THE PATH TO NET ZERO: DECARBONISING AUSTRALIA'S TRANSPORT SYSTEM

AITPM Policy Issues Paper No 1

FOR CONSULTATION

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Contents

1. About AITPM

AITPM (the Australian Institute of Traffic Planning & Management) is the leading national membership body for Australia's transport professions. AITPM represents all practitioners working in transport, across fields including transport planning, transport and traffic engineering, transport modelling, active travel, travel demand management and travel behaviour change.

AITPM members and stakeholders work together to ensure multimodal transport systems are designed, built and operated in ways that support healthy people, communities and economies in all parts of Australia.

1.1. Why have we prepared this Policy Issues Paper?

When AITPM asks members and stakeholders what they see as the most important community challenges calling out for AITPM's advocacy, *'minimising transport's contribution to climate change'* sits near the top of people's concerns. They also state that better integration of land use and transport planning, and promoting active transport, are major priorities. With both of these being critical to reducing emissions generated by Australian transport projects and operations, the decarbonisation of the sector is appropriate as the subject to be addressed by AITPM's first Policy Issues Paper.

The Path to Net Zero: Decarbonising Australia's transport system has been prepared by a working group of AITPM members, bringing evidence to bear on recommended actions that will get Australian transport moving on its overdue journey towards achieving Net Zero.

Importantly, AITPM's recommendations address governments at all levels in Australia. They are also reflected in AITPM's own commitments as a peak body. Together, these recommendations and commitments act as a call to the nation's transport community to take concerted action.

On that basis, AITPM has prepared this Policy Issues Paper to:

- Advocate for clear and targeted policy directions that all governments in Australia should adopt
- Establish best practice for transport professionals taking a critical role in implementing Net Zero in their everyday work
- Provide a pathway for AITPM, working with other professional and industry bodies, to advocate for a fully decarbonised transport sector
- Educate the broader community on the role of transport in achieving Net Zero.

2. At a glance: AITPM recommendations and commitments

The Path to Net Zero recommends that all levels of government, and the private sector, should adopt an Avoid-Shift-Improve approach to rapidly decarbonise Australia's transport sector. That is, planning and investment should, in order of priority: seek to minimise the need to travel; consider no-build and low-build alternatives to transport infrastructure; invest in, and promote, the shift to more sustainable travel modes; and roll out low and zero-carbon fuels and technologies.

This paper sets out 21 recommendations that all three levels of government – the Australian Government, State and Territory governments, and local governments – should take on board if they are seriously committed to decarbonising our transport systems. It also includes actions that AITPM will take to demonstrate leadership, in collaboration with other professional and industry associations, to show that the transport sector is part of the solution.

Broadly, these recommendations cover four key areas:

AVOID the need to travel, and the need for more infrastructure

Integrate land use, digital and transport infrastructure based on:
- Smarter planning
- Building for tomorrow's vision, not yesterday's forecast.

SHIFT to sustainable transport modes

Transform people's travel choices through:
- Behaviour change
- Public, active and shared mobility
- Pricing mechanisms
- Low Emission Zones.

IMPROVE how vehicles are powered to move and infrastructure is built

Provide efficient and modern vehicles and systems for:
- Different modes of travel
- Efficient transport networks and materials
- Low-carbon materials.

LEAD the way to rapid decarbonisation

Address the governance and systems that enable decarbonisation including:
- The role of carbon budgets
- Alignment of guidance and action
- Decision-making delegated to the most effective level
- The power of funding.

2.1.   AITPM's commitments

1. AITPM will collaborate with other professional and industry associations to advocate to governments to implement an integrated and decarbonisation-positive approach to urban policy, planning and housing development.

2. In order to influence a shift to sustainable transport, AITPM will advocate for improved access to, and information about, active and public transport. These choices should be easy, appealing and affordable for a broad range of the community, including children, the elderly, people living with a disability, and people in different socio-economic groups.

3. AITPM will advocate for governments and other stakeholders to achieve Net Zero across the transport sector. To do this, AITPM will support the Australian transport community in:

    –   envisioning the preferred Net Zero mobility future for Australia

    –   using the Avoid–Shift–Improve model to identify and prioritise interventions

    –   integrating diverse and multidisciplinary solutions.

4. By curating resources, promoting training and sharing technical expertise, AITPM will enlarge the transport profession's capacity to evaluate decarbonisation-related challenges and opportunities at each stage in the transport project lifecycle.

3.   A framework for Australia's Net Zero journey

Adopt and apply the 'Avoid–Shift–Improve' approach to decarbonise the transport sector. Planning and decision-making should follow this order of priorities.

The Australian Government has enshrined in law the target of Net Zero greenhouse gas emissions by 2050 and an interim 2030 emissions reduction target of 43 per cent below 2005 levels.[i]

Carbon emissions from transport account for nearly 20 per cent of Australia's total. This makes transport the second largest-contributing sector after energy. Just under two-thirds of transport emissions come from the use of cars, utes and vans.[ii]

Unlike other sectors, Australian transport emissions have stubbornly continued to rise even as internal combustion engines have become cleaner. Australia's fleet of 20 million vehicles is among the oldest and most polluting of the world's advanced economies.[iii] It is also super-sized, with the trend towards larger and heavier vehicles contributing to the persistence of high transport emissions. In 2011 SUVs made up less than one in four of new car sales in Australia. By 2023 this had risen nearly 59 per cent and passenger sedans plummeted to 16 per cent.[ivv]

TRANSPORT EMISSIONS PER CAPITA
(excluding aviation) tonnes of CO_2 per capita in 2021
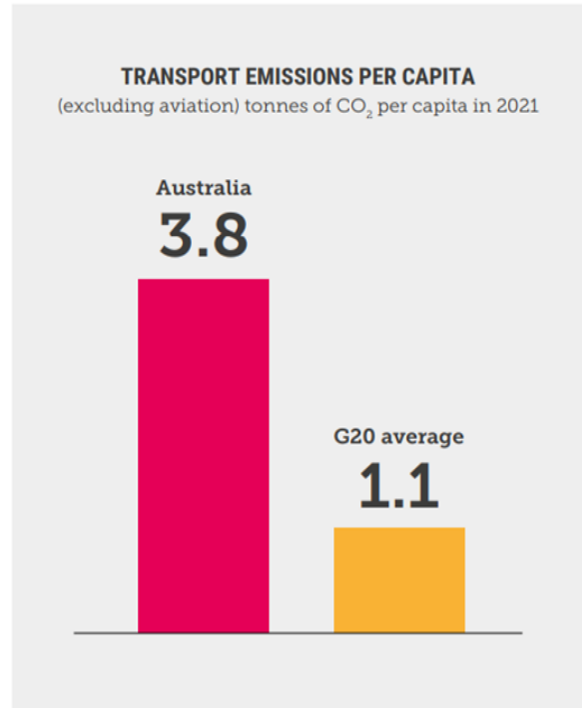
Australia
3.8

G20 average
1.1

Figure 1: Transport emissions per capita for Australia compared to the G20 average (source: Climate Transparency, 2022)

Australian per-capita transport emissions are more than three times the average seen across all of the G20 developed and economically advanced nations (Figure 1). Our vehicles are dirty and – as a function of the ways in which Australian land uses and transport systems have evolved – we use them a lot.

3.1.   The Avoid–Shift–Improve approach

Avoid–Shift–Improve is a useful framework to encompass the suite of actions needed to reduce Australia's transport emissions. It spans initiatives to be taken within different timeframes, under three categories:

− smarter land use and transport planning will enable Australians to **avoid** the need to travel, as well as shortening people's trips and reducing the distance that freight needs to be transported. Additionally, it **avoids** the need to build significantly more roads

− when travel is required, the focus should be on enabling Australians to **shift** their transport mode of choice away from driving and towards sustainable public and active transport

− we must concurrently **improve** the efficiency of vehicles – mainly through electrification of the fleet – and reduce the carbon emissions associated with the infrastructure that they use.

3.2. Avoid–Shift–Improve benefits

Australia's Climate Change Act (2022) requires reducing national greenhouse gas emissions by 43 per cent below 2005 levels by 2030, and to zero by 2050.[vi] In order for Australia's transport sector to stay aligned with this legislated target, it will need to avoid emitting a total of 1,330 MtCO$_2$-e between 2025 and 2050 (Figure 2).[vii]
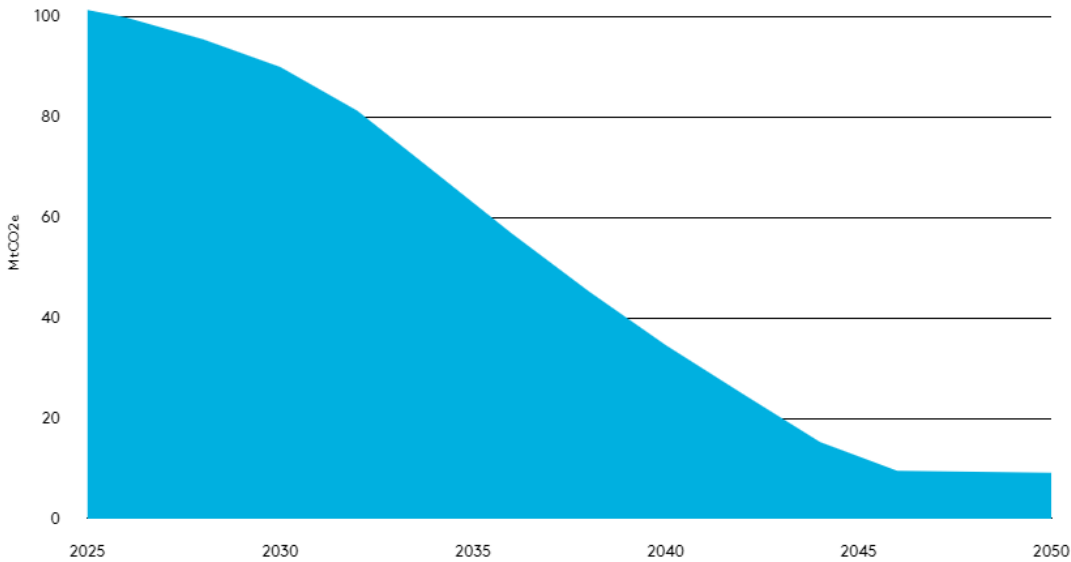

Figure 2: Transport sector emissions reduction required, 2025-2050 (source: Climateworks Centre, 2023)

Meeting this objective will require a mix of different interventions. While the large-scale transition to electric vehicles is essential to Australia achieving Net Zero, 'Improve' actions in this area will not be enough on their own for targets to be met. Supporting the use of multifaceted and diverse 'Avoid-Shift' actions, Climateworks Centre research highlights how measures to reduce overall travel and shift trips away from driving are essential to meet our Net Zero targets.[viii] Such measures reduce our reliance on technological change alone – while offering extra affordability, user health, transport safety and network decongestion benefits that electric vehicles will not deliver.

AITPM recommendation 1

All levels of government should adopt an 'Avoid–Shift–Improve' approach to decarbonise the transport sector. Planning and decision-making should follow this order of priorities:

1. Minimise the need to travel, and enable people to travel shorter distances for their daily needs.

2. Give robust consideration to no-build and low-build solutions.

3. Invest in, and promote, the shift to more sustainable travel modes.

4. Roll out low and zero-carbon fuels and technologies across the private and commercial vehicle fleet.

The 'Avoid–Shift–Improve' framework provides a robust structure for this Policy Issues Paper. The following three sections address each category of intervention in turn. A final section outlines the governance structures and other systemic changes required to **lead** transport Net Zero actions.

4. Avoid the need to travel, and the need for more infrastructure

Integrate land use, digital and transport planning for fewer and shorter journeys, through:

- **Smarter planning**

- **Building for tomorrow's vision, not yesterday's forecast.**

Even under the most optimistic Shift-Improve scenarios, Australia will still need to reduce its reliance on driving to meet our targets. Modelling by the Climateworks Centre shows that, by 2035, Australia will need to reduce passenger kilometres travelled by 10 per cent and freight-tonne kilometres travelled by five per cent.[ix]

Likewise, the UK's Climate Change Committee has identified the critical role of demand reduction for that country to meet its emissions reduction target.[x] This points to the need for a decrease of up to four per cent in vehicle kilometres travelled by 2030, and of between four and 12 per cent by 2050. Transport for London has calculated that for that city to reach its 2030 Net Zero target there will need to be a 27 per cent reduction in the total distance travelled by cars.[xi]

4.1. Smarter planning

There is a clear connection between spatial planning, travel demand, mode choice and carbon emissions. Research shows that one of the most effective decarbonisation levers that governments can use is to get spatial planning right. This can be the primary mechanism both for avoiding the need to travel, and for enabling the shift to more sustainable transport.[xii]

Smarter planning for an efficient transport and land use system is characterised by:

- compact, mixed use urban development that minimises the need to travel long distances for everyday needs[xiii]

- high quality walking and cycling networks to access local destinations

- frequent, reliable and integrated public transport services for medium to long-distance travel.

These outcomes are increasingly supported by digital systems that enable remote working, learning, deliveries and access to services, as an alternative to personal travel.

The need for integrated transport and land use planning has long been understood. However, metropolitan planning systems in all Australian cities continue to provide for a significant portion of new developments in areas that may never be able to sustain a high-quality public transport system.[xiv]

Attempting to encourage sustainable travel behaviour in car-dependent communities with inadequate public transport, hostile conditions for active transport and few local services will continue to fuel the cycle of car dependence in Australia's suburbs.

Infrastructure Victoria has recommended that we urgently need to address perverse planning rules and subsidies that enable and fuel outwards urban expansion, and instead focus on compact development that is more economically and environmentally sound.[xv] Likewise, National Cabinet

has signalled reforms to address the growth of cities and suburbs, including an independent review of infrastructure investment.[xvi]

The Planning Institute of Australia recommends setting universal minimum targets for all precincts to reduced reliance on cars, and to provide walkable streets. This would be expressed, for example, through the modernising of car parking provisions to align with Public Transport Accessibility Level (PTAL) ratings, and the removal of minimum car parking requirements.[xvii]

These directions present the opportunity for AITPM to work with relevant professional and industry associations to advocate for the best integrated land use and transport policy outcomes.

AITPM recommendation 2

Planning authorities in State and local governments should set mandated targets, supported by regulations, that ensure that all new housing and other urban development is delivered in locations that offer:

- High-quality, high-frequency public transport within a reasonable walking distance

- A mix of land uses, so that residents are able to reach their daily needs within a 15-minute walk or bicycle ride

- Less than 30 per cent single detached dwellings

- Permeable street layouts, with at least 45 intersections per square kilometre.

AITPM recommendation 3

Planning authorities in State and local governments should remove minimum car parking mandates for urban developments, and significantly reduce the demand for car parking, in line with world's best practice.

AITPM commitment 1

AITPM will collaborate with other professional and industry associations to advocate to governments to implement an integrated and decarbonisation-positive approach to urban policy, planning and housing development.

4.2. Building for tomorrow's vision, not yesterday's forecast

The scale of road building in Australia is large by global standards. Since 2011, NSW has seen a boom in spending on major transport projects, with much of this directed towards major roads. In 2022-23 alone capital expenditure by Transport for NSW totalled $21.3 billion, or $2,608 for each person in the state. [xviii] In contrast, Transport for London's capital budget for this period was equivalent to about $393 per person in that world city. [xix]

Similarly to NSW, Victoria, Queensland and Western Australia continue to invest heavily in road building as a solution to transport challenges facing urban as well as rural areas.

Road building is a carbon-intensive activity in itself, and by enabling rates of private motoring to continue or even increase, road building at the level seen in Australia generates carbon emissions

incompatible with Australia's legislated reduction targets. It reveals governments to be missing the opportunity of a more balanced approach that could deliver a range of sustainable transport choices, from intercity high-speed rail to the integration of first and last-mile public and active transport networks.

Both NSW and, in the UK, Wales are experiencing similar rates of population growth. Unlike Australia's largest state, however, Wales reviewed its entire proposed road-building program in 2023 and concluded that most major road schemes in the pipeline were incompatible with national policies for decarbonisation and the wellbeing of future generations. This review highlighted that many projects had failed to establish a robust business case or demonstrate value for money.[xx] As a result, many previously proposed Welsh road projects have been cancelled or modified, with associated funding reallocated to active and public transport.

By diverting investment away from major road-building and road-widening works, we can avoid the need for carbon-intensive infrastructure building, and instead focus on sustainable transport and 'sweating' our road assets.

AITPM recommendation 4

The Australian Government, in partnership with State and Territory governments, should instigate an 'Australian Roads Review' as part of its Net Zero Roadmap. This would examine the contribution of proposed projects towards emissions, their compatibility with Net Zero targets and the value for money they offer in the context of an updated price for carbon, when compared to alternative transport investments. This information should be used to inform future priorities.

5. Shift to sustainable transport modes

Transform people's travel choices through:

- **Behaviour change**

- **Public, active and shared mobility**

- **Pricing mechanisms**

- **Low emission zones.**

5.1. Enable behaviour change

A meta-analysis of a wide range of behaviour change interventions found that 'access' (to material or logistical resources to facilitate new behaviour) has the largest effect on change, followed by social support (information or financial assistance) until the new behaviour becomes habitual (automatic, efficient and without awareness).[xxi]

Applied to travel, this means that the most effective way of changing travel behaviour is to provide access to safe, attractive and efficient public transport services, walking and cycling infrastructure, and e-bikes. This needs to be reinforced with information, and potentially financial assistance, to ensure that people are armed with enough knowledge and incentive to make the travel behaviour habituated.

Reinforcing this, Transport for NSW has shown that personal travel options need to align with four criteria: easy, attractive, social and timelyy.[xxii] Switching people's habitual choice requires that sustainable options are even more attractive, easy and fast than driving. This may require driving to be made more difficult and expensive where there are easy alternatives; for example, through parking charges, or making driving routes less direct than walking or cycling.

In Western Australia, the Department of Transport has been running travel behaviour change programs with some success for a number of years. 'Your Move' is a WA engagement program that helps people with information and support to make it easier for them to walk, wheel and ride to the places they need to go. The program aims to improve the health and wellbeing of children and adults and reduce the traffic congestion and environmental impacts arising from car use. A flagship program initiative is 'Your Move Schools', which supports government, industry and community efforts to encourage increased rates of walking and riding to school. There are currently over 270 Your Move schools in WA, reaping the benefits of a comprehensive active travel support program.

A recent trial by Uber Australia demonstrated the success of improved access and information. It showed that people given access to four different modes of transport reduced their car use by 88 per cent; and increased bike-riding by 322 per cent, train by 156 per cent, and bus by 86 per cent.[xxiii]

AITPM recommendation 5

All levels of government should incentivise travel behaviour change through these actions:

- Fund and deliver incentives for sustainable travel, such as e-bike subsidies, shared mobility rebates and reduced fares for disadvantaged groups

- In tandem with improved access to sustainable transport, provide targeted information that enables people to make informed travel decisions

- Disincentivise the appeal and convenience of short-distance travel by private motor vehicle.

AITPM commitment 2

In order to influence a shift to sustainable transport, AITPM will advocate for improved access to, and information about, active and public transport. We believe it should be easy, appealing and affordable for a broad range of the community, including children, the elderly, people living with a disability, and people in different socio-economic areas.

5.2. Invest in walking, cycling and micromobility

Walking is fundamental to all forms of transport: there are more than 1.5 billion walking and bike riding trips a year in NSW alone, and nearly all public transport journeys require a walk to the station or stop.[xxiv] Yet walking is particularly overlooked as a mode of transport, and passed on to local governments to fund, deliver and maintain.

People walking, riding and scooting often need to share the same path, although they are largely incompatible due to their relatively different speeds. In locations with medium to high volumes of people walking or cycling, users need to be separated from each other. They also need to be separated from vehicular traffic, except in locations where traffic is low and speeds are less than 30 km/h. In order for walking and cycling infrastructure to be easily used by people of all ages and abilities, it needs to be safe, fully connected, direct, attractive, and comfortable.[xxv] Bicycles also require adequate parking at destinations – whether at public transport, in public spaces, at home or at work.

Electric-assisted micromobility (such as e-bikes, cargo bikes and e-scooters), as well as share bikes, are proving a game-changer for personal travel and last-mile goods delivery. The sale of e-bikes has accelerated in Australia and overseas because they overcome most of the usual barriers to riding, including hilly topography, hot or humid weather, and the need to carry goods, children or dogs (all of which are possible using cargo bikes).[xxvi]

Governments in many nations, from Ireland to the Netherlands and Sweden, invest up to 20 per cent of their transport budgets in walking and cycling, while in Australia investment sits around one per cent or less across most jurisdictions. This under-investment is resulting in significantly constrained levels of walking and cycling in our urban areas, with consequences for emissions, health, equity and basic accessibility.

> ### AITPM recommendation 5
>
> Governments should allocate between 10 and 20 per cent of transport budgets to walking and cycling infrastructure, in line with world's best practice.
>
> All levels of government should prioritise the planning, funding, delivery and maintenance of active transport infrastructure in accordance with delivering these outcomes:
>
> – Footpath and cycling networks that are safe, direct, connected, comfortable to use, attractive and adaptable to change
>
> – Facilities that are fully separated from high-speed and high-volume traffic
>
> – Extensive bicycle parking and shared mobility facilities.

5.3. Extend the reach and appeal of public transport

Many cities aim to ensure that public transport capital works and services keep up with population growth. In China and India, investment programs are developing metros, mass transit systems and active mobility infrastructure in all main metropolitan areas as a matter of urgency.[xxvii] Likewise, in Indonesia and Singapore new housing developments are planned to integrate with light rail, bus rapid transit and metro.

Complementing these capital investments are incentives such as making the cost of public transport travel lower than car use and ensuring that the frequency and quality of services out-compete driving.

This is often not the case in Australia, with public transport services lacking flexibility due to long-standing contractual obligations, and a lack of investment in capital works and services in comparison with road infrastructure investment. In many locations, particularly outer metropolitan locations and regional towns, public transport is largely absent, and unlikely to be sustainable in the future.

> ### AITPM recommendation 6
>
> All levels of government should use all levers at their disposal to enable maximum mode shift from driving to public transport, including through:
>
> – Growing public transport services faster than road networks
>
> – Reducing the price of public transport in comparison to driving
>
> – Improving public transport travel times and ease of use relative to car travel.

5.4. Promote shared mobility

Shared mobility programs provide for the shared use of fleets of e-bikes, e-scooters, cars, utes and vans. Compared to private vehicle ownership these offer easy and more affordable access to a wide range of transport options that are responsive to a person's needs for the task at hand. The shared

transport continuum extends to demand-responsive transport services, where the timetable, route, vehicle assignment and/or operator choice can adapt flexibly in response to user demand.

People with access to shared mobility, including shared cars, are more likely to choose other options than driving for many day-to-day trips.[xxviii] As well as enabling people to own fewer cars, and drive less often, shared mobility can reduce transport disadvantage and social exclusion because it mitigates the prohibitive cost of car ownership that is a hurdle faced by many households.

AITPM recommendation 7

All levels of government should facilitate reduced car ownership by improving access to shared mobility choices, with a particular focus on:

– Providing specific parking allocations for shared vehicles

– Areas where people experience transport disadvantage, including in regional towns and low-income areas

– Urban areas (including in regional and rural locations) with small and/or declining populations.

5.5. Pricing mechanisms

Adjusting the way motorists pay for using roads can create a cleaner, lower-emissions mobility system that is also more equitable and financially resilient.[xxix] Road pricing mechanisms such as city centre cordons, distance-based pricing and kerbside (parking) pricing are 'push' measures to promote modal shift and reduce travel demand.

A voluntary trial, through Transurban, by over 1,600 motorists in Melbourne in 2016 addressed the impact and user acceptance of different road pricing regimes (including usage-based and congestion-based models).[xxx] The trial identified scenarios where public transport use increased by 21-30 per cent, walking increased by 17-23 per cent and cycling increased by between one and five per cent – all of which would result in an overall reduction in transport emissions.

Parking charges can also play a role in incentivising sustainable transport. Yarra City Council recently decided to investigate increasing parking charges for larger and higher-emitting vehicles.[xxxi] Such an initiative would if implemented follow the example of Paris, where parking fees for SUVs were trebled following a public referendum.[xxxii]

AITPM recommendation 8

All levels of government should develop and apply a range of differential pricing mechanisms to incentivise mode shift and the use of lower-carbon transport options. Mechanisms can include:

– Kerbside and off-street parking regimes

– Road user charging reform.

5.6.   Low Emission Zones

Low Emission Zones (LEZs) are areas where vehicles which produce more than a specified amount of CO_2-e per km are either not permitted to travel, or are subject to a charge in order to reduce emissions and improve air quality.

There are many LEZs currently operating in European cities, with Paris planning to go even further by banning all petrol and diesel-powered vehicles from entering the city from 2030. [xxxiii] The London LEZ was introduced in 2008, and extended in 2019 and 2023 as an Ultra Low Emission Zone (ULEZ) to form the largest clean air zone in the world. Non-compliant vehicles are subject to a daily charge – in addition to the £15 congestion charge where also applicable. Monitoring of the London ULEZ shows it to have been highly effective in reducing the number of older and more polluting vehicles in the UK capital. The ULEZ has saved 800,000 tonnes of CO_2 emissions between 2019 and 2022 as well as reducing NO_2 pollution by almost 50 per cent. [xxxiv]

AITPM recommendation 9

Local governments should progressively roll out Low Emission Zones and incentivise low and zero-emission vehicles through multiple policy levers.

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6. Improve how vehicles are powered to move and infrastructure is built

Provide efficient and modern vehicles and systems for:

- **Different modes of travel**

- **Efficient transport networks and materials**

- **Low-carbon materials.**

In the face of climate change, cities and communities across the globe are fast adopting low and zero-carbon transport technologies. Emissions reduction targets and fuel efficiency standards have pushed vehicle manufacturers to increase the production of low or zero emission vehicles (ZEVs) to replace internal combustion engine vehicles (ICEVs).

The availability and affordability of ZEV technology varies by travel mode, with 'hard-to-abate' sectors such as heavy road vehicles, maritime and aviation lagging behind smaller, lighter vehicles. To decarbonise Australian transport operations, a multimodal approach is essential. This will have to encompass a variety of vehicle technologies and alternative fuels.

In addition, technological solutions need to be complemented by pricing mechanisms, consistent with approaches described in the previous section. For example, the application of low-carbon standards can be reinforced by pricing the carbon emissions of transport power sources, through mechanisms such as a carbon tax.

6.1. Different modes of travel

This section addresses the decarbonisation of these travel modes:

- cars, vans and microfreight

- trucks and buses

- rail

- maritime

- aviation.

6.1.1. Cars, vans and microfreight

The amount of emissions released by light vehicles can be significantly reduced by transitioning away from fossil-fuelled ICEVs and towards ZEVs. An evolving range of engine and fuel types is available, producing lower emissions than the internal combustion engine.

The Australian motor vehicle fleet is currently dominated by ICEVs. The number of electric vehicles of all types that are being purchased in Australia is increasing gradually, from less than one percent (prior to 2022) to just over eight per cent in 2023.[xxxv] The recent introduction by the Australian Government of an Australian New Vehicle Efficiency Standard (NVES) should lead to the increased availability of cleaner, cheaper-to-run vehicles in the local market as international manufacturers and distributors respond to increased Australian demand.

Supported by smarter planning and network management interventions, a wider variety of microfreight vehicles, such as electric cargo bikes, can replace vans and delivery trucks in congested city settings. The use of low and zero-emission last-mile delivery technologies will be enabled by the operation of small city-edge freight depots and smart kerbside parking regimes that control loading zone access.

AITPM recommendation 10

The Australian Government should incentivise the increased supply of zero-emission vehicles through both new and second-hand markets including through:

- Signalling its intention to tighten the NVES at each review

- Progressive reductions in import-related costs

- Targeted purchaser-specific subsidies

- Reform of subsidies and tax breaks for higher-polluting vehicles.

AITPM recommendation 11

All levels of government should accelerate the roll-out of:

- Publicly accessible EV charging infrastructure

- Facilities to support microfreight operations for last-mile deliveries.

6.1.2. Trucks and buses

Compared to diesel-powered vehicles, electric trucks are likely to require shorter range and lighter payload trade-offs – at least until battery technology and charging infrastructure access improves.[xxxvi] Hydrogen or other low-carbon liquid fuels may be required for larger payloads and distances, with consideration having to be given to the pavement damage impact of heavy vehicles.

The Australian Government is currently working with States and Territories to remove axle width and mass-related regulatory barriers to the adoption of Euro VI diesel engine standards. These will impose requirements for advanced fuel-saving technologies onto Australian models as for other countries. However, Euro VI mass limits will still limit the deployment of larger battery electric truck models. Although this technology may become lighter over time, further reforms to mass limits will be necessary to increase the range of zero-emission trucks available in Australia.

For buses, fleet electrification is well under way, albeit at various rates in different jurisdictions. The Queensland Government, for one, has adopted a policy that from 2025 it will only be purchasing zero-emission buses.[xxxvii] Currently, the upfront capital cost of electrifying bus depots remains a major barrier, and electric buses make up only 0.2 per cent of Australia's bus fleet.[xxxviii]

This percentage will grow as technological improvements are brought to bear on the sector. The under-development bus-based 'Brisbane Metro' system, for example, incorporates flash-charging infrastructure that will enable the electric fleet to recharge during the time taken to drop off and pick up passengers.

AITPM recommendation 12

Governments should enable the reduction of heavy vehicle emissions through the following actions:

– Accelerate an update to Australian Design Rules to allow the uptake of heavier battery and fuel cell-powered trucks and buses

– Support the production of renewable biodiesel as a transition fuel to support short-term emission reductions while other technologies continue to be developed

– Provide access to low-cost loans or other financial incentives for operators to purchase zero-emission vehicles

– Support the roll-out of electric vehicle recharging and hydrogen refuelling infrastructure where needed to reduce reliance on internal combustion engine vehicles in remote areas and/or for long supply chains.

6.1.3. Rail

Electric rail is considered a lower-emission transport solution than other motorised modes, when powered with renewable energy. This makes the shift of freight and passenger movements from road to rail an important emissions reduction strategy, wherever the opportunity exists.

Currently just 11 per cent of Australia's rail network is electrified, with the balance of the network being used by diesel-powered locomotives. Network electrification is only financially viable for intensively used lines, such as inner-city passenger networks. While the electrification of long-distance freight lines remains difficult to justify economically without a higher carbon price, battery electric locomotives (BELs) are emerging as an economical option.

Battery electric locomotives are being trialled by resource companies in the Pilbara, under a vision for 'infinity trains' that recharge their batteries through regenerative braking on downhill track sections, reducing the need for external recharging. In some situations, hydrogen fuel cell electric locomotives may be more appropriate. The University of Queensland found this likely to be the case for high-energy routes of approximately 1,000 km in length.[xxxix]

AITPM recommendation 13

The Australian, State and Territory governments should adopt priorities from the Australasian Railway Association's *Critical path to decarbonise Australia's rolling stock* report (July 2024), including:

– Establish a shared vision across government and industry, and a long-term plan

– Invest in and provide financing for the electrification and decarbonisation of railway lines in urban areas

– Support continuing trials of the use of fuel cell electric and battery electric locomotive technology for freight rail

– Develop enabling infrastructure to support the transition.

6.1.4. Maritime

Maritime is another hard-to-electrify transport sector. Low carbon liquid fuels, hydrogen-derived fuels (such as green hydrogen, green ammonia and e-methanol) and vessel electrification and energy efficiency improvements will all likely be needed to decarbonise maritime transport. Actions under the Australian Government's *Maritime Emissions Reduction National Action Plan* will aim to decarbonise the nation's domestic maritime transport sector, as well as our contribution to international shipping emissions. Australia's reliance on international vessels for coastal shipping services means international decisions influence the decarbonisation of maritime transport.

Low-emissions technology suitability varies by vessel size and duty cycle. Electrification has emerged as a suitable option for small boats with electric outboards – and is already available for vessels shorter than seven metres. Urban passenger ferries also make good candidates for electrification because they typically travel short distances between periods spent at a base wharf, allowing them to be recharged at this point of origin.

> **AITPM recommendation 14**
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> The Australian, State and Territory governments should support the production and availability of renewable biodiesel and advanced biofuels for use in the maritime sector.

6.1.5. Aviation

Production and use of sustainable aviation fuel (SAF) will be the primary technological focus of efforts to reduce aviation emissions in the short to medium term. Types of SAF are already available for use in existing engines without the need for substantial retrofitting ('drop-in fuels'). Governments can encourage the development and deployment of SAF and other low-carbon liquid fuels, including opportunities to expand domestic SAF production capacity. However, it is important to note that the amount of land, water and feedstocks required to produce LCLFs (including SAF) means their usage will need to be prioritised, as domestic supply will not be sufficient for these fuels to be used across all sectors.

Other technologies such as battery electric and hydrogen-powered aircraft are expected to be trialled in Australia by regional domestic airlines. In the longer term, the potential development of electric high-speed rail lines connecting Australia's larger cities offers the opportunity to reduce reliance on aviation for some intensively serviced passenger routes.

> **AITPM recommendation 15**
>
> The Australian Government should reduce aviation carbon emissions through the following:
>
> – Support the production of sustainable aviation fuel
>
> – Enable trials of battery electric planes and passenger and non-passenger drones in regional areas
>
> – Invest in electric high-speed rail networks.

6.2. Efficient transport networks and systems

Transport networks can be actively managed so that their operation results in lower emissions being generated per person or vehicle using the network than would otherwise be the case. For instance, network management can prioritise bus movements, or the ease with which people walking or cycling can cross the road.

Cooperative Intelligent Transport Systems (C-ITS) combine information technology and mobile communications advancements to enable data and command sharing between vehicles, roadside infrastructure and central management systems. As well as reducing the intensity of emissions generation due to network operations, this can improve safety outcomes. Traffic microsimulation trials comparing C-ITS operations with existing methods indicate potential delay reduction benefits of about 10 per cent when at least 20 per cent of motor vehicles (and roadside infrastructure) are C-ITS-enabled.

AITPM recommendation 16

The Australian, State and Territory governments should ensure that their support for Cooperative Intelligent Transport Systems delivers benefits for high-occupancy passenger and high-productivity freight vehicles in preference to low-occupancy cars.

6.3. Low-carbon materials

A 2023 analysis by the Institution of Structural Engineers on materials decarbonisation found a significant gap between the decarbonisation trajectories for key materials – including steel and concrete – and the trajectories required to achieve Net Zero by 2050 (see Figure 3).[xl]

In the case of road building, carbon savings of approximately 10 per cent are possible through more efficient design while a further saving of this order is possible through the use of new technology and lower-carbon concrete. Overall, a carbon saving of around 20 per cent compared to 'business as usual' is theoretically achievable before significant additional costs begin to be incurred.

Even if all roads were being constructed in Australia using these best-practice methods – and they most certainly are not at present – a 20 per cent reduction in embodied carbon does not come close to the required Net Zero pathway. It is therefore not surprising that IStructE's Hierarchy of Net Zero Design emphasises that 'using less stuff, (i.e., 'reduce') is the first recourse if we are to achieve the recommended IPCC emissions reduction trajectory. This principle does not just relate to more efficient design; according to the IStructE hierarchy, the first question that should be asked by a structural engineer is: 'Is construction the answer?'. This approach is consistent with PAS2080 – the world's first specification for managing whole-life carbon in infrastructure.

As previously noted, in road building, as in most sectors, we cannot rely on technological innovation to bring emissions down at the rate required. We must challenge the need to build in the first place.
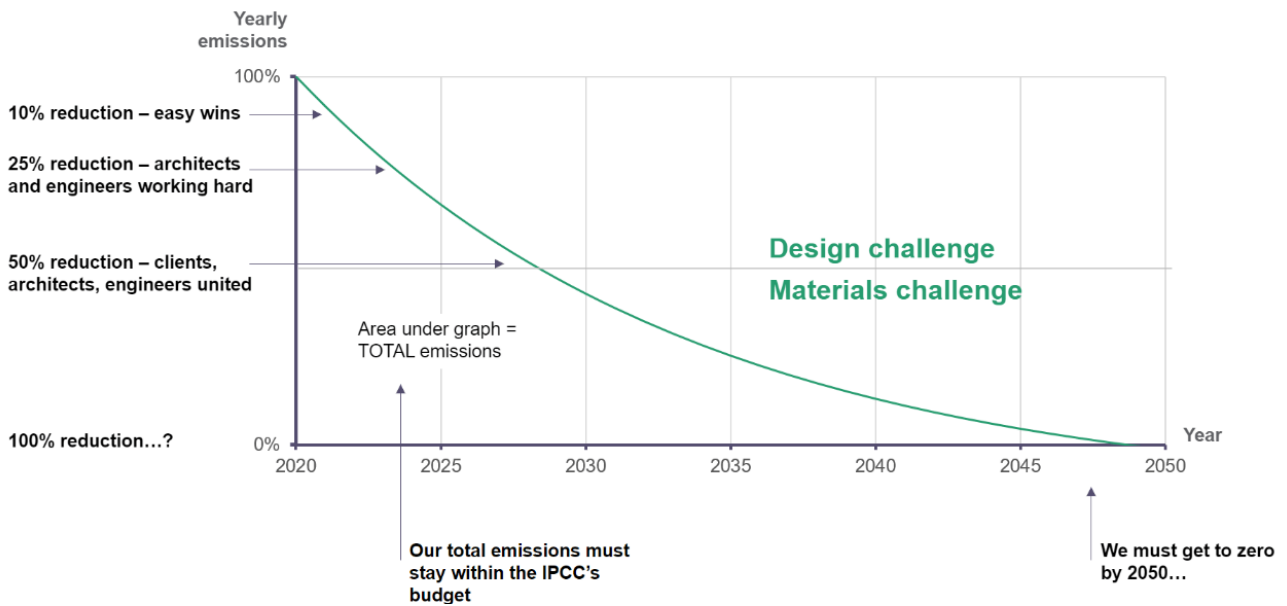
Figure 3: Net Zero design challenges (source: Institution of Structural Engineers)

AITPM recommendation 17

The Australian, State and Territory governments should address the significant embodied carbon cost associated with transport infrastructure, particularly road building, and transparently confront the decarbonisation challenge, including by:

   a) Consistently challenging the need to build new transport infrastructure

   b) Instead, looking to low-build and no-build solutions that optimise the use of existing assets

   c) Adopting the Infrastructure Sustainability Council's infrastructure sustainability ratings scheme for all major transport projects

   d) Providing funding and other resources to support research into ways of reducing embodied emissions.

7. Lead the way to rapid decarbonisation

Address the governance and systems that enable decarbonisation including:

- **The role of carbon budgets**

- **Alignment of guidance and action**

- **Decision-making delegated to the most effective level**

- **The power of funding.**

Bold leadership is needed. There is a need to reform governance and structural systems to dismantle barriers and catalyse the transition to low and zero-carbon Australian transport. Leadership must sustain urgent collective action to mitigate the environmental impact of one of the world's most egregious greenhouse gas-emitting sectors

Government policies should align with private sector initiatives, incentivise innovation and keep pace with the community's willingness to adopt greener travel habits. The flow-on benefits of cleaner, greener transport solutions must be equitably shared. Wherever successful and relevant examples of good practice are to be found, these must be leveraged to accelerate Australia's shift to sustainable mobility.

This paper proposes governance that embraces innovation, is oriented towards achieving robust targets, and ensures equitable access for all of the Australian community to the benefits of decarbonised transport systems.

AITPM commitment 3

AITPM will advocate for governments and other stakeholders to achieve Net Zero across the transport sector. To do this, AITPM will support the Australian transport community in:

- Envisioning the preferred Net Zero mobility future for Australia

- Using the Avoid–Shift–Improve model to identify and prioritise interventions

- Integrating diverse and multidisciplinary solutions.

7.1. The role of carbon budgets

In Australia there is a strong focus on the Net Zero timeline; however, carbon budgets are actually more important. The starting premise of this concept is that there is a finite amount of carbon we can emit to stay within bounds set by international agreements. Carbon budgets seek to take a nationally determined contribution and split that between sectors of an economy. The carbon budget allocations recognise that different sectors and different places decarbonise at different rates.

Carbon budgets have played a crucial role in delivering the United Kingdom's decarbonisation agenda. In the UK there is a legal requirement for the Government to demonstrate its progress towards five-yearly carbon budgets that are set by an independent body, the Climate Change

Committee. In Australia we should be looking to adopt a similar legal framework and governance process to introduce accountability and transparency into the decarbonisation effort.

At present, the transport sector's Net Zero roadmap focuses heavily on technology, with there being general uncertainty about whether the transition to EVs will achieve decarbonisation at the necessary pace or scale. There is also no contingency plan in place should additional measures be needed to close the emissions gap.

A robust carbon budget process allows for different pathways and policy scenarios to be modelled to account for uncertain futures, while always maintaining a Net Zero trajectory that accords with international obligations.

AITPM recommendation 18

The Australian Government should lead other levels of government, and involve the broader community, in developing a target-based framework to guide the decarbonisation of transport. This framework should:

- Be founded on a science-based carbon budget

- Set specific, time-based targets for the implementation of actions, and the measurement and achievement of outcomes

- Among these, set targets for mode shift and reductions in VKT (both total and per capita)

- Specify monitoring mechanisms and periodic reporting.

7.2. Alignment of guidance and action

At a high level, Australian Government guidance on transport decarbonisation aligns upwards with the international imperative to achieve Net Zero. Recognising transport as the third-largest source of greenhouse gas emissions in this country, the Australian Government has already sketched out the draft roadmap to a Net Zero future for this sector (among others).[xli]

The alignment of transport decarbonisation guidance must now flow downwards and outwards to ensure that the actions taken over the next 25 years and more by other sectors and levels of government are mutually supportive and highly effective. This calls for the Australian transport community to fully consider user emissions through our approaches to assessing and prioritising projects.

7.2.1. Modelling and appraisal

AITPM is strongly connected to technical traffic and transport planning domains, including the deployment of modelling tools to inform evidence-based network investment and management decisions. These domains should now expand to integrate emerging methods for assessing the carbon intensity of transport projects and operating scenarios. As developed by the cross-jurisdictional Austroads collective, and endorsed by Infrastructure Australia, methods should be applied that align with these approaches:

- **Damage cost** – Estimating the opportunity cost to society, and the cost of repairing environmental systems and infrastructure, arising from the damage caused by emissions

– **Avoidance (abatement) cost** – Estimating the cost of preventing or mitigating the environmental damage associated with transport investments and operations

– **Social cost of carbon** – Estimating the present value of the cost of all environmental damage caused by transport emissions.[xlii]

7.2.2. Vision and validate

In the Australian context, a vision for transport is a strategic plan that outlines the future direction and goals of the country's transport system. For instance, all governments in Australia have committed to a vision of zero deaths and serious injuries by 2050, known as Vision Zero. This vision represents a commitment to delivering a road transport system that does not kill or seriously injure people.[xliii]

In a transport context, vision-setting is crucial for planning and implementing sustainable and inclusive transport systems. A properly articulated vision highlights future challenges and opportunities, and sets the space for strategies that are flexible and adaptable to changes in technology and society.

In response, the talent of the Australia's transport community, including AITPM, is positioned to validate a Net Zero vision – by embracing technology, new funding models, and techniques to appraise impacts across many areas of society and nature.

AITPM recommendation 19

The Australian Government should work with States and Territories to ensure a consistent approach to transport decarbonisation through standardised policy, guidance and appraisal methodologies covering the whole emissions lifecycle, including user emissions and uses a consistent set of emissions factors.

AITPM commitment 4

By curating resources, promoting training and sharing technical expertise, AITPM will enlarge the transport profession's capacity to evaluate decarbonisation-related challenges and opportunities at each stage in the transport project lifecycle.

7.3. Decision-making delegated to the most effective level

As the most locally connected level of government in Australia, councils are afforded varying degrees of autonomy in delivering transport infrastructure and services. In most jurisdictions, public transport operations are the responsibility of the State or Territory government, while (for example) buses run on roads and pull up at stops that are often a council responsibility. Councils' are also limited by a highly constrained financial capacity.

State and Territory transport and roads agencies generally have ultimate control over substantial changes to the road environment, through their control of regulatory frameworks and funding sources. Councils must ensure that changes to their own roads align with these frameworks.

When considering actions required or encouraged by the Australian, State or Territory governments, councils are by the nature of their role more responsive to local stakeholders than those higher tiers

of government. This can have unpredictable consequences for transport, with outcomes relating to (for example) the density of urban development, the protection of road space for bike-riders, parking policy and local speed limits are all subject to different council perspectives. In some settings, this can challenge the delivery of initiatives from higher tiers of government – from connected cycleway networks to parking management regimes – that will be critical to achieving Net Zero.

> **AITPM recommendation 20**
>
> All levels of government should work together to ensure a consistently effective approach to the delivery of transport decarbonisation initiatives, so that the benefits of innovation are experienced equitably across all jurisdictions. To ensure all urban areas benefit from the completion of high-standard active transport facilities that cross local government area boundaries, this support should include increased funding for local governments to deliver local links in cross-regional networks.

7.4.   The power of funding

Through its funding capacity, the Australian Government is uniquely positioned to lead the Australian transport community in the direction of decarbonisation.

There is a sustained history of Australian Government financial support for road projects in particular. This has contributed to State and Territory roads agencies' and councils' reliance on Australian Government support in meeting their road network management responsibilities. For example, in 2024-25 the Main Roads WA capital program is budgeted to receive $840 million from Commonwealth Grants, equivalent to 39 per cent of its total capital funding.[xliv] Similarly, in 2021-22 local government roads funding in Western Australia was sourced 29 per cent from Australian Government grants and 23 per cent from State Government grants, with many funding sources accessed by councils not being applicable to active or public transport projects.[xlv]

Ultimately, to achieve Net Zero the Australian Government can and must fundamentally realign its allocation of funds to transport investments. In broad terms, this should lead to increased support for urban active and public transport projects, and long-distance freight and intercity passenger rail, thereby reducing the dominance in the funding mix of road projects that enable more people to drive cars further and more often.

> **AITPM recommendation 21**
>
> The Australian Government should ensure that all grant funding, including transport and housing stimulus funding, is conditional on the achievement of decarbonisation objectives. This should involve:
>
> - The development of robust and transparent methodologies for the appraisal of funding requests, and project assurance under executed funding agreements
>
> - Under these methodologies, the progressive reallocation of Australian Government urban transport capital funding from road projects to public and active transport
>
> - The use of 80/20 (or better) funding agreements to incentivise States' and Territories' delivery of public and active transport projects.

8. Glossary of terms and abbreviations

Term or abbreviation	Definition
Active travel	Walking, cycling or wheeling on a human-sized mobility device using human or electric power, or a combination of both
AITPM	Australian Institute of Traffic Planning and Management
Car dependence	Where people are forced to drive to access their daily needs, due to past urban planning decisions and a lack of public and active transport options
Carbon tax	A price set by a government that emitters must pay for each unit of greenhouse gases they emit.
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent, showing the global heating effect of different greenhouse gases (including but not limited to CO_2). For example, methane has 25 times the global heating impact of CO_2, so 1 tonne of emitted methane equates to 25 tonnes of CO_2-e.
Climate Change Act (2022)	The Commonwealth Climate Change Act (2022) legislates that Australia must reduce its net greenhouse gas emissions to 43 per cent below 2005 levels by 2030, and to zero by 2050.
Cooperative Intelligent Transport Systems (C-ITS)	Enable direct communication between vehicles and roadside infrastructure. C-ITS-enabled vehicles and infrastructure can also communicate with central data management systems run (for example) by road managers or vehicle manufacturers.
Decarbonisation	Reducing carbon output by limiting trips, shifting to different modes of transport and switching to carbon-neutral or low-carbon fuel sources
DRT / Demand-responsive transport	Public transport services that run in response to passenger demand rather than following a set timetable and/or route
Embodied carbon	Carbon emissions associated with the manufacturing process of a product or material
Emissions	The expulsion of into the atmosphere of a gas that negatively impacts environmental health
Euro VI	Standards, adopted by the Australian Government, that impose restrictions on the amount and type of greenhouse gas emissions able to be generated by new trucks and buses
EV	Electric vehicle
GHG / Greenhouse gas	Gases that trap heat within the earth's atmosphere, including carbon dioxide, methane and nitrous oxide
HEV	Hybrid electric vehicle
ICEV	Internal combustion engine vehicle, powered by fossil fuel
Land use planning / spatial planning	In an urban setting, the layout of cities and towns, controlling the size, placement and development of housing, retail, educational, recreational, commercial and other zones
LCLF / Low carbon liquid fuel	Fuel sources that generate electric power through thermal energy, generating fewer emissions than fossil fuels
Microfreight	Delivery of goods and services using micromobility devices

Term or abbreviation	Definition
Micromobility	Human-sized mobility devices using human or electric power, such as electric bicycles (e-bikes), electric scooters and electric cargo bikes
Mode choice	A person's selection of their travel mode (e.g., walking, driving, catching the train), being typically influenced by individual characteristics, the availability of different modes and their relative attractiveness to users
Mode shift	Increasing the share of people's travel by public transport, walking and cycling, and correspondingly reducing reliance on driving
Mt	Megatonne (of emissions)
National Urban Policy	The Australian Government's draft policy for urban areas, developed in line with UN-Habitat Sustainable Development Goals
Net Zero	Outcome achieved when measured carbon dioxide-equivalent emissions are balanced or equalised by an amount of carbon that is preferably sequestered (i.e., remaining unreleased into the atmosphere) or, failing that, offset through other actions
NVES / New Vehicle Efficiency Standard	Under the NVES, from January 2025 car companies in Australia will be incentivised to supply new cars which are more fuel-efficient. Each company will be subject to a set CO_2 target for the vehicles they produce, which will be lowered over time and may be offset by carbon credits.
Paris Agreement	A legally binding international treaty on climate change, adopted by a majority of UN signatories in 2015, including Australia
Paris target	The overarching goal of the Paris Agreement is to hold *'the increase in the global average temperature to well below 2°C above pre-industrial levels'* and pursue efforts 'to limit the temperature increase to 1.5°C above pre-industrial levels.' The UN's Intergovernmental Panel on Climate Change (IPCC) indicates that crossing the 1.5°C threshold risks significant impacts on natural systems.
Private travel	Personal or individual transport modes which are not available for use by the general public
Public transport	Passenger transport infrastructure and services contracted by governments for general public use, potentially including DRT services. Public transport services operate within and between urban and regional areas at all scales.
SAF	Sustainable Aviation Fuel
SUV / Sports Utility Vehicle	A car classification that combines elements of road-going passenger cars with features from off-road vehicles, such as raised ground clearance and four-wheel drive
TfNSW	Transport for New South Wales
Travel demand	The need for the movement of people or goods that is generated by human activities
TDM / Travel demand management	Strategies and techniques to influence travel demand by incentivising travel avoidance (e.g., through remote working), mode shift and changing the time and/or route of a journey
Ute / Utility vehicle	A small truck with a rear tray that has an open back and low sides designed to carry loads
ZEV	Zero-Emission Vehicle

9. Acknowledgments

9.1. Status

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AITPM Board

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