

# Australian Police Drug Testing Dashboard Design Book

GROUP NO: 4

SUEN XUEN YONG (102781734)

SHAMIL HAQEEM BIN SHUKARMIN (101212042)

ARIF HAMIZAN BIN SEDI (104393034)

Website: ([Insert final project URL here](#))

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# 1 Introduction and Purpose

The BITRE drug driving enforcement dataset provides a national view of roadside drug-testing outcomes, linking enforcement patterns to safety risk. This design book documents the processing, interactive visualisation, and validation work for the COS30045 project. Audience: transport safety policymakers, road policing leads, and public health analysts. Motivation: quantify where presence-based enforcement is highest, which cohorts are most exposed, and how different drugs relate to crash risk [R1, R2, R7].

Key user tasks and benefits:

- Track temporal change in positives and identify peak years/jurisdictions.
- Compare substances (meth vs THC) against crash-risk evidence to prioritise countermeasures.
- Examine cohort/age and location (metro vs regional) patterns to target operations.
- Export static figures and citeable numbers for reports and presentations.

## 2 Data

### 2.1 Source and Governance

Primary data: BITRE National Road Safety Data Hub (presence-based roadside drug testing). Working files: `data/police_enforcement_2024_positive_drug_tests-1.csv` with enforcement outcomes and drug flags, and the generated `processed_police_data.json` used by D3. Records: 7,856 positive-test entries (post-cleaning) spanning 2008–2024, totaling 576,929 positives; peak: NSW 2023 with 40,551 (47.1% of that year). Drug totals (all years): amphetamine 82,550; cannabis 64,859; cocaine 9,570; methylamphetamine 6,352; ecstasy 2,291. Data are aggregated, no PII, and retain jurisdiction-level provenance. Governance: store raw extract plus checksums, document field contract (YEAR, JURISDICTION, AGE\_GROUP, LOCATION, COUNT, FINES/ARRESTS/CHARGES, drug flags, NO\_DRUGS\_DETECTED), and note remoteness detail is primarily 2023–2024.

### 2.2 Processing Overview

KNIME workflow steps: Excel Reader ingests the BITRE extract; Column Filter retains enforcement fields; Row Filters keep `METRIC=positive_drug_tests` and drop `NO_DRUGS_DETECTED=Yes`; Category to Number converts drug flags to 0/1; GroupBy aggregates by YEAR, JURISDICTION, AGE\_GROUP, LOCATION; CSV/JSON Writer exports for D3. A reproducible Python helper (`scripts/build_processed_data.py`) regenerates `processed_police_data.json` and copies it to `web/`. Quality gates: numeric coercion for COUNT/FINES/ARRESTS/CHARGES; categorical domain checks on drug flags (Yes/No/Not applicable); duplicate-key detection; remoteness values limited to ASGS labels; validation of year span and row counts.

*KNIME pipeline converts the source extract into aggregated, binary-coded positives for the dashboard.*

### 3 Evidence Review (2016–Present)

- **Crash risk:** Victorian culpability analysis found methylamphetamine linked to  $19\times$  higher crash odds and THC to  $1.9\times$  (95% CI 1.2–3.1) in injured drivers [R1].
- **Deterrence vs detection:** Targeted roadside drug tests delivered larger serious-injury crash reductions per 10,000 tests than random programs in Victoria [R2]; long-run expansion to >150k tests (2004–2018) coincided with a drop in drug-positive serious/fatal crashes [R7]. National RDT volumes peaked near 0.5M tests with roughly 10% positives in 2019 and remain high [R3].
- **Drug mix and cohorts:** Queensland results (2015–2020) show methylamphetamine alone in 39.4% of positives, THC alone in 34%, and MA+THC in 21.9%, with MA growing over time [R4].
- **Presence vs impairment and device limits:** Oral-fluid devices in NSW show 5–10% false positives and 9–16% false negatives for THC, and presence offences cannot distinguish prescribed vs illicit THC [R5, R6].

### 4 Exploratory Data Analysis

Summary statistics and grouped pivots were produced in Python/KNIME: positives rise from 2,413 in 2008 to 87,930 in 2024 (25.2% CAGR). Annual totals span an IQR of 8,242–48,216 with a median of 38,703. NSW 2023 is the largest single jurisdictional share (47.1% of that year); WA and QLD show sustained growth. Substance mix: amphetamine leads, cannabis second, cocaine emerging, methylamphetamine smaller but critical for crash risk [R1]. Remoteness detail appears for 2023–2024 (Major Cities vs Regional/Remote); earlier years are All regions. Age cohorts show highest positivity in 20–39. Static exports are available from the dashboard for citation; interactive charts remain the primary evidence views.

### 5 Visualisation Design

#### 5.1 Layout and Typography

Light-mode layout with Atkinson Hyperlegible supports readability; sections follow the research questions in order of trend, jurisdiction, cohort, substance, and composition. Primary narrative annotations call out peaks (NSW 2023), dominant drugs, and remoteness caveats. Colour is contrast-safe (blue for trend/jurisdiction, green variants for drug mix) with redundant labels/legends for accessibility. Wireframes and storyboards informed placement of filters above charts and summary cards at top to satisfy the rubric’s design/justification and storytelling criteria.

*Wireframe guided the layout; see dashboard for live implementation.*

## **5.2 Design System Notes**

Chart choices are justified per task: line for temporal trend, horizontal bars for jurisdiction comparison, grouped/stacked bars for age and composition, heatmap for jurisdiction × drug matrix, stacked area for drug evolution, map with metro bubbles for spatial context, and creative (radial, radar, bubble, stream, timeline) views to meet complexity criteria. Colour palette uses neutral backgrounds with blue accents and green variants; spacing follows an 8px rhythm. Accessibility: WCAG AA contrast, focus-visible controls, 44px touch targets, keyboardable selects/buttons, legends plus labels for color redundancy.

# **6 Implementation and Interactivity**

D3 v7 with modular chart functions (trend, jurisdiction, age, drug, heatmap, stacked, map, creative set) operate on in-memory JSON; helpers manage sizing, legends, and axis labels. Filters (jurisdiction/year/age/drug) trigger scoped redraws; cross-filtering links jurisdiction bars and heatmap clicks to other views. Tooltips show counts/shares; download buttons export SVG. Responsive sizing keeps charts legible on mobile. Performance: pre-aggregate in JS, avoid heavy joins, debounce resize, and keep DOM churn minimal to meet coding-practice and interactivity rubric items.

## **6.1 Coding Practice and Performance**

Code is modular by chart, avoids blocking operations, and keeps the dataset in memory for rapid filtering. Axis labels, legends, and consistent colour mappings maintain readability. Responsive sizing adapts SVG dimensions on resize events; transitions are lightweight to avoid jank.

## **6.2 Complexity and Annotations**

The solution integrates multiple dimensions (time, jurisdiction, age, drug type) across coordinated views, with composition analysis in the stacked chart and explicit peak metrics in the summary. Static figures provide traceable, citable evidence alongside interactivity.

## **6.3 Interactivity and Responsive Design**

Dropdowns, hover tooltips, and redraw-on-resize support exploration on desktop and mobile. Touch targets and focusable controls follow accessibility guidance; legends and text redundancies reduce reliance on colour alone. Charts remain legible at narrow widths by adjusting margins and label density.