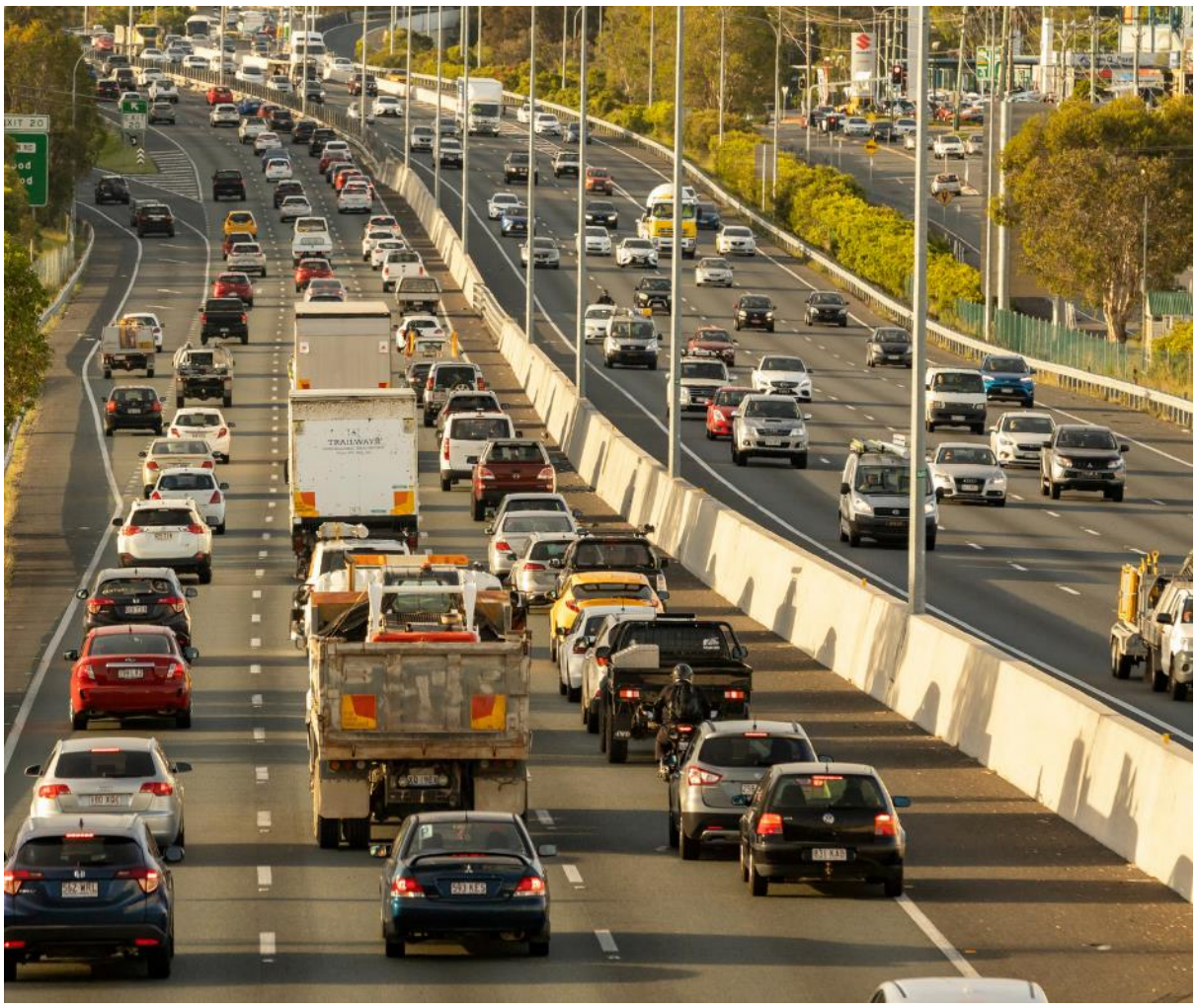
SUSTAINABLE ROADS THROUGH NETWORK EFFICIENCY AND TRANSPORT OPTIONS

According to the 2019 Australian Infrastructure Audit, road congestion and public transport crowding cost the Australian economy $19.0 billion in 2016. There are predictions this will more than double to $39.6 billion by 2031 without continued investment into improved infrastructure decision making (Infrastructure Australia 2019).

Reducing road congestion and emissions have become vital considerations for the future sustainable environment. This article demonstrates how the ARRB Mobility Futures Team contributes to sustainable roads by helping make the road network more efficient, productive, and able to better cater for cleaner transport options (such as low and zero emission vehicles, cyclist, public transport, pedestrians).



1. OPERATIONAL PERFORMANCE

The movement of goods and people is critical to the function of each and every city. As our cities grow, we have more vehicles on the road and therefore more congestion in the network. There is a greater need for changes, through enhancing public transport efficiency and connectivity. This is through addressing the congestion experienced at various bottlenecks within our network. This is to

keep up with the demand of transport users. This requires road managers to carefully plan and implement solutions to achieve the intended outcomes.

Incentivise Modes

A key means of improving sustainability is through incentivising modes of transport which are more efficient at moving people, such as mass public transport. Modal shift is an important tool in achieving a sustainable transport outcome and can be supported through the means of incentivising public transport, or disincentivising driving on the road. ARRB have looked at this as part of a few projects, one of which was the 'Tram Signal Priority Using Connected Technologies' for the Victorian Department of Transport (formerly VicRoads) as part of the Victorian Government's Smarter Journeys program.

The project involved the installation of communication-based technology into the trams and roadside to improve the management of tram signal priority at intersections. By improving the management of tram signal priority, improvements can be made to tram operations, while minimising the impact on other users of the road. This can be done through improved efficiency by calling for conditional tram priority only when required (e.g. when running late and able to utilise the priority) as opposed to non-conditional priority based on the when the tram is at the intersection and may be unable to utilise the priority (e.g. not behind schedule and stopped to load and unload passengers).

Improving traffic signal priority for public transport (trams and buses) can improve the level of service of the public transport mode and make it more attractive for users. Therefore encouraging modal shift to this more sustainable mode of transport and away from personal car use. By implementing the priority when the public transport vehicle needs it and can use it, can minimise the impact on other road users.

Multi-modal Transport

Active transport which includes walking and cycling, is a key component of reducing transport emissions and creating a more sustainable transport system. Catering for active transport through improvements to the infrastructure can help to incentivise and encourage use of these modes either for the full journey or part of a multi-modal transport journey.

ARRB are well versed with providing guidance for the design of active transport infrastructure. This is through experience obtained by updating the Austroads Guide to Traffic Management Part 4 (GTM 4). This included incorporating and updating the Movement and Place, Network Operation Planning and Level of Service Frameworks into GTM 4. In addition, ARRB has prepared the Cycling Aspects of Austroads Guides and has practical experience through the provision of advice to a local city council on their Bicycle Strategy.

Enhanced Dataset for Congestion Management

Addressing congestion cost in our road network has always been a key initiative for a sustainable future. ARRB have been working on a three-year NACOE project which aims to provide an automatic system to report the cost of congestion (CoC) of a network with roads from different jurisdictions. Using a hybrid data model as the ultimate data source (which blends in multiple data sources including detection loops, Bluetooth devices and probe vehicles), this project developed a web-based software prototype designed to test the quality and performance of hybrid data. This is compared to currently available individual data sources.

The project has demonstrated sufficient confidence to the coverage, quality and accuracy of hybrid datasets and is intended as a starting point to enable road managers to apply the CoC methodology at a network level. The CoC prototype tool will provide significant benefits to road managers by enabling fast and accurate CoC comparisons between selected networks which will help improve decision-making and prioritisation of the congested management investment.

2. VEHICLE AND INFRASTRUCTURE TECHNOLOGY

As we improve our transport technology, our vehicle and operational efficiency improves, leading to a more sustainable outcome.

Smart infrastructure

Other technological advancements include the use of connected ITS infrastructure. This was demonstrated as part of the 'Evolution of Smart City Initiatives', undertaken for the Mornington Peninsula Shire. The project trialled smart technology, which included smart sensors, vision-based systems, and cloud-based analytics.

Smart technology can be used to improve the understanding of where spare parking spots are located and when bins need to be emptied as well as the quality of air and water. This allows for sustainable management of the operations of the town, through optimisation of time and fuel in tasks such as finding a car park or in sending garbage trucks to pick-up full bins.

CAV

The main driver for connected and autonomous vehicles (CAV) is to improve safety and convenience of road mobility. However, the evolution of these vehicles presents an opportunity to improve vehicle efficiency and reduce emissions in the transportation sector (refer to the discussion on Low and Zero Emission Vehicles below).

ARRB are currently working with iMOVE to establish a new automated probe vehicle as a test bed to enable applied research into the deployment of CAVs in Australia. The ARRB automated probe vehicle would be established as a standardised probe (automated) vehicle (up to Level 4). This would enable a benchmark for comparing with emerging CAV technologies going forward, enabling integrating and testing/benchmarking of technology (e.g. is the software tested capable of detecting glass bridge). This project is bringing together the research, transport, automotive and telecommunications industries in Australia to further understand the CAVs technology and infrastructure readiness as a first step towards a fully integrated intelligent transport system. This leads us one step closer to the connected, automated, and sustainable future.

Low and Zero Emission Vehicles

There is a need to move away from the current internal combustion engine, to reduce the emissions produced in the transportation sector. This requires the move to hybrid, electric or fuel cell electric vehicles, which requires an understanding of the current and future infrastructure and vehicles to allow for a smooth transition. The Mobility Futures team have experience in this, with work undertaken for Austroads assessing the key actions required by the road operators to support the transition to electric vehicles. Other work includes the assessment of electric vehicle charging infrastructure with regards to their lifecycle costs, and to quantify the environmental impact of electric vehicle fast-charging stations.

With new technology, refuelling infrastructure is also required, of which projects have been undertaken to review symbols and signage internationally for low and zero emission vehicles. This paves the way for the adoption of consistent symbols in the road rules and manuals. This is an important step in the adoption of the newer vehicles, as proper signage for infrastructure will provide the general public with recharging information, and help support uptake.

ARRB is also beginning to explore the viability of hydrogen fuel for heavy vehicle / freight operations in Australia and what role it can take in making the transport system more sustainable through the wider use of low and zero emission vehicles. Hydrogen is an emerging industry offering many opportunities to decarbonise industry. It can be used to power buses, heavy vehicles and smaller vehicles. Currently, ARRB is partnering with leading energy provider to deliver a high-level business case to determine the cost competitiveness of hydrogen fuel cell bus services in Queensland. The

assessment compares hydrogen against electric and diesel alternatives from a whole of life perspective, to determine the optimal use case, break even, timeframe and transition plan. The business case focuses on the transition to zero emissions and identifies where hydrogen buses add value to a fleet operation.

3. CONTACT US

If you would like to know more about how operational performance and vehicle and infrastructure technology can contribute to sustainable roads, please contact ARRB's Mobility Futures team at info@arrb.com.au to discuss further.

4. REFERENCE

Infrastructure Australia 2019, Urban Transport Crowding and Congestion, Supplementary report, Infrastructure Australia, Canberra, ACT, viewed 2 October 2021,