Inquiry into e-mobility safety and use in Queensland

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This submission is made in response to the Parliamentary Committee for State Development, Infrastructure and Works Committee's inquiry into e-mobility safety and use in Queensland

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OVERVIEW OF THIS SUBMISSION

The **INTRODUCTION** provides a summary of the 'scope' of our submission.

PART ONE provides a broad directional focus for the detailed findings, recommendations and actions established in the following PARTS of this report

PARTS TWO, THREE, FOUR & FIVE are the separate research 'nodes' used to construct a complete picture of what is needed for Queensland to develop a comprehensive and long term strategy to increase active transport with a specific focus on e-Mobility.

> **PART TWO** seeks to set out the *benefits, safety issues and the current shortcomings* in the regulatory landscape.
>
> **PART THREE** looks carefully at *pavement suitability* and highlights the shortcomings in Queensland existing pre E-mobility pavements. It seeks to bring to light the need for us getting 'the horse in front of the cart' - capacity must be balanced with opportunity and we can't afford to let the existing problems escalate.
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> **PART FOUR** looks at the *example of Paris as an Olympic City* to upgrade its active transport and e-mobility
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> **PART FIVE** considers a *step by step process, with prioritisation by selected areas* essential for an orderly outcome that fits with *Active Transport and Olympic Venues implementation*.

PART SIX is a consolidated list of *Findings, Recommendations and Actions*.

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INTRODUCTION

Queensland Parliamentary Inquiry into E-mobility Safety and Regulation

The Queensland Government has initiated a significant Parliamentary Inquiry into personal e-mobility devices, including e-scooters and e-bikes, marking a pivotal moment in the state's approach to these transport modes.

We understand that the primary catalyst for this inquiry is a dramatic increase in safety concerns. Statistics reveal a concerning 112% rise in injuries to riders, passengers, and pedestrians between 2021 and 2024, culminating in a tragic eight fatalities in 2024 alone. Minister for Transport and Main Roads, Brent Mickelberg, emphasized the urgency of the situation, stating that "unsafe and unlawful riding cannot be ignored" and that the government is committed to "boost safety for both pedestrians and riders." This commitment is particularly pertinent as Queensland prepares to welcome visitors for the 2032 Olympic Games, highlighting the need for robust and safe transport systems. Beyond direct safety incidents, the inquiry also aims to address broader community concerns, perceived "inadequate laws," and the growing "availability and use of illegal e-mobility devices" that often exceed legal specifications.

The inquiry, established by the State Development, Infrastructure and Works Committee, is operating under comprehensive terms of reference that directly relate to our concerns regarding the present inadequacy of the PMD in Queensland. We seek to consider the following issues within our submission :

- **Benefits of e-mobility:** Examining the positive impacts of these devices for Queensland.
- **Safety issues:** Investigating increasing crashes, injuries, fatalities, and community concerns.
- **Issues associated with e-mobility ownership:** Including the critical risk of fire, storage, and disposal of lithium batteries, and potential mitigation strategies.
- **Suitability of current regulatory frameworks for PMDs and e-bikes:** This is a crucial term, explicitly mandating a review of existing laws, informed by approaches in Australia and internationally. This directly creates an opening for discussions about whether a registration system or similar identification mechanism is a suitable addition to the regulatory framework.
- **Effectiveness of current enforcement approaches and powers:** Assessing how well current methods address dangerous riding behaviors and the use of illegal devices. A registration system could be considered a tool to enhance enforcement efficacy by providing a means of identification.
- **Gaps between Commonwealth and Queensland laws:** Specifically concerning the importation and use of illegal devices. This term addresses a significant challenge related to distinguishing legal from illegal devices, where identification could play a role.

- **Communication and education:** Evaluating the effectiveness of public awareness campaigns regarding device requirements, rules, and consequences for unsafe use.
- **Broad stakeholder perspectives:** Ensuring input from diverse groups, including community members, road user groups, disability advocates, health and trauma experts, academia, the e-mobility industry, and all levels of government.

Public Consultation Process and Timeline

The inquiry includes a public consultation phase, during which the committee actively invites submissions from all interested parties, providing clear guidelines for participation. The deadline for public submissions closes Friday, June 20, 2025. The committee is mandated to table its report to the Legislative Assembly no later than March 30, 2026.

The Queensland Parliamentary Inquiry's explicit mandate to assess the "suitability of current regulatory frameworks" and the "effectiveness of current enforcement approaches" creates a significant opportunity for important important improvements relating to

- **Urban planning and transport systems**
- **Enforcement and Registration of PMDs**
- **PMD vehicle standards**
- **Safety and Health Benefits**
- **Public infrastructure standards within the Public Realm**

None of these perspectives stand alone. For example, registration is a widely recognized tool for identification, accountability, and enforcement within transport regulation. Given the stated and documented concerns about rising injuries, fatalities, and the proliferation of illegal devices, the inquiry is highly likely to consider whether a registration system, or a similar identification mechanism, could effectively improve public safety and enhance compliance. As an another example, ‘separation’ of pedestrians and PMDs is a foundational concept when considering the safety of all concerned: but separation cannot occur without the transport and urban planners coming to a resolution of how to establish pavement design and construction standards that facilitate optimal separation across the hierarchy of different roads within the transport network.

To date there has been inadequate consideration of how to make these ‘linkages’ between Queensland Police Service, Local Government Planning and Maintenance, Safety and Health Benefits and Risks, State and Regional Planning [Urban and Transport]. As well there is the need for a clear connection between Local Governments, State and Commonwealth governments in regard to the availability of devices that meet standards regarding batteries and vehicle suitability.

The inquiry's findings and recommendations, due by March 2026, will be pivotal in shaping any

future policy decisions regarding PMDs in Queensland. If the current planning and regulatory frameworks are found to be insufficient or enforcement mechanisms are deemed ineffective in addressing the escalating public safety issues then it is likely that the inquiry will explore alternative or enhanced planning and regulatory tools.

Table 2: Queensland Parliamentary Inquiry: Key Focus Areas and Timeline

Feature	Details
Inquiry Name	Parliamentary Inquiry into Personal E-mobility Devices
Convening Body	State Development, Infrastructure and Works Committee
Primary Rationale	Improve safety, address community concerns, rising injuries/fatalities
Key Focus Areas (Terms of Reference)	Benefits of e-mobility; Safety issues (crashes, injuries, fatalities, community concerns); Ownership issues (e.g., battery fire risk, storage, disposal); Suitability of current regulatory frameworks; Effectiveness of current enforcement approaches; Gaps in laws allowing illegal device importation; Communication and education; Broad stakeholder perspectives
Public Submission Deadline	Friday, June 20, 2025
Report Due Date	No later than March 30, 2026

This submission seeks to make a contribution to the Queensland Government's efforts to enhance the deployment of PMDs across the State. In so doing we have attempted to embrace a 'family' of inter connected issues including -

- **Leveraging the Woolloongabba Public Realm Document for Active Transport and E-mobility**
- **Prioritising Pedestrian Safety and Accessibility**
- **The Feasibility and Necessity of Temporarily Reallocating E-mobility Traffic**
- **Benefits of E-mobility for Queensland**
- **Issues Associated with E-mobility Ownership**
- **Suitability of Current Regulatory Frameworks for PMDs and Ebikes**
- **Effectiveness of Current Enforcement Approaches and Powers**
- **QPS Perspective on Registration and "Illegal Devices"**

- **Challenges in Enforcement and Compliance**
- **Gaps Between Commonwealth and Queensland Laws**
- **Communication and Education About Device Requirements**
- **Pavement Design and Suitability for Modern Mobility Devices**
- **Safety Implications of Pavement Conditions for E-Mobility Users**
- **Pavement Wear and Tear**
- **Key Active Transport Reforms in Paris**
- **Progressive Steps for Pavement Arrangements for Pedestrians and E-riders**

PART ONE: Core Issues for Consideration

1. Overview:

This submission addresses the critical need for the Queensland Government to develop and implement clear standards for e-mobility devices, such as e-scooters and e-bikes. The increasing popularity of these devices has led to significant safety concerns, particularly regarding their interaction with pedestrians. Drawing guidance from the principles of public space use and pedestrian priority, and with reference to the Woolloongabba Priority Development Area (PDA) Public Realm Guideline [1], this submission argues for the urgent development of comprehensive and enforceable e-mobility standards. Furthermore, to ensure the immediate safety of all public space users, a temporary reallocation of e-mobility traffic to existing roadways and bikeways is proposed until pedestrian footpaths can be rendered suitable and safe for everyone.[5] Key recommendations include the development of clear e-mobility standards [6], a temporary shift of e-mobility to roadways and bikeways [5], investment in infrastructure improvements for both pedestrians and e-mobility users [5], enhanced enforcement of regulations [9], public education campaigns [10], and a thorough review of pedestrian footpaths before considering the return of e-mobility devices to these spaces.[5] This submission is made in response to the State Development, Infrastructure and Works Committee's inquiry into e-mobility safety and use in Queensland.[11]

2. Introduction:

The Queensland Government's Parliamentary Inquiry into e-mobility safety and use, established by the State Development, Infrastructure and Works Committee [11], presents a crucial opportunity to address the evolving landscape of personal mobility devices. The inquiry's broad terms of reference encompass the benefits and safety issues associated with e-mobility, the suitability of current regulations, enforcement approaches, and stakeholder perspectives.[11] This submission is made in response to the committee's call for public input [11] and aims to highlight the pressing need for clear e-mobility standards and enhanced safety for all road and path users in Queensland. Submissions to the inquiry are open until Friday, 20 June 2025.[11]

The adoption of e-mobility devices, including e-scooters and e-bikes, has grown rapidly across Queensland, offering a popular means of transportation and recreation.[16] This surge in usage, however, has been accompanied by increasing safety concerns [18], prompting the Queensland Government to launch this inquiry to improve safety and address community anxieties.[16] Notably, there has been a significant 112% rise in injuries to e-mobility device riders, passengers, and pedestrians between 2021 and 2024, and tragically, eight e-mobility device users died in Queensland last year.[18] This concerning trend underscores the urgency of the issues being examined by the Parliamentary Committee.[20] The need for action is further supported by

medical professionals who have witnessed the consequences of e-mobility incidents [21] and organizations such as Bicycle Queensland, which has welcomed the inquiry and called for a comprehensive review of e-mobility regulations.[10] The collective concern from various stakeholders emphasizes the critical need to establish a robust framework for e-mobility in Queensland.[6]

3. The Urgent Need for Clear E-mobility Standards in Queensland:

The current regulatory framework governing e-mobility in Queensland appears to lack the comprehensive and consistent standards necessary to ensure the safety of all road and path users.[20] While some regulations exist [20], the overall landscape is perceived as fragmented, potentially leading to confusion among users and challenges for effective enforcement.[6] The lack of uniformity in e-mobility regulations across different states and territories in Australia [20] further complicates the issue, particularly for individuals traveling across state lines or for businesses operating shared e-mobility schemes.[6] The Queensland Transport Minister has also acknowledged the strain on resources, noting that the police are "woefully understaffed to enforce regulations" [19], highlighting a critical gap in the current approach.

The absence of clear and consistent standards has significant safety implications, contributing to the documented rise in accidents, injuries [18] and fatalities [18] involving e-mobility devices. Data indicates a concerning prevalence of e-micro mobility-related deaths and emergency department presentations for injuries.[20] Furthermore, reports from Queensland highlight a trend towards more stringent regulation due to the increasing number of serious accidents involving e-scooters.[9] These statistics underscore the urgent need for preventative measures through the establishment of clear and enforceable standards.[6]

Arguments supporting the development of clear e-mobility standards are compelling.[6] A recent inquiry in New South Wales identified several key benefits of such standards, including addressing safety concerns, ensuring consistent regulations across jurisdictions, facilitating more effective enforcement by law enforcement agencies, and providing guidance for the development of appropriate infrastructure.[6] Moreover, technology can play a role in enhancing safety, with features like speed governors and designated parking zones being adopted by some shared mobility services.[22] Clear standards can encourage the broader implementation of such safety technologies.[6] It is particularly important to establish standards for device specifications, such as limitations on power output and maximum speed, to effectively differentiate between devices that are safe for public use and those that pose a higher risk.[10] Bicycle Queensland has specifically called for the distinction between legal, safe devices and high-powered, potentially illegal alternatives.[10] Similarly, the New York City Comptroller's report emphasizes the varying safety risks associated with different types of powered two-wheelers based on their size and speed, reinforcing the need for regulations that reflect these distinctions.[23]

4. Leveraging the Woolloongabba Public Realm Document for Active Transport and E-mobility Standards:

The Woolloongabba Priority Development Area (PDA) represents a significant urban renewal initiative in Brisbane [25], with the aim of revitalizing underused inner-city areas to support more people living closer to public transport, workplaces, and services.[25] The Woolloongabba PDA Development Scheme (also known as The Woolloongabba Plan) [25] and Public Realm Guideline [1] serve as regulatory documents to manage growth and facilitate transformative urban regeneration within this precinct.[25] These documents provide a detailed planning framework [25] that can offer valuable insights for the development of broader e-mobility standards across Queensland. The Woolloongabba PDA was declared on 22 September 2023, and the development scheme came into effect on 20 September 2024.[25]

The Woolloongabba precinct renewal strategy explicitly addresses traffic management with the goal of improving connectivity and prioritising pedestrians and cyclists.[28] Key strategies include optimizing the surrounding road network, reviewing car parking rates, prioritising pedestrian and cyclist movement through street design and signal phasing, and developing new cycle infrastructure and linkages.[28] The Woolloongabba PDA Public Realm Guideline further supports these objectives by providing guidance on public realm outcomes, including the creation of more open space and green streets, and how proposed developments can align with the PDA's vision and relevant development requirements.[1] The emphasis on active travel and the creation of pedestrian-friendly environments within the Woolloongabba PDA offers a relevant model for integrating e-mobility safely into the broader urban context.[25]

Specific elements within the Woolloongabba Public Realm Guideline can inform the development of e-mobility standards for Queensland.[2] The guideline details a streetscape hierarchy, including major and minor subtropical boulevards, neighbourhood streets, and cross-block linkages.[2] This hierarchical approach could be adapted to define appropriate zones and infrastructure for different types of e-mobility devices, ensuring their safe and efficient integration within urban areas. For instance, major boulevards with existing bike lanes might be suitable for higher-speed e-bikes, while neighbourhood streets could accommodate lower-speed e-scooters. The guideline also provides design considerations for shared spaces and movement corridors, emphasizing the importance of pedestrian comfort and safety.[2] These considerations, such as minimum widths for pathways and clear sightlines, can be applied to develop standards for shared paths that accommodate both pedestrians and e-mobility users.[29] The guideline aims to establish a connected network of high-quality public spaces and revitalized green streets, promoting and prioritising active travel, and uplifting amenity, accessibility, and pedestrian comfort.[2]

It is also important to consider the feedback and concerns raised by various stakeholders on the Woolloongabba PDA plans. The Property Council of Australia expressed concerns that the

proposed Development Scheme and Draft Public Realm Guideline, in their current form, could unnecessarily constrain development potential due to prescriptive and uneconomical requirements.[30] This highlights the need for e-mobility standards to be practical and consider potential impacts on infrastructure and urban development. Conversely, community feedback on the Woolloongabba PDA emphasized the desire for more people-friendly spaces and improved active transport options.[26] This aligns with the need for e-mobility standards to prioritise pedestrian safety and enhance the overall amenity of public spaces. Greater Brisbane's support for the proposed development scheme and public realm guidelines [32], along with Q Shelter's support for prioritising active travel within the PDA [33], further illustrate the diverse perspectives on urban mobility that need to be considered when developing e-mobility standards for the entire state.

5. Prioritising Pedestrian Safety and Accessibility:

Ensuring the safety and accessibility of pedestrian footpaths is paramount, especially in light of the increasing use of e-mobility devices.[18] Queensland has established standards for universal access to pedestrian infrastructure, guided by principles of equitable use, flexibility, simplicity, perceptible information, tolerance for error, low physical effort, and appropriate size and space.[29] These standards cover aspects such as the gradient and surface treatments of footpaths, the inclusion of kerb ramps at intersections, and the incorporation of Tactile Ground Surface Indicators (TGSIs) to assist people with vision impairments.[29] For instance, a continuous accessible path should ideally have a gradient no steeper than 1 in 20 and a cross fall no steeper than 1 in 40, with a minimum clear width of 1.8 meters.[29] Brisbane City Council has also implemented various initiatives to enhance pedestrian accessibility, including the installation of braille trails in the CBD and tactile street signs at key intersections.[34] These efforts demonstrate a commitment to creating a more inclusive urban environment.[34]

Despite these measures, the operation of e-mobility devices on pedestrian footpaths poses significant safety risks, particularly for vulnerable users.[18] A submission to the Parliamentary Inquiry highlights concerns that the unsafe use of personal mobility devices can restrict people's safe access to footpaths, public parks, and green spaces, potentially leading to social isolation and a decline in quality of life.[5] The New York City Comptroller's report also points out how the presence and parking of micro mobility devices on sidewalks and in crosswalks can create obstacles and difficulties for pedestrians, especially those with disabilities.[23] The potential for collisions between faster-moving e-mobility devices and pedestrians, who may be less mobile or have sensory impairments [35], underscores the need to carefully consider the appropriateness of allowing these devices to operate on footpaths. Statistics indicate that a significant percentage of pedestrians with vision impairment have been involved in collisions or near collisions with vehicles or bicycles.[35]

prioritising pedestrian safety and accessibility aligns with the fundamental principles of urban

planning and the creation of liveable communities.[36] Safe and accessible pedestrian infrastructure is essential for all members of society, regardless of their age, ability, or mode of transport.[29] This principle is reflected in the concept of universal design [29] and the broader movement towards "Complete Streets" [36], which aim to accommodate the needs of all road users, including pedestrians, cyclists, and those using micro mobility devices. The Federal Highway Administration in the United States also emphasizes the critical importance of prioritising pedestrian safety in transportation planning and infrastructure development.[37] Therefore, any framework for e-mobility in Queensland must place the safety and accessibility of pedestrians at its core.[5]

6. The Feasibility and Necessity of Temporarily Reallocating E-mobility Traffic:

Given the safety concerns associated with e-mobility devices operating on pedestrian footpaths [18], a temporary reallocation of this traffic to existing roadways and bikeways in Brisbane appears to be a feasible and necessary measure.[5] Brisbane's e-mobility strategy already permits e-mobility devices on various roadways and bikeways under specific conditions.[7] These include bike lanes on roads with a speed limit of 50 km/h or less, as well as local streets with the same speed limit and no dividing line.[7] This existing framework suggests that a temporary shift of e-mobility devices to these designated areas is practically achievable.[7] However, it is crucial to carefully assess the capacity of these existing infrastructures to accommodate an increased volume of e-mobility traffic and to consider the potential safety implications for all users, including motorists and cyclists.[5]

This temporary reallocation offers several potential benefits, most notably a reduced risk of injuries to pedestrians on footpaths and an improved overall pedestrian amenity.[5] By physically separating faster-moving e-mobility devices from pedestrians, the likelihood of collisions and near misses can be significantly decreased.[5] This would create a safer and more comfortable environment for pedestrians, particularly vulnerable individuals who may find it challenging to navigate shared spaces with e-mobility devices.[35] Reallocating roadway and parking space to create footpaths and separate lanes for bikes and PMDs is also a recommendation based on risk management principles.[5]

However, this temporary reallocation also presents potential challenges. Clear rules and strict enforcement will be essential to ensure the safety of e-mobility users on roadways and their interaction with vehicular traffic.[9] This may include specific regulations regarding speed limits for e-mobility devices on roads, lane positioning, and right-of-way rules at intersections. Additionally, the safety of cyclists on bikeways also needs to be considered with a potential increase in e-bike traffic.[5] To mitigate these challenges, supporting measures will be necessary. This includes the implementation of clear signage indicating where e-mobility devices are permitted and any specific rules that apply in these areas. Furthermore, comprehensive public awareness campaigns will be crucial to educate all road users – pedestrians, motorists, cyclists,

and e-mobility users – about the temporary changes and to promote safe and responsible behaviour.[10]

7. Recommendations:

Based on the analysis of the current e-mobility landscape, the principles outlined in the Woolloongabba Public Realm documents, and the paramount importance of pedestrian safety and accessibility, the following recommendations are put forth for the Queensland Government's consideration:

1. **Develop and implement clear, comprehensive, and enforceable e-mobility standards for Queensland:** These standards should draw upon the principles of pedestrian priority and public space usage as exemplified in the Woolloongabba Public Realm Guideline.[2] They should also incorporate best practices from other jurisdictions that have successfully addressed e-mobility safety [22], such as the use of technology for safety features [22], regulations on device specifications [23], and prioritisation of pedestrian infrastructure.[36] These standards should address device specifications (including power and speed limits) [6], rules of operation on different types of paths and roadways [7], helmet requirements [9], age restrictions [9], and parking regulations.[23]
2. **Consideration of Tiered Registration/Identification:** The inquiry should thoroughly explore the feasibility and benefits of a tiered registration or identification system for PMDs. This approach could differentiate between low-power, compliant devices and higher-power, non-compliant or "illegal" devices. For compliant PMDs, this might involve unique digital identifiers (e.g., QR codes linked to owner details) rather than traditional physical plates. Such a system could facilitate post-incident identification, data collection, and enforcement without imposing undue burden on users of legally compliant devices.
3. **Implement a clear timeline and strategy for the temporary reallocation of e-mobility traffic (excluding motorized wheelchairs and similar mobility aids) to designated roadways (with speed limits of 50 km/h or less and no dividing line) and existing bikeways within urban areas:** This reallocation should remain in effect until pedestrian footpaths are thoroughly assessed and upgraded to ensure safety and accessibility for all users.[5] The upgrades should include, where necessary, widening footpaths to meet a minimum clear width of 1.8 meters as per Queensland standards [29], smoothing surfaces, and ensuring the presence of appropriate accessibility features such as kerb ramps and TGSIs.[29]
4. **Invest in infrastructure improvements to enhance the safety and suitability of both pedestrian footpaths and designated e-mobility corridors:** This investment should focus on widening and improving the condition of footpaths, ensuring they meet accessibility standards.[29] Simultaneously, designated e-mobility corridors, such as dedicated lanes on roadways and clearly marked bikeways, should be developed to safely accommodate e-mobility traffic and minimise potential conflicts with vehicular traffic and pedestrians.[5]
5. **Strengthen enforcement of e-mobility regulations and implement comprehensive**

public education campaigns: Increased monitoring and penalties should be applied to unsafe riding behaviours, such as speeding, riding under the influence of drugs or alcohol, riding on footpaths where prohibited, and the use of illegal devices.[19] Public education campaigns should be launched to promote responsible e-mobility use, increase awareness of traffic rules for all road users, and inform the public about the temporary changes in e-mobility traffic allocation.[10]

6. **Conduct a comprehensive review of existing pedestrian footpaths in high-use areas to identify necessary upgrades before considering the return of e-mobility devices to these footpaths:** This review should involve consultation with disability advocacy groups [11] and other relevant stakeholders to ensure that the upgraded footpaths meet the needs of all users.[29] The decision to allow e-mobility devices back on footpaths should be based on evidence that these spaces can safely and comfortably accommodate both pedestrians and e-mobility users.[5]

8. Conclusion:

The increasing prevalence of e-mobility devices in Queensland presents both opportunities and challenges.[6] While these devices offer a sustainable and convenient mode of transport [7], their rapid adoption has raised significant safety concerns, particularly for pedestrians.[18] This submission underscores the pressing need for the Queensland Government to take decisive action by developing and implementing clear, comprehensive, and enforceable e-mobility standards.[6] Drawing inspiration from the principles of pedestrian priority and public space usage evident in the Woolloongabba Public Realm documents [1], and recognising the immediate need to protect pedestrians, a temporary reallocation of e-mobility traffic to existing roadways and bikeways is proposed.[5] It is our hope that the Parliamentary Committee will carefully consider the recommendations outlined in this submission to ensure a safe and sustainable future for e-mobility in Queensland, one that balances the benefits of this emerging mode of transport with the fundamental right of all citizens to safe and accessible public spaces.[29]

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PART TWO: E-Mobility: Benefits, Safety, and Regulatory Landscape

1. Overview

E-mobility, encompassing personal mobility devices (PMDs) such as e-scooters and e-skateboards, and e-bikes, has witnessed a significant surge in popularity across Queensland. This trend reflects a global shift towards more sustainable and efficient modes of transport, offering potential benefits for the environment, the economy, and the community.[1] In response to the increasing prevalence and use of these devices, the Queensland Legislative Assembly has established the State Development, Infrastructure and Works Committee to conduct a comprehensive inquiry into e-mobility safety and use within the state.[1] This report aims to provide detailed research and analysis on the multifaceted aspects of e-mobility in Queensland, addressing the eight specific terms of reference outlined for the Parliamentary Inquiry. By drawing upon a range of authoritative sources, including government reports, academic research, and reputable organizations, this analysis seeks to inform stakeholders and contribute to a well-researched submission to the inquiry. The findings presented will cover the benefits of e-mobility for Queensland, the safety issues associated with its use, concerns related to ownership, the suitability of current regulations, the effectiveness of enforcement approaches, gaps in existing laws, the efficacy of communication and education efforts, and the perspectives of various stakeholder groups.[1]

2. Benefits of E-mobility for Queensland

The adoption of e-mobility in Queensland presents a range of potential advantages across environmental, economic, and social domains, and offers improved integration with existing transport networks.

2.1. Environmental Benefits

E-mobility offers a pathway to reducing transport emissions, aligning with Queensland's broader environmental objectives. The Queensland Government's Zero Emission Vehicle Strategy 2022-2032 explicitly recognises the role of e-bikes and e-scooters in achieving a cleaner transport future.[2] The E-Mobility Rebate Scheme, although concluded, was a tangible initiative aimed at encouraging the uptake of safer and higher-quality e-bikes and e-scooters, thereby supporting the transition to a more sustainable transport mode and contributing to emission reduction targets.[4] Electric vehicles, including e-bikes and e-scooters, provide the benefit of emission-free travel when powered by renewable energy sources. Even when utilising the existing Queensland energy grid, these vehicles typically result in lower overall emissions compared to traditional internal combustion engine vehicles.[6] This shift towards e-mobility can lead to improved air quality and a reduction in noise pollution, particularly in densely populated urban areas.[6] The elimination of tailpipe emissions associated with electric vehicles directly

addresses local air pollution concerns, which have been linked to significant health problems.[6]

2.2. Economic Benefits

Beyond the environmental advantages, e-mobility holds considerable economic promise for Queensland. Individuals can potentially realise cost savings through the reduced expenses associated with fuelling and maintaining electric vehicles compared to their petrol counterparts.[6] The emergence and growth of the e-mobility sector also present opportunities for local businesses and job creation in areas such as retail, maintenance, and infrastructure development.[8] Brisbane's e-mobility strategy, for instance, aims to foster the growth of this industry within the city.[8] Furthermore, the increased spending on e-mobility devices and related services contributes to the overall Queensland economy. riding under the influence of drugs or alcohol

ling conducted by We Ride Australia indicates a substantial return on investment for government incentives aimed at boosting e-bike usage, suggesting broader economic benefits stemming from increased e-mobility adoption.[9] In fact, bicycle and scooter riders collectively contribute billions of dollars to the Queensland and Australian economies each year, encompassing benefits to the health system as well.[9]

2.3. Social and Health Benefits

Promoting active transport is a key social and health benefit associated with e-mobility. Initiatives like the E-Mobility Rebate Scheme directly aimed to encourage more active modes of transportation.[4] Research suggests that riding e-bikes can positively impact mental and physical health, contributing to an increased sense of happiness and overall wellbeing.[10] By making mobility easier and more accessible, especially for longer distances or hilly terrains, e-bikes can encourage more frequent riding for various purposes, including transport, exercise, and leisure.[2] Moreover, the increased use of e-mobility options can lead to a reduction in traffic and parking congestion, particularly in urban centers.[11] Choosing to ride an e-bike or e-scooter for shorter journeys instead of driving a car can alleviate pressure on road infrastructure and parking facilities.[13] Additionally, bike riding, including e-biking, offers mental health benefits such as decreased stress and anxiety levels, and active transport in general can foster a stronger sense of community and social connection.[13]

2.4. Multi-modal Transport Integration

E-mobility plays an increasingly important role in supporting and enhancing the integration of different transport modes. E-bikes and e-scooters can provide crucial first-and-last-mile connectivity solutions, making public transport options more accessible and convenient for commuters.[8] These devices allow individuals to efficiently travel to and from train or bus stations, thereby extending the catchment areas of existing public transport services.[13] By bridging these connectivity gaps, e-mobility contributes to a more efficient and user-friendly overall transport network.

3. Safety Issues Associated with E-mobility Use

Despite the numerous benefits of e-mobility, significant safety concerns have emerged alongside its increasing popularity in Queensland.

3.1. Increasing Crashes, Injuries, and Fatalities

Queensland has witnessed a concerning rise in the number of crashes, injuries, and fatalities involving e-mobility devices. Data indicates a substantial increase in injuries to riders, passengers, and pedestrians between 2021 and 2024.[14] Tragically, in 2024 alone, eight fatalities involving personal mobility device users were recorded.[14] Furthermore, hospital data reveals a significant surge in emergency department presentations related to e-scooter incidents across the state.[15] These statistics underscore the urgent need to address the safety challenges associated with e-mobility. The death of a child while riding an e-scooter serves as a stark reminder of the potential severity of these incidents.[14]

3.2. E-scooter and E-bike Weight and Impact on Injuries

Vehicle Weight and Injury Severity: The weight of an e-mobility device significantly impacts the severity of injuries during collisions, particularly for vulnerable road users. While heavier cars might improve safety for their occupants, the opposite is true for pedestrians involved in crashes with heavier vehicles.

- E-scooters can weigh up to 55 kg for rental models, while private e-scooters typically weigh 15-30 kg.
- E-bikes can also be heavier, with "fat bikes" weighing around 50 kg, which can be a factor for path wear when combined with usage frequency.
- The baseline risk of fatalities increases by 47% when a person is hit by a vehicle that is 1000 pounds (approximately 453 kg) heavier. This general statistic on vehicle weight implies that collisions with heavier e-mobility devices could lead to more severe outcomes.
- The rider's weight drastically impacts an e-scooter's centre of gravity, influencing stability, especially at lower velocities. A heavier e-scooter (31.5 kg) has shown superior braking performance compared to a lighter one (11.3 kg).

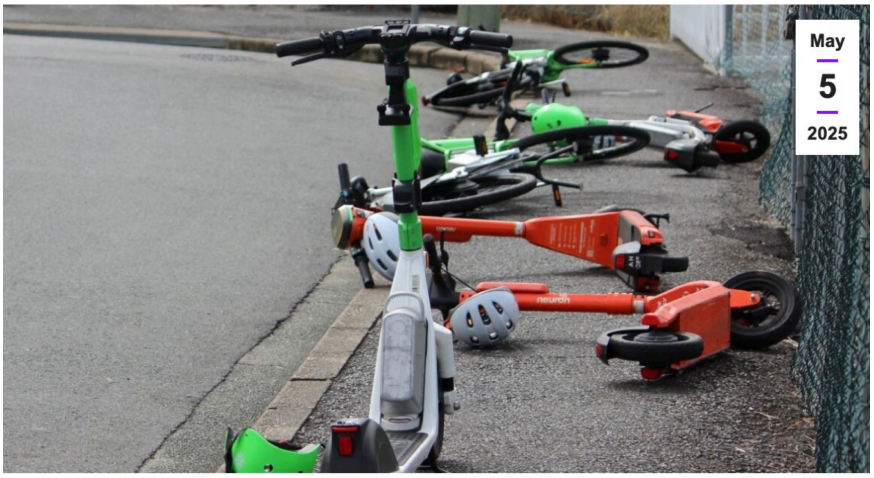
3.3 Impact on Injuries:

- E-scooters generally require longer braking distances than **bicycles**. The maximum allowable deceleration for standing e-scooters to prevent flipping is approximately 5 m/s^2, which is significantly lower than for seated e-scooters (6.7 m/s^2) or bicycles (7.5 m/s^2). This indicates a lower probability of stopping safely in emergencies.

- E-scooterists often present with a **greater share of head, face, and neck injuries** compared to cyclists, partly due to lower helmet use rates. Alcohol-involved crashes are also more prevalent among e-scooterists.
- Injuries to lower extremities are more prevalent in e-scooterists, possibly from hopping off during loss of control.
- E-bike riders are more likely to suffer internal injuries compared to e-scooter riders, and injuries involving e-bikes are often more severe than e-scooter injuries, with higher relative speed cited as a contributory factor. E-bikes can travel 3.0 km/h faster than conventional bicycles, and speed-pedelecs (up to 45km/h) can be 62% faster.
- Over one-third of incidents involving children on e-scooters are linked to speeding, and 13% involve "doubling" (carrying a passenger), highlighting the need for improved education.

3.4 Community Concerns

The growing prevalence of e-mobility devices has also led to increasing unease within the community regarding safety.[16] This concern is often fuelled by observations of dangerous riding behaviours, such as speeding, riding without helmets, riding under the influence of drugs or alcohol and carrying passengers on devices designed for single riders.[1] The use of illegal, high-powered devices on public paths and roads further exacerbates these community worries.[1] **Pedestrians, particularly those with disabilities, have voiced concerns about footpath safety and accessibility due to the presence and behaviour of some e-mobility device users.**[11] The Parliamentary Inquiry itself was initiated, in part, to address these growing community safety concerns.[16]



4. Issues Associated with E-mobility Ownership

Ownership of e-mobility devices brings forth specific issues related to safety and environmental responsibility, particularly concerning the lithium batteries that power these devices.

4.1. Risk of Fire from Lithium Batteries

A significant safety concern associated with e-mobility devices is the increasing risk of fires involving their lithium-ion batteries.[17] These batteries, while offering high energy density, are more volatile than traditional battery types and can pose a fire hazard if damaged, faulty, or charged incorrectly.[18] The potential for thermal runaway, a process where the battery's internal

temperature uncontrollably increases, can lead to fires, explosions, and the release of toxic and flammable vapors.[19] Factors such as using incorrect chargers, continuing to charge batteries after they are full, exposing batteries to extreme temperatures or moisture, and tampering with or modifying batteries can all increase the risk of fire.[18] Given the rising number of e-mobility devices in use, understanding and mitigating these fire risks is crucial for ensuring public safety.

4.2. Storage and Disposal of Lithium Batteries

The safe storage and proper disposal of lithium batteries from e-mobility devices are essential for preventing fires and minimising environmental harm. Improper storage, especially in residential buildings, can heighten the risk of battery fires.[20] Regulations and guidelines for the disposal of these batteries are necessary due to the fire hazards and the presence of hazardous materials within them.[21] Incorrect disposal in general household waste or recycling bins can lead to fires in waste collection trucks and facilities, as well as causing environmental pollution from leaked toxic substances.[22] To address this, both council initiatives and national schemes have been established to facilitate the safe recycling of batteries, providing designated drop-off locations and guidelines for handling and transporting used or damaged batteries.[22]

4.3. Consideration of Mitigants or Controls

To address the risks associated with e-mobility device ownership, several mitigants and controls have been recommended and implemented. Guidelines and safety standards for lithium-ion batteries provide crucial information for users on safe operation and maintenance.[20] Emphasizing the importance of using the correct charger and avoiding damage or modifications to the battery or device is paramount in preventing fires.[18] Safe storage recommendations include keeping devices and batteries in cool, dry, and well-ventilated areas, away from combustible materials.[20] Furthermore, public education on proper disposal methods through council facilities and battery recycling programs is vital to ensure that end-of-life batteries are handled safely and responsibly.[18] By implementing these measures, the risks associated with e-mobility device ownership can be significantly reduced, promoting safer usage and environmental stewardship.

5. Suitability of Current Regulatory Frameworks for PMDs and Ebikes

Queensland has established a regulatory framework for personal mobility devices (PMDs) and e-bikes, but its effectiveness in addressing safety concerns is currently under scrutiny.

5.1. Queensland Regulations

The Queensland regulations define personal mobility devices (PMDs) and e-bikes based on specific criteria related to size, weight, power output, and speed capabilities.[24] These regulations also outline the rules governing their use, including age restrictions for riders, speed limits in different zones (footpaths, shared paths, roads), and mandatory helmet use.[24] Riders who fail to

comply with these rules are subject to fines.[27] recognising the evolving nature of e-mobility and the emerging safety challenges, the Queensland Government has implemented several safety action plans and amendments to the existing road rules.[11] These initiatives aim to enhance safety for both e-mobility users and other members of the community. However, the increasing number of incidents and community concerns suggest that the current regulatory framework may need further review and adjustments to ensure its suitability.

5.2. Approaches in Australia and Internationally

Examining the regulatory approaches adopted in other Australian states and territories, and internationally, can provide valuable insights for Queensland. Different states in Australia have varying regulations concerning e-scooter speed limits, helmet requirements, and where these devices are permitted to be ridden.[29] Similarly, major European cities like Paris, Berlin, London, and Amsterdam have implemented diverse regulatory frameworks for e-scooters, addressing aspects such as speed limits, parking restrictions, and mandatory equipment.[30] Countries like Singapore and New Zealand also have specific regulations in place for e-bikes and e-scooters, often focusing on power output, speed restrictions, and usage areas.[33] By comparing these different approaches, Queensland can identify potential best practices and innovative solutions to enhance its own regulatory framework for e-mobility devices. The lack of national consistency across Australian states highlights the need for a more unified approach to ensure clarity and safety for all users.

5.3. National Transport Commission's Role

The National Transport Commission (NTC) plays a crucial role in promoting national consistency in road transport regulations, including those related to personal mobility devices.[35] The NTC has developed the Australian Road Rules (ARRs), which serve as a model for state and territory governments to adopt or adapt into their own legislation.[35] While Queensland's regulatory framework is informed by the ARRs, it is essential to consider the NTC's ongoing efforts to achieve greater national uniformity in the regulation of PMDs.[36] Aligning Queensland's regulations with national guidelines, where appropriate, can help reduce confusion for users who may travel across state borders and contribute to a more consistent safety standard across Australia. The NTC's work aims to address barriers to the safe use of PMDs and ensure that regulations keep pace with the evolving technologies in the e-mobility sector.[37]

6. Effectiveness of Current Enforcement Approaches and Powers

The Queensland Police Service (QPS) is responsible for enforcing the road rules applicable to personal mobility device (PMD) riders.[26] Their enforcement efforts include targeting dangerous riding behaviours such as speeding and the failure to wear helmets.[38] The QPS conducts high-visibility operations and enforcement blitzes in areas where e-mobility device usage is high to ensure compliance with the regulations.[28] Fines are issued to riders who violate the rules, with

penalties varying depending on the specific offence.[27] While these enforcement actions are in place, concerns persist regarding their overall effectiveness in curbing unsafe behaviours and reducing the number of incidents involving e-mobility devices. Many community members and stakeholders perceive a lack of consistent enforcement and believe that more could be done to ensure riders adhere to the rules.[39] Challenges in enforcement include the difficulty in identifying and apprehending offenders, particularly with the increasing number of private e-mobility devices that are not subject to the same monitoring as shared schemes.[40] Resource constraints on police services also pose a limitation to the extent of enforcement that can be carried out.[39] Additionally, enforcing rules for younger riders and those riding without adult supervision presents unique challenges.[41] However, technology offers potential solutions to enhance enforcement efforts. The use of drone technology for monitoring e-mobility device usage in certain areas has been trialed.[42] For shared e-mobility schemes, GPS and IoT speed-limiting technologies are already in use to automatically regulate speed in high-pedestrian zones and alert riders in prohibited areas.[43] Exploring further integration of technology into enforcement strategies could improve compliance and overall safety.

7. Enforcement and Compliance Mechanisms for PMDs

The enforcement of Personal Mobility Device regulations in Queensland primarily rests with the Queensland Police Service (QPS), which employs various mechanisms to ensure compliance and address unsafe riding behaviors.[16]

Current Enforcement Powers and Penalties

The QPS is responsible for enforcing existing PMD rules, issuing significant penalties for non-compliance. For instance, riders caught using a mobile phone while operating a PMD face on-the-spot fines exceeding $1,000.[3] General non-compliance with PMD rules can result in fines of at least $133.[5] Recent legislative changes in October 2024 introduced an offense for riding a PMD or bicycle "without due care and attention" on any road-related area, including footpaths. This offense carries a maximum penalty of 40 points, equivalent to a substantial monetary fine.[18] To enforce speed limits, including the 12 km/h limit on footpaths, QPS officers utilize calibrated speed radar guns.[16] Furthermore, PMD riders involved in a crash are legally obligated to stop and provide their personal particulars, including name and address, to other parties involved.[16]

QPS Perspective on Registration and "Illegal Devices"

The QPS possesses powers to impound and confiscate non-compliant devices.[16] A key aspect of the QPS's articulated stance regarding registration for PMDs is its focus on "illegal devices." A statement from the QPS indicates that "Legitimising these illegal devices by giving them registration plates will not help—the focus must be on permanently removing illegal devices from Queensland roads and paths".[16] This position primarily targets devices that exceed the legal specifications for PMDs and are effectively classified as illegal vehicles (e.g., high-powered e-bikes that function as unregistered motorcycles). For these "illegal e-bikes," existing "unregistered and uninsured vehicle offences" and associated licensing requirements already apply, treating them as conventional motor vehicles rather than PMDs.[16] However, within a broader discussion of measures to improve safety, "registration for legal electric bikes" has been mentioned alongside enhanced awareness, education, legislation, and insurance.[16] This suggests a potential openness to considering registration for *compliant* devices if such a measure were integrated into a comprehensive safety strategy.

Challenges in Enforcement and Compliance

Significant enforcement challenges arise from the proliferation of "illegal e-mobility devices," many of which possess high-powered motors and throttle control.[2] These devices often bear a visual resemblance to legal PMDs, making immediate identification difficult for both law enforcement and the general public. The absence of a general registration system for PMDs further complicates the identification of riders or devices after an incident, such as a hit-and-run, making effective compliance action reliant on less direct forms of evidence. This situation can lead to difficulties in establishing accountability and pursuing appropriate legal action.

Additionally, enforcing rules against minors (under 18) using e-bikes and e-scooters, particularly in protected areas, presents specific complexities. Rangers, for example, face limitations in issuing penalty infringement notices or conducting interviews with minors without a parent or guardian present.[16] This points to an accountability gap for a significant user demographic.

The Queensland Police Service's strong articulated position against registering "illegal devices" reveals a fundamental dichotomy in the current enforcement policy: a primary focus on the punitive removal of non-compliant, high-powered devices, as opposed to a framework for regulating compliant PMDs. While this approach aims to directly address dangerous devices, it implicitly acknowledges the inherent difficulty in identifying and tracking such non-compliant devices without a robust registration or identification system. The inquiry's specific focus on "gaps between Commonwealth and Queensland laws that allow illegal devices to be imported and used" suggests that the root cause of these enforcement challenges lies upstream, in the

unchecked supply and sale of devices that do not meet Queensland's PMD specifications.[10] Without a clear and easily identifiable distinction, perhaps via a registration plate or similar marker, between legal and illegal devices, police face ongoing operational difficulties in effective enforcement. This can lead to public perceptions of inconsistent enforcement or "police overreach".[19] This highlights that a comprehensive solution may require addressing the supply chain of non-compliant devices, potentially through identification mechanisms, to truly enhance enforcement efficacy. The QPS position implies a reactive enforcement model where they must identify and remove devices that are already in circulation and being used dangerously. This is a resource-intensive and challenging task when the devices themselves lack clear identification. The problem is exacerbated by the ease with which non-compliant devices can be imported and sold, blurring the lines between legal PMDs and illegal motor vehicles. If a registration system (or a similar identification scheme) were in place, it could serve as a proactive filter, making it easier to distinguish legal, compliant devices from illegal ones. This shift from reactive "catch-and-crush" to a system of clear identification would significantly enhance enforcement by providing a visible marker of legality, thereby supporting the broader goal of improved safety and compliance. The inquiry's focus on importation laws is crucial because it addresses the source of the problem, which directly impacts the effectiveness of on-the-ground enforcement.

7. Gaps Between Commonwealth and Queensland Laws

A potential area of concern involves the gaps between Commonwealth and Queensland laws, particularly concerning the importation of e-mobility devices. There are concerns that the current legal framework at the Commonwealth level may allow for the importation and subsequent use of non-compliant, high-powered devices that do not meet Queensland's safety standards.[44] This issue is compounded by a perceived lack of clarity on the definition and regulation of e-bikes at the federal level.[45] The Commonwealth Government's power to regulate road vehicles under the Road Vehicle Standards Act 2018 and the classification of e-mobility devices within this framework appear to be areas where inconsistencies or gaps may exist.[46] For instance, while the Commonwealth regulates the importation of road vehicles based on Australian Design Rules, it is unclear whether all types of e-bikes and e-scooters, especially those exceeding state power limits, are consistently classified as road vehicles for import regulation purposes.[46] This can lead to situations where devices that are legal to import under Commonwealth law may be illegal to use on public roads or paths in Queensland due to differing state regulations on power and speed limits.[47] Bicycle Queensland has specifically raised concerns about the widespread importation of illegal and non-compliant e-bikes and e-scooters without adequate regulatory oversight.[48] They advocate for stricter controls on the importation of high-powered e-bikes that do not meet Australian standards.[49] Addressing these legal inconsistencies between the Commonwealth and Queensland is crucial to prevent the influx and

use of unsafe or non-compliant e-mobility devices within the state. harmonising definitions and standards across different levels of government would provide greater clarity for consumers and facilitate more effective enforcement.

8. Communication and Education About Device Requirements

The Queensland Government, along with local councils, industry stakeholders, and advocacy groups, has undertaken various initiatives to communicate and educate the public about the requirements, rules, and consequences for unsafe use of e-mobility devices. The Queensland Government's StreetSmarts website serves as a key resource, providing comprehensive information on the rules and safety tips for riding personal mobility devices.[26] The E-Mobility Rebate Scheme also incorporated an educational component by requiring applicants to read the Queensland road rules for e-bikes and e-scooters, as well as safe charging practices, as part of the eligibility criteria.[50] Furthermore, the government has launched safety campaigns and developed educational materials to raise awareness about the safe and responsible use of e-mobility devices.[51] Local councils, such as the Brisbane City Council, have also developed their own e-mobility strategies and conducted workshops to educate the community on safe riding practices.[8] Shared e-mobility providers often include educational resources within their apps, providing users with information on local rules and safe operation.[28] Retailers also have a role in educating consumers at the point of sale about the legal requirements and safe usage of the devices they sell.[28] Advocacy groups like Bicycle Queensland actively participate in raising awareness about e-bike and e-scooter regulations and safety.[2] Despite these ongoing efforts, the persistently high rates of incidents and the prevalence of risky behaviours, such as low helmet use, suggest that current communication and education strategies may need to be further enhanced or targeted more effectively.[52] Understanding why unsafe behaviours persist despite these efforts is crucial for developing more impactful strategies to promote safer e-mobility practices across Queensland.

9. Broad Stakeholder Perspectives

The Parliamentary Inquiry into e-mobility safety and use in Queensland has called for broad stakeholder perspectives to ensure a comprehensive understanding of the issues. Various groups have expressed their views and concerns regarding e-mobility. Community members often raise concerns about safety, particularly in relation to pedestrians and shared public spaces, as well as the behaviour of some riders.[53] Road user groups, including representatives of motorists and cyclists, emphasize the need for clear rules, dedicated infrastructure, and responsible riding to ensure the safety of all individuals sharing roads and paths.[39] Disability advocates highlight the potential risks posed by e-mobility devices to people with vision and mobility impairments, particularly concerning footpath accessibility and safety.[54] Health and trauma experts provide critical data on the increasing number and severity of e-scooter and

e-bike related injuries, advocating for preventative measures such as mandatory helmet use and stricter regulations.[53] Academia contributes valuable research on e-mobility usage patterns, safety risks, and potential solutions, informing evidence-based policy recommendations.[55] The e-mobility industry offers perspectives on regulations, safety standards, and the practicalities of implementing different policies, while also highlighting the benefits and growing demand for these devices.[4] Finally, all levels of government – Commonwealth, state, and local – have a role in regulating and managing e-mobility, with ongoing discussions about the need for better coordination and consistent approaches.[1] These diverse stakeholder perspectives underscore the complexity of the e-mobility landscape and the importance of considering all viewpoints in developing effective and balanced regulations and policies.

10. Conclusion and Recommendations

E-mobility presents significant benefits for Queensland, offering a sustainable, economical, and healthy alternative for transportation. However, the rapid increase in its adoption has also brought forth considerable safety challenges, as evidenced by the rising number of crashes, injuries, and fatalities. Concerns surrounding the safety of riders and pedestrians, the risks associated with lithium battery ownership, and questions about the adequacy of the current regulatory framework are prominent within the community and among key stakeholders.

The analysis of the research material reveals several key areas that warrant the attention of the Queensland Parliamentary Inquiry:

- **Enhancing Safety Regulations:** While Queensland has established regulations for e-mobility devices, the persistent rise in safety incidents suggests a need for a thorough review and potential strengthening of these rules. This includes considering stricter speed limits in certain areas, mandating safety equipment such as helmets for all riders, and clarifying rules regarding riding on footpaths and shared pathways.
- **Improving Enforcement:** The effectiveness of the current enforcement approaches appears to be limited by resource constraints and the challenges of monitoring compliance, particularly for privately-owned devices. Exploring technological solutions and increasing enforcement efforts in high-risk areas could improve rider behaviour and overall safety.
- **Addressing Legal Gaps:** The inconsistencies between Commonwealth and Queensland laws, particularly concerning the importation of non-compliant devices, need to be addressed. Collaboration between different levels of government is crucial to ensure that only safe and legal e-mobility devices are available for use in Queensland.
- **Strengthening Communication and Education:** While various communication and education initiatives are underway, their effectiveness in reducing risky behaviours needs to be evaluated. Targeted campaigns and easily accessible resources that clearly outline the rules and consequences of unsafe use are essential for promoting a culture of safety among e-mobility device users.

- **Incorporating Stakeholder Perspectives:** The diverse views and concerns of community members, road user groups, disability advocates, health experts, academia, and the e-mobility industry must be carefully considered in shaping future regulations and policies. A balanced approach that addresses the needs and concerns of all stakeholders is crucial for the successful and safe integration of e-mobility in Queensland.

Recommended Actions:

- **Conduct a comprehensive review of the current regulatory framework for PMDs and e-bikes in Queensland**, taking into account best practices from other Australian states and international jurisdictions. This review should specifically focus on speed limits, helmet requirements, and rules of use on different types of infrastructure.
- **Investigate and recommend strategies to enhance the enforcement of e-mobility laws**, including exploring the use of technology and increasing resources for police services in high-risk areas.
- **Collaborate with the Commonwealth Government to address the legal gaps** that allow the importation and use of illegal and non-compliant e-mobility devices in Queensland. This may involve advocating for clearer definitions and stricter import controls at the federal level.
- **Develop and implement a comprehensive, targeted communication and education strategy** aimed at all e-mobility device users, and the broader community, to raise awareness about device requirements, rules, safety practices, and the consequences of unsafe use.
- **Ensure ongoing engagement with all relevant stakeholder groups**, including community members, road user groups, disability advocates, health experts, academia, and the e-mobility industry, throughout the inquiry process and in the development of future policies and regulations.
- **Consideration of Tiered Registration/Identification:** The inquiry should thoroughly explore the feasibility and benefits of a tiered registration or identification system for PMDs. This approach could differentiate between low-power, compliant devices and higher-power, non-compliant or "illegal" devices. For compliant PMDs, this might involve unique digital identifiers (e.g., QR codes linked to owner details) rather than traditional physical plates. Such a system could facilitate post-incident identification, data collection, and enforcement without imposing undue burden on users of legally compliant devices.
- **Consider the implementation of specific regulations for shared e-mobility schemes**, such as mandatory speed limits in pedestrian-heavy zones, designated parking areas enforced through geofencing technology, and requirements for user safety training and insurance.
- **Explore options for mandating minimum safety standards for e-mobility devices and batteries** sold in Queensland, aligning with national or international standards to mitigate fire risks and ensure product safety.

- **Investigate the feasibility of establishing a clear and accessible system for reporting safety incidents and near misses** involving e-mobility devices to better understand the factors contributing to accidents and inform targeted interventions.

For Enforcement Agencies (Queensland Police Service):

- **Clarified Enforcement Strategy:** The development and clear communication of a refined enforcement strategy that explicitly distinguishes between compliant PMDs and illegal devices is recommended. This strategy should outline how identification (or the lack thereof) impacts enforcement actions and how police will differentiate between device types in the field.
- **Technological Integration:** Exploration of how existing or emerging technologies, such as the Internet of Things (IoT) capabilities often embedded in PMDs , could be leveraged to assist in identification, tracking, and enforcement is encouraged. This could potentially offer alternatives or complements to traditional physical registration.

Broader Policy Considerations:

- **Infrastructure Development:** Continued advocacy for and investment in dedicated and protected mobility lanes is paramount. Separating PMDs from pedestrians and conventional vehicular traffic is a fundamental safety measure that reduces collision risks and improves overall road user safety, irrespective of any registration system.
- **Insurance Frameworks:** A comprehensive review of the current insurance landscape for PMDs is advisable. This should include considering whether a mandatory third-party insurance scheme (similar to that for MMDs [9]) should be introduced for PMDs, potentially linked to an identification system, to provide greater protection for victims of PMD-related incidents and address liability concerns.
- **National Consistency:** Given the interest from national bodies like the National Transport Commission, it is recommended that Queensland's findings and any subsequent policy changes contribute actively to the development of a nationally consistent approach to PMD regulation across Australia. This would ensure clarity and predictability for manufacturers, retailers, and users across state borders.

By carefully considering these recommendations, the Queensland Parliamentary Inquiry can contribute to a safer and more sustainable future for e-mobility within the state, balancing the benefits of these innovative transport options with the need to protect all members of the community.

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PART THREE; Pavement Suitability and Safety for Modern Mobility Devices in Queensland

Overview

The rapid proliferation of e-bikes, e-scooters, and other Personal Mobility Devices (PMDs) presents both opportunities and significant challenges for urban transport infrastructure, particularly concerning the suitability and safety of existing pavements. This report addresses concerns regarding pavement adequacy for these new uses in Queensland, focusing on issues of design, safety, wear and tear, and funding.

Analysis of current Australian and international design standards reveals an evolving understanding of the needs of PMD users. However, a considerable gap often exists between these contemporary guidelines and the condition of older, existing pavements, many of which were not designed for the speeds, weights, and usage patterns of modern PMDs. Queensland's "existing and pre E-mobility" pavements, as highlighted by user concerns, exacerbate these issues, potentially leading to increased safety risks and accelerated pavement degradation. Pavement characteristics such as surface roughness, width, and material type significantly influence PMD stability and rider safety, with smoother, wider, and more durable surfaces like asphalt and concrete generally preferred.

Safety data from Queensland and international sources indicate a rise in PMD-related injuries, with a notable proportion being single-vehicle incidents or falls, suggesting a strong link to environmental factors including pavement condition. While direct research quantifying pavement wear specifically from e-scooters and e-bikes is limited, analogous studies on dynamic loading and surface abrasion indicate a potential for accelerated deterioration of pavement surfaces, particularly on already compromised or lower-specification paths.

Current funding mechanisms for pavement maintenance in Queensland do not appear to specifically account for the potential additional wear and tear imposed by PMDs. This suggests a potential unfunded liability for local governments responsible for maintaining this infrastructure. Life Cycle cost analysis for shared paths must evolve to incorporate data on PMD-specific wear rates to ensure sustainable management.

This report concludes with strategic recommendations focusing on updating pavement design and assessment guidelines to explicitly consider PMD requirements, enhancing safety through targeted infrastructure upgrades, commissioning research to quantify PMD-induced wear, and exploring sustainable funding models to address increased maintenance needs. The ongoing Queensland Parliamentary Inquiry into e-mobility safety provides a critical opportunity to address these multifaceted infrastructure challenges.

1.The Evolving Landscape of Urban Mobility and Pavement Infrastructure in Queensland

The 21st century has witnessed a significant transformation in urban mobility, marked by the rapid adoption and increasing popularity of Personal Mobility Devices (PMDs), such as e-scooters and e-bikes. These devices are increasingly utilised for commuting, leisure, and solving the "last-mile" problem in cities across the globe, including those in Queensland. This surge in PMD use offers benefits like reduced traffic congestion and lower emissions, but it has also brought to the forefront critical questions about the adequacy and safety of existing urban infrastructure. The Queensland Government has acknowledged the growing use of PMDs and associated safety concerns, evidenced by the initiation of a Parliamentary Inquiry into e-scooter and e-bike safety. This inquiry aims to address community concerns and improve safety for all road and path users.

This report directly addresses concerns regarding the suitability of "old" and "existing" pavements in Queensland, particularly those described as "existing and pre E-mobility," for the mixed-use demands of pedestrians, cyclists, and these new PMDs. There is a tangible apprehension that these modern mobility devices may cause substantial wear and tear on pavements, an impact potentially not being adequately funded or addressed by current government frameworks. The proliferation of PMDs appears to have outpaced both infrastructure adaptation and comprehensive regulatory foresight. This is suggested by the user's observation of "old" pavements being used by new devices, coupled with governmental inquiries [1] and the ongoing efforts by national bodies like Austroads to update planning and design guidance for micromobility. Such a reactive posture, where policy and infrastructure development follow the emergence of problems, can lead to a cycle of safety incidents and public concern, rather than integrated, future-proofed planning. Consequently, existing pavements may be subjected to stresses and user conflicts for which they were not originally designed.

The specific mention of "existing and pre E-mobility" pavements in Queensland points to a critical mismatch. Ideal operating conditions for PMDs involve smooth, sufficiently wide paths, yet the on-ground reality may differ significantly. This disparity has direct implications for both user safety and the longevity of the devices themselves, and it may also accelerate pavement wear due to increased dynamic loading and vibration, as research indicates that pavement roughness significantly impacts e-scooter dynamics and rider safety.

The objectives of this report are therefore to:

- Analyse the relationship between pavement suitability and safety for PMDs.
- Assess the adequacy of existing pavement infrastructure for diverse, modern uses.
- Investigate the nature and extent of wear and tear on pavements attributable to e-mobility

devices.
- Examine current funding mechanisms and maintenance responsibilities for pavement infrastructure in light of these new demands. This analysis will draw upon a range of sources, including government reports, industry studies, and academic research, to provide an evidence-based understanding of these complex issues.

2. Pavement Design and Suitability for Modern Mobility Devices

The suitability of pavement infrastructure for the safe and efficient operation of modern mobility devices is fundamentally linked to its design, construction, and the materials used. As PMDs become more prevalent, existing standards and practices are being re-evaluated.

2.1. Current Australian and International Design Standards for Shared Paths

In Australia, Austroads provides foundational guidance for the design of paths. The *Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling* (AGRD06A) outlines considerations for path users, including operating spaces, path widths, clearances, surface treatments, and maintenance requirements.[2] This guide has seen updates to include considerations for mobility scooters and path widths based on user volumes, indicating an evolution in design thinking. However, the core document predates the widespread adoption of e-scooters and similar PMDs, suggesting that while foundational, it may not fully address the specific nuances of these newer devices.[2]

A more contemporary and detailed example is the South Australian "Guide to Bikeway Pavement Design, Construction & Maintenance".[3] This guide is significant as it explicitly includes "scooters" and "other users of wheeled devices" within its definition of bikeway users, encompassing a broader range of PMDs. It provides comprehensive details on various pavement types (flexible and rigid), materials (such as asphalt, concrete, and pavers), design life considerations, and economic aspects of bikeway provision. Notably, it highlights that certain surfaces, like unsealed gravel or concrete block pavers with significantly chamfered edges, are generally unsuitable for small-wheeled devices due to issues with rideability and stability.[3] The guide also provides expected service lives for different surfacing types, for instance, 10-20 years for dense graded asphalt and 40 years for concrete, though the latter may require retexturing.

Local governments also adapt and implement these standards. For example, the Townsville City Council Planning Scheme Policy for Development Works references Austroads guidelines and specifies design parameters for pathways and cycleways, including considerations for width, gradient, crossfall, and clearances, explicitly mentioning "personal mobility devices". These local policies emphasize safety, accessibility, and the creation of a continuous accessible path of travel, free from hazards.

International perspectives offer further insights. A report by the European Commission, for

instance, recommends that e-scooters should ideally be banned from pavements to protect pedestrians. Instead, it suggests the use of cycle paths, provided they are wide enough to safely accommodate different types of vehicles, including PMDs and bicycles, and that their surfaces are smooth and well-maintained.[4] This highlights a global trend towards recognising the need for dedicated or appropriately adapted infrastructure for PMDs.

While these design guidelines are evolving, a significant disparity likely exists between the standards for new or reconstructed paths and the actual characteristics of "old" or "existing" pavements that constitute the majority of the current network. There is no explicit mechanism detailed in these guides for systematically assessing and upgrading vast networks of older paths to meet new PMD-driven demands beyond general maintenance protocols. This implies a long-term and potentially costly challenge of retrofitting infrastructure. Until such upgrades occur, PMD users will continue to operate on potentially suboptimal pavements, with inherent safety and wear concerns.

Furthermore, the definition of "shared use" is critical and is often stretched by the introduction of PMDs that are faster and heavier than the devices traditionally common on footpaths. The South Australian Guide, for instance, includes a wide array of users on shared paths.[3] However, the dynamic characteristics, operational speeds, and potential impact forces of e-scooters and e-bikes differ significantly from traditional pedestrian use or even standard bicycles. This raises questions about whether original "shared use" design parameters adequately cover the forces exerted and the safety envelopes required by this new generation of PMDs. A re-evaluation of the "shared use" path design philosophy may be necessary, moving beyond simple designation to a more nuanced approach that considers specific PMD operational characteristics and their potential for conflict or accelerated wear.

The following table provides a comparative overview of key aspects from relevant pavement and path design guidelines:

Table 1: Comparative Overview of Relevant Pavement/Path Design Guidelines

Guideline/Source	Primary Design Users Explicitly Mentioned	Key Recommended Widths (Shared Use)	Recommended Surface Types & PMD Suitability Notes	Specific PMD Considerations (Examples)
Austroads AGRD06A [2]	Pedestrians, Cyclists, Mobility	Variable, based on volume and	Bituminous, concrete, unsealed, timber (Appendix C3).	Sight distance, gradients, operating spaces. Evolving to

	Scooters	context (e.g., 2.5m min for some shared paths)	General guidance, less specific to e-scooter/PMD nuances.	include newer user types.
SA "Guide to Bikeway Pavement Design" [3]	Pedestrians, Cyclists, Wheelchairs, **Scooters**, Skateboards, Small-wheeled vehicles	Shared paths: 2.5m desirable min, 3.0-4.0m for major paths.	Asphalt, concrete (good rideability for all wheeled traffic). Granular with slurry/asphalt surfacing recommended. Gravel, some pavers unsuitable for small wheels.	Design traffic loading considers various users including maintenance vehicles. Surface smoothness and skid resistance are key.
Townsville City Council Planning Scheme Policy	Pedestrians, Cyclists, **Personal Mobility Devices**, Wheelchairs	Pedestrian paths: 1.8m desirable min. Shared paths: 2.5m absolute min, 3.0-4.0m (3.5m desirable) for major recreation.	References Austroads. Emphasises smooth, all-weather, skid-resistant, dust-free surfaces.	Universal access, clear continuous path, void of tripping hazards.
European Commission Report (Recommendations) [4]	E-scooters, Cyclists, Pedestrians	Cycle paths need to be "wide enough" for safe co-use.	Smooth and well-maintained surfaces for cycle paths used by PMDs.	Ban e-scooters from pavements; provide alternatives like wider cycle paths; designated parking.

This table illustrates that while PMDs are increasingly acknowledged, the specificity of design guidance varies. The South Australian guide stands out for its explicit inclusion of scooters and detailed pavement considerations.

2.2. Assessing the Adequacy of "Old" and "Existing" Pavements for Mixed Use

A primary concern is the suitability of "old" and "existing" pavements, which were often designed and constructed before the widespread emergence of e-scooters and e-bikes. These older footpaths and bikeways were typically engineered for pedestrian loads and lower-speed, lighter-weight bicycles. Their design life and intended use did not anticipate the types of dynamic loads or the intensity of traffic now being introduced by PMDs.

The characteristics of "existing and pre E-mobility" pavements, as described in the Queensland context, often fail to meet current best-practice guidelines for shared paths. Recommended widths in contemporary guides (e.g., 2.5m to 4.0m for shared paths) are frequently not met by older infrastructure, leading to reduced space for manoeuvre and increased potential for conflict between users. Similarly, surface regularity is a key functional requirement, and "bumpy" surfaces directly contradict this.

A significant issue is the apparent lack of specific, widely adopted guidance on how to systematically retro-assess older pavements for their suitability for PMD traffic beyond general maintenance condition assessments. While the South Australian Bikeway Guide, for example, discusses monitoring functional performance (like roughness and shape) and structural integrity (cracking, deformation) [3], this is primarily in the context of ongoing maintenance for their originally intended use or a general mix of users. It does not detail a specific methodology for re-evaluating an *old* path's fundamental design adequacy for *new* and different device types like e-scooters, especially concerning dynamic load capacity or specific wear resistance to these devices.[3] Austroads AGRD06A also lacks specific advice on assessing the suitability of existing or older pavements for e-scooters/PMDs.[2]

This points to a critical information gap regarding methodologies to systematically evaluate the suitability of existing, older pavement networks for safe and sustainable PMD use. Design guides tend to focus on new construction, while maintenance guides address repairing existing damage to often outdated standards. The core question of whether the *original design* of these old paths is fundamentally adequate for new PMD uses remains largely unaddressed by a formal assessment framework. Without such methodologies, local governments may struggle to prioritise upgrades effectively. This can lead to a patchwork of pavement conditions across the network, with persistent safety and wear concerns on older sections, and potentially inefficient allocation of limited maintenance and upgrade funds.

The "bumpiness" of pavements is a particularly salient issue. It is not merely a matter of comfort but represents a significant safety hazard and a potential accelerator of wear for PMDs. Research directly links pavement roughness, often quantified by the International Roughness Index (IRI), to increased vibrations, rider discomfort, and potential health and safety risks for e-scooter users, largely due to their small wheel size and often rudimentary suspension systems.[5] Furthermore, increased dynamic loads resulting from PMDs bouncing on uneven surfaces could accelerate pavement micro-damage and overall deterioration. Therefore, addressing the "bumpiness" of Queensland pavements should be a high priority, not only for enhancing user experience but also as a core measure for safety and asset preservation in the context of increasing PMD use. This may necessitate the adoption of more stringent surface regularity standards for paths frequently used by PMDs.

2.3. Pavement Material Performance and Suitability for E-Mobility

The choice of pavement material significantly influences the performance, safety, and longevity of shared paths, especially with the introduction of diverse PMDs. Common materials include asphalt, concrete, various types of pavers, and, less commonly for high-use urban paths, unsealed granular surfaces. Each material presents different performance characteristics in terms of initial smoothness, skid resistance, durability, waterproofness, maintenance requirements, and expected service life.

For PMD suitability, smoothness and skid resistance are paramount. The South Australian "Guide to Bikeway Pavement Design, Construction & Maintenance" notes that asphalt and concrete generally offer good rideability for all users, including those on small-wheeled devices.[3] Conversely, surfaces like loose gravel or pavers with wide or deep chamfers can be problematic, leading to instability and discomfort. Academic research supports the preference for asphalt and concrete, which typically exhibit good skid resistance, a crucial factor for PMD safety given their braking capabilities and the need for quick responses in mixed traffic environments. In contrast, some decorative pavements, such as painted cobbles or very smooth tiles, have been found to offer poor skid resistance, potentially increasing accident risk.

The interaction between PMDs and pavement roughness is a critical area of research. Studies focusing on e-scooter dynamics have demonstrated that pavement roughness (quantified by IRI) directly influences the level of vibration and dynamic acceleration experienced by riders. This not only affects comfort but can also pose safety risks, particularly on uneven surfaces like stone pavements, or where there are frequent joints and discontinuities.[5] The small wheel diameter of many e-scooters makes them particularly sensitive to such irregularities. This research directly validates concerns about "bumpy" pavements being a safety issue.

Where existing pavements exhibit deficiencies, various surface treatments can be employed to enhance or restore their characteristics. For asphalt pavements, these can include seal coats (like fog seals or sand seals) or thin slurry seals and micro-surfacings, which can improve skid resistance, seal minor cracks, and provide a smoother riding surface. For concrete, retexturing may be needed over time to maintain skid resistance. Specialised pedestrian traffic coatings, often elastomeric or polyurethane-based, can also provide durable, skid-resistant, and waterproof surfaces, though their application is typically for specific areas like plazas or bridges.

The proliferation of PMDs has made the choice of pavement material for shared paths more critical than ever. It has shifted the focus from primarily pedestrian comfort and aesthetics towards encompassing the dynamic safety needs of faster, often small-wheeled, devices. Materials that are perfectly acceptable for walking might prove hazardous or prone to rapid wear under frequent PMD traffic. This suggests that pavement selection for new paths, and resurfacing choices for existing ones, must now explicitly consider PMD operational characteristics. In high PMD use areas, this might necessitate prioritising smoother, more durable, and skid-resistant surfaces like well-compacted asphalt or properly finished concrete

over certain types of unit pavers or decorative finishes that may compromise safety or longevity.

A potential conflict can arise between aesthetic urban design preferences for pavement surfaces and the functional safety requirements of PMDs. For example, the poor skid resistance of "painted cobble and smooth painted tile pavements" is a concern, as these materials are often selected for their visual appeal in urban plazas or pedestrian-priority zones. If PMDs are permitted in these areas, such surfaces could pose an elevated risk. This underscores the need for closer collaboration between urban designers and transport planners to ensure that material choices in shared spaces effectively balance aesthetic considerations with the safety needs of all users, including the specific requirements imposed by PMDs. This might involve strategically designating PMD-friendly routes with optimized surfaces even within larger, aesthetically designed public spaces.

3. Safety Implications of Pavement Conditions for E-Mobility Users

The interaction between PMDs and pavement conditions is a critical determinant of user safety. Suboptimal pavement characteristics can significantly increase risks for riders and other path users.

3.1. Documented Safety Risks and Injury Patterns Associated with E-Mobility Devices

The rise in PMD use has unfortunately been accompanied by an increase in related injuries and, in some cases, fatalities. In Queensland, between 2021 and 2024, there was a reported 112% increase in injuries to PMD riders, passengers, and pedestrians, with eight PMD users dying in the state in the year preceding May 2025. This alarming trend prompted the Queensland Government to launch a parliamentary inquiry into e-mobility safety.

International data mirrors these concerns. A US study using National Electronic Injury Surveillance System data from 2000 to 2017 found that persons injured using e-bikes were more likely to suffer internal injuries and require hospital admission compared to pedal cyclists. Powered scooter injuries were nearly three times more likely to cause a concussion. This study also noted that e-bike-related injuries were more than three times as likely to involve a collision with a pedestrian. European research suggests that injuries resulting from e-scooter crashes tend to be more severe than those from bicycle crashes, with head injuries being particularly common, followed by fractures of the lower and upper limbs, and soft tissue injuries.[4] The low rate of helmet use among e-scooter riders is a significant contributing factor to the severity of head injuries.

A high proportion of PMD crashes are reported as falls or single-vehicle incidents.[4] While rider inexperience or error can play a role, such incidents are also strongly indicative of interaction with the riding environment, including pavement defects or unsuitable surfaces. Academic studies have noted a dramatic increase in e-scooter injuries treated in emergency departments

following the introduction of shared e-scooter services, with up to 10% of surveyed e-scooter riders in one multi-country study reporting having experienced a crash. The financial impact of these injuries can also be substantial, with one US study reporting average total billing charges for e-scooter clinical encounters at over $95,000, although this study did not directly link injuries to pavement conditions.

The high incidence of single-vehicle PMD crashes, particularly falls, strongly suggests that environmental factors, including pavement condition, play a more significant role in safety outcomes than perhaps commonly acknowledged. While rider behaviour and collisions with other road users are critical aspects of PMD safety, the interaction with the physical infrastructure—the pavement itself—is a fundamental determinant of device stability and control. Potholes, cracks, uneven surfaces, loose material, or inadequate skid resistance can all precipitate a loss of control, especially for devices with small wheels and limited suspension. Therefore, improving pavement quality, focusing on smoothness, skid resistance, and the absence of defects, could be a highly effective, yet perhaps underemphasized, strategy for reducing a significant portion of PMD-related injuries. This shifts some of the safety focus from solely rider education and enforcement towards a more holistic approach that includes infrastructure quality as a primary preventative measure.

The following table summarizes key safety issues and injury data related to e-mobility devices:

Table 2: Summary of E-Mobility Safety Issues and Injury Data

Jurisdiction/Study Source	Key Safety Statistic/Finding	Reported Contributing Factors	Specific Link to Pavement/Infrastructure (If Mentioned/Implied)
Queensland Government	112% rise in PMD injuries (2021-2024); 8 PMD user deaths in 2024.	Unsafe/unlawful riding.	Implied: general environment, inquiry to investigate.
US Study (NEISS data)	E-bike users: more internal injuries, hospital admissions. Scooter users: higher concussion rates. E-bikes: more pedestrian collisions.	Differing injury patterns by device.	Not explicitly detailed, but falls are a common mechanism for such injuries.

European Commission Report [4]	E-scooter injuries are often more severe than bicycle injuries; head injuries are common. High proportion of crashes are falls (unilateral). Most severe injuries/deaths involve motor vehicles.	Low helmet use.	Implied: Falls suggest surface interaction. Smooth, well-maintained surfaces recommended.
Academic Study (Injury increase post-shared e-scooters)	Significant increase in e-scooter injuries post-introduction of shared services. Up to 10% of riders reported a crash.	Increased exposure and use.	Not explicitly detailed for pavement, but crashes include falls.
US Study (Financial Impact)	Average total billing for e-scooter clinical encounters: $95,710.	N/A (focus on cost).	Not linked to pavement.

This consolidation highlights the widespread nature of PMD safety concerns and underscores the need to investigate all contributing factors, including the role of pavement infrastructure.

3.2. The Influence of Pavement Characteristics (width, surface defects, bumps) on Rider Safety and Device Stability

Pavement characteristics have a direct and profound influence on the safety and stability of PMDs. Research has established a clear link between pavement roughness (often measured by the International Roughness Index, IRI), vehicle speed, and the vibrations and dynamic accelerations experienced by e-scooter riders.[5] These studies show that even on pavements with good overall roughness characteristics, medium to high speeds (e.g., 16-26 km/h) can lead to uncomfortable or even harmful levels of vibration for the rider. Surfaces such as stone pavements, those with frequent construction joints, or other discontinuities are particularly problematic due to the small wheel size and often limited suspension of e-scooters.[5] This makes riders more susceptible to losing control when encountering potholes, cracks, bumps, or abrupt changes in level.

The "existing and pre E-mobility" pavements identified as a concern in Queensland directly align with these research findings. Narrow paths inherently increase the risk of conflict with pedestrians and other users, as they limit the space for safe overtaking and evasive manoeuvres.

This is particularly relevant where PMDs share space with pedestrians, and Queensland rules permit PMD operation on footpaths at speeds up to 12 km/h. "Bumpy" surfaces, as discussed, directly compromise device stability and rider control, increasing the likelihood of falls. European recommendations for PMD infrastructure explicitly call for road surfaces to be "smooth and well-maintained".[4]

Furthermore, research into e-scooter rider behaviour has indicated that riding on pavements (footpaths) is often influenced by the perceived inadequacy or unsafe nature of alternative infrastructure. A study using AI cameras on e-scooters found that nearly three-quarters of pavement riding occurrences were influenced by road and infrastructure conditions, such as cycle lanes ending abruptly onto pavements, blocked dedicated paths, or riders feeling safer on the pavement than on the road. This suggests that a lack of continuous, well-designed, and well-maintained dedicated facilities can inadvertently push PMD users onto pedestrian infrastructure, which may not be suitable for their safe operation, thereby increasing risks for all parties.

Sub-optimal pavement conditions can thus create a detrimental feedback loop. Paths that are bumpy, narrow, or poorly maintained lead to rider discomfort and can encourage unsafe practices such as riding on pedestrian-only sections of footpaths or making unpredictable swerving movements to avoid hazards. These behaviours, in turn, increase the risk of conflict and accidents, which can further erode public confidence in PMDs and lead to calls for more restrictive regulations. Investing in high-quality, continuous, and sufficiently wide pavements suitable for PMDs is therefore not merely an amenity; it is a fundamental requirement for breaking this negative cycle and fostering the safer, more harmonious integration of PMDs into the urban transport mix.

The "last mile" convenience often touted as a key benefit of PMDs is also significantly undermined if the infrastructure for that "last mile"—typically local streets and footpaths—is unsafe or uncomfortable to navigate. If these critical links in the transport chain are characterised by narrowness, bumpiness, or discontinuities, as suggested by the user's concerns and supported by findings about path network deficiencies, the perceived safety and overall utility of PMDs for this purpose diminishes. To truly realise the transport benefits of PMDs, a consistent quality of pavement infrastructure is essential across the entire journey, including crucial access points and connections to public transport hubs, not just on isolated segments of dedicated cycleways.

3.3. Regulatory and Investigative Responses to E-Mobility Safety

In response to the safety challenges posed by the rise of e-mobility, governments and transport authorities have initiated various regulatory and investigative measures. A prominent example in Queensland is the establishment of a Parliamentary Inquiry into e-scooter and e-bike safety. The

terms of reference for this inquiry are broad, covering safety risks, the adequacy of current rules and enforcement, importation laws, and soliciting diverse stakeholder views.[1] While not explicitly singling out pavement conditions or maintenance funding in its primary terms, the inquiry's scope for examining "safety issues" and "broad stakeholder perspectives" provides a crucial avenue for these infrastructure-related concerns to be formally raised and considered.[6]

Similar actions have been taken elsewhere. New South Wales also conducted a Parliamentary Inquiry into e-mobility, which resulted in recommendations for a comprehensive regulatory framework, significant investment in dedicated cycleways, and specific rules for the use of e-mobility devices on footpaths.[7] This indicates a regional recognition of the need for both regulatory and infrastructural solutions.

Nationally, Austroads is actively working to update its planning guidance for cycling and micro mobility to better incorporate these new transport modes. This involves revising key documents like the Austroads Guide to Traffic Management and developing tools to assist planners in creating safer and more accessible networks.[8]

Locally, regulations are in place governing PMD use. In Queensland, including Brisbane, rules specify speed limits (typically 12 km/h on footpaths and 25 km/h on separated paths and bikeways), mandatory helmet use, and restrictions on where devices can be ridden. These rules aim to manage interactions between PMD users and other path users, particularly pedestrians. European countries exhibit a range of approaches, with varying legal statuses for e-scooters, but a general trend towards allowing their use on bicycle facilities, and, in some expert recommendations, banning them from pedestrian pavements to enhance safety.[4]

Current regulatory responses, such as imposing speed limits for PMDs on footpaths, often represent attempts to manage the risks associated with operating these devices on infrastructure that may not be ideally suited for them. For example, a 12 km/h speed limit on footpaths acknowledges the potential danger to pedestrians. However, if these same footpaths are also "bumpy" and uneven, as per user concerns and research on e-scooter dynamics, even this reduced speed might pose a stability risk to PMD riders or fail to prevent discomfort. This suggests that regulations alone can act as a temporary or partial measure, rather than a complete solution for underlying issues of inadequate pavement design or condition. A more effective, long-term strategy would involve a dual approach: implementing appropriate regulations for device use *and* making significant investments in upgrading infrastructure to be genuinely fit-for-purpose. Relying predominantly on rules without concurrently improving deficient pavements may not achieve the desired comprehensive safety outcomes.

The inclusion of "stakeholder views" in governmental inquiries [1] is a critical mechanism. It provides a formal opportunity for concerns about specific issues like pavement wear, maintenance challenges, and funding shortfalls—as articulated in the initial query prompting this

report—to be tabled and considered by policymakers. The effectiveness of such inquiries in addressing these often technical and less publicly debated aspects of infrastructure management depends significantly on the quality, evidence base, and persistence of stakeholder submissions, particularly from local governments, engineering bodies, and informed community groups.

4. Pavement Wear and Tear: Investigating the Impact of E-Bikes and E-Scooters

A significant concern accompanying the rise of e-mobility is the potential for accelerated wear and tear on pavements, particularly those not originally designed for such intensive use by new types of devices.

4.1. Understanding Potential Pavement Degradation from E-Mobility Devices (dynamic loads, abrasion)

While PMDs such as e-scooters and e-bikes are considerably lighter than cars and trucks, their interaction with pavement surfaces can still lead to degradation through several mechanisms. The small, often hard, wheels of some PMDs, particularly e-scooters, can concentrate loads onto smaller contact areas of the pavement surface. This concentration of stress, repeated over many passes, could contribute to surface wear.

A key factor is dynamic loading. On smooth surfaces, the load exerted by a PMD is close to its static weight. However, on "bumpy" or uneven pavements, PMDs can experience vertical accelerations, leading to impact forces significantly higher than their static weight. This phenomenon is well-documented for heavier vehicles, where dynamic loads caused by the interaction of vehicle speed and pavement roughness can reduce pavement life and accelerate failure. While the magnitude of PMD loads is smaller, the principle remains. Increased dynamic impacts from PMDs on uneven surfaces could accelerate micro-damage, such as the initiation or propagation of fine cracks in asphalt or concrete, or the loosening of aggregate particles. Research on the effects of high-frequency, low-impact loading, particularly in the presence of water, indicates that such conditions can lead to pore water pressure buildup and fatigue cracking in asphalt pavements. Surface waves or "washboarding" can also result from improper compaction or mix issues, and if severe enough, can cause vehicles to bounce, increasing impact loading.

Surface abrasion is another potential concern. Frequent acceleration, braking, and turning manoeuvres by PMDs, especially those with solid tyres or operating on more susceptible surfaces, could lead to gradual wearing away of the pavement's surface layer. While distinct from the aggressive wear caused by studded tyres in colder climates, the underlying principle of concentrated stress and friction causing material attrition over time is relevant. Studies on

studded tyre wear have shown that repeated passes can erode the surface matrix of both asphalt and Portland cement concrete, exposing coarse aggregate and altering surface texture.

The South Australian "Guide to Bikeway Pavement Design" considers overall traffic loading in its design examples, which sometimes includes occasional heavy maintenance vehicles.[3] However, it does not specifically isolate or quantify the unique wear characteristics that might be associated with high volumes of PMD traffic. Similarly, the NSW Parliamentary Inquiry into e-mobility heard from one local council that traditional bicycles (and by extension, likely e-bikes of comparable weight and tyre type) cause negligible road damage compared to cars. However, the same submission raised concerns about the potential impact of heavier "fat bikes," which can weigh around 50 kg, suggesting a threshold where device weight, combined with usage frequency, might become a factor for path wear.[7] Standard e-scooters typically weigh between 12-25 kg, but heavier and more powerful models are available.

The primary concern for PMD-induced pavement wear may not be immediate, catastrophic structural failure, as might be seen with overloaded trucks on under-designed roads. Instead, it is more likely to manifest as accelerated surface degradation. This could include increased roughness over time, the development of micro-cracking, surface ravelling (loss of fine aggregate), or localised abrasion in areas of high PMD traffic concentration (e.g., at stops, starts, or sharp turns). Such degradation would occur particularly on lower-specification pavements, older paths already exhibiting some distress, or surfaces not designed for the intensity and type of loading imposed by frequent PMD use. This type of wear wouldn't necessarily cause immediate sub-base failure but would degrade ride quality, reduce safety (e.g., through increased slipperiness or trip hazards), and necessitate more frequent and costly resurfacing or rehabilitation interventions.

A significant knowledge gap exists regarding the specific quantification of PMD-induced wear on typical shared path materials. While the concern about wear is valid and theoretically plausible, the available research snippets do not point to direct, empirical studies that measure, for example, millimeters of asphalt wear per hundred thousand e-scooter passes under controlled conditions. The Australian Road Research Board (ARRB), now the National Transport Research Organisation (NTRO), conducts extensive research on "evolving pavements" and long-term pavement performance, but this work has historically focused on road pavements subjected to much heavier vehicular loads. Without specific data on PMD wear rates, it is challenging for asset managers to accurately predict future maintenance needs, justify funding requests specifically for PMD-related wear, or optimize material selection for enhanced PMD durability. This highlights a critical need for targeted research in this area.

4.2. Review of Available Research on Pavement Wear (direct and analogous studies)

Direct research specifically quantifying the wear and tear on pavements caused by e-scooters

and e-bikes is notably limited in the provided materials. No studies were found that offer precise measurements of pavement surface loss or degradation rates directly attributable to PMD traffic under typical operating conditions. The South Australian "Guide to Bikeway Pavement Design, Construction & Maintenance," while comprehensive in many areas, does not specifically detail wear and tear from e-scooters or e-bikes.[3] Similarly, the NSW Parliamentary Inquiry report on e-mobility touches upon council views regarding damage from different vehicle types but does not present specific research on e-device wear.[7]

However, insights can be drawn from analogous research areas and established pavement engineering principles:

- **Dynamic Loading Principles:** Research on road pavements clearly demonstrates that dynamic loads, generated by the interaction of vehicle speed and pavement roughness, significantly influence pavement response and can shorten its effective life. Rougher surfaces lead to greater dynamic forces, which can accelerate pavement failure mechanisms. While these studies focus on heavier vehicles, the underlying physics of dynamic impact is applicable to PMDs, especially given their sensitivity to surface irregularities. Surface waves and other defects that cause vehicles to bounce increase impact loading, and repeated water pressure fluctuations under dynamic loading can also contribute to pavement degradation.
- **Abrasion from Concentrated Stresses:** Studies on the effects of studded tyres on road surfaces, though an extreme example of abrasive elements, illustrate how concentrated stresses applied repeatedly by wheels can lead to measurable wear on both asphalt and concrete surfaces. The process involves the erosion of the surface matrix and exposure or dislodgement of aggregate particles. While PMD wheels are not studded, the principle of concentrated stress from small, potentially hard wheels, particularly during acceleration, braking, and turning, could contribute to long-term surface abrasion.
- **Pavement-Device Interaction Dynamics:** Research focusing on e-scooter dynamics and rider comfort has quantified the significant vertical accelerations and vibrations experienced by riders on different pavement types, particularly rough or uneven ones.[5] These studies, while primarily aimed at rider safety and comfort, inherently describe the forces at the tyre-pavement interface. Higher vibrations and accelerations on the device imply correspondingly greater dynamic forces being exerted back onto the pavement surface, which are the precursors to wear.

The work of organisations like ARRB/NTRO in areas such as "Evolving Pavements" and long-term pavement performance (LTPP) studies is primarily oriented towards road networks and the impacts of heavy freight vehicles. However, their expertise in pavement materials science, load response, and condition assessment technology is relevant. ARRB Systems, for instance, develops and deploys sophisticated pavement assessment equipment, including tools like the Walking Profiler G3, which could be adapted or utilised for detailed monitoring of shared path

conditions, including roughness. The concept of "intrusive pavement sensors" mentioned in ARRB's work could, in the future, offer a means to directly measure loads and usage patterns on shared paths.

The current pavement management paradigm for shared paths may not adequately capture or model the specific wear mechanisms potentially introduced by high-frequency PMD traffic. Traditional maintenance schedules for footpaths and cycleways might be based on assumptions about pedestrian loads, environmental degradation (e.g., weathering, tree root damage), and occasional light maintenance vehicle traffic. The introduction of potentially millions of passes per year by PMDs, with their unique wheel characteristics and load patterns, especially on imperfect or older surfaces, represents a new loading regime that may not be explicitly accounted for in existing deterioration models or maintenance planning. This could lead to an underestimation of future maintenance needs and associated budget requirements, highlighting the need for research to develop or adapt pavement deterioration models that specifically incorporate the effects of PMD traffic on various common path types.

The following table provides an overview of research areas relevant to understanding pavement-device interaction and potential wear factors from PMDs:

Table 3: Overview of Research on Pavement-Device Interaction and Potential Wear Factors

Research Area/Study Type	Key Findings Relevant to PMDs	Implied Pavement Impact by PMDs	Source Snippets
E-scooter Dynamics & Rider Comfort	Pavement roughness (IRI) significantly increases e-scooter vibrations and rider discomfort/risk. Stone pavements, joints are problematic.	Higher dynamic forces exerted on pavement, potential for accelerated micro-damage from vibration and impact on uneven surfaces.	S27, S31, [5]
Dynamic Road Loading (General)	Dynamic loads increase with speed and roughness, reducing pavement life. Rougher surfaces cause greater pavement response and can accelerate	"Bumpy" paths will subject pavements to higher effective loads from PMDs than their static weight, potentially leading to faster surface degradation.	S33, S34, S57

	failure.		
Water Impact on Pavements	High-frequency loading combined with water can increase pore water pressure, leading to fatigue cracking and degradation.	PMD use on wet, cracked, or poorly drained paths could exacerbate water-related damage.	S58
Surface Abrasion Studies (e.g., Studded Tyres)	Concentrated, repeated stresses can abrade pavement surfaces, eroding matrix and exposing aggregate.	Potential for long-term surface abrasion from PMD wheels, especially during turning, acceleration, and braking on susceptible surfaces.	S55, S56
Pavement Condition Assessment Technology	Tools exist for measuring pavement roughness, structural condition, and other performance indicators.	Existing or adapted technologies could be used to monitor PMD impacts on path conditions over time.	S16

This table underscores that while direct evidence of PMD wear is scarce, established engineering principles and analogous research provide a strong basis for concern and for targeted investigation.

4.3. Considerations for Queensland's "existing and pre E-mobility" Pavements

The specific characteristics of pavements in Queensland, described by the user as frequently "existing and pre E-mobility," are likely to exacerbate the potential for both safety issues and accelerated wear from PMD use.

Narrowness in pathways can lead to the channelisation of PMD traffic. Instead of traffic being distributed across a wider area, repeated passes occur over the same limited wheel paths. This concentration of loading and abrasive action can accelerate localised wear, potentially leading to the formation of ruts or depressions over time, similar to how wheel track wear develops on roads.

The "bumpiness," or high surface roughness, of many existing Queensland pavements is a more immediate concern. As established by research, uneven surfaces significantly increase the dynamic loads exerted by PMDs. Each bump or irregularity encountered causes the device to

jolt, and this impact is transferred back to the pavement. These repeated, higher-than-static impact forces can lead to increased stresses within the pavement structure, potentially initiating or propagating micro-cracks, dislodging aggregate particles, and generally accelerating the deterioration of the pavement surface. Older, "bumpy" pavements are also more likely to already possess surface defects such as cracks and potholes. These existing defects are not only direct safety hazards for PMD riders, who can easily lose control if a small wheel encounters such an obstacle, but they also act as points of weakness in the pavement structure. Water can infiltrate these cracks, weakening the underlying layers, and the passage of PMD traffic over these compromised areas can further dislodge material and enlarge the defects.

Poor drainage, often associated with older, uneven pavements that may have lost their original crossfall or developed depressions, can also interact negatively with PMD traffic. Water ponding on the surface or saturating the pavement layers can reduce the strength of unbound materials and, under the repeated loading from PMDs, contribute to issues like the pumping of fine particles from the sub-base or base layers, leading to loss of support and further surface deformation.

Therefore, Queensland's specific context of an existing path network that includes many "existing and pre E-mobility" sections suggests that the region may experience more pronounced safety issues and potentially faster rates of pavement degradation from PMD traffic compared to jurisdictions with newer, higher-standard, and more uniformly well-maintained shared path networks. The negative interactions between PMDs and suboptimal pavement surfaces—leading to increased safety risks for riders and higher dynamic loads on the pavement—will likely be amplified under these conditions. This underscores that generic findings on PMD impacts might underestimate the problem in Queensland, making localised research, detailed condition assessments, and targeted upgrade programs even more critical.

5. Funding and Maintenance of Pavements in the Age of E-Mobility

The introduction and rapid uptake of PMDs raise critical questions about how the maintenance of shared path infrastructure is funded and whether current models are adequate to address potential new wear patterns.

5.1. Current Pavement Maintenance Funding and Responsibilities in Queensland

In Queensland, as in most Australian jurisdictions, the responsibility for the maintenance of local footpaths and cycleways typically rests with local government authorities. Funding for this maintenance is predominantly sourced from general council rates. While state and federal governments often provide grants for the construction of new active transport infrastructure or significant upgrades, dedicated, ongoing funding streams specifically for the routine maintenance of existing paths, let alone for addressing accelerated wear from new user types like PMDs, are less common.

The Queensland Government did implement an E-Mobility Rebate Scheme, which provided $1.93 million in rebates to residents for the purchase of e-bikes and e-scooters. The scheme aimed to promote safer usage by encouraging the uptake of high-quality devices as clean and active transport options. However, this initiative was focused on device acquisition and explicitly stated that "there are no plans to provide a new round of funding or launch a similar scheme".[2] It did not allocate funds towards infrastructure maintenance or upgrades related to PMD use.

Federal initiatives, such as the Active Transport Fund, have provided funding for projects across Queensland to build new or upgrade existing bicycle and walking paths. For instance, $24 million was invested in 25 projects, including new shared paths and cycling bridges. While such programs are beneficial for expanding and improving the active transport network, they are generally project-based and may not specifically target the incremental, ongoing wear and tear on the *entire existing network* that might be attributed to increased PMD traffic.

The available information does not point to any dedicated funding streams within Queensland specifically established to address pavement wear and tear caused by e-mobility devices. This situation is not unique; a New South Wales Parliamentary Inquiry noted that "Local councils have borne the brunt of the current fragmented approach and regulatory gaps... being asked to support e-mobility without adequate funding or support".[7] This suggests a common challenge across states where the responsibility for managing the infrastructural consequences of new mobility trends falls to local governments, often without commensurate additional funding. The current Queensland Parliamentary Inquiry into e-mobility safety and use, while not having pavement maintenance funding as an explicit term of reference, does allow for "broad stakeholder perspectives" [6], which could provide a platform for these financial concerns to be voiced.

There appears to be a misalignment between policies that promote PMD uptake—such as rebate schemes and official recognition of PMDs as sustainable transport options—and the establishment of dedicated funding mechanisms to manage the potential infrastructural consequences, like increased pavement wear, that may arise from that uptake. This situation can create an unfunded mandate for local governments. They are tasked with maintaining footpath and shared path assets but may face accelerated degradation due to new usage patterns without a corresponding increase in their maintenance budgets. This could lead to a decline in the overall quality of the path network over time or necessitate the diversion of funds from other essential local services to cover increased pavement maintenance costs.

The following table outlines current and potential funding avenues for shared path maintenance, with relevance to PMD impacts:

Table 4: Current and Potential Funding Avenues for Shared Path Maintenance in Queensland

Funding Source	Relevance to PMD Wear	Current Status in QLD (Examples)	Key Snippets
Local Government General Rates	Primary source for routine maintenance; may be insufficient for *accelerated* PMD wear.	Existing, ongoing.	General local government responsibility.
QLD Gov Grants (Specific Programs)	Historically focused on new builds/upgrades (e.g., Cycle Network Local Government Grants). The E-Mobility Rebate Scheme was for devices, not infrastructure.	E-Mobility Rebate concluded. Other grant programs may exist but are not specific to PMD wear.	S17, S21, S37
Federal Active Transport Fund	Supports new paths and upgrades.	Existing projects funded in QLD.	S22
PMD Operator Fees/Permits	Potential to contribute to safety upgrades or maintenance.	Explored elsewhere (e.g., for safety). Not explicitly for wear in QLD context from snippets. Brisbane has shared e-mobility schemes.	S25
Specific State/Federal Levies or Earmarked Funds for PMD Infrastructure Impacts	Could directly address wear and tear.	Not identified as existing in provided snippets.	

This table highlights that while general funding for paths exists, dedicated mechanisms to address the specific issue of PMD-induced wear and tear are not apparent.

5.2. Is E-Mobility Wear and Tear Accounted For?

Based on the available research and government information, there is no clear evidence that specific wear and tear on pavements caused by e-mobility devices is systematically accounted for in current Queensland government or local council funding models for pavement maintenance. While general maintenance budgets for footpaths and cycleways undoubtedly exist, whether these are calibrated or sufficient to cover any *accelerated* deterioration due to the unique characteristics and increasing prevalence of PMDs is the central question, and it remains largely unaddressed by specific programs or policies identified in the research.

The absence of dedicated funding programs for PMD-induced wear in initiatives like the Queensland E-Mobility Rebate Scheme (which focused on device purchase) or general active transport upgrade funds supports this observation. Analyses of key guidance documents, such as the South Australian "Guide to Bikeway Pavement Design" [3] and Austroads AGRD06A [2], also confirm no specific mention of funding for upgrades or increased maintenance necessitated by e-mobility impacts.

The experience in other jurisdictions, such as New South Wales, where a parliamentary inquiry highlighted that local councils often bear the primary burden of managing e-mobility impacts without adequate additional funding [7], suggests that this is a broader systemic issue rather than one confined to Queensland. This reinforces the likelihood that PMD-specific wear and tear is not yet a distinct, funded item in many asset management plans.

The user's perception that PMD-related wear and tear is "not being funded by governments" appears to be largely consistent with the lack of specific funding programs or explicit policy statements to this effect in the provided research. While PMDs are being integrated into the transport system, the corresponding financial adjustments to manage their long-term impact on shared infrastructure seem to be lagging. This validates the user's concern and points towards a need for greater advocacy, research, and policy development to address this potential funding gap. Ensuring the long-term sustainability and safety of shared path infrastructure requires that all significant factors contributing to its deterioration, including new forms of traffic, are adequately understood and resourced. The ongoing Queensland Parliamentary Inquiry [1] presents an important opportunity for stakeholders, including local governments and engineering bodies, to formally table evidence and concerns regarding these unfunded impacts.

5.3. Lifecycle Costing and Sustainable Funding Models for Shared Path Infrastructure

To ensure the long-term viability and serviceability of shared path infrastructure in an era of increasing PMD use, a comprehensive approach to life cycle cost analysis (LCCA) and the development of sustainable funding models are essential. LCCA is a process that evaluates the total economic worth of a pavement asset over its entire life, encompassing initial construction costs, ongoing maintenance costs, periodic rehabilitation costs, and sometimes user costs associated with delays or poor conditions. The South Australian "Guide to Bikeway Pavement

Design" acknowledges this principle, noting that higher initial capital cost bikeways, such as those surfaced with asphalt or concrete, generally incur lower ongoing maintenance costs, and it references ARRB (now NTRO) resources on the economic analysis of bikeways.[3]

If increased wear and tear from PMDs is a significant factor, it would directly impact LCCA calculations by potentially shortening the effective service life of pavement surfaces, necessitating more frequent maintenance interventions, or requiring earlier rehabilitation than originally planned. This would, in turn, increase the overall lifecycle cost of the asset. However, effective LCCA for shared paths in the PMD era requires robust, empirical data on PMD-specific wear rates on various pavement materials. As previously noted, such data is currently lacking. Without this quantitative understanding, LCCAs will continue to be based on assumptions that may not accurately reflect the new loading conditions, potentially leading to an underestimation of future maintenance liabilities and budgets. This could cause a gradual decline in network quality, ironically making paths less safe and suitable for the very PMDs contributing to the wear, and ultimately leading to higher costs when extensive repairs become unavoidable. Investment in research to quantify PMD wear rates is therefore a critical prerequisite for sound LCCA and informed asset management.

Addressing the potential funding shortfall requires exploring sustainable and equitable models. Some potential avenues include:

- **Contributions from Shared PMD Operators:** Given that commercial shared PMD services benefit directly from access to public pavement infrastructure and their operations contribute significantly to usage intensity, a model where operators contribute to maintenance or upgrade funds could be considered. One source suggests that permit fees from operators could fund safety upgrades; this principle could potentially be extended to cover a portion of pavement wear and tear.
- **Reallocation of Existing Transport Budgets:** As PMDs contribute to mode shift away from private vehicles, a case could be made for reallocating a portion of road-related budgets towards the upkeep of active transport infrastructure that supports these cleaner modes.
- **Dedicated State or Federal Grants/Levies:** Governments could establish specific grant programs or consider minor levies (e.g., on device sales or registrations, though this can be contentious) to create a dedicated fund for shared path maintenance and adaptation for PMDs.

Research into the life cycle assessment (LCA) of e-scooters themselves often focuses on the environmental impact of the devices' manufacturing, use (electricity consumption, collection for charging), and disposal, rather than their impact on pavement life cycle costs. However, these studies highlight that factors like device durability and lifetime mileage are crucial for the overall environmental and economic viability of e-scooter systems. Higher usage intensity, while good for the viability of the PMD service, could translate to increased stress on pavements if not

managed with appropriate infrastructure investment.

Ultimately, sustainable funding for shared path maintenance in the context of widespread PMD use may require a diversified approach. This could involve a combination of continued local government investment from general revenue, targeted grants from higher levels of government, and potentially contributions from commercial entities that profit from the use of this public infrastructure. Such a multi-faceted approach would aim to create a more equitable funding model where the costs of infrastructure upkeep are shared more broadly, ensuring that paths remain safe, accessible, and fit for purpose for all users. However, the design of any such funding mechanisms would require careful consideration to avoid stifling innovation in the PMD sector or placing undue financial burdens on users.

6. Queensland's Pavement Infrastructure Challenges

The general issues of pavement suitability, safety, and wear and tear take on specific dimensions when considered within the context of Queensland's existing infrastructure and policy environment.

6.1. Specific Issues Highlighted for Queensland (narrowness, bumpiness, existing design)

The user's initial observation regarding Queensland's pavements being frequently "existing and pre E-mobility" encapsulates a core challenge. These characteristics, common in older or less prioritised sections of the path network, directly conflict with the ideal operating conditions for PMDs and amplify many of the risks and concerns discussed previously.

Narrowness: As established, narrow paths [user query] limit manoeuvrability, increase the likelihood of conflicts between PMDs, cyclists, and pedestrians, and reduce the space for users to take evasive action to avoid hazards or each other. With PMDs permitted on many Queensland footpaths at speeds up to 12 km/h, and potentially faster on other shared paths, insufficient width becomes a critical safety factor. Furthermore, narrowness can lead to the channelisation of PMD traffic, concentrating wear along specific wheel paths and potentially accelerating localised pavement deterioration.

Bumpiness: "Bumpy" surfaces, indicative of high pavement roughness or discrete defects like potholes and cracks, pose a direct threat to PMD stability and rider safety. Research has unequivocally shown that e-scooters, with their small wheels and often minimal suspension, are highly sensitive to surface irregularities, leading to increased vibrations, rider discomfort, and a higher risk of loss of control or falls.[5] This "bumpiness" also exacerbates dynamic loading on the pavement itself. Each jolt and impact translates into a force greater than the device's static weight being applied to the pavement structure, which, over many repetitions, can accelerate the formation of new defects or the worsening of existing ones.

Existing Design: Many of Queensland's existing paths were designed and constructed before the advent of widespread PMD use. Their original design parameters likely focused on pedestrian loads and perhaps low-intensity cycling, not anticipating the frequency, speed, or concentrated wheel loads associated with modern e-scooters and e-bikes. Retrofitting such an extensive network to meet contemporary standards for PMD suitability presents a significant logistical and financial challenge for local and state authorities. The very existence of the Queensland Parliamentary Inquiry into e-scooter and e-bike safety is an implicit acknowledgment of these and other challenges in adapting to the new mobility landscape.

An additional factor pertinent to Queensland is its climate. The state experiences periods of high temperature and intense rainfall. Heat can soften asphaltic surfaces, making them more susceptible to deformation under load. Heavy rainfall can exploit cracks and imperfections in older or poorly sealed pavements, leading to water ingress, which can weaken underlying pavement layers and contribute to various forms of distress, including potholes and stripping. The frequent passage of PMD traffic over pavements already stressed by these climatic factors could further accelerate their deterioration. Therefore, pavement design, material selection, and maintenance strategies in Queensland must be particularly robust to withstand both the demands of PMD traffic and the challenges posed by the local climatic conditions.

6.2. Local Government Initiatives and Perspectives (e.g., Brisbane City Council, Gold Coast)

Local governments in Queensland are at the forefront of managing the integration of PMDs into their communities. Brisbane City Council, for instance, has developed an e-mobility strategy aimed at supporting sustainable transport options, improving safety, and ensuring public confidence. Key initiatives include the establishment of e-mobility parking hubs to reduce footpath clutter and improve accessibility, and working with shared e-mobility providers on operational rules, including speed limits and no-go zones in certain areas at specific times. The Council's messaging emphasizes safety tips for riders and the importance of being mindful of other path users.

Similarly, Gold Coast City Council has an Active Transport Plan focused on improving cycling and walking facilities, aiming to build an integrated and sustainable transport network. While their plans are noted as being under review, the broader strategic goals include creating liveable places and connected communities.

The Queensland Department of Transport and Main Roads has also developed an e-Mobility Parking Plan, in collaboration with various stakeholders including local government representatives. This plan seeks to improve e-mobility parking practices to create more accessible and inclusive paths, focusing on solutions like designated parking areas and clear guidance for users and providers.

While these initiatives demonstrate active efforts by local and state bodies to manage the

operational aspects of PMD use—such as parking, rider behaviour, and immediate safety concerns—the provided information does not detail specific, widespread engineering strategies or dedicated funding programs at the local council level aimed directly at addressing the potential long-term pavement *wear and tear* caused by PMDs. The focus appears to be more on managing how PMDs are used on existing infrastructure, rather than systematically upgrading that infrastructure to better withstand new loading patterns or to meet enhanced suitability criteria for PMD operation beyond general safety and accessibility.

This observation suggests that local governments in Queensland, while proactively addressing the immediate societal and safety impacts of PMD proliferation, may be constrained by a lack of specific technical guidance on PMD-pavement interaction, insufficient data on wear rates, or inadequate dedicated funding to tackle the longer-term implications for pavement infrastructure. This reinforces the potential for an "unfunded mandate," where councils are responsible for maintaining assets that may be degrading faster due to new, encouraged forms of transport, without a commensurate increase in resources or specialised knowledge to manage these novel impacts effectively. The emphasis on parking solutions, while important for amenity and accessibility, does not address the underlying condition of the pavement surface itself, which is critical for both safety and long-term durability.

7. Conclusion and Strategic Recommendations

The integration of e-bikes, e-scooters, and other Personal Mobility Devices (PMDs) into Queensland's urban transport system presents a complex interplay of benefits, safety challenges, and infrastructure considerations. This report has examined the suitability of existing pavements for these new devices, the safety implications of pavement conditions, the potential for wear and tear, and the associated funding and maintenance issues.

7.1. Synthesis of Key Findings

1. **Safety Concerns are Significant:** There is clear evidence of increasing PMD-related injuries in Queensland and internationally, with pavement conditions (roughness, defects, width) playing a crucial role, particularly in single-vehicle incidents and falls.
2. **Existing Pavements Often Suboptimal:** Many "old" and "existing" pavements in Queensland, often described as "existing and pre E-mobility," were not designed for the current intensity or specific characteristics of PMD traffic, falling short of evolving best-practice guidelines for shared use.
3. **Pavement Characteristics Directly Impact PMD Safety and Dynamics:** Surface roughness (IRI), material type, and path width significantly influence PMD stability, rider comfort, and the risk of accidents. Smoother, wider paths with good skid resistance are critical.[5]
4. **Research on PMD-Specific Wear is Limited but Concerns are Valid:** While direct,

quantitative research on pavement wear caused specifically by e-scooters and e-bikes is scarce, principles from analogous research on dynamic loading and surface abrasion suggest a potential for accelerated surface degradation, especially on lower-quality or older pavements. This is a critical knowledge gap.

5. **Funding for PMD-Induced Wear is Not Clearly Established:** Current funding mechanisms for pavement maintenance in Queensland do not appear to specifically account for or address the potential additional wear and tear imposed by PMDs, raising concerns about unfunded liabilities for local governments.[7]
6. **Holistic Approach Needed:** Addressing pavement suitability for PMDs is not merely an engineering challenge but a vital component of achieving broader sustainable urban mobility goals. Safe, durable, and appropriate infrastructure is essential for the successful and safe integration of PMDs.

7.2. Recommended Actions for Pavement Design, Assessment, and Upgrades for E-Mobility

1. **Update and Adopt Comprehensive Design Guidelines:** Queensland authorities (State and Local Governments) should ensure that their pavement design and construction guidelines for shared paths are updated to explicitly incorporate the specific requirements of PMDs. This should include consideration of PMD load spectra, dynamic loading effects, desired surface characteristics (smoothness, skid resistance), and durability requirements for various pavement materials, referencing best practices from sources like the South Australian "Guide to Bikeway Pavement Design" and evolving Austroads guidance.
2. **Develop a Pavement Suitability Assessment Methodology:** A standardized methodology should be developed and implemented for assessing the suitability of existing and older pavements across Queensland for PMD traffic. This assessment should consider factors such as effective width, surface condition (specifically International Roughness Index - IRI), material type, current user volumes (including PMDs), and safety records.
3. **prioritise Upgrades for High-Risk Pavements:** Based on the assessment methodology, a program should be established to prioritise and fund upgrades for sections of the path network identified as high-risk or unsuitable, particularly focusing on addressing "existing and pre E-mobility" conditions on key commuter and recreational routes.
4. **Specify Minimum Performance Standards:** For paths designated for, or experiencing heavy use by PMDs, minimum standards for surface regularity (e.g., maximum acceptable IRI values) and skid resistance should be established and enforced for both new construction and resurfacing projects.

7.3. Recommended Actions for Safety Enhancements Related to Pavement Infrastructure

1. **Invest in Infrastructure Improvements:** Targeted investment is needed to widen narrow paths, improve surface smoothness, rectify defects (potholes, cracks, uneven joints), and enhance drainage on routes frequently used by PMDs.
2. **Improve Path Connectivity and Design Consistency:** Address issues such as paths

abruptly ending or transitioning poorly between different surface types or environments (e.g., cycle lanes ending onto pedestrian-focused pavements), to provide a more continuous and predictable experience for PMD users.

3. **Enhance Separation Where Feasible:** In high-volume or high-conflict areas, explore options for greater separation between pedestrians and faster-moving PMD/cycle traffic, through wider paths with clear delineation or physically separated facilities where warranted and practicable.

7.4. Recommended Actions for Research, Policy, and Funding to Address Wear and Tear

1. **Commission Targeted Research on PMD Pavement Wear:** Urgent, Queensland-specific research should be commissioned (potentially through partnerships with NTRO/ARRB, universities, or industry) to quantify the wear effects of different types of PMDs (e-scooters, e-bikes of various weights) on common Australian pavement types (asphalt, concrete, pavers) under local climatic and usage conditions. This research should specifically investigate dynamic load effects and abrasion mechanisms.
2. **Develop PMD-Inclusive Pavement Deterioration Models:** Based on research findings, existing pavement deterioration models should be updated, or new models developed, to incorporate the impact of PMD traffic. This will enable more accurate lifecycle cost analyses and maintenance forecasting.
3. **Investigate and Implement Sustainable Funding Models:** A comprehensive review of funding models for shared path maintenance and rehabilitation is required. This should explore options for sustainable funding that accounts for PMD impacts, potentially including:
    - Increased allocations from general transport budgets.
    - Dedicated state or federal grant programs for PMD infrastructure adaptation.
    - Contributions from commercial PMD operators, linked to their usage of public infrastructure, to help cover increased maintenance costs.

The challenges identified in this report, particularly those relating to adapting legacy infrastructure for rapidly evolving transport technologies and user behaviours, are not unique to Queensland but reflect a global trend. By proactively addressing these issues through targeted research, evidence-based policy, and strategic investment, Queensland has the opportunity to enhance the safety and sustainability of its urban transport system and potentially become a leader in developing best practices for PMD-compatible infrastructure.

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PART FOUR: Case Study: Paris's Implementation of Active Transport Reforms for the Olympics

Paris has undertaken a significant transformation of its urban landscape to prioritise active transport, particularly cycling and walking, a strategy heavily influenced by its commitment to sustainability and its role as the host city for the 2024 Olympic and Paralympic Games.

1.Key Active Transport Reforms in Paris:

1.1 Fifteen-Minute City Concept:

Paris aims to become a "fifteen-minute city," where residents can access essential services (like schools, groceries, banks, workplaces, and government offices) within a 15-minute walk or active travel. This concept guides the expansion of cycling and walking infrastructure.

1.2 Expansion of Cycling Lanes:

The **Plan Vélo**, initiated in 2015, aimed to double bike lanes from 700 km to 1,400 km by 2020. By 2019, Paris had over 1,000 km of bike paths, increasing the percentage of bike trips from 5% to 10%.

For the 2024 Olympics, **around 60 km of new cycle lanes have been built** to link all Olympic event spaces across the city and surrounding region. These routes, called 'olympistes', are marked in pink and green to guide visitors.

The **2021-2026 Vélo Plan** aims to make Paris 100% cycling-friendly by 2026, with an additional 180 km of new cycling paths planned, building on temporary lanes installed during the pandemic. The city aims for a total of 1,500 km of cycling lanes.

Protected bike lanes have been a focus, proving popular with female cyclists and those with children.

2. Pedestrianisation and Road Space Reallocation:

In 2001, Mayor Delanoe's **'Espaces Civilisés' programme** invested 24 million Euros to double sidewalk widths from 4m to 8m, setting a precedent for prioritising pedestrians.

The Seine Riverbanks have been pedestrianised since 2016.

Rue de Rivoli, a major east-west thoroughfare, was converted into a bicycle highway, with three of its four vehicle lanes repurposed for cyclists. Other thoroughfares like Boulevard Saint-Michel and Rue Saint-Jacques also saw similar changes.

The city has been working to **remove over 70,000 on-street car parking spaces** (reclaiming 60 hectares of public space), transforming them into pedestrian streets, EV charging stations, bicycle parking, and urban vegetation.

"School Streets" initiatives transform streets previously designed for vehicles into pedestrian-only spaces to protect schoolchildren. These spaces also serve as extra playgrounds and are open to neighbours outside school hours.

3. Speed Limits:

Paris implemented a **30 km/h speed limit for cars** in 2021 on most city streets, with exceptions for selected major roads like the Champs-Élysées (50 km/h) and the main ring road (70 km/h). This measure aims to improve road safety, reduce noise pollution, and free up public space. Residents were consulted, with 59% favoring reducing speed limits.

4. Bike Parking and Services:

An additional **10,000 temporary bike parking spaces** have been provided at competition venues, along with 3,000 new Vélib' hire bikes. The 2021-2026 Vélo Plan includes implementing 120,000 new bike parking spaces, tripling the total to 180,000.

5. Modal Shift Success:

Between 2010 and 2020, car traffic in central Paris reduced from 12.8% to 6%, while cycling and walking's share increased from 55.4% to 68%. Public transport accounts for 25% of journeys, cars for 5%, and bikes and e-scooters for 10%.

6. Implementation Timeline Relative to the Olympics:

Paris's active transport reforms were part of a **long-term strategy** that predates its 2024 Olympic hosting. The city has leveraged the Olympics as a catalyst to accelerate and enhance existing plans.

- **Initial steps (pre-2014):** Champs-Élysées rehabilitation began 1977-1995, Paris's first bicycle plan in 1996, and the 'Espaces Civilisés' programme in 2001. Vélib' was implemented in 2007.
- **Acceleration towards 2024 Olympics:** Mayor Anne Hidalgo, elected in 2014, significantly promoted these efforts. The 2015-2020 Cycling Plan created an Express Bike Network. The 2021-2026 Bike Plan aims for a 100% cyclable city by 2026, with the 60 km of Olympic-specific bike lanes being built over the **two years leading up to the Games**. The ban on shared e-scooters was implemented in August 2023, less than a year before the Games, following a referendum.

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PART FIVE: Progressive Steps for Pavement Arrangements for Pedestrians and E-riders

We advocate ***for a holistic but phased approach*** to improve safety for pedestrians and e-riders, particularly by reallocating road space and upgrading infrastructure. Some of these issues are covered in the sections above but we have repeated them here because they are implementable progressively by way of the 'suburb by suburb' approach

Current Challenges and the Need for Change:

- Existing pavements are often "old" and "pre-e-mobility," not designed for the current intensity or characteristics of Personal Mobility Device (PMD) traffic, leading to safety concerns like single-vehicle incidents and falls.
- Pavement conditions (roughness, surface defects, width) directly affect stability, comfort, and accident risk for PMD users, especially small-wheeled e-scooters. Many footpaths lack minimum clear width standards (e.g., 1.8 metres in Queensland) and accessibility features like kerb ramps and Tactile Ground Surface Indicators (TGSIs).
- The perceived inadequacy of alternative infrastructure (e.g., abrupt cycle lane endings) can push PMD users onto unsuitable pedestrian infrastructure, increasing risks.
- There's a lack of specific funding for additional wear and tear from PMDs, creating an "unfunded liability" for local governments.
- Concerns persist about inconsistencies between Commonwealth and state laws regarding non-compliant device imports.

Progressive Steps and Strategies:

1. **Reallocation of Road Space (Starting Point / Early Interventions):**

    - **Prioritise a shift away from car-centric infrastructure:** This is a crucial step towards more balanced and safer transportation modes.
    - **Reduce motor vehicle speed limits:** Lowering speed limits (e.g., from 50 km/h to 40 km/h, and to 30 km/h around city centres, schools, and high streets) improves road safety for e-mobility devices and pedestrians by creating more homogeneous speeds among road users.
    - **Temporarily re-allocate e-mobility traffic:** While infrastructure upgrades are pending, a feasible and necessary measure is to temporarily relocate e-mobility traffic (excluding mobility aids) to designated roadways (with speed limits of 50 km/h or less and no dividing line) and existing bikeways in urban areas. Clear rules, strict enforcement, and public awareness campaigns are essential for this transition.

- **Convert existing road space:** Cities can repurpose road space (e.g., car lanes, parking spaces) for wider footpaths, pedestrian-only zones, and dedicated active transport corridors.

2. **Infrastructure Development and Upgrade (Suburb-by-Suburb / Phased Approach):**

- **Conduct comprehensive reviews of existing footpaths:** In high-use areas, identify necessary upgrades by consulting disability advocacy groups and other stakeholders to ensure needs are met. The decision to allow e-mobility devices back on footpaths should be evidence-based.
- **Establish dedicated and well-connected micro mobility networks:** Develop a comprehensive urban plan that incorporates mixed and protected micro mobility infrastructure, ensuring connectivity with existing transport networks. This includes specific focus on junction treatments for increased visibility and awareness for car and truck traffic.
- **Create "Mobility Super Highways":** These are high-quality, separated infrastructure for e-scooters and bicycles, strengthening suburban links and providing direct connectivity between key growth centres and major event venues..
- **Prioritise walkable precincts:** Enhance inner-city mobility by developing new pathways, improving crossing points, and investing in active transport infrastructure, including more shade, seating, and signage.
- **Upgrade pavement standards:** Update pavement design and construction guidelines for shared paths to explicitly include PMD requirements, considering load spectra, dynamic loading effects, surface characteristics (smoothness, skid resistance), and durability.

3. **Maintenance, Regulation, and Funding (Ongoing Support):**

- **Proactive and regular maintenance:** Implement regular maintenance for micro mobility infrastructure, shared paths, and road surfaces, prioritising high-traffic areas to minimise crashes from poor conditions. Operators can contribute by reporting infrastructure issues.
- **Clearer regulations and stricter enforcement:** Implement increased monitoring and penalties for unsafe riding behaviours (e.g., speeding, riding on prohibited footpaths, use of illegal devices), supported by technology like geo-fencing.

    - **Address legal gaps:** Collaborate with the federal government to address inconsistencies in laws that allow importation of non-compliant devices.
    - **Mandate minimum safety standards:** Explore options for mandating safety standards for e-mobility devices and batteries sold, aligning with national or international standards.
    - **Explore new funding models:** Seek increased allocations from general transport budgets, dedicated state or federal grant programmes, and contributions from commercial PMD operators to cover increased maintenance costs.
    - **User education:** Develop comprehensive, targeted communication and education strategies for all e-mobility users and the broader community.

The concept of a "Safe System" approach is emphasised, where the responsibility for safety lies with the system designers (planners and authorities) rather than solely the road users. This involves designing urban forms that prioritise human-first design principles, focusing on pedestrians and cyclists, supported by high-quality public transport, and only considering motor traffic in the last stage.

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Summary of Findings, Recommendations and Actions

PART ONE
OVERARCHING APPROACH

1. **Develop and implement clear, comprehensive, and enforceable e-mobility standards for Queensland:** These standards should draw upon the principles of pedestrian priority and public space usage as exemplified in the Woolloongabba Public Realm Guideline.[2] They should also incorporate best practices from other jurisdictions that have successfully addressed e-mobility safety [22], such as the use of technology for safety features [22], regulations on device specifications [23], and prioritisation of pedestrian infrastructure.[36] These standards should address device specifications (including power and speed limits) [6], rules of operation on different types of paths and roadways [7], helmet requirements [9], age restrictions [9], and parking regulations.[23]
2. **Implement a clear timeline and strategy for the temporary reallocation of e-mobility traffic (excluding motorized wheelchairs and similar mobility aids) to designated roadways (with speed limits of 50 km/h or less and no dividing line) and existing bikeways within urban areas:** This reallocation should remain in effect until pedestrian footpaths are thoroughly assessed and upgraded to ensure safety and accessibility for all users.[5] The upgrades should include, where necessary, widening footpaths to meet a minimum clear width of 1.8 meters as per Queensland standards [29], smoothing surfaces, and ensuring the presence of appropriate accessibility features such as kerb ramps and TGSIs.[29]
3. **Invest in infrastructure improvements to enhance the safety and suitability of both pedestrian footpaths and designated e-mobility corridors:** This investment should focus on widening and improving the condition of footpaths, ensuring they meet accessibility standards.[29] Simultaneously, designated e-mobility corridors, such as dedicated lanes on roadways and clearly marked bikeways, should be developed to safely accommodate e-mobility traffic and minimise potential conflicts with vehicular traffic and pedestrians.[5]
4. **Strengthen enforcement of e-mobility regulations and implement comprehensive public education campaigns:** Increased monitoring and penalties should be applied to unsafe riding behaviours, such as speeding, riding on footpaths where prohibited, and the use of illegal devices.[19] Public education campaigns should be launched to promote responsible e-mobility use, increase awareness of traffic rules for all road users, and inform the public about the temporary changes in e-mobility traffic allocation.[10]
5. **Conduct a comprehensive review of existing pedestrian footpaths in high-use areas to identify necessary upgrades before considering the return of e-mobility devices to these footpaths:** This review should involve consultation with disability advocacy groups [11] and other relevant stakeholders to ensure that the upgraded footpaths meet the needs of all users.[29] The decision to allow e-mobility devices back on footpaths should be based on evidence that these spaces can safely and comfortably accommodate both pedestrians and e-mobility users.[5]

PART TWO

1. **Enhancing Safety Regulations:** While Queensland has established regulations for e-mobility devices, the persistent rise in safety incidents suggests a need for a thorough review and potential strengthening of these rules. This includes considering stricter speed limits in certain areas, mandating safety equipment such as helmets for all riders, and clarifying rules regarding riding on footpaths and shared pathways.
2. **Improving Enforcement:** The effectiveness of the current enforcement approaches appears to be limited by resource constraints and the challenges of monitoring compliance, particularly for privately-owned devices. Exploring technological solutions and increasing enforcement efforts in high-risk areas could improve rider behaviour and overall safety.
3. **Addressing Legal Gaps:** The inconsistencies between Commonwealth and Queensland laws, particularly concerning the importation of non-compliant devices, need to be addressed. Collaboration between different levels of government is crucial to ensure that only safe and legal e-mobility devices are available for use in Queensland.
4. **Strengthening Communication and Education:** While various communication and education initiatives are underway, their effectiveness in reducing risky behaviours needs to be evaluated. Targeted campaigns and easily accessible resources that clearly outline the rules and consequences of unsafe use are essential for promoting a culture of safety among e-mobility device users.
5. **Incorporating Stakeholder Perspectives:** The diverse views and concerns of community members, road user groups, disability advocates, health experts, academia, and the e-mobility industry must be carefully considered in shaping future regulations and policies. A balanced approach that addresses the needs and concerns of all stakeholders is crucial for the successful and safe integration of e-mobility in Queensland.

Recommended Actions:

- **Conduct a comprehensive review of the current regulatory framework for PMDs and e-bikes in Queensland**, taking into account best practices from other Australian states and international jurisdictions. This review should specifically focus on speed limits, helmet requirements, and rules of use on different types of infrastructure.
- **Investigate and recommend strategies to enhance the enforcement of e-mobility laws**, including exploring the use of technology and increasing resources for police services in high-risk areas.
- **Collaborate with the Commonwealth Government to address the legal gaps** that allow the importation and use of illegal and non-compliant e-mobility devices in Queensland. This may involve advocating for clearer definitions and stricter import controls at the federal level.
- **Develop and implement a comprehensive, targeted communication and education strategy** aimed at all e-mobility device users, and the broader community, to raise

awareness about device requirements, rules, safety practices, and the consequences of unsafe use.

- **Ensure ongoing engagement with all relevant stakeholder groups,** including community members, road user groups, disability advocates, health experts, academia, and the e-mobility industry, throughout the inquiry process and in the development of future policies and regulations.
- **Consideration of Tiered Registration/Identification:** The inquiry should thoroughly explore the feasibility and benefits of a tiered registration or identification system for PMDs. This approach could differentiate between low-power, compliant devices and higher-power, non-compliant or "illegal" devices. For compliant PMDs, this might involve unique digital identifiers (e.g., QR codes linked to owner details) rather than traditional physical plates. Such a system could facilitate post-incident identification, data collection, and enforcement without imposing undue burden on users of legally compliant devices.
- **Consider the implementation of specific regulations for shared e-mobility schemes**, such as mandatory speed limits in pedestrian-heavy zones, designated parking areas enforced through geofencing technology, and requirements for user safety training and insurance.
- **Explore options for mandating minimum safety standards for e-mobility devices and batteries** sold in Queensland, aligning with national or international standards to mitigate fire risks and ensure product safety.
- **Investigate the feasibility of establishing a clear and accessible system for reporting safety incidents and near misses** involving e-mobility devices to better understand the factors contributing to accidents and inform targeted interventions.

For Enforcement Agencies (Queensland Police Service):

- **Clarified Enforcement Strategy:** The development and clear communication of a refined enforcement strategy that explicitly distinguishes between compliant PMDs and illegal devices is recommended. This strategy should outline how identification (or the lack thereof) impacts enforcement actions and how police will differentiate between device types in the field.
- **Technological Integration:** Exploration of how existing or emerging technologies, such as the Internet of Things (IoT) capabilities often embedded in PMDs , could be leveraged to assist in identification, tracking, and enforcement is encouraged. This could potentially offer alternatives or complements to traditional physical registration.

Broader Policy Considerations:

- **Infrastructure Development:** Continued advocacy for and investment in dedicated and protected mobility lanes is paramount. Separating PMDs from pedestrians and conventional vehicular traffic is a fundamental safety measure that reduces collision risks and improves overall road user safety, irrespective of any registration system.

- **Insurance Frameworks:** A comprehensive review of the current insurance landscape for PMDs is advisable. This should include considering whether a mandatory third-party insurance scheme (similar to that for MMDs [9]) should be introduced for PMDs, potentially linked to an identification system, to provide greater protection for victims of PMD-related incidents and address liability concerns.
- **National Consistency:** Given the interest from national bodies like the National Transport Commission, it is recommended that Queensland's findings and any subsequent policy changes contribute actively to the development of a nationally consistent approach to PMD regulation across Australia. This would ensure clarity and predictability for manufacturers, retailers, and users across state borders.

PART THREE

1. **Safety Concerns are Significant:** There is clear evidence of increasing PMD-related injuries in Queensland and internationally, with pavement conditions (roughness, defects, width) playing a crucial role, particularly in single-vehicle incidents and falls.
2. **Existing Pavements Often Suboptimal:** Many "old" and "existing" pavements in Queensland, often described as "existing and pre E-mobility," were not designed for the current intensity or specific characteristics of PMD traffic, falling short of evolving best-practice guidelines for shared use.
3. **Pavement Characteristics Directly Impact PMD Safety and Dynamics:** Surface roughness (IRI), material type, and path width significantly influence PMD stability, rider comfort, and the risk of accidents. Smoother, wider paths with good skid resistance are critical.[5]
4. **Research on PMD-Specific Wear is Limited but Concerns are Valid:** While direct, quantitative research on pavement wear caused specifically by e-scooters and e-bikes is scarce, principles from analogous research on dynamic loading and surface abrasion suggest a potential for accelerated surface degradation, especially on lower-quality or older pavements. This is a critical knowledge gap.
5. **Funding for PMD-Induced Wear is Not Clearly Established:** Current funding mechanisms for pavement maintenance in Queensland do not appear to specifically account for or address the potential additional wear and tear imposed by PMDs, raising concerns about unfunded liabilities for local governments.[7]
6. **Holistic Approach Needed:** Addressing pavement suitability for PMDs is not merely an engineering challenge but a vital component of achieving broader sustainable urban mobility goals. Safe, durable, and appropriate infrastructure is essential for the successful and safe integration of PMDs.

Pavement Design, Assessment, and Upgrades for E-Mobility

7. **Update and Adopt Comprehensive Design Guidelines:** Queensland authorities (State and Local Governments) should ensure that their pavement design and construction

guidelines for shared paths are updated to explicitly incorporate the specific requirements of PMDs. This should include consideration of PMD load spectra, dynamic loading effects, desired surface characteristics (smoothness, skid resistance), and durability requirements for various pavement materials, referencing best practices from sources like the South Australian "Guide to Bikeway Pavement Design" and evolving Austroads guidance.

8. **Develop a Pavement Suitability Assessment Methodology:** A standardized methodology should be developed and implemented for assessing the suitability of existing and older pavements across Queensland for PMD traffic. This assessment should consider factors such as effective width, surface condition (specifically International Roughness Index - IRI), material type, current user volumes (including PMDs), and safety records.
9. **prioritise Upgrades for High-Risk Pavements:** Based on the assessment methodology, a program should be established to prioritise and fund upgrades for sections of the path network identified as high-risk or unsuitable, particularly focusing on addressing "existing and pre E-mobility" conditions on key commuter and recreational routes.
10. **Specify Minimum Performance Standards:** For paths designated for, or experiencing heavy use by PMDs, minimum standards for surface regularity (e.g., maximum acceptable IRI values) and skid resistance should be established and enforced for both new construction and resurfacing projects.

Safety Enhancements Related to Pavement Infrastructure

11. **Invest in Infrastructure Improvements:** Targeted investment is needed to widen narrow paths, improve surface smoothness, rectify defects (potholes, cracks, uneven joints), and enhance drainage on routes frequently used by PMDs.
12. **Improve Path Connectivity and Design Consistency:** Address issues such as paths abruptly ending or transitioning poorly between different surface types or environments (e.g., cycle lanes ending onto pedestrian-focused pavements), to provide a more continuous and predictable experience for PMD users.
13. **Enhance Separation Where Feasible:** In high-volume or high-conflict areas, explore options for greater separation between pedestrians and faster-moving PMD/cycle traffic, through wider paths with clear delineation or physically separated facilities where warranted and practicable.

Research, Policy, and Funding to Address Wear and Tear

14. **Commission Targeted Research on PMD Pavement Wear:** Urgent, Queensland-specific research should be commissioned (potentially through partnerships with NTRO/ARRB, universities, or industry) to quantify the wear effects of different types of PMDs (e-scooters, e-bikes of various weights) on common Australian pavement types (asphalt, concrete, pavers) under local climatic and usage conditions. This research should specifically investigate dynamic load effects and abrasion mechanisms.
15. **Develop PMD-Inclusive Pavement Deterioration Models:** Based on research findings,

existing pavement deterioration models should be updated, or new models developed, to incorporate the impact of PMD traffic. This will enable more accurate lifecycle cost analyses and maintenance forecasting.

16. **Investigate and Implement Sustainable Funding Models:** A comprehensive review of funding models for shared path maintenance and rehabilitation is required. This should explore options for sustainable funding that accounts for PMD impacts, potentially including:
    - Increased allocations from general transport budgets.
    - Dedicated state or federal grant programs for PMD infrastructure adaptation.
    - Contributions from commercial PMD operators, linked to their usage of public infrastructure, to help cover increased maintenance costs.

PART FOUR

1. Review learnings from Case Studies and adapt learnings accordingly.

PART FIVE

1. Adopt a progressive targeted approach for progressive and layered implementation applied to appropriate sized geographical areas [suburb/wards/towns] in concert with relevant State Government departments/ agencies [including QPS] and Local Authorities. The initial focus for the application of physical infrastructure elements would be to achieve safe connectivity in major population areas and major venue requirements. This could be integrated with 'legacy' projects associated with the 2032 Olympic Games.