Applying AI to Smarter Transport Investment

National Local Roads & Infrastructure Congress 2025

Presenter: John Zannes | Date: 11 November 2025

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A Personal Story

My Grandmother

When I think about road safety, I don't start with crash statistics or cost-benefit ratios.

I think about my grandmother, she was funny, stubborn, and the kind of person who insisted on making you a cup of tea.

But as she got older, her world started to shrink bit by bit. Her knees were failing her. First her garden, then the shops, and eventually the hallway felt like a hill.

She needed a knee replacement. Her doctor scheduled the surgery, but months turned into years. There were reasons, as there always are. Emergencies happen. Trauma cases come in. The system did its best.

She learnt to accept compromises. She judged a good day by whether she could reach the letterbox, how many steps, how much pain, and how long until she had to sit down.

> What do you think about when you think about road safety?

Overview: What We'll Cover Today

1. The problem
2. The True Cost of Road Trauma
3. Beyond Safety: The Broader Impact of Prevention
4. AI for Smarter Transport Investment
5. Practical Implementation
6. Community Benefits & Social Outcomes

> By understanding these key areas, we can work towards a future where our roads are safer, and our communities thrive.

The Problem

Safe System

Adopt a holistic approach that prioritises forgiving roads, safe speeds and vehicle protection.

Post-Crash Care

Strengthen emergency response, hospital care and rehabilitation to reduce long-term harm.

Protect Vulnerable Users

Focus interventions for pedestrians, cyclists and motorcyclists to reduce high-energy impacts.

Move beyond incremental fixes to systemic change that prevents deaths and serious injuries.

Why This Matters: The Hidden Cost of Road Trauma

Preventing road trauma isn't just about fewer sirens or headlines.

It's also about doctors being able to run scheduled lists instead of constantly catching up, nurses who spend more time caring rather than just coping, and allied healthcare clearing their backlog.

When we invest in prevention, we free up hospital beds, theatre time, and allied healthcare whilst building more productive communities.

> So people like my grandmother don't have to wait years for surgery that can restore the lives they were born to live.

2017 Road Trauma by the Numbers

Indicator	Value
Road deaths in 2017	1,226
Deaths per 100,000 population	4.98
Share of fatal crashes in ≥100 km/h zones	≈45%
Urban share of fatal crashes (2016)	37%

Source: BITRE, 2018

High-Speed Concentration

Almost half of fatal crashes occur in high-speed environments (≥100 km/h), where kinetic energy problems are concentrated and median barriers, clear zones, and speed management produce the biggest life-saving dividends.

Regional Vulnerability

The national rate of 5 deaths per 100,000 masks local variability. Many regional LGAs carry far higher per-capita risk because of exposure on high-speed corridors and longer time-to-care windows.

The Economic Impact: $22–30 billion

The Australian Automobile Association commissioned Economic Connections to quantify the system-wide impact in 2015:

- Office of Best Practice Regulation methodology was estimated at $22.2 b.
- Using a willingness-to-pay approach was estimated at $29.7 b.
- Government budgets alone faced more than $3.7 b.
- This includes lost taxation revenue and increased income support payments resulting from road trauma

> Where else would you tolerate a recurring multi-billion-dollar leakage?

Where's the Money?

Casualty Type	Number	Total Cost	Cost Per Person
Fatalities	1,205	$5,228.9 m	$4.339 m
Hospitalised injuries	37,964	$9,072.5 m	$0.239 m
Disabled persons*	4,436	$3,078.9 m	$0.694 m
Non-hospitalised injuries	227,572	$2,830.6 m	$0.012 m
TOTAL	**266,741**	**$17,132.0 m**	—

*Disabled persons = lasting disability arising from road trauma. Source: AAA, 2017

Per-Case Impact

Fatalities carry an enormous per-case valuation, reflecting lost life and societal willingness to avoid that harm.

Volume Matters

Hospitalised injuries and disability dominate total cost because of their volume and long-tail impacts on care, productivity and quality of life.

Missing Half the Picture

- Linked hospital–police records in New South Wales identify more than 131,000 serious injuries over 2005–2015.
- 55% of hospitalised injuries match a police report.
- If you rely on police reports alone, you're missing nearly half of the serious harm.

Item	Figure
Period	2005–2015
Total serious injuries (all hospitalised)	>131,000
Matched to police report	≈55% (72,152)
Unmatched to police report	≈45% (59,177)
Pedal cyclist unmatched share	≈82%
Motorcyclist unmatched share	≈56%

Source: Transport for NSW, 2017

Why Uncounted Injuries Matter

Distorted Risk Assessment

Uncounted injuries distort both risk and economic valuation. Understating serious harm amongst vulnerable road users leads to under-investment in infrastructure.

Hidden Health-System Costs

It masks the health-system opportunity cost. The clinic sessions and elective procedures deferred whilst trauma care takes precedence.

Capacity Pressure

When your hospital is running at 90–95% occupancy, every additional serious injury can push planned care into next week, next month, or next quarter.

> Too much road trauma is not just a transport problem; it is a whole-of-community cost borne in lost lives, disability, delayed care and budget drag.

Three Questions You Should Be Asking

Are we measuring what we actually treat?

Or just the harm we record? The gap between police reports and hospital data reveals serious blind spots in how we understand road trauma.

Are we valuing outcomes properly?

Does our valuation reflect what your community would truly pay to avoid death and injury? The willingness-to-pay framework offers a more complete picture.

Are we focusing investment where it matters most?

Where kinetic energy and vulnerability intersect—high-speed corridors, town approaches, and places where cyclists and motorcyclists are at risk.

> The case for action is clear: When you prevent high-severity crashes and soften the ones that still occur, you save lives, give time back to your health system.

What the Literature: Tells Us

Prevention Offers Wide Benefits

Clinical displacement and human impact extend far beyond crash statistics. Prevention protects scarce outpatient, mental health and theatre capacity.

Valuation Needs Overhaul

Top-down models average away local risk and struggle to predict treatment impact in specific places. A broader lens is essential.

AI Is the Practical Tool

Machine learning integrates diverse datasets and produces site-specific, defensible investment priorities with lower error rates.

> There is a consistent story across health, economics, and engineering: prevention is better than cure, we must value what matters, and we should use modern tools to target action.

Prevention's Hidden Dividend

Clinical Displacement

Serious injury patients displace planned care and delay rehabilitation, producing months-long waits in regional areas and compounding disability.

Family Burden

Heavy reliance on family or costly transport to reach city specialists increases pain and anxiety, causing some patients to miss appointments entirely.

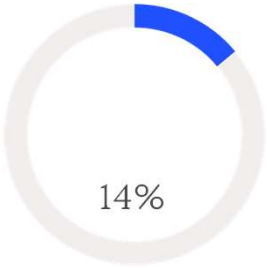
Freed Capacity

Every serious injury prevented protects scarce outpatient, mental health and theatre capacity, and reduces the burden borne by families and carers.

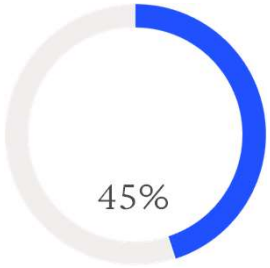
> When you explicitly cost displaced care, the prevention dividend becomes clearer and larger.

Why Local Reality Beats National Averages

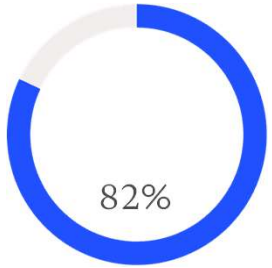
- **Local reality over averages:** Top-down crash models average away.
- **Mind the regional bias:** Smoothing effects can skew funding.
- **Value beyond the carriageway:** Use a broader lens that counts user benefits and system spillovers—productivity, accessibility, resilience—and the hospital freed capacity.
- **Be explicit on valuation:** Human-capital vs willingness-to-pay shifts totals and who benefits



Non-User Benefits Captured



Missing Hospital Data



Cyclist Injuries Unmatched

> In practice, this can bias funding against regional or semi-urban locations where high-energy roads intersect with vulnerable users and long retrieval times – you need to value beyond the carriage way.

AI in Practice: From Data to Decision

Is artificial intelligence a practical tool for smarter transport investment?

Work with Real Data

Begin with the data you already hold, find gaps, model the gaps and test for error. The aim isn't perfection; it's robust choices under real-world constraints.

Avoid Black Boxes

We prefer "glass-box" approaches. A Generalised Linear Model provides a transparent baseline; then gradient-boosted trees capture non-linearities.

Embed Equity

We embed distributional metrics in the objective and report both average and equity impacts across socio-economic quintiles.

Manage Privacy

Use de-identified, aggregated features at SA2, LGA or road-segment scale; follow data minimisation; and keep separate audit logs.

> AI is not a silver bullet; it’s a tool that helps you turn evidence into prioritised action.

The Practical Workflow: Four Steps

Prepare the Evidence Base

Build and align all inputs to the Australian Statistical Geography Standard 2021 so crash records, Census indicators, hospital catchments and network attributes share the same spatial frame.

Build Explainable Models

Combine statistics and AI to balance interpretability with predictive power. Generalised Linear Model sets a transparent baseline; gradient-boosted trees capture non-linear patterns.

Embed in Investment Decisions

Turn explainable predictions into portfolio choices that are easy to compare and defend, with site-specific safety impacts and freed capacity estimates.

Validate Against Reality

Use spatial-block cross-validation and rolling time windows so we never "peek" at the answers; back-test against realised outcomes.

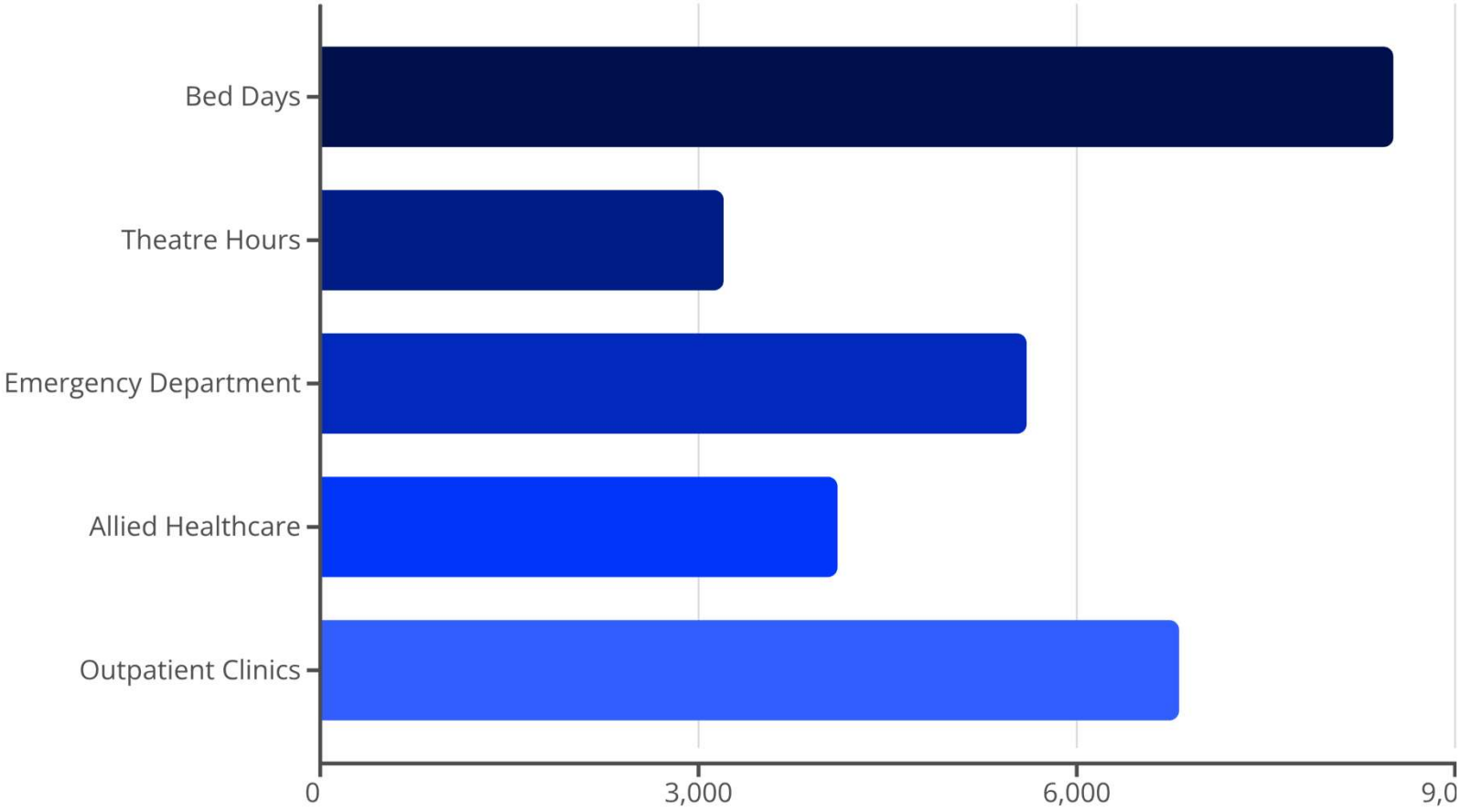
> This sequence keeps the loop tight: evidence → model → decision → outcomes → feedback. Each stage feeds the next, and each output is designed to be understood by engineers, clinicians and finance teams alike.

Valuing the Freed Capacity

- Converting freed capacity into monetary terms.
- Wage Price Index – Health Care & Social Assistance is used for clinician and allied-health wages, as these don't track household price movements.
- Producer Price Index – Health Output is applied for non-labour costs such as sterilisation, imaging, linen and facilities.
- Consumer Price Index (CPI) is used to present both real (inflation-adjusted) and nominal results.

$185	$890	$4.3M
Hourly Theatre Cost	Daily Bed Cost	Annual Dividend
Average cost per hour of operating theatre time saved	Average cost per day of freed hospital bed capacity	Estimated annual value of freed clinical capacity from prevention

From Safer Roads to Freed Hospital Resources



What's Genuinely New: Decision Design

One Map, One Truth

Aligning everything to ASGS 2021 ends boundary disputes and eliminates weeks of reconciliation. Every dataset pull is logged with queries and versions.

Explainable Decisions

For each site, we show which factors moved it up or down the priority list and by how much. SHAP values make the logic transparent.

Hospital Opportunity Cost Counted

Avoided injuries become freed bed-days and theatre hours, priced with proper indices. This ties road projects to elective stability.

Designed for Comparison

Results are delivered in a portfolio view: site-specific safety impact, freed capacity, equity lens, and pounds with uncertainty ranges.

> The "newness" is less about algorithms and more about decision design. With this approach, you keep professional judgement at the centre. AI supplies consistent evidence and a repeatable path from data to decision to delivered outcomes.

The Promise: A System That Works

I encourage you to view AI as a crucial part of a comprehensive plan for smarter transport investment. This strategy will help revolutionise our transportation systems and deliver lasting benefits beyond our transport system.

Safety Dividend

Fewer serious injuries, more free hospital bed-days, and more available theatre hours

Reduced Caregiver Strain

Less burden on families who must transport, support and care for injured loved ones

Stronger Communities

More productive, resilient regional economies with better access to healthcare

Reflecting on the question I asked at the start:

W*hat would this mean for your family, friends, colleagues and community if we could understand the real cost of road trauma?*

I believe we all have the responsibility to do better. And it's personal.

> We build a system where people like my grandmother don't have to wait so long for the life they were ready to live, where a walk to the letterbox isn't an ambition—it's just a walk.

That's the promise of using AI to make smarter transport investments.

Questions & Discussion

Your Questions & Feedback

I welcome your insights and are ready to address any questions you may have about today's discussion.

Connect with John Zannes

Feel free to reach out directly at jpzannes@gmail.com for further discussion or information.

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Please remember, this presentation reflects my personal views and not those of my employer or any other organisation.