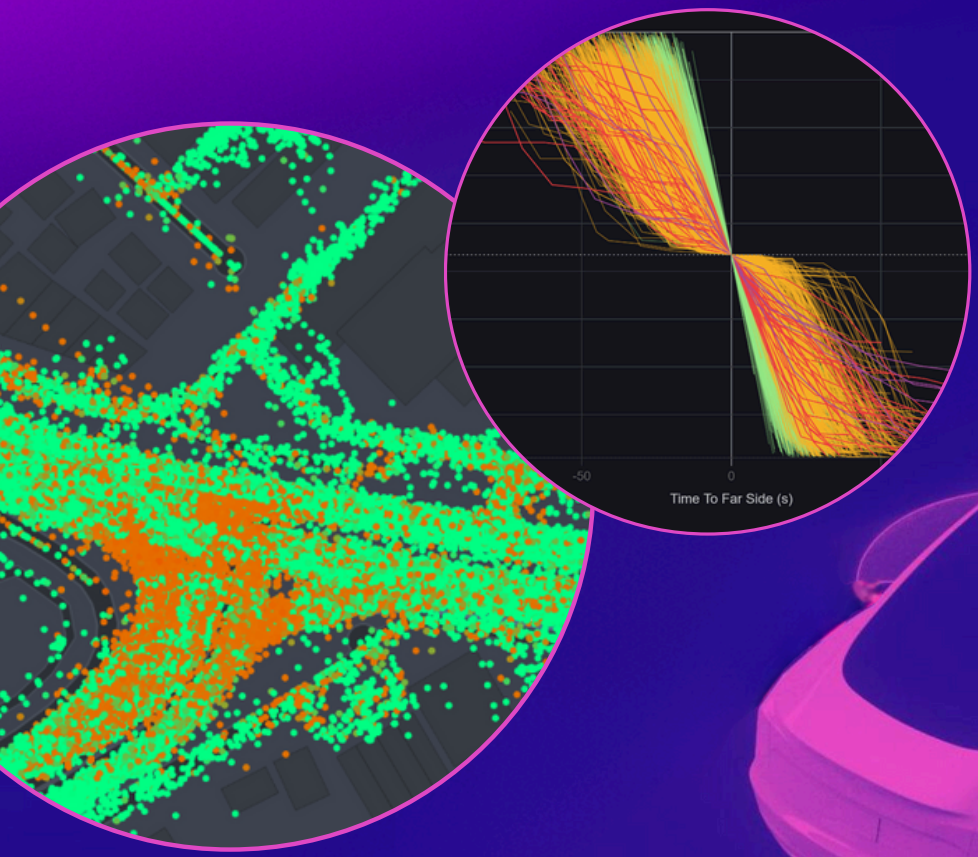
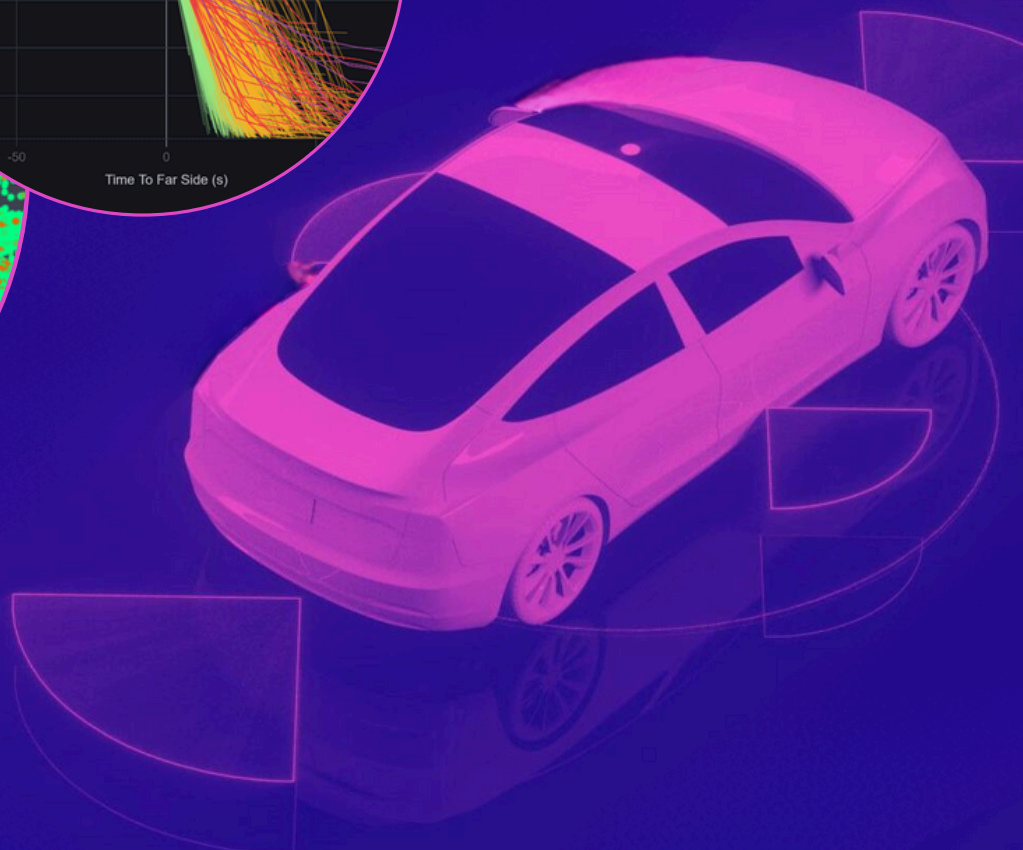
COMPASS

Understanding Connected Vehicle Data

Compass IoT
2024





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Introduction

Connected Vehicle data provides granular insights and metrics that support a variety of use cases across road safety, asset maintenance, network operations, and local area traffic management for state government, local government, research, and private sector organisations.

One of the most significant challenges for Connected Vehicle data is education. This paper defines what a Connected Vehicle is and how it differs from traditional hardware and other forms of data, such as geolocation data.

About the Author

Founded in 2018, Compass IoT is a Connected Vehicle data aggregator that uses vehicle-generated insights to help transport professionals build better, safer, and more resilient cities. Servicing over 40 clients, Compass provides granular insights to transport professionals from across Australia, New Zealand, the United Kingdom, and Asia.

What is a Connected Vehicle?

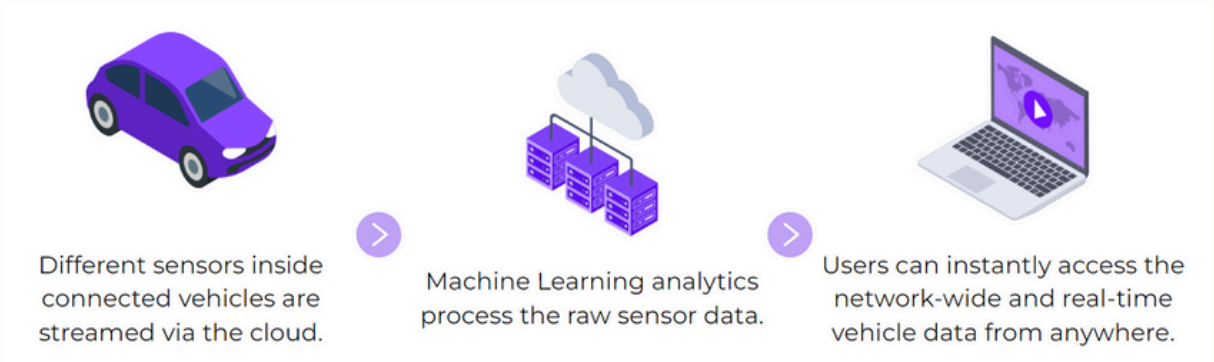
Most modern passenger, private and freight vehicles have a SIM card embedded at the point of manufacture. This SIM allows an internet connection to connect to other devices or smart sensors. These connections allow the transfer of data between the car and the manufacturer. Vehicles that have this capability are considered Connected Vehicles.

Any vehicle with an internet connection is considered a Connected Vehicle. Connected Vehicles are like smart devices.

In 2023, it was estimated that by 2030 96% of all new cars will be globally connected.

- Australia is estimated to have over 1.2 million connected cars, a 5% sample of the 21 million registered cars.
- In 2017, there were an estimated 9 million Connected Vehicles in the UK.
- The USA is estimated to have the largest percentage of Connected Vehicles. In 2020, 91% (over 13 million) of the new cars sold were connected.

The data Connected Vehicles provide is known to be more accurate than other forms of data collection.



How Connected Vehicles work to supply data.

How is CV data different to other forms of data?

Traditionally, most data about drivers, their cars and behaviours is collected using external hardware, such as:

- Tube counts
- Manual counts by people
- Cameras
- Mobile phone data
- External plug-in devices

Many organisations provide geolocation data, often obtained through mobile phone data and other hardware, however:

- ✗ **Mobile datasets can be unreliable** and heavily skewed in vehicles with multiple devices (i.e. a bus or car with more than one person).
- ✗ **Most hardware-reliant methods do not offer the same level of granularity** provided by other embedded sensors because they are external to the car (i.e. cameras and phones, by design, are limited in what data they can collect).
- ✗ **Large-scale hardware is difficult and expensive to scale** in new locations, such as numberplate scanners, and doesn't offer flexibility for different driver use cases (i.e. taxis that make multiple daily trips).

Alternatively, CV data has greater coverage and accuracy as it comes from the vehicle and provides several data variants. These variants include:

- G-Forces (the measure of acceleration)
- Braking
- Swerving
- Travel time
- Timestamps
- Median Speed
- Make and model
- Gyroscopic and axis changes
- Latitude and Longtitude

What is the benefit?

Connected Vehicle data can add value in many ways.

- ✅ **Proactive**: CV data can identify trends before they become severe and impact road users.
- ✅ **Granular**: CV data collects everything from battery life, axel movements, location, speed, and heading to whether the windows are opened or closed.
- ✅ **Constant**: CV data is passively collected as drivers drive around road networks, all the time, across virtually every road.
- ✅ **Scale**: Connected Vehicles provide opportunities to scale. The more Connected Vehicles on roads, the greater the number of cars across different locations to draw data.

With this type of data, it leads to use cases across:

- Road Safety
- Freight
- Origin-Destination
- Asset Maintenance
- Transport Modelling
- Parking and Capacity
- Autonomous Ready Networks
- EV Charging Network Planning
- Local Area Traffic Management
- Road User Charging (RUC) and Tagless Tolling
- Trajectory

What does Compass provide?

Ingesting billions of vehicle-generated data from Connected Vehicles and on-vehicle units, across multiple makes and models means Compass helps solve complex problems traditional hardware cannot. Passively collected across every road, this helps transport professionals make proactive decisions backed by data.

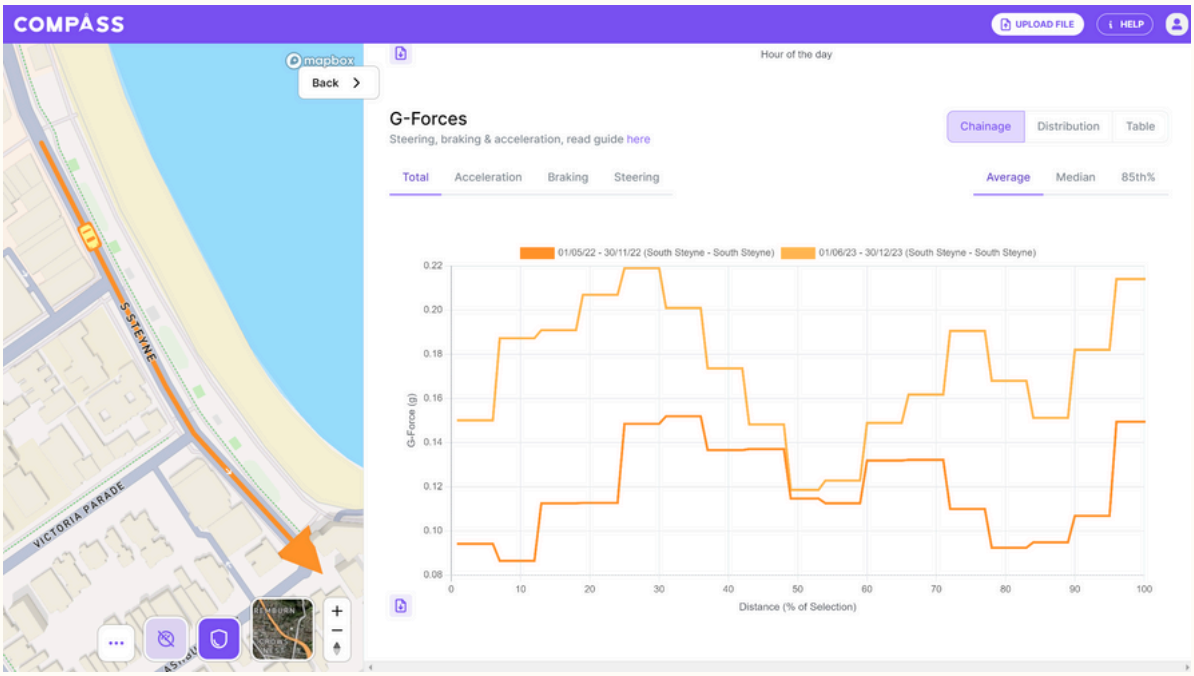
Compass data variants include:

- ✅G-Forces (the measure of acceleration)
- ✅Braking and Steering
- ✅Accelerating
- ✅Location
- ✅Travel Time
- ✅HCV, LCV and Freight

Compass does not ingest phone data and rather relies on vehicle-generated insights from multiple makes and models.

Live and Historical Data

We provide both live and historical data. Live data - accessed through Real-Time Trajectory on the Compass platform - allows transport professionals to understand driver behaviour in real-time, helping identify trends before they negatively impact the road network. With historical data from 2020 onwards, Compass enables users to perform before-and-after comparisons.

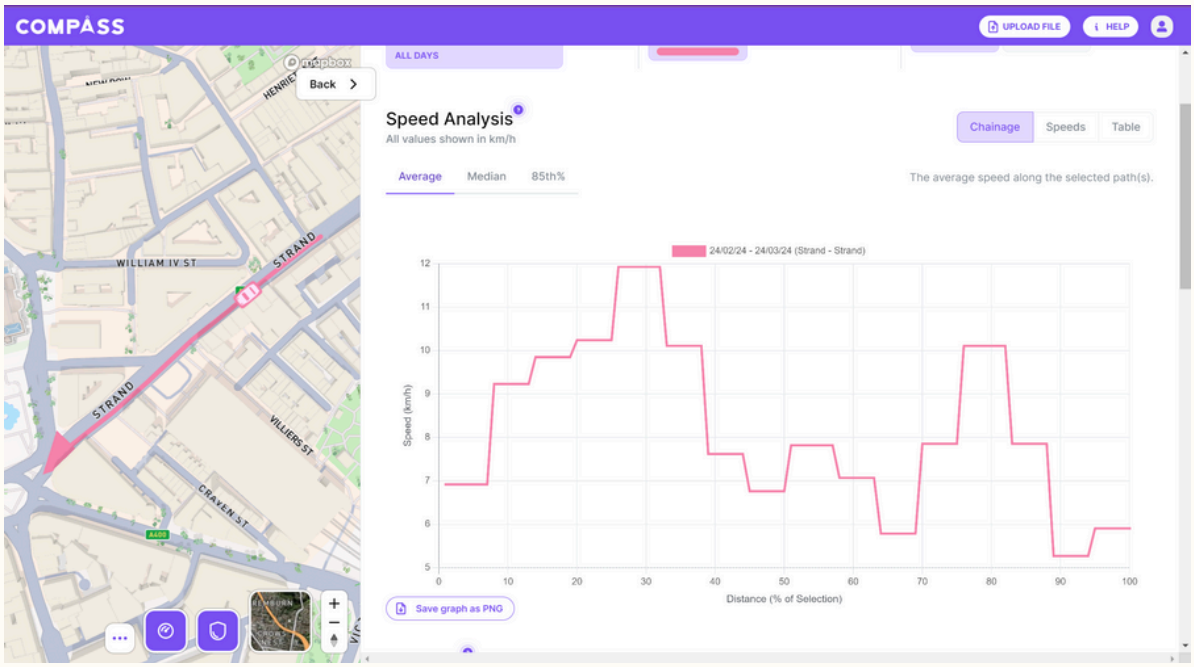


Compass Road Intelligence platform compares past (dark orange line) and present (light orange line) Connected Vehicle data helping transport professionals measure changes in driver behaviour and infrastructure changes.

Customer Analysis of Compass data

A customer performed a comparative study of Compass data with other data sources to check the quality. Their investigation found that:

- Compass data has greater flexibility in allowing users to impose their calculations over the data, such as harmonic speed calculations or binomial distribution.
- Compass offered higher and multiple speed profiles.
- Compass speed data took into account where cars slow down at traffic lights, roundabouts and other road infrastructure without skewing the data and considering this as congestion.



Compass Road Intelligence platform provides average, median and 85th percentile speed profiles for any section of road.

Limitations of CV data

While CV data presents a rich base for new insights, it is important to recognise the limitations of this emerging technology.

Composition and Size

At this point in time, CV data represents only a portion of the traffic on our roads. The composition of cars across cities, countries and populations vary and so there is not a consistent composition and size. For example, a rural area is less likely to have as much traffic as inner suburbia.
However, Connected Vehicle data, while a sample of the traffic on our roads, is autonomous and scalable, providing transport professionals with a larger sample size of data than hardware methods allow. For a robust analysis of our roads using Connected Vehicle data, you only need a 3-5% penetration rate.

New Car Bias

Connected vehicles have become more common since 2017; however, for some drivers, there are socioeconomic factors involved that impact fleet turnover. It takes approximately 5 years for new vehicles (i.e. Connected Vehicles) to circulate through the customer base and market. Therefore, it is important to consider how an area's socioeconomics may impact the level of CV data available.

OEMs, Third-Party Vendors and Databases

The data that is provided by third-party data aggregators is a sample. Not one vendor has access to all makes and models, as this is dependent on the variety of OEMs their data is extracted form. Compass itself only has a subset of all Connected Vehicles. This should increase in scale as older fleets of vehicles cycle through the population.

It's important to be informed about what calculation methods are used in different contexts and collection methods to make informed and accurate decisions, particularly when comparing different data sources. For example, not all methodologies of calculating speed are the same or are applicable for all use cases.

Use Cases: Understanding Road Closures

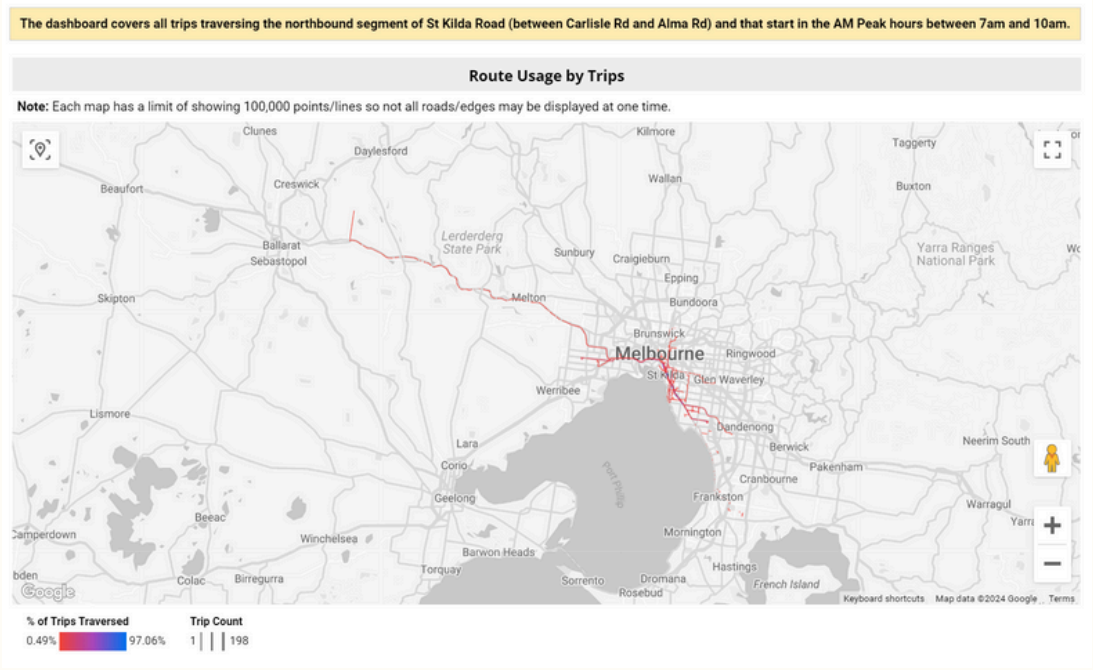
Connected Vehicle data can help transport organisations better visualise drivers' behaviour when roads are closed or under construction. Specifically, the data can be used to analyse travel time, how long it takes drivers to get from A to B, routes taken and speed.

St Kilda Road Closure Dashboard

Compass built a template dashboard identifying how traffic between 7am and 10am reacted to the closure of St Kilda Road.

While Bluetooth detectors can be installed, it is costly to scale and they only detect the Bluetooth signals emitted from smart devices and vehicles, capturing data for the specific point in the road where it is installed.

Using CV data, a total of 198 trips were identified. These showed that most drivers that used St Kilda Road came from Moorabbin, and most travelled to Brighton and Truganina. The roads in which trips ended were also identified.
This dashboard helps identify what specific routes drivers were taking and how many drivers took them, and it can be scaled to capture every Victorian road closure.



Results from the St Kilda road closure dashboard showing the trips made through the study area.

Daresbury Road Closure

In September 2023, the Daresbury Expressway in the UK was closed for road works. As a result of the closure, drivers had to take alternative routes. With Origin-Destination data, how the closure impacted journey times, what alternative routes drivers took, and whether these closures increased congestion can be uncovered.

Possible detour sites were identified during September 2023, starting from the Mersey Gateway, leading into the Central Expy, and ending in Chester Rd. The data showed that the closure of Daresbury Expy increased journey times to 10 minutes, resulting in an 8-minute increase. Once the expressway re-opened, average journey times decreased to 1 minute and 40 seconds.

Routes taken when Daresbury Expressway was closed.

Use Cases: Intersection Analysis

Connected Vehicle data is transformative to understanding and improving the performance of traffic signals and intersections, providing data that can be used to measure trajectory, identify split failures, and manage traffic flow.

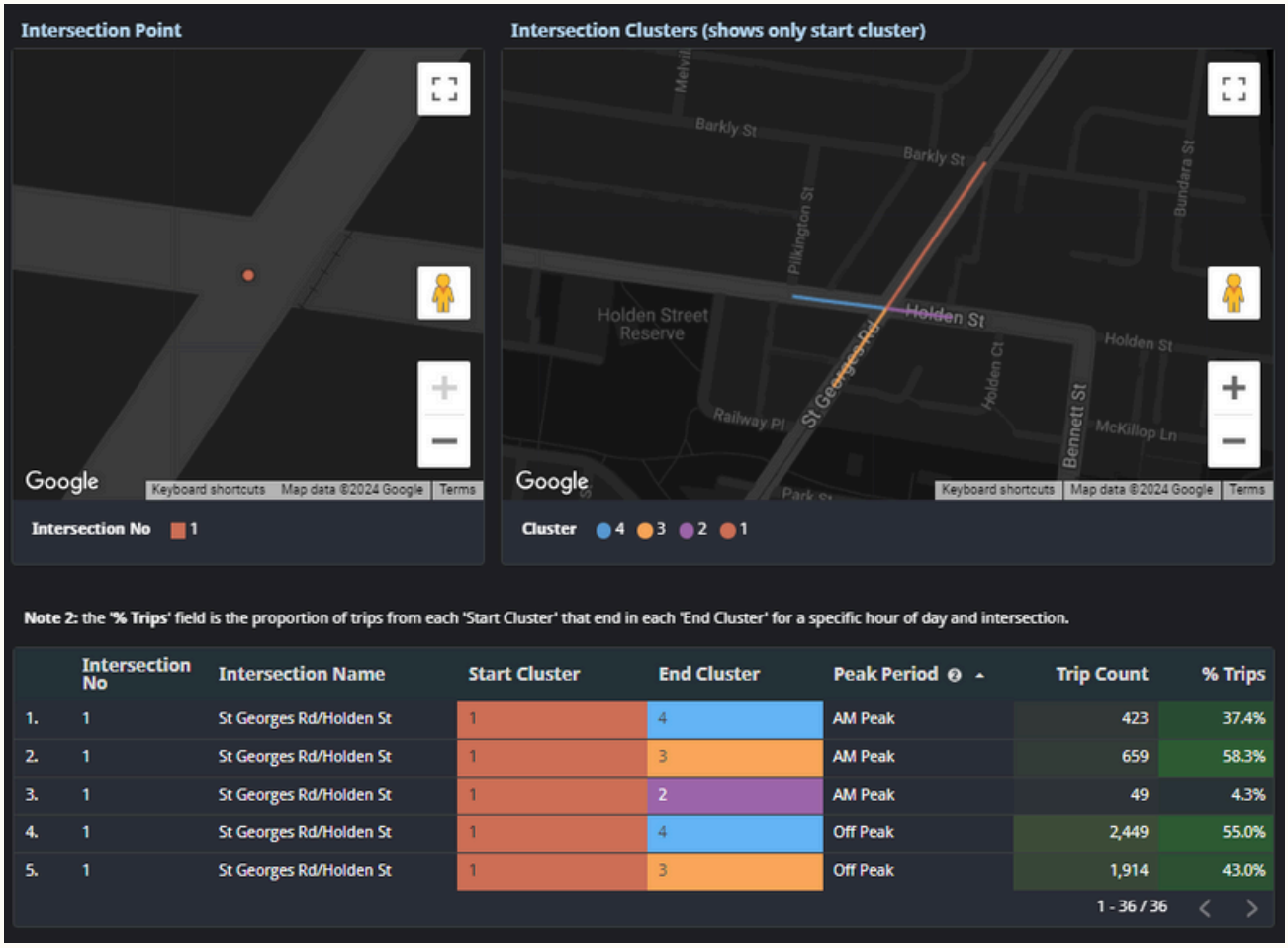
St Georges Rd and Holden St Dashboard

Using CV data, Compass can identify where cars travelling through intersections are turning, particularly in shared lanes where drivers can travel through or turn left or right. While tube counts can count the number of cars that use specific lanes, they cannot identify where cars turn in a shared lane and how many. Phone data may also be used; however, it can skew the data if multiple devices are in a single vehicle (e.g., a bus with multiple travellers).

Compass built a dashboard identifying the number of trips taken through intersections and identifying how drivers used shared lanes. The percentage of vehicles travelling through or turning at the intersection was also calculated across AM, off, and PM peak hours.

For St Georges Rd and Holden St intersection, it was found:

- The majority of drivers travelling eastbound turned left.
- Drivers travelling Westbound were likely to right or travel through.
- Those travelling northbound and southbound often turned left.



Note 2: the **'% Trips'** field is the proportion of trips from each 'Start Cluster' that end in each 'End Cluster' for a specific hour of day and intersection.

	Intersection No	Intersection Name	Start Cluster	End Cluster	Peak Period	Trip Count	% Trips
1.	1	St Georges Rd/Holden St	1	4	AM Peak	423	37.4%
2.	1	St Georges Rd/Holden St	1	3	AM Peak	659	58.3%
3.	1	St Georges Rd/Holden St	1	2	AM Peak	49	4.3%
4.	1	St Georges Rd/Holden St	1	4	Off Peak	2,449	55.0%
5.	1	St Georges Rd/Holden St	1	3	Off Peak	1,914	43.0%

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St Georges Rd and Holden St number of Connected Vehicle trips calculated.

COMPASS

Get In Touch

Traditional survey methods are challenging to scale and provide partial historical data. Geolocation data only offers a snapshot of data.

With Compass, Connected Vehicle data originates from the vehicle itself all the time, minimising these gaps, and with live and historical data, transport professionals are open in their analysis.

Compass fuels your best work, improving road safety and infrastructure for all road and roadside users.

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