

The background of the entire page is a blue-tinted photograph of a city street with a network overlay of white lines and dots. The network lines are more prominent in the foreground and bottom, suggesting a digital or data-driven theme. The street scene includes buildings, a bridge, and vehicles.

MICHELIN

MOBILITY INTELLIGENCE

KEPLER MAPS USER GUIDE

Customized for:
Washington Traffic Safety Commission



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Under 23 U.S. Code § 148 and 23 U.S. Code § 407, safety data, reports, surveys, schedules, lists, compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

WHAT IS A KEPLER MAP?

A Kepler map is an interactive tool that visualizes complex data on a map, making it easy to explore and understand various patterns and trends. In the context of the study on Yakima County and South King County, Kepler maps display important insights such as traffic speeds, hotspots for harsh braking and acceleration, crash locations, and areas where pedestrians and cyclists are at higher risk. These maps allow users to view different layers of data, apply filters, and interact with the information to gain a deeper understanding of high-risk areas and traffic behaviors.

HOW TO ACCESS AND USE KEPLER MAPS

Opening Your Kepler Map

1. Download the Kepler Map
2. Click on the Kepler Map, which will be in your downloads folder as an .html file, to open in your preferred web browser

These maps, based on anonymous driving data from Arity, provide insights into:

- Harsh Braking
- Harsh Acceleration
- Vulnerable Road Users

Each map—one for Yakima County and one for South King County—lets you explore these datasets individually or together using the map's controls. For more details, see the User Guide.

File Names:

- Yakima County – WTSC Delivery.html
- South King County – WTSC Delivery.html

By using these maps, you'll be able to:

- Identify hotspots for harsh braking and acceleration
- Recognize areas where pedestrians and cyclists are most vulnerable
- Visualize socioeconomic and demographic characteristics of census tracts in each county

Together, these maps offer a powerful tool to better understand high-risk areas within Yakima and South King County, helping to improve road safety and inform future planning efforts.

Geography Note for South King County

South King County is defined as the southernmost part of King County, with Burien and Renton marking its borders in the northwest, running south of US-90 across to the eastern border of King County. The exact borders of South King County can be found here, with the exception of Vashon Island being excluded from the scope of the GHSA study: [Geographical definitions - King County, Washington](#)

FEATURES

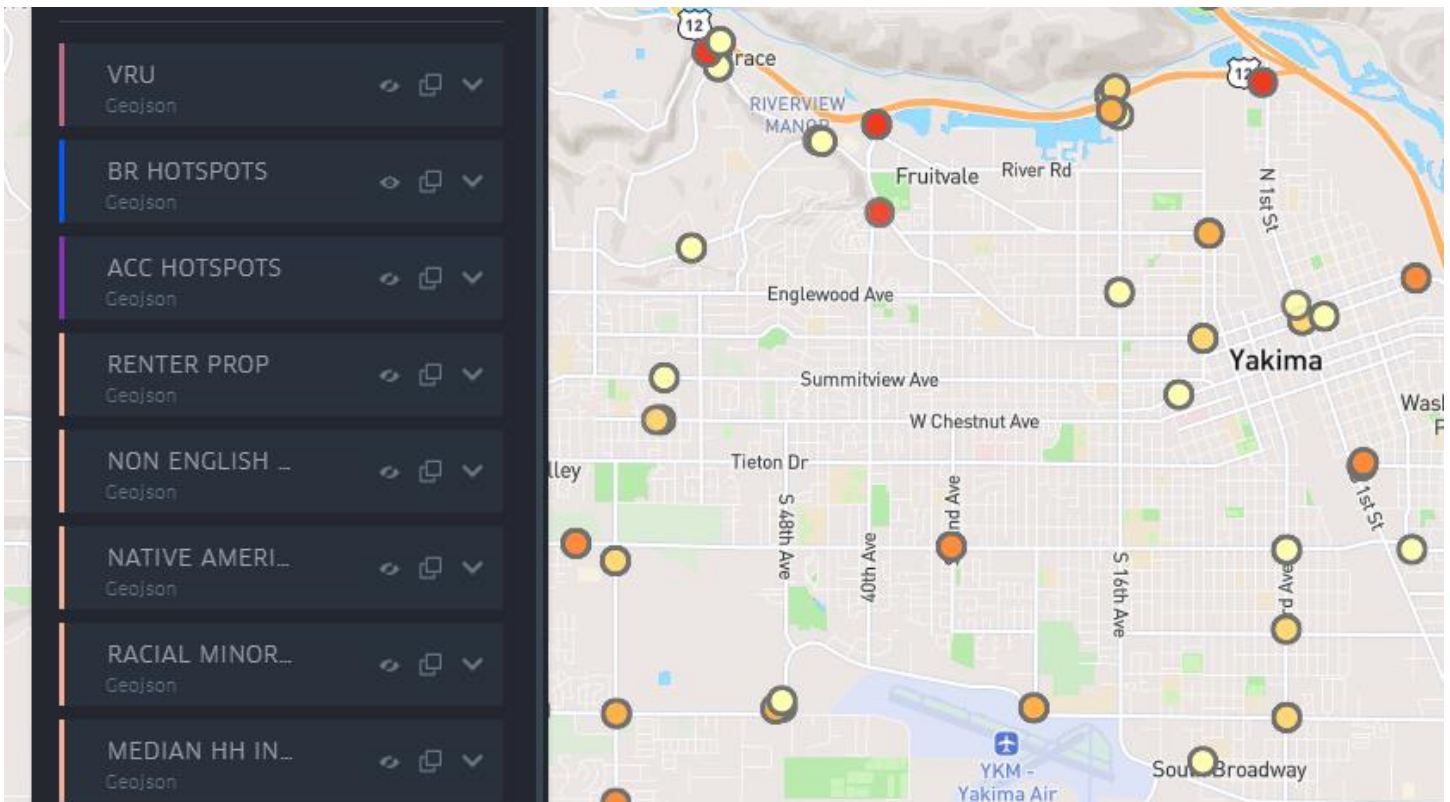
Layers & Datasets

What Are Layers?

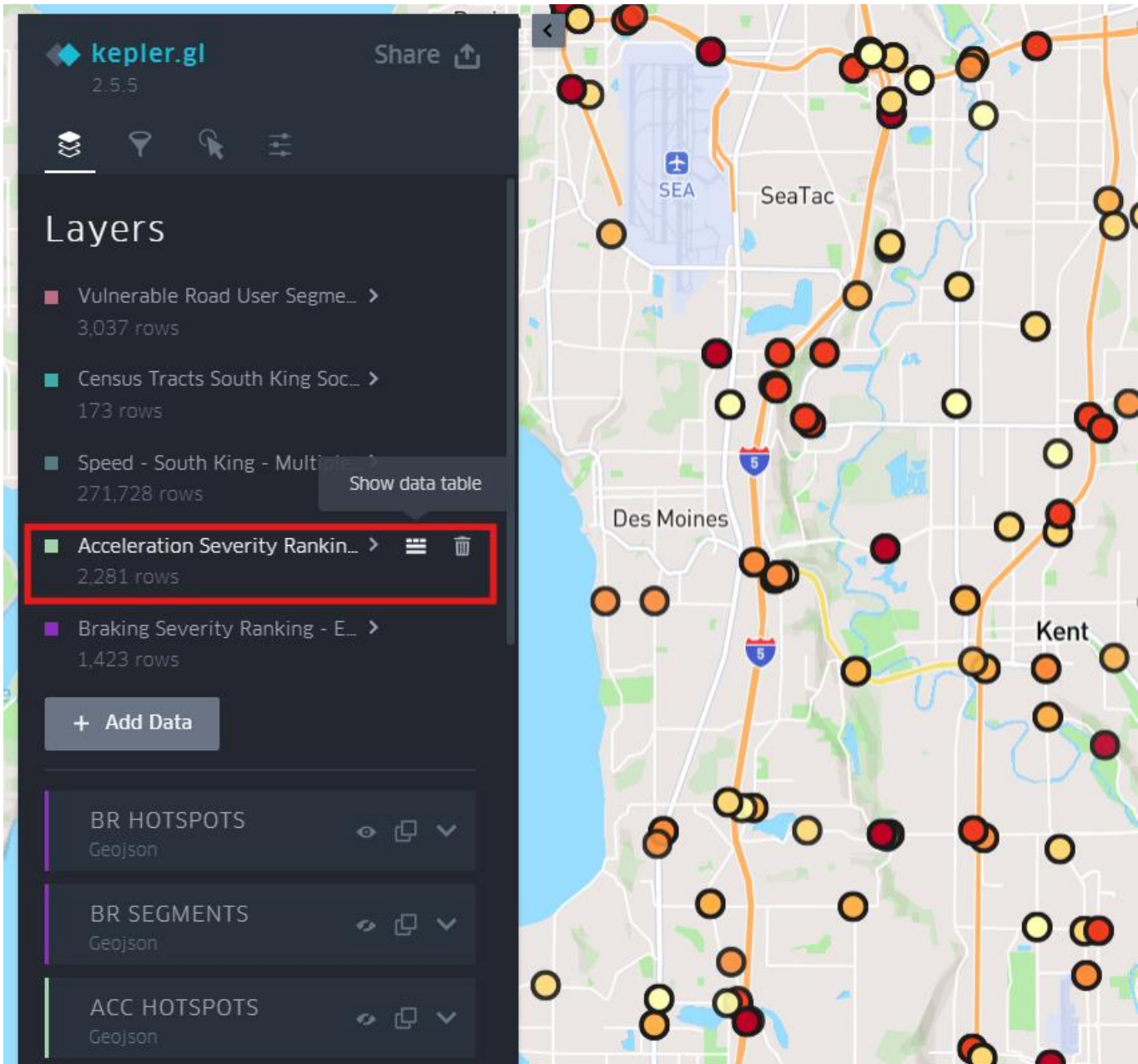
Layers are essentially different sets of information that you can see on the map. For example, one layer might show where crashes have occurred, while another shows areas with harsh braking. You can turn these layers on or off depending on what you want to focus on.

How to Use Layers:

- To view a specific layer, **simply click the eye icon next to its name**. If the eye icon has a slash through it, that layer is currently hidden.
- You can view multiple layers at the same time to see how different datasets overlap or relate to each other.



Each layer corresponds to one of the five datasets included in the map. You can view and manage these layers in the same tab where the datasets are listed. To view and export the dataset behind a layer, simply click **“Show data table”** next to the dataset name.





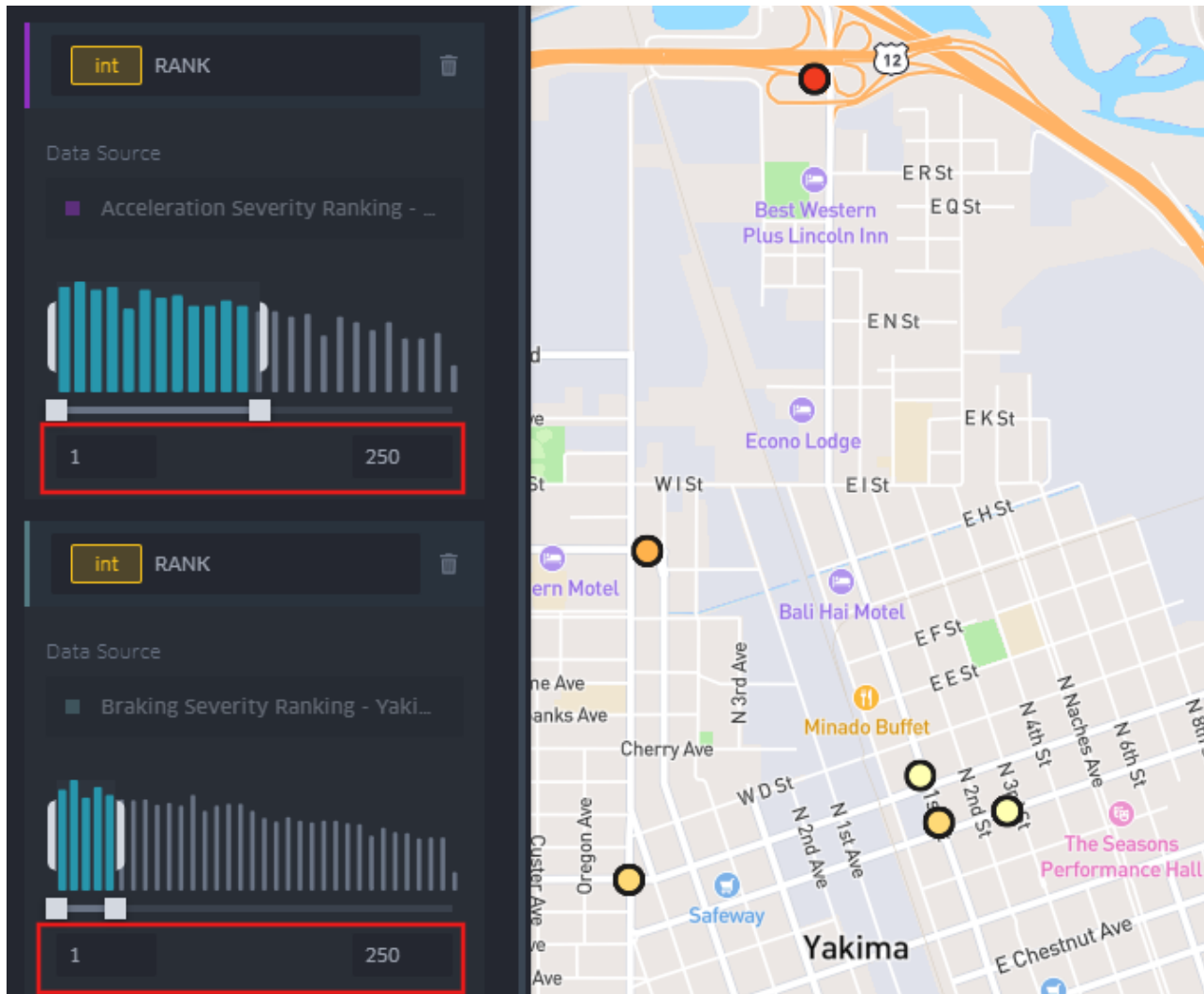
Filters

What Are Filters?

Filters allow you to narrow down the data you're looking at to specific details that interest you. For example, you might want to only see the top 250 harsh braking hotspots.

How to Use Filters:

- Select the dataset you want to filter from.
- **Click “+Add Filter,”** choose the field you want to filter by, and enter the values that interest you.
- You can filter by numbers (like showing only the top-ranked braking hotspots) or categories (like filtering for crashes involving pedestrians).
 - *EXAMPLE Filter by numbers: show all braking clusters with a Rank <250*
 - *EXAMPLE Filter by non-numeric data: Show all crashes where TYPE_OF_CRASH is ‘VEHICLE’*





Interactions

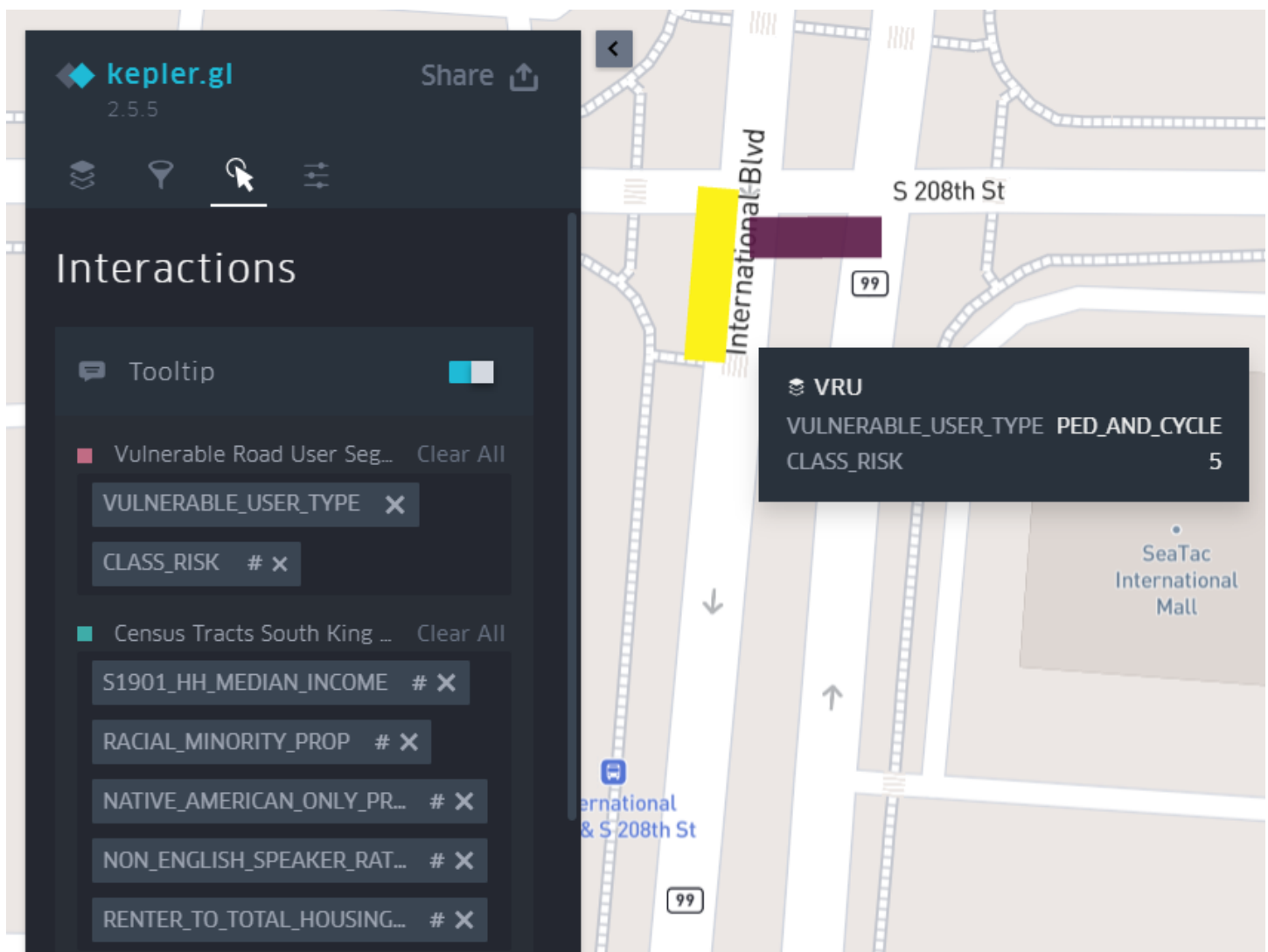
What Are Interactions?

Interactions are the ways you can engage with the map data, such as seeing additional details when you hover over a point on the map.

How to Use Interactions:

- The most useful interaction is the Tooltip, which shows extra information when you hover over a data point.
- You can customize what information appears in the Tooltip by checking or unchecking boxes next to the data fields under each dataset and add or remove fields to be displayed in the tooltip.

EXAMPLE: In the image below, data points taken from MMI Vulnerable Road User data show road segments where pedestrians and cyclists are especially vulnerable. The two variables displayed show the specific type of vulnerable road user and the level of risk they face when a map user hovers over the road segment.



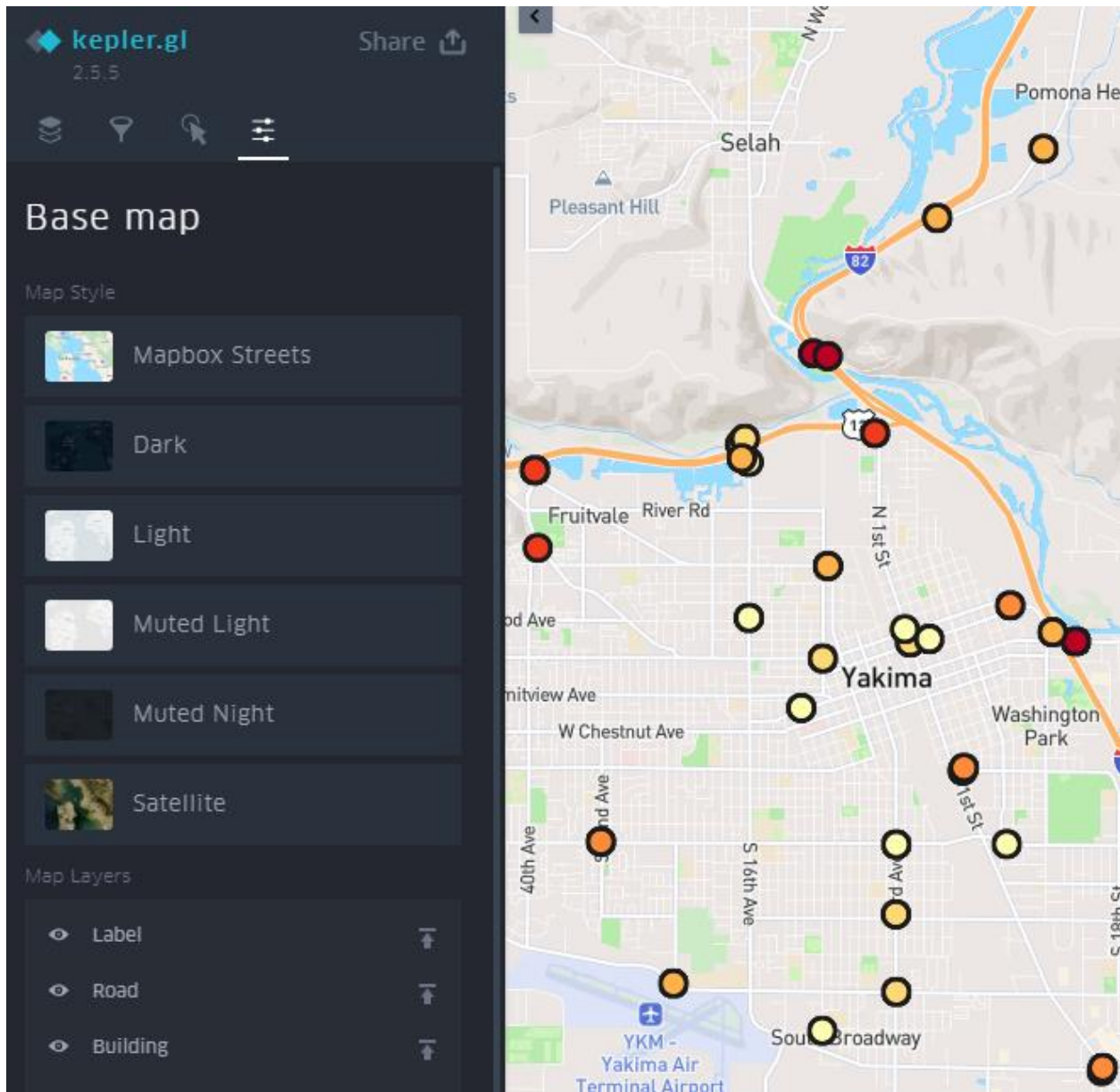


Basemap

The basemap is the background of your map. You can change its appearance to suit your preferences or needs.

How to Use the Basemap:

- You can choose different themes like light, dark, or others.
- You can decide whether to show or hide roads, buildings, and labels.



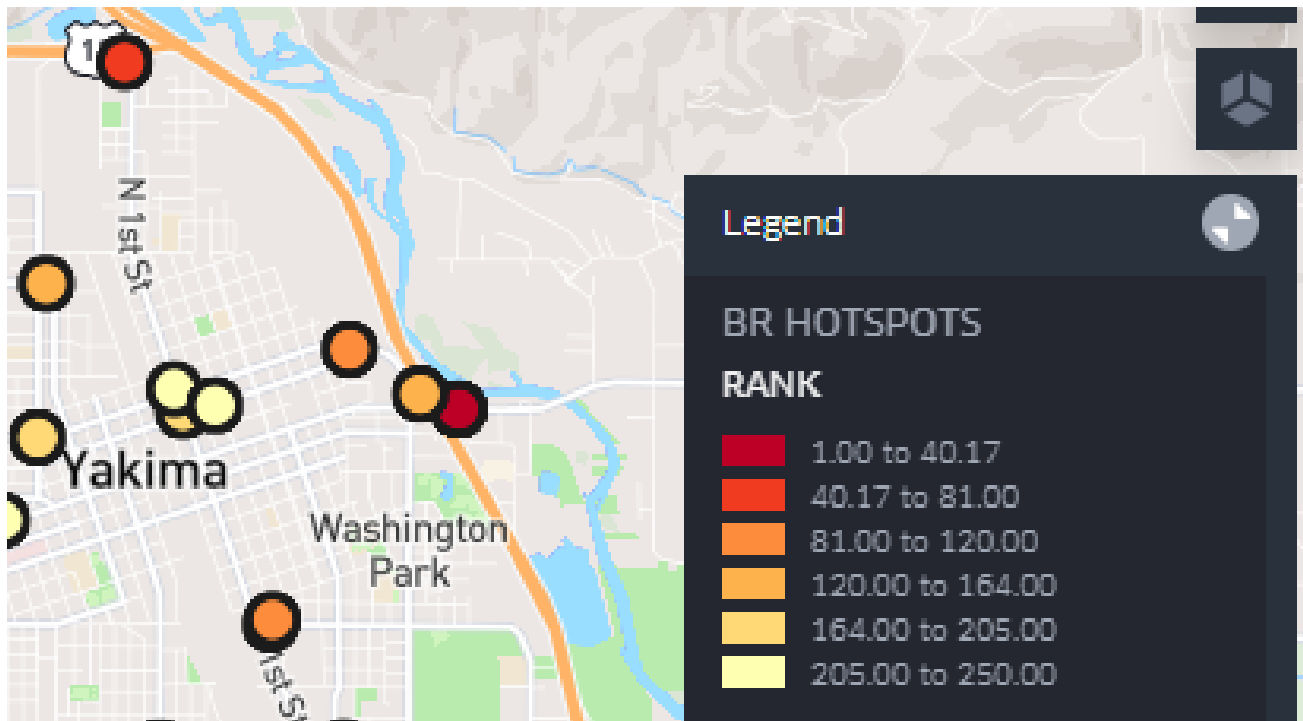
Legends

What Are Legends?

Legends explain what the colors, shapes, and symbols on the map represent.

How to Use Legends:

- Legends can be displayed or hidden as needed. They appear in the top right corner of the map and help you make sense of the data visualized on each layer.





DATA DICTIONARY

FOR THE TECHNICAL USER, PRECISE DEFINITIONS OF THE LAYERS AND COLUMNS FOUND IN THE DATASETS USED IN THESE MAPS.

Layer Descriptions:

- **BR SEGMENTS**
 - A geographic dataset of the road segments identified by MMI's models as being the location of a dense cluster of severe braking events (i.e. where an abnormally high number of harsh braking events occur, relative to the number of trips that are taken, over a certain area of road).
- **BR HOTSPOTS**
 - A set of latitude/longitude points identified by MMI's models as being the location of a dense cluster of severe braking events (i.e. where an abnormally high number of harsh braking events occur, relative to the number of trips that are taken, over a certain area of road)
- **ACC SEGMENTS**
 - A geographic dataset of the road segments identified by MMI's models as being the location of a dense cluster of severe acceleration events (i.e. where an abnormally high number of harsh acceleration events occur, relative to the number of trips that are taken, over a certain area of road).
- **ACC HOTSPOTS**
 - A set of latitude/longitude points identified by MMI's models as being the location of a dense cluster of severe acceleration events (i.e. where an abnormally high number of harsh acceleration events occur, relative to the number of trips that are taken, over a certain area of road)
- **V85 SPEED**
 - A geographic dataset of all road segments in the county's road system where MMI data is present, showing the 85th percentile of driver speed for each road segment. Only road segments with 100 GPS data points or more are including in this data layer.
- **VRU (Vulnerable Road Users)**
 - A geographic dataset of all road segments in the county's road system that MMI's VRU crash risk model has identified as being especially risky to vulnerable road users.
- **MEDIAN HH INCOME**
 - The median household income across all households surveyed in this census tract (sourced from S1901 American Community Survey data)
- **RACIAL MINORITY PROP**
 - Across all 18+ residents of a census tract, this is the proportion of residents who do not identify as white, single-race (sourced from P1 Census survey data)

- **NATIVE AMERICAN PROP**
 - Across all 18+ residents of a census tract, this is the proportion of residents who identify as Native American or Alaska Native (sourced from P1 Census survey data)
- **NON-ENGLISH SPEAKER PROP**
 - Across all 18+ residents of a census tract, this is the proportion of residents who do not speak English well or at all (sourced from S1601 American Community Survey data)
- **RENTER PROP**
 - Across all households in a census tract, this is the proportion of households that are renting their primary residence (sourced from DP04 American Community Survey data)
- **INCOME INEQUALITY INDEX (GINI INDEX)**
 - The Gini Index or Income Inequality Index is a measure of inequality. It is commonly used to gauge how evenly income or wealth is distributed within a population.
 - A Gini Index of 0 means perfect equality—everyone has the same amount of income or wealth.
 - A Gini Index of 1 (or 100%) means perfect inequality—one person or group has all the income or wealth, while everyone else has none.

OVERVIEW OF ACCELERATION AND BRAKING SEVERITY RANKINGS

The MMI Driving Behavior Severity Ranking algorithm first identifies the locations in a road network that have clusters of harsh braking/acceleration events (where cluster is defined as many events happening in a concentrated area). Then, the algorithm ranks the severity of these clusters from most to least severe, based on how commonly these events happen relative to the number of trips that happen on that road segment (in other words – a cluster with 100 events and 1000 trips would be ranked higher than a cluster with 100 events and 5000 trips, all else being equal), and how intense or harsh those events typically are.

For MMI's analysis, these clusters (also known as hotspots) are filtered down to the 250 most severe braking and 250 most severe acceleration clusters to identify the locations of the riskiest behavior patterns.

DESCRIPTIONS OF COLUMNS IN MAP DATASETS:

Acceleration/Braking Severity Ranking – South King/Yakima

The structure of the datasets for braking and acceleration Driving Behavior Severity Ranking (DBSR) are the same, as the MMI severity ranking model generates output in the same format when evaluating both acceleration hotspots and braking hotspots.

- **Centroid:** Lat-long point indicating center of the hotspot, in geometric data format
- **Rank:** Severity rank of the clusters (determined by the cluster's score)
- **Cluster_arcs:** road segments where the hotspots are located, in geometric data format

Speed – South King/Yakima

(Note: Data will be null in a given column if there are not at least 100 GPS data points available for analysis on a given road segment)

- **Separate_geom:** geometric representation of the dimensions and location of each road segment but split into two to represent lanes of roads going in opposite directions, to allow for analysis of different driver behavior going in different directions on the same road segment.
- **Road_priority:** Classification of road type from 1-15 according to OpenStreetMaps road classification, where lower is slower-speed, residential or service roads, higher indicates highways, and the middle are city streets and medium-speed roads.
- **Arc_id:** Road segment identifier
- **V85_Speed_All:** 85th percentile of speed for all trip points captured on this road segment
- **V15_Speed_All:** 15th percentile of speed for all trip points captured on this road segment
- **Median_Speed_All** 50th percentile of speed for all trip points captured on this road segment
- **Mean_Speed_All:** average speed of all trip points captured on this road segment
- **V85_All_Category:** Categorical variable with buckets to simplify visualizing the Speed_85 variable
- **Trip_Point_Count_All:** Count of all trip points captured on this road segment
- **V85_Speed_Early_Morning:** 85th percentile of speed for trip points captured on this road segment between midnight and before morning peak traffic. The timeframe for V85 Speed is between 0:00 AM and 5:59 AM
- **Trip_Point_Count_Early_Morning:** Count of all trip points captured on this road segment between midnight and before morning peak traffic

- **V85_Speed_Morn_Rush_Hour:** 85th percentile of speed for trip points captured on this road segment during the morning rush hour period. The timeframe for V85 Speed is between 6:00 AM and 9:59 AM
- **Trip_Point_Count_Morn_Rush_Hour:** Count of all trip points captured on this road segment during the morning rush hour period
- **V85_Speed_Midday:** 85th percentile of speed for trip points captured on this road segment after the morning rush hour period until early afternoon. The timeframe for V85 Speed is between 10:00 AM and 2:59 PM
- **Trip_Point_Count_Midday:** Count of all trip points captured on this road segment after the morning rush hour period until early afternoon
- **V85_Speed_Afternoon_RUSH_HOUR:** 85th percentile of speed for trip points captured on this road segment between early afternoon and the evening rush hour period. The timeframe for V85 Speed is between 3:00 PM and 5:59 PM
- **Trip_Point_Count_Afternoon_RUSH_HOUR:** Count of all trip points captured on this road segment between early afternoon and the evening rush hour period
- **V85_Speed_Evening_Rush_Hour:** 85th percentile of speed for trip points captured on this road segment during the evening rush hour period. The timeframe for V85 Speed is between 6:00 PM and 7:59 PM
- **Trip_Point_Count_Evening_Rush_Hour:** Count of all trip points captured on this road segment during the evening rush hour period
- **V85_Speed_Night:** 85th percentile of speed for trip points captured on this road segment after the evening rush hour period and before midnight. The timeframe for V85 Speed is between 8:00 PM and 11:59 PM
- **Trip_Point_Count_Night:** Count of all trip points captured on this road segment after the evening rush hour period and before midnight
- **V85_Speed_During_Week:** 85th percentile of speed for trip points captured on this road segment between 12:00am Monday and 11:59pm Friday
- **Trip_Point_Count_During_Week:** Count of all trip points captured on this road segment between 12:00am Monday and 11:59pm Friday
- **V85_Speed_On_Weekend:** 85th percentile of speed for trip points captured on this road segment between 12:00am Saturday and 11:59pm Sunday
- **Trip_Point_Count_On_Weekend:** Count of all trip points captured on this road segment between 12:00am Saturday and 11:59pm Sunday



Vulnerable Road User Segments – South King/Yakima

- **Vulnerable_user_type:** A simplified classification derived from the Label column indicating the most vulnerable user type for this particular road segment, where the four possible values are:
 - “PED” if only PED, or PED and VEHICLE are identified as at elevated risk in this segment
 - “CYCLE” if only CYCLE, or CYCLE and VEHICLE are identified as at elevated risk in this segment
 - “PED_AND_CYCLE” if both PED and CYCLE are identified as at elevated risk in this segment
 - “VEHICLE” if only VH is identified as at elevated risk in this segment
- **Class risk:** the level of risk that a road user faces on this road segment. The values in this column range from 1-5, where 1 is a risk is present but no crashes of this type have happened here before, and 5 is where a risk is present and crashes of this type have happened here relatively recently. The class risk value increases with the severity and/or recency of past crashes.
- **Separate_geom:** geometric representation of the dimensions and location of each road segment, but split into two to represent lanes of roads going in opposite directions, to allow for analysis of different driver behavior going in different directions on the same road segment.





Census Tracts Socioeconomic and Demographic Data – South King/Yakima

- **GEOIDFQ_TRACT:** Unique ID of census tract from US Census Bureau
- **GEOM_TRACT_FOR_MAP:** Geometric representation of the location and dimensions of the census tract, used for plotting outlines of the census tract on the map.
- **COUNTY:** County in which this tract is located
- **S1601_LANGUAGE_SURVEY_ALL_18+:** Count of adult respondents to American Community Survey Language Survey in this census tract
- **S1601_SPEAK_LANG_OTHER_THAN_ENGLISH:** Count of adult respondents to American Community Survey Language Survey in this census tract who speak a language other than English at home
- **S1601_SPEAK_SPANISH:** Count of adult respondents to American Community Survey Language Survey in this census tract who speak Spanish well or fluently
- **DP04_HOUSEHOLD_SURVEY_TOTAL_HOUSING_UNITS:** Count of housing units, occupied and vacant, in this census tract
- **DP04_RENTER_OCCUPIED_UNITS:** Count of renter-occupied housing units in this census tract
- **DP04_VACANT_UNITS:** Count of vacant housing units in this census tract
- **S1901_HOUSEHOLDS_TOTAL:** Total count of households in this census tract
- **S1901_HH_MEDIAN_INCOME:** Median income in this census tract
- **S1901_GINI_INDEX:** Measure of income inequality across respondents within this census tract, where values closer to 1 indicate higher inequality
- **P1_RACE_SURVEY_TOTAL_RESPONDENTS:** Count of all respondents to 2020 Census P1 Race survey
- **P1_WHITE_ALONE_RESIDENTS:** Count of all respondents to 2020 Census P1 Race survey identifying as white, single-race
- **P1_BLACK_OR_AFRICAN_AMERICAN_ALONE_RESIDENTS:** Count of all respondents to 2020 Census P1 Race survey identifying as black or African-American, single-race
- **P1_AMERICAN_INDIAN_OR_ALASKA_NATIVE_RESIDENTS:** Count of all respondents to 2020 Census P1 Race survey identifying as Native American or Native Alaskan
- **NON_ENGLISH_SPEAKER_RATIO:** Proportion of all respondents to Language Survey who do not speak English fluently or well.
- **SPANISH_ONLY_SPEAKER_RATIO:** Proportion of all respondents to Language Survey who speak only Spanish, and no other languages fluently or well.
- **RENTER_TO_TOTAL_HOUSING_RATIO:** Proportion of all households in the census tract that are renter-occupied



- **VACANT_TO_TOTAL_HOUSING_RATIO:** Proportion of all households in the census tract that are vacant
- **RACIAL_MINORITY_PROP:** Proportion of all respondents to P1 Census Survey that did not identify as white, single-race
- **AFRICAN_AMERICAN_ONLY_PROP:** Proportion of all respondents to P1 Census Survey that identified as black or African American, single-race
- **NATIVE_AMERICAN_ONLY_PROP:** Proportion of all respondents to P1 Census Survey that identified as Native American or Native Alaskan
- **TRACT_CENTER:** Geometric representation of the location of the center of the census tract, used as an additional option for viewing different tract-level metrics.
- **TRACT_CENTER_LONGITUDE:** Longitude of census tract's center, used with TRACT_CENTER_LATITUDE to plot tract center if necessary
- **TRACT_CENTER_LATITUDE:** Latitude of census tract's center, used with TRACT_CENTER_LONGITUDE to plot tract center if necessary