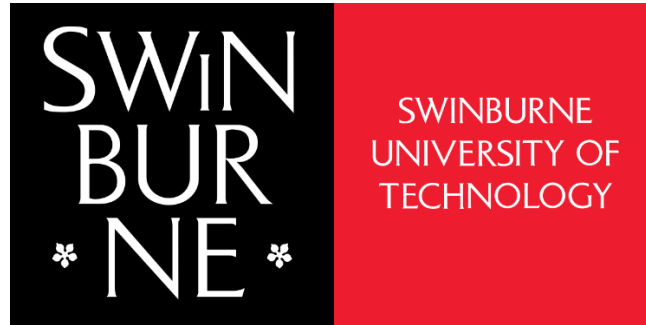


COS30045 – Data Visualisation

Visualisation Design Book



Team: DV09_T05

Title: Data Visualisation of Australian Mobile Phone Driving Offences in 2023

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1. Introduction

1.1 Background and Motivation

Distracted driving is a growing concern to today road safety. The research by Social Determinants of Health highlights mobile phone use while driving as a key example of driver distraction (World Health Organization, 2011). It also proved that using mobile phones while driving is four times more likely to result in accidents whether the phone is hand-held or hands-free, since the main issue is mental distraction. To help raise public awareness about the dangers of distracted driving, especially mobile phone use, this project focuses on visualising data related to mobile phone violations while driving.

The Bureau of Infrastructure and Transport Research Economics (BITRE) has been publishing Australian transport information since 1970. They have collected data on how road safety laws are enforced (like fines for using mobile phones, speeding, and drug testing) since 2008. However, in 2023, they started collecting more specific information about this enforcement. They have updated more detailed data where available including monthly granularity, age groups, remote areas and detection methods used (Bureau of Infrastructure and Transport Research Economics, 2024).

However, the current Police Enforcement Dashboard does not reflect this new level of detail. As part of this project, we aim to create interactive visual tools that highlight the updated 2023 dataset, with a focus on mobile phone offences by age group and location. Our team will work on refining the mobile phone dashboard to improve data accessibility and support a clearer understanding of mobile phone-related violations in 2023.

1.2 Target Audiences

To ensure our project product is useful to the users, we first identified the key target users and their purposes in exploring this data. Here are the target audience groups of the dashboard:

The young drivers and students: According to *The Medical Journal of Australia*, individuals aged 17–25 exhibit higher rates of mobile phone use while driving compared to older age groups. This increasing usage is associated with a greater rate of collisions and near-misses among this population. It emphasises the need for targeted interventions aimed at younger drivers to mitigate the risks associated with mobile phone use while driving. Some of the questions they might ask are: “Which states issue the most fines for mobile phone use?”, “Are camera-detected fines replacing police-issued fines?”

General public: This group will be benefited by gaining awareness of penalties and risks, with questions such as “What are the charges I would have if I got caught using mobile phone while driving?” or “Is phone use while driving increasing?” The dashboard supports both analysis and public education.

Government officials and Policymakers: Policymakers and law enforcement need accurate data to evaluate enforcement methods like mobile phone detection cameras and shape safety strategies. Their focus is on outcomes, asking questions like “Are cameras effective?” or “Which areas have the highest number of violations committed?”.

Transport safety analyst: They study behavioural patterns and risk factors related to road safety. This dashboard provides them with valuable insights into trends in mobile phone-related enforcement,

allowing them to investigate questions such as, “Are mobile phone offences increasing in certain states?” or “What enforcement methods are linked to lower offence rates?”

Educators and academic researchers: Researchers in road safety and behavioural science use data to uncover patterns and test hypotheses. Questions they might explore include “*What socio-demographic factors correlate with mobile phone use while driving?*”, “*Has policy implementation led to statistically significant changes in behaviour?*”.

Why the visualisation is important?

The visualisation update users with the latest changes in the dataset of collecting more fine-grained data in locations and age groups of mobile phone use while driving. This problem is a growing concern, particularly among young drivers aged 17–25. The dashboard combines critical enforcement data in one location, making it clear and easy to analyse. It helps overcome difficulties such as lack of public awareness, restricted access to enforcement statistics across states, and the difficulty in analysing the impact of enforcement measures over time. Overall, it supports safer driving behaviours, evidence-based legislation, and public education.

Key tasks users will perform using this visualisation:

1. Young drivers and students: They can use it to explore which states issue the most fines, understand the difference between police-issued and camera-detected fines, and become more aware of the risks associated with mobile phone use.
2. General public: They use it to check how many fines are issued in their state and observing trends over time, helping them stay informed and adjust their behaviour accordingly.
3. Government officials and Policymakers: They use to evaluate the effectiveness of camera enforcement, compare strategies across jurisdictions, and identify areas for improved policy and resource allocation
4. Transport safety analyst: They use to study behavioural trends, identify enforcement patterns, and correlate data to better understand risk factors.
5. Educators and academic researchers: They can apply filters to analyse specific groups, download data for deeper research, and develop materials to teach or present findings related to road safety.

1.3 Visualisation Purpose

The visualisation can be used as an educational resource and a tool for assessing the effectiveness of enforcement strategies and policy implementation.

- **For young drivers and students:** They might seek answers for these questions from the visualisation: “Which states issue the most fines for mobile phone use?”, “Are camera-detected fines replacing police-issued fines?”
To effectively address their questions, our visualisations illustrate the fines count by 10,000 licences by jurisdictions, indicating that NSW is leading in violations count. Another chart

represents the trends of mobile phone offences recorded by detection methods (mobile camera or police issued). From this, users can clearly see the efficiency of using camera detection; however, it is noted that not all jurisdictions reported camera-detected fines (Bureau of Infrastructure and Transport Research Economics, 2024).

- **For general public:** This group might wonder if the risks of “using mobile phone while driving is increasing”. The line chart visualising trends of mobile phone offence in 2023 clearly shows that the number of fines is increasing in this year. To explore what kind of fines people would face if they violated, the stacked bar chart of fines, arrests and charges can inform them about the penalties of using mobile phone while driving.
- **For government officials and policy makers:** To evaluate the means of detecting mobile phone offences while driving, this group can benefit from the visualisation as the usage of camera detection method can be proven effective through the line chart of mobile phone offences in 2023. However, it is hard to say since not all states implement camera for detecting road violations. With the newly updated information on locations, even though only 3 states have location data available, the area with most fines detected is in major cities. This reflects either higher non-compliance rate or more detection coverage.
- **For transport safety analysis, educator and researcher:** The visualisation provides them with information about which demographics group tend to be distracted by mobile phone while driving. The bar chart of fines count by age group has shown that high non-compliance group is young drivers from 26-39 years old. In addition, the pie chart of location breakdown per jurisdiction also highlights that the majority of violations come from the major cities of Australia.

2. Data

2.1 Data Source and Governance

2.1.1 Data source

The dataset used for this analysis is collected from the Bureau of Infrastructure and Transport Research Economics (BITRE). It is publicly accessible via the link:

<https://www.bitre.gov.au/publications/2024/road-safety-enforcement-data>

Data summary table:

Attribute	Description
Number of records	5017
Key attributes	Year, Start_date, End_date, Jurisdiction, Location, Age_group, Metric, Detection_method, Fines, Arrests, Charges
Time coverage	2008 - 2023
Geographic coverage	All Australian states and territories
Update Frequency	Annually

From 2023 onwards, the dataset was updated to include more detailed information about police enforcement. New additions to the 2023 data include:

- Monthly reporting, where available
- Age group details, where available
- Remoteness area information, where available
- More detail on the detection method used
- Number of charges and arrests

To take into account the new level of detail, our project only visualises the mobile phone violations while driving data in 2023, allowing users to explore the latest data regarding age groups, locations, charges and arrests. Only the Fines dataset is analysed along with the Data Dictionary for the project. Fines data can be accessible via this link:

https://www.bitre.gov.au/sites/default/files/documents/police_enforcement_2023_fines_2024-09-20.csv

2.1.2 Data governance

1. Data Collection Process

The original dataset used in the dashboard is sourced from reports provided by police and road safety authorities across all Australian states and territories. It covers annual mobile phone use while driving offences from 2008 to 2023. As the data is compiled from multiple jurisdictions with varying standards and definitions, there may be some concerns regarding consistency, potential bias, and overall data quality.

To provide more context for users and strengthen our message, we leveraged data from the Australian Road Deaths Database. We present the total number of road deaths in Australia in 2023 to highlight the severity of the issue and encourage users not to use their mobile phones while driving, as this significantly increases their risk of being involved in an accident.



Figure 1. Context of road deaths in Australia 2023

2. Data Quality Assessment

- **Consistency Issues:** According to the Data Dictionary, reporting standards vary across jurisdictions. For instance, the ACT and NT do not provide data on camera-detected fines, while arrest data is not available for NSW and Tasmania (Bureau of Infrastructure and Transport Research Economics, 2024). These inconsistencies affect the comparability of data across regions.
- **Bias Considerations:** Jurisdictions with more extensive camera-based enforcement systems may report higher numbers of offences, not necessarily due to a greater number of violations, but because of broader detection coverage. This suggests the dataset may reflect enforcement capacity more than actual offence rates.

- **Completeness:** While the dataset is relatively comprehensive, some records may lack full attribute coverage due to jurisdictional differences in data collection and reporting practices (e.g., “unknown” values in Location and Age_group fields of several states).

3. Security, Privacy, and Ethical Considerations

- **Data privacy:** The dataset does not contain personally identifiable information (PII). Fields like Location and Age_group are generalised and anonymised.
- **Compliance:** The dataset aligns with Australian data protection legislation and ethical research standards (Jarmul, 2023).
- **Ethical use:** Usage is restricted to aggregate analysis and policy development, ensuring no individual or group is targeted or identifiable.

2.2 Data Processing and Analysis

KNIME is used process the data. As this project only work on 2023 data, we first filtered out only records of mobile phone use in 2023 by the Row Filter node with criteria are “Year = 2023” and “metric = mobile_phone_use”.

Handle Missing Values: We checked statistics view to see if the data has missing values. For these missing values, it might be because the data was not recorded, or the methods were not applicable in some states. We decided to replace them with 0 (for arithmetic calculations) and add a note for users to know that the metrics are not available in some regions to avoid misleading.

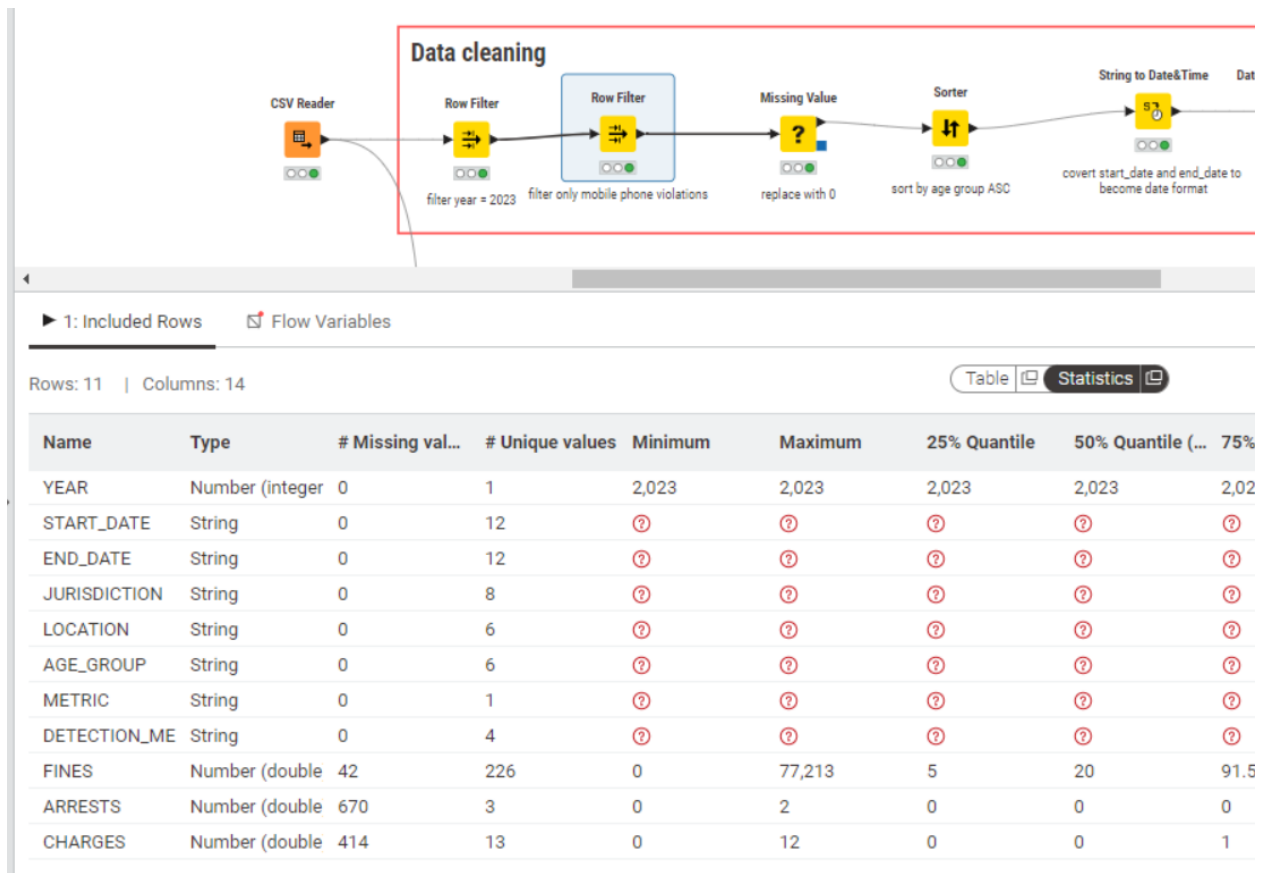


Figure 2. Missing values in Fines, Arrests and Charges showed in Statistic view

Normalisation and transformation:

- **Convert String to Date & Time and Month calculation:** In the original dataset, Start and End date attributes were in string format. We converted them to date format using String to Date&Time node, facilitating the month calculation. To sort out which record represents which month, we used the Date&Time Part Extractor to extract the End_date attribute into Month.

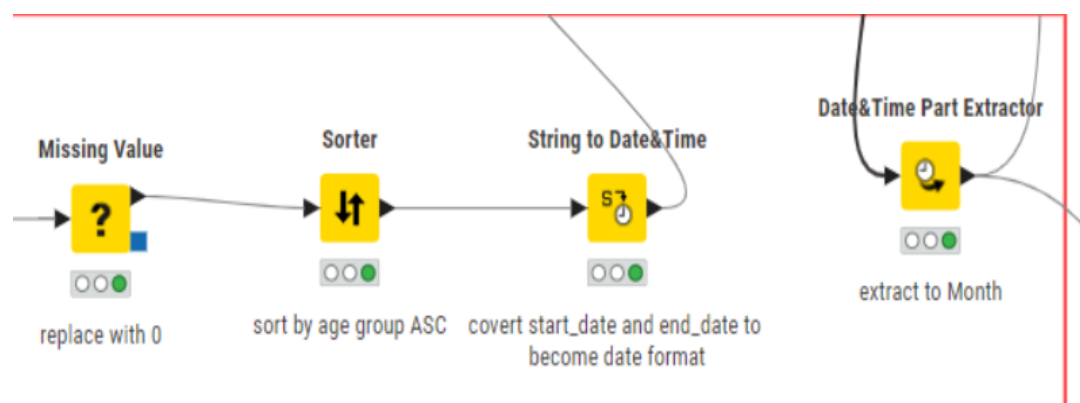


Figure 3. Convert date type and extract to Month

► 1: Included Rows

► 2: Excluded Rows

⚙ Flow Variables

Rows: 2 | Columns: 11

Table

Statistics

<input type="checkbox"/>	#	RowID	YEAR <small>Number (integer)</small>	START_DATE <small>Local Date</small>	END_DATE <small>Local Date</small>	JURISDICTI... <small>String</small>	LOCATION <small>String</small>	AGE_GROUP <small>String</small>	METRIC <small>String</small>	DETECTION... <small>String</small>	FINES <small>Number (double)</small>	ARRESTS <small>Number (double)</small>	CHARGES <small>Number (double)</small>
<input type="checkbox"/>	1	Row18	2023	2023-01-01	2023-12-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	77,213	0	0
<input type="checkbox"/>	2	Row18	2023	2023-01-01	2023-12-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	3,079	0	0

Figure 5. QLD data before normalisation

Rows: 780 | Columns: 11

Table Statistics

<input type="checkbox"/>	#	RowID	YEAR <small>Number (integer)</small>	START_DATE <small>Local Date</small>	END_DATE <small>Local Date</small>	JURISDICTION <small>String</small>	LOCATION <small>String</small>	AGE_GROUP <small>String</small>	METRIC <small>String</small>	DETECTION <small>String</small>	FINES <small>Number (double)</small>
<input type="checkbox"/>	1	Row0	2023	2023-01-01	2023-01-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	2	Row1	2023	2023-01-02	2023-02-28	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	3	Row2	2023	2023-01-03	2023-03-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	4	Row3	2023	2023-01-04	2023-04-30	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	5	Row4	2023	2023-01-05	2023-05-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	6	Row5	2023	2023-01-06	2023-06-30	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	7	Row6	2023	2023-01-07	2023-07-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	8	Row7	2023	2023-01-08	2023-08-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	9	Row8	2023	2023-01-09	2023-09-30	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	10	Row9	2023	2023-01-10	2023-10-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	11	Row10	2023	2023-01-11	2023-11-30	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	12	Row11	2023	2023-01-12	2023-12-31	QLD	Unknown	Unknown	mobile_phone_use	Fixed or mobile ca	6,434
<input type="checkbox"/>	13	Row12	2023	2023-01-01	2023-01-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	14	Row13	2023	2023-01-02	2023-02-28	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	15	Row14	2023	2023-01-03	2023-03-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	16	Row15	2023	2023-01-04	2023-04-30	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	17	Row16	2023	2023-01-05	2023-05-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	18	Row17	2023	2023-01-06	2023-06-30	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	19	Row18	2023	2023-01-07	2023-07-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257
<input type="checkbox"/>	20	Row19	2023	2023-01-08	2023-08-31	QLD	Unknown	Unknown	mobile_phone_use	Police issued	257

Figure 6. QLD data after normalisation

Data filtering: After processing the data, we filtered out “Unknown” values and unnecessary columns, tailoring to the need of each visualisation. The final step is exported the data using the CSV Writer node. We used these CSV files to read in D3 and visualise the meaningful charts for users.

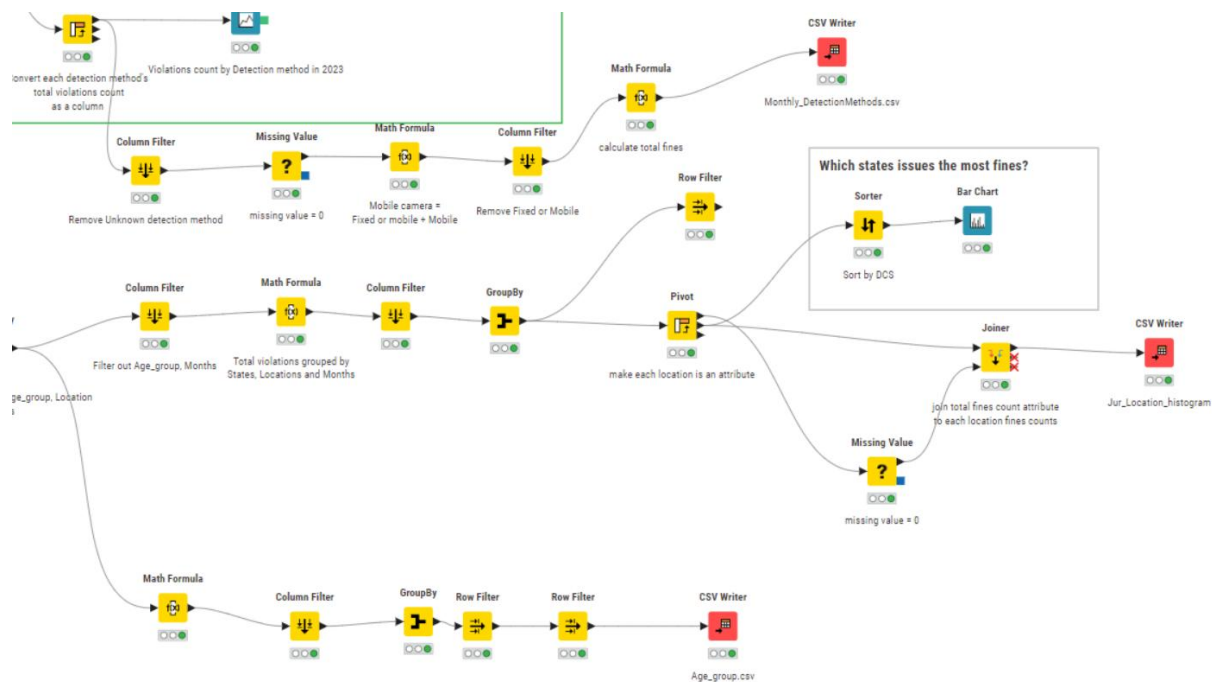


Figure 7. Filter and export dataset in CSV format for drawing charts

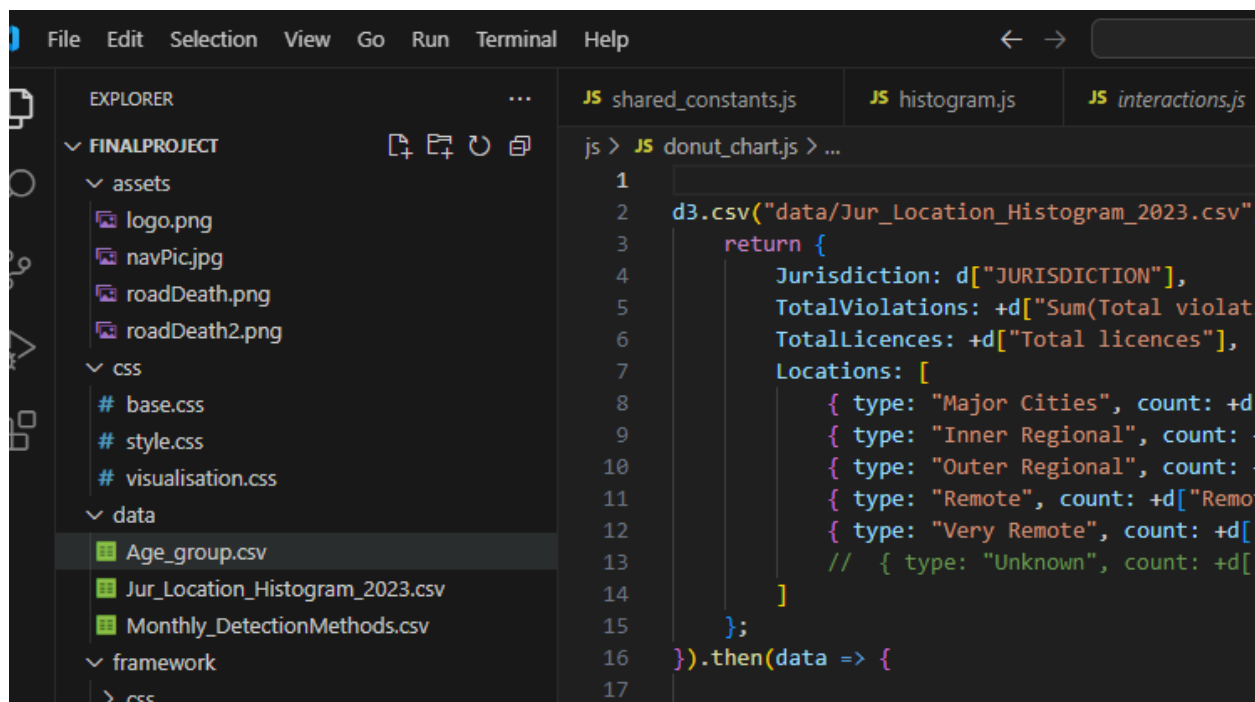


Figure 8. CSV files are stored in data folder and read by D3 for visualisations

2.3 Data Exploration

KNIME is a powerful tool to explore the data. Its statistic view allows us to check for missing values and skewness of the dataset. It also identifies the type of each attribute, facilitating the process of recognising outliers and anomalies. For example, the Start_date and End_date were originally in a string format. We

had to convert it to Date format using String to Date&Time node for further Month calculation. From the End_date, we can transform the data into monthly based information by using Date&Time Part Extractor node.

► 1: Included Rows 📄 Flow Variables

Rows: 11 | Columns: 14

Name	Type	# Missing val...	# Unique values	Minimum	Maximum	25% Q
YEAR	Number (integer)	0	1	2,023	2,023	2,023
START_DATE	String	0	12	?	?	?
END_DATE	String	0	12	?	?	?
JURISDICTION	String	0	8	?	?	?
LOCATION	String	0	6	?	?	?
AGE_GROUP	String	24	6	?	?	?
METRIC	String	0	4	?	?	?
DETECTION_ME	String	0	8	?	?	?
FINES	Number (double)	181	1250	0	469,785	4
ARRESTS	Number (double)	3913	64	0	106	0
CHARGES	Number (double)	2537	192	0	800	0

Figure 9. Statistic view for data exploration

We visualised some simple charts with KNIME to ensure the data processed is accurate and make sense to audiences. For instance, we drew this line chart of violation count by detection methods in 2023. From the illustration, we can see there is an “Unknown” category and the number of counts is really low. The supervisor suggested us to remove the “Unknown” records as it is not informative to users. We later filtered out the “Unknown” and merged “Fix and mobile camera” to “Mobile camera”, combine the detection methods to 2 categories (police issued and mobile camera).

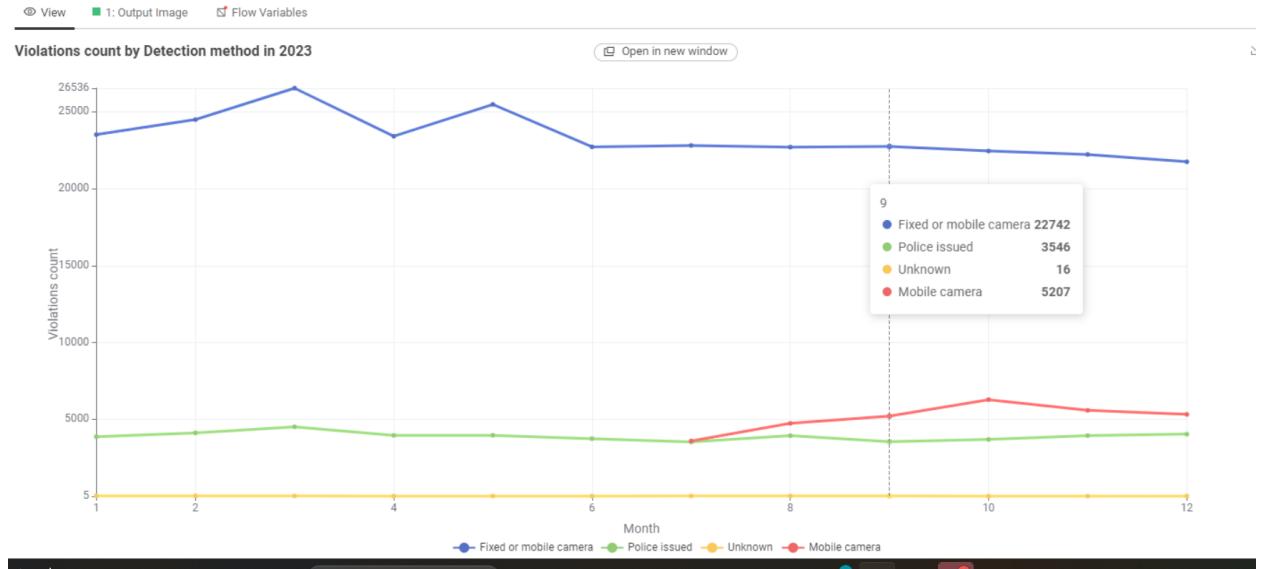


Figure 10. Line chart drawn by KNIME

In this bar chart of Total violations by Jurisdiction. Due to the large gap between states, some low-metrics states such as NT and ACT bars could not be drawn or very hard to see. Therefore, our team think it would be more sensible to represent the normalised ratio of fines recorded in each state per 10,000 issued licenses. This method not only visualise better the bar representing each state but also support fair comparison among states regardless of their population size.

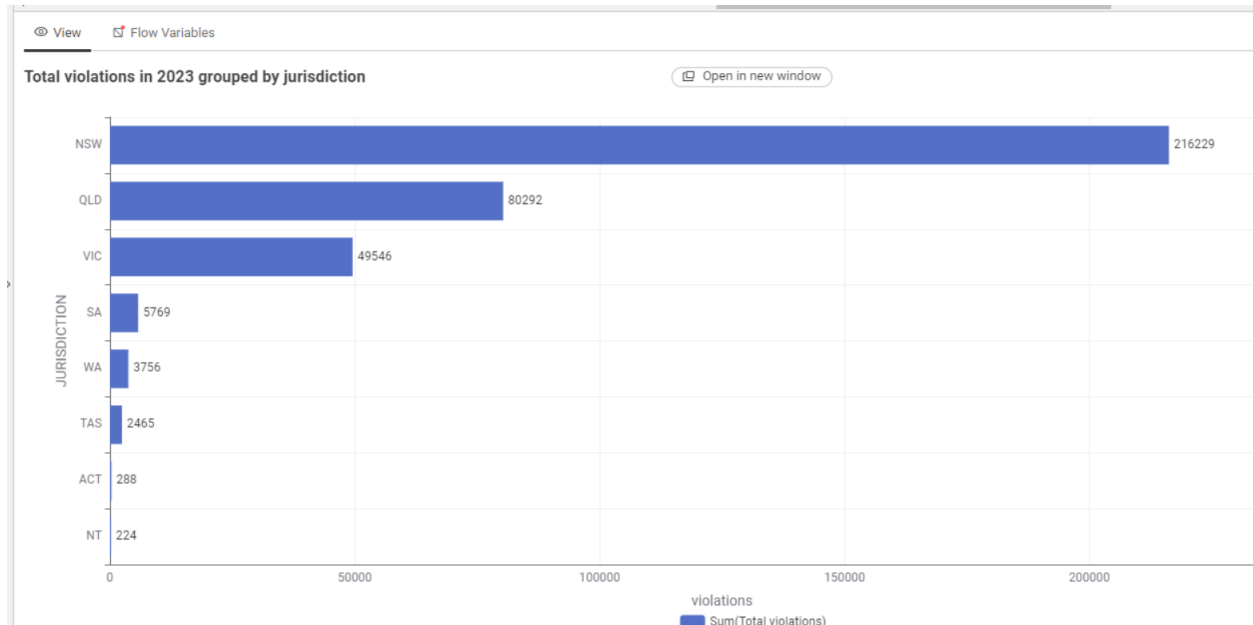


Figure 11. Total violations by jurisdiction drawn in KNIME

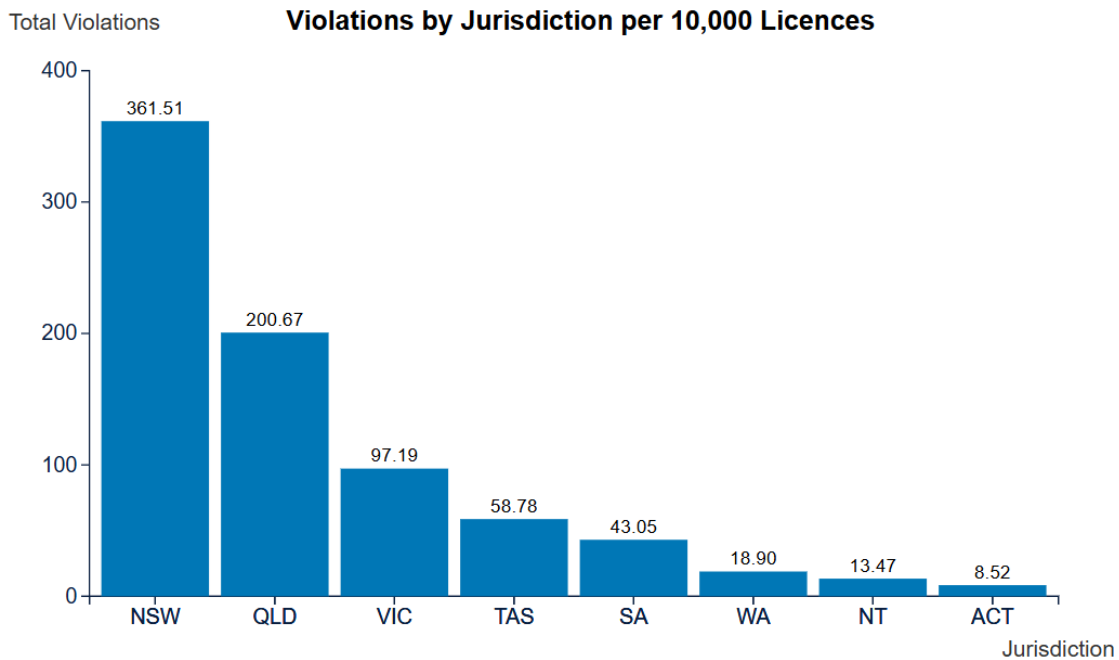


Figure 12. Violations per 10,000 licenses in our website

Challenges

During the data exploration process, we encountered some problems interacting with KNIME.

- **Could not generate more rows or attributes using KNIME nodes:** When transforming the QLD records into 12 records for 12 months, we could not find the node to generate more rows with the same metrics. That is why we had to export it to Excel file and manually add the data.
- **Struggle to turn each location to an attribute for visualisation:** the location details (e.g., Major cities, Inner Regional, Remote area, etc) are values of the Location column. To be able to draw the pie chart of Location breakdown for each state, we needed to read each location as a categorical value. After some research on KNIME tutorials, we figured out that the Pivot node can turn the columns into rows and vice versa. Pivot also support aggregation of selected columns.



Figure 13. Pivot helps convert unique values of Location to an attribute

1: Pivot table 2: Group totals 3: Pivot totals Flow Variables

Rows: 8 | Columns: 2

#	RowID	JURISDICTION String	Sum(Total violations) Number (double)
1	Row0	ACT	288
2	Row1	NSW	216,229
3	Row2	NT	224
4	Row3	QLD	80,292
5	Row4	SA	5,769
6	Row5	TAS	2,465
7	Row6	VIC	49,546
8	Row7	WA	3,756

Figure 14. Aggregate Total violations grouped by Jurisdiction

3. Visualisation Design

3.1 Website Design

There is a wireframe of our webpage layout which displays how our actual website looks, including navigation structure such as Main and About Us, headings, tooltips, and small descriptions to summary the details of each visualisation for user to easily understand what the chart displays about.

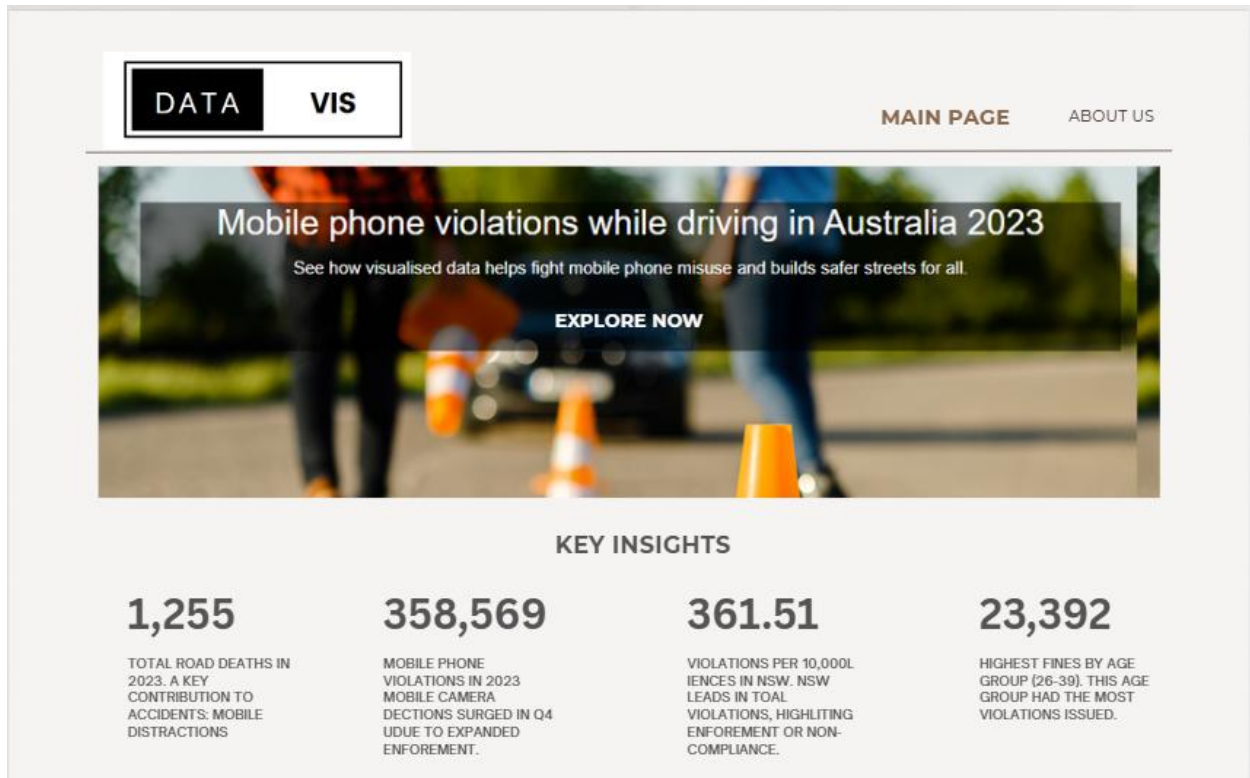


Figure 15. Wireframe 1



Figure 16. Wireframe 2

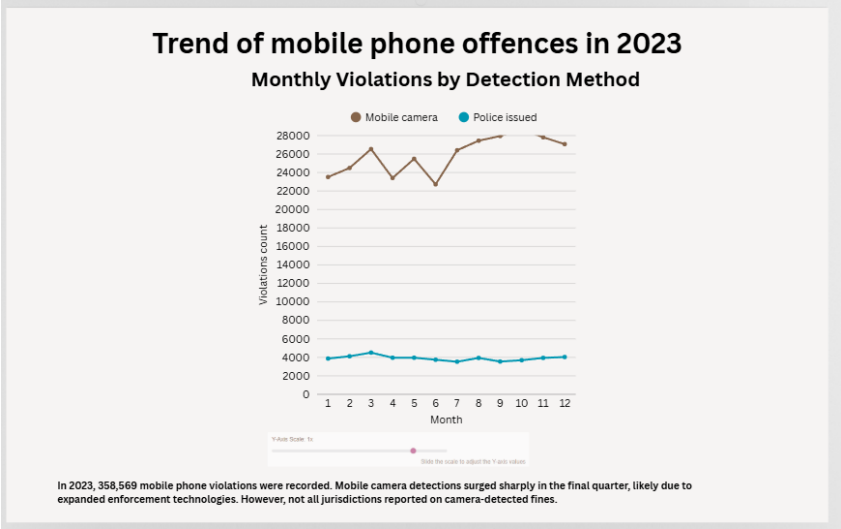


Figure 17. Wireframe 3

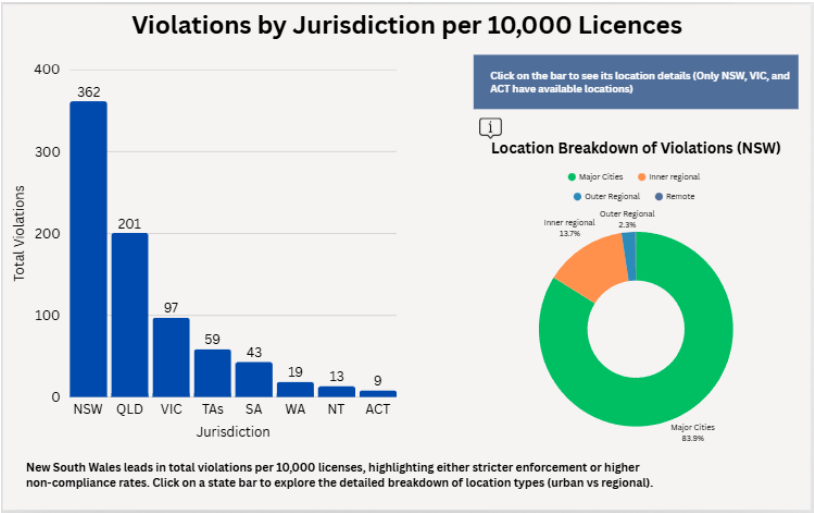


Figure 18. Wireframe 4

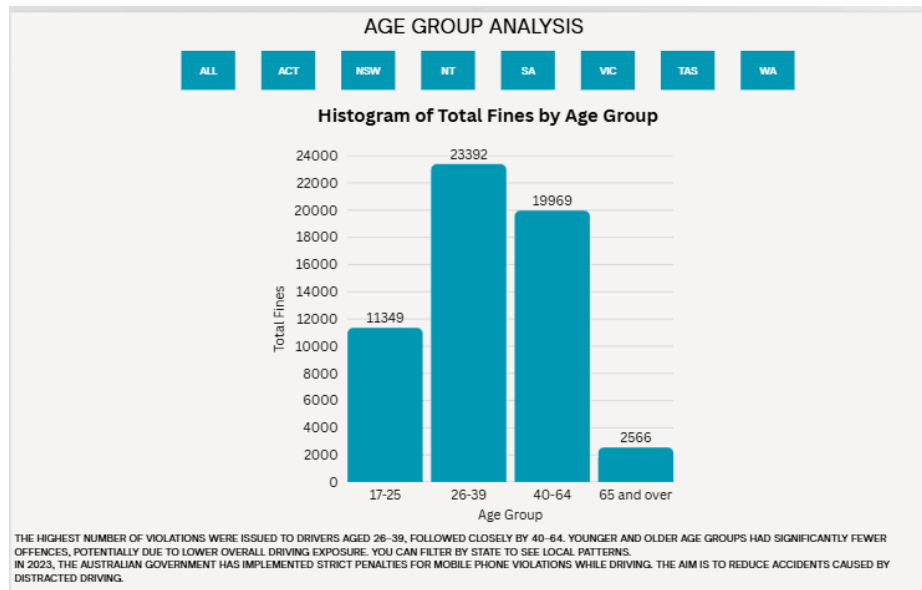


Figure 19. Wireframe 5

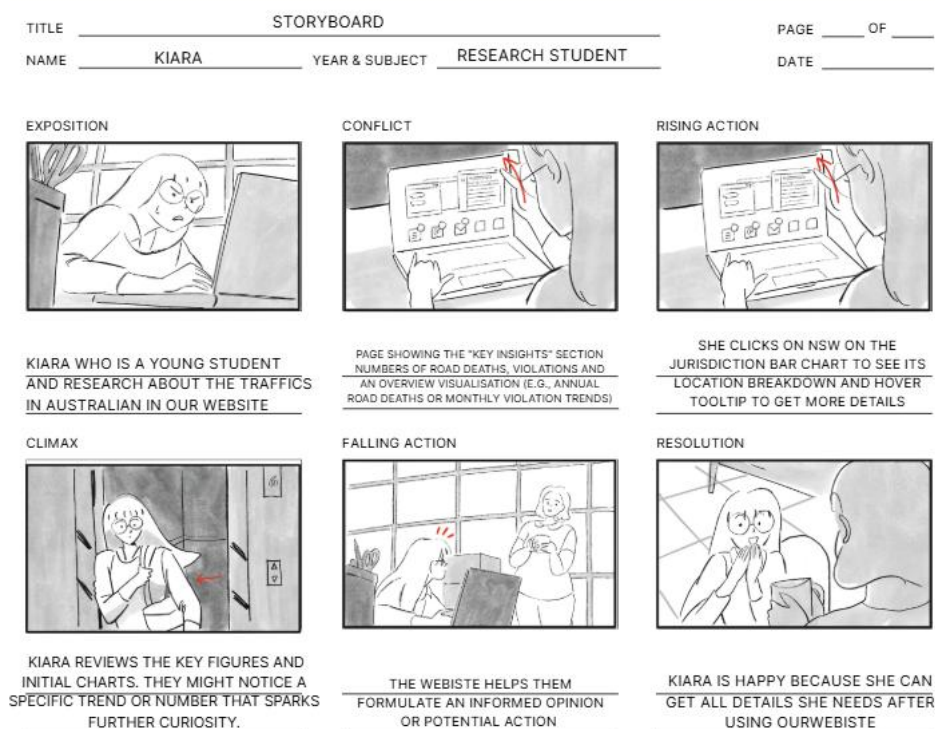


Figure 20: Storyboard

There is a created story board is used to present how the user interacts with the website or data visualisation. It breaks down the interaction into small steps to illustrate how a user will navigate the platform and engage with is features to achieve a specific purpose and answer the questions. This helps user to understand more about their topic, find out the answers and it also helps us to get the user

experience flow, identify potential usability issues and ensure that the design effectively guides users towards the intended purpose of the website.

3.2 Visualisation Design

Our dashboard presents four main visualisations designed to raise awareness about mobile phone use while driving across Australian jurisdictions. Each chart was selected based on the type of data and how effectively it can communicate the patterns and trends. The design choices are aligned with good visualisation principles, focusing on readability, accessibility, and usability across devices.

1. Line chart of Monthly Fines by Detection Method

Line chart is ideal for displaying “Whether phone use while driving is increasing.” It clearly shows trends and changes in data over time. By plotting fine counts against months, users can easily identify patterns, detect fluctuations, and understand the broader progression of mobile phone use while driving. This is especially useful for policymakers assessing the impact of cameras and transport safety analysts asking questions such as “Are mobile phone offences increasing?” or “Is camera detected method more efficient?”

The x-axis represents the interval variable (month), and the y-axis shows total fines issued for mobile phone use while driving. The chart displays monthly trends for 2023, comparing two detection methods: police-issued and camera-issued fines. Since “line graphs are most commonly used to plot continuous data” (Knafllic, 2015), this is an effective way to visualise change over time within a single year.

Two lines use colour hue with saturation (blue for police and lighter blue for camera) to represent categories. This is a suitable method for encoding categorical data using colour (Munzner, 2014). The lines act as visual marks, guiding the viewer to compare trends and spot fluctuations. The chosen colours contrast well with the dark background.

Text style is clean and simple, with large font sizes (14–16px) for readability. The chart follows Tufte’s principles of graphical integrity. It uses a zero-baseline to avoid distortion and maintains a high data-ink ratio by reducing non-essential elements (Tufte, 1983). Tooltips on hover support interaction and data transparency without visual clutter. A scale/slider is added to support users to getting a better view of line fluctuations. As police issued values are quite small to put on the same scale with camera detected fines, we provide the slider to help users adjust the y-axis.

Trend of mobile phone offences in 2023

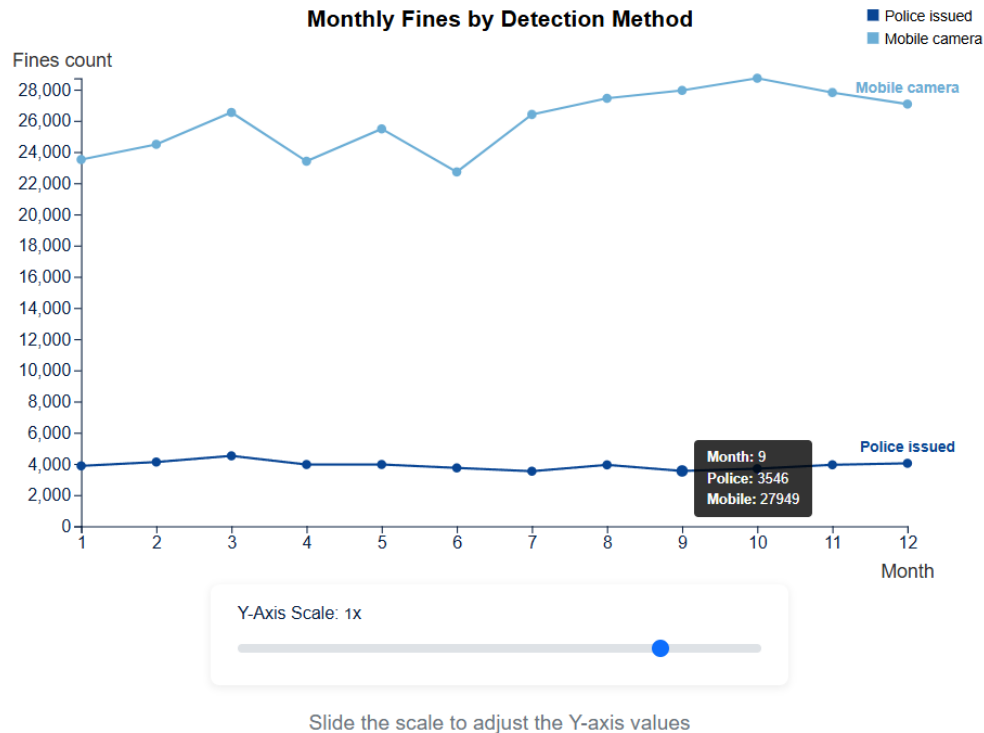


Figure 20. Line chart of Monthly Fines by detection method with hovering tooltip

2. Bar chart of Fines by Jurisdiction per 10,000 Licences

This bar chart shows the fines rate of mobile phone use violations when driving per 10,000 licenses of each jurisdiction. Instead of using total fine numbers, we use a normalised rate. This helps avoid misleading comparisons, as larger states naturally have more fines. Using fines per 10,000 licences makes it easier to see which states are enforcing the rules more strictly, regardless of population size.

Bar charts are ideal for comparing separate categories like states and territories (Munzner, 2014). They allow users to quickly answer questions such as “Which state has the highest fine rate?” Each bar shows one region, and the bar’s height represents the fine rate, making differences easy to see.

The chart follows good design principles. The axes are clearly labelled and the values are scaled from zero to maintain graphical integrity (Tufte, 1983). Colours are chosen to match the dashboard’s theme but will be checked to ensure they’re colourblind-friendly. Number of fines rate are displayed on top of each bar so that areas with fewer fines like NT or ACT are still easy to spot. Labels are clear and readable with enough contrast for accessibility.

By using the Bootstrap grid system, the chart layout is responsive. It adjusts well on different screen sizes. Tooltips appear when users hover over a bar, showing total fine counts and issued licenses of each jurisdiction.

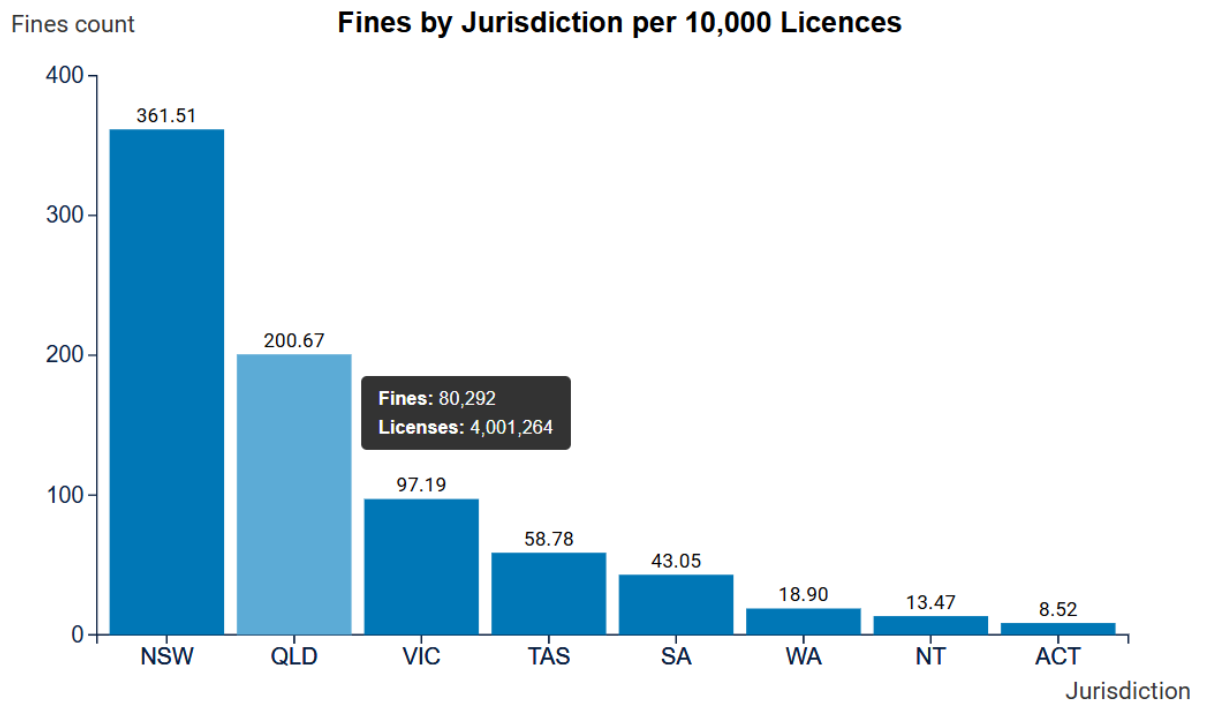


Figure 212. Bar chart of Fines per 10,000 licenses by Jurisdiction

3. Bar chart of Total Fines by Age group

To visualise the total fines count by age group across different states, the bar chart is used for its advantage in comparing discrete categories. The x-axis represents categorical variables (age groups), while the y-axis shows the total number of fines (a quantitative variable). The chart allows users to identify which age groups are most frequently fined for mobile phone use while driving. This supports one of the dashboard’s key goals to raise public awareness about high-risk demographics.

Each bar encodes the total fine count through height, making it easy to identify that drivers aged 26–39 have received the highest number of fines, followed by those aged 40–64. This is likely due to their higher driving frequency. Fewer fines among those aged 65+ may reflect reduced road exposure.

The filter buttons above the chart allow the user to view age group patterns for a specific jurisdiction. This interaction enables users to compare age-related enforcement within their own state or territory. This is particularly valuable for policy makers and educators who want to localise safety campaigns.

The use of a consistent hue for all bars maintains a clean aesthetic. While it does not distinguish between groups via colour, the separation is handled through position and labelling, which is enough for a small number of categories. Bar labels show the exact values, improving precision without requiring tooltips.

The chart adheres to Tufte’s design principles by using a zero-baseline to avoid scale distortion and maintaining a high data-ink ratio (Tufte, 1983). The font choices are readable and consistent with the dashboard theme.

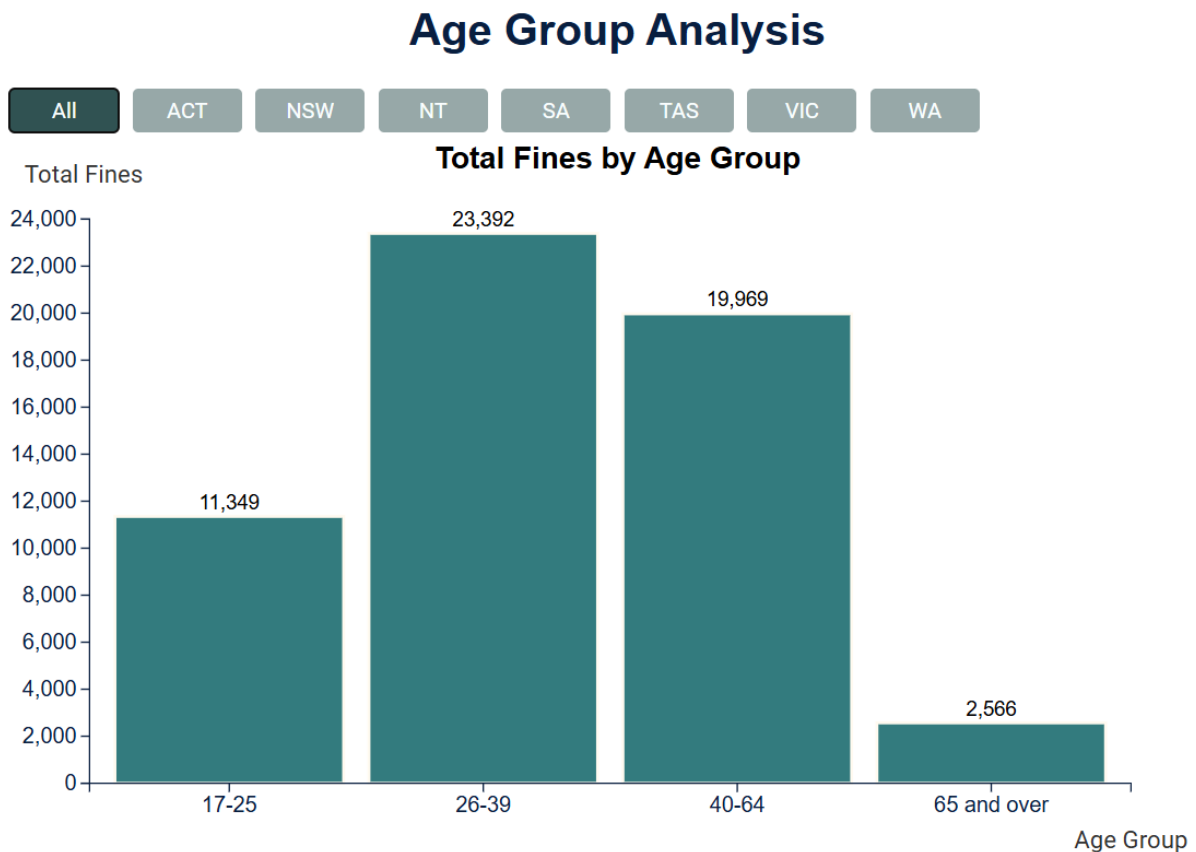


Figure 23. Bar chart of Total Violations by Age groups

4. Donut chart of Location breakdown of Fines by Jurisdiction

This chart displays the distribution of mobile phone fines between different locations per states. The locations are grouped into five categories: Major Cities, Inner Regional, Outer Regional, Remote, and Very Remote areas. This chart appears dynamically when users click on the jurisdiction bar on the “Fines per 10,000 licenses by Jurisdiction” bar chart to display the state’s location breakdown of violations. Donut chart is excellent at showing the relational proportions between data (Doughnut and Pie Charts | Chart.js, 2025), which is suitable for providing a high-level overview of which area has the most fines. This chart helps users quickly understand whether mobile phone violations are more common in metropolitan or rural areas.

The use of simple and colour with different levels of intensity makes the proportion visually distinct. The title is clear and straightforward with bold text help improves readability. The percentage labels directly on the chart, helping users immediately understand the distribution without needing to hover. A legend placed below the chart to pair the colour with its categorical value. Percentage labels that are smaller than 5% cannot be drawn on the chart will be displayed on the legend. The legend text is smaller than other text but still maintain readability.

A notification box above the chart informs users that only NSW, VIC, and ACT have available location data. If a user clicks on a jurisdiction without location data, a message appears stating: “Location of

violations are undefined.” This avoids confusion and ensures the interface communicates data availability clearly.

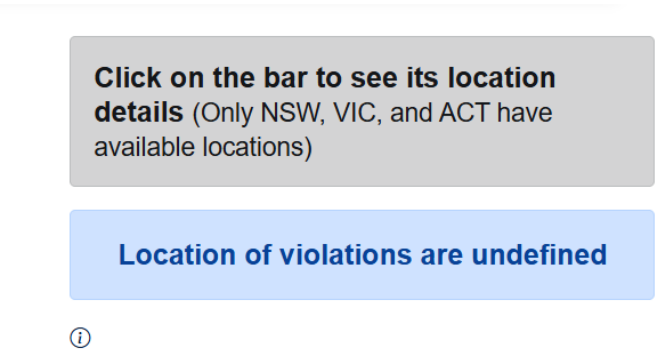


Figure 224. Alert text box appears when users click on jurisdiction with undefined location data

By adding this visual, users can start to ask important questions like whether regional areas are being under-monitored, or if cities have more fines simply due to higher population. Overall, it adds depth to the main chart and encourages further exploration.

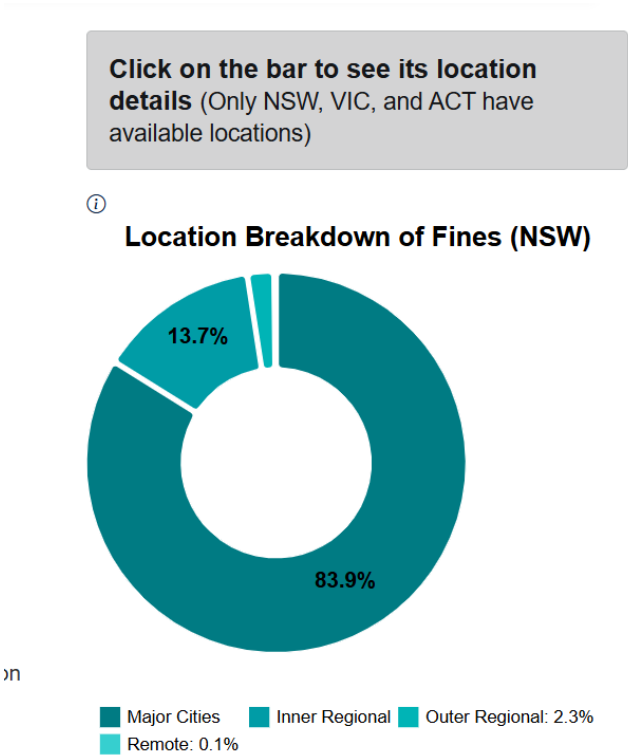


Figure 23. Donut chart of Location breakdown in a Jurisdiction

Adhere to Good Design Principles

1. Graphical integrity

- **Clear baselines:** All bar charts begin at zero on the Y-axis to maintain graphical integrity. This avoids exaggerating small differences and ensures the length of each bar accurately reflects the data.
- **Appropriate chart types:** Chart types were carefully selected to effectively visualise the data. Line charts are used for continuous data such as monthly trends, while bar charts are used for discrete comparisons between age groups and jurisdictions. The use of donut chart highlights the proportions out of a whole. This ensures graphical integrity by using the most suitable visualisation for the data.
- **Transparent data presentation:** Axes are clearly labelled with correct units and data sources are shown in the references section. This adds credibility and ensures users are not misled by unclear labels or missing context.

2. Accessibility

- **Colour:** To ensure the accessibility, we tested if our visualisations are colour-blind friendly using Coblis – Colour Blindness Simulator. The main theme of the website is navy blue, following the Australian Government colour. To represent categorical values, blue shades with different saturation are used to ensure people with all kinds of colour blindness including monochromacy can differentiate. The donut chart of Location breakdown of Fines by Jurisdiction has the greatest number of categorical values, therefore, it is essential to use saturation hue for separation. The figures below showed our test results on the accessibility of the colours used for the visualisations.

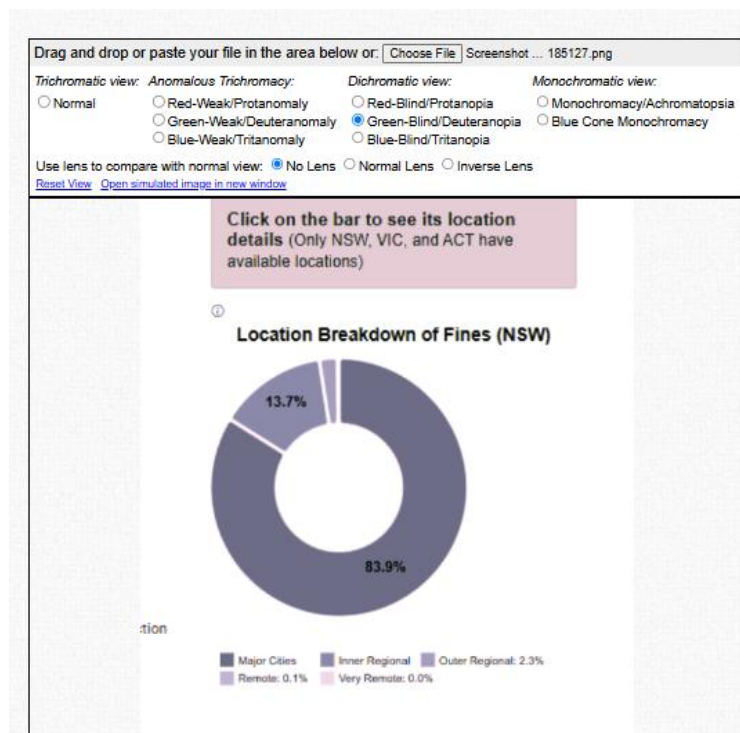


Figure 24. Donut chart tested against colour blindness simulator

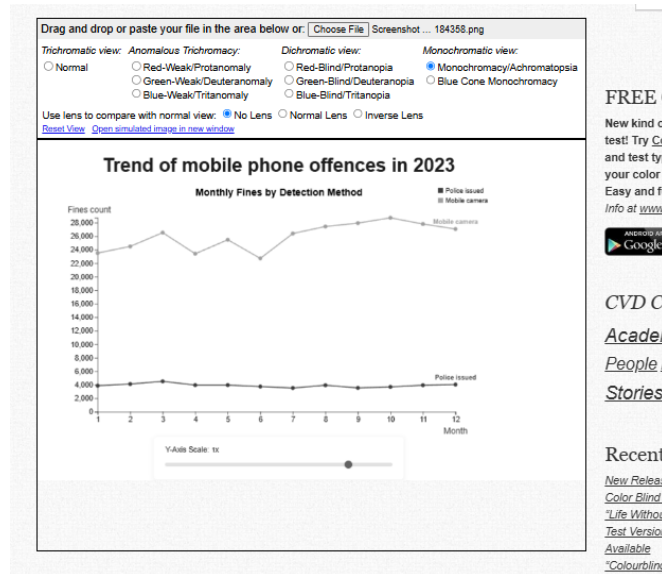


Figure 25. Line chart tested against colour blindness simulator

- **Font size:** Standard font sizes (12–14px for body text, larger for headings) are used across all components for readability.
- **Readability:** High contrast between text and background colours will be maintained for optimal readability. Text is placed against high-contrast backgrounds (white on navy, or black on white) to improve readability and meet WCAG standards. We choose the ‘blue’ colour scheme which aligns well with Australian Government-related themes.
- **Consistency:** Consistent colour schemes will be applied across similar charts to avoid confusion.
- **Interactive elements:** Focus states for interactive elements (Eg: Filters, tooltips)

3. Scalability

The dashboard is built with scalability in mind, allowing it to function effectively across desktops, tablets, and mobile devices:

- A responsive layout is implemented using web-friendly technologies such as D3.js and Bootstrap. Visualisations adjust fluidly to different screen sizes through scalable SVG graphics and flexible containers.
- Charts such as bar charts and line graphs reflow appropriately when the screen is resized, ensuring that all information remains visible and accessible without horizontal scrolling.

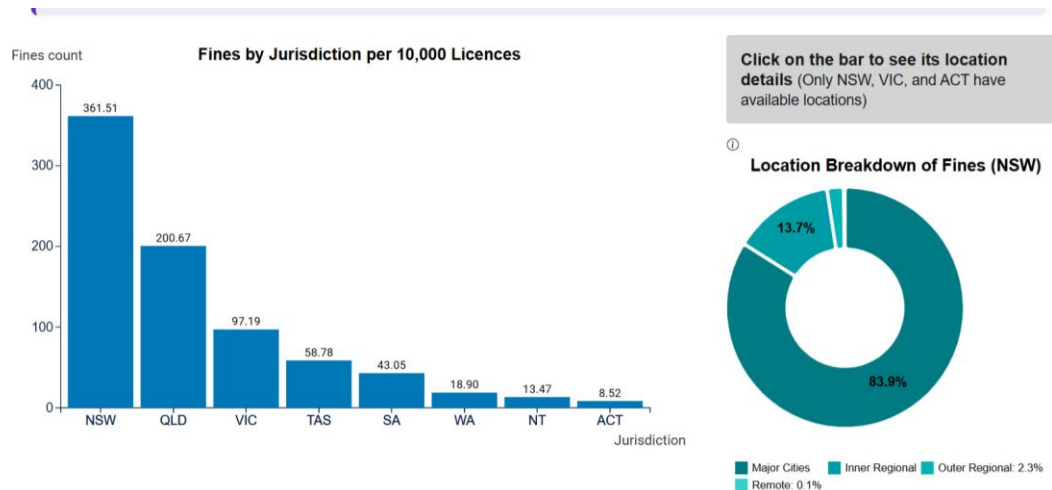


Figure 26. Normal view on Desktop

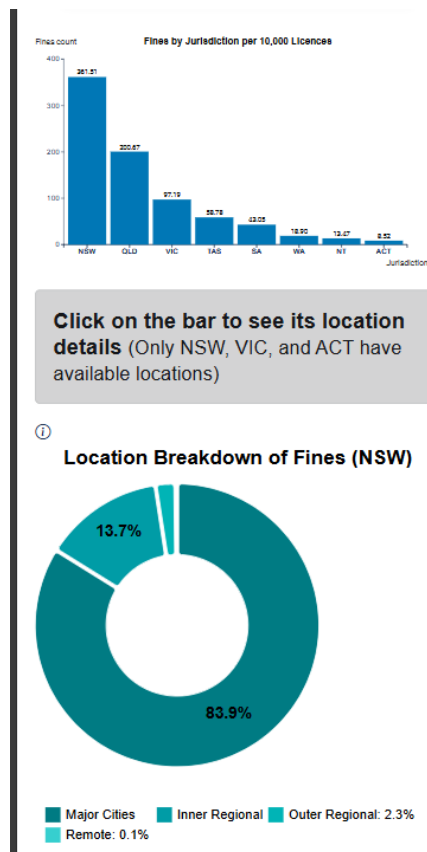


Figure 27. Responsive layout on mobile phone

3.3 Interaction Design

- **Scale/ slider:** It support users to explore the trends. Due to the big gap in volume between mobile camera and police issued fines, the movement of police issued fines line could not be

shown clearly. In figure 28, the line represents police issued violations looks almost linear with minimal fluctuations. After adjusting the scale, the line movement appeared better over the times (in figure 29).

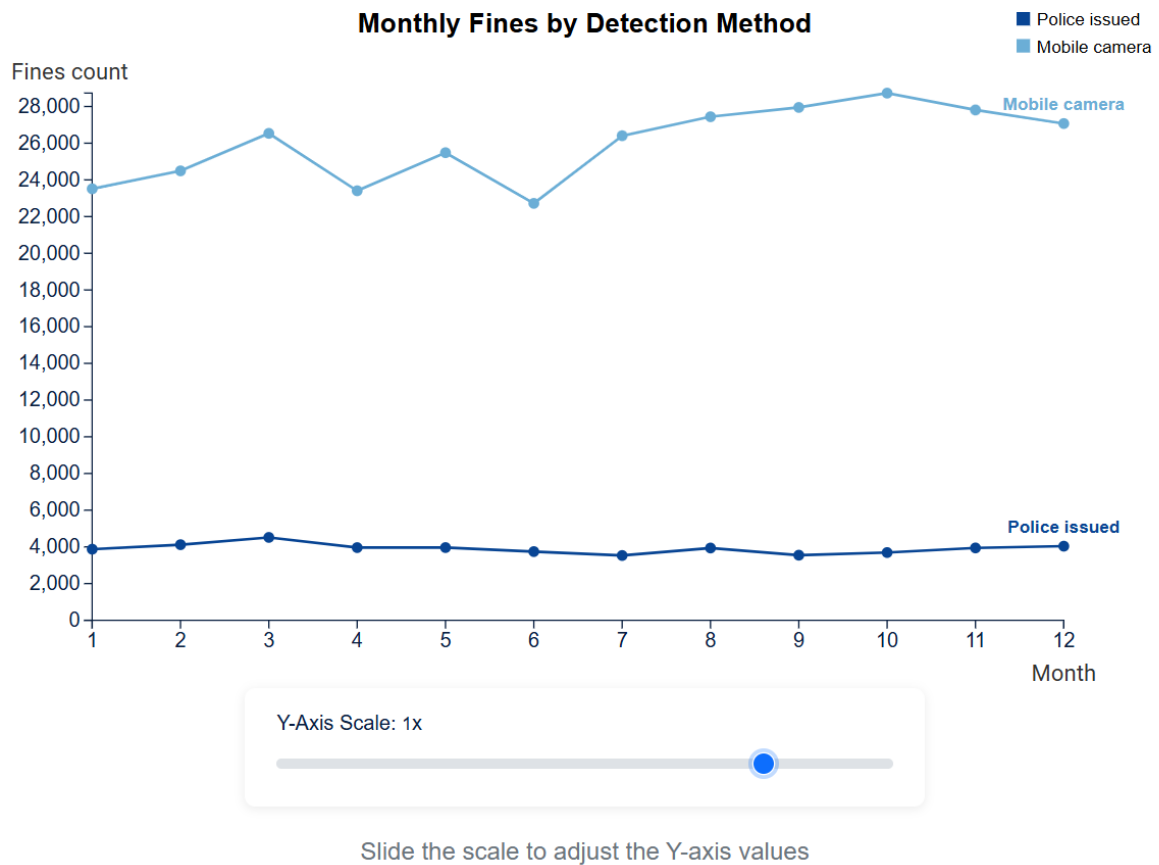


Figure 28. Police issued line before scaling

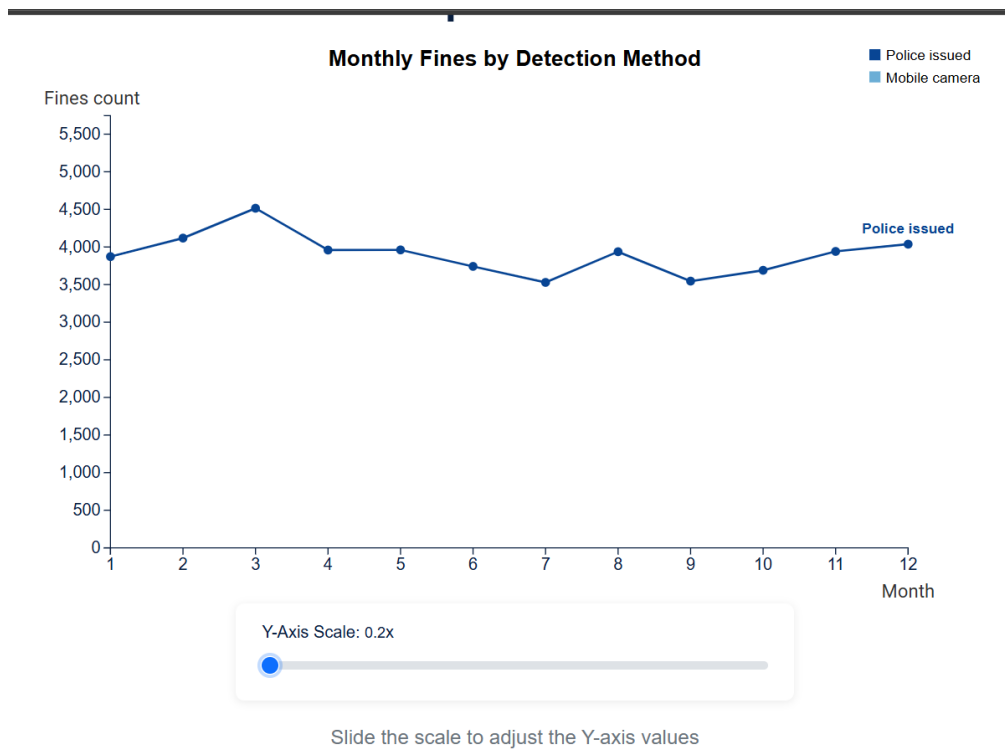


Figure 29. Police issued line after scaling

- **Filtering:** Users can segment and focus on specific subsets of the data by filtering. For instance, users can filter the Age Group Analysis chart by jurisdiction using the buttons provided at the top like ACT, NSW, NT, etc. This allows viewers to focus on fine totals within a specific state or territory. The filter usage enables policymakers, educators, and the general public to explore how age-related trends differ between states. Another filter implemented is when user select a bar in the bar chart of Fines per 10,000 licences, the donut chart represents the distribution of fines across different location types within that state will change accordingly. Currently, this feature is limited to jurisdictions with available location data such as NSW, VIC, and ACT. These interactive filters help reduce visual complexity by narrowing the data to one relevant subset at a time.

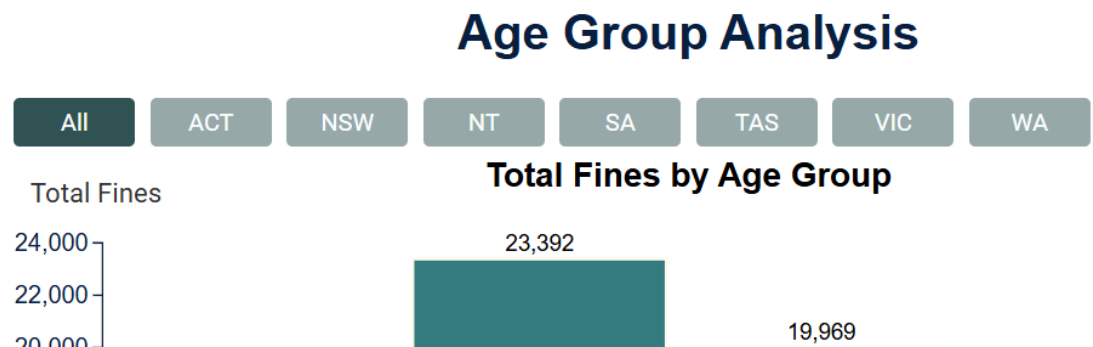


Figure 30. Filter buttons for jurisdictions

- **Tooltip:** Tooltip is a crucial feature that available in most of the major charts, including the line chart (Monthly Fines by Detection Method), bar charts (Jurisdiction Fines and Age Groups), and the donut chart (Location Breakdown). When users hover over a data point, the tooltip reveals contextual information such as exact fine counts or category labels. This is especially helpful for users who want to explore specific values without cluttering the visualisation with permanent labels. For example, a user can hover over a monthly data point to find out how many fines were issued by mobile camera in June or check the proportion of regional fines in NSW. These tooltips improve data understanding and support exploration without overwhelming the default layout.

We also designed an informative icon that will informs the users about any metrics below 5% will be shown on the legend (in figure 32). This tooltip provides clear guidance for users when interacting with the charts and reduces confusion.

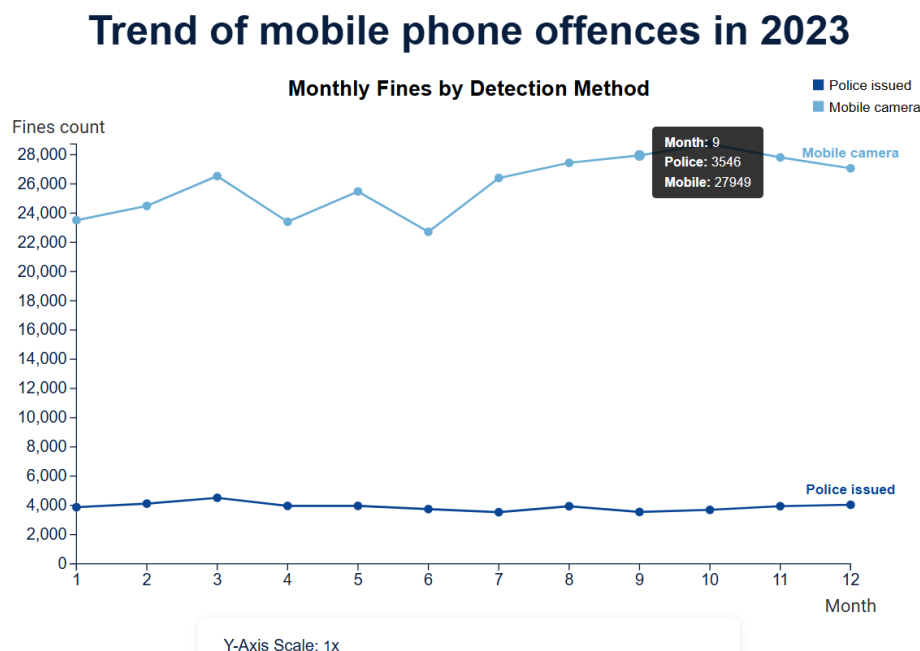


Figure 31. Tooltip displaying monthly number of fines

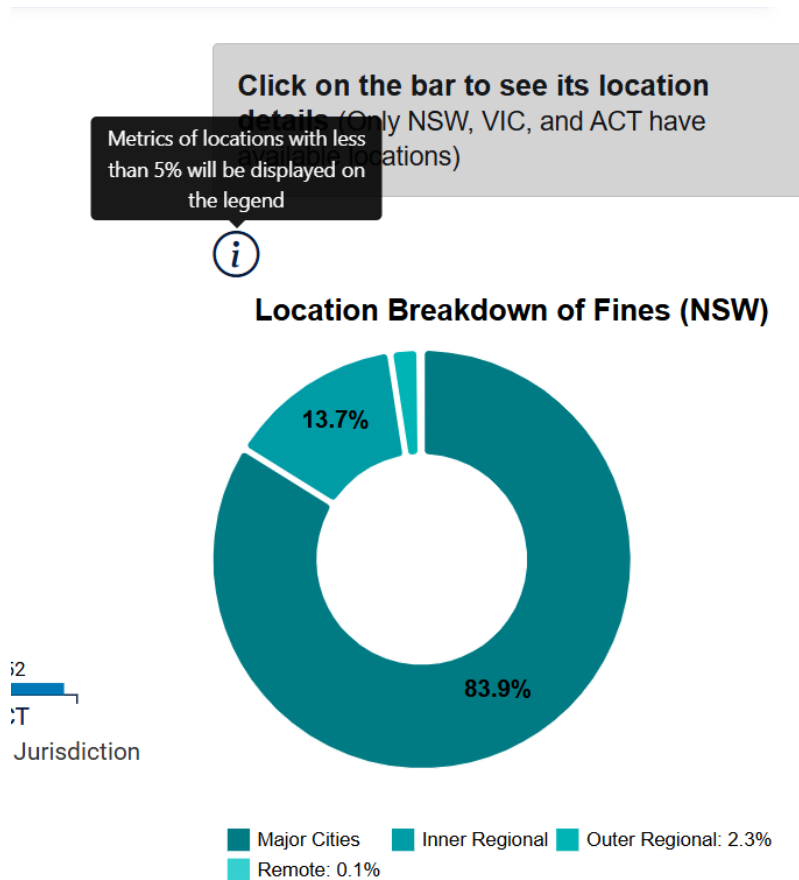


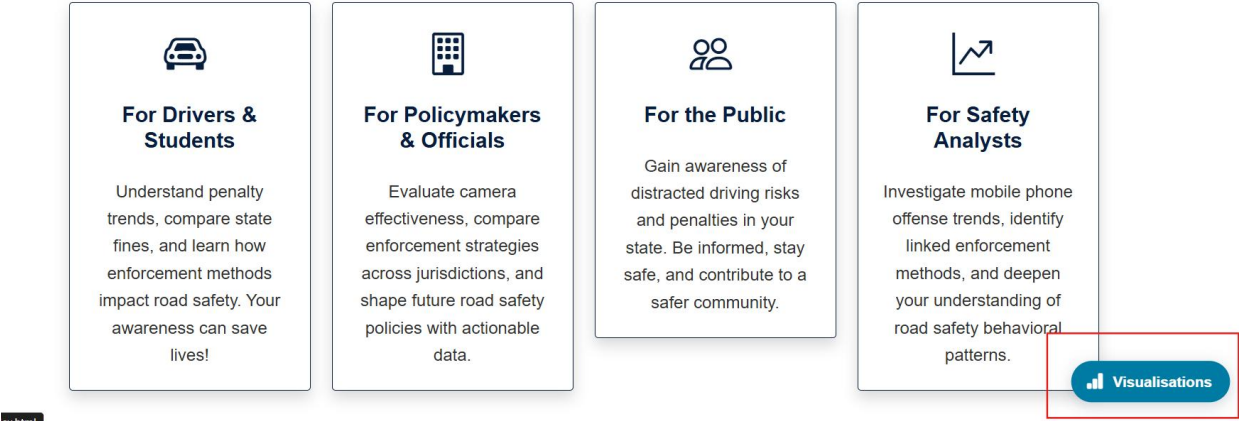
Figure 32. Informative tooltip notify users that metrics below 5% will be displayed on the legend

- **Floating button link to another page:** Our website design has a floating button on the About Us page. This button allows users to skip the reading and go straight to the visualisations whenever they want. The About page, known as data story, is designed to explain the purpose of the dashboard and help users identify which target audience they belong to. To support a smoother experience, the floating button stays fixed in the bottom right corner, removing the need to scroll back up to access the main navigation bar.



What's Your Role in Road Safety?

Our data story offers unique insights tailored to different perspectives. Find out how this dashboard empowers you!



ex.html

Figure 33. Floating button for easy navigation

Interaction Method	Expected User Behaviour	Response
Scale/Slider	User adjusts the Y-axis scale using the horizontal slider under the line chart	The line chart dynamically updates the Y-axis domain, allowing the user to better visualise low-volume trends such as police-issued fines. However, due to large volume gap, the mobile issued fines line may not be displayed when y-axis scale is decreased.
Filtering	User selects a jurisdiction either by clicking a button above the Age Group chart or a bar in the Fines per 10,000 Licences chart.	The displayed data updates to show only the relevant subset, reducing cognitive load and preventing data overload. Users can easily compare the change of age-related trends across different jurisdictions.
Tooltip	User hovers over a chart element (line point, bar, donut slice)	A tooltip appears after 1-2 second hover, displaying detailed information such as fine counts, categories, or percentages without cluttering the visual layout.

		This feature supports users in understanding or collecting more specific information/data points and answering their questions.
Floating button	User clicks on the floating action button on the About Us page.	The button redirects the user directly to the visualisation section in the Main page, improving navigation flow and reducing the need to scroll manually.

Table 1: Interaction table with interaction method & expected user behaviour and response

4. Iteration and Validation

4.1 Testing and refinements

- Addressing “Unknown” value in the dataset:

In our visualisation of violations recorded by locations, many jurisdictions did not have the location information available. Hence, many values are classified as “Unknown”. We have raised questions during stand up 2 about how we should address this. Since the location is “unknown”, it does not provide users with useful information. One member in our group provided 2 options while presenting like deleting the unknown record as unnecessary and does not affect too much to the dataset or separating this as new

category for analysis. The supervisor also suggested removing these unknown records as they are not helpful to users even though they constitute the majority of the analysis dataset.

Jurisdiction Location Bar Chart

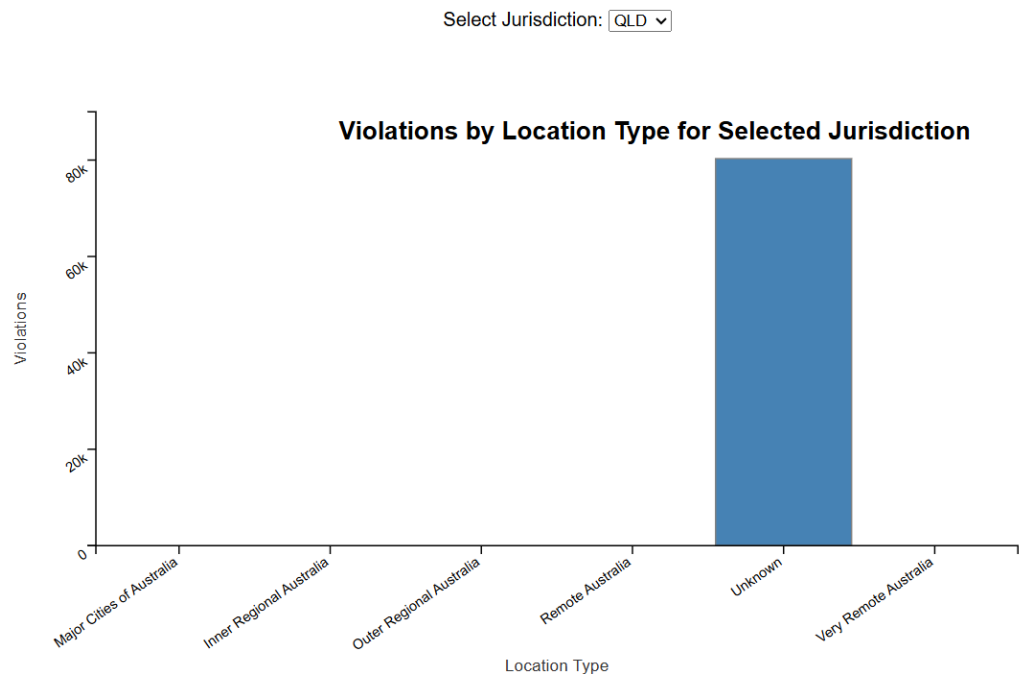


Figure 34. Location "unknown" has the majority of violations found

Considering that only 3 states (NSW, VIC and ACT) have location information available, our team decided not to use the bar chart for violations by locations of selected jurisdiction anymore. Instead, we visualise the bar chart of fines count per 10,000 driving licenses by jurisdictions and a pie chart demonstrating the proportion of locations where violations were recorded if available.

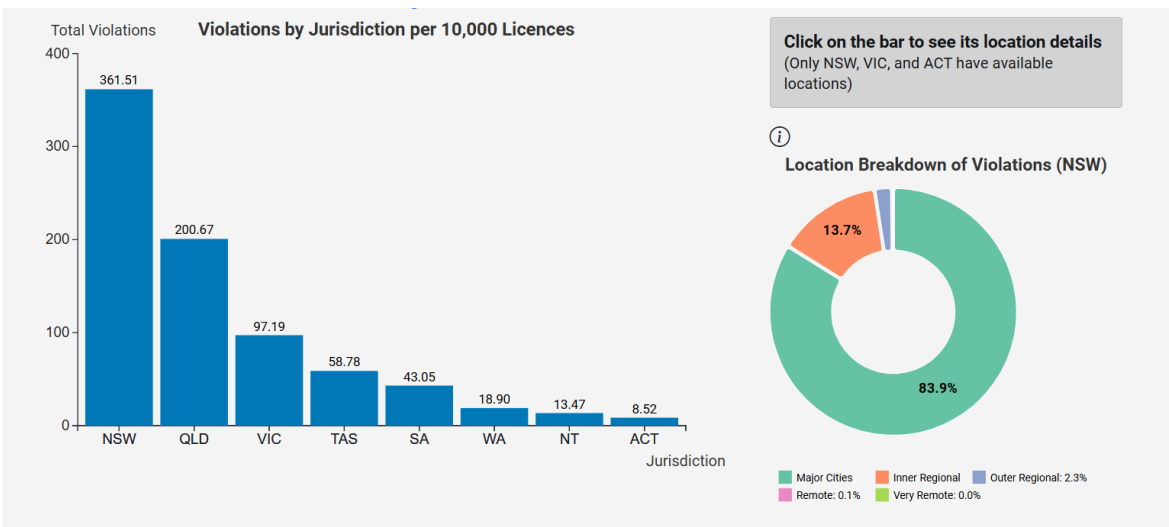


Figure 35. New visualisations given that there are only 3 states have location information.

- Removing the age group of 0-16:

In the bar chart displaying the fines count by age group, the 0-16 group has significantly smaller amounts compared to the other groups of older ages. As a result, its bar could not be drawn due to the massive gap in numerical value. While the highest number of violations recorded was 23,392, the 0–16 group only accounted for 40 fines. This extreme disparity caused the bar representing this group to be invisible, which skewed the viewer's perception of the age distribution. This violates the key principle of effective data visualisation about proportional accuracy (Scale distortion) and visual interpretability.

Our team felt that this was not a good visualisation, as the difference in frequency was not clearly illustrated. One user also recommended that we should remove this age group since it does not serve any help to the user in collecting information. After discussion, we made the decision to remove the 0–16 group from the chart. According to Australia Driver Licensing (2015), the minimum legal driving age is 16 and some states require 17. Individuals under 16 are not legal to drive, so any fines recorded in this group may be outliers. Removing this age group improved the overall clarity and allowed for more meaningful comparison among valid driving-age populations.

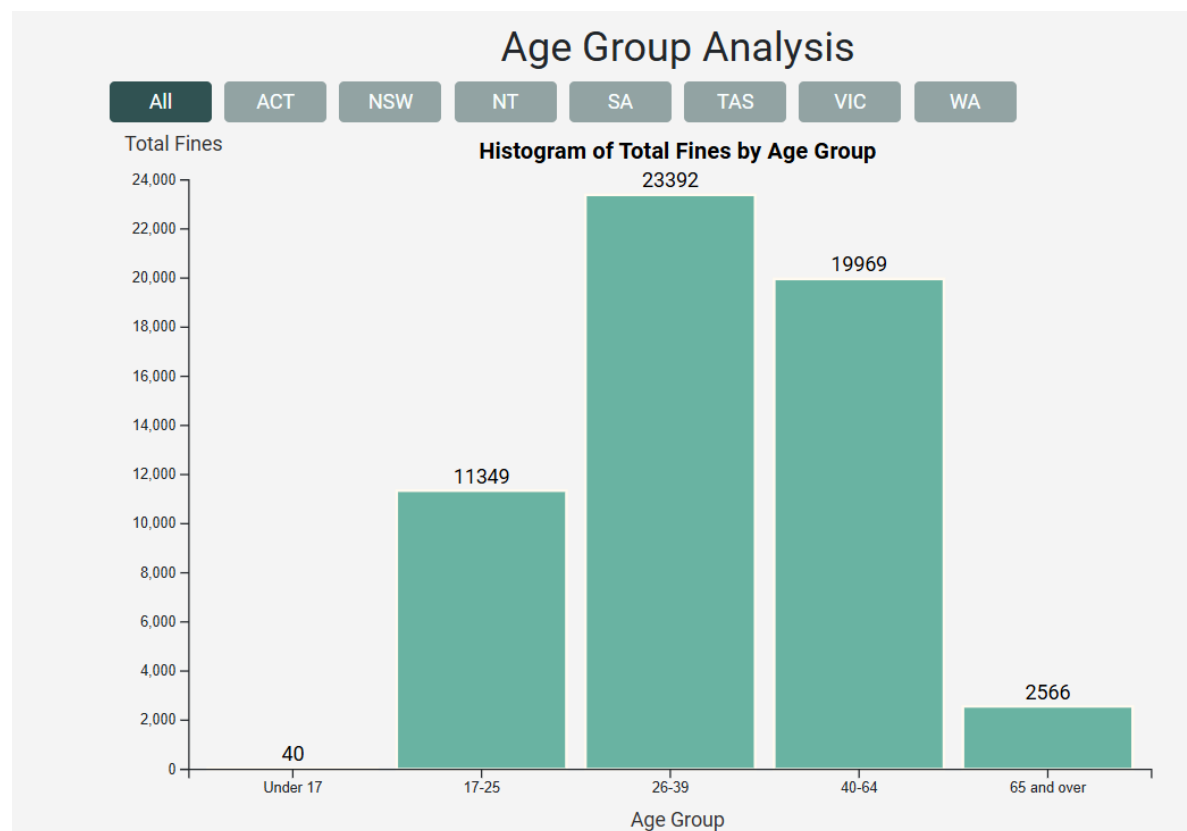


Figure 36. Group of 0-16 years bar is invisible

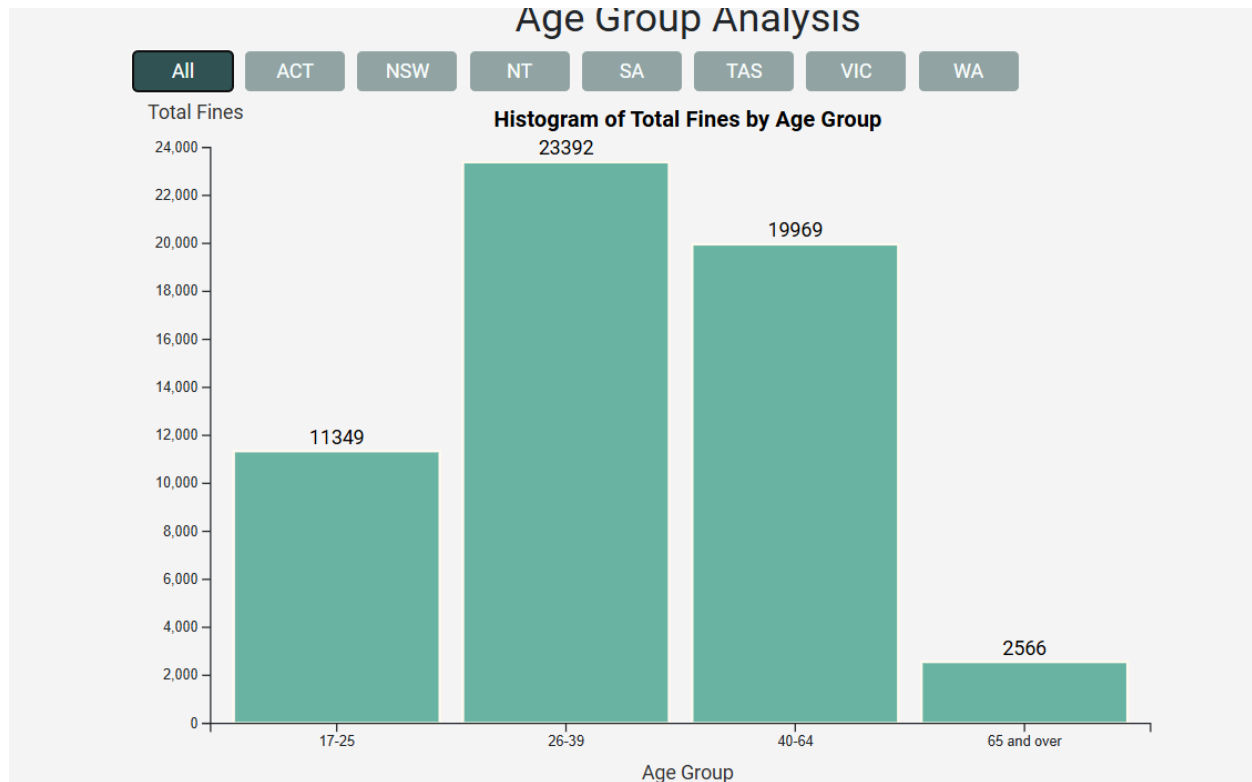


Figure 37. A more meaningful visualisation of valid driving age-group

- Change colour scheme of donut chart to be colour blind friendly:

Previously, we used schemeSet2 of D3 library for the colour scale. Despite the visual appeal, these colours are not really friendly to people with colour blindness since their lightness are similar to each other. After tested with the colour blindness simulator, we realised people with monochromacy could not differentiate the categories on the donut chart. Hence, we changed these to the Teal colour with saturation so it could still stay consistent with the website colour theme while be more accessible.

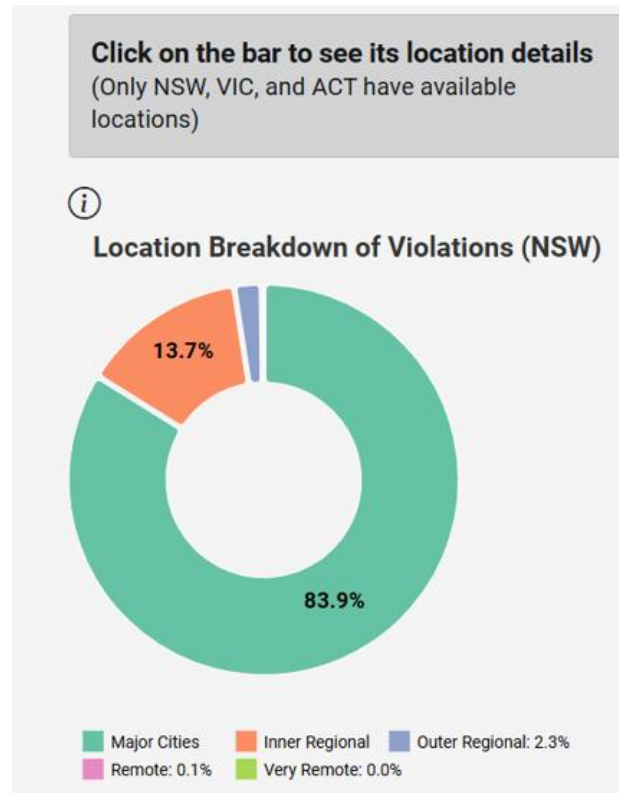


Figure 38. Donut chart before tested against colour blindness simulator

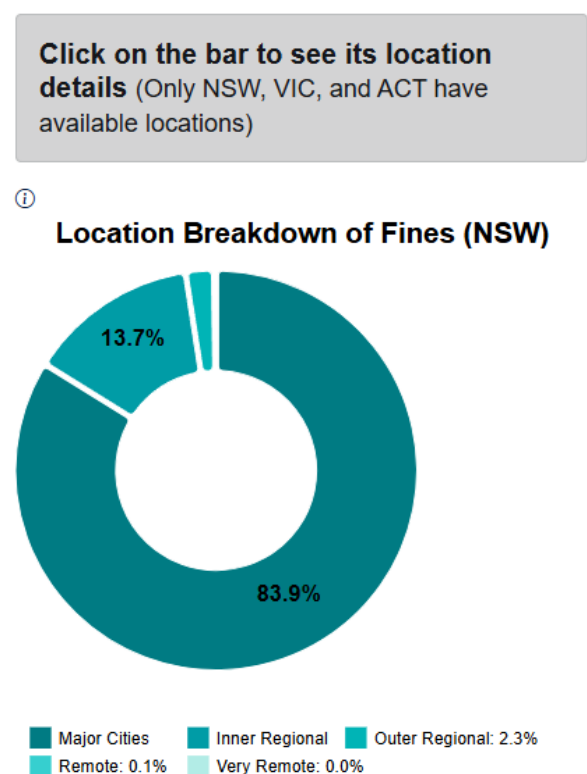


Figure 39. Donut chart's colour changed to be more accessible

- Change the style of website layout:

At first, for the design concepts, we planned to create 2 pages for our website including Main page and Comparison page to display the visualisations as seen in early mockups of the Figma wireframe (as shown in image 41), which provided a basic layout for displaying Annual fines and Monthly violation trends. However, during the programming development period in week 11 and week 12, we recognised the responsiveness of interactive charts across different screen sizes and the efficient loading of large dataset, required multiple design modifications. For example, the initial idea of combining or comparing 2 visualisations on a single line in one dashboard showed the challenges for best performance and mobile accessibility.

Then, with the change in designing, several different visualisations presented clearly and allowing for better navigation and appropriate visuals. The approach also guided the choice of reducing several interactive components that were extremely time consuming. Furthermore, accessibility features such as tooltips and 'explore' button were a top priority throughout the design and programming process (as shown in image 40). Key implementations included features such as high contrast for visual elements like texts, heading and graphics or image banner which can see the traffic cones in order to show the main purpose of this dashboard, writing small descriptive text for the image and each visualisation to summary the key information for users to easily understand without distracting them with many words.

The final website layout, as seen in the image 40, reflects these modifications, providing an improved and accessible dashboard than the original design idea in the image 41 while successfully delivering the important information and key insights on mobile phone violations in Australia.

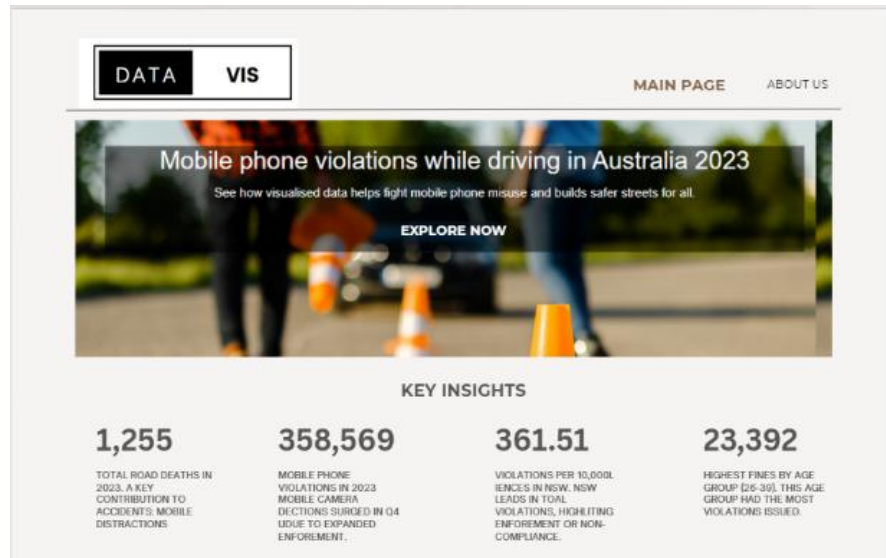


Figure 40. Current main dashboard wireframe



Figure 41. Initial Figma wireframe

- Remove the horizontal bar on the chart display Charges and Arrests by State/Jurisdiction:

When developing the visualisation of chart display Charges by Jurisdiction, the initial design provided the chart for displaying three types of Charges (Fines, Arrests and Charges) by Jurisdiction. However, programming issue like technical challenges in D3 combined with data discrepancy we faced during development, especially concerning on the vast difference in the number of Fines compared to the lower number of arrests and charges, which created a big gap in our design process.

The main challenge came when attempting to show the three types of charges (Fines, Arrests and Charges) by state using a horizontal bar or sketched bar, even when broke down “per 10,000 licenses”. The magnitude difference between the number of fines and the quite lower number of both arrests and charges made it virtually impossible to display all three on the same scale as the smaller values became unrecognisable. This programming constraint had a direct impact on the design, leading to the removal of this chart from the final development.

Finally, we decided to remove this visualisation. As shown in the chart (image 42), the “Arrests” and “Charges” categories were often reduced to barely visible lines, especially in states such as Western Australia (WA), where they showed as small lines at the chart row. This programming limitation had a direct effect on the design to exclude this chart to ensure data clarity and effective presentation.

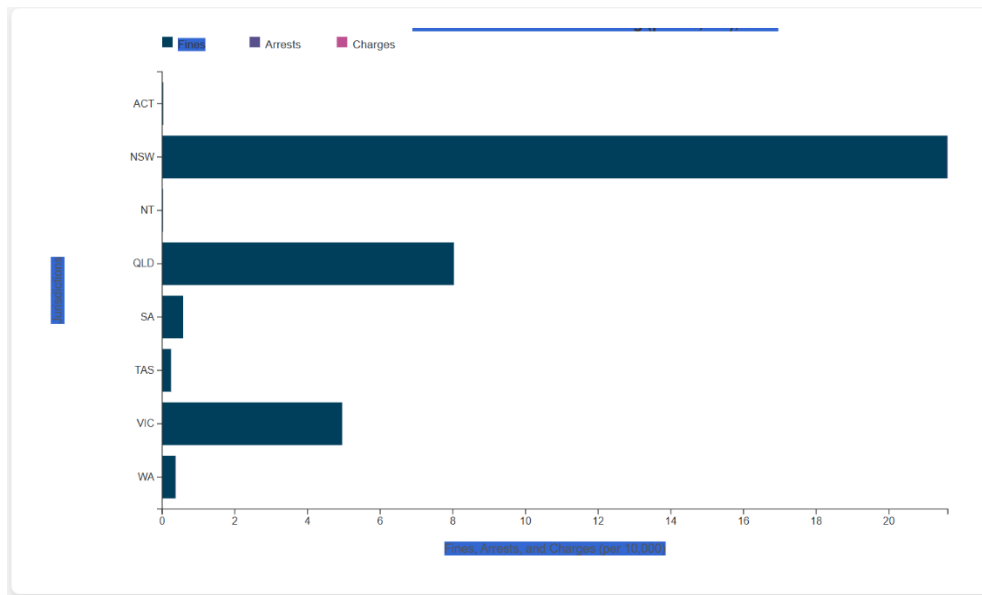


Figure 42. D3 horizontal bar which displays 3 types of charges by states



Figure 43. Charges are displayed in WA with small line at the top of the chart row

- Remove the bar chart that displayed Charges by Month

When developing the visualisation, we have tried to figure out the way to display the fines by displaying the total Fines (Fines, Arrests and Charges) by month. However, the number of Fines overwhelmed the statistics for arrests and charges, which were quite small. Because of the great contrast in scale, the bars describing arrests and charges became nearly invisible on the chart, reduced to small, illegible lines at the top of the 'fines' bars. The visual representation failed to convey the information for arrests and charges, making to confusing and uninformative to users. To maintain graphical consistency and ensure that all presented data was clearly discernible and valuable, we decided to remove this visualisation. Our tutor also suggested to delete this chart because it does not contain enough or helpful information for users.

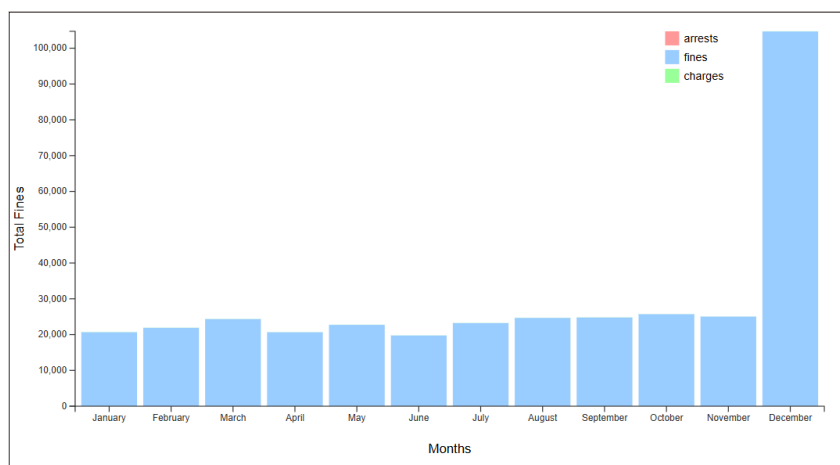


Figure 44. Total Charges by Month

4.2 Usability evaluation

Conducting usability evaluation is essential to the project. To ensure a smooth user experience, we created a usability evaluation form and asked users from different backgrounds to go through the website, explore the data and give feedback. The results of user evaluation are in the Appendix of this report.

After user feedback on the website layout and visualisations made, we made some improvements such as using a colour-blind friendly colour palette, put the chart insights into a box to make it pop, and rewrote the About us page to make the content less wordy and lengthy. We further removed the 0-16 (under 17) age group as it has fewer advantage to find the needed information.

COS30045 - Usability Form

Project Title: Data Visualisation Project
Team Code: DV09, 305
Principal Investigator(s): Savana Thoring, Han Nguyen

Thank you for helping us test this prototype. To help us understand how you felt about your experience, please answer the following questions.

* Required

Instructions
Thank you for helping us test our prototype. To help us understand how you felt about your experience, please answer the following questions.

1. Participant ID (we will tell you what to put for this Question) *

Enter your answer

2. How frequently do you look at or interpret data visualisations (such as bar charts, line graphs, scatter plots etc)?

Enter your answer

3. Do you have viewed data visualisations or read content related to statistics in the past 3 months?

Enter your answer

4. What did you like most about this visualisation?

Enter your answer

5. What did you like least about the product?

Enter your answer

6. On a scale of 0 to 10, how likely are you to recommend our project page to your colleagues, organization, or professional networks? *

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

Not at all likely Extremely likely

Next Page 1 of 2

Never give out your password! [Report abuse](#)

Figure 45. Evaluation Form part 1

COS30045 - Usability Form

Required

System Usability Scale

Please tick the option that best represents your reaction to the system. Don't think too hard about each question. We are interested in your first reaction.

7. System Usability Scale *

Strongly Disagree

Strongly Agree

	0	1	2	3	4
1. I would use this website to find information about Australian traffic trends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I found the website unnecessarily complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. The visualisations effectively communicate insights about mobile phone usage in traffic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. The website's content is relevant to Australian traffic and mobile phone data.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I found the various functions/interactions in this website were well integrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I thought there was too much inconsistency in this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I would imagine that most people would use this website very quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I found the website easy to navigate and understand.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Overall, I found the information presented on this website valuable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. What could be improved to make it more helpful?

Enter your answer

9. Any other comments:

Enter your answer

10. Please rate the difficulty of this task

☆☆☆☆

11. Thank you for helping us test our prototype. You are now finished with the evaluation.

Back

Submit

Page 2 of 2

Never give out your password. [Report abuse](#)

Figure 46. Evaluation Form part 2

5. Conclusion and Future Improvements

This project successfully developed an interactive website dashboard that visualised mobile phone violations while driving in Australia which focus in updated 2023 data from BITRE. A key lesson learned throughout this development process was the balancing design with technical programming skills and data constraints. For example, the substantial gap in size between fines, arrests and charges forced to remove of a proposed combined bar chart since lower values were undetectable, affecting graphical integrity. Similarly, the choice to change the website layout from a multipage structure to a more single

main page approach directly addressed issues with responsiveness and efficient loading of huge datasets across a range of screen sizes.

The final dashboard efficiently meets the needs of its target users such as student and young drivers, the general public, government officials, transportation safety analysts, and researchers. Key findings shown how by the visualisations include an increase trend in mobile phone in 2023, the leading role of NSW in violations, the effectiveness of camera detection methods (where applied), and an unequal number of fines issued to the 26-39 age group. Furthermore, major cities account for the majority of violations in jurisdictions where location data is available. The project prioritised accessibility by implementing high contrast designs, testing colour palettes for colourblind friendliness, ensuring readable font sizes, and providing interactive elements such as filters and tooltips to improve user understanding and data exploration. Overall, the dashboard successfully provides critical public safety statistics while also demonstrating how visualisations may increase awareness and improve decision making.

Future improvement

Find a way to visualise data on Arrests and Charges to provide users with detailed information about penalties for mobile phone use violations when driving. We could also refine the line chart to make it scale smoothly and the mobile phone issued fines will not go out of frame.

Adding additional filtering options such as by time of day, specific road types or vehicle categories (find data from research papers to support) could allow advanced users to conduct more detailed analyses, while incorporating predictive models to forecast future trends in mobile phone violations based on historical data and policy changes would provide valuable insight for transport safety analysts and policymakers.

Find more dataset from different reliable sources or information to support or improve the data for many 'unknown' values.

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Appendices

Gen AI Declaration

We (DV09_T05) acknowledge the used generative AI tools like ChatGPT, Gemini to help restructure our report and refine our paragraphs. All analysis, critical evaluation, and reasoning are based on our own. After using this tool/service, we reviewed and edited the content as needed and took full responsibility for the content of this assignment.

For refine opinions in writing:

Prompt 1: Paraphrase or rephrase our sentences/words if we used it multiple times in the report.

Prompt 2: Refine the ideas or paragraphs to convey better information.

The Prompt 1 is used for following sections:

Sections: Interaction Design, data processing, iteration and validation.

The Prompt 2 is used for following sections:

Sections: Interaction Design, Iteration and validation.

Sample GENAI Outputs

Improve clarity

- Enhance brief sentences by combining them into a meaningful paragraph.
- Ensure ideas are connected smoothly to make the text easier to understand.

Improve formality:

- Enhance readability by ensuring logical connections between ideas.

For programming:

- Prompt 3: simplest way to add a comma or dot after 3 digits to represent thousands in number
HTML

Output: The simplest way to format numbers with commas or dots for thousands in HTML is by using JavaScript with the `toLocaleString()` method.

- Prompt 4: Suggest a colour-blind friendly palette for the donut chart
Output:

Here's a commonly recommended palette for color blindness (suitable for categorical data like your donut chart):

Color Blind–Friendly Palette (5 colors):

- #0072B2 (Blue)
- #E69F00 (Orange)
- #009E73 (Green)
- #F0E442 (Yellow)
- #D55E00 (Red)

- Prompt 5: style the slider to make it look better

Output:

To style your slider and its container for a more modern, visually appealing look that matches your site, you can:

- Add a card-like background with a subtle shadow and rounded corners.
- Apply Bootstrap classes such as “form-label”, “form-range”.
- Make the slider track and thumb match your primary blue color.
- Increase spacing and align the label and value nicely.
- Make the slider more accessible and visually prominent.

- Prompt 6: why the button Check out our visualisations doesn't look like the Explore Now on index.html

Output:

- The "Check out our visualisations" button on [Aboutus.html](#) looks different from the "Explore Now" button on [index.html](#) because:
- On index.html, the button uses the class btn btn-outline-light btn-lg, which applies Bootstrap's outline style and your custom color overrides from base.css.
- On Aboutus.html, the button uses btn text-white btn-lg, which does not apply the outline style or your custom color overrides.

Reflection:

By using GENAI, it enhances our coding by offering quick suggestions and debugging help such as while using D3 and expand opinions. Overall, it helps to improve the writing and programming skill more effectively and interactive.

Notes/data collected in usability evaluation



Figure 47. Evaluation feedback 1

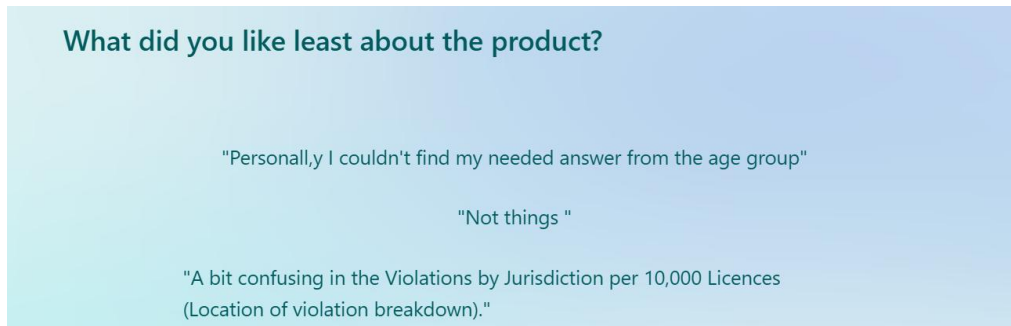


Figure 48. Evaluation feedback 2

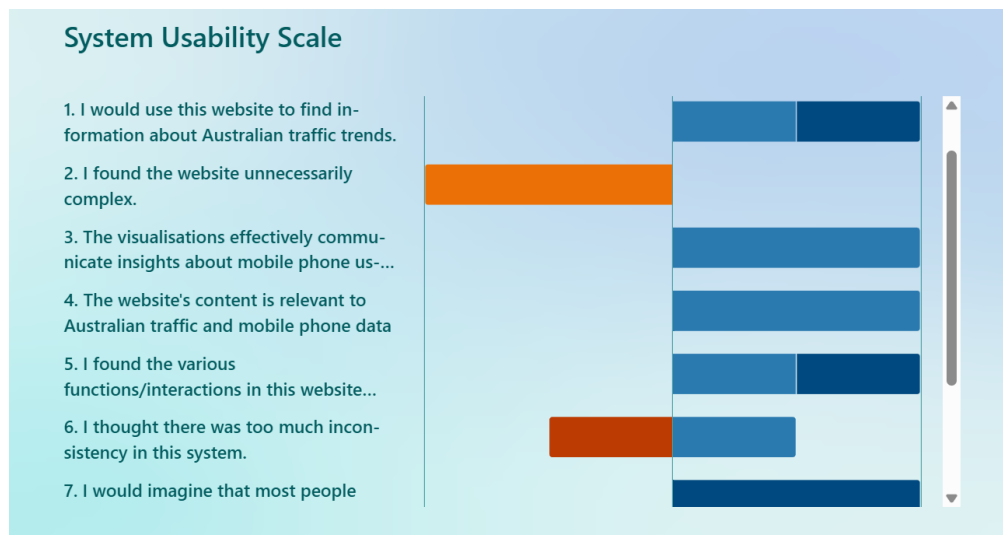


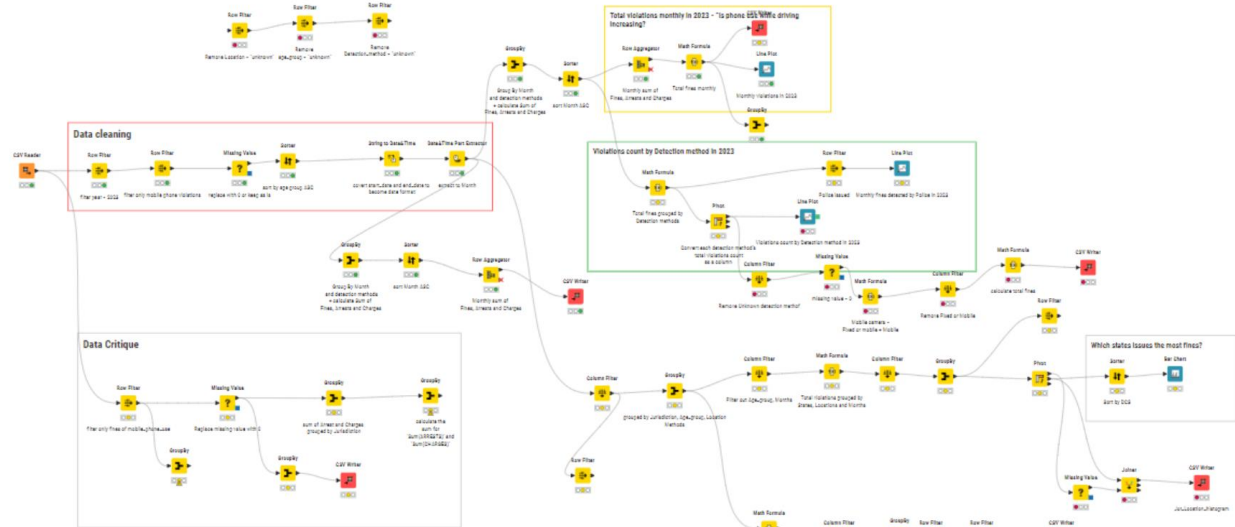
Figure 49. Evaluation feedback 3

These are feedback from the usability evaluation from our friends. We gained essential insight into how users interact with our project. Several aspects were acknowledged, including the clear navigation with a click link button like "Explore now" in main dashboard or "Visualisation" button in About Us page, which made it easy for people to interact with the website content.

However, some challenges were found, especially regarding clarity in the breakdown visualisation, which some users found confusing, such as age group from 0-16 as it has less advantage to find the needed

information. Then, by taking this feedback into consideration, our next steps will be to further develop these areas, improve user interface clarity, increase accessibility, and optimise functionality as needed.

KNIME workflow during the design process:



KNIME complete workflow:

