Barriers to the safe use of personal mobility devices

August 2020

Decision Regulation Impact Statement

National Transport Commission

Report outline

Title	Barriers to the safe use of personal mobility devices
Type of report	Decision Regulation Impact Statement (Decision RIS)
Purpose	For presentation to the Transport and Infrastructure Council in November 2020.
Abstract	In this Decision Regulation Impact Statement (Decision RIS), the National Transport Commission (NTC) details the draft policy to address the barriers in the Australian Road Rules (ARRs) that prevent the safe and legal use of personal mobility devices (PMDs). The proposal is based on the Consultation Regulation Impact Statement (Consultation RIS) released by the NTC in October 2019 and incorporates extensive stakeholder feedback received in submissions and via a jurisdictional national working group. The Decision RIS includes a discussion on whether the preferred option safely addresses the problem and the impacts on industry, governments and the community. Additionally, further consideration has been given to the appropriateness of the methodology used for measuring the impacts of each policy option, and the appropriateness of the preferred option from a national policy perspective.
Attribution	This work should be attributed as follows: Source: National Transport Commission 2020, *Barriers to the safe use of personal mobility devices*, *Decision Regulation Impact Statement*, NTC, Melbourne. If you have adapted, modified or transformed this work in any way, please use the following: Source: Based on National Transport Commission 2020, *Barriers to the safe use of personal mobility devices*, *Decision Regulation Impact Statement*, NTC, Melbourne.
Key words	Personal Mobility Devices (PMDs), Australian Road Rules (ARRs), electric scooters, electric skateboards, footpath, shared path, separated path, bicycle path, local road.
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Executive summary

Personal Mobility Devices (PMDs), such as electric scooters and electric skateboards, are typically small, portable and designed to carry one person over short to medium distances. These devices are growing in popularity globally as people look for more innovative and efficient ways to move around cities and communities. This shift in transportation preference, known as micro-mobility, is seeing people becoming less dependent on traditional forms of transport, such as cars, buses, trains and trams, in favour of these more individualised modes of transport.

Many PMDs are already available in Australia, however, the Australian Road Rules (ARRs) predate the emergence of most of these devices. This means most PMDs are not recognised within the existing road rules. Due to the public demand for PMDs, many jurisdictions have been under increasing pressure to introduce regulations that permit the legal use of these devices. This has resulted in PMDs operating in an undefined and increasingly inconsistent regulatory environment.

Queensland (QLD), South Australia (SA) and the Australian Capital Territory (ACT) are the only Australian states and territory that have implemented legislation to enable PMDs to be legally used on roads and paths, albeit with some variations. However, there is anecdotal evidence of PMD use in states where they are not currently permitted, with users likely unaware that the devices cannot be legally used on roads and paths.

To better understand the key safety and regulatory issues associated with PMDs, the National Transport Commission (NTC) has undertaken extensive consultation and sought feedback from government, industry and community stakeholders. This has included a national workshop, an issues paper, as well as receiving ongoing policy advice from a national working group of key stakeholders, which included representatives from all state and territory governments. Further, the NTC has undertaken a review of national and international regulations and reviewed the research around PMDs and other associated devices that have similar risks, vulnerabilities, crash and injury profiles.

The NTC developed options out of this extensive analysis and consultation which it presented in the Consultation Regulation Impact Statement (Consultation RIS) it published in October 2019.

In the Consultation RIS, the NTC proposed a framework that set out key requirements for PMDs such as motor type, braking, dimensions and weight to enable appropriate types of PMDs to be used on roads and paths whilst also providing flexibility within the ARRs to accommodate new PMDs as they emerge.

The NTC assessed four options for PMD access to road and path infrastructure and three speed approaches. The analysis conducted by the NTC includes an assessment of safety risks, access and amenity impacts, broader economic impacts, as well as compliance and enforcement challenges. The NTC's analysis considered that the best approach to balance mobility and safety would be to permit PMDs that comply with the proposed regulatory framework on footpaths and shared paths at a maximum speed of 10km/h, and on bicycle paths and local roads at a maximum speed of 25km/h (Option 3; Speed Approach 1).

The final assessment of these options affirmed the challenge of establishing a common national approach to permitting access of PMDs onto public roads and paths. Each variation of infrastructure access and speed approach results in trade-offs between the safety and amenity of different user types, broader economic benefits as well as compliance and enforcement challenges.

While the NTC affirms its assessment on this basis, it also agrees that the preferred approach would vary if an assessment were made at individual state and territory level.

For instance:

- Jurisdictions with urban environments that tend to have wide, flat and sparsely used footpaths with limited local roads (as defined for in Option 3) will tend to prefer use on footpaths with higher speed allowances; whereas
- Jurisdictions with urban environments that tend to have narrow, fractured footpaths relied on heavily for mobility by vulnerable users will tend to prefer options that more significantly restrict speeds on footpaths for PMD users or even not allow access at all.

Notwithstanding this, the NTC considers it important to achieve as much consistency as possible in the Australian Road Rules. The NTC believes that this can be most effectively achieved through the model law adopting:

- The Framework for PMDs as set out in Chapter 4 Table 1.
- Access to the infrastructure set out in Option 3 which includes shared paths, separated paths and bicycle paths, and subject to the law of the jurisdiction, footpaths and local roads with a speed limit of 50km/hr or less.
- That speed on each infrastructure type be subject to the law of the jurisdiction.

1 Statement of the problem

Background to PMDs

Many cities around the world have embraced urban mobility transport systems, such as bike share and car share. More recently, there has been the emergence of what are known as micro-mobility transport systems, which are characterised by more innovative types of devices, such as electric bikes, electric scooters and electric skateboards.

These micro-mobility systems have grown in popularity largely in response to increasing community demand for more efficient transport choices as travel costs and times continue to rise. This has resulted in less dependence on traditional forms of transport (e.g. cars, buses, trams and trains).

Personal Mobility Devices (PMDs) represent a specific category of micro-mobility transport systems and include electric skateboards and electric scooters. PMDs are a category that includes a variety of devices that are small, portable and designed to carry one person over short to medium distances. Several benefits have been identified from the use of PMDs, including:

- greater mobility choice
- environmental benefits such as reduced pollution, greenhouse gas emissions, noise and use of resources
- reduced traffic congestion
- direct cost savings to users from reduced spending on travel, vehicle maintenance and reduced capital costs such as garaging, compared with motor vehicles, and
- health and fitness benefits.

As PMDs are still relatively new and emerging forms of transport it is likely that their design and function, in addition to the associated benefits and risks, will continue to evolve over time. Many PMDs are already available in Australia and in use on roads and paths.

Regulatory problem with PMDs

The Australian Road Rules (ARRs) have not kept pace with the rate of change and growth of PMDs. The ARRs predate the emergence of most new technologies relating to these devices, meaning they do not recognise most newer PMDs. Currently, the ARRs only provide for the use of low-powered motorised scooters that have a maximum speed of 10km/h.

This has resulted in PMDs largely operating in an undefined regulatory environment with a lack of national consistency. For example, Queensland, South Australia and the Australian Capital Territory have recognised the growing popularity and availability of PMDs and have adopted regulatory frameworks in their road safety legislation, although the regulations somewhat differ. These regulatory frameworks set out the requirements for the legal use of PMDs, including safe control, dimensions, motor type, speed and where they can be used.

In states and territories where there are no PMD regulations, there is anecdotal evidence that the devices are being used on public roads and paths and it is likely that many device users are unaware they cannot be legally used. However, as more PMDs become available on the Australian market other jurisdictions are coming under increasing pressure to effectively regulate their use to align with the expectations of road users (Austroads, RS1978).

These regulatory inconsistencies also raise the issue of whether or not PMD users are aware of their responsibilities when integrating with others sharing the same infrastructure. The evidence emerging also demonstrates that with increased exposure of PMDs on roads and paths, there is also a likely increase in risk and associated injuries (Portland Bureau of Transportation, 2018; RACS, 2019).

Given these devices are relatively new to Australia, there is little published research or outcomes from trials undertaken to better understand how PMDs operate in existing environments and the associated safety risks. More generally there is a lack of good aggregate data available on the sale and use of PMDs throughout Australia. As such there is little data that is specific to the Australian context regarding the number of different PMD devices in use; the proportion that are being used for recreational usage, last mile or longer commutes; road infrastructure type being used and the demographics of PMD users.

This Decision Regulation Impact Statement (Decision RIS) assesses regulatory options that consider how PMDs can be integrated onto roads and/or paths, whilst also ensuring the ARRs are future proofed to account for evolution in PMD technology and infrastructure design (e.g. road user separation). The regulatory options being considered aim to provide a nationally consistent approach to the safe and legal use of PMDs.

2 Objectives of government action

2.1 Background

In May 2018, the Transport and Infrastructure Council (the Council) directed the NTC to review the Australian Road Rules (ARRs) and identify regulatory barriers preventing the safe and legal use of Motorised Mobility Devices (MMDs) and Innovative Vehicles (or Personal Mobility Devices; PMDs) on public roads and paths.

During the consultation and policy development process, the NTC identified that PMDs and MMDs are inherently different. That is, MMDs are designed to assist people who have difficulties or are unable to walk. They enable a basic human right and should be considered as a medical device rather than a vehicle (ATSA, 2019). PMDs, on the other hand, are designed for recreational use and commuting. They offer a genuine and alternative mode of transport to more traditional travel modes.

Due to the key differences between MMDs and PMDs, the NTC found that it was not appropriate to capture the full range of these devices in the same analysis. Both MMDs and PMDs require individual sets of analyses and the NTC agreed to separate these projects to allow for a more efficient and effective progression of the policy development and legislative reform process.

In October 2019, the NTC released a Consultation RIS on the '*Barriers to the safe use of personal mobility devices*'. Its focus was on addressing the regulatory barriers to the safe use of PMDs. The Consultation RIS proposed regulatory options to overcome the barriers identified. A separate proposed policy paper for MMDs is scheduled to be presented to the Transport and Infrastructure Council in November 2020.

This Decision RIS updates the Consultation RIS based on the feedback received through the consultation process.

2.2 Policy objective of this project

The policy objective of this project is to provide a nationally consistent approach to regulating PMDs that enables safe mobility and independence for all road users. The NTC has an existing role in developing national regulatory reform which includes providing nationally consistent road rules to make it easier for all road users to know and understand their responsibilities. The NTC considers that having a consistent set of rules across jurisdictions that are easy to understand is likely to improve safety outcomes and encourage compliance.

3 Consultation

3.1 Issues Paper Consultation

To better understand the key regulatory issues associated with the safe use of PMDs, the NTC has undertaken consultation which has assisted with the problem identification as well as development of the policy options.

- In November 2018, the NTC held a national stakeholder workshop to gather information about the key issues associated with the safe use of PMDs and MMDs.
- In January 2019, the MMD and PMD issues identified in the national stakeholder workshop were explored further in an issues paper published for public consultation. There were 62 submissions received from a diverse range of stakeholders. The PMD issues and views are detailed in the Consultation RIS.
- Ongoing feedback has also been received from key stakeholders as part of a national working group. This assisted the NTC to develop the policy options as well as conclude that it was appropriate to separate the MMD and PMD projects.

Throughout the consultation process the NTC has received feedback from the following stakeholders:

- Austroads
- Academia
- Disability associations
- E-scooter share scheme companies
- Vehicle and device importers and manufacturers
- Insurers
- Local governments
- Advocacy groups
- Police
- State and territory governments, including road safety commission representatives
- The Australian Road Research Board
- The Department of Infrastructure, Transport, Regional Development and Communications

As set out in Chapter 4 of the Consultation RIS, the following issues were identified through submission to the Issues Paper:

- The risks of conflict between PMDs and other road users
- The use of PMDs is illegal in most jurisdictions
- A lack of national consistency could create confusion
- Limited understanding of safety risks associated with PMDs

These issues provided the context for the development and assessment of options presented in this Regulation Impact Statement.

3.2 Consultation RIS

A Consultation RIS analyses the potential impacts of proposed new regulatory options and presents an evidence base for deciding on a preferred option. This process seeks to gather evidence and facilitate consultation with key stakeholders and the wider community.

Specifically, the PMD Consultation RIS sought feedback on:

- the problem to be addressed
- feasibility of the proposed regulatory options for a nationally consistent approach to enable the safe use of PMDs
- impacts of proposed policy options on industry, governments and the community
- approaches to measuring these impacts, and
- conclusions on the most effective solution to the identified problem.

The NTC received 62 submissions to the Consultation RIS from a diverse range of stakeholders, including: Commonwealth, state, territory and local government; motoring clubs; advocacy groups; academia; injury prevention groups; insurance groups; PMD operators and suppliers; and various other groups and individuals interested in PMDs.

3.3 Decision RIS and Next Steps

The evidence and views gathered from the submissions to the Consultation RIS, along with targeted consultation with the State and Territory Governments and industry peak bodies, informed the development of this Decision RIS.

This Decision RIS details the draft policy to be presented to the Transport and Infrastructure Council (the Council) in November 2020 for consideration. Draft legislative amendments to implement the proposed policy will be presented to Council in May 2021.

Figure 1. Project milestones and timelines

4 Options to address the problem

4.1 Proposed regulatory framework

Through the policy development and consultation process the NTC has identified a proposed regulatory framework that could be adopted into the ARRs. The key requirements of this proposed framework, outlined in Table 1, are similar to those set out in the Queensland, South Australian and the Australian Capital Territory road rules as well as being similar to those currently used by the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) to provide administrative importation approval of PMDs.

Adopting the proposed regulatory framework into the ARRs is expected to provide a nationally consistent approach to capturing and recognising PMDs that are portable, capable of travelling medium range distances and suitable for recreation or commuting. It will also provide flexibility in the ARRs to accommodate new PMDs.

In response to stakeholder feedback from the C-RIS, two categories of PMDs are specified in Table 1 based on mass and dimensions. Category A outlies the specifications for smaller and lighter PMDs, whereas Category B provides optional specifications for larger, heavier devices.

Additional information about the proposed framework and the specific requirements is provided in Appendix A. Appendices C and D provide further information on the rationale and information used to develop the policy.

Table 1. Proposed regulatory framework for PMDs

A personal mobility device is a device that:

- has 1 or more wheels
- is propelled by 1 or more electric motors
- is designed for use by a single person only
- has an effective stopping system controlled by using brakes, gears or motor control
- when propelled only by the motor, cannot reach a speed greater than 25km/h on level ground
- is not equipped with any sharp protrusions

Category A (small, light devices)

- is not more than:
  - 1250mm in length by 700mm in width by 1350mm in height
  - 25kg when the vehicle is not carrying a person or other load

Category B - optional (large, heavier devices)

  - 700mm in length by 1250mm in width by 1350mm in height
  - 60kg when the vehicle is not carrying a person or other load

Devices excluded from the framework

- Power-assisted pedal cycles
- Motorised scooters not capable of travelling more than 10km/h on level ground.
- Motorised mobility devices (i.e. motorised wheelchairs and mobility scooters)

Age restrictions

The ARRs currently provide for individuals of any age to use a motorised scooter that is incapable of travelling more than 10km/h on level ground on roads and paths.

Jurisdictions that have already implemented similar frameworks have imposed age restrictions on the use of PMDs. For example, in Queensland a person must be at least 16 years old, or at least 12 years old if supervised by an adult, to be eligible to use a PMD.

The NTC acknowledges that enforcement of different speeds based on users' age and device type will present many challenges. To reduce enforcement challenges, it is recommended that children under the age of 16 years old be permitted to continue using motorised scooters incapable of travelling more than 10km/h on level ground. However, they should not be permitted to use any other device that fits the proposed PMD framework, even if it is incapable of travelling more than 10km/h on level ground.

4.2 Regulatory Options

The NTC developed four new regulatory options for consultation, as well as considering the status quo. The implementation of any of the four new options is dependent on the proposed regulatory framework being adopted into the ARRs. The options are primarily focused on permitting PMD access to road and path infrastructure and setting maximum speed requirements.

Three different speed approaches were proposed for consideration as options two, three and four. Of these three speed approaches, one reflects a variable speed approach and two reflect fixed speed approaches. The impact analysis in Chapter 5 provides an analysis of the potential risks and benefits of each option and speed approach.

Summary of options

- **Option 1 (status quo):** most PMDs remain unlawful to use on public roads or paths.
- **Option 2**: access permitted to most pedestrian infrastructure and bicycle paths.
- **Option 3**: access permitted to most pedestrian infrastructure, bicycle paths and local roads.
- **Option 4**: access permitted to most pedestrian infrastructure, bicycle infrastructure and roads.
- **Option 5**: access permitted to bicycle infrastructure and roads.

Options 2, 3 & 4 are associated with three speed approaches:

- **Speed Approach 1:** 10km/h maximum speed on pedestrian infrastructure; and 25km/h maximum speed on bicycle infrastructure and roads (where the option permits).
- **Speed Approach 2:** 15km/h maximum speed on all permitted infrastructure.
- **Speed Approach 3**: 25km/h maximum speed on all permitted infrastructure.

4.2.1 Option 1: Status quo - No change to the Australian Road Rules

This option has been included as the baseline to which all other options will be compared. This is required by the Guideline for Ministerial Councils and National Standard Setting Bodies (COAG, 2007).

The majority of PMDs will continue not to be recognised by the ARRs and remain illegal to use in most states and territories. The ARRs currently only provide for the use of motorised scooters that have a maximum power output of no more than 200 watts and are not capable of going faster than 10km/h on level ground.

As the ARRs are model legislation, they can be adopted by a state or territory as drafted or with variations. For example, in December 2018, Queensland amended the *Transport Operations (Road Use Management – Road Rules) Regulation 2009* (thus departing from the ARRs) to permit the use of PMDs. In February 2019, South Australia similarly amended the *Road Traffic (Miscellaneous) Regulations 2014* to permit the use of an electric personal transporter and in December 2019, the Australian Capital Territory amended the *Road Transport (Road Rules) Regulation 2017* to permit the use of a wider range of PMD's and personal use of those devices.

Maintaining the status quo will not promote a nationally consistent approach to the safe and legal use of PMDs.

4.2.2 Option 2: Permit the use of personal mobility devices on most pedestrian infrastructure and bicycle paths

Access:

- Footpaths
- Shared paths
- Separated footpaths (designated for the use of bicycles)
- Bicycle paths.

Speed Approach 1:

- Not permitted to travel at a speed faster than 10km/h on a footpath or shared path
- Not permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles) or a bicycle path.

Speed Approach 2:

- Not permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

Speed Approach 3:

- Not permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

Implementation:

This option is dependent on the proposed regulatory framework being adopted into the ARRs.

4.2.3 Option 3: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle paths and local roads

Access:

- Footpaths
- Shared paths
- Separated footpaths (designated for the use of bicycles)
- Bicycle paths
- Local roads (50km/h or less, no dividing line or median strip and not a one-way road with more than 1 marked lane).

Speed Approach 1:

- Not permitted to travel at a speed faster than 10km/h on a footpath or shared path
- Not permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or local road.

Speed Approach 2:

- Not permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

Speed Approach 3:

- Not permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

Implementation:

This option is dependent on the proposed regulatory framework being adopted into the ARRs. Appendix B presents how Option 3 could be implemented by generally applying the current ARRs that apply to pedestrians and wheeled recreational device users to PMD users.

4.2.4 Option 4: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle infrastructure and roads

Access:

- Footpaths
- Shared paths
- Separated footpaths (designated for the use of bicycles)
- Bicycle paths
- Roads (except where a no bicycle sign indicates otherwise).

Speed Approach 1:

- Not permitted to travel at a speed faster than 10km/h on a footpath or a shared path
- Not permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or road.

Speed Approach 2:

- Not permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

Speed Approach 3:

- Not permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

Implementation:

This option is dependent on the proposed regulatory framework being adopted into the ARRs.

4.2.5 Option 5: Permit the use of personal mobility devices on bicycle infrastructure and roads

Access:

- Separated footpaths (designated for the use of bicycles)
- Bicycle paths
- Roads (except where a no bicycle sign indicates otherwise).

Speed Approach:

- Not permitted to travel at a speed faster than 25km/h on separated footpaths (designated for the use of bicycles), bicycle paths or roads.

Implementation:

This option is dependent on the proposed regulatory framework being adopted into the ARRs.

5 Impact analysis – summary

This section summarises the key potential impacts of the proposed regulatory options and outlines the NTC's preferred option. The full impact analysis is presented in Appendix D and provides further detail and evidence on the assessment for each option.

5.1 Approach

The options for allowing PMDs to be used on roads and paths were assessed using a qualitative cost-benefit assessment framework. This approach is consistent with the Office of Best Practice Regulation's (OBPR) cost-benefit analysis guidelines (OBPR, 2007).

Each option was assessed against the criteria set out in Table 2. These criteria were developed to ensure that all significant potential implications of each option were addressed in this assessment.

Table 2. Impact assessment criteria

Criteria		Description
Safety	PMD user	What are the possible safety risks of each option for PMD users?
	Other road/path users	What are the possible safety risks of each option for other road/path users?
Access and Amenity	PMD users	What are the impacts to access and amenity for PMD users of each option?
	Other road/path users	What are the impacts to access and amenity for other road/path users of each option?
Broader Economic Costs and Benefits		What (if any) are the broader economic costs and benefits of each option?
Compliance and Enforcement		How easy is it to comply with and enforce each option?

5.2 Analysis of options and speed approaches

The overall assessment of options is depicted in Table 3. This table highlights the challenge of establishing a common national approach to permitting access of PMDs onto public roads and paths. Each variation of infrastructure access and speed approach results in trade-offs between the safety and amenity of different user types, broader economic benefits, enforcement and compliance challenges. As a result, no one option is superior to another across the criteria.

5.2.1 Options assessment

The options were assessed against the status quo option (baseline; see Appendix D). The key implications from the assessment are summarised as follows:

Option 2: *Permit the use of PMDs on most pedestrian infrastructure and bicycle paths*

Permitting access to paths would enable basic leisure, recreational use and shorter commutes (i.e. first/last mile travel). However, without access to any road infrastructure medium to longer commuting would be difficult.

Restricting PMD use to paths only will likely have a minor negative impact on safety to PMD users as it limits exposure to motor vehicles (e.g. intersections, crossing the road). However, there is likely to be some associated increased risk to other path users as they become more exposed to PMDs. However, the level of risk to other path users is likely to be dependent on the speed approach (10km/h, 15km/h, or 25km/h).

This option was assessed as being likely to lead to a minor increase in broader economic benefits primarily due to increasing demand in the market for PMDs and associated services.

Option 3: *Permit the use of PMDs on most pedestrian infrastructure, bicycle paths and local roads*

Permitting access to paths as well as local roads would likely have a moderate positive impact on enabling PMDs to be used practically for short to medium distance commuting. However, only allowing access to paths and lower speed roads (50km/h or less) will make medium to long commutes difficult.

Exposing PMDs to motor vehicles at speeds up to 50km/h is expected to have a moderate negative impact on safety risk to PMD users.

There is also likely to be some associated increase in safety risk to other path users as they become more exposed to PMDs. However, the level of risk to other path users is likely to be dependent on the speed approach (10km/h, 15km/h or 25km/h). The risk to other local road users is likely to be minimal.

This option was assessed as being likely to lead to a moderate increase in broader economic benefits primarily due to increasing demand in the market for PMDs and associated services (as local road access makes PMD use more viable for transport than Option 2).

Option 4: *Permit the use of PMDs on most pedestrian infrastructure, bicycle infrastructure and roads*

This option would permit the greatest access to the road network and enable PMDs to be used viably for longer commutes by providing access to most paths and roads.

However, this option exposes PMD users to motor vehicles on roads that exceed 50km/h. This may have a major negative impact on safety in the event of a PMD-motor vehicle crash.

This option is also likely to have some increase safety risks to other path users, the level of which is dependent on the speed approaches (10km/h, 15km/h or 25km/h). There is unlikely to be a significant increase in safety risk to other road users.

This option was assessed as being likely to lead to a moderate increase in broader economic benefits primarily due to increasing demand in the market for PMDs and associated services (as road access makes PMD use more viable for transport than Options 2 and 3).

Option 5: *Permit the use of PMDs on bicycle infrastructure and roads at 25km/h*

It is expected that permitting access to bicycle infrastructure and roads, and not pedestrian infrastructure, is likely to somewhat inhibit the benefits of using a PMD for short to medium distance commuting. This is because demand for PMDs may not be as high from people that are uncomfortable using roads.

Having no access to pedestrian areas is likely to result in a major negative impact on safety to PMD users due to significant exposure to motor vehicles. On the other hand, it results in no safety risk to pedestrian areas. This option was assessed as being likely to lead to only a minor increase in broader economic benefits primarily due to increasing demand in the market for PMDs and associated services.

The assessment reflects that a lack of access to paths is likely to deter recreational users, and adversely affect tourism and rental/share businesses that rely on access to pedestrian infrastructure.

5.2.2 Analysis of speed approaches

Options 2, 3 and 4 are associated with three speed approaches. The implications of the speed approaches largely depend on the infrastructure access being granted by the option.

This section summarises the common themes identified through the analysis. As with the options, the key implications from the assessment of the speed approaches highlighted trade-offs.

Speed Approach 1: *10km/h maximum speed on pedestrian infrastructure; and 25km/h maximum speed on bicycle infrastructure and roads (where permitted).*

For pedestrian paths, the benefits of PMD use for commuting are likely to be restricted by constraining device speed to a maximum of 10km/h. However, 10km/h is generally accepted as a safe speed based on safety considerations for pedestrians and is expected to minimise risk in these areas.

For bicycle paths, permitting PMD to travel at 25km/h may result in some conflict with other bicycle path users, i.e. as PMDs and bicycle riders pass each other. However, based on average travel speeds of bicycle riders on bicycle paths (between 18km/h and 30km/h), the frequency of passing at 25km/h is expected to be less than the alternative speed approach of 15km/h (Speed Approach 2).

When combined with Options 3 and 4, this approach may also result in some PMD users preferring to use the road at 25km/h rather than travel on a footpath at 10km/h, when this choice is available, resulting in higher exposure of PMDs in these areas.

A variable speed approach is also likely to raise challenges with compliance and enforcement.

Speed Approach 2: *15km/h maximum speed on all permitted infrastructure.*

For pedestrian paths, travelling at 15km/h rather than 10km/h would marginally improve the use and benefits of PMDs for commuting. However, travelling at a maximum of 15km/h is likely to result in a greater safety risk to PMD users as well as other road and path users, compared to a maximum speed of 10km/h.

For bicycle paths, the benefits would not be as great when permitting PMDs to travel at a maximum of 15km/h, as opposed to 25km/h. However, while 15km/h compared to 25km/h will likely result in better safety outcomes in the event of a collision, the chances of collisions are likely to be more frequent at 15km/h as bicycle riders and PMD users pass each other more frequently. This is likely to result in higher rates of conflict and potential injury compared to the other speed approaches (this is based on research finding average bicycle riding speeds between 18km/h and 30km/h on bicycle paths, see Appendix D).

Allowing PMDs to travel up to 15km/h across all permitted infrastructure may result in some PMD users perceiving it to be safer travelling on a path rather than on a road, when this choice is available. This may result in higher levels of exposure of PMDs and risk to pedestrians in these areas.

A fixed speed approach would be easier to enforce and comply with than a variable speed approach.

Speed Approach 3: *25km/h maximum speed on all permitted infrastructure.*

For pedestrian paths, permitting PMDs to travel at a maximum speed of 25km/h presents the highest safety risk of the speed approaches for these areas. It is also likely to significantly increase the *perceived* risk of other users of pedestrian infrastructure, reducing their amenity and potentially deterring some vulnerable users.

For bicycle paths, permitting PMDs to travel at 25km/h may result in increased risks of conflict as PMDs and bicycle riders pass each other. However, based on average travel speeds the frequency of passing at 25km/h is expected to be less than at 15km/h (Speed Approach 2).

Allowing PMDs to travel up to 25km/h across both road and path infrastructure may result in some PMD users perceiving it to be safer to travel on a path rather than on a road, when this choice is available. This may result in higher levels of exposure of PMDs and risk to pedestrians in these areas.

A fixed speed approach would also be easier to enforce and comply with than a variable speed approach.

5.2.3 Preferred options of submissions

The NTC received 62 submissions to the Consultation RIS of which:

- 21 (34%) supported the Consultation RIS recommendation: Option 3 Speed Approach 1.
  - 4 (6%) supported Option 3: Speed Approach 1 in principle.
- 17 (27%) proposed different options that were not explored in the Consultation RIS.
- 13 (21%) supported a different Speed Approach or Option proposed in the Consultation RIS.
- 7 (11%) provided a statement or information without supporting a clear position.

Table 3. Overall assessment of options

Criteria		Option 1 Status quo	Option 2 Access to most ped infrastructure and bicycle paths			Option 3 Access to most ped infrastructure, bicycle paths and local roads			Option 4 Access to most ped and bicycle infrastructure and roads			Option 5 Access to bicycle infrastructure and roads
			Speed App 1	Speed App 2	Speed App 3	Speed App 1	Speed App 2	Speed App 3	Speed App 1	Speed App 2	Speed App 3	
Safety Risk	PMD users	=	-	-	-	--	--	--	---	---	---	---
	Other road users	=	-	--	---	-	--	---	-	--	---	=
Access and Amenity	PMD users	=	+	+	+	++	++	++	+++	++	+++	+
	Other road users	=	-	-	--	-	-	--	-	-	--	=
Broader Costs and Benefits	Commercial Value	=	+	+	+	++	++	++	++	++	++	+
	Regulatory Burden	=	+	+	+	+	+	+	+	+	+	+
Compliance and Enforcement		=	--	-	-	--	-	-	--	-	-	-

Assessment Rating Key	
Major positive impact (compared to Option 1)	+++
Moderate positive impact	++
Minor positive impact	+
Little to no difference	=
minor negative impact	-
moderate negative impact	--
Major negative impact	---

6 Evaluation and recommendation

The overall assessment of options as summarised in Table 3 highlights the challenge of establishing a common national approach to permitting access of PMDs onto public roads and paths. Each variation of road/path access and speed approach results in trade-offs between the safety and amenity of different user types, broader economic benefits, as well as compliance and enforcement challenges. As a result, no one option is superior to another across the criteria.

In addition, a national response is made far more challenging by the very different nature of dimensions, condition and usage of road and path infrastructure across Australian urban environments.

6.1 NTC National preferred option

The NTC's assessment identified that the best approach to balance mobility and safety across the country would be to adopt the following into the ARRs:

- **PMD regulatory framework, and**
- **Option 3 - Speed Approach 1**

The NTC assessed this option as providing the highest net benefit. The benefits associated with PMD access, commercial opportunities and congestion reduction outweigh the costs associated with minor increases in safety risks to pedestrians, compliance and enforcement challenges.

Permitting PMDs to travel up to a maximum of 10km/h on pedestrian infrastructure is an appropriate speed based on safety considerations for pedestrians. For bicycle paths and local roads, a maximum speed up to 25km/h is considered safe and appropriate and there is little justification to further restrict PMD speed in these areas.

Allowing PMDs to be used for their intended purposes with moderate restriction is likely to enable the achievement of close to their full potential economic benefits (e.g. commercial opportunities and congestion reduction).

The NTC acknowledges that to minimise the safety risks for this option there will need to be a high level of compliance and clear enforcement with the proposed road rules. While there may be a variety of challenges with regulating variable speeds across different roads and paths, these difficulties in isolation should not offset the potential benefits of minimising PMD speed around pedestrians.

The NTC notes that this approach received strong support from formal submissions with 40 per cent providing support (including "in-principle" support).

6.2 Recommended Policy

Further consultation with state and territory road authorities has made it clear that there is no possibility of a complete consensus in support of Option 3 – Speed Approach 1.

Due to the primary organising principle of pursuing nationally consistent road rules, the NTC's assessment has been based on an implicit "averaging" of road and path conditions, dimensions and usage. While the NTC stands by its assessment on this basis, it also agrees that the preferred approach could vary if an assessment were made at individual state and territory level.

For instance:

- Jurisdictions with urban environments that tend to have wide, flat and sparsely used footpaths with limited local roads (as defined for Option 3) will tend to prefer use on footpaths with higher speed allowances; whereas
- Jurisdictions with urban environments that tend to have narrow, fractured and footpaths relied on heavily for mobility by vulnerable users will tend to prefer options that more significantly restrict speeds on footpaths for PMD users or even not allow access at all.

Notwithstanding this, the NTC considers it important to achieve as much consistency as possible in the road rules. The NTC believes that this can be most effectively achieved through the model law adopting:

- The framework for PMDs as set out in Chapter 4 Table 1.
- Access to the infrastructure set out in Option 3 (and detailed implementation presented in Appendix B), with footpaths and local roads with speed limits of 50km/hr or less, subject to the law of the jurisdiction.
- That speed on each infrastructure type be subject to the law of the jurisdiction.

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Glossary

Term	Definition
Bicycle path	Bicycle path means a length of path beginning at a bicycle path sign, or bicycle path road marking, and ending at the nearest of the following: - an end bicycle path sign or end bicycle path road marking - a separated footpath sign or separated footpath road marking - a road (except a road-related area) - the end of the path.
Footpath	Means an area open to the public that is designated for, or has as one of its main uses, use by pedestrians.
Local road	A local road is a road that has a speed limit of 50km/h or less, does not have a dividing line or median strip and is not a one-way road with more than 1 marked lane.
National Transport Commission	The NTC is a statutory agency that proposes nationally consistent land transport reforms.
Road	A road is an area that is open to, or used by, the public and is developed for, or has as one of its main uses, the driving or riding of motor vehicles.
Road-related area	A road-related area is any of the following: - an area that divides a road - a footpath or nature strip adjacent to a road - an area that is not a road and that is open to the public and designed for use by cyclists or animals - an area that is not a road and that is open to, or used by, the public for driving, riding or parking vehicles.
Shared path	A shared path is an area open to the public (except a separated footpath) that is designated for, or has as one of its main uses, use by both the riders of bicycles and pedestrians, and includes a length of path for use by both bicycles and pedestrians beginning at a shared path sign or shared path road marking and ending at the nearest of the following: - an end shared path sign or end shared path road marking - a no bicycles sign or no bicycles road marking - a bicycle path sign or bicycle path road marking - a road (except a road-related area) - the end of the path.
Separated footpath	Separated footpath means a length of footpath beginning at a separated footpath sign or separated footpath road marking, and ending at the nearest of the following:

	- an end separated footpath sign or end separated footpath road marking - a bicycle path sign or bicycle path road marking - a no bicycles sign or no bicycles road marking - a road (except a road-related area) - the end of the footpath.
Transport and Infrastructure Council	The Council comprises Commonwealth, State, Territory and New Zealand ministers who are responsible for transport and infrastructure. The Australian Local Government Association is also a Council member.

Appendix A Development of the proposed PMD regulatory framework

The Personal Mobility Device (PMD) regulatory framework proposed by the National Transport Commission (NTC) was initially developed as part of an Austroads project (RS1978) in 2015. The objective of the Austroads project, similar to the current NTC project, was to develop a national policy framework to ensure PMDs are regulated consistently across Australia. The requirements outlined in Chapter 4 Table 1 are based on this Austroads work.

Queensland, South Australia and the Australian Capital Territory have already implemented similar, albeit different, frameworks to enable the use of PMDs on certain roads and paths. In addition, a similar framework is currently used by the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) to provide administrative importation approval of PMDs.

The NTC undertook a review of the Austroads work and the regulatory frameworks already implemented in Australia. Most of these requirements are appropriate for adoption into the Australian Road Rules (ARRs), although key considerations remain around access and speed (see Chapter 4).

A.1 Rationale for the proposed PMD framework requirements

Design requirements for pedestrian infrastructure

The dimensions are based on ensuring that PMDs can fit reasonably on the infrastructure they are most intended to be used: pedestrian infrastructure.

Given that footpaths are the narrowest corridor in the road network, if PMDs can fit on this infrastructure they should theoretically fit on all other infrastructure as well (Austroads, RS1978).

The *Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths (2009)* states that, as a guide, the minimum design requirements for footpaths are:

- Absolute min width: 1000mm
- Desirable min width: 1200mm

Design requirements for public transport

Given a key purpose of PMDs is for 'first/last mile' transport, they should be designed for public transport conveyance. A summary of the relevant public transport accessibility standard dimensions is provided in Table 4.

Table 4. Summary of relevant public transport accessibility standards

Relevant standard	Minimum dimension/s
Access path	W 1200mm
Between front wheel arches of a bus	W 750mm
Doorway restriction	W 800mm, H 1410mm
Ramps	W 800mm
Minimum allocated space for mobility aids	W 800mm, L1300mm

- Given the minimum width between the front wheel arches of a bus, devices should be less than 750mm in width.
- Given the minimum length of allocated space for mobility aids on public transport, devices should be less than 1300mm in length.
- Given the minimum height of a doorway restriction, devices should be less than 1410mm in height.

The required dimensions are based on these standards and the assumption that a minimum of 50mm is acceptable to allow room for manoeuvring.

Maximum weight

A maximum weight of 60kgs was selected as it was consistent with the existing PMD framework in Queensland. This has since been adopted by South Australia and the Australian Capital Territory.

Given vehicles such as mobility scooters (which can weigh up to 150kgs) are allowed on similar infrastructure in some jurisdictions with minimum safety concerns, a 60kg maximum for PMDs was considered acceptable.

While 60kgs is to be considered an absolute maximum, this ensures heavier devices such as Segways can also be captured by the framework. This eliminates the need for an exemption process for Segways that are currently allowed on the road network.

Speed selection

The maximum speed of 25km/h for a PMD was determined based on the interaction between appropriate path design (Austroads, 2009), the Australian Design Rules (ADRs), average travel speeds and maximum permitted speeds of similar existing devices that are used on roads and paths.

For example, the *Guide to Road Design – Part 6A: Pedestrian and Cyclist Paths* (Austroads, 2009, p9) outlines that bicycle paths are *most appropriate* where they allow for “uninterrupted and safe travel at a relatively high constant speed (say 30km/h)”. Whilst noting path design may accommodate faster speeds (i.e. > 30 km/h), the mean travel speed of cyclists on these paths is noted as approximately 25 km/h (see Appendix C). Therefore, the *mean* travel speed for existing devices is consistent with the *most appropriate* design of bicycle paths (i.e. within

5 km/h). In addition, other electric vehicles captured within the ADRs (e.g. pedelecs) are permitted to travel at a maximum speed of 25km/h. Further, any vehicle capable of exceeding 25 km/h requires a braking system in accordance with the ADRs (Austroads, RS1978).

Given this alignment of information, it is reasonable to allow PMDs to travel at a maximum of 25 km/h. While 25km/h is the absolute maximum speed for the purpose of the framework, this may be reduced to 15km/h or 10km/h, dependent on the infrastructure and speed permitted by the law of the jurisdiction.

See Appendices C and D for further discussion on appropriate speed for various infrastructure.

Kinetic energy

Table 5 outlines the kinetic energy differentials between 10km/h, 15km/h and 25km/h for PMDs at the absolute maximum weight of 60kg (as well as at 25kg) and compares these to the requirements in the ARRs for a motorised mobility device (i.e. an existing device that uses similar infrastructure).

This shows that the kinetic energy differentials are similar at 10 km/h for PMDs weighing 60 kg and MMDs weighing 110 kg. The kinetic energy figures are also similar for a 170 kg MMD at 10 km/h and a 25 kg PMD at 15 km/h. Further, the differential of 843j between a 25 kg and 60 kg PMD travelling at 25 km/h can also be considered minimal.

However, it is important to note that in the context of actual injury, these figures are relatively low and need to be interpreted with caution. That is, in this context kinetic energy can be used as a guide for impact forces only and do not necessarily translate into actual injury outcomes. These calculations of kinetic energy also do not consider other important crash-related factors, such as biomechanical tolerance, vehicle and infrastructure characteristics. It should further be noted that often injuries occurring to pedestrians from collisions with devices on paths are often the result of secondary forces, such as the pedestrian being knocked to the ground and sustaining injury from the fall.

Table 5. Kinetic energy differentials for PMDs and motorised mobility devices

	Person (kg)	Device (max. kg)	Speed (max km/h)	KE (J)
MMD	80	110	10	733
MMD	80	170	10	965
PMD	80	60	10	540
PMD	80	60	15	1215
PMD	80	60	25	3375
PMD	80	25	10	405
PMD	80	25	15	911
PMD	80	25	25	2532

Accommodating both smaller and larger devices

A number of jurisdictions have indicated that they would not support the inclusion of heavier devices (such as Segways and like vehicles) on their infrastructure on the grounds that:

- The PMD framework should be constrained by the principle that the PMD should be able to be carried by the user.
- Their footpaths are not wide enough for Segways to be safely used, including to allow passing of other footpath users.

As such, it was determined that the PMD framework within the model rules should provide for two size options. That is that a PMD:

- is not more than – Category A (small, light devices)
  - 1250mm in length by 700mm in width by 1350mm in height
  - 25kg when the vehicle is not carrying a person or other load

  And optional Category B (large devices including Segways)
  - 700mm in length by 1250mm in width by 1350mm in height
  - 60kg when the vehicle is not carrying a person or other load

Appendix B Implementation of Preferred Option

Table 6. Implementation of Option 3

	Implementation of Option 3
Classification in the ARRs	A person in, or on, a PMD is classified as a pedestrian.
Travelling on roads	A person in, or on, a PMD must not travel on a road with: ▪ a dividing line or median strip ▪ a length of road for which the speed limit applying to a driver is more than 50km/h ▪ a one-way road with more than 1 marked lane. The above does not apply to a person who is crossing a road in, or on, a PMD if the person: ▪ crosses the road by the shortest safe route ▪ does not stay on the road longer than necessary to cross the road safely ▪ is not prohibited by another law of this jurisdiction from crossing the road in, or on, the PMD. A person in, or on, a PMD is permitted to travel on a road if: ▪ there is an obstruction on a footpath, nature strip, bicycle path or shared path adjacent to the road (an adjacent area) ▪ because of the obstruction, it is impracticable to travel on the adjacent area ▪ the user travels less than 50m along the road to avoid the obstruction. A person in, or on, a PMD travelling on a road: ▪ must keep as far to the left side of the road as is practicable ▪ must not travel alongside more than 1 other pedestrian or vehicle travelling on the road in the same direction as the user, unless the user is overtaking other pedestrians.
Travelling on bicycle paths and separated paths	A person in, or on, a PMD may be on a bicycle path or part of a separated footpath designated for the use of bicycles. A person in, or on, a PMD must not be on a separated path that is designed for the use of pedestrians.
Travelling on footpaths and shared paths	A person travelling in, or on, a PMD on a footpath or shared path must: ▪ keep to the left unless it is impractical to do so

	▪ give way to any pedestrian (except a person travelling in, or on, a wheeled recreational device, wheeled toy or PMD) who is on the footpath or shared path ▪ travel a sufficient distance from a pedestrian so the person in, or on, a PMD can, if necessary, stop safely to avoid a collision with the pedestrian.
Travelling across a crossing	A PMD user riding across a road, or part of a road, on a children's crossing, marked foot crossing or pedestrian crossing must: ▪ proceed slowly and safely ▪ gives way to a pedestrian on the crossing ▪ keep to the left of the crossing unless it is impracticable to do so ▪ pedestrian does not include a person using a personal mobility device.
Bicycle crossing lights	A PMD user is required to comply with the bicycle crossing light provisions in the ARRs when crossing at an intersection or another place on the road.
No wheeled recreational device or toy sign	A person in, or on, a PMD must not travel past a no PMD sign.
Towing	A person must not be in, or on, a PMD that is being towed by a vehicle. A person in, or on, a PMD must not hold onto another vehicle while the vehicle is moving. A person in, or on, a PMD must not travel within 2m of the rear of a moving motor vehicle continuously for more than 200m. A person in, or on, a PMD must not tow another object/device while the PMD is moving.
Helmets	A person who is travelling in, or on, a PMD on a road or road-related area must wear an approved bicycle helmet securely fitted and fastened on their head.
Carrying people / animals	A person in, or on, a PMD must not carry any other person or an animal on the PMD.
Travel to the left of oncoming PMD users or riders on a path	A person in, or on, a PMD on a bicycle path, footpath, separated footpath or shared path must keep to the left of any oncoming bicycle rider or other PMD user on the path.
Using PMD at night	A person must not use a PMD at night or in hazardous weather conditions causing reduced visibility, unless the person, or the device, displays:

	- a flashing or steady white light that is clearly visible at least 200m from the front of the device - a flashing or steady red light that is clearly visible at least 200m from the rear of the device - a red reflector that is clearly visible for at least 50m from the rear of the device when light is projected on it by a vehicle's headlight on low-beam.
Exemption for police officers using PMDs	A police officer using a PMD is not subject to restrictions regarding: - speed, or - areas of use if the police officer is taking reasonable care and it is reasonable that the restrictions should not apply.

Appendix C Road safety review

Introduction

While legal Personal Mobility Device (PMD) use in Australia is still relatively new, there has been little opportunity for safety research to be published and the key issues to be addressed. When considering how PMDs should be integrated into the existing transport network, the National Transport Commission (NTC) has considered how these devices compare to other permitted vehicles and devices. The NTC reviewed the submissions received from the issues paper and undertook a review of the research to better understand the issues surrounding device use, misuse, safety concerns and crash/injury statistics.

Various international studies have reported that some PMDs and other transport modes have similar risks and vulnerabilities (Austroads, RS1978). For example, some research has demonstrated that Segways and bicycles are similar in performance and injury outcomes following a crash (German Insurance Association, 2009; Goodridge, 2003). Other research has likened the risk of pedestrian-Segway interactions to that of pedestrians-joggers/wheelchairs, which is lower compared to pedestrian-bicycle interactions (Litman & Blair, 2017).

Xu et al (2016a) suggested that in the event of a PMD-motor vehicle crash, PMD users have a similar injury risk as a bicycle rider. The key reason for this was that both modes of transport have high centres of gravity. It was reported that the range of injuries experienced by pedestrians following a PMD crash would reflect those experienced in a pedestrian-bicycle crash. Furthermore, e-scooters have been reported to have similar risks and vulnerabilities as bicycles (Bird, 2019).

Based on the assumption that PMDs and other currently legal devices/vehicles are comparable, the NTC has reviewed the safety implications of these devices/vehicles and their risk profiles across a variety of infrastructure and applied this risk profile to PMDs. By overlaying the Safe System principles to the analysis, the NTC has developed a range of options that may suitably integrate PMDs into the existing transport network. The following sections present the key issues and available evidence related to the safety risks associated with the use of PMDs on roads and paths.

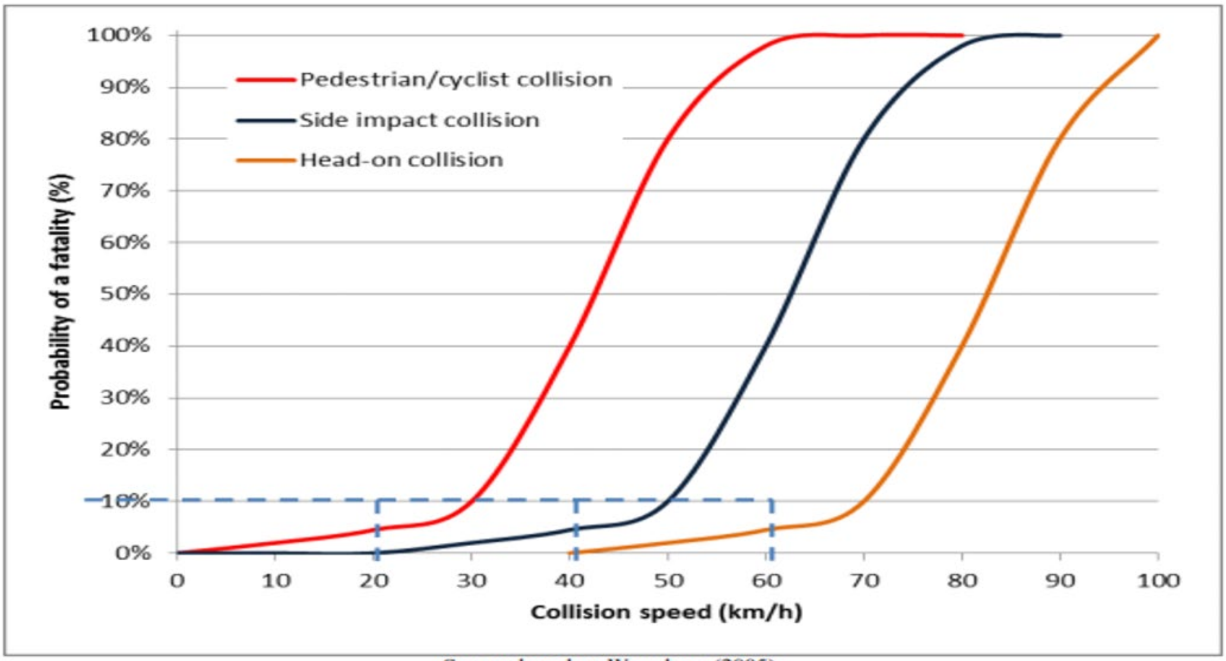
Safety

The influence of speed in the likelihood of crash occurrences and injury severity has been extensively studied. It is well established that even small increases in vehicle speed can reduce the amount of time available to react to a safety-critical event, which increases the risk of crashing. A small increase in speed is also associated with a large increase in kinetic energy (or crash forces), which is a key factor in injury severity (Elvik et al, 2004; Khorasani-Zavareh et al, 2015).

The design of most PMDs means users are particularly vulnerable in the event of a crash with a motor vehicle, mainly due to their lack of protection to potentially violent crash forces. A key guiding principle to the Safe System approach is that the road system should be designed so people are not exposed to forces that impact beyond physical tolerance (ATC, 2011).

The model in Figure 2 has generally been adopted in Australia and New Zealand to illustrate the probable effect of impact speeds on the severity of selected crash types (Jurewicza et al, 2015; Wramborg, 2005). The red curve shows that the risk of bodily injury is less than 10% if a vulnerable road user, specifically a pedestrian or bicycle rider, is hit by a motor vehicle travelling at 30km/h or less. This rises to about 50% if the vehicle is travelling at 45km/h.

Figure 2. Wramborg's model for fatality probability vs. vehicle collision speeds



Source: based on Wramborg (2005).

Based on the assumption that PMDs and bicycles have similar performance and risk profiles, Figure 2 outlines the potential risk of fatal injury to users of PMDs in the event of a crash with a motor vehicle.

Previous research has identified the safety risks and implications of mixing vulnerable road users, such as bicycle riders and pedestrians, with motor vehicles in Australia. This has shown that the majority of fatal and serious injuries to bicycle riders occur from riding a bicycle on a road where there are other motor vehicles (Chong et al, 2010; O'Hern & Oxley, 2019; Queensland Legislative Assembly, 1993).

While more recent research from the Australian Institute of Health and Welfare (2019a) has found that higher proportions of on-road injuries occur from non-collision events rather than collision events with a motor vehicle, it may be suggested that the presence of a motor vehicle itself may indeed contribute to non-collision events (e.g. swerving to avoid direct contact).

If PMDs are exposed to similar interactions with motor vehicles as bicycle riders, it may be reasonable to expect similar injury trends to occur. The NTC is concerned about the potential emergence of this risk profile, particularly at a time when significant focus and attention is on strategies to reduce road trauma to vulnerable road users (ATC, 2011).

To minimise these risks, Safe System principles guide a response that would separate PMDs from motor vehicles, where practical to do so. This would mean preferencing PMD access to pedestrian and bicycle paths. Indeed, jurisdictions in Australia that already allow the use of PMDs generally restrict these devices to pedestrian and bicycle infrastructure and low-speed roads. However, there is no specific Australian research published that provides insight into PMD safety on roads.

International research (Trivedi et al, 2019) has investigated injuries associated with e-scooter use on roads in Southern California (where it is prohibited to ride these devices on footpaths). A total of 249 patients presented to the emergency department with injuries associated with standing electric scooter use. The majority of injuries were from falls (80.2%), colliding with an object (11.0%), and being hit by a moving vehicle or object (8.8%). Only about four per cent of injuries occurred to pedestrians following an e-scooter collision, and only two people in total sustained serious head injuries.

Similarly, an e-scooter trial in Portland that also prohibited the devices from being used on footpaths found that while e-scooter-related injuries increased during the trial period, most injuries were not severe enough to warrant emergency transport. There were no e-scooter-related traffic deaths during the pilot period, and most injuries (84%) were fall-related. While riding on the footpath was not permitted, it was clear from the trial that some users were ignoring this rule. As such, approximately three per cent of injuries resulted from collisions with pedestrians (Portland Bureau of Transportation, 2018).

The reason for falling from the e-scooter was not documented within these research studies, although it may be suggested that falls may occur due to swerving or to avoid colliding with a motor vehicle, suggesting that the presence of a motor vehicle may play a role.

In its submission to the Consultation RIS, the South Australian Department of Planning, Transport and Infrastructure provided the following evidence from the City of Adelaide's e-scooter trial:

As of 31 May 2019, the City of Adelaide e-scooter trial (running since February 2019) had 9 reported injuries and an injury rate of 6 per 100,000 trips compared with 20 per 100,000 trips in cities such as Austin, and media reports of 80 injuries in 2 months in Brisbane (see CoA E-Scooter Trial Update Report and CoA presentation to the IPWEA SA State Conference). These injuries were mostly minor.

Safety of other users on pedestrian and bicycle infrastructure

Reducing exposure to motor vehicles is regarded as a key strategy to reduce trauma to vulnerable road users (Tingvall & Haworth, 1999). This can be achieved through the concept of separation, which is to permit and encourage vulnerable road users, such as bicycle riders, or PMDs in this case, to use dedicated paths.

This raises the issue of safety of others that use these areas, such as pedestrians. Grzebieta et al (2011) outlined that the kinetic energy (specifically speed and mass) differential between a motor vehicle-bicycle collision (i.e. vehicle 50km/h/bicycle 30km/h) and bicycle-pedestrian collision (i.e. bicycle 30km/h) is not too dissimilar. However, while speed and mass are the two key properties of kinetic energy, in this scenario it is likely that other crash-related factors (i.e. biomechanical tolerance, vehicle and infrastructure characteristics) are likely to also impact injury outcomes.

The differences in vehicle characteristics alone between a motor vehicle and PMD/bicycle are likely to result in a different risk profile to pedestrians. For example, modelling has shown that a pedestrian can sustain a serious head injury by hitting their head on the pavement after being knocked to the ground by a bicycle rider (Short et al, 2007). In other words, the injury appears to be the result of a secondary impact, as opposed to a crash with a motor vehicle in which the initial crash forces are often what cause injury (Xu et al, 2016a; Xu et al, 2016b).

Therefore, when assessing the appropriateness of integrating PMDs into bicycle and pedestrian infrastructure it is important to understand the existing level of risk and injuries experienced by users of paths. As pointed out by Grzebieta et al (2011), people that use paths have differing degrees of ability and experience, health and fitness, reaction and perception time, age and purpose. Their reasons for using these areas vary and may include recreation, social, sporting and commuting. This means there are a wide variety of people moving around at unpredictable speeds. This is likely to increase the risk of conflict, especially in busier areas.

With PMD use in Australia still relatively new, little empirical research has been published that explores the safety issues associated with PMDs. However, the Royal Australian College of Surgeons' (RACS, 2019) submission to the NTC Issues Paper provided an outline of injuries resulting from e-scooter use in Queensland (where PMDs are not permitted on roads that exceed 50km/h or have a dividing line). This suggests that much of the data would likely relate to PMD use on paths.

RACS collected presentation data for five central Emergency Departments in Brisbane and identified a total of 134 patients presenting for treatment of an injury after an e-scooter-related incident over an approximate two-month period. Most of these injuries were minor, with the main injuries being contusions/abrasions (60%), upper limb fractures (21%) and sprains (17%). However, it is worth noting three of these cases did, in fact, sustain a serious head injury. However, this data is unable to draw conclusions around frequency of crashes, causation, whether or not other road users were involved, or if the injury was sustained by the e-scooter user or another road user such as a pedestrian.

Lime's submission (Lime, 2019) to the NTC Issues Paper provided injury data from trials in New Zealand, where e-scooters are permitted on either the footpath or the road. This showed that while some injuries are occurring from e-scooter usage, the nature of these injuries is usually minor. The data also showed that a high majority of injuries (over 80%) were due to the e-scooter riders themselves rather than other road users, with the key reason being loss of balance. While the reasons for loss of balance were not documented, there may be several explanations, such as lack of experience using the e-scooter or manoeuvring around other road users. Further, Lime reported that injuries involving collisions on their e-scooters have occurred in only 0.001% (or 1 in 100,000) of journeys in New Zealand.

The limited information available around the safety implications of PMDs points to similarities to that of bicycle crashes. That is, most injuries to PMDs users and bicycle riders are due to falls which occur following a loss of control or collision with an object. Similarly, it appears that across both modes of transport only small proportions of crashes and subsequent injuries involve pedestrians (Boufous et al, 2018; Chong et al, 2010; De Rome et al, 2014; Poulos et al, 2015). When collisions with pedestrians occur, generally any injuries sustained are minor in nature, while fatal outcomes are rare.

While there is potential for collisions and subsequent injuries to occur from PMD use on pedestrian and bicycle paths, similar to that of pedestrians and bicycles on shared paths (Austroads, 2006; NSW Roads and Traffic Authority, 2009), it may be that the perception of danger exceeds the actual safety risks and that the risk of using PMDs in pedestrian areas may be low.

Safety of vulnerable pedestrians

The risks involved with PMD use on paths may be a greater safety concern to more vulnerable pedestrians such as children, older people, and people with functional impairments. Various submissions to NTC's Issues Paper (COTA NSW, 2019; Pedestrian Council of Australia; Vision Australia, 2019; Victoria Walks, 2019) highlighted the need for appropriate regulation of path use in pedestrian areas so that PMD use does not compromise safety.

Victoria Walks submission outlined the following:

> *"…the types of people most at risk of being affected by motorised vehicles on the footpath include:*
>
> - *Older people, particularly those without a driver licence or who are hesitant to drive, that rely on walking for social and shopping purposes.*
> - *People who are blind or have low vision.*

- *People who have a disability.*
- *Young children who need to have freedom of movement on footpaths. Under carer supervision, footpaths are important public spaces where they learn to move, play and interact.*

> *"Fast moving electric scooters and similar devices present comparable problems to cyclists on footpaths. Research on footpath cycling was commissioned by Victoria Walks and found that footpath cycling is a particular concern for the most vulnerable pedestrians. Older people and people who are blind or have low vision often rely heavily on walking and accessing public transport to travel independently but feel extremely nervous sharing environments with cyclists. In one survey, approximately 40% of seniors identified cyclists on shared walking and cycling paths to be a factor which discouraged them from walking. Older people make up a significant proportion of the Australian population and this cohort is growing."*

The nature of PMDs as an electric vehicle may also pose unique challenges to vulnerable pedestrians. For example, Liu et al (2018) found that 35 per cent of people who are blind or have low vision had either a collision or near-collision with an electric or hybrid car. Furthermore, many of these incidents happened where cars should have given way (e.g. at pedestrian crossings and footpaths). The quiet motor that makes it difficult to hear the vehicles coming, particularly when travelling at low speeds, was reported as a key reason. Vision Australia called for changes to vehicle standards to align these with other countries to ensure an Acoustic Vehicle Alerting System is fitted to all hybrid and electric vehicles. It is likely similar experiences will occur with PMDs, such as electric scooters, used in similar areas.

Most of the submissions from vulnerable road user groups generally acknowledged and accepted that PMDs can indeed be used in pedestrian areas safely, but that speed should be kept to a minimum, 5-10km/h, to minimise risks to pedestrians.

Setting a safe speed

Determining a safe speed for travel on pedestrian and bicycle paths is often debated within the literature. Nonetheless, speed management is considered a key strategy for reducing risk of crashes in areas used by vulnerable road users (Austroads, 2009).

As a general principle, the speed limits within the road transport system should be determined by the technical standard of vehicles and roads so as not to exceed the level of violence that the human body can tolerate (Tingvall & Haworth, 1999).

The *Guide to Road Design Part 6A: Pedestrian and Cycling Paths* (Austroads, 2009) outlines that 15km/h is a suitable speed for cycling on a footpath because this infrastructure usually has driveway crossings or side streets intersecting at frequent intervals. Bicycle paths should be designed to allow bicycle riders uninterrupted and safe travel at about 30km/h.

The ADRs outline braking requirements for any vehicle capable of exceeding 25km/h. PMDs are excluded from the requirements set out in the Motor Vehicle Standards Act 1989 to comply with the Australian Design Rules via an administrative importation approval process. Determining a safe and suitable speed for travel in pedestrian areas (e.g. footpaths, separated footpaths and shared paths) has long been debated.

Speeds of 5-10km/h are generally accepted based on safety considerations for pedestrian interaction (Hatfield & Prabhakharan, 2013; Paine, 2011; Short et al, 2007), while path characteristics that support separation from pedestrians may allow relatively higher speeds, and associated amenity, without substantial loss of safety (Boufous et al, 2018).

As a guide, the speed of a pedestrian is typically:

- Slow walk - 3km/h
- Normal walk - 4km/h
- Fast walk - 5km/h
- Slow jog - 7km/h
- Fast jog - 9km/h
- Running - 12km/h or more.

Average cycling speed on footpaths and shared paths has been estimated to be between 18km/h to 30km/h (Austroads, 2006; Boufous et al, 2018; De Rome et al, 2014; Grzebieta et al, 2011; Victoria Walks, 2015; Virkler and Balasubramanian, 1998;). Very few studies have found bicycle riders to travel at, or below, the recommended speed of 10km/h on footpaths or shared paths. Despite these potentially unsafe speeds (18km/h to 30km/h), there is evidence that bicycle riders self-regulate their speed to accommodate pedestrians (Boufous et al, 2018). This appears feasible given the infrequent nature of crashes and subsequent injuries occurring in these areas (Chong et al, 2010; De Rome et al, 2014; Haworth et al, 2014; Centre for Road Safety, 2015; Poulos et al, 2015).

Dowling et al (2015) investigated the use of a range of different PMDs (in a university campus setting) which included a focus on how users of these devices interact with pedestrians. When PMD users travelled at a maximum of 10km/h, these authors did not report any significant issues or conflict between these users or pedestrians. As per above, users adjusted their behaviour to accommodate pedestrians. In addition, a 10km/h speed limit for PMDs has been associated with potential performance issues such as devices struggling to go uphill and having to be pushed, and a perception that devices were 'underpowered'.

Table 7 outlines the kinetic energy differentials between 10km/h, 15km/h and 25km/h for PMDs at the absolute maximum weight of 60kg (as well as at 25kg) and compares these to the requirements in the ARRs for a motorised mobility device (i.e. an existing device that uses similar infrastructure).

Table 7. Kinetic energy differentials for personal mobility devices and motorised mobility devices

	Person (kg)	Device (max. kg)	Speed (max km/h)	KE (J)
MMD	80	110	10	733
MMD	80	170	10	965
PMD	80	60	10	540
PMD	80	60	15	1215
PMD	80	60	25	3375
PMD	80	25	10	405
PMD	80	25	15	911
PMD	80	25	25	2532

This shows that the kinetic energy differentials are similar at 10 km/h for PMDs weighing 60 kg and MMDs weighing 110 kg. The kinetic energy figures are also similar for a 170 kg MMD at 10 km/h and a 25 kg PMD at 15 km/h. Further, the differential of 843j between a 25 kg and 60 kg PMD travelling at 25 km/h can also be considered minimal.

However, it is important to note that in the context of actual injury, these figures are relatively low and need to be interpreted with caution. That is, in this context kinetic energy can be used as a guide for impact forces only and do not necessarily translate into actual injury outcomes.

These calculations of kinetic energy also do not consider other important crash-related factors, such as biomechanical tolerance, vehicle and infrastructure characteristics. It should further be noted that often injuries occurring to pedestrians from collisions with devices on paths are often the result of secondary forces, such as the pedestrian being knocked to the ground and sustaining injury from the fall.

Appendix D Impact analysis

D.1 Approach

The options for allowing PMDs that comply with the framework discussed in Chapter 4.1 for use on roads and paths will be assessed using a qualitative cost-benefit analysis.

This approach has been chosen due to the following challenges in measuring and quantifying the costs and benefits of these options that would support a fully quantitative cost-benefit analysis to be undertaken:

- PMDs cover a range of vehicle types that are likely to have different capabilities and safety levels
- there is a very large and diverse number of users of roads and paths whose safety and amenity may be affected by some of the considered options
- currently, PMDs are not permitted to be used on roads and paths in most states and territories, as discussed in the problem statement, making it very difficult to estimate how much PMD activity is being prevented or the likely behavioural response to removing restrictions, and
- research on safety and other aspects of PMDs is limited.

The qualitative assessment will be structured around a set of criteria that best captures the key potential impact considerations of options to permit the use of PMDs.

The assessment adopted the following approach:

- establish the criteria against which the options are to be assessed
- for each criterion
  - key aspects or factors of the criterion are discussed with relevant evidence presented
  - an assessment of the status quo is presented, providing a baseline against which each option is assessed
  - options are assessed against the status quo option (baseline) with each additional option assessed in variance to the previous (given the progressive infrastructure access on which the options are structured to avoid repetition)
  - a summary assessment of all the options is provided, and
  - a final overall criteria assessment is provided.

The summary assessment of the options against each criterion is framed by an ordinal scale that is highlighted in Table 8.

Table 8. Personal mobility device ordinal assessment scale

The option entails a **major positive impact** compared to the baseline	The option entails a **moderate positive impact** compared to the baseline	The option entails a **minor positive impact** compared to the baseline	The option has little to **no difference** compared to the baseline	The option entails a **minor negative impact** compared to the baseline	The option entails a **moderate negative impact** compared to the baseline	The option entails a **major negative impact** compared to the baseline

The overall assessment is made based on an implicit subjective weighting of each criteria.

D.2 Criteria development

Allowing PMDs on roads and paths has a range of safety implications for both the people using the devices and existing road users. These implications will likely vary between infrastructure and road user type.

PMD users and existing road users may also be impacted by the options in other ways. For instance, potential PMD users will benefit by gaining access to the infrastructure they are currently not allowed to use. However, existing users may experience a reduction in the benefits they receive, i.e. due to congestion or perception of safety risk. The reduction in benefits experienced may vary depending on the user type: for example, vulnerable infrastructure users may experience greater loss of benefits than other road and path users.

The existing restrictions on the use of PMDs likely suppress their demand and, in turn, the productivity of industries involved in PMD importation, manufacturing and other services.

Finally, compliance and enforcement may be a challenge in establishing specific rules around determining a safe and appropriate speed across different infrastructure. This impact assessment has adopted the criteria set out in Table 9.

Table 9. Personal mobility device impact assessment criteria

Criteria		Description
Safety	PMD user	What are the possible safety risks of each option for PMD Users?
	Other road and path users	What are the possible safety risks of each option for other users?
Access and Amenity	PMD users	What are the impacts to access and amenity of PMD users of each option?
	Other road and path users	What are the impacts to access and amenity of other users of each option?
Broader Economic Costs and Benefits		What (if any) are the broader economic costs and benefits of each option?
Compliance and Enforcement		How easy is it to comply with and enforce each option?

D.3 Safety

There are many reports, mainly from the media, of emerging injury trends associated with PMD use. Although there is little published empirical research, trials or evaluations undertaken help better understand potential injury trends and broader safety implications, as well as how to implement best practice regulation and encourage compliance.

In undertaking this safety assessment, the NTC reviewed the available road safety literature for PMDs and other devices that have similar risks, vulnerabilities, crash and injury profiles (e.g. bicycles, motorised scooters). The safety review undertaken by the NTC is detailed in Appendix C and has guided the analysis of the potential safety implications for each proposed option.

Due to increased take-up and usage of PMDs, Options 2 to 5 are expected to result in an increase in safety risks to PMD users and other road and path users, relative to Option 1 (the status quo). However, this increased safety risk from increased PMD use should not be considered in isolation. A full assessment must compare this increased safety risk against the benefits that any change in policy would lead to (such as the benefits received by PMD users). Further, if increased PMD use occurs as a result of substitution of transport modes, there would be reduced safety risks on other transport modes, all else constant, because there would be fewer users on those modes of transport.

Notwithstanding this, the addition of new types of vehicle on roads and paths (that is, that behave differently to existing vehicle types) are likely to increase overall risk all else being equal. The following analysis assumes this net increase in risk.

The analysis of each option below considers the benefits and disadvantages by assessing the potential safety risks to PMD users and other road and path users (including vulnerable users) across a variety of road infrastructure.

D.3.1 Option 1 – Status quo: No change to the Australian Road Rules

As outlined in the problem statement, the majority of PMDs are not recognised or captured in the ARRs, albeit with some exceptions (e.g. low powered motorised scooters). There are inconsistent road rules across Australian states permitting the use of PMDs, and it is difficult to estimate the number of these devices used in Australia, although this is unlikely to be large.

There is also limited data available to accurately assess the prevalence of injuries resulting from PMD use. For example, injury reports generally show that injuries to lower powered motorised scooter users are infrequent, not often serious, and are often children who have fallen when using the scooter for recreation/leisure (Cassell & Clapperton, 2014).

It is difficult to estimate the numbers of higher powered PMDs (up to 25km/h) currently in use across Australia. Although in Queensland (QLD), Lime estimated they initially deployed 500 e-scooters in Brisbane, and that this number has increased to 750. Additionally, Neuron Mobility has also indicated they plan to deploy 600 e-scooters in Brisbane in the future.

Despite there being one fatality reported in the media from e-scooter use in Brisbane (ABC, 2019), more generally the prevalence of injury cannot be accurately estimated. In the absence of published scientific evidence, the Royal Australian College of Surgeons (RACS, 2019) submission to the NTC issues paper provided an outline of hospitalisations from e-scooter use in QLD. This data showed an increase in minor injuries associated with e-scooter use since the regulations were introduced in QLD. However, this data was unable to draw conclusions around the frequency of crashes, kilometres travelled, total number of trips, causation, involvement of other road users, or if the injury was sustained by the e-scooter user or to another road user.

Further, it is expected that road crash statistics are not likely to capture when PMD use was involved as it is likely any injury cases would be coded as “pedestrians”. VicRoads CrashStats shows that over the past five years there has been an average of seven pedestrian fatalities and 202 serious injuries in 50km/h or less speed zones in Victoria. Therefore, it does not appear these devices are significantly contributing to injury statistics.

In states where PMDs are permitted (QLD, SA and ACT), most e-scooters deployed by share companies are in CBD areas where there are very few local roads (e.g. 50km/h or lower with no dividing line). Therefore, it may be assumed that very few e-scooters are currently used on local roads, meaning the existing safety risks are likely to be minimal. In states where PMDs are not currently permitted, there is anecdotal evidence of some illegal PMD use.

A lack of national regulatory consistency for PMDs may be resulting in increased safety risks to PMD users as well as other road users due to confusion about which rules to comply with. For the sake of clarity, the assessment of options will be conducted against a baseline of prohibited use of PMDs in all jurisdictions (i.e. alignment with ARRs), notwithstanding the permitted use of PMDs in QLD and SA state-based legislation.

D.3.2 Option 2: Permit the use of personal mobility devices on most pedestrian infrastructure and bicycle paths

This option provides for the use of PMDs (that comply with the PMD regulatory framework described in Section 4.1) on a footpath, shared path, separated footpath (designated for the use of bicycles) and bicycle path.

Appendix C sets out the risks of interactions between vulnerable road users and motor vehicles. This option is expected to minimise the increased risk to PMD users by restricting their use to paths only. As a general road safety principle, vulnerable road users should not be exposed to motor vehicles at speeds of 30km/h or greater, as in the event of a crash, it is at these speeds when the probability of fatality significantly increases.

This option is likely to increase exposure of PMDs on pedestrian and bicycle paths compared to Option 1, increasing the safety risks to others using these areas. As discussed in Appendix C, there is a risk of conflict and injuries to users of bicycle and pedestrian infrastructure. However, crashes are generally infrequent, and outcomes are usually minor in nature. Therefore, this option may be associated with some increase in minor injuries. However, it is possible that while there may be an initial increase in injuries associated with PMD use, this may reverse and stabilise at a lower rate of crashes over time. This assumption is based on some international research that reported one-third of injuries to e-scooter riders were first-time users (Austin Public Health, 2019).

Overall, this option is assessed as likely to result in a ***minor increase in safety risk to PMD users*** compared to Option 1 (varying only marginally based on speed approach).

The option is assessed as likely to result in a ***minor to moderate increase in safety risk to “other users”***. This primarily relates to the speed allowed on footpaths and the associated increased risk to pedestrians. The assessment of safety risk of the various speed approaches under Option 2 is detailed below.

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles) or bicycle path.

A maximum permitted speed of 10km/h is generally accepted as a safe speed based on safety considerations for pedestrians as discussed in Appendix C. This approach is expected to minimise the safety risks on pedestrian infrastructure.

The Austroads guidelines recommend that bicycle paths allow riders uninterrupted and safe travel at a relatively high constant speed of about 30km/h. There appears to be little justification to restrict PMD speed to below 25km/h in these areas. Key safety concerns relate to increased exposure potentially creating increased risks associated with PMDs and bicycles passing each other. However, permitting PMDs to travel at 25km/h is likely to minimise the frequency of passing incidents (e.g. as bicycle riders are likely to be travelling at similar speeds, between 20km/h and 30km/h). Hence, this is considered the most appropriate and risk-averse speed for these areas.

A variable speed limit may result in compliance and enforcement challenges. These may have a marginal impact on the outcomes of this approach. Compliance and enforcement are assessed as a separate criterion in Section D.6.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

A maximum permitted speed of 15km/h on pedestrian infrastructure is likely to result in a small increase in safety risk compared to Speed Approach 1. This is based on the principles of kinetic energy explained in Appendix C.

This approach reduces the maximum permitted speed for bicycle paths from 25km/h to 15km/h. This is unlikely to discourage PMD use on bicycle paths. While decreasing speed will improve injury outcomes in the event of a crash, lowering speed may increase the chances of conflict as bicycle riders and PMD users pass each other (i.e. given research has found average bicycle riding speeds between 20km/h and 30km/h on paths). This may result in bicycle riders being at a greater risk as they will need to anticipate potentially unpredictable movements of PMD users.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

Permitting PMDs to travel at a maximum speed of 25km/h on pedestrian infrastructure presents the highest safety risk for these areas. For instance, a speed of 25km/h compared to 10km/h or 15km/h will reduce the user’s ability to identify, process, and respond to potential hazards, and result in a substantially higher impact force in a crash.

A maximum permitted speed of 25km/h is considered safe and suitable for bicycle paths and is likely to be more in line with existing speed than bicycle riders travel, thus minimising additional safety risks when permitting PMDs onto bicycle paths.

D.3.3 Option 3: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle paths, and local roads

Option 3 allows PMDs to be used on all the infrastructure types permitted in Option 2 as well as on local roads.

Allowing access to local roads increases the risk of PMD users crashing with motor vehicles at speeds of up to 50km/h or less compared to the baseline.

Similar to Option 2, this option is likely to increase exposure on pedestrian and bicycle paths, increasing safety risks in these areas.

Allowing PMD access to roads may slightly increase risk to other road users, such as motorbikes and bicycle riders. It is assumed the level of risk is likely to be low, as per the current risk between motorbike and bicycle riders.

Overall, this option is assessed as likely to result in a ***moderate increase in safety risk to PMD users*** compared to Option 1 (varying only marginally based on speed approach).

As with Option 2, this option is assessed as likely to result in a ***minor to moderate increase in safety risk to "other users"***. This primarily relates to the speed allowed on footpaths and the associated increased risk to pedestrians. The assessment of safety risk of the various speed approaches under Option 3 is detailed below.

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or local road.

A maximum permitted speed of 10km/h is generally accepted as a safe speed based on safety considerations for pedestrians, as discussed in Appendix C. This approach is expected to minimise the safety risks on pedestrian infrastructure.

This approach may result in a higher proportion of PMD users preferring local road use over a footpath when this choice is available, as it is likely that some PMD users will prefer road use at 25km/h rather than travel on a footpath at 10km/h.

This may result in some slight increase in exposure on local roads, conversely resulting in a small decrease in exposure on pedestrian infrastructure.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

Permitting PMDs to travel up to 15km/h across all infrastructure is likely to slightly decrease exposure and risk to motor vehicles on local roads, while slightly increasing exposure and risk to pedestrians. This is due to likely substitution from local roads to pedestrian infrastructure, as some PMD users may perceive it to be safer to travel 15km/h on a footpath than on a road.

A maximum permitted speed of 15km/h on pedestrian infrastructure is likely to result in a small increase in safety risk to pedestrians compared to Speed Approach 1.

As under Option 2, this speed approach may increase the chances of conflict between bicycle riders and PMD users, as bicycle riders will need to anticipate potentially unpredictable movements of PMD users.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

A maximum permitted speed of 25km/h on pedestrian infrastructure is likely to result in a large increase in safety risk to pedestrians compared to Speed Approach 1, and moderate increase in safety risk compared to Speed Approach 2.

As outlined for Speed Approach 1, a maximum permitted speed of 25km/h is considered safe and suitable for bicycle paths and is likely to align more with the existing speed that bicycle riders travel (i.e. between 20km/h and 30km/h). This may result in fewer safety risks compared to Speed Approach 2 as it may reduce the frequency of various users passing each other.

D.3.4 Option 4: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle infrastructure and roads

Option 4 allows PMDs to be used on all the infrastructure types permitted in Option 3 as well as on most other roads (except for freeways and other roads that bicycles are currently not permitted to use).

As such, Option 4 entails all the risks associated with Option 3, with the additional risk associated with permitting PMDs access to roads that exceed 50km/h as discussed in Appendix C. PMDs' increased exposure to these roads is likely to result in significantly greater safety risk for PMD users.

The increased exposure across local roads, pedestrian and bicycle infrastructure outlined in Options 2 and 3 is likely to be similar for Option 4, though perhaps very marginally reduced due to the increased road access.

As with Option 3, allowing PMDs onto local and main roads will likely have a very marginal increase in risk to existing users of main roads in line with the increased number of PMDs.

Overall, this option is assessed as likely to result in a ***major increase in safety risk to PMD users*** compared to Option 1 (varying only marginally based on speed approach).

As with Options 2 and 3, this option is assessed as likely to result in a ***minor to moderate increase in safety risk to "other users"***. This primarily relates to the speed allowed on footpaths and the associated increased risk to pedestrians. The assessment of safety risk of the various speed approaches under Option 4 is detailed below.

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or road.

As under Options 2 and 3, restricting PMD speeds to a maximum of 10km/hr on pedestrian infrastructure will result in a similarly low increase in safety risk for other pedestrians.

Likewise, it may result in some PMD users shifting to bicycle paths and roads as in Option 3. Under Option 4 this would mean increased interaction between PMDs and motor vehicles on higher speed roads.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

As with Option 3, permitting PMDs to travel up to 15km/h across all infrastructure is likely to slightly decrease PMDs' exposure to motor vehicles on roads, while slightly increasing their exposure and risk to pedestrians.

Also, along with Option 3, this may also present increased risks to bicycle riders on paths due to setting a speed limit for PMDs that is below the average speed for bicycle riders.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

As in previous options, a maximum permitted speed of 25km/h on pedestrian infrastructure is likely to result in a significant increase in safety risks to pedestrians.

As outlined for Speed Approach 1, a maximum permitted speed of 25km/h is considered safe and suitable for bicycle infrastructure and is likely to align more with the existing speed that bicycle riders travel. This will result in fewer safety risks compared to Speed Approach 2 as it may reduce the frequency of various road users passing each other.

D.3.5 Option 5: Permit the use of personal mobility devices on bicycle infrastructure and roads

Option 5 allows PMDs to be used on all the infrastructure types permitted in Option 4 except for pedestrian infrastructure (i.e. footpaths or shared paths).

As such, Option 5 entails all the risks associated with Option 4, with the exception of the risk to pedestrians. Without access to pedestrian areas, this option is likely to further increase exposure to PMD users who may otherwise choose to use an adjacent footpath.

Overall, this option is assessed as likely to result in a ***major increase in safety risk to PMD users*** compared to Option 1.

It is assessed as likely having ***no significant increase in safety risk to "other users"*** as the option largely avoids interactions with pedestrians compared to the status quo.

Speed approach:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path, or road.

D.3.6 Summary Assessment

Table 10 provides a summary assessment of safety risks to PMD users under different options.

Table 10. Summary of assessment of safety risk to PMD users

Assessment Scale	Safety Risks to PMD users of Options
No change in safety risk compared to the baseline	**Option 1 - status quo**
Minor increase in safety risk compared to the baseline	**Option 2** involves a minor increase in risk to PMD users compared to the baseline (that is, where PMDs are not permitted onto pedestrian infrastructure). This risk is possibly slightly higher for **Speed Approaches 1 and 3** where PMDs are permitted to travel at speeds of up to 25km/hour on bicycle paths (for **Speed Approach 1**) and both bicycle and pedestrian infrastructure (for **Speed Approach 3**) respectively.
Moderate increase in safety risk compared to the baseline	**Option 3** involves a moderate increase in risk to PMD users compared to the baseline under all speed approaches, as it involves granting access to low-speed roads and increases potential interactions with motor vehicles.
Major increase in safety risk compared to the baseline	**Options 4 and 5** involve a major increase in risks to PMD users compared to the status quo under all speed approaches, as it involves granting access to major roads and increases interactions with motor vehicles at higher speeds. Risks are likely to be higher for **Option 5 than Option 4,** as it prevents the use of pedestrian areas.

Table 11 provides a summary assessment of safety risks to other users under different options. The summary assessment on the safety risks to "other users" is primarily focussed on pedestrians given that they are far more likely to be affected in a crash with a PMD than drivers of motor vehicles. However, there are also possible minor increases in risk to cyclists and motor vehicle passengers.

Table 11. Summary of assessment of safety risks to other users

Assessment Scale	Safety Risks to Other users
No change in safety risk compared to the baseline	Given **Option 5** will minimise interactions with pedestrians, it is assessed as resulting in no additional risk to other infrastructure users compared to the baseline.
Minor increase in safety risk compared to the baseline	**Options 2, 3 and 4** under **Speed Approach 1** are assessed as having a minor increase in exposure and risk to pedestrians due to PMDs being allowed on pedestrian infrastructure at safe speeds of 10km/h. Exposure and risks are likely to be slightly lower for **Options 3 and 4** given these two options allow PMDs to use adjacent road infrastructure at 25km/h, e.g. users may prefer travel at 25km/h on road rather than 10km/h on a footpath, particularly to gain benefits of first/last mile.

Moderate increase in safety risk compared to the baseline	**Options 2, 3 and 4** under **Speed Approach 2** are assessed as having a moderate increase in risk to pedestrians due to PMDs being allowed on pedestrian infrastructure at maximum speeds of 15km/h. Risks are likely to be slightly lower under **Options 3 and 4** given these options allow PMDs to use adjacent road infrastructure.
Major increase in safety risk compared to the baseline	**Options 2, 3 and 4** under **Speed Approach 3** are assessed as having a major increase in risk to pedestrians due to PMDs being allowed on pedestrian infrastructure at maximum speeds of 25km/h. Risks are likely to be slightly lower under **Options 3 and 4** given these options allow PMDs to use adjacent road infrastructure.

D.4 Access and Amenity

In addition to the safety of road infrastructure users, permitting PMDs onto roads and paths will provide other benefits to PMD users through that access. On the other hand, this is likely to impact on the amenity of other users of the infrastructure.

Table 12 summarises the benefits other vehicle/user types receive from different infrastructure types.

Table 12. Infrastructure use benefits

<table>
<tr><th></th><th>Footpaths</th><th>Shared Paths</th><th>Bike Paths</th><th>Low-speed roads</th><th>Main roads</th></tr>
<tr><td>Pedestrians</td><td colspan="2">Access, commuting, fitness and recreation</td><td colspan="3">Cannot legally use</td></tr>
<tr><td>Wheeled Recreational device users</td><td colspan="4">Access, commuting, fitness and recreation</td><td>Cannot legally use</td></tr>
<tr><td>Bicycles</td><td colspan="5">Access, commuting, fitness and recreation</td></tr>
<tr><td>Motor Vehicles</td><td colspan="3">Cannot legally (or practically) use</td><td colspan="2">Access, commuting and goods movement</td></tr>
</table>

Pedestrian infrastructure can be used by a variety of people with differing degrees of ability. This includes, but is not limited to, people on wheeled recreational devices (such as skateboards and scooters), people using mobility devices and joggers. In most states and territories, bicycle riders are also allowed to use footpaths, although they are more inclined to use bike paths and roads.

Shared paths are paths that are designed to facilitate wheeled devices as well as pedestrian movement. Bike paths are primarily for the commuting and recreational use of bicycles. Roads are designed for motor vehicles to carry people and goods. The majority of roads are also used by bicycle riders for commuting and recreation. Low-speed roads (such as local roads) provide access for motor vehicles and bicycle riders, particularly to places of residence.

Benefits to personal mobility device users accessing roads and paths

PMDs are largely marketed as a key solution to the 'first/last mile' problem as they enable riders to travel short distances quickly and transfer between transport modes (Dowling et al, 2015). Several additional benefits have also been identified for both the users and the broader community, including:

- greater mobility choice
- environmental benefits such as reduced pollution, greenhouse gas emissions, noise and use of resources
- direct cost savings to users because of reduced spending on petrol, tolls and vehicle maintenance and reduced capital costs such as vehicles and garaging, compared with motor vehicles, and
- health and fitness benefits from the physical exercise associated with some types of innovative vehicles.

Potential impacts on existing infrastructure users

The safety implications of integrating PMDs into the existing infrastructure were assessed in Section D.3. More broadly, the amenity of existing users may be affected through the integration of PMDs by:

- *Congestion and incompatibility:* allowing these devices on certain infrastructure types may impact the ability of certain user types to maintain certain benefits from the infrastructure they are used to.
- *Perceived safety risk*: certain existing users may experience fewer benefits or be discouraged from using infrastructure they are currently using.

D.4.1 Option 1 - Status quo: No change to the Australian Road Rules

Currently, the majority of PMDs are not permitted under the ARRs to be used on roads or paths, with the exceptions discussed in the problem statement.

These exceptions aside, PMDs are not generally permitted on Australian roads and paths. Essentially this means that potential users of PMDs, due to denied access, forgo the utility they would otherwise receive if they were able to use this infrastructure.

To simplify the assessment, the options will be assessed against the status quo baseline of PMDs not being permitted access to roads and paths, notwithstanding this is not completely the case as highlighted in Section D.3.1 (Option 1 – status quo).

D.4.2 Option 2: Permit the use of personal mobility devices on most pedestrian infrastructure and bicycle paths

This option provides for the use of PMDs (that comply with the proposed framework described in Section 4.1) for use on a footpath, shared path, separated footpath (designated for the use of bicycles) and bicycle path.

For PMD users, this would enable basic leisure, recreational use and smaller commutes that align with the purpose of PMDs (i.e. first/last mile commutes). Unless bicycle paths are available, longer commuting using PMDs would be difficult under this option.

Under this option, it is assumed that PMDs would primarily use footpaths given they may be the only infrastructure legally available to be used in most circumstances. If there was substantial take-up of PMDs, this could adversely impact pedestrians who currently use footpaths by:

- potentially increasing congestion and affecting flow in urban areas
- affecting the perception of safety risk on footpaths, particularly among certain vulnerable groups (such as older people).

It is also possible that there might be some modest reduction in the benefits to cyclists from having to share bicycle paths with PMD users.

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles) or bicycle paths.

PMDs will only be able to travel at a maximum speed of 10km/h on pedestrian infrastructure.

Although this option allows for speeds up to 25km/h on bicycle paths, in most circumstances PMD users will only have pedestrian infrastructure available. This will greatly reduce the benefits of PMD use as an alternative transport mode.

Pedestrians would likely have a minor reduction, if any, in their safety risk perception when sharing footpaths with PMDs that can only travel up to 10km/h compared to the status quo. This is the current speed limit for electric scooters. It is also comparable to speeds of wheeled recreational devices, and less than the speeds bicycles are known to travel at on pedestrian infrastructure.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

Speed Approach 2 would marginally improve the benefits to PMDs of accessing pedestrian infrastructure by allowing them to travel at speeds up to 15km/h. This would be offset somewhat by only being able to travel at 15km/h on shared infrastructure and bicycle paths where available.

Allowing PMDs to travel at 15km/h on pedestrian infrastructure will likely increase the perception of safety risk to some pedestrians.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles) or bicycle path.

Under Speed Approach 3, PMDs will be able to travel at a maximum speed of 25km/h on pedestrian infrastructure. This would allow the PMD users to get the full benefit of these devices on the infrastructure types available to them.

Given PMDs would still be able to use primarily pedestrian infrastructure, this option is likely to result in a significantly higher loss of amenity for pedestrians if there is a large take-up of PMDs that can travel at speeds up to 25km/h. It is possible this could result in some vulnerable groups avoiding the use of pedestrian infrastructure where they are likely to encounter PMDs.

D.4.3 Option 3: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle paths and local roads

Option 3 allows PMDs to be used on all the infrastructure types permitted in Option 2 as well as on local roads.

The addition of low-speed roads would increase the benefits of PMD users and the ability of PMD devices to be used viably for commuting. It may also reduce the relative impact on pedestrians compared to Option 2 by decreasing the relative use of footpaths by PMDs.

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or local road.

Having a speed limit of 10km/h on pedestrian infrastructure but allowing PMDs to be used on local roads at 25km/h, would likely see the majority of PMD users choosing to use the road over the footpath where it is appropriate and legal to do so. This would likely result in a lower adverse impact on pedestrians' perception of safety risk than under Option 2.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

Speed Approach 2 may see some PMD users choose to use pedestrian areas rather than the road, as they may find it safer to travel on this infrastructure at the same speed. This may result in a higher adverse impact on pedestrians' perception of safety risk than if there was a 10km/hour speed limit. However, if footpaths are crowded, PMD users may prefer not to use pedestrian areas, since the traffic conditions on other infrastructure may be clearer and allow them to travel at, or closer to, the permitted speed under this option.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or local road.

Having the same speed limit of 25km/h on pedestrian and bicycle paths plus low-speed roads might see some PMD users shift from roads back to pedestrian infrastructure, further increasing pedestrians' perception of safety risk. However, if footpaths are crowded, PMD users may prefer not to use pedestrian areas, since the traffic conditions on other infrastructure may be clearer and allow them to travel at, or closer to, the permitted speed under this option.

D.4.4 Option 4: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle infrastructure and roads

Option 4 allows PMDs to be used on all the infrastructure types permitted in Option 3 as well most other roads (except for freeways and other roads that bicycles are currently not permitted to use).

The addition of all roads would increase the benefits of PMD users and substantially increase the ability of PMD devices to be used viably for commuting. It may further reduce the relative impact on pedestrians compared to Option 3 by decreasing the relative use of footpaths by PMDs (i.e. on pedestrian infrastructure adjacent to non-low-speed roads).

Speed Approach 1:

- a PMD user would not be permitted to travel at a speed faster than 10km/h on a footpath or shared path
- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle path or road.

Having a speed limit of 10km/h on pedestrian infrastructure but allowing PMDs to be used on all roads at 25km/h, would perhaps see the majority of PMD users choosing to use the road over the footpath where it is appropriate and legal to do so, including on higher speed roads. This would likely result in a marginally lower adverse impact on pedestrians' perception of safety risk compared to Option 3 where PMDs are compelled to use the footpath adjacent to major roads.

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

Having the same speed limit of 15km/h on pedestrian infrastructure and low-speed roads might see some PMD users shift from roads back to pedestrian infrastructure, particularly from higher speed roads. However, if footpaths are crowded, PMD users may prefer not to use pedestrian areas, since the traffic conditions on other infrastructure may be clearer and allow them to travel at, or closer to, the permitted speed under this option.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

Having the same speed limit of 25km/h on pedestrian infrastructure and low-speed roads might see some PMD users shift from roads back to pedestrian infrastructure, particularly from higher speed roads. However, if footpaths are crowded, PMD users may prefer not to use pedestrian areas, since the traffic conditions on other infrastructure may be clearer and allow them to travel at, or closer to, the permitted speed under this option.

D.4.5 Option 5: Permit the use of personal mobility devices on bicycle infrastructure and roads

Option 5 allows PMDs to be used on all the infrastructure types permitted in Option 4 except for pedestrian infrastructure (i.e. footpaths or shared paths).

The removal of pedestrian infrastructure would somewhat reduce the benefits for PMD users compared to Option 4, particularly for those who are less comfortable using road infrastructure.

Pedestrians using dedicated pedestrian infrastructure would not be adversely affected by this option relative to the status quo option. This option would minimise the number of interactions between vulnerable path users and PMD users.

Speed Approach:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a separated footpath (designated for the use of bicycles), bicycle paths, or roads.

Summary Assessment

Table 13 summarises the benefits to PMD users by having access to roads and paths.

Table 13. Benefits to personal mobility device users accessing roads and paths

Assessment Scale	Access Benefits to PMD users
Major increase to access benefits to PMD users	**Option 4** provides full access to road and road-related infrastructure to PMD users, with **Speed Approach 3** allowing full benefits of the devices**. Speed Approach 1** would slightly reduce the benefits by placing a 10km/h restriction on the use of pedestrian infrastructure.
Moderate increase to access benefits to PMD users	**Option 4** provides full access to road and road-related infrastructure by PMD users, but **Speed Approach 2** constrains them to speeds of 15km/h. **Option 3** provides access to pedestrian and bicycle paths plus low-speed roads, allowing most benefits of the devices. **Speed Approach 1** would slightly reduce the benefits by placing a 10km/h restriction on the use of pedestrian infrastructure. **Speed Approach 2** would provide increased benefits on pedestrian infrastructure by allowing PMD users to travel at higher speeds than **Speed Approach 1**, but this would be offset by the decreased benefits associated with the 15km/h constraint on other infrastructure.
Minor increase to access benefits to PMD users	**Option 2** provides access to pedestrian and bicycle paths to PMD users, allowing most benefits of the devices. **Speed Approach 1** and **2** would reduce these benefits compared to **Speed Approach 3** by placing a 10km/h and 15km/h restriction respectively on the use of pedestrian infrastructure. **Option 5** provides access to all bicycle and road infrastructure, but benefits are significantly offset by not allowing use of pedestrian infrastructure at all.
No change to access benefits to PMD users	**Option 1 - Status quo**

Table 14 summarises the impact assessment on the amenity of existing users of roads and paths infrastructure by the PMD access options.

The summary assessment on the amenity impact to “other users” is primarily focussed on pedestrians given that they are considered to be most affected and at risk of amenity loss.

Table 14. Assessment of impact on the amenity to other users

Assessment Scale	Amenity Benefits to other users
No change to amenity benefits to other users	Given **Option 5** involves no interactions with pedestrians, it is assessed as resulting in negligible loss of amenity to other infrastructure users compared to the status quo.
Minor decrease to access benefits to other users	**Options 2, 3 and 4** under **Speed Approach 1** are assessed as having a minor adverse impact on pedestrian user amenity – primarily through increased perception of safety risk due to PMDs being allowed on pedestrian infrastructure at maximum speeds of 10km/h. Loss is likely to be slightly lower under **Options 3 and 4** given they allow PMDs to use adjacent road infrastructure at 25km/h. Under **Speed Approach 2** (for **Options 2, 3 and 4**) there would be a larger loss of amenity to pedestrians compared to **Speed Approach 1**, but it is only minor overall.
Moderate decrease to access benefits to other users	**Options 2, 3 and 4** under **Speed Approach 3** are assessed as having a moderate adverse impact on pedestrian user amenity – primarily through increased perception of safety risk – due to PMDs being allowed on pedestrian infrastructure at maximum speeds of up to 25km/h. Loss is likely to be slightly lower under **Options 3 and 4** given they allow PMDs to use adjacent road infrastructure.

D.5 Broader Costs and Benefits

The direct benefits from PMDs and their potential impacts on other infrastructure users are covered under the previous criteria set out in Section D.2.

Allowing access for these devices on roads and paths may enable or increase private sector economic opportunities, including for:

- importers, retailers and (potentially) manufacturers of PMDs
- tourism and ride share operators.

Many PMDs are legal to manufacture, import and own in Australia. Shops selling a wide variety of devices already exist in Australia. There are also local manufacturers selling their devices to local and foreign markets.

Evolve Skateboards is an Australian company that sells designer electric skateboards in 30 countries (Advanced Queensland, 2018). In 2016, the company won the Queensland Export Award and it has been named in the BRW Fast 100 list for the past three years (Consulting Hall, 2018).

Lime is a US-based transportation-sharing company that has recently rolled out its e-scooter service in Brisbane where 750 scooters are in operation making up to 9,000 trips a day (ABC, 2019). They operate under permit. Brisbane City Council receive a flat $5,000 permit fee plus $570 a scooter. As an example of related employment, the model uses a team of drivers known as "juicers" who are responsible for collecting the e-scooters and returning them to spots of anticipated high use.

Victoria Police's submission noted that greater use of PMDs could negatively affect revenues in other industries, such as public transport or industries associated with motor vehicles (including servicing, tyres and petrol). The NTC acknowledges that there may be some transfer of revenues between industries if there is substitution to PMDs from other modes of transport.

However, the NTC notes that greater use of PMDs need not represent a loss of revenue for public transport in all circumstances. For example, some PMD users may have purchased monthly or annual tickets for public transport, meaning that they would not pay more to the public transport authority regardless of whether they used a PMD or public transport for a particular journey. In addition, PMDs may enable users to combine multiple transport modes—including public transport—as a substitute for a journey they previously made by car.

Congestion and emissions

Another key potential benefit of PMD devices is the reduction of traffic congestion and carbon pollution by providing an alternative to cars (Austroads, RS1978). For example, international research has estimated that approximately one-third of trips using e-scooters normally would have been undertaken using a car (Bird, 2019; Portland Bureau of Transportation, 2018).

Regulatory Burden Reduction

Having a common national set of rules may reduce the regulatory burden on businesses that make, sell or operate PMDs, as well as provide a consistent set of rules across jurisdictions that communities can easily follow. National harmonisation will also help to simplify compliance and enforcement across jurisdictions.

Neuron Mobility's submission to the Consultation RIS noted that the current lack of clarity of regulations for PMDs imposes costs on PMD operators; Victoria Walks' submission noted that some retailers selling PMDs are not aware of the laws applicable to them in the relevant jurisdiction. The regulatory burden includes direct costs, such as those incurred in understanding the different regulations applying in various states and territories, and the potential inability to achieve economies of scale due to having several separate markets rather than a single national market. In addition, Neuron noted that the lack of clarity of regulations could make it difficult for PMD operators to form partnerships with businesses and to enter into long term contracts (such as with suppliers).

The NTC acknowledges these views and concludes that it supports the ratings for different options. Clarity and national consistency of regulations are likely to be critical factors affecting the regulatory burden, but it is more difficult to differentiate the regulatory burden impacts between options or speed approaches.

D.5.1 Option 1 - Status quo: No change to the Australian Road rules

Currently, with PMDs not allowed on roads and paths under the ARRs, it is likely that businesses importing and selling these devices would have suppressed sales. It is also likely that existing rules inhibit the possibility of innovation and manufacturing of PMDs occurring in Australia – already arguably at a disadvantage due to a relatively small isolated market.

There are some existing tourism operators that are required to have permits to operate Segways. This process adds an administrative burden to their operations that may not be necessary if general access to PMDs is granted.

Businesses that do sell or operate PMDs under existing arrangements are constrained in opportunities to grow and innovate.

The following options will be compared to the status quo base case to the extent they are:

- likely to affect the opportunities for PMD use and thus potential market size for PMDs. This will proxy for the measure of broader economic benefits (including commercial and reductions in congestion and carbon emissions) of PMDs.
- likely to affect the regulatory burden on the existing (or potential) PMD-related businesses. Unlike previous criteria assessments, which for clarity established a baseline of no existing access, the regulatory burden assessment will take into account the emerging pattern of disparate approaches taken in granting access to PMDs.

D.5.2 Option 2: Permit the use of personal mobility devices on most pedestrian infrastructure and bicycle paths

This option provides for the use of PMDs that comply with the proposed framework described in Section 4.1 for use on a footpath, shared path, separated footpath (designated for the use of bicycles) and bicycle path.

Given this option increases the opportunities for potential PMD users, it will likely increase the market for PMDs and PMD services. As such, it will increase the opportunities for business in those areas.

It is assumed that current operators of Segways would not have to apply for permits going forward. More generally, importers and manufacturers operating across state borders would only need to comply with a common set of rules.

D.5.3 Option 3: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle paths and local roads

Option 3 allows PMDs to be used on all the infrastructure types permitted in Option 2 as well as on local roads. This would allow PMDs to be more practically used for last-mile commuting compared with Option 2 and thus likely further increase the demand for PMDs and the resultant opportunities for businesses importing, making or providing services with them.

The increased feasibility as an alternative transport option, by allowing access to local roads, may also result in a shift from car travel to PMD use (particularly as a first/last mile option in combination with public transport). At the margins, this could result in a reduction in road congestion and vehicle emissions.

Option 3 is likely to result in the same reductions in regulatory burden as Option 2.

D.5.4 Option 4: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle infrastructure and roads

Option 4 allows PMDs to be used on all the infrastructure types permitted in Option 3 as well as on most other roads (except for freeways and other roads where bicycles are not permitted). This would allow PMDs to be used for longer distance commuting compared to Option 3 and, consequently, likely further increase the demand for PMDs and the resulting opportunities for businesses importing, making or providing services with them. On the same basis, this option may result in a marginally higher shift from car to PMD use than option 3, with associated reductions in congestion and vehicle emissions.

Option 4 is likely to result in the same reductions in regulatory burden as Option 2.

D.5.5 Option 5: Permit the use of personal mobility devices on bicycle infrastructure and roads

Option 5 allows PMDs to be used on all the infrastructure types permitted in Option 4 except for pedestrian infrastructure (i.e. footpaths or shared paths). This is likely to reduce demand for PMDs compared to Option 4 as some potential recreational users may be unwilling to use them on roads.

Existing Segway-based tourism businesses operating Segways on footpaths will need to continue to apply for an exemption in some jurisdictions.

D.5.6 Summary assessment of broader economic benefits

The overall assessment of each option in terms of broader economic benefits is set out in Table 15.

Table 15. Broader economic benefits related to personal mobility device use

Assessment Scale	Broader Economic Benefits
Moderate increase to broader economic benefits	**Option 4**, in allowing for the use of all road-related infrastructure types, would likely maximise demand for PMDs just ahead of **Option 3** which would not permit them to be used on main roads. These options would open up demand for most commuting and recreational purposes.
Minor increase to broader economic benefits	**Option 2** would allow for use primarily on pedestrian infrastructure which would allow for recreational use and very limited commuting. **Option 5** would allow for commuting but would likely deter recreational users and significantly impact tourism and rental businesses that rely on access to pedestrian infrastructure.
No change to broader economic benefits	**Option 1 - Status quo**

The overall assessment of each option in terms of regulatory burden is set out in Table 16.

Table 16. Regulatory burden related to personal mobility device use

Assessment Scale	Regulatory Burden
Minor reduction to regulatory burden	It is assumed that by removing general restrictions on the use of PMDs, current operators (such as Segway tourism and rental operators) would not have to apply for exemptions going forward under **Options 2, 3, and 4**. More generally, importers and manufacturers operating across state borders would only need to comply with a common set of rules. **Option 5** would either prevent access to pedestrian infrastructure or rely on exemption schemes like those that currently exist. However, manufacturers and importers would still benefit from having a consistent set of national rules.
No change to regulatory burden	**Option 1 - Status quo**

D.6 Compliance and enforcement

The success of setting a speed limit to improve safety around the use of PMDs will depend on high levels of compliance and clear enforcement. Evidence suggests that there are a variety of challenges with compliance and enforcement when considering setting a mandatory speed limit on paths (Transport and Main Roads, 2014; Boufous et al, 2018).

Currently, the only devices and vehicles that have a regulated speed on pedestrian infrastructure are motorised mobility devices and motorised scooters. These devices are restricted to a maximum speed of 10km/h in the ARRs, which is considered suitable and safe for areas where pedestrian interaction is likely (see Appendix C). Other vehicles, such as bicycles, are largely permitted to travel on most paths without a regulated speed limit in all Australian states, other than Victoria. While there may be some perceived safety concerns with various devices and vehicles traveling on paths, the evidence suggests the perceived risks often outweigh the actual risks (Austroads, 2006).

The most efficient method for ease of enforcement and to maximise compliance with PMD speed would be to set a fixed speed limit and restrict PMDs from travelling above this speed, i.e. 15km/h or 25 km/h. It would be difficult for a PMD user to comply with a variable speed limit (i.e. Speed Approach 1) without some form of speed measuring device fitted. While many PMDs on the market are designed with some form of speed measuring device, many others are not, and it may be impractical to retrofit or expect compliance with third party speed measuring devices, e.g. phone apps.

Both Victoria Walks and Victoria Police submitted that a variable speed limit could be problematic, as enforcement would be either 'impractical' or 'impossible'. Both submissions also questioned the effectiveness of voluntary compliance with a variable speed limit under Speed Approach 1, particularly as some PMDs may not have a speedometer enabling a user to know if they were complying. Victoria Walks suggested that applying different laws to different types of infrastructure or road types would be confusing for PMD users. Neuron Mobility noted that under shared PMD schemes, compliance with speed limits could be assured through geofencing, which can be used to prevent PMDs from exceeding a particular speed in certain areas.

D.6.1 Summary assessment of compliance and enforcement

The overall assessment of options relating to compliance and enforcement is set out in Table 17.

Table 17. Summary assessment of options in relation to compliance and enforcement

Assessment Scale	Impact on Compliance and Enforceability
No change to enforcement resources and/or difficulty	**Option 1 - Status quo**
Minor increase in enforcement resources and/or difficulty	Under the approaches where the same speed limit is applied regardless of the infrastructure (**Option 5 and Speed Approaches 2 and 3 for Options 2, 3 and 4**) enforcement will not face the challenge of having to enforce different speeds. However, the expected increase of PMDs will still have a minor impact on enforcement resources.
Moderate increase in enforcement resources and/or difficulty	Under **Speed Approach 1 (Options 2, 3 and 4)** it is likely to be moderately more difficult due to having to enforce a different speed limit on different infrastructure.

D.7 Summary of submissions to the Consultation RIS

The NTC received 62 submissions to the Consultation RIS from a diverse range of stakeholders, including: Commonwealth, state, territory and local government; motoring clubs; advocacy groups; academia; injury prevention groups; insurance groups; PMD operators and suppliers; and various other groups and individuals interested in PMDs.

Submissions supported a range of options with Option 3 Speed Approach 1 being the most preferred option. Of the 62 submissions (see Table 18):

- 21 (34%) supported the Consultation RIS recommendation: Option 3 Speed Approach 1.
  - 4 (6%) supported Option 3: Speed Approach 1 in principle.
- 17 (27%) proposed different options that were not explored in the Consultation RIS.
- 13 (21%) supported a different Speed Approach or Option proposed in the Consultation RIS.
- 7 (11%) provided a statement or information without supporting a clear position.

Table 18. Summary of submitters' preferred options

Option	Speed Approach	Support (n=)	Submitters
3	1	21	Brisbane City Council, Australian Local Government Association, Dept of Infrastructure Planning & Logistics, Dept of Infrastructure Transport Cities & Regional Development, Dept of Transport Vic, Insurance Australia Group, Motorcycle Council of NSW, Physical Disability Council of NSW, Royal Automobile Association, State Growth Tas (1st preference), Vehicle Design and Research, Gray. A, Day. B, McLelland. C, Spencer. C, Perry. D, Tai. J, Gordon. P, Gamble. S, Shu. Y, Vytilingam, J.
		4 (In principle)	Municipality Association of Victoria, Monash Institute of Transport Studies, Royal Automobile Association of Victoria, City of Greater Dandenong,
5	NA	5	Municipality Association of Victoria (2nd preference in principle), Vision Australia, Rathgen. C, Klaus. K, Michael A.
3	2	3	Dept of Planning Transport & Infrastructure, VicPol, State Growth Tas (3rd preference).
3	3	2	Department of Transport & Main Roads, Clark. T.
4	1	2	McCann. J, Fry. J.
4	3	1	Mohamed, H.
Submitters proposing various options		17	Surf Coast Shire, Ben Buckler Boards, Bicycle Network, Victoria Walks, Neuron, State Growth TAS (2nd preference), WalkSydney, Wyndham City Council, Zipidi, eRiders United, Uber, Donovic.T, Eckerman. M, Meagher.M, Cusack. P, Nelson. R, Poon. Y.
Submitters providing a statement or information		7	CARRS-Q, Pedestrian Council of Australia, joint submission from '*Jamieson Trauma Institute Queensland, Royal Australian College of Surgeons, Australian Injury Prevention Network & Queensland Injury Surveillance Unit*', two anonymous submissions, Lock. D, Pettett. J.
Total (N=)		**62**	

Some submitters were not in favour of allowing PMDs on footpaths, primarily due to the risks to pedestrians or the risks to PMD users due to the potentially uneven surfaces on footpaths (cracks, lips, etc.).

For bicycle lanes, some submissions (Bicycle Network) were in favour of prohibiting PMDs from bicycle lanes to preserve them for active transport users, while others supported expanding the definition of bicycle infrastructure available under Option 3 in the Consultation RIS to include on-road bicycle lanes (RACV). A range of views were received about suitability of different road infrastructure, the appropriate definitions of roads and the appropriate speed approach for use on roads. However, on balance, the option that received the most support was the NTC's recommended option in the Consultation RIS: Option 3, Speed Approach 1.

D.8 Other matters raised in submissions to the Consultation RIS

The NTC has made some amendments to the impact assessment based on submissions made to the Consultation RIS. A number of other issues were raised, or alternative cases made through submissions that were relevant to the impact assessment. For the most part these either lacked sufficient evidence and/or were considered by the NTC unlikely to affect the outcome of the assessment.

Private ownership and shared schemes for PMDs

Several submissions to the Consultation RIS indicated that the safety risks may differ between PMD users that use PMDs from shared schemes and those who own their PMDs (for example CARRS-Q, Neuron Mobility and Ben Buckler Boards). The NTC acknowledges the views of several submissions (for example Ben Buckler Boards, e-Riders United Australia) that, in general, private owners of PMDs may have greater skill and knowledge of road rules than users of shared PMD schemes, due to more frequent use of the PMD. These submitters also suggested that private users may have a greater incentive to take care of their PMD and ride safely because they have made an investment to purchase the PMD.

Despite these points, the NTC has generally not distinguished between PMD use through private ownership and shared schemes in the impact analysis. This is for several reasons. Firstly, there is some ambiguity about the claims that PMD users on privately owned devices will always be safer than PMD users of shared schemes. For example, new/inexperienced users may be equally unsafe on PMDs under both ownership models. Secondly, the design of the PMD may also affect its safety outcomes, and private PMDs are likely to have a greater variety of designs than shared schemes. Some of the private PMD designs may be inherently safer than those used in shared schemes and others may be less safe, and these design differences could potentially exacerbate or offset some or all of any skill differentials between user types. Thirdly, the perceived risk from other road and path users, particularly vulnerable road users, is not likely to be affected by the ownership model for PMDs in and of itself.[1]

The NTC accepts that compliance and enforcement may be more effective under shared schemes for PMDs than individual ownership. For example, shared schemes may be able to use geofencing to restrict access and/or limit speeds in certain areas, and enforcement could be more effective if users of shared schemes can be identified by enforcement authorities where required. However, there is no policy proposal to only allow one ownership model of PMDs (i.e., shared schemes only, or privately owned PMDs only). Therefore, under all

[1] However, any speed limiting that is imposed by shared PMDs used on footpaths or shared paths could potentially reduce perceived risk, relative to a situation where privately owned PMDs were being used at higher speeds.

proposed options and speed approaches there would be an unknown proportion of both private and shared PMDs, and it is difficult to assess differences in enforcement and compliance for the different options/speed approaches as a result of ownership models.

The paragraphs above summarise why the NTC has not differentiated between privately owned and shared PMDs in the impact analysis. Further, the NTC does not consider it appropriate to allow for different infrastructure access or maximum speeds depending on whether a PMD user owns their PMD or is using one from a shared scheme, as advocated in some submissions (for example, e-Riders United Australia). The NTC considers that it would be impractical to allow different infrastructure access or speed approaches for the different user types, due to the additional complexity of potentially having to understand two sets of rules. For example, this could require enforcement authorities to treat similar—or potentially identical, if PMDs from shared schemes are sold to private buyers after a certain period of use—PMDs in different ways.

PMDs on Public Transport

Some submissions to the Consultation RIS suggested that PMDs would reduce the access and amenity of existing public transport users (for example DPTI; Victoria Police) or cyclists (for example Bicycle Network). The NTC acknowledges that the amenity of existing public transport users could be reduced if PMDs are brought onto public transport at peak times.[2] However, the extent of any loss of amenity is uncertain and likely to be small compared to access and amenity of users of roads and road-related infrastructure. It depends on a number of factors such as: how many people would bring PMDs on to public transport, as part of their journey (as opposed to using them as a substitute to public transport); how often this would occur at peak times, where space is limited; and the amount of space taken up by the PMDs. This matter is in any case a policy decision for public transport authorities in the relevant jurisdiction, who—depending on the jurisdiction and transport mode—in many cases already allow items such as bikes, shopping trolleys and luggage to be brought onto public transport.

Impact of PMDs on public health

Public health fits within the ‘broader economic costs and benefits’ criterion used for the impact analysis. The following sections consider the potential impacts of PMDs on health through the mechanisms of changes to physical activity, air pollutants and impacts on the public health system. The first two sections contain a summary of the mechanisms by which PMDs may impact on the relevant health factor. However, there is too much uncertainty about how PMD use, and business models, will develop in the future to meaningfully take these factors into account formally in the impact analysis.

Impact of PMDs on physical activity

A number of submissions (including Victoria Walks, CARRS-Q and Victoria Police) stated that PMDs may be used as a substitute for active transport modes (such as walking or cycling), and included summaries of survey results from other countries in support of this view. The NTC accepts that, where this substitution occurs, there is potential for some negative impacts on public health. In principle, the scope for substitution from active transport to PMDs may depend on the infrastructure availability and allowed speeds for PMDs. That is, PMD use may be higher the more infrastructure is available, and the higher the speed that can be travelled (suggesting that substitution would potentially be most likely to occur for Option 4, Speed Approach 3).

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[2] This may be more likely to occur with privately owned PMDs than those from shared schemes.

However, the impact of PMDs on public health is not straightforward. The availability of PMDs as a journey option may not necessarily mean a reduction in walking or cycling trips for all user types. The potential public health impact is only relevant for trips made on PMDs that would otherwise have been made using active transport.[3]

Other submitters, such as CARRS-Q, suggested that PMDs from shared schemes tend to be used at off-peak times, implying recreational use of PMDs rather than use for commuting. However, use of PMDs for recreational purposes also does not necessarily imply that there would be a reduction in physical activity for all such journeys. There would only be a reduction in physical activity—with potential impacts on public health—if the recreational PMD user would have used active transport to complete their journey in the absence of PMDs.

Given the uncertainty about potential transport mode substitution, we have not taken changes to physical activity into account as part of the impact analysis. The NTC is of the view that it is unlikely to materially change the impact assessment. As noted above, not all PMD trips would have resulted in active transport if PMDs were not available (as assumed under the Option 1, the status quo)—some may have been done by train, tram, bus, car or not made at all. In addition, some PMD users may already lead an active lifestyle, such that the marginal benefit to their health of walking on part of their journey, rather than using a PMD, may be relatively limited.

Table 19 summarises the mechanisms by which PMDs may lead to increased or decreased exercise.

Table 19. Mechanisms by which PMDs may affect exercise

Potential mechanisms leading to increased exercise	Potential mechanisms leading to decreased exercise
▪ In a shared scheme, users may need to walk to find a PMD to begin their journey, and potentially from their parking spot to the final destination if parking is restricted to certain areas. ▪ Limited amounts of incidental exercise (walking/lifting the PMD where necessary; muscles used for balance).	▪ Reduced exercise if using a PMD to complete a trip instead of active transport (such as walking or cycling).

Impact of PMDs on air pollutants and greenhouse gas emissions

Another potentially relevant health consideration, which was discussed in submissions by TMR and Uber, is the impact that PMDs may have on air pollutants (particularly in densely populated areas such as central business districts). If journeys are made on PMDs—instead of internal combustion engine vehicles[4]—there could be a reduction in air pollutants such as particulate matter, nitrogen oxide and carbon monoxide. However, if shared schemes for

[3] For example, prior to PMDs being available, a person may have had a journey to work consisting of a car from home to the train station, train into a city train station, and a tram from a city train station to work (and vice versa). With PMDs available, they may substitute to using a PMD instead of the car and tram journeys, but for this particular use case there would not be any reduction in walking or cycling.

[4] This benefit will not be present if PMDs are used as a substitute for other transport modes (such as active transport, public transport, or electric vehicles).

PMDs use internal combustion engines vehicles when repositioning and/or recharging PMDs, this could lead to increased release of air pollutants (albeit potentially occurring overnight or at other off-peak times).

Table 20. Mechanisms by which PMDs may affect air pollutants

Potential mechanisms leading to decreased air pollutants	Potential mechanisms leading to increased air pollutants
▪ Reduced air pollutants in densely populated areas if substituting from an internal combustion engine car.	▪ Shared PMD schemes may involve vehicle travel for charging/re-positioning the PMDs. This will lead to an increase in air pollutants if using an internal combustion engine vehicle.

Victoria Walks stated that PMDs would increase greenhouse gas emissions relative to trips taken using active transport or buses. The NTC acknowledges that these disbenefits may occur when substituting to PMDs from these modes of transport. However, uncertainty about mode substitution means it is not clear what proportion of trips will occur due to substitution away from active transport, public transport, or vehicles. In the longer term, the relative greenhouse gas disbenefit of PMDs relative to active transport may reduce as electricity grids transition to renewable energy, and if more components of PMDs can be re-used or recycled at the end of their lives.

Impact of PMDs on the public health system

As noted in submissions by IAG and Victoria Police, there could potentially be some detrimental impacts to public health from allowing use of PMDs due to the presence of externalities in healthcare.[5] By choosing to use a PMD, users have demonstrated that their personal benefits exceed their perceived personal costs from using the PMD. However, any health costs arising from reduced physical activity, or injuries arising from accidents, are to some extent borne by others in society due to there being a public health system where individuals don’t bear the full healthcare costs of their actions. (There may be others also affected by externalities in the event of an accident, such as employers and friends or family members who need to provide care.) Nevertheless, this issue is very difficult to quantify or meaningfully take into account in the impact analysis as it is highly dependent on use cases for PMDs.

All modes of transport carry some degree of accident risk: some will have higher risk and others lower risk than PMDs. Taking any extra healthcare costs arising from accidents due to PMD use into account in the impact analysis would require estimating levels of risk from each transport mode and how much substitution would occur from each transport mode to PMDs. There is too much uncertainty about potential future use of PMDs, and what substitution of transport modes may occur, to do this in a meaningful way.

[5] Any accidents arising from PMD use could potentially lead to broader economic costs due to externalities. For example, some of the costs arising from accidents may be borne by others such as employers or taxpayers (under a public health system).

Impact of PMDs on access and amenity, and congestion

As captured in the criteria in the impact analysis, PMDs may impact on the access and amenity, or congestion levels, experienced by users of infrastructure.

Submissions from Uber and TMR noted the potential for greater use of PMDs to reduce congestion on roads. However, people may shift to using PMDs from a range of transport modes. The nature of the impacts experienced by different users will depend on the degree of substitution occurring from different transport modes to PMDs, and the congestion levels currently experienced on different infrastructure. All else constant, existing users of affected infrastructure may be made worse off if PMDs begin to use the infrastructure at times of peak demand (particularly if the PMD users were previously using other modes of transport). However, any substitution to PMDs from other transport modes may help to relieve congestion on those other modes.

The following table outlines some of the impacts that PMDs may have on congestion. PMDs may have both positive and negative impacts on congestion/crowding on various types of infrastructure. There is too much uncertainty about future use of PMDs—including the amount of use, the dominant business model (shared/private), the types of infrastructure used, and the demand at different times of the day—and transport mode substitution to conclude what overall impact PMDs may have on congestion.

In summary, congestion impacts are highly dependent on assumed use cases (before/after PMDs are allowed) and relative amounts of free capacity on different transport infrastructure. For example, if public transport is at or exceeding full capacity but bicycle infrastructure is not, seeing some mode shift from public transport to using PMDs on bike paths would be beneficial in reducing congestion from a city-wide perspective.

Table 21. PMD impacts on congestion on different types of infrastructure

Infrastructure	Potential factors reducing congestion	Potential factors increasing congestion
Road	Reduced congestion on roads if substituting from car (particularly single occupancy car) to PMDs.	Shared PMD schemes may involve vehicle travel for charging/re-positioning the PMDs, which could add to congestion on roads if this was done at peak times.
Public transport	If some PMD users switch from public transport to PMDs for some/all of their journey, additional capacity will be available for other/new users of public transport.	PMDs taken on public transport would take up additional space (which could be problematic during peak hours).[6]

[6] Submissions from DPTI and Victoria Police also considered that PMDs on public transport could create additional risk of injury to passengers if these devices were not restrained.

Bicycle infrastructure	In the longer term, if PMD use increases significantly, road managers may increase infrastructure capacity to cater to the increased demand (additional, or wider, paths may be built).	More users using infrastructure, which may increase congestion at peak times.
Footpaths		Available footpath space could decline in CBDs, particularly under shared PMD schemes if PMDs are parked outside on footpaths in densely populated areas.

D.9 Overall Assessment

The overall assessment of options is depicted in Chapter 5 Table 3. This table highlights the challenge of establishing a common national approach to permitting access of PMDs onto public roads and paths. Each variation of infrastructure access and speed approach results in trade-offs between the safety and amenity of different user types, broader economic benefits and enforcement challenges. As a result, no one option is superior to another across the criteria.

Notwithstanding this, the NTC believes, if a national approach were to be adopted for the integration of PMDs, then Option 3, Speed Approach 1 would provide the highest implicit net benefit. That is, to permit the use of PMDs on pedestrian infrastructure at a maximum speed of 10km/h, and on bicycle paths and local roads at a maximum speed of 25km/h. This adheres to the Safe System approach to road safety that aligns PMD road access with most PMDs' intended use and design, that is first/last mile transport.

Permitting PMDs to travel up to a maximum of 10km/h on pedestrian infrastructure is the most appropriate speed based on safety considerations for pedestrians. For bicycle paths and roads, a maximum speed up to 25km/h is considered safe and appropriate, and there appears to be little justification to further restrict PMD speed in these areas.

Additionally, allowing PMDs to be used for their intended purposes with moderate restriction will likely enable them to achieve close to their full potential economic benefits (e.g. commercial opportunities and congestion reduction).

The NTC acknowledges that while there may be a variety of challenges with regulating variable speeds across different infrastructure, these difficulties in isolation should not offset the potential benefits of minimising PMD speed around pedestrians.

Of the other infrastructure access options assessed:

Option 2: Permit the use of personal mobility devices on most pedestrian infrastructure and bicycle paths

Not allowing access to low-speed roads would reduce risks to PMD users from interacting with motor vehicles but would substantially reduce the ability of PMD users to achieve the full benefits of these devices.

Option 4: Permit the use of personal mobility devices on most pedestrian infrastructure, bicycle paths and roads

This option would permit even greater access to the road network than Option 3, exposing PMD users to too high a risk by allowing them to interact with motor vehicles at high speeds (e.g. up to 80km/h).

Option 5: Permit the use of personal mobility devices on bicycle infrastructure and roads

This option removes interaction with pedestrians on footpaths – improving their safety and amenity. However, it greatly reduces the practical use of PMDs while still exposing users to the high risks associated with interacting with motor vehicles moving at high speed.

Of the other speed approaches assessed:

Speed Approach 2:

- a PMD user would not be permitted to travel at a speed faster than 15km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

This option would be easier to comply with and enforce but the benefit of this is unlikely to be worth the modest increase in risk to pedestrians and the reduced benefit of using these devices to commute.

Speed Approach 3:

- a PMD user would not be permitted to travel at a speed faster than 25km/h on a footpath, shared path, separated footpath (designated for the use of bicycles), bicycle path or road.

This option would allow the devices to operate at full speed on footpaths. However, it would create an unacceptable increase in safety risk. It would also increase the safety risk perception by pedestrians and vulnerable users of pedestrian infrastructure.

Appendix E Examples of PMDs

Device	Length/ Width/Height (mm)	Weight (kg)
Onewheel 	230 x 292.1 x 726	11
Solowheel 	430 X 330 x 490	12
Evolve - Electric skateboard 	1020 x 306 x 83	7.9
Segway 	650 x 630 x 1,300	37
Boosted Rev – Electric scooter 	1118 x 610 x 1138 (44 x 24 x 44.8 inches)	20.9
Segway Drift W1 e-skates 	291 x 162 x 121 (single e-Skate)	3.5

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