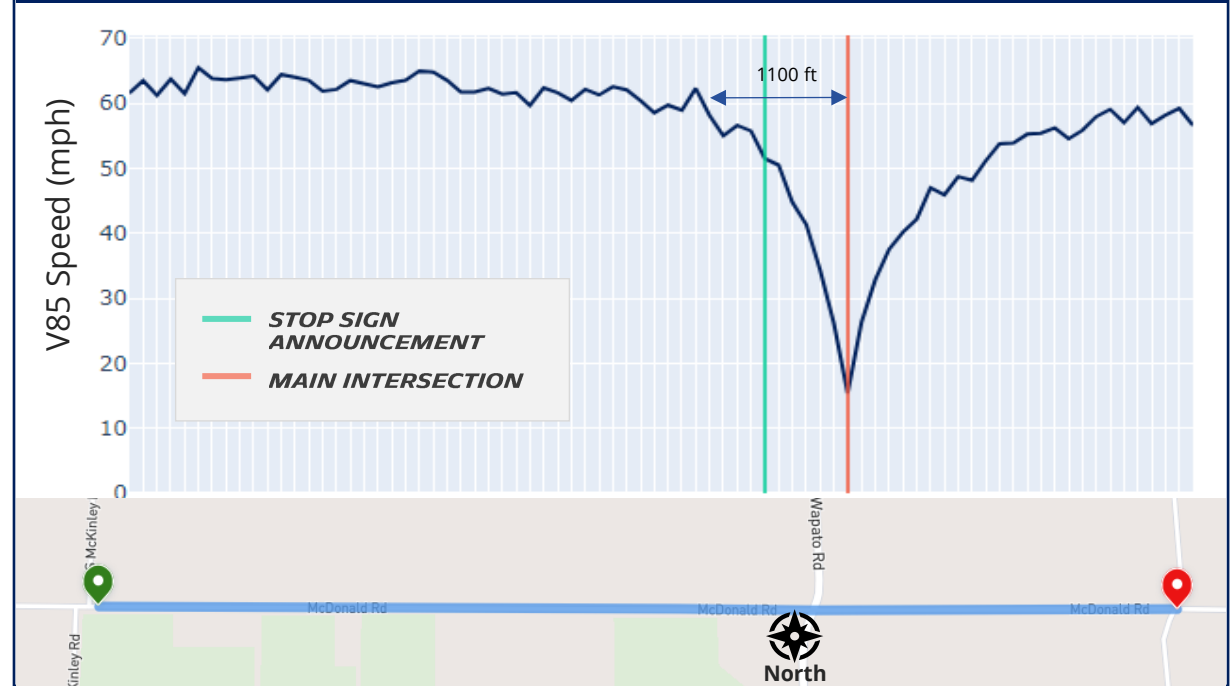
OBSERVATIONS

- Drivers drive around 60mph coming from North or South.
- Drivers decelerate later when coming from the North (900ft compared to 1100ft) while having the same speed.
- Drivers decrease their speed when the sign appears when they are coming from the North

V85 FROM WEST TO EAST



V85 FROM EAST TO WEST



OBSERVATIONS

- Drivers drive around 60-65mph.
- Deceleration starts to occur roughly the same distance away from the intersection from both east and west
- Deceleration approaching this intersection from east and west is less abrupt than drivers approaching the intersection from north and south.

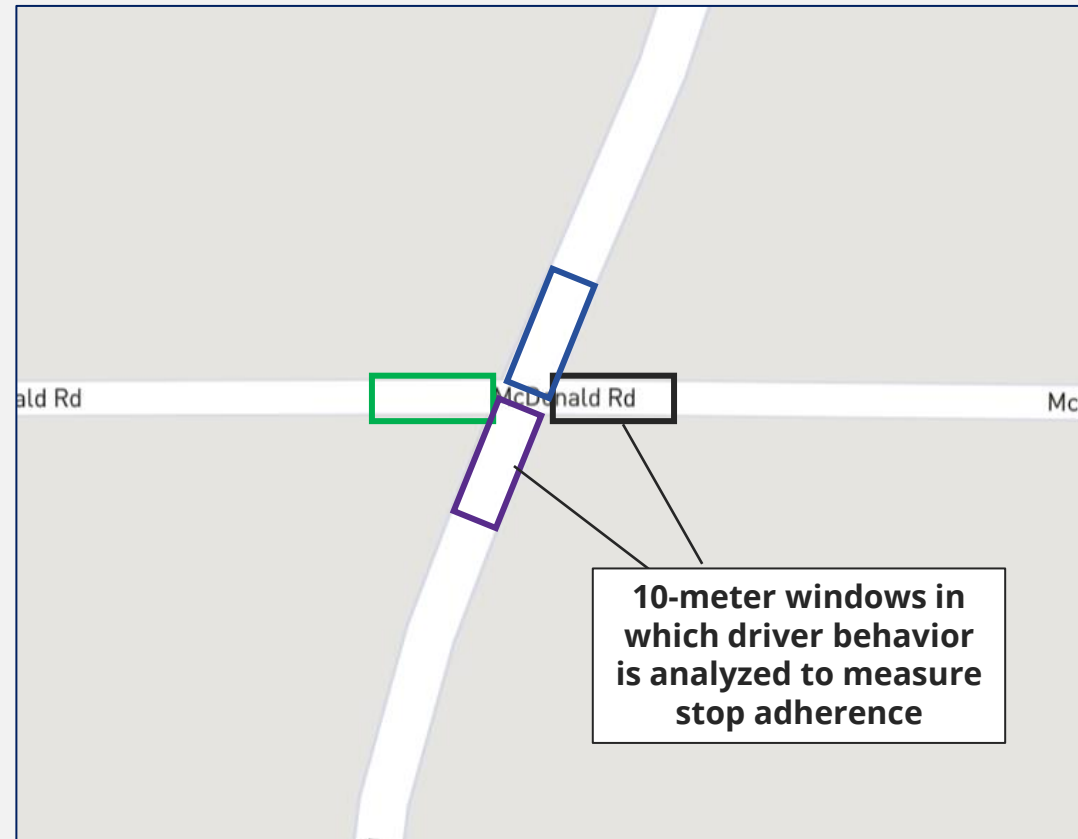
OBJECTIVE

Identify driver behavior at stop signs, specifically how commonly we see full stop adherence and how commonly we see failure to stop.

Approach:

- Identify where the most low/zero-speed data points are clustered, and define a 10-meter window around the center of this cluster as the "correct stopping window"
- The size of this window acknowledges the fact that not everyone who stops at a stop sign stops in exactly the same place.
- Once this window is identified, we can determine how many drivers in this window are going at speeds that indicate they did not stop fully, or at all, at the stop sign.

STEP 1: DEFINING THE STOPPING WINDOW



STEP 2: ESTABLISHING BEHAVIOR BASELINE AT 6 NEARBY INTERSECTIONS

Baseline Comparison:

- Analyzing 6 nearby, similar intersections determined that a baseline for full stop sign adherence is **83.9%**
- This means 83.9% of trip points in the stopping window were under 10 MPH

Findings:

- Every approach to this intersection in focus has significantly lower stop adherence than the baseline.
- This is especially the case for the approach from the south (**71.9% adherence**)

STEP 3: EVALUATING BEHAVIOR AT INTERSECTION IN FOCUS

Intersection Name	% of data points in stopping window within 0-10 MPH	% of data points in stopping window within 10-20 MPH	% of data points in stopping window within 20-30 MPH	% of data points in stopping window above 30 MPH
	"Adherence"	"Possible Adherence"	"Violation Risk"	"High Violation Risk"
Wapato/McDonald (From South) 1616 trip points	71.9%	24.9%	2.4%	0.6%
Wapato/McDonald (From North) 1642 trip points	74.1%	23.9%	1.3%	0.6%
Wapato/McDonald (From West) 501 trip points	77.0%	19.1%	2.6%	1.1%
Wapato/McDonald (From East) 787 trip points	74.9%	23.4%	1.1%	0.5%

ESTABLISHING A BASELINE FOR BEHAVIOR

EXAMINING NEARBY INTERSECTIONS

6 intersections nearby the Wapato/McDonald intersection with similar design were evaluated using this approach.

Results:

- The average rate of full adherence across 6 comparison intersections was 83.9%
- This means that on average, 83.9% of trip points in the window where drivers are supposed to stop, were below 10mph.
- One outlier was identified here (the approach to Ashue/McDonald from the south), which could be evaluated further in a follow-up analysis.

Intersection Name	% of data points in stopping window within 0-10 MPH	% of data points in stopping window within 10-20 MPH	% of data points in stopping window within 20-30 MPH	% of data points in stopping window above 30 MPH
	"Adherence"	"Possible Adherence"	"Violation Risk"	"High Violation Risk"
Fort Rd / South Wapato Rd (From South)	82.6%	14.7%	1.3%	1.3%
Fort Rd / South Wapato Rd (From North)	86.9%	12.1%	0.7%	0.2%
Branch Rd / South Wapato Rd (From East)	82.5%	16.3%	0.7%	0.4%
Branch Rd / South Wapato Rd (From West)	87.8%	11.0%	0.8%	0.3%
Ashue Rd / McDonald Rd (From South)	77.0%	18.8%	3.3%	0.8%
Ashue Rd / McDonald Rd (From North)	86.3%	12.4%	0.9%	0.2%

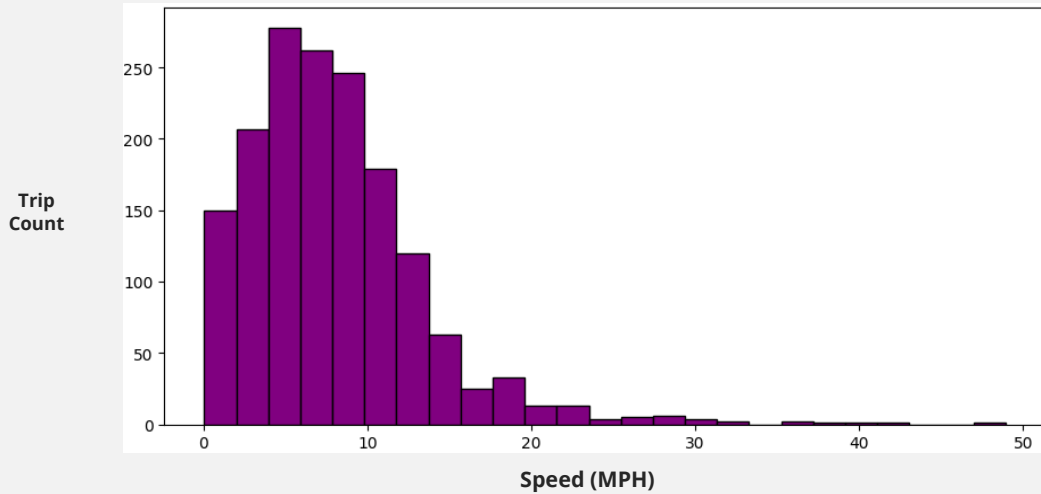
STOP ADHERENCE RATE (FROM SOUTH)

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
71.9% (1162/1616)	24.9% (403/1616)	2.4% (40/1616)	0.6% (11/1616)
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



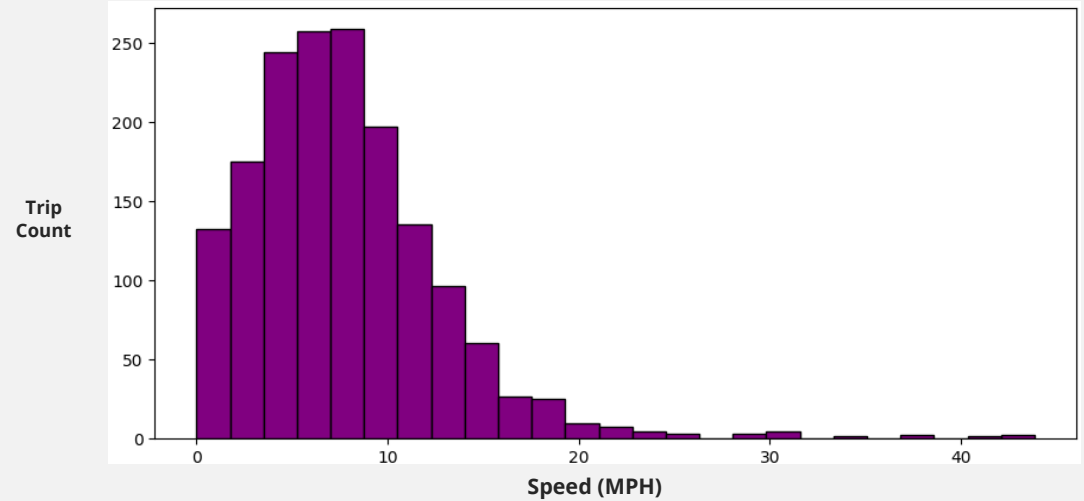
STOP ADHERENCE RATE (FROM NORTH)

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
74.1% (1218/1642)	23.9% (392/1642)	1.3% (22/1642)	0.6% (10/1642)
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



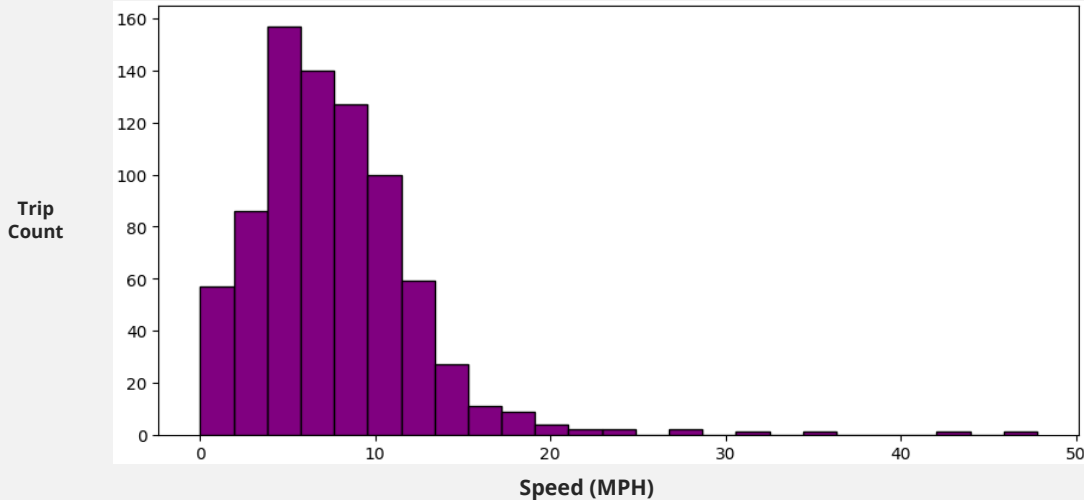
STOP ADHERENCE RATE (FROM EAST)

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
74.9% (590/787)	23.4% (184/787)	1.1% (9/787)	0.5% (4/787)
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



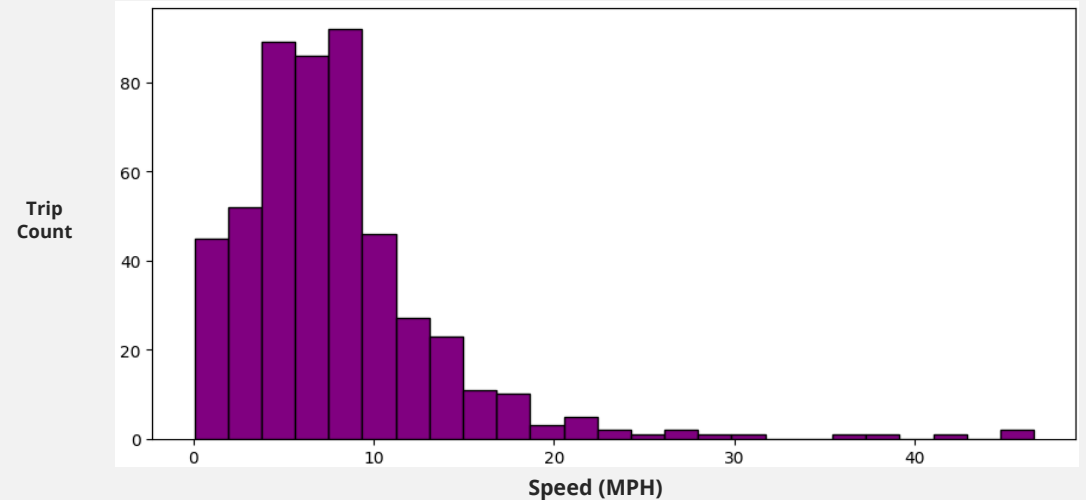
STOP ADHERENCE RATE (FROM WEST)

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
77.0% (386/501)	19.1% (96/501)	2.6% (13/501)	1.1% (6/501)
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



KEY TAKEAWAYS

- Drivers coming from both north and south, but especially south, exhibit extremely severe braking behavior around the stop signs.
- Drivers coming from the north also exhibit dangerous speed and braking patterns, as they decelerate the latest for the stop sign (900ft from the intersection compared to 1100ft for other directions).
- Drivers coming from the south are much more likely to fail to stop at the stop sign than drivers at other intersections in the area are.
- From all directions, stop sign adherence at this intersection is lower than at other intersections in the area.

MICHELIN

MOBILITY INTELLIGENCE

K ***SOUTH KING COUNTY***

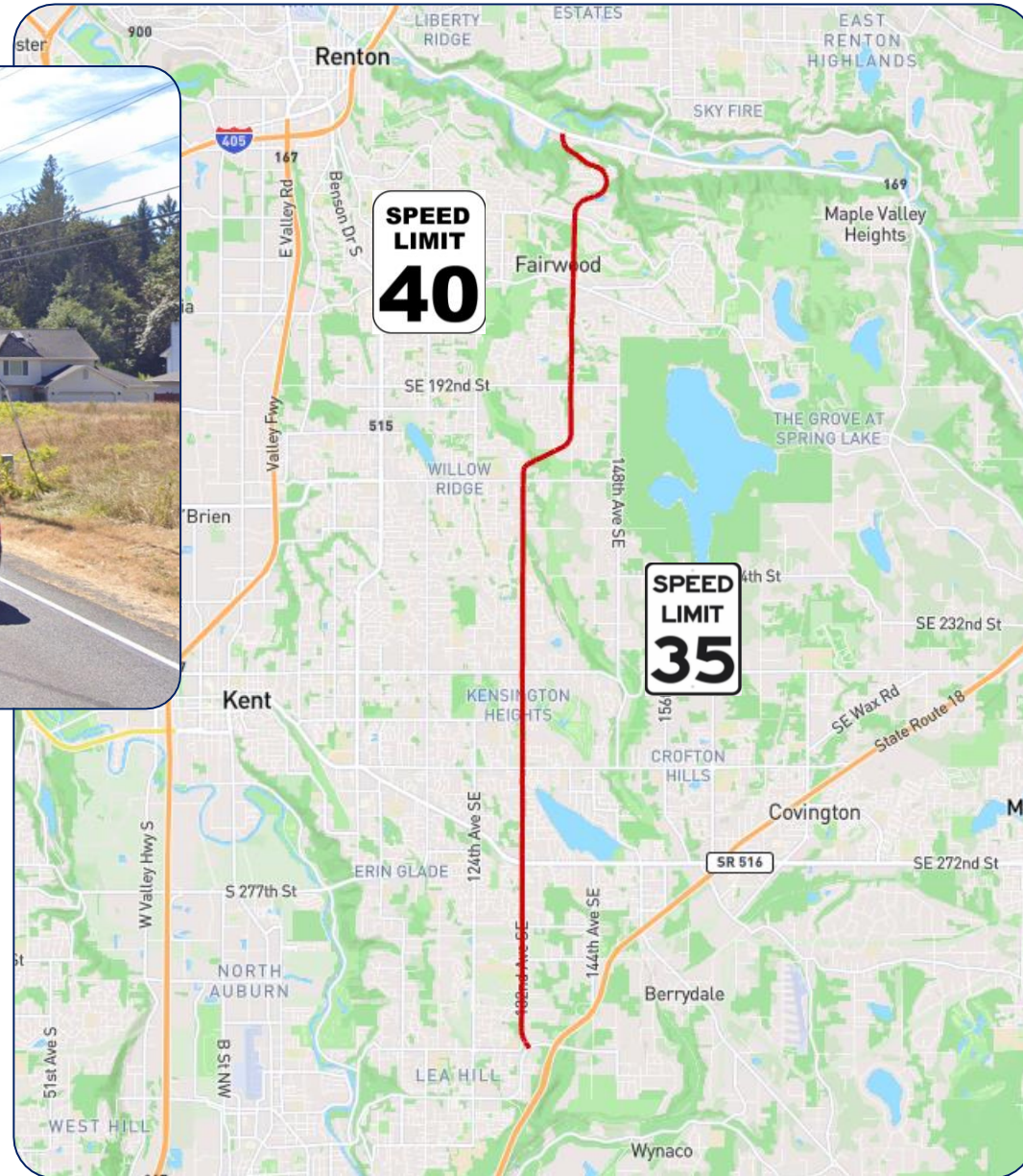
MICHELIN

MOBILITY INTELLIGENCE

K1

**140TH AVE SE. TO 132ND
AVE. SE CORRIDOR**

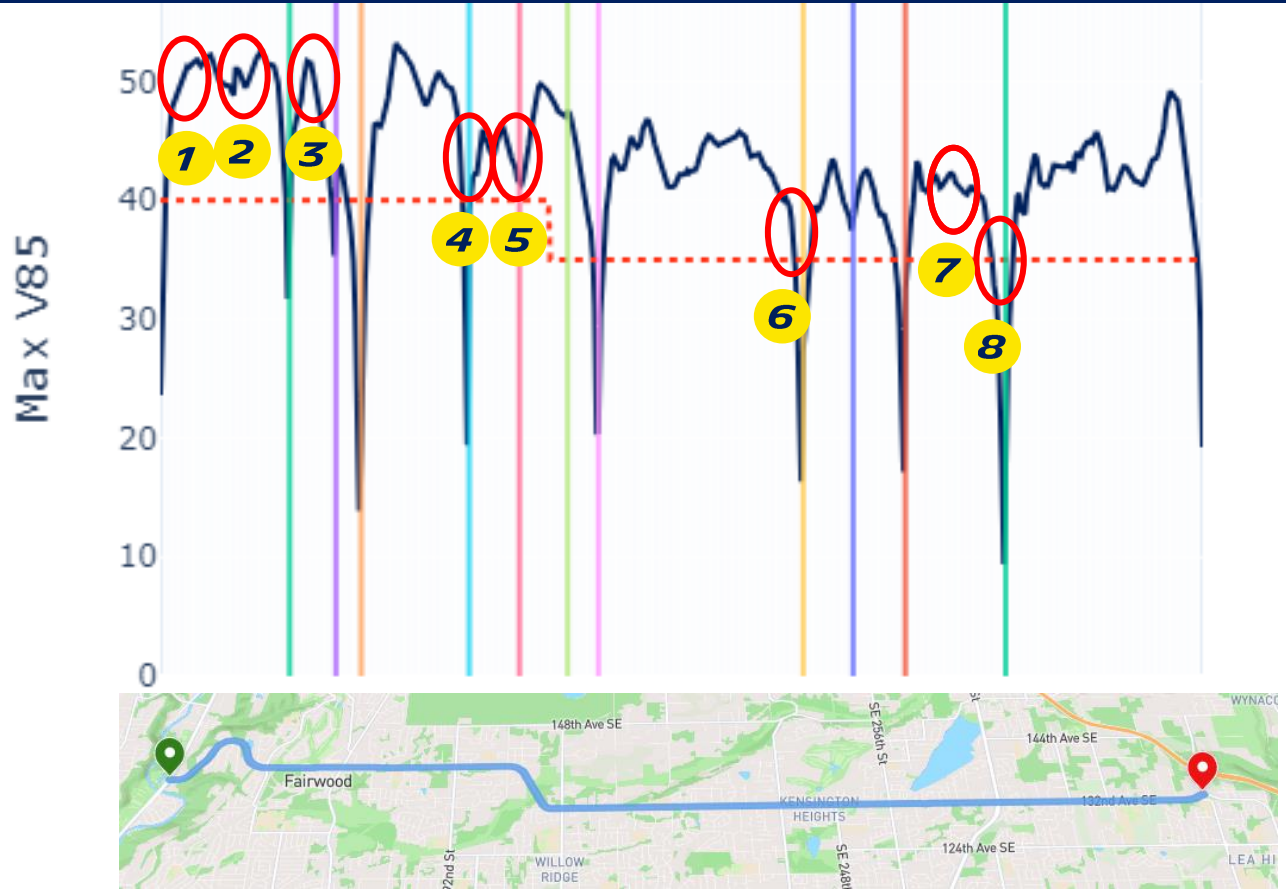
AREA ANALYZED



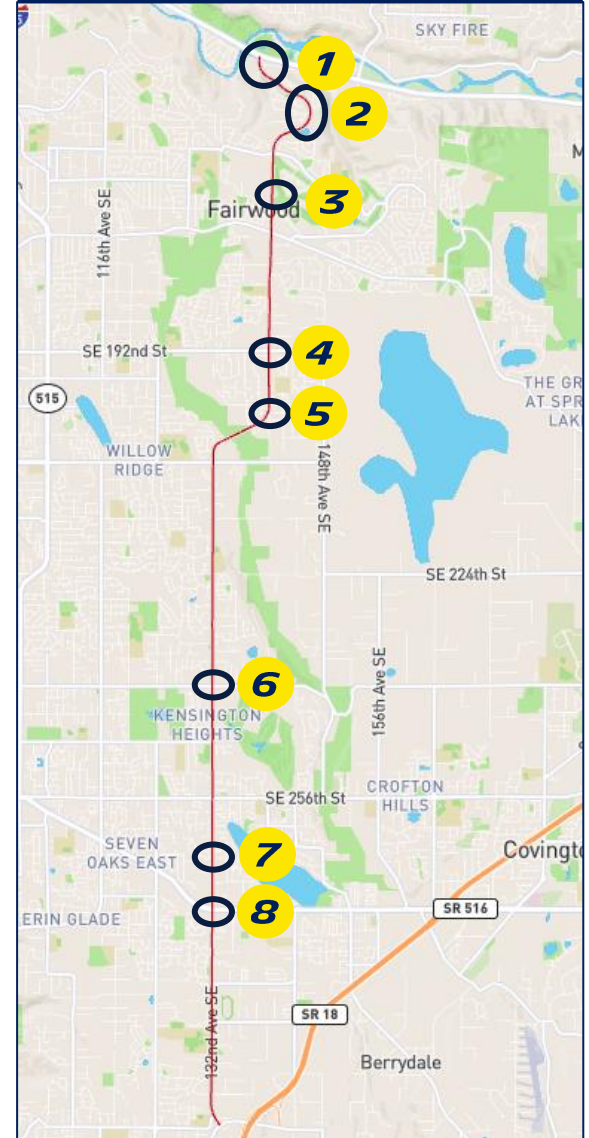
OBSERVATIONS

- The speed limit for the corridor is 40 mph headed north and 35 mph when headed south
- 11 miles long

V85 FROM NORTH TO SOUTH



IMPORTANT ZONES



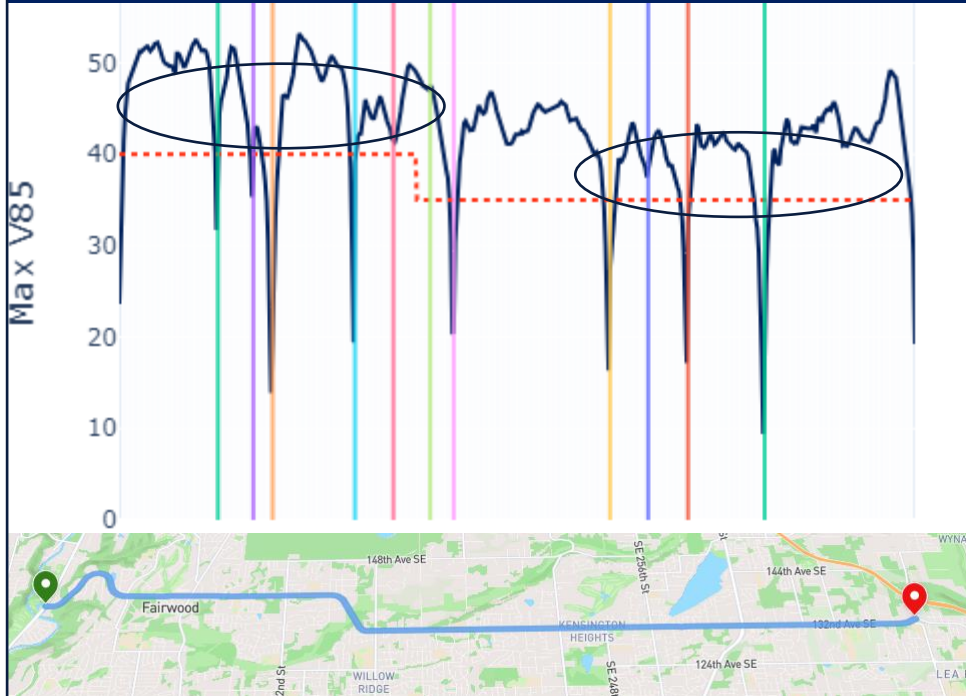
# Area	Area Name	Braking Behavior Severity (Rank)	Acceleration Behavior Severity	Speeding	VRU Crash Risk	Crashes (since 2020)	Total score
1.	Before SE 158th	3 (6)	3 (6)	4 (8-10mph)	5	4 (12)	19
2.	Northern Curve	2 (12)	4 (5)	3 (7mph)	0	2 (6)	11
3.	Fairwood Golf	5 (2)	4 (4)	5 (10+mph)	0	1 (3)	15
4.	SE 192nd St	4 (5)	5 (1)	4 (8-10mph)	0	2 (4)	15
5.	SE 200th St	5 (1)	0	1 (4-5 mph)	0	1 (2)	7
6.	SE 240th St	3 (7)	5 (3)	2 (5-7mph)	0	5 (20)	15
7.	SE 266th St	3 (8)	0	3 (7-8mph)	0	1 (2)	7
8.	SE 272nd St	1 (21)	1 (16)	3 (7-8mph)	5	2 (6)	12

EVENTS
SPEEDING
CRASH RISK

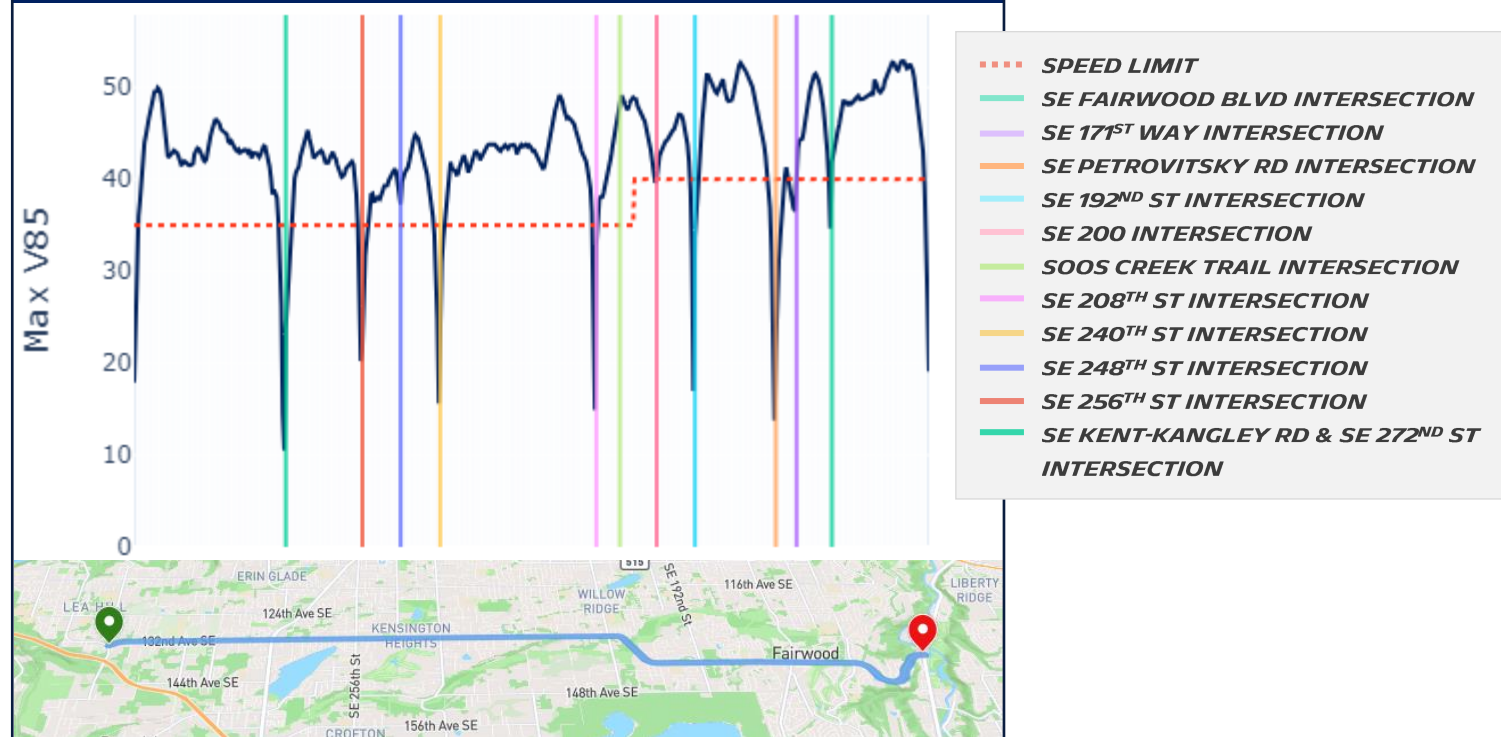
OBSERVATION

- We give a **score out of 5** for each criteria
- **More detailed analyses** are done on an area when scores are relatively high for different services

V85 FROM NORTH TO SOUTH



V85 FROM SOUTH TO NORTH

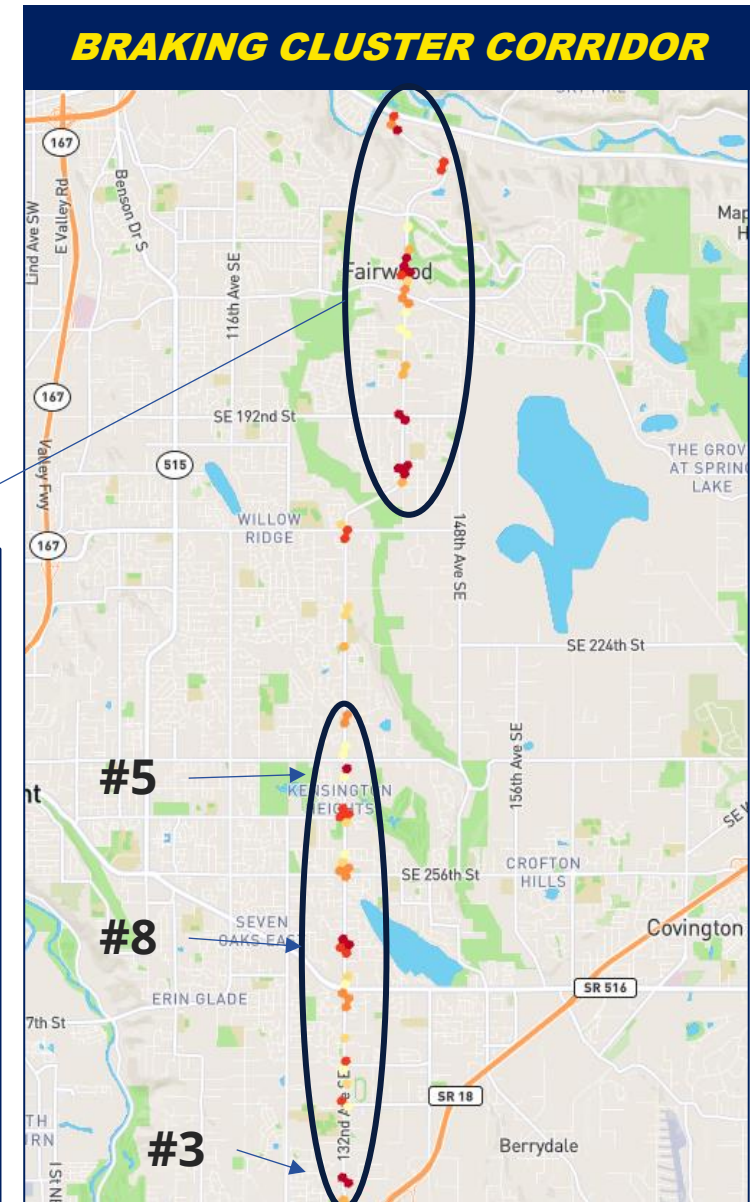
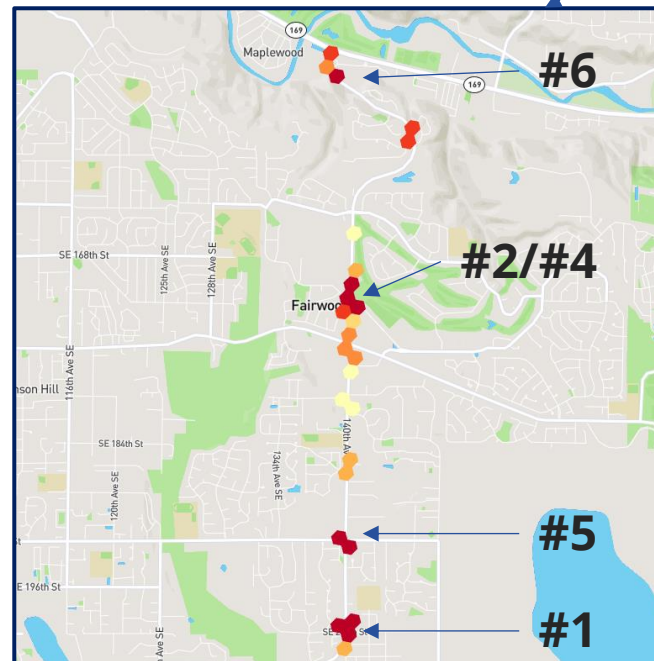


OBSERVATIONS

- Speeding is rampant throughout the corridor. V85 is 10 mph over the speed limit at times.
- Consistent with the change in speed limit, drivers generally drive faster on the northern part of the route than on the southern part.

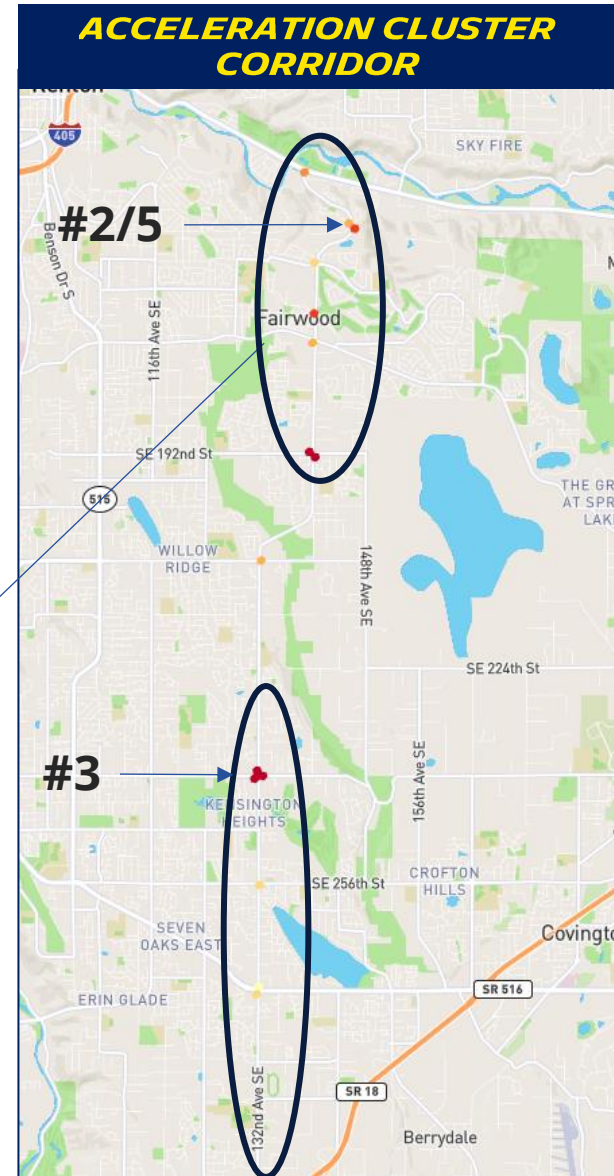
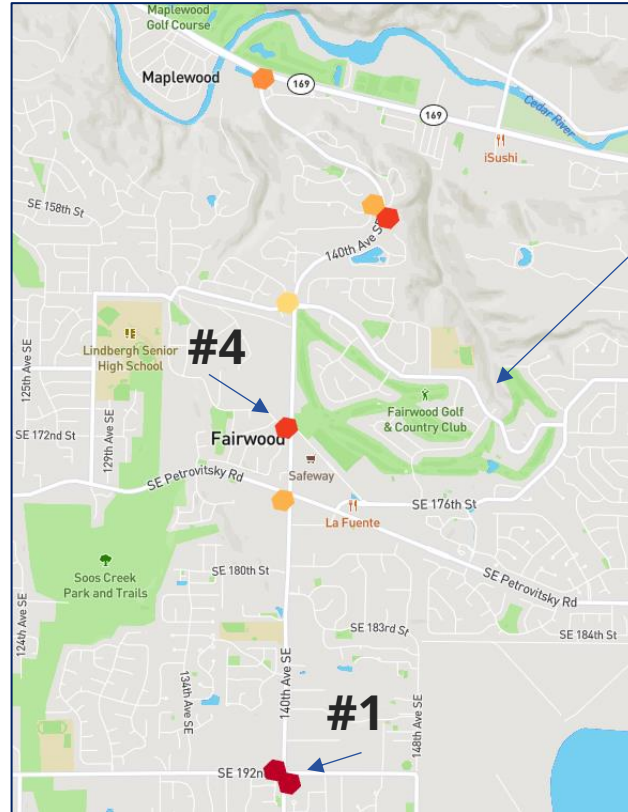
OBSERVATIONS

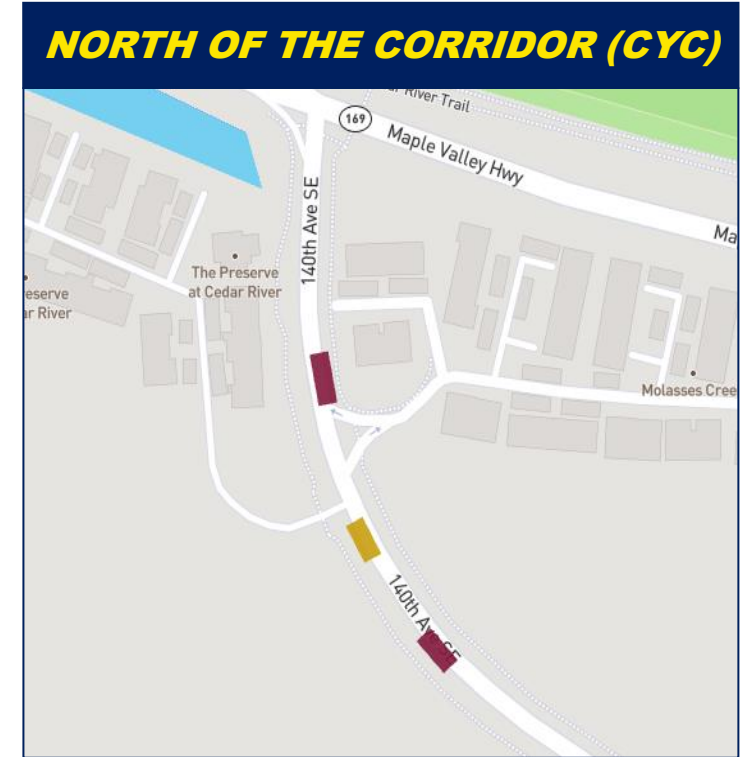
- We applied the driving behavior severity ranking service only on the corridor to see which areas have the most severe and abnormal braking.
- The northern part of the Corridor has the highest-ranking braking clusters. Clusters on the southern straight stretch of the route are more numerous, but their scores are lower.



OBSERVATIONS

- We applied the driving behavior severity ranking service only on the corridor to see which areas have the most acceleration.
- The northern part of the Corridor has both the highest-severity acceleration clusters as well as the highest number of clusters.

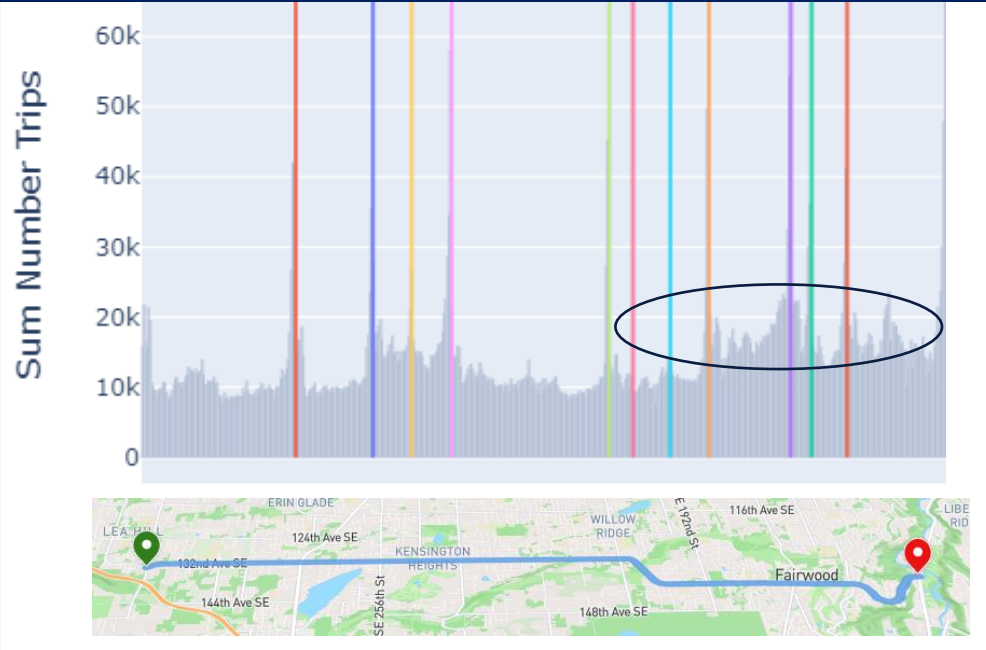




OBSERVATIONS

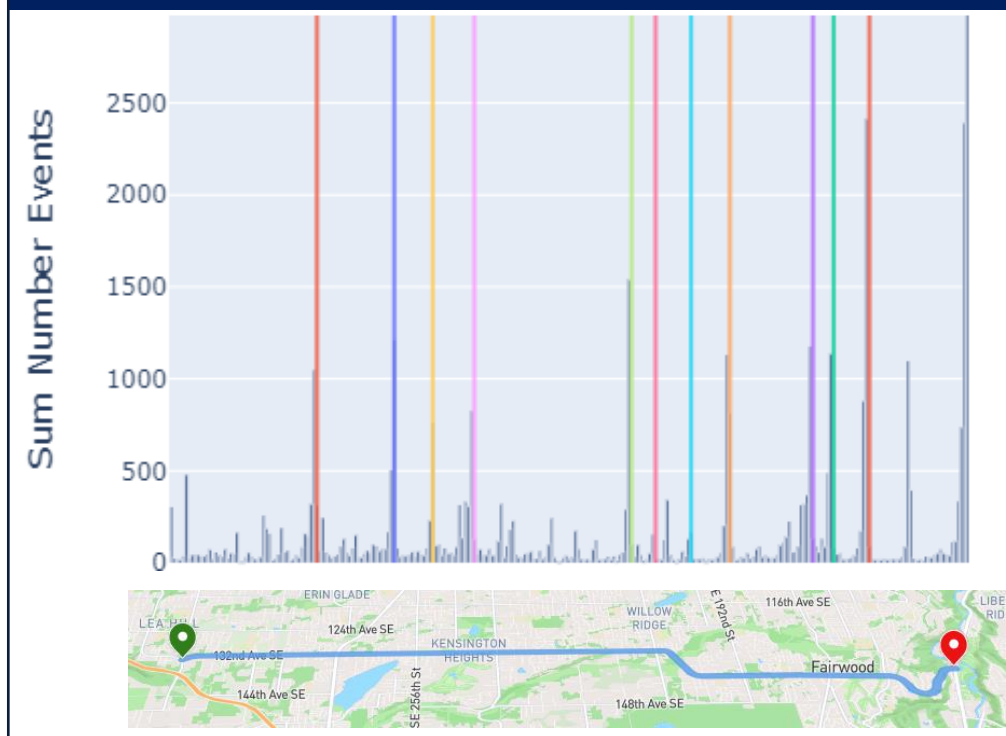
- Danger to pedestrians and cyclists is present at several locations in this corridor, including at the northern entry to the corridor.
- This danger is also present at two intersections in a 1 mile stretch in the southern part of the corridor.

NUMBER OF TRIPS FROM SOUTH TO NORTH



- SE FAIRWOOD INTERSECTION
- SE 171ST WAY INTERSECTION
- SE PETROVITSKY RD INTERSECTION
- SE 192ND ST INTERSECTION
- SE 200 INTERSECTION
- SOOS CREEK TRAIL INTERSECTION
- SE 208TH ST INTERSECTION
- SE 240TH ST INTERSECTION
- SE 248TH ST INTERSECTION
- SE 256TH ST INTERSECTION
- SE KENT-KANGLEY RD & SE 272ND ST INTERSECTION

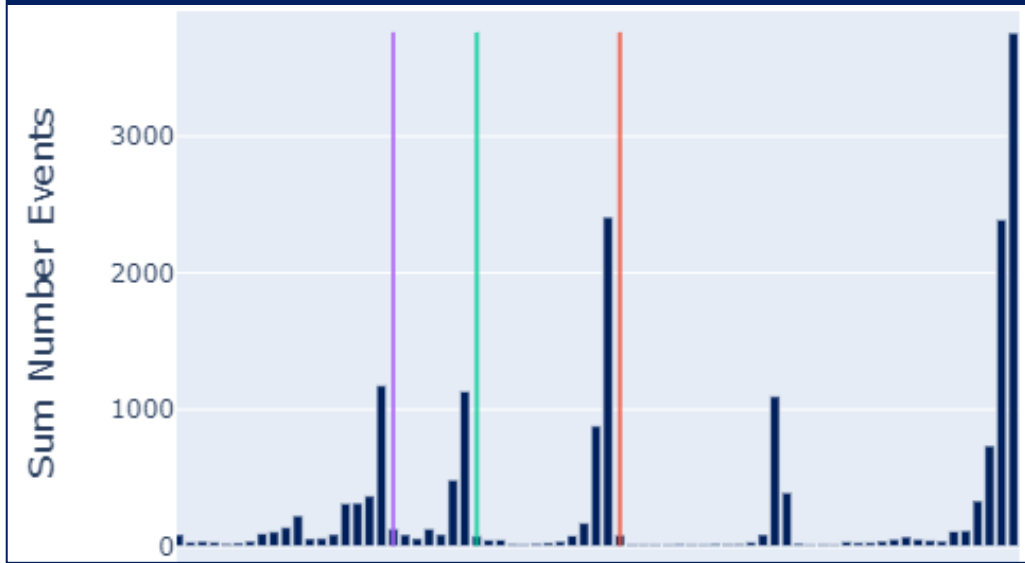
NUMBER OF BRAKING FROM SOUTH TO NORTH



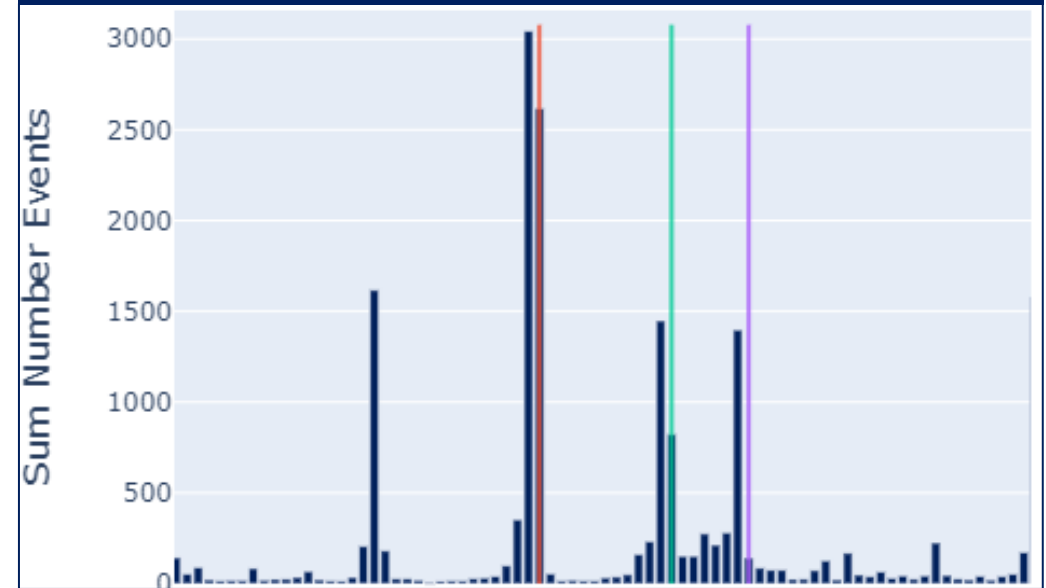
OBSERVATIONS

- We have a greater number of trips on the north side of the route for the south-north direction. Peak braking is much greater to the north of the route at intersections.
- The same conclusions can be drawn for the other direction

NUMBER OF EVENTS FROM SOUTH TO NORTH



NUMBER OF EVENTS FROM NORTH TO SOUTH

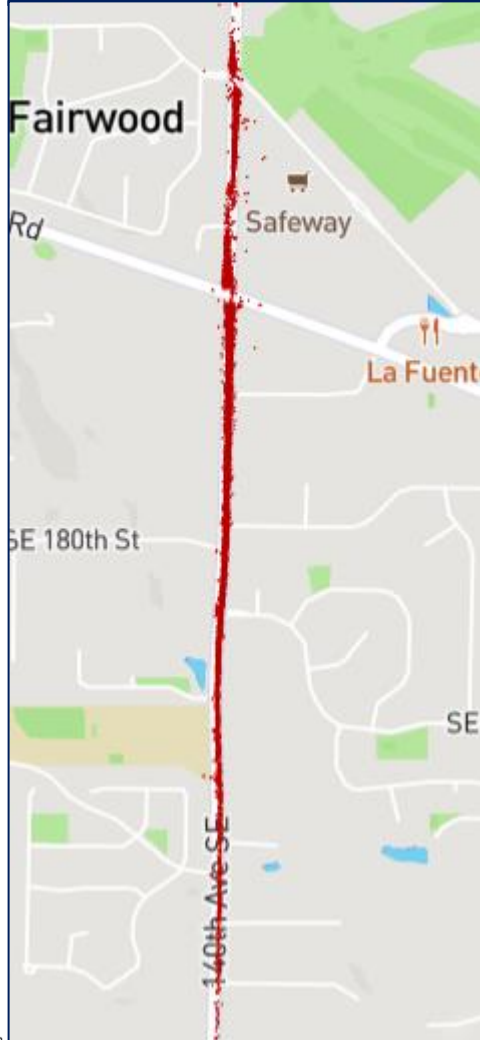


OBSERVATIONS

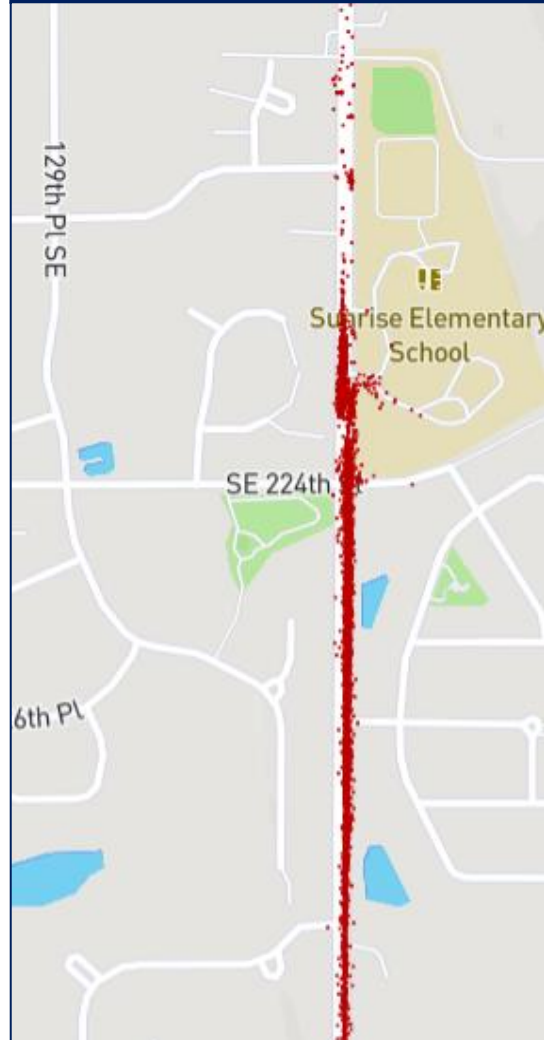
- Here's a zoom on the north of the route. We have between 15,000 and 20,000 trips for this area of the analysis. There's a significant amount of braking, over 2,000 at the intersection with Fairwood Blvd.
- We also note that in the south-north direction, there are many events at the end of the route to join WA-169.

- [POI] Intersection with se fairwood blvd
- [POI] Intersection with se 171st way
- [POI] Intersection with se petrovitsky rd

TRAFFIC JAM FAIRWOOD



TRAFFIC JAM SUNRISE ELEMENTARY SCHOOL



TRAFFIC JAM FAIRWOOD BLVD



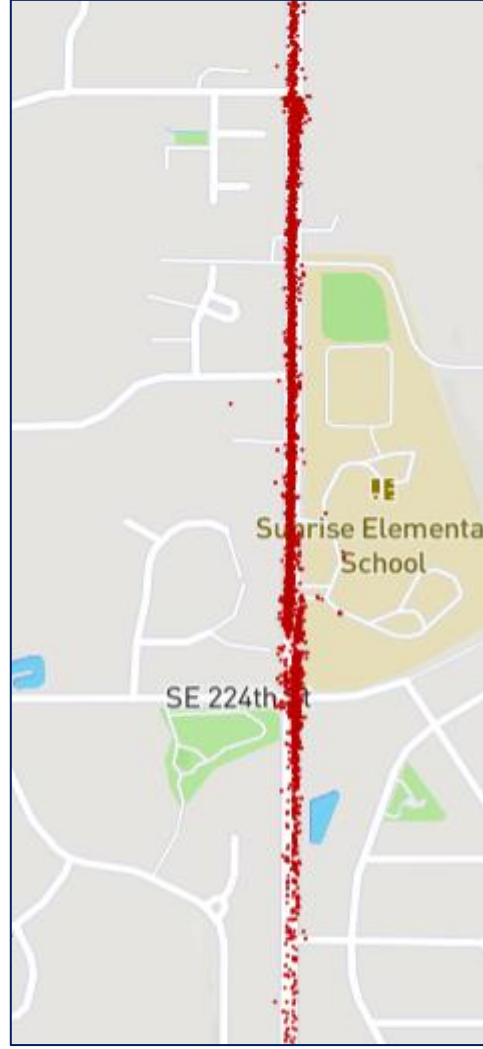
OBSERVATIONS

- Each point corresponds to a driver driving less than 5mph.
- Between 8a.m. and 9a.m. is the first traffic jam of the day.
- There is a huge traffic jam in Fairwood in average.
- Sunrise Elementary School seems to create a huge traffic jam in the morning. People are coming from the South.
- On Fairwood Boulevard, there is also some traffic jam coming from South but not comparable to other intersection.

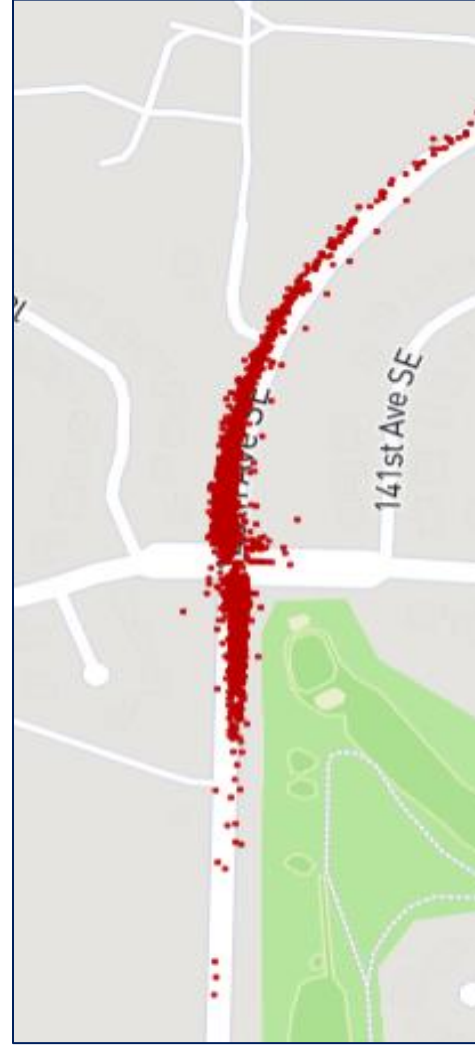
**TRAFFIC JAM
FAIRWOOD (4:00 to
5:00p.m.)**



**SUNRISE
ELEMENTARY (2:45
to 3:45p.m.)**



**TRAFFIC JAM
FAIRWOOD BLVD
(4:00 to 5:00p.m.)**



OBSERVATIONS

- Traffic jam in the afternoon starts around 2p.m. with a peak between 4 and 5p.m.
- Traffic jam around Sunrise Elementary School is around 3p.m. while the other traffic jam on other intersections are around 4:30p.m.
- In contrary to the morning, traffic jam here is coming more from the North.
- In Kent, the corridor has a huge traffic jam during all the afternoon.
- Traffic jam really decreases a lot after 6p.m.

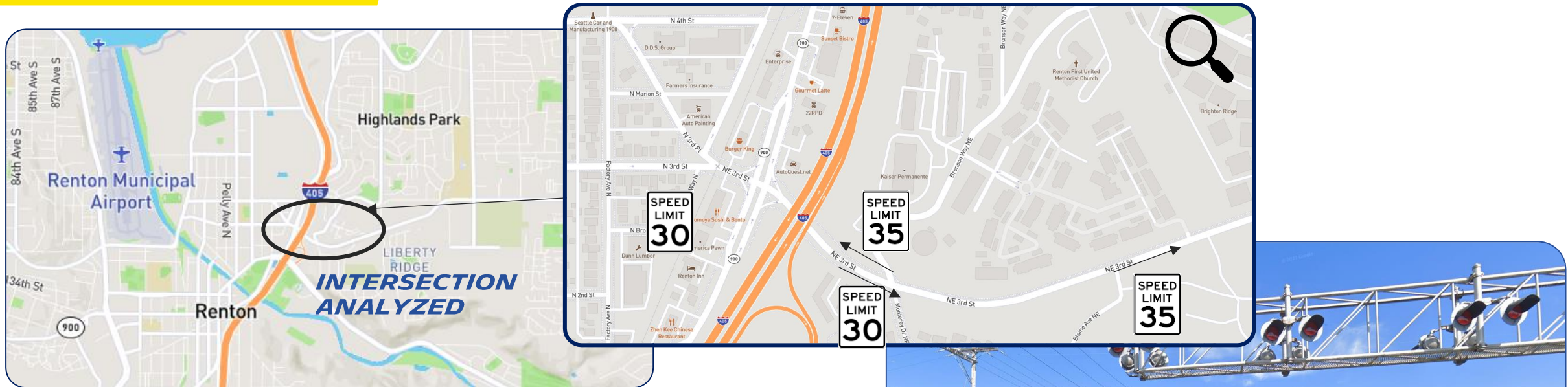
KEY TAKEAWAYS

- Frequent and severe speeding is present all along the route.
- In the north, we have very severe braking behavior at intersections.
- In the southern portion of the corridor, harsh braking behavior is still present at intersections, but this behavior is generally less severe and more typical.
- In terms of crashes, we have a large number of crashes at Fairwood, but they are generally less serious. We do, however, have serious crashes between Fairwood and WA 169. There are also a large number of crashes at and above Kensington Heights, as well as at the intersection with SR 516.

MICHELIN

MOBILITY INTELLIGENCE

K2 *SUNSET BLVD & N 3RD ST*

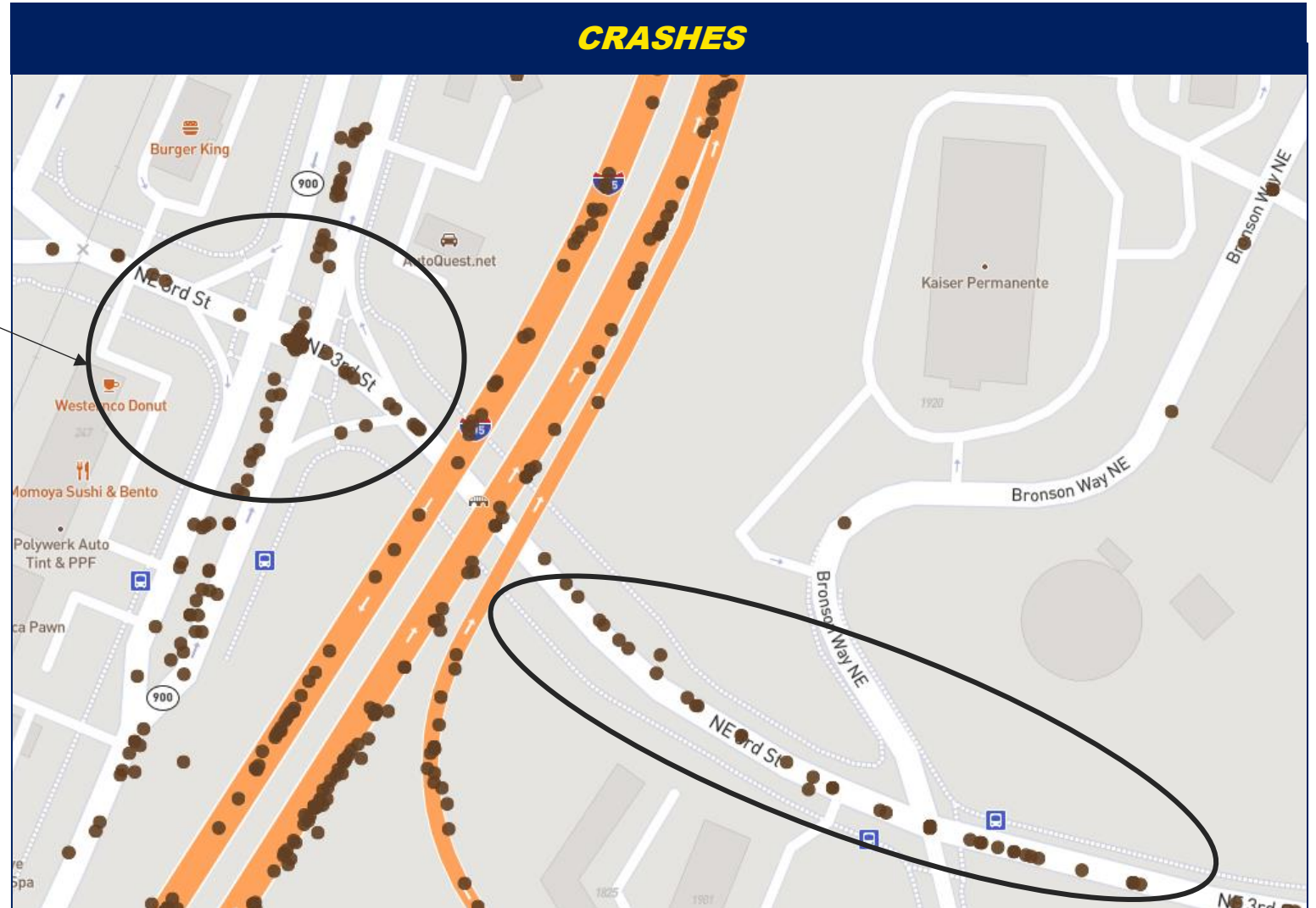


OBSERVATIONS

- N 3rd St and Sunset Blvd N have a speed limit of 30 mph
- NE 3rd St has a speed limit of 35 mph on most of the road segment analyzed (30 mph elsewhere)
- A railway runs parallel to Sunset Blvd N
- There are traffic lights at the intersection between Sunset Blvd N and 3rd St
- Traffic lights at the intersection between NE 3rd St and Bronson Way NE/Monterey Dr NE

OBSERVATIONS

- Numerous crashes observed, including more than 50 at the intersection between Sunset Blvd N and 3rd St



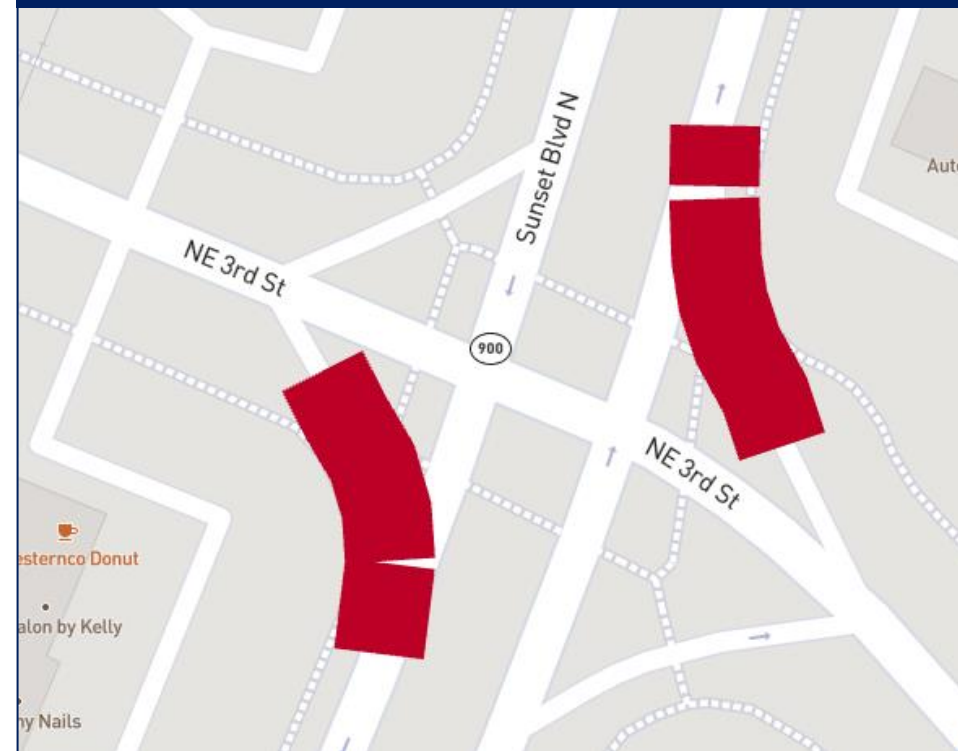
BRAKING CLUSTER



OBSERVATIONS

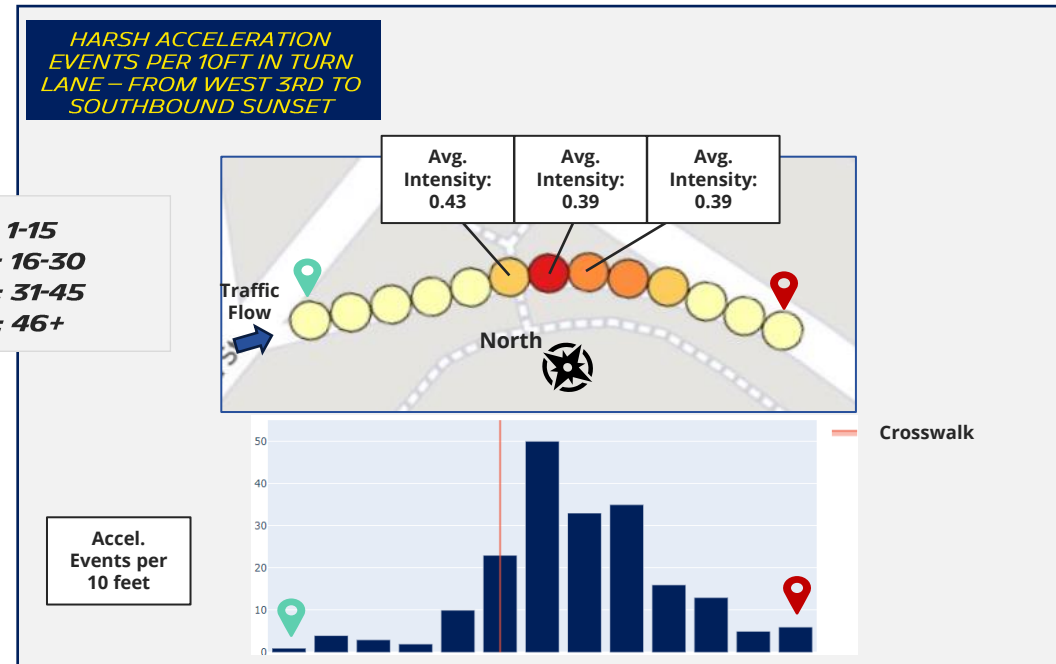
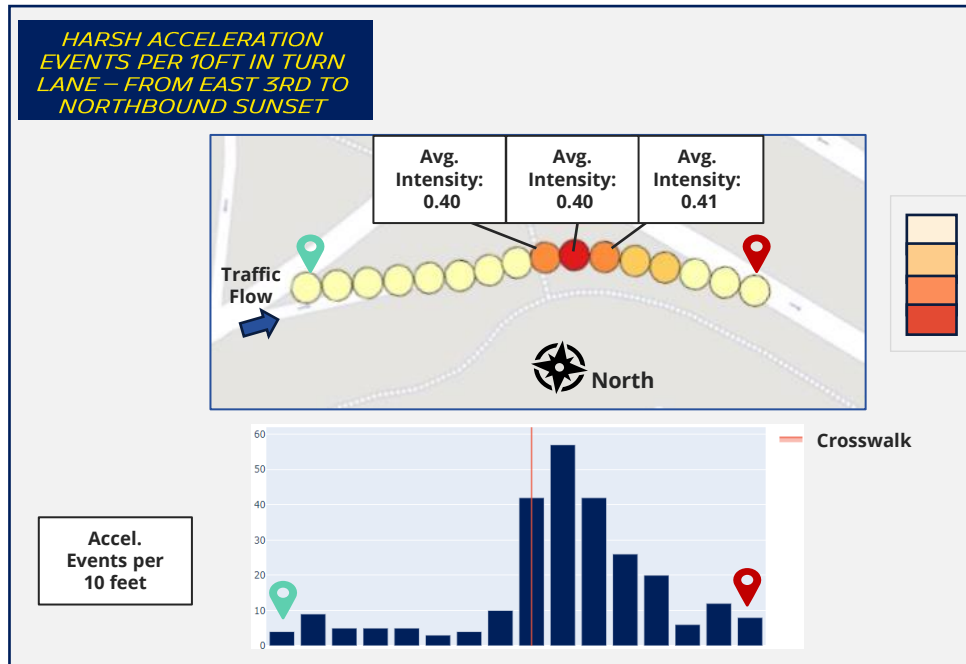
- Braking Cluster observed at on ramp when driving from East to North (Rank 188/1665).

ACCELERATION CLUSTER



OBSERVATIONS

- Two Acceleration Cluster at Sunset & 3rd (Rank 7/488 on the ramp from East to North and rank 9/488 on the ramp from West to South)

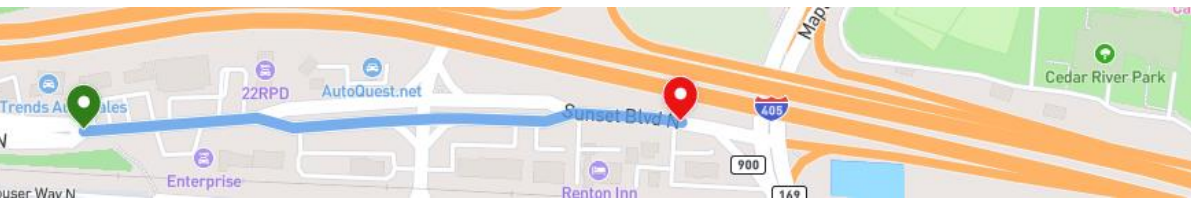
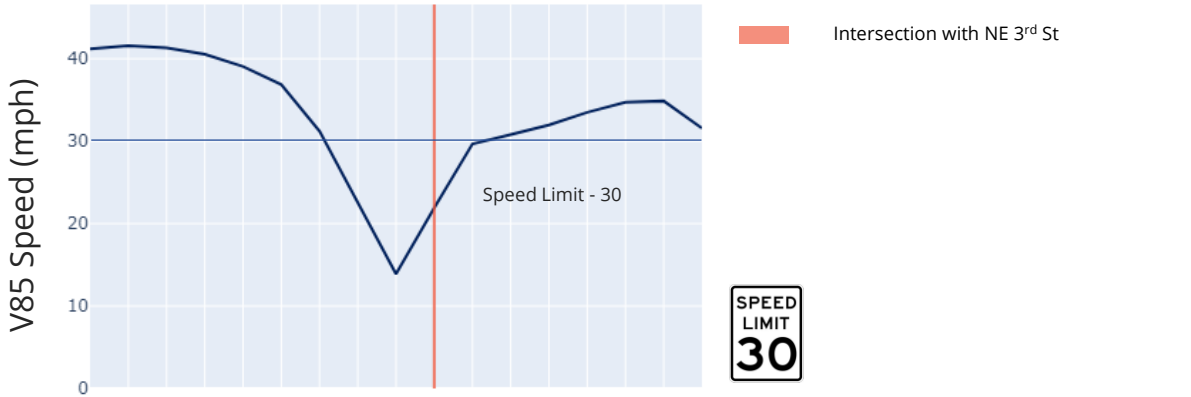


KEY TAKEAWAYS

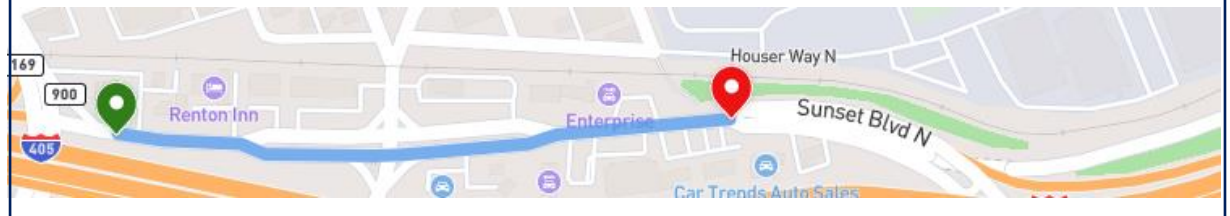
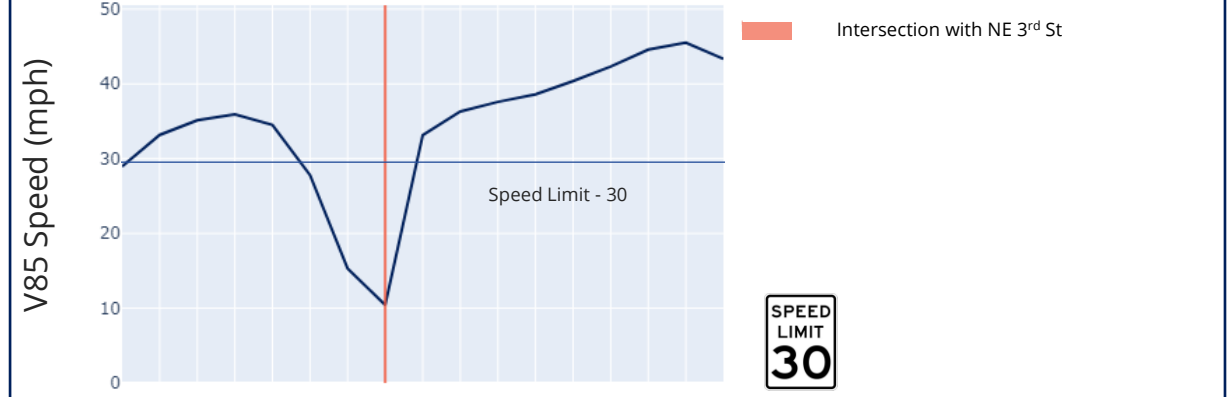
- Frequent acceleration from 3rd onto Sunset, and although the bulk of the acceleration happens after the crosswalk, there are still a concerning number of events happening in and before the crosswalk – in both turn lanes going from 3rd to Sunset.

KING 2: V85 SPEED ON SUNSET BLVD N

V85 FROM NORTH TO SOUTH



V85 FROM SOUTH TO NORTH

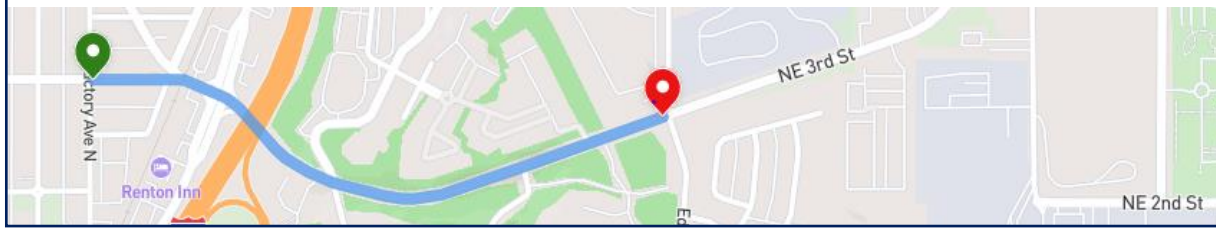
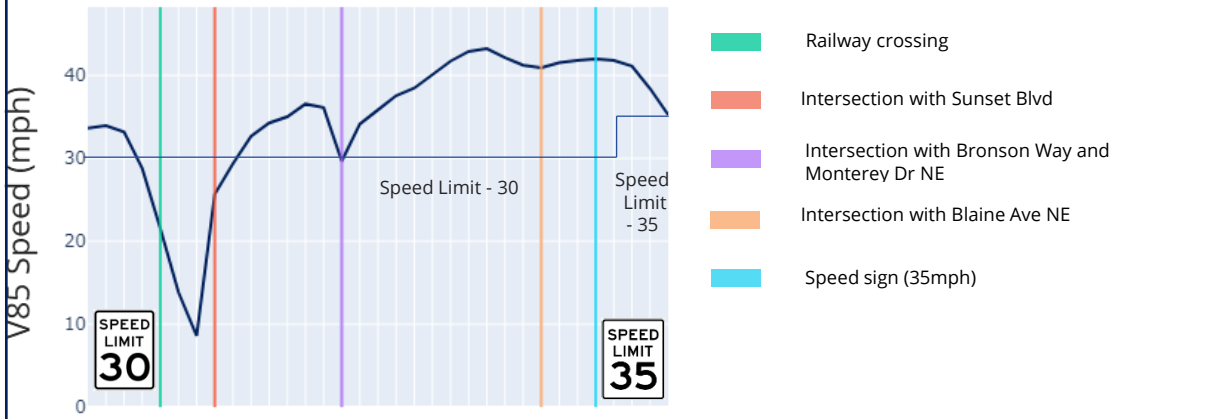


OBSERVATIONS

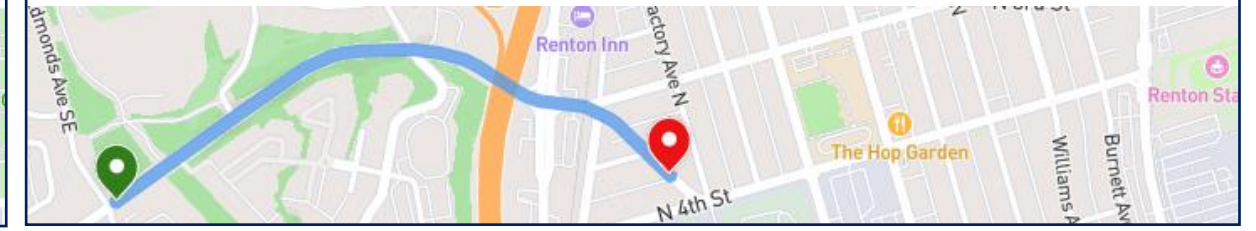
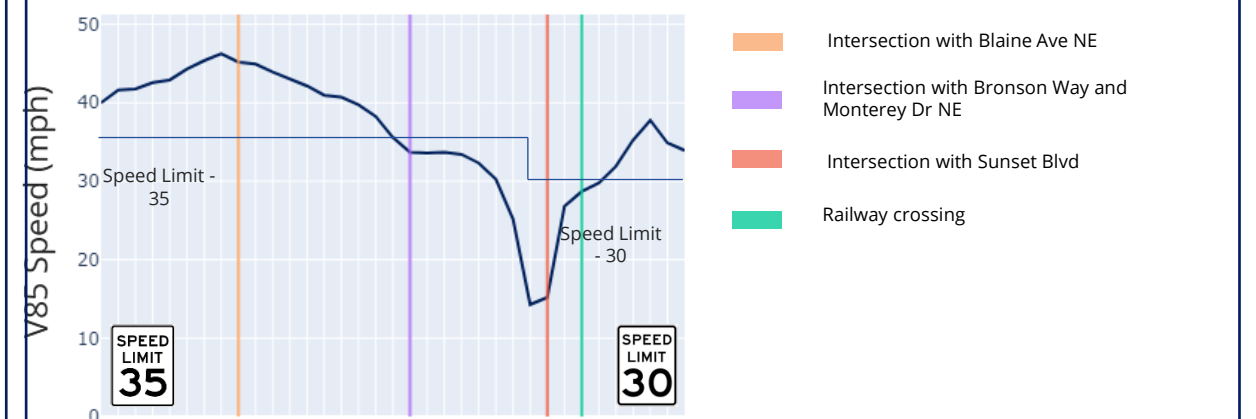
- Drivers speed decreases before intersection with 3rd St

KING 2: V85 SPEED ON 3RD ST

V85 FROM WEST TO EAST



V85 FROM EAST TO WEST

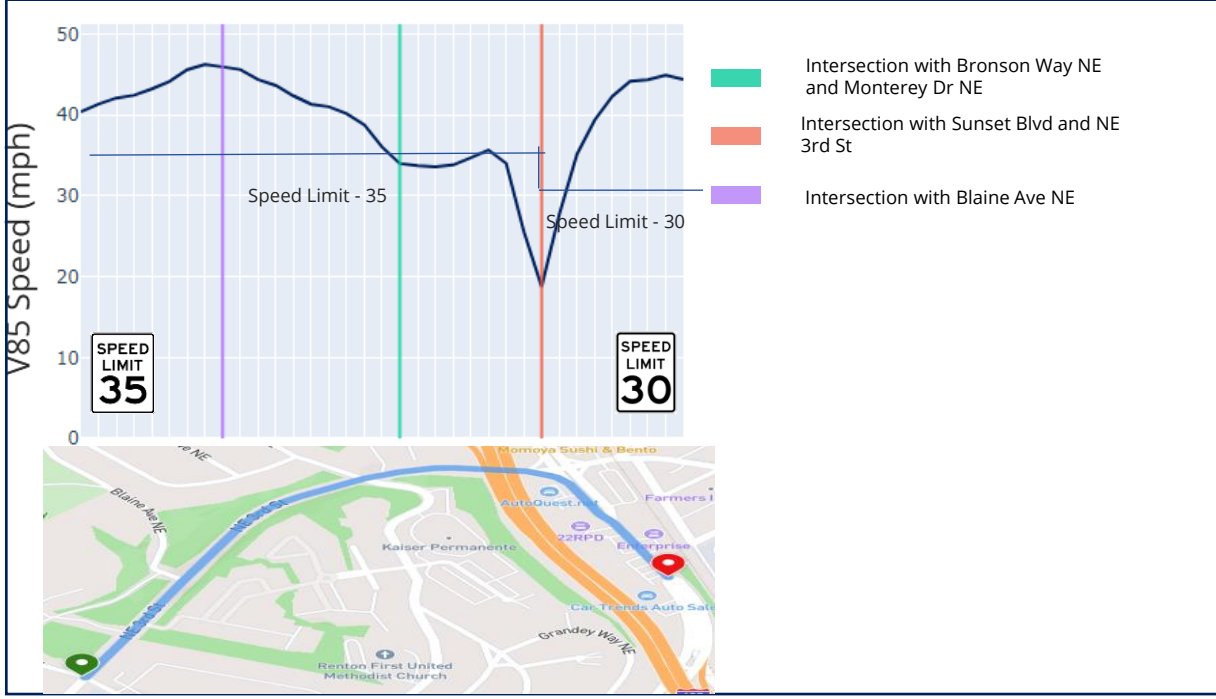


OBSERVATIONS

- Significant speeding : 15% of drivers drive 10 mph over the speed limit on NE 3rd St when driving to the East

KING 2: TURNS WITH SEVERITY RANKING

V85 FROM EAST TO NORTH



V85 FROM WEST TO SOUTH



OBSERVATIONS

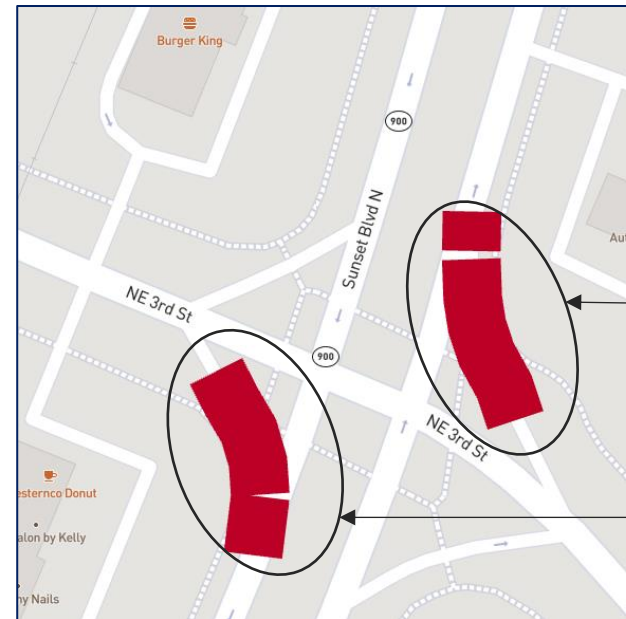
- Drivers decrease their speed to 20mph when coming from East to North and 15mph when coming from West to North

KING 3: ACCELERATION EVENTS ON RAMPS

Ramp	Number Events	85 th Percentile of Intensity
East-North	260	0.46
West-South	201	0.43

OBSERVATIONS

- The 85th percentile of intensity are relatively high, especially for the East-North ramp



Ramp
East-North

Ramp
West-South

KEY TAKEAWAYS

- High intensity braking events near Sunset Blvd and 3rd Street intersection
- High intensity acceleration events near the ramps
- High crash count area
- Some speeding, especially on NE 3rd Street when driving to the East

MICHELIN

MOBILITY INTELLIGENCE

K3

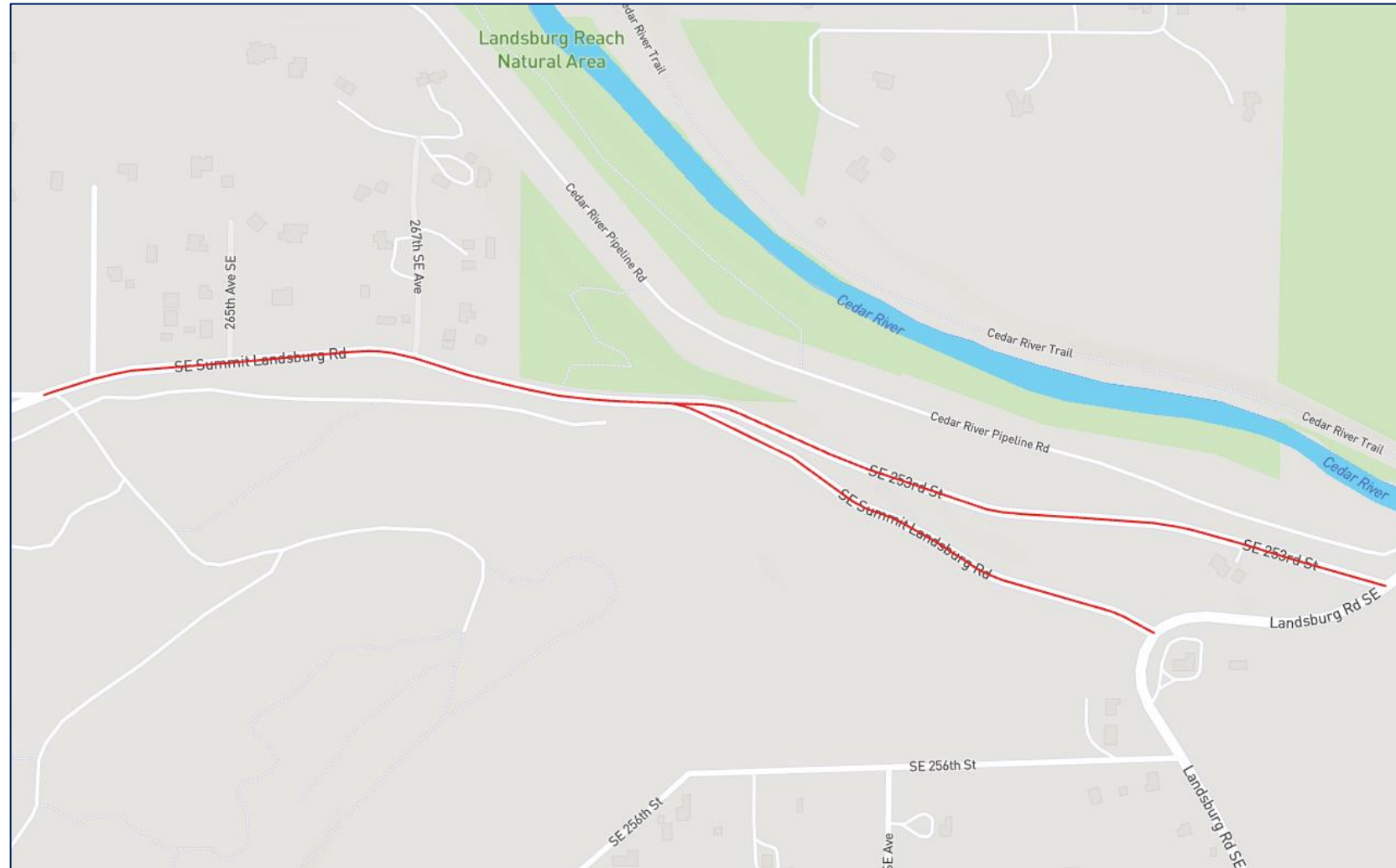
***SE SUMMIT LANDSBURG &
253RD ST SE***

AREA OF INTEREST

- SE Summit Landsburg Rd intersecting with 253rd ST SE, east of Maple Valley and south of Hobart

NOTEWORTHY FEATURES

- Dual stop signs with alternating right of way to continue west onto Summit Landsburg



STOP SIGN CONFIGURATION LEADS TO HARSH BRAKING

- Eastbound traffic flow has right of way
- Westbound (either SE Summit Landsburg or SE 253rd), stopping at unusual stop sign configuration is required
- If there is a failure to stop from Westbound SE Summit Landsburg, there is a high risk of head on collision due to crossing traffic flows

Traveling eastbound, traffic going to 253rd cuts across westbound traffic from SE Summit Landsburg

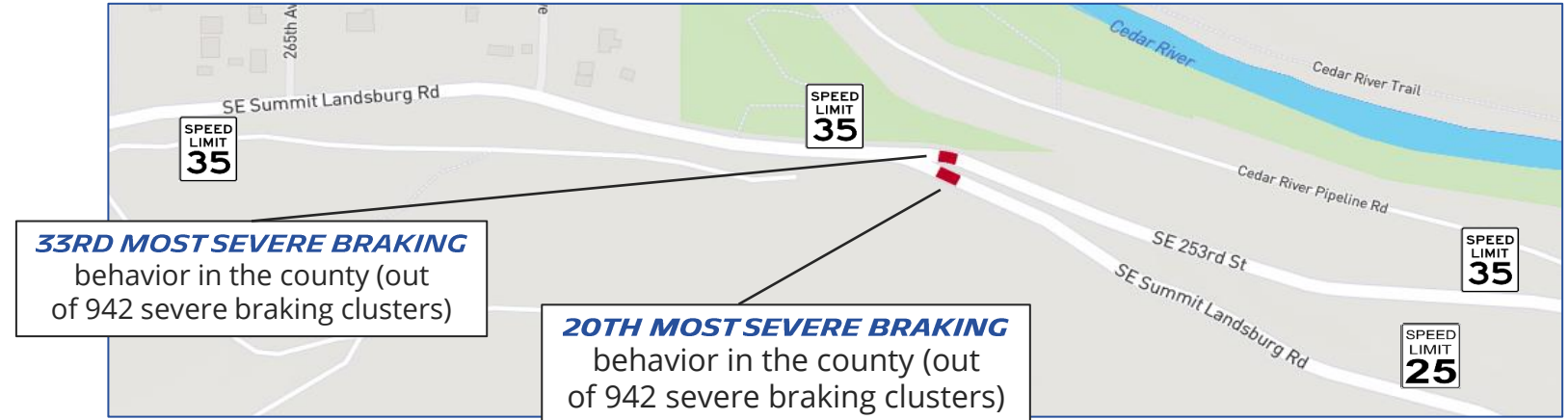


Traveling westbound on either of the two roads, traffic must stop and determine correct priority through stop signs



DRIVING BEHAVIOR

- For drivers traveling west towards SE Summit Landsburg Rd from **both** SE 253rd and SE Summit Landsburg, abnormally severe braking behavior was detected

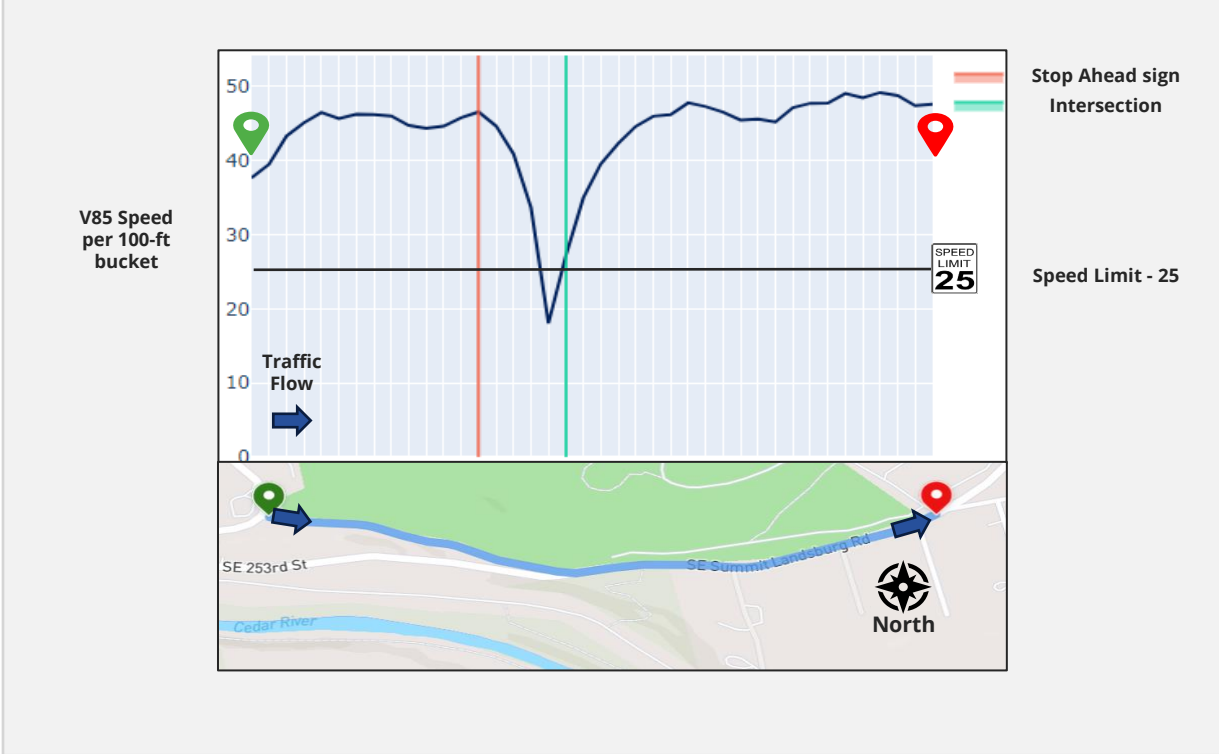


CRASH HISTORY

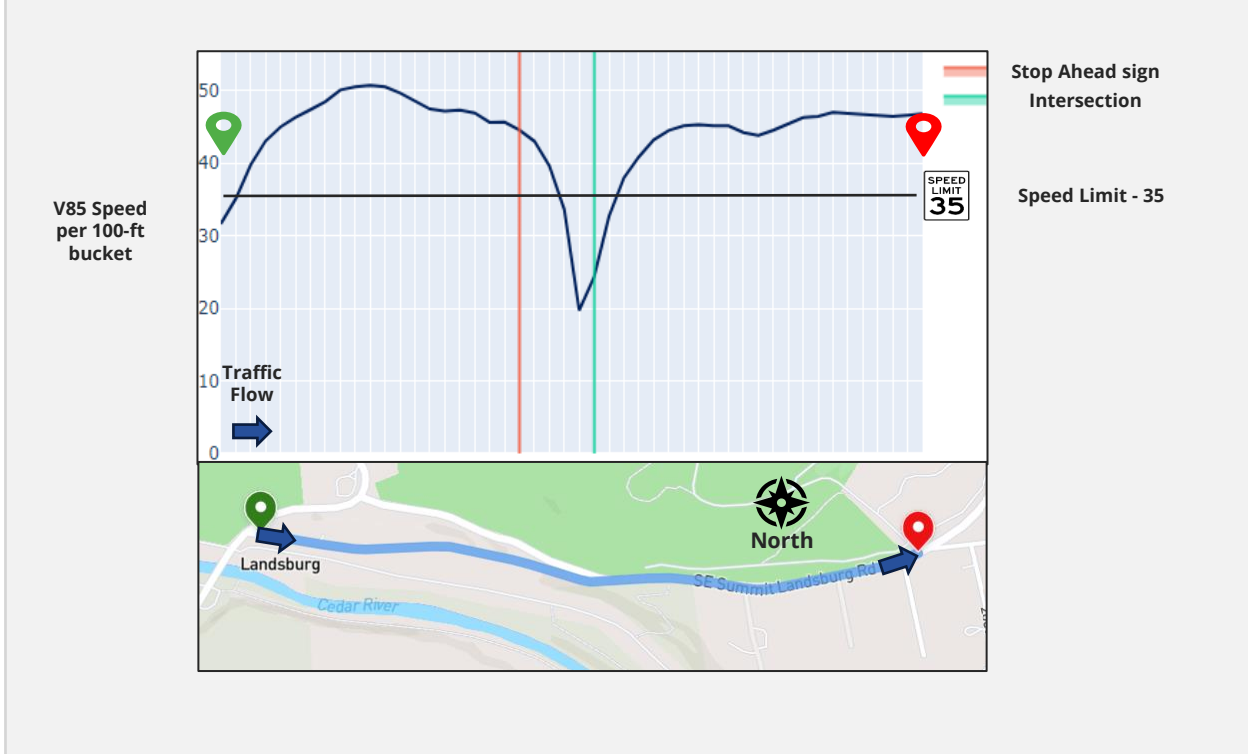
- Vehicle-to-vehicle (V2V) crashes are marked in brown points
- No history of crashes at intersection, but number of crashes in broader focus area
- One VRU crash (cyclist, highlighted in blue)



V85 FROM SOUTHEAST TO WEST (25MPH Speed Limit)



V85 FROM NORTHEAST TO WEST (35MPH Speed Limit)



OBSERVATIONS

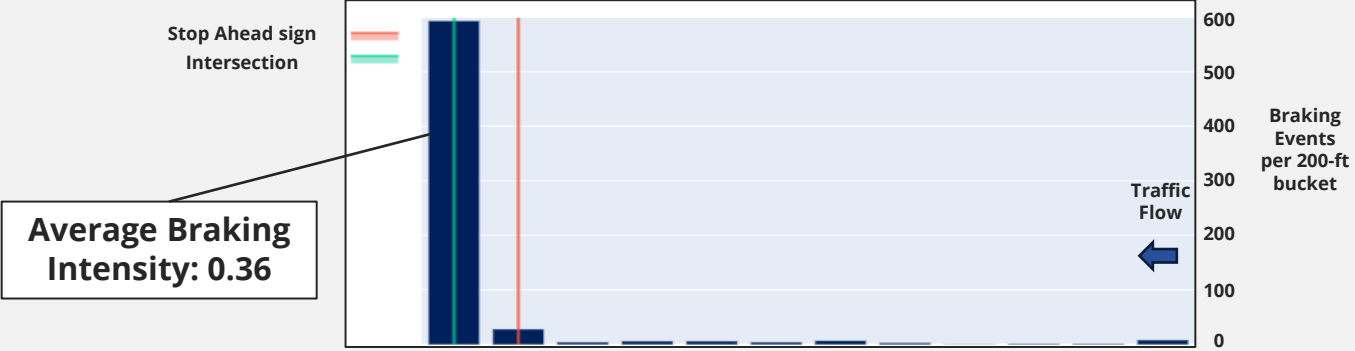
- V85 significantly exceeds the speed limit for both westbound approaches to the intersection, especially from the southeast approach (Summit Landsburg westbound)
- The start of deceleration corresponds to the placement of the "Stop Ahead" sign on the southeast approach (Summit Landsburg westbound)

BRAKING COUNT BY ROAD SECTION

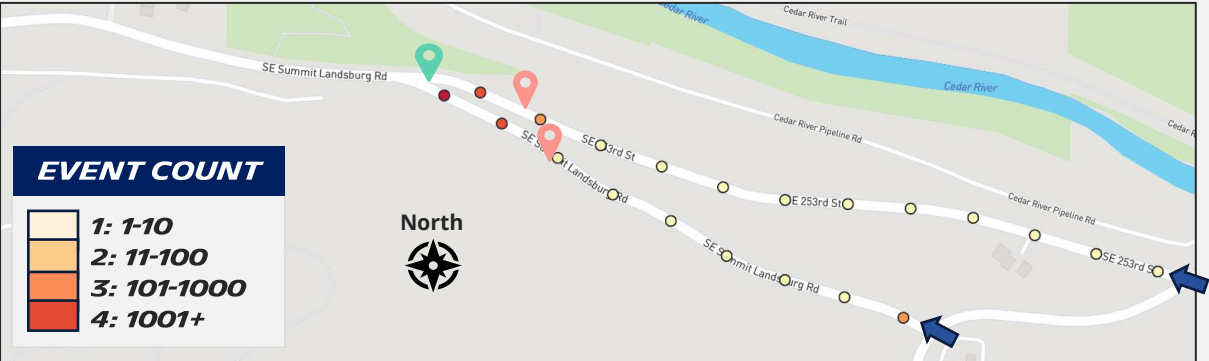
OBSERVATIONS

- Severe braking behavior is also demonstrated by examining the number of harsh braking events in every 200-ft section of road leading up to the intersection from both westbound roads.

**HARSH BRAKING
EVENTS PER BUCKET
FROM NORTHEAST**



**HARSH
BRAKING COUNT
S PER BUCKET
FOR TRIPS
HEADING WEST
TOWARDS
INTERSECTION**

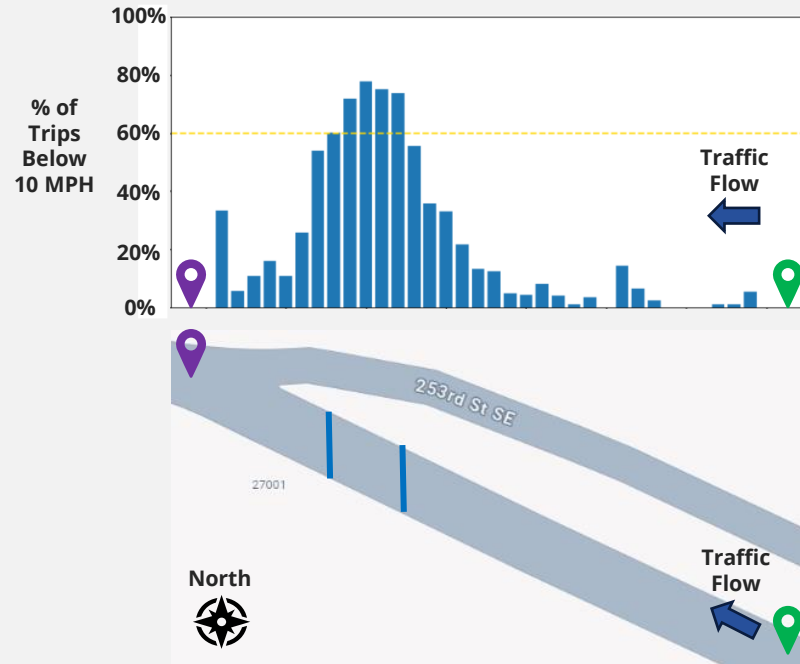


**HARSH BRAKING
EVENTS PER BUCKET
FROM SOUTHEAST**



DEFINING THE STOPPING WINDOW

The correct stopping window was identified by finding the 10-meter stretch of road with the highest proportion of trips under 10mph (threshold was set at 60% of trips)



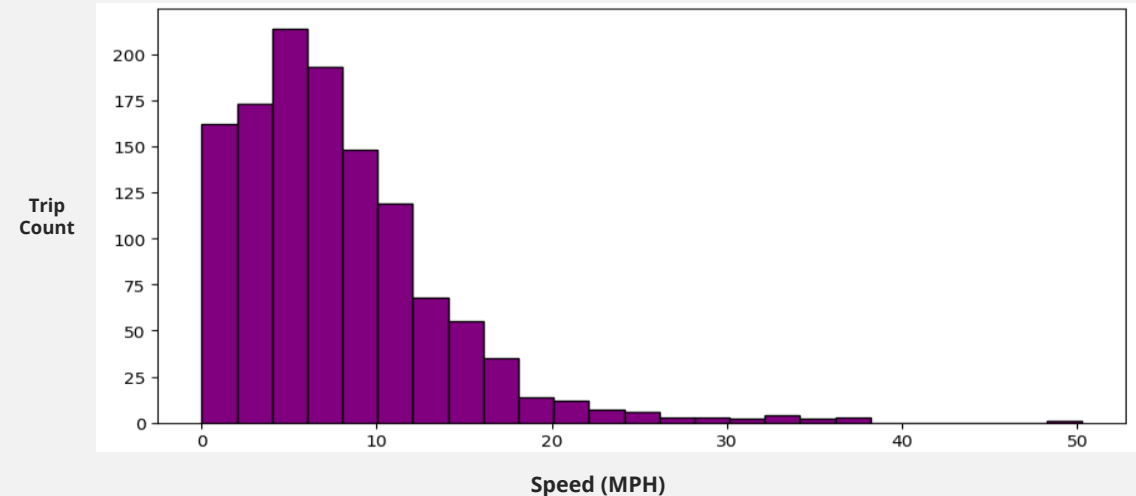
STOP ADHERENCE RATE

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
72.4%	24.1%	2.5%	1.0%
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

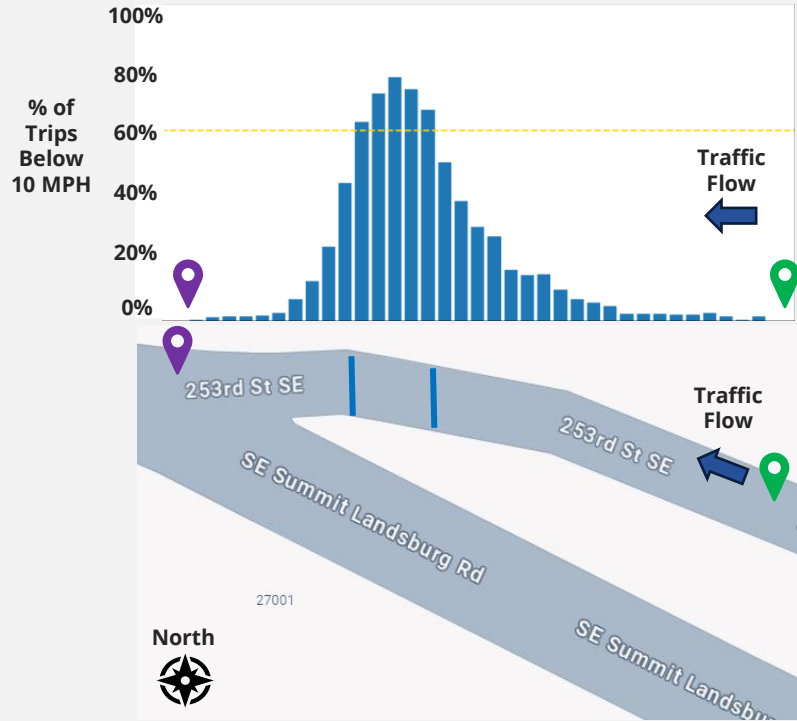
SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



DEFINING THE STOPPING WINDOW

The correct stopping window was identified by finding the 10-meter stretch of road with the highest proportion of trips under 10mph (threshold was set at 60% of trips)



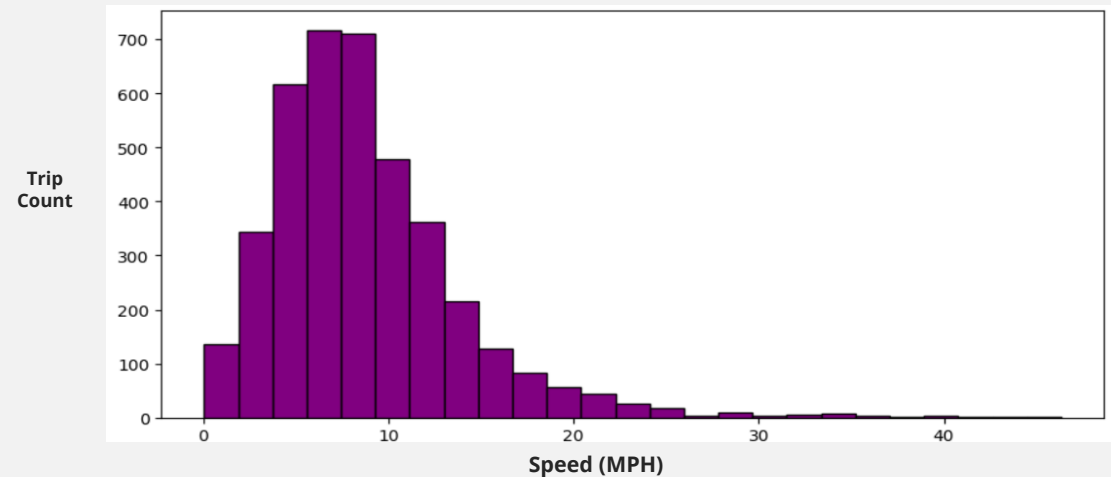
STOP ADHERENCE RATE

- Note: Most trips with even a perfect stop will not be measured at exactly 0mph because trip points are only captured every 15 seconds

0-10 MPH	10-20 MPH	20-30 MPH	30+ MPH
69.2%	27.2%	2.7%	0.8%
"Adherence"	"Likely Adherence"	"Violation Risk"	"High Violation Risk"

SPEED DISTRIBUTION IN 10-METER STOPPING WINDOW

In the 10-meter stopping window, the highest density of trips are under 10mph, but with some notable outliers.



CONCLUSIONS:

- This intersection has abnormally severe braking behavior on both westbound roads.
- This is partially related to the excessive speeding behavior frequently seen, with a V85 of 20mph **over** the speed limit for most of the stretch of Summit Landsburg heading westbound to the intersection, and with a V85 of 10-15mph **over** the speed limit for much of 253rd westbound towards the intersection.
- The speeding issue is likely compounded by the somewhat unexpected location and unusual configuration of the stop signs. Traffic tends to start slowing down sharply very near where the "Stop Ahead" signs are located.
- A change in signage or signage location could help prepare drivers to start slowing down sooner.

MICHELIN

MOBILITY INTELLIGENCE

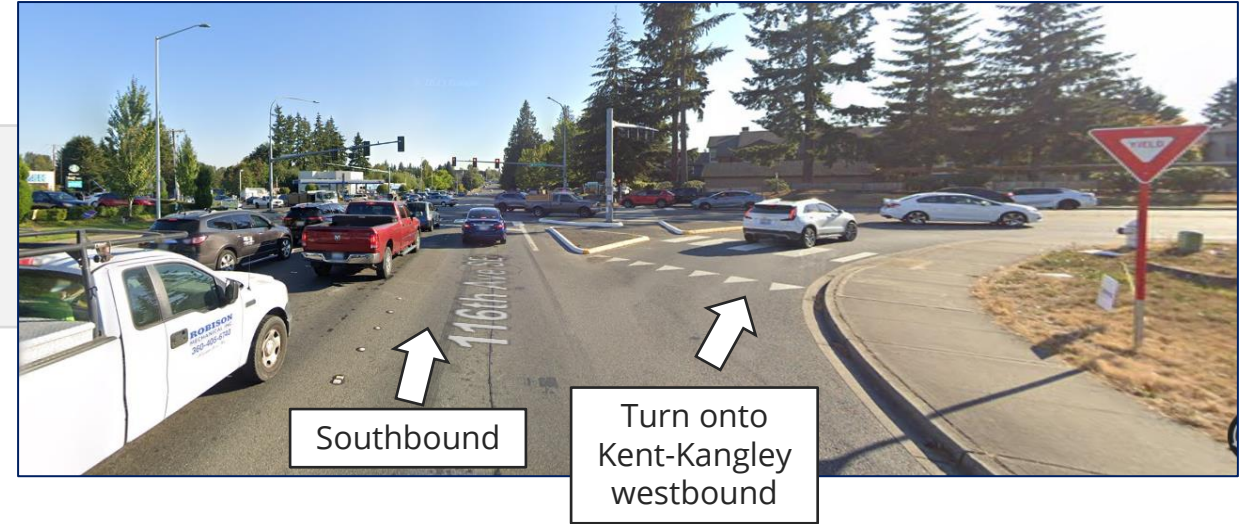
K4

***KENT-KANGLEY RD &
116TH AVE SE***

FOCUS AREA OVERVIEW

- V85 speed on Kent-Kangley going both directions is consistently well above the speed limit of 35, especially to the east of the intersection.
- Turning right onto Kent-Kangley from 116th from both the south and the north requires use of short turn lanes, both of which have pedestrian crosswalks bisecting them.
- There are several restaurants, gas stations, and shopping centers with entrances and exits very near the intersection.

View from 116th north of the intersection with Kent-Kangley, heading south



View from Kent-Kangley, east of the intersection with 116th



KENT-KANGLEY & 116TH AVE SE – SPEED PATTERNS

V85 Kent-Kangley Eastbound



V85 116th turning East onto Kent-Kangley

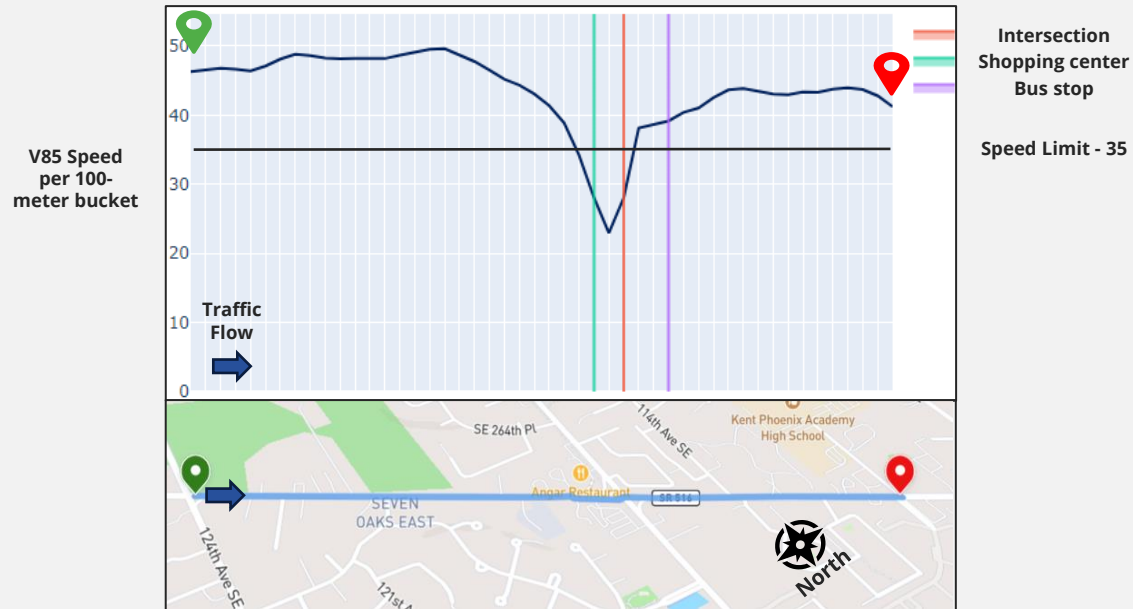


OBSERVATIONS

- V85 on Kent-Kangley from the west is at 35mph by the time drivers reach where drivers from 116th are turning right onto Kent-Kangley. Deceleration at the intersection coming from the west generally occurs before the intersection, indicating high traffic density at the traffic light.
- Drivers coming from the south (116th) turning right get up to speed quickly, consistent with aggressive acceleration.
- Drivers coming from 116th go faster on Kent-Kangley than drivers coming from Kent-Kangley west of intersection.

KENT-KANGLEY & 116TH AVE SE – SPEED PATTERNS

V85 Kent-Kangley Westbound



V85 116th Southbound to Kent-Kangley Westbound



OBSERVATIONS

- V85 on Kent-Kangley from the east is at 30mph by the time drivers reach where drivers from 116th are turning right onto Kent-Kangley. Deceleration at the intersection coming from the west generally occurs before the intersection, indicating high traffic density at the traffic light.
- V85 dips to 15.3mph for drivers turning right onto Kent-Kangley westbound but is back up to 32 within 200 feet, indicating significant acceleration past the bus stop.

KENT-KANGLEY & 116TH AVE SE (OVERALL RESULTS)

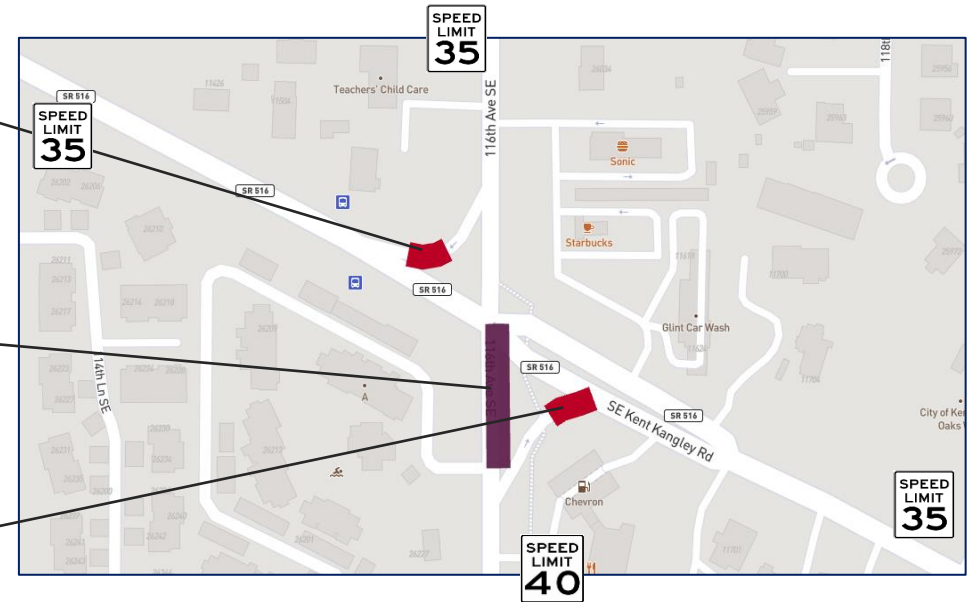
DRIVING BEHAVIOR

- For drivers turning right onto Kent-Kangley from 116th SE from both north and south, abnormally severe acceleration behavior was detected.
- Additionally, the southern section of 116th leading into the intersection has a high VRU risk

8th most severe acceleration
behavior in the county (out of 1632 severe acceleration clusters)

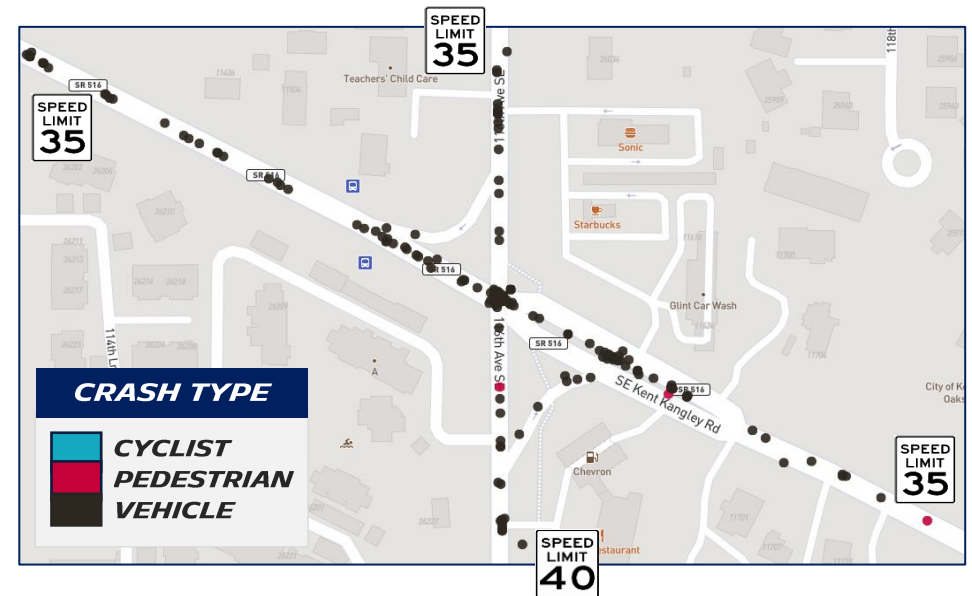
VRU pedestrian class risk

3rd most severe acceleration
behavior in the county (out of 1632 severe acceleration clusters)



CRASH HISTORY

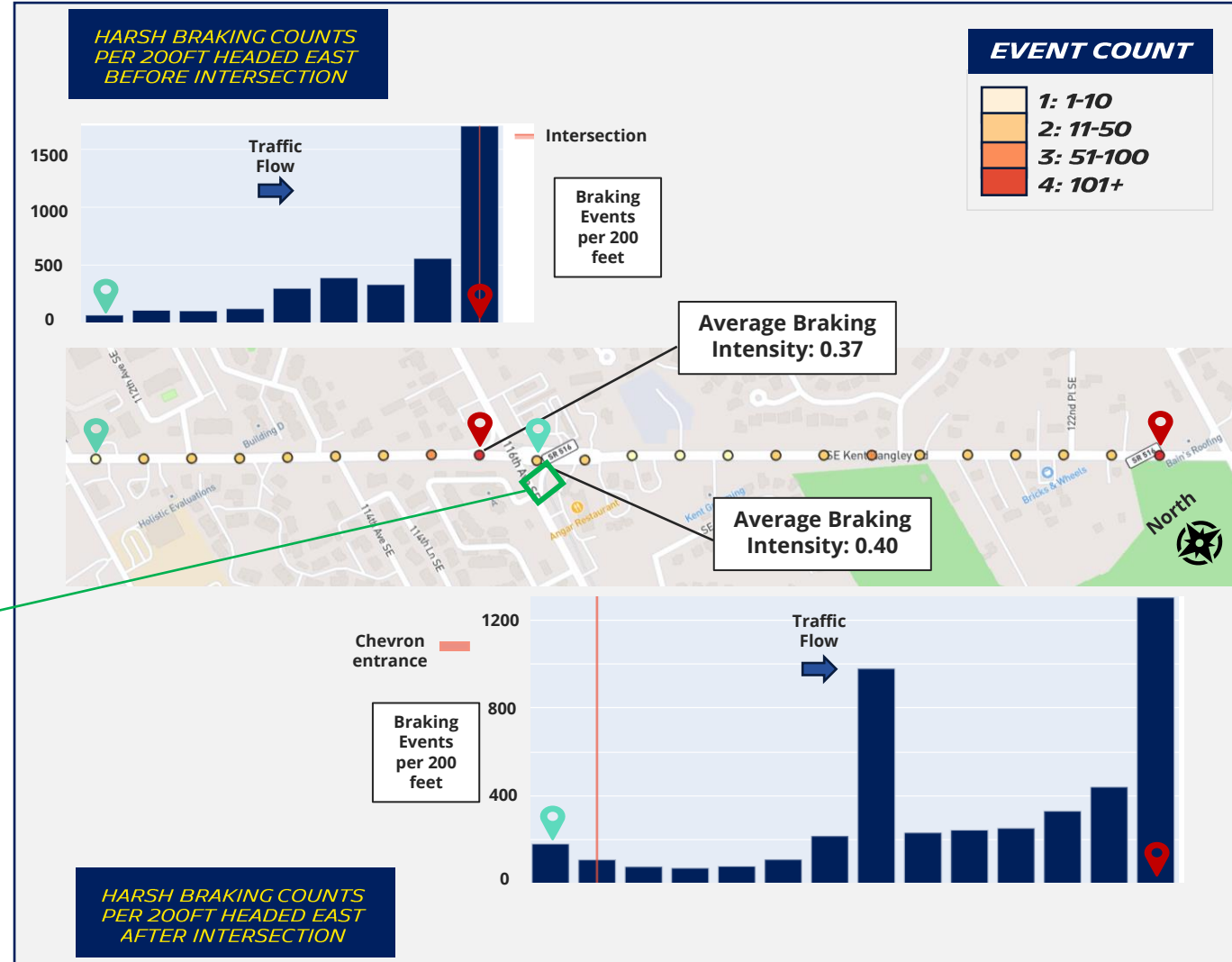
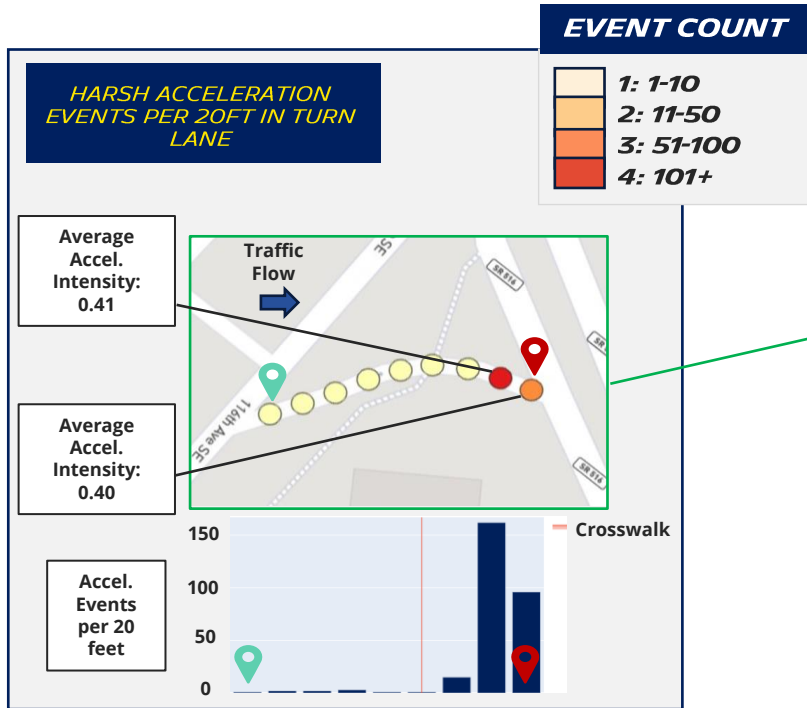
- Vehicle-to-vehicle (V2V) crashes are marked in brown points, pedestrian in red
- Significant crash history both in center of intersection as well as in all directions of approach



BRAKING ON KENT-KANGLEY EASTBOUND & ACCEL ON TURN FROM 116TH

KEY TAKEAWAYS

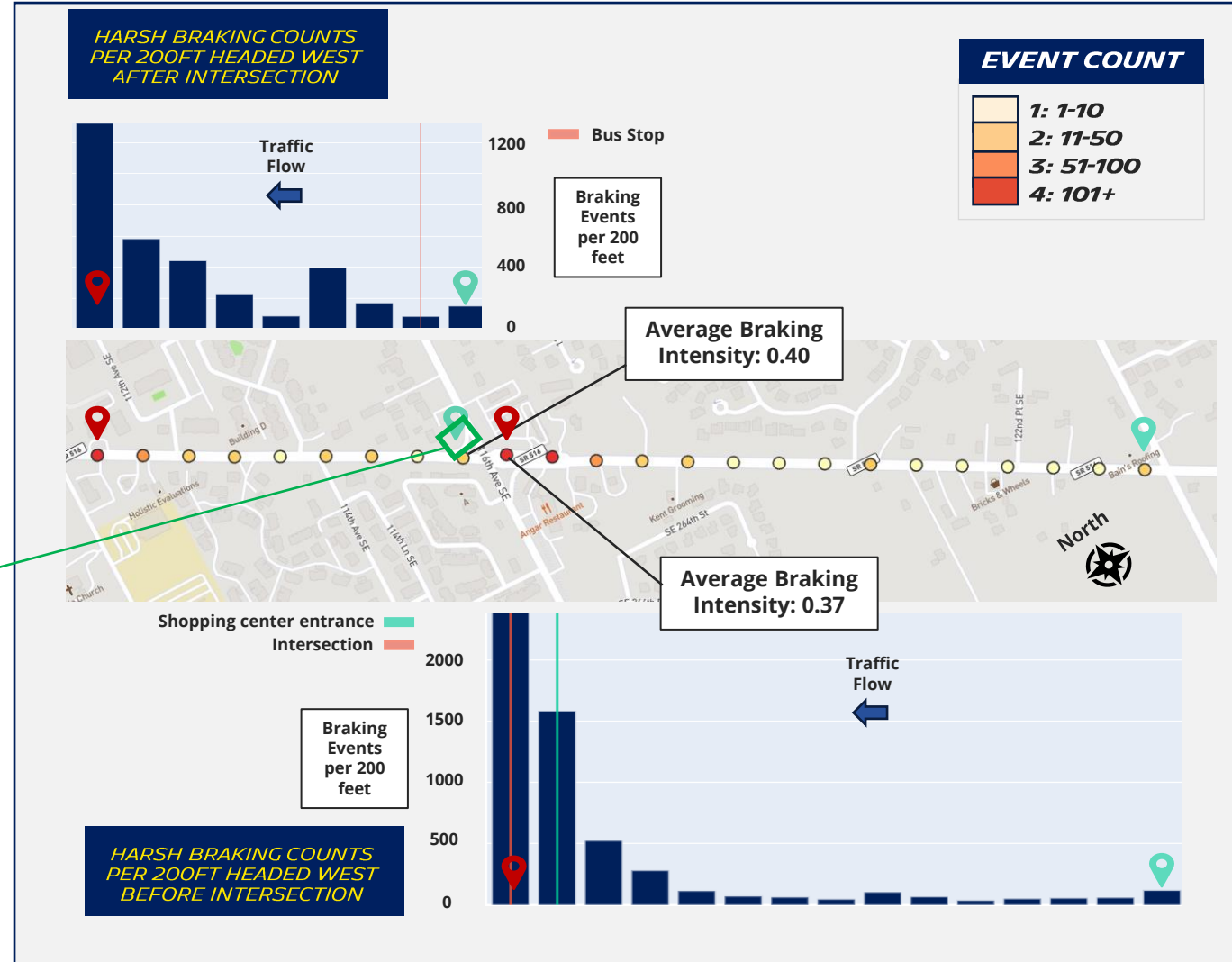
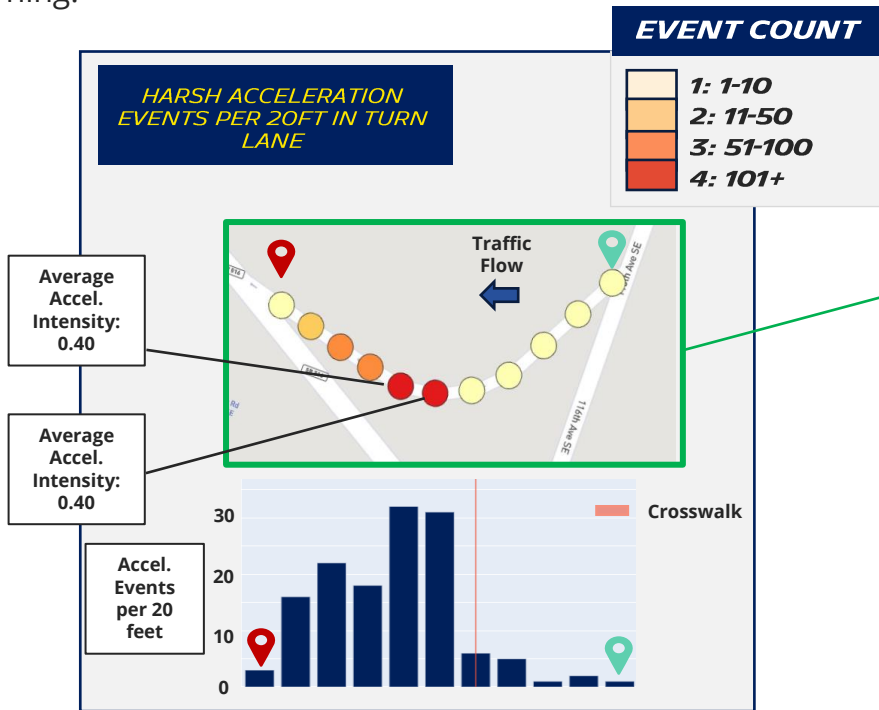
- Although severe acceleration from 116th right onto Kent-Kangley Eastbound occurs frequently, most of it happens after drivers have passed the crosswalk. However, the area still holds risk for pedestrians.
- The relatively normal number of harsh braking events on Kent-Kangley immediately after the intersection indicates there are fewer near misses than might have been expected solely from the acceleration numbers.



BRAKING ON KENT-KANGLEY WESTBOUND & ACCEL ON TURN FROM 116TH

KEY TAKEAWAYS

- Severe acceleration while turning onto Kent-Kangley from 116th happens frequently, although not as often as from the turn lane opposite the intersection. Similarly, most harsh acceleration happens after the crosswalk, but risk to pedestrians still exists.
- The bus stop right after the turn lane adds to the difficulty of the turn, but the normal amount of harsh braking events after the intersection indicates westbound drivers through the intersection generally have enough time to react to drivers turning.



CONCLUSIONS:

- This intersection has abnormally severe acceleration behavior on both right-turn lanes onto Kent-Kangley, which is coupled with risk to pedestrians partially due to crosswalks crossing these turn lanes.
- Although there is still risk to pedestrians in these areas, most of the harsh acceleration happens after cars are past the crosswalk in the turn lane.
- A potential cause for the elevated harsh acceleration is the speed going both ways on Kent-Kangley – the V85 speed of drivers on Kent-Kangley going past where the turn lane enters is between 35 and 40mph. This creates a situation where drivers turning need to accelerate quickly once they leave the turn lane.
- Complicating factors exist after both turn lanes – for the northern turn lane, there is a bus stop within 100 feet of the turn lane, and for the southern turn lane, there are entrances to both a gas station and a car wash/shopping center on either side of the road in about the same distance.
- Ultimately, braking patterns on Kent-Kangley before and around where the turn lanes enter indicate there aren't as many near misses as we might expect from the acceleration patterns, but the acceleration patterns alone indicate the presence of both V2V and pedestrian crash risk.
- Efforts to reduce speed on Kent-Kangley approaching the intersection from either direction, or to change the yield sign on the southern turn lane to a no-turn-on-red sign, could have a positive effect on reducing crash risk in this intersection.

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THANK YOU!

