DEVELOPMENT OF A ROAD SAFETY STRATEGY FOR MORNINGTON PENINSULA SHIRE, 2021-2025

Technical report

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EXECUTIVE SUMMARY

Towards Zero

In 2016, Mornington Peninsula Shire Council became the first municipal council in Australia to formally commit to the eventual elimination of deaths and serious injury from its roads. The Council was actively supported by Victoria's road safety partners; the Transport Accident Commission (TAC), the state road authority (then VicRoads) and Victoria Police. This road safety strategy, which spans the next five years, has been developed to contribute to the eradication of the loss of life and long-term health by 2050 for those who use Peninsula roads for work, education, to visit, or simply enjoy life as a resident.

This strategy is the next step in taking away the fear so many of us live with, that the people who mean the most to us could be lost in an instant, as they go about their everyday lives. Our efforts during coming years will not only help to protect them, but also ourselves and future generations.

The Peninsula's Road Trauma Challenge

While every road crash has its unique features, the same limited number of types of crash types recur, year upon year, in unacceptable numbers. This has been so on Peninsula roads for decades.

On the Shire's rural roads, people in vehicles commonly leave the road at high speed or collide with an approaching vehicle, also at high speed. Hitting a tree, a pole, overturning or crashing head-on, even at legal speeds and in vehicles with the most modern safety features, produce horrific injuries and sometimes death. Crashes at intersections and private property driveways are another common source of risk. Again, in these circumstances, modern vehicles, driven at legal speeds cannot provide the required protection when the inevitable human error occurs. Simple human errors—a mistake made when turning from a quiet side road—should not be penalised with death or life-long injury.

On urban roads, crashes are also common at intersections, particularly those with traffic signals. The higher the speed limit, the more likely we are to crash and the more likely we will sustain severe injury (or severely injure others) when we crash. Being struck in the side of our vehicle, or while turning across the path of an approaching vehicle are common sources of severe injury at intersections. Neighbourhood streets across the Shire also account for a large number of severe injuries and deaths. Crashes occur both at intersections of local streets and along these streets between intersections. These are the places where people live, go to school and kindergarten, play, visit family and neighbours, or start and end their longer journeys within and beyond the Peninsula.

Growth is occurring in the active, healthy and sustainable modes of travel, which will continue into the future as traffic congestion builds and society recognises the value of these modes to health and wellbeing. People walking and cycling are essentially unprotected in traffic and have much lower thresholds to severe injury when struck by a vehicle. Children and older people are at even higher risk, and in need of greater protection than has generally been afforded them in past. While their crashes are predominantly in urban settings, especially in local streets and shopping/commercial areas, cyclists use the higher speed roads on the Peninsula, where their risks are unacceptably high. There is a wave of change in mobility options building globally, with the popularity of innovative devices, known as micro-mobility; they include e-scooters, e-skateboards, e-bikes, and the more familiar scooters for the mobility-impaired (and an assortment of others). As a sustainable and

space-efficient form of mobility, they have much to recommend them; however, users are unprotected in traffic and will need special attention in the years ahead.

While described at a high level only, these are our challenges. They are not unique to Mornington Peninsula, but are common the world over to greater or lesser degrees. This means we can draw on global expertise and successes in setting our course towards zero deaths and serious injuries.

The Path Towards Zero

Globally, the rising problem of road trauma is recognised by the World Health Organisation and the United Nations as requiring new and vastly different approaches to managing speed, designing roads and using vehicles compared with the way in which we have historically done so. The Academic Expert Group (AEG) formed to advise the 3rd Global Ministerial Conference on Road Safety in February 2020 made nine strategic recommendations to save lives beyond 2020. The emphasis was on making large and lasting changes to the inherent risk faced by those who use the road transport system. The report of the AEG is extensive and offers numerous new opportunities. It also proposes a vision for the evolution of road safety, recommending:

- the setting of a new target of 50 percent reduction in road deaths and serious injuries by 2030, based on expanded application of the five pillars of the Safe System;
- integration of road safety among the Sustainable Development Goals;
- future comprehensive integration of road safety activity in policy-making and the daily operations of governments, businesses, and corporations through their entire value chains;
- further engagement of the public and private sectors and civil society in road safety activities and capacity-building among road safety professionals worldwide.

A set of nine recommendations in the following areas were proposed to realise the vision over the coming decade:

- sustainable practices and reporting;
- procurement;
- modal shift;
- child and youth health;
- infrastructure;
- safe vehicles across the globe;
- zero speeding;
- 30 km/h in densely-populated urban areas;
- technology.

Mornington Peninsula Shire's strategy seeks to address all these issues, to the extent appropriate at this time. Initiatives that address speed and speeding, Safe System infrastructure, safe vehicles and procurement practices can be enacted now, with a high level of confidence and a high state of readiness. Issues such as sustainable practices and reporting, child and youth health, and technology are less well-developed and will likely require more careful planning and development, before full implementation. Within this context, it is recommended that the Mornington Peninsula Shire endorses the setting of a date by which zero or close to zero road deaths and serious injuries will be achieved. The world's leading countries in road safety aim to achieve zero by 2050.

A considerable body of work is underway in Victoria to define how roads and streets should look and how they should operate in order that the risk of death or serious injury will be close to zero within

three decades. This approach will rely heavily on the gradual and full replacement of today's vehicle fleet with a five-star 2025 vehicle (or better) fleet by 2050. Under the Zero by 2050 approach:

1. Today's *urban or rural* roads performing a high movement function, and therefore requiring high speeds (100 km/h) for economic reasons, will need to have:
    a. **continuous flexible barriers** along them to provide effective physical separation of opposing directions of vehicles and to prevent high-speed lane departures of vehicles into the roadside;
    b. either the **removal of intersections** along them or vehicle **entry speeds not exceeding 50 km/h** (up to 70 km/h for merging manoeuvres);
    c. **physical separation for pedestrians and cyclists** needing to use or cross these roads;
2. Today's *rural* and semi-rural roads performing a medium to low movement function will need to have speed limits of 80 km/h or lower, with medium movement function roads potentially also needing:
    a. **sealed shoulders** where these roads are undivided;
    b. **continuous flexible barriers** where roadway curvature elevates the risk of vehicles leaving their lanes. This is needed to provide effective physical separation of opposing directions of vehicles and to prevent high-speed lane departures of vehicles into the roadside;
    c. either the **removal of intersections** along them or vehicle **entry speeds not exceeding 50 km/h** (up to 70 km/h for merging manoeuvres);
3. Today's high movement function *urban* roads will need to have **speed limits of 60 km/h** or lower, with medium function roads potentially needing:
    a. **50 km/h speed limits** or, where, for example, there are pedestrians, cyclists or micro-mobility users are expected, **30 km/h**;
    b. **continuous flexible barriers** where speed limits exceed 50 km/h and roadway curvature elevates the risk of vehicles leaving their lanes. This is needed to provide effective physical separation to prevent high-speed lane departures of vehicles into the roadside;
    c. either the **removal of intersections** along them or vehicle **entry speeds not exceeding 30 km/h** where there are pedestrians and cyclists mixing with traffic. Otherwise, entry speeds should be limited to not more than **50 km/h**.

To support the aspiration of zero deaths and serious injuries by 2050, a range of other initiatives will be needed during the 30 years ahead. Police enforcement to assure compliance with speed limits, unimpaired driving (drugs, alcohol, fatigue and distraction), as well as unauthorised driving will continue to be needed. However, as vehicle safety features and other forms of technology mature and are integrated within the road transport system, active enforcement by police will become less necessary. Programs and actions to accelerate the take-up of proven vehicle safety features will continue to be needed over coming years, to ensure that the important combinations of infrastructure and speed described above will be effective in eliminating the systemic crash types in each of the settings present on the Mornington Peninsula.

Implementation is Critical

A strong conclusion of the 3rd Global Ministerial Conference on Road Safety was that political and institutional inaction have made the first Decade of Action on Road Safety (2011-2020) a wasted period and that, given the rising global death toll, the world cannot afford a repeat of this gross failure to tackle the problem in the next decade to 2030. There can be no more excuses.

With this in mind, this strategy focuses on *successful implementation*. Unless inherent safety is actively introduced onto Peninsula roads and into the minds of users, nothing can change and road trauma will rise. Action is critical. Systemic impediments to action must be removed.

ACKNOWLEDGEMENTS

The following organisations and individuals are gratefully acknowledged for their contribution to the strategy development process.

- TAC for providing the serious casualty dataset;
- Officers of the Mornington Peninsula Shire for their cooperation and support in the development of this document.

1 INTRODUCTION

1.1 Background

Mornington Peninsula Shire endured a horrific year for road trauma in 2019, with 14 lives lost[1] and more than 100 people seriously injured. While the whole of Victoria experienced a significantly higher than average number of fatalities last year, Mornington Peninsula Shire suffered the highest loss of life of all of Victoria's 79 municipalities in two years of the last decade (2010 and 2019).

A once rural area, the Shire's permanent population increased greatly towards the end of the twentieth century. The Shire also experiences exceptionally high visitation rates over the peak summer period. Roads that were constructed to service rural properties and small townships are now thoroughfares to popular locations, and provide direct and indirect access to a range of new developments, wineries, tourist attractions and residential dwellings.

The Shire consists of 40 townships which are modest in size by metropolitan Melbourne standards and dispersed throughout the Peninsula. Connecting many of the townships are rural roads of varying standard that now constitute some of the main road safety risks within the Shire. Many of the Shire's townships are now busy, particularly during the warmer months of the year. Within the townships, road, pedestrian and cyclist safety is often less than ideal without high standard facilities accommodating safe movement for all modes.

Historic default speed limits of 100 km/h outside of the built-up areas present a high risk for road users and, until recently, have not changed along with the changing nature of the Peninsula. Crashes on these high speeds on roads without safety barriers are almost certain to lead to death or serious injury.

High numbers of visitors creates challenges in managing road congestion in peak times, but also adds additional road safety risks for those drivers unfamiliar with the road network and conditions. In addition, the increase in the number of vehicles on the road and visitors within the Shire increases the probability of crashes (for vehicle occupants, cyclists and pedestrians) due to increased exposure to road safety risks.

With only 18 per cent of the Peninsula serviced by public transport, there is a heavy reliance on car travel. The Shire is also popular with recreational cyclists, but most cycling routes do not provide high standard bicycle lanes.

The impact of road trauma is not only present due to lives lost. With an average of around 150 people seriously injured every year within the Mornington Peninsula, serious injuries are considered the 'hidden road toll' due to the ongoing pain, suffering and impairment caused to individuals and their families, whose lives are suddenly upended by the physical and mental trauma of road crashes.

All road users expect a high level of road safety. At current levels, road trauma is a significant risk to human life and health to the community and visitors across the road network within the Mornington Peninsula.

[1] Official TAC statistics for 1 January to 31 December 2019 report 12 fatalities. The difference is likely due to crashes occurring on Shire boundaries, crashes resulting from pre-crash medical events or the presence of suicides (which are excluded from official statistics).

1.2 Local Government road safety

Local Governments play a key role in road safety. Each municipality has responsibility for the safety of the roads it manages (1364 km of sealed and 336 km of unsealed roads within Mornington Peninsula Shire), has an important advocacy role to federal and state governments for safety improvements on arterial roads and funding for Council-managed roads, as well as engaging and empowering its community in relation to road safety.

The responsibility taken by Victorian local governments in the management of the road network is vital, being responsible for 70% by road length[2] with speed limits of 100 km/h or higher accounting for 30% of fatalities and seriously injured persons on LGA roads statewide[3]. Despite this, local government receives a disproportionately small share of road funding relative to the state-managed network. This combination of wide-ranging responsibility for service delivery and inadequate funding combine to create major challenges for the Shire in ensuring safe travel on the Peninsula.

In the face of these pressures, Council is determined to eliminate severe road trauma, formally committing in 2016 to become the first 'Towards Zero' municipality[4] in Victoria and strongly supports the Safe System strategic approach to preventing deaths and serious injury. Regarded as international best practice, the Safe System and equivalent philosophies have been adopted by the Netherlands and Sweden, two consistent world leaders in reducing road trauma.

To address this severe road trauma problem on the Peninsula and to encourage the acceleration of progress throughout Victoria, the Shire is advocating to the Victorian government for support to expand the scope of its Toward Zero commitment by serving as a demonstration area for innovative system-based design and speed management, supported by other trauma reduction measures.

This strategy is specifically targeted at the period 2020 to 2025, but aims to define a trajectory towards achieving zero deaths on the Shire's roads by the conclusion of the 30 years in 2050.

[2] Authors via Victorian Department of Transport, 2019

[3] Authors from TAC-RCIS FSI database, 2019.

[4] See: http://www.tac.vic.gov.au/about-the-tac/media-room/news-and-events/2016/tac-congratulates-victorias-first-towards-zero-council

1.3 Road safety strategy development

In response to the challenge of reducing road trauma, the Shire engaged Monash University Accident Research Centre (MUARC), in partnership with Corben Consulting and David Healy Consulting, to develop a new five-year road safety strategy for the period 2020-2025. The long-term aim is for all journeys to be safe and to feel safe for all road users, including for cyclists and pedestrians. This strategy aims to confirm the aspirations of Towards Zero and commits to zero deaths by 2050. The strategy considers both Shire-managed and state-managed roads as this gives a full picture of road trauma within the Mornington Peninsula. While the Shire has control over Shire-managed roads, reducing road trauma on arterial roads needs ongoing advocacy and collaboration with the Department of Transport, Safer Roads and Road Safety Victoria.

MUARC has been undertaking strategy development since the 1990s, assisting VicRoads (now the Victorian Department of Transport) with the development of the 'Arrive Alive 2008-2017' road safety strategy. Since then, over a dozen strategy development exercises have been undertaken throughout the states and territories of Australia and in support of the development of the National Road Safety Strategy 2011-2020. MUARC has also assisted with the development and modelling of several strategy action plans as well as modelling the allocation of substantial road infrastructure funding for the New Zealand Transport Agency. Until his departure in 2013, Dr Bruce Corben led strategy development at MUARC, with Dr David Logan taking over since that time. In 2016 Corben Consulting collaborated with MUARC and David Healy Consulting to prepare a road safety strategy for the City of Stonnington[5].

The key project tasks to be addressed in the Mornington Peninsula Shire are as follows:

1. Analysis of the nature and extent of the current road safety problem within the Mornington Peninsula municipality.
2. Identification of a robust combination of infrastructure and speed solutions to address the key problems identified, while being consistent with Safe System principles.
3. Identification of supporting and facilitating initiatives from the road user behaviour, vehicles and enforcement cornerstones to help support those mentioned above, as well as to help Council reinforce its role as a community leader in road safety.
4. Matching of each of the proposed initiatives with a lead agency and funding source and create an implementation plan outline. In addition, development of a set of safety performance indicators (SPIs) and targets to help ensure that the short and long-term goals of the plan are achieved.
5. Assistance with the determination of the stakeholders and community groups important to the consultation process.
6. Identification of a program of capacity-building to deliver the strategy.
7. Preparation of a summary report documenting the method, problem analysis, initiatives selected and implementation plan in a format suitable for use by the Council communications team in the preparation of a public document.
8. Presentation of problem analysis and final outcomes to Council officers and Councillors as required.

The development of the strategy incorporates the above key tasks and was undertaken within the four cornerstones of the Safe System and aimed to focus on a manageable number of the most serious problems, rather than attempting to spread resources too thinly across a broad range of

[5] See: https://www.stonnington.vic.gov.au/Live/Roads-and-Roadworks/Road-Safety

issues. Recommendations will focus primarily on what can be done to achieve lasting reductions in the risks of deaths and serious injuries.

This report documents each of the above key stages, providing sufficient technical detail to underpin Council's public strategy document.

2 STRATEGY CONTEXT

2.1 Vision Zero and the Safe System

2.1.1 Vision Zero

Vision Zero is the name given to the Swedish vision for road safety that emerged in the 1990s with the goal of ultimately eliminating deaths and serious injuries from the country's roads. In 1997, the Swedish Parliament formally adopted Vision Zero as an ethically- and scientifically-sound way forward. Sweden has one of the lowest rates of road deaths per capita in the world, and has consistently held this position for many years. Vision Zero takes the stance that it is unacceptable for lives to be lost and for severe, sometimes permanent, injury to be sustained on Swedish roads as citizens go about their everyday lives. Further, on ethical grounds Vision Zero challenges the long-standing practice of trading lives and long-term health for the benefits that come from using the road transport system. Allowing unsafe speeds in the pursuit of reduced travel times is one example of an unacceptable trade-off under the Vision Zero philosophy.

To meet the long-term goal of no deaths or serious injuries, Vision Zero holds that:

- We must acknowledge that humans are imperfect and are prone to make mistakes in traffic, but that death or serious injury is an unacceptable penalty;
- We must acknowledge that humans have limited tolerance to the forces that they can sustain in everyday crashes before risking death or serious injury. The level of tolerance to crash violence varies with age and health status;
- To provide the protection that society seeks, the road transport system must be forgiving of human errors and ensure that the forces experienced in crashes involving compliant road users do not result in severe injury or death. This demands a holistic, 'system-view' be taken of how roads are designed and operated;
- For death and serious injury to be prevented, road users must comply with a number of key rules when using the roads. Assuming a compliant user, the road designers and system operators must design and operate to ensure crashes forces remain within the biomechanical limits of the humans involved. System failures—defined as when the outcome of a crash is death or serious injury—must be addressed by system designers and operators to ensure that shortcomings in compliance and/or design are eliminated.

In summary, Vision Zero is a highly ambitious, ethically- and scientifically-based vision for the eventual elimination of severe road trauma. In a variety of forms, Vision Zero has been adopted in many countries, individual states/provinces and cities over the past 20 years and is regarded by major global organisations such as the World Health Organisation, the OECD, the United Nations, the European Union and the European Transport Safety Council, as best practice in arresting the growth in global road trauma. Worldwide, it is estimated that around 1.35 million deaths and many times this number of serious injuries occur each year. Road deaths are the leading cause of death among children and young people aged 5 to 29 years, comprising 14% of male and 5% of female deaths (Patton *et al.*, 2009).

2.1.2 Human tolerance to crash forces

Mathematical relationships describing fatal and serious injury risk as a function of impact speed have been defined by international and local researchers to help in estimating the potential savings in severe trauma from changes in travel and impact speeds. Accurate mathematical relationships are

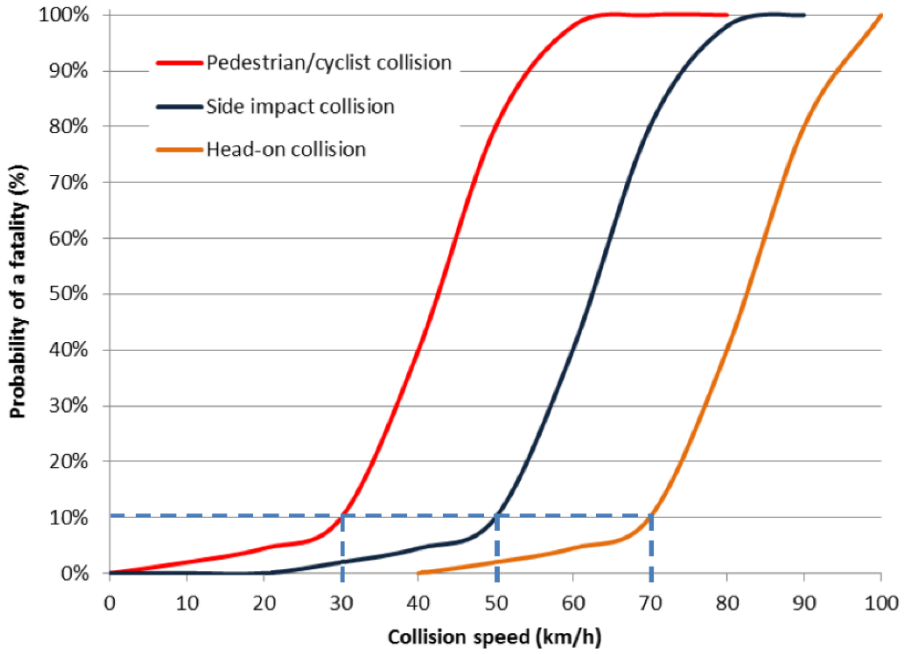
important for estimating the aggregate savings in deaths and severe injuries from large-scale reductions in speed limits, however, precision is less important in setting individual impact speeds, for each major crash type, which should not be exceeded if severe injury is to be prevented. Until more robust research and improved accuracy in estimates is available, the adoption of a practical set of maximum tolerable impact speeds for each major crash type is needed.

Setting impact speeds, above which the risk of death rises rapidly with increasing impact speed, provides valuable practical guidance for road designers and system operators (Swedish Transport Administration, 2019). These threshold speeds also accord with our real-world experiences with road trauma outcomes. These speeds coincide on the corresponding risk curves with an estimated ten percent likelihood of death in the event of a crash (ITF, 2016, SWOV, 2006). The following maximum tolerable impact speeds are recommended to meet Safe System principles:

- frontal-impacts into narrow rigid objects (e.g., roadside trees and utility poles) – **50 km/h**;
- side-impacts of passenger cars into narrow rigid objects (e.g., roadside trees and utility poles) – **30 km/h**;
- head-on impacts between passenger cars of similar mass – **70 km/h**;
- side-impacts between passenger cars of similar mass – **50 km/h**;
- impacts with pedestrians, cyclists and motorcyclists – **30 km/h**.

Where one or more of the impacting vehicles is, for example, a truck or bus, or older road users (e.g., 65 years or older) are involved, the maximum tolerable impacts speeds for avoiding serious injury will be considerably lower.

Figure 1 shows conceptually the relationship between the typical risk of a fatality and impact speed for a selection of the configurations listed above. The 10% risk threshold (marked on the graph by the dotted lines) is generally regarded as presenting an acceptable risk.



Source: Jurewicz, Sobhani et al. (2015) and based on Wramborg (2005)

Figure 1. Relationship between probability of a fatality and impact speed for different crash types and configurations.

2.1.3 The Safe System

In 2004, Austroads, Australasia's peak roads organisation, representing New Zealand and the states and territories of Australia, adopted the Safe System as the means by which both countries would most effectively tackle road trauma over the long term. As with Vision Zero, the Safe System sets the ambitious goal of eventually eliminating road deaths and serious injuries, while embracing the same ethical and scientific principles outlined above for Vision Zero.

The Safe System is founded on four pillars, each representing the fundamental elements of the road transport system (some jurisdictions recognise a fifth pillar, covering post-crash response and care):

- Safe Roads and Roadsides;
- Safe Vehicles;
- Safe People; and
- Safe Speeds.

Experience gained with working in Australasia with the Safe System pillars over the past 15-20 years has revealed that the Safe Speeds pillar functions with a strong overarching influence across the three *physical* elements of the system. The Safe Speeds pillar is intrinsically linked to the quality of the road, the safety capabilities of vehicles and the road user compliance and capabilities in traffic. Speed is the means by which kinetic energy—the primary agent of injury—is created within the system and managed to avoid crashes. When crashes do occur, the transfer of kinetic energy to the human must remain below the levels that produce severe injury. Speed is a continuous variable that can be used to regulate risk by ensuring all combinations of compliant humans, in specific vehicles being driven on specific roads operate safely, even if a crash occurs. This principle applies not just to

vehicle occupants, but also to road users external to vehicles, such as pedestrians, cyclists and motorcyclists (and a host of other emerging, innovative personal mobility devices).

The Safe System is the version of Vision Zero, adapted for global use. It endeavours to incorporate the best features of Vision Zero, including the key principles that uniquely distinguish it from traditional, less ambitious approaches. The Safe System has proven to be a powerful means for driving innovation and ambition, though implementation on a large-scale across Australasia remains a challenge for all levels of government. To date, the implementation of Safe System thinking has been restricted to continuous lengths of barriers, construction of urban and rural roundabouts, where costs were not prohibitive, and lower urban speed limits, supported by traffic-calming infrastructure, where walking and/or cycling are commonplace. Ongoing vehicle safety improvements, through more rigorous safety standards and consumer purchasing decisions, also make a substantial contribution to progression towards the Safe System.

The Safe System continues to be regarded by road safety experts as the best approach to tackling road safety and has been the driving force for the creation of Towards Zero in Victoria, which also has the ambition of eradicating death and serious injury, while acknowledging that getting 'close to zero' serious trauma may be a more helpful and practical long-term aspiration.

2.2 National Road Safety Strategy

A recent enquiry into the National Road Safety Strategy (2011-2020) identified that improvements in road safety in Australia had at best stalled and, with rises in the two years prior to the initiation of the enquiry, even regressed (Woolley and Crozier, 2018). A key finding of the report was that although the Safe System philosophy had been espoused nationwide, there were significant failures in implementation. The lack of focus on harm minimisation in favour of the traditional approach of incremental safety improvements was still being applied rather than targeting absolute safe outcomes. The enquiry highlighted the need for substantial changes to road safety management practices in Australia, including recognition of the fact that poor road safety outcomes manifest themselves as poor health, societal and productivity outcomes. Acknowledgement of this in the form of a multi-agency response driven by the highest levels of government is essential to effect real change.

In early 2020 the newly-formed national Office of Road Safety[6] initiated the development of a new road safety strategy for the ten-year period 2021-2030. While the goals for the strategy have not yet been made public, MUARC has been awarded the tender to undertake the modelling of potential countermeasures and will be advocating strongly for a level of ambition commensurate with the achievement of a Safe System in Australia.

2.3 Victorian Towards Zero Strategy

The current Victorian road safety action plan, 'Towards Zero 2016-2020'[7], targeted a 20% reduction in deaths and 15% in seriously injured persons (compared with 2012-2014 levels) by 2020. Integral to the plan was the creation of a new office, then known as the Safe System Road Infrastructure Program, to coordinate over a billion dollars of investment in safer road infrastructure. Supplementing this was a limited number of speed limit adjustments on low volume high speed roads. A new Victorian road safety action plan for the period 2021-2023 is currently under

[6] See: https://www.officeofroadsafety.gov.au/

[7] See: https://www.towardszero.vic.gov.au/what-is-towards-zero/road-safety-action-plan

development, led by Road Safety Victoria, with the aim of targeting zero deaths by 2050. This ambitious goal will require significant commitment by both government and the community to plot a realistic trajectory over a 30-year period that progressively transforms the entire system. To achieve this goal, road and roadside infrastructure, speed limits and the capabilities of vehicles will need to be aligned Victoria-wide. At the time of writing, no clear timetable has been set for this transformation.

Finally, there is a current state government inquiry into the increase in Victoria's road toll, to which Mornington Peninsula Shire has made a detailed submission and intends to present to the committee.

3 STRATEGY DEVELOPMENT

3.1 Strategy vision

Mornington Peninsula Shire has four overarching goals for this road safety strategy:

1. To eliminate death and serious injury on the Shire's roads by 2050.
2. To significantly contribute to the achievement of the state government's long-term and intermediate targets of 'Zero by 2050' on Victoria's roads.
3. To contribute to the adoption of a harm elimination approach: historically road safety interventions have been reactive to existing or emerging problems. Given increases in both knowledge and capability, this new knowledge must be applied proactively and no longer build systemic risk into new roads or redesigns of existing roads.
4. To contribute to making a fundamental, long-term shift in approach: system-based design needs to be incorporated into all future modifications and expansions to the road system through the modernisation of thinking and practices. The continuation of practices that actively trade lives and health for economic benefits is unacceptable.

The long-term goals of the strategy for travel on the roads of the Mornington Peninsula are:

- On roads with speed limits above 80 km/h to be protected by mid- and/or side barrier to minimise serious and fatal head-on and run-off-road crashes;
- Where the use of barriers is not practical or desirable (for environmental or other reasons), road users travelling in at least a 2025 5-star vehicle should be protected by speed limits of 80 km/h or lower and supporting treatments such as sealed shoulders, linemarking, signage and guideposts. It is not yet clear whether this combination of measures will be able to eliminate the majority of fatal and serious trauma on this class of road and the effectiveness of this combination should be monitored regularly;
- At intersections, entry speeds will not be greater than 50 km/h or, where this is not feasible, conflicts minimised;
- Residential areas will be limited to 30 or 40 km/h travel and designed for these speeds
- Townships and other places used for social and business purposes will not only be safe, but enjoyable and will provide a high level of liveability;
- Around schools and other educational facilities and places where children, senior citizens or mobility-impaired people live or gather will be limited to 30 or 40 km/h;
- Walking and cycling should be low-risk and convenient choices for short to medium length journeys;
- Access to coastal and tourist attractions, local events and sporting, recreational and entertainment venues will aim to present the lowest practicable risk.

In accordance with the principles of the Safe System approach, road users will be sufficiently trained and competent drivers and riders will recognise that road safety is a shared responsibility. In conjunction with Victoria Police, road users will be encouraged and supported to comply with key rules including driving within speed limits, driving, riding and walking unimpaired; using seat belts and child restraints and driving or riding only when authorised.

Cyclists and motorcyclists will be supported to wear helmets and appropriate protective clothing. Motorists will be encouraged to purchase or travel in five-star safety rated vehicles and motorcyclists to select and use motorcycles equipped with anti-lock braking systems (ABS) and any new safety

technologies projected to show substantial benefits, such as motorcycle electronic stability control (ESC).

An essential element of making tangible progress towards zero deaths and the elimination of serious injury is the use of sound principles sand robust evidence to drive innovation. The Shire supports undertaking trials or demonstration projects following Safe System principles, design innovation, technologies and programs, with human-centred design integrated where possible with planning, development, design and maintenance processes.

This strategy considers both Shire managed and state managed roads as this gives a full picture of road trauma within the Mornington Peninsula. While the Shire has control over Shire managed roads, reducing road trauma on arterial roads will require advocacy and collaboration with Department of Transport, Safer Roads and Road Safety Victoria.

3.2 Movement & Place

As the many natural benefits to society arising from increased liveability of urban places and vibrant streets are recognised, greater attention to the qualities of Place is vital for walking and cycling, not only in metropolitan areas, but also increasingly in regional cities and towns. In these environments, motor vehicles have been allowed to dominate, resulting in poor outcomes for pedestrians and cyclists who are highly vulnerable in crashes.

The Movement & Place (M&P) concept guides the appropriate uses of roads and streets, taking into consideration—for example—movement function and transport mode priorities, while fully accounting for actual and desired land use. This integration process is inherently complex. By developing M&P guidance, including appropriate levels of service for each mode, optimal elements meeting Safe System performance can be identified for all road users.

The M&P framework is being increasingly used to guide transport planning in delivering a more integrated transport system to improve road user outcomes and support the full range of user groups, especially those who are unprotected in traffic. Work is already underway in some jurisdictions to integrate Safe System principles and treatments within the Movement and Place Framework to safely cater for all road users and enable more proactive and lasting road safety benefits. This is particularly important for the liveability of places and vibrant streets, where greater numbers of pedestrians and cyclists gather. They are inherently more vulnerable in crashes and, in some environments, highly exposed to the risk of crashes.

A recent Austroads project developed written guidance (Corben, 2020) for Australasian jurisdictions to support the transition to safe use of roads and streets by pedestrians and cyclists. Those who design and operate the road transport system can be guided when upgrading existing roads and streets or designing new roads, and so achieve large and lasting reductions in risk. By integrating Safe System principles for pedestrians and cyclists into the Movement and Place Framework, jurisdictions can move close to eliminating deaths and serious injuries to pedestrians and cyclists from their roads.

The report sets out a process for assessing how well-aligned specific measures for pedestrians and cyclists are with Safe System principles, using the following evidence-based criteria:

- a severe injury (or death), given a crash;
- the likelihood of a crash occurring, given the volumes of vehicles;
- crashes due to the exposure of pedestrians and cyclists to traffic volumes.

The first of these three criteria, that is, the assessment of injury risk, in the event of a crash, is fundamentally important to the approach.

To deliver Safe System-aligned risk levels, travel speeds should not exceed of 30 km/h where vehicles interact with pedestrians and cyclists. Where such speeds conflict with M&P considerations effective physical separation must be provided to ensure Safe System principles are met, otherwise pedestrians and cyclists will continue to be exposed to unacceptable levels of risk while mixing with vehicular traffic. The report notes that "While this logic is simple and clear, it presents challenges for society in deciding what comes first – protecting the lives and long-term health of individuals or maximising the efficiency of the road transport system to deliver mobility and access."

Typical treatments in urban areas where pedestrians and cyclists are present include a reduction in the current 50 km/h urban default speed limit, speed platforms, roundabouts with 'wombat' crossings, raised intersections and other design changes that secure speeds to 30 km/h. In the case of cyclists on roads with higher travel speeds, physical separation, in the form of segregated cycle paths, is needed to meet Safe System principles. This general approach to managing speeds to protect the lives of pedestrians has been used with great success in many European cities, such as Gothenburg, Stockholm, London and Oslo. In the case of Oslo, the city recorded a fatality-free year in 2019 for pedestrians and cyclists, with only one fatality—involving a vehicle occupant—occurring across the entire city last year[8].

Movement and Place is now being widely used by the Department of Transport and other agencies to bring a better balance between the importance of movement on particular roads and the value of the place through which roads pass. Roads of high movement value tend to operate at high speeds in non-built up areas and at the higher end of the range of urban speeds in cities and towns. The value assigned to 'place', and the extent of road use by the most vulnerable road users, can moderate these speed values.

The Victorian M&P framework and family definitions is shown in Figure 2. It comprises six street families with M5 having the lowest and M1 the highest movement classification, and P5 having the lowest and P1 the highest place values (Department of Transport, 2019).

[8] See: https://www.smh.com.au/national/nsw/oslo-cut-road-deaths-to-one-in-2019-can-sydney-do-the-same-20200111-p53qmz.html

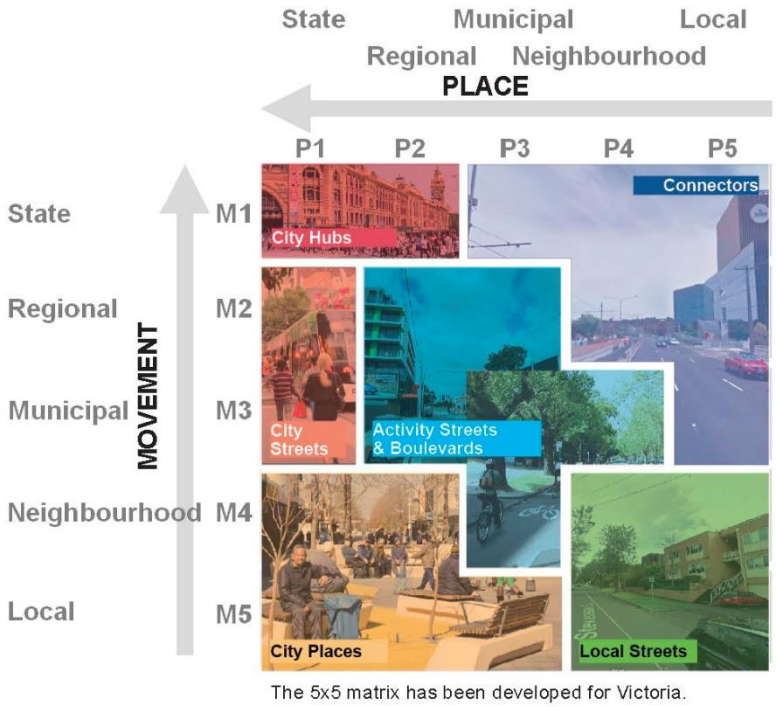


Figure 2: Proposed Movement and Place framework showing road/street families. *After Department of Transport (2019).*

The following descriptions of the Movement and Place categories have been taken from Department of Transport (2019).

3.2.1 City Hubs

City Hubs are dense and vibrant places that also have a high demand for movement and act as focal points for businesses and culture. City Hubs should aim to reduce the impact of high traffic volumes while accommodating high pedestrian numbers, multi-modal journeys and access to public transport and essential emergency services. Pedestrians are present in significant numbers, accessing the City Hub as a final destination as well as traversing between transport interchanges, commercial and retail destinations within. Cyclists are present in large and increasing numbers, both privately and undertaking commercial delivery services. City Hubs contain major public transport interchanges, resulting in the challenges of the introduction of large vehicles into the traffic setting, particularly in conjunction with pedestrians. Finally, significant levels of general traffic are present, including taxi and rideshare/ride hailing services.

The types of facilities found in City Hubs include:

- places of employment
- entertainment, retail and restaurant precincts
- recreation facilities and open spaces
- special event venues such as sporting stadiums
- major transport interchanges.

The Mornington Peninsula has no areas classified as City Hubs.

3.2.2 City Streets

Compared with City Hubs, City Streets have a similarly high place value, but less emphasis on movement and aim to provide a world-class pedestrian friendly environment. They aim to support businesses, on-street activity and public life while ensuring excellent connections with the wider transport network. City Streets are also characterised by high levels of cycling and walking, public transport connections and high levels of general traffic. Typical facilities are similar to those found in City Hubs.

Mornington Peninsula has very few City Streets and has had only one serious injury in the most recent five-year period.

3.2.3 City Places

City Places are roads and streets with high demand for pedestrian activities and lower levels of vehicle movement. City Places are places dedicated to the value of communities and for people and visitors to enjoy. Pedestrian activity should be prioritised in City Places, and consequently while cycling should be encouraged as a means of access, it is important to manage their movements within these areas for the safety and comfort of pedestrians. Public transport connections are also important, with interchanges carefully designed to provide a safe environment for pedestrians. General traffic is of low priority, with speeds managed to afford a low risk environment for pedestrians.

City Places on the Peninsula contribute only around two serious injuries each year to the road trauma burden of the Shire.

3.2.4 Activity Streets and Boulevards

Successful Activity Streets and Boulevards provide access to shops and services by all modes. There is high demand for movement as well as place with a need to balance different demands within the available road space. Activity Streets and Boulevards aim to ensure a high-quality public realm with a strong focus on supporting businesses, traders and neighbourhood life and thus potentially present the greatest road safety challenges in striking a balance between the values of movement and place. In comparison to City Hubs, City Streets and City Places, more freight must be accommodated on Activity Streets and Boulevards, including service/construction and delivery vehicles.

Mornington Peninsula experiences around 9% of annual road trauma on Activity Streets and Boulevards, with about 16 people admitted to hospital annually.

3.2.5 Local Streets

Successful Local Streets should provide quiet, safe and desirable residential access for all ages and abilities that foster community spirit and local pride. They are part of the fabric of residential neighbourhoods and facilitate local community access. In Local Streets, walking should be encouraged, but is rarely concentrated. Pedestrians should be able to move freely between residences, public facilities as well as being able to walk for exercise and pleasure. Cycling is also commonplace and should be encouraged for children to access schools and to support principal cycling networks away from Connectors. Public transport is represented primarily by buses, with safe infrastructure needing to be provided for their efficient operation. General traffic and freight are permitted primarily for access and to provide connections to roads of higher movement function.

Key places within Local Streets include:

- residential dwellings
- local public transport bus and tram stops
- community facilities
- parkland, playgrounds and sporting fields
- schools and kindergartens.

Local streets are a common road type on the Peninsula and generate the second-highest numbers of fatalities (an average of three annually) and serious injuries (around 70 each year).

3.2.6 Connectors

Successful Connectors should provide safe, reliable and efficient movement of people and goods between regions and strategic centres and mitigate the impact on adjacent communities. While not a major priority, pedestrians and cyclists still need to be accommodated on this road type, particularly where Place value is high and present significant challenges to road designers with regards to accommodating cyclists and parking, or pedestrians at busy intersections where signal timings need to favour traffic flow. Similarly, Connectors are used to move people on public transport and care needs to be taken at bus stops and other public transport interchange points. General and freight traffic should be catered for specifically by this road type, with safe infrastructure and appropriate speeds allowing high volumes of traffic to be carried over sometimes significant distances.

On the Peninsula, an average of four people is killed annually and 90 seriously injured on Connectors.

3.3 Strategy development philosophy

The strategy development philosophy will comprise two main components, each with different time frames. The primary component aims to transform the Peninsula's road network to create large and lasting reductions in fatality and serious injury (FSI) risk. The second component is required to complement the primary component by managing risk for high-risk groups while the transformation of the network takes place over the next 30 years.

3.3.1 Safe System Transformation

The cornerstone of the strategy for MPS is to match speed limits and infrastructure such that the principles of the Safe System are achieved throughout the Shire. With this as the prime directive, issues relating to Safe Road Use, Safe Vehicles and enforcement will be used to address the residual issues or help ensure road user compliance.

The general principles by speed zone are as follows:

1. **Greater than 80 km/h**: if the route has a movement priority (M1-M3) and few vulnerable road users, wire rope safety barrier in both the mid and side positions is the favoured route treatment. Intersections should be either (a) removed through grade separation; (b) the number of conflict points minimised (e.g. restrict access to low-volume side roads, left-in left-out) or; (c) conflicts brought to within Safe System limits through the conversion to roundabouts, vertical deflection and/or local intersection speed limits. If the high-speed route does not have high movement priority, the speed limit should be reduced to 80 km/h or less. Where vulnerable road users are present (or prioritised), they must be either separated onto cycle lanes and footpaths (for high movement roads) or speed limits reduced

for M4 and M5 category routes. Pedestrians and cyclists also require safe places to cross, as well as when moving along roads as cyclists.

2. **80 km/h**: without physical separation this travel speed is currently believed to be marginal from a Safe System viewpoint, but relies on advanced vehicle technology to reduce impact speeds through pre-crash braking. Furthermore, 80 km/h appears to be becoming acceptable to the community on undivided rural roads of the type common on the Peninsula. Modern vehicle safety systems are likely to have a high probability of preventing serious injury or death at mid-block locations at 80 km/h, provided crash incidence is minimised through the fitment of active lane guidance systems (and carriageways are clearly painted with edge and centrelines). It is anticipated that by 2050, the majority of the Victorian vehicle fleet will have 2025 vehicle safety features (based on the average vehicle life of 20-25 years). The safety performance of such road lengths must be actively monitored to determine whether further measures are required. Supporting measures such as sealed shoulders, tactile edge and centre linemarking, guideposts, and signage may be appropriate to improve safety, although will not be sufficient alone. Where vulnerable road users need to be accommodated, they should be separated as far as practicable, to avoid FSI involvement. Intersections will need to be addressed in the same way as for roads of greater than 80 km/h.
3. **Less than 80 km/h**: where there is no pedestrian activity demand, existing speed limits of 70 km/h and below are unlikely to be problematic in a typical modern vehicle with current crash avoidance systems and five-star crashworthiness. In areas of high pedestrian and cyclist activity, speed limits should be reduced to no higher than 30 km/h, supported by traffic-calming measures wherever practicable, and pedestrians should be sufficiently separated from vehicles with footpaths and appropriate road crossing facilities. In areas of high pedestrian activity or high place value (such as in main shopping strips), measures to reduce exposure (i.e. reduce traffic volumes) could be considered, although these would not be considered Safe System on their own. Intersections will need to be reconfigured to prevent right-angle crashes at greater than 50 km/h. Where cyclists are present in areas where 30 km/h speed limits are not appropriate, they should be provided with safe facilities and separated from motorised traffic as far as is practicable.

3.4 Safe System initiatives

3.4.1 Introduction

To illustrate the magnitude of reductions in the risk of death and serious injury that can be expected from some of the measures proposed for implementation, the following treatment types have been evaluated and found to substantially decrease the risk of serious trauma outcomes:

- Roundabouts: estimated 80 to 90% reductions at intersections;
- Continuous flexible mid/median and side safety barriers: estimated 85% for lane departure crashes on roads with speed limits above 80 km/h;
- Speed limit reductions from 100 to 80 km/h: around 30% reduction in deaths and 20% reduction in serious injuries for travel speed reductions of 95 to 85 km/h. Clearly even greater benefits can be realised from full compliance;

- Speed limit reductions from 50 to 40 km/h in residential streets and areas of high pedestrian activity: estimated 30 to 40% reduction in pedestrian fatalities[9]. 30 km/h speed limits with high levels of compliance would virtually eliminate pedestrian fatalities.

While the above estimates are indicative, actual benefits and cost-effectiveness can be enhanced by sensitive design and selective deployment of measures. Speed reductions in particular are highly sensitive to resultant travel speeds, with a 15 km/h reduction in rural travel speeds instead of 10 km/h increasing the benefits substantially, and therefore widespread methods to improve compliance will maximise the outcomes of this treatment type.

3.4.2 Treatments

This section describes in greater detail the types of investments that will be needed in safe infrastructure and speed management to reach close to zero FSIs by 2050.

Tables 1, 2 and 3 set out indicative design forms that:

- target the systemic crash types relevant to each setting and, in aggregate, account for a major proportion of FSIs within the Shire;
- focus attention on three main M&P families in Mornington Peninsula Shire, namely Connectors, Local Streets and Activity Streets & Boulevards;
- address the three broad categories of speed limit that exist across MPS (i.e., >80 km/h, 80 km/h and <80 km/h). Finer differentiation of speed limits is needed below 80 km/h to reflect the different attributes of place on these roads;
- are assessed as meeting Safe System principles for design and operation – this entails the application of system-based design, which is human-centric in nature, and combines compatible groupings of latest proven vehicle safety technologies, road and roadside design forms, and assumptions about future speed limits to create the lowest practical levels of residual risk (reference the Zero 2050 work of Moon et al.).

Ticks (✓) appearing in the tables indicate a Safe System aligned treatment likely to be appropriate to the specific combination of M&P family and speed limit, while crosses (✗) indicate a Safe System aligned treatment forms unlikely to be suited to the specified M&P family/speed limit combination. In a limited number of cases, a yellow tick (✓) has been used to indicate that there is a lack of robust evidence on how effectively key vehicle safety technologies will perform in the future for some combinations of systemic crash type and speed limit, or how suitable the treatment might be for the M&P family and speed limit under consideration. Combinations of treatment types and M&P families annotated in this way could be the focus of future trials of alternative road cross-sections to assist in determining the future design requirements to achieve Zero 2050.

If implemented progressively over the years ahead, these measures are expected to set the Shire on a course for near-zero deaths and serious injuries by 2050.

The design forms shown in these tables are not intended to be exhaustive or absolute. Rather, they offer guidance, based on the latest available knowledge on treatment effectiveness, and on how the

[9] Recent work by the authors suggests that the benefits of a 5 km/h reduction from 45 km/h to 40 km/h could lead to 45-50% reductions in pedestrian fatalities and 3-22% reduction in combined fatality and serious injury risk (for older and middle-aged pedestrians respectively) (Logan, Corben and Lawrence, 2019).

For a middle-aged cyclist travelling at 25 km/h involved in a right-turn-against conflict with a car at 40 km/h instead of 45 km/h, fatality risk is predicted to reduce by 40% and combined FSI risk by 10-15%.

Shire can move, together with its partners, to a road transport system that exposes users to vastly lower levels of risk. Unlike many other road safety measures such as increased driver education, these measures can be expected to create lasting reductions in the risks of severe injury because they address the intrinsic risk inadvertently designed into the system and/or inherited as a result of a slowly evolving road system that pre-dates modern motorised travel.

Several qualifying comments have been included as footnotes in an attempt to accommodate the diverse array of road user types, physical settings and permitted travel speeds. Put another way, the determination of the most appropriate design form for a particular intersection or road length is not always clear-cut, and therefore a range of Safe System aligned options are provided to help in making informed choices. As a general observation, lower speed limits have a lower requirement for costly infrastructure designed to ensure low residual risks for FSIs.

The thinking embedded in this work seeks to define the combinations of infrastructure and speed needed to achieve close to zero by 2050. However, these combinations are based on the expected performance of modern (2025) five-star ANCAP rated vehicles as they fully penetrate the Victorian vehicle fleet over the coming 20-30 years. In the intervening period, investment priorities will need to consider what is required to eliminate risk until the composition of the Victorian vehicle fleet is capable of handling many of today's safety challenges. For some parts of the network of roads within the Shire, it will be possible to move directly to a design form that meets the Zero by 2050 aspiration, while in other cases, a cost-efficient transition path will need to be defined. Relatively low-cost interim measures including more comprehensive and consistent application of signage, line-marking, sealed shoulders, rumble strips on approaches to high risk intersections, intersection lighting and the like should be applied to all roads in the Shire. It should be emphasised, however, that these are not Safe System, but rather minimum good practice and will be required in many environments to support emerging high level vehicle driver assistance systems and future self-driving vehicles.

Table 1. A guide to indicative Safe System-aligned intersection designs by M&P Family and speed limit.

M&P Family [10]/ Speed Limit[11]	Connectors			Local Roads			Activity Streets and Boulevards		
	>80	80	<80	>80	80	<80	>80[12]	80[13]	<80
Roundabouts[14]	✓	✓	✓	✓	✓	✓	n/a	n/a	✓
Grade-separation	✓	✓	✗	✗	✗	✗	n/a	n/a	✗
Left-in, Left-out[15]	✓	✓	✓	✓	✓	✓	n/a	n/a	✓
Closure of side roads to remove intersections	✓	✓	✓	✓	✓	✓	n/a	n/a	✓
Traffic signals with safety platforms	✗	✓	✓	✗	✗	✗	n/a	n/a	✓
Traffic signals with innovative intersection designs (e.g. cut-throughs)[16]	✗	✓	✓	✗	✗	✗	n/a	n/a	✓
Stop/give way signs with safety platforms	✗	✗	✓	✗	✓	✓	n/a	n/a	✓
Stop/give way signs with raised intersections	✗	✗	✓	✗	✓	✓	n/a	n/a	✓
Side road activated speeds (SRAS)[17]	✓	✓	✓	✓	✓	✓	n/a	n/a	✗
Permanent localised intersection speed limits	✗	✓	✓	✗	✓	✓	n/a	n/a	✓

[10] Highest M value of the specific intersecting roads

[11] Highest speed limit of the specific intersecting roads

[12] Speed limits of 80 km/h and higher are not considered appropriate for Activity Streets & Boulevards

[13] *See previous note.*

[14] Including zebra crossings on platforms and/or separation for cyclists, as applicable to the M&P setting, particularly regarding the Place value assigned

[15] Need safe and convenient U-turn option when requiring left turn only

[16] See Appendix B.

[17] The Side Traffic Activated Reduced Speeds treatment is only Safe System if the activated speed is 50 km/h or below

Table 2. A guide to indicative Safe System-aligned mid-block designs by M&P Family and speed limit.

M&P Family/Speed Limit	Connectors			Local Roads			Activity Streets and Boulevards		
	>80	80	<80	>80	80	<80	>80[18]	80[19]	<80
Flexible mid-barrier[20]	✓	✓	✓	✗	✗	✗	n/a	n/a	✓
Flexible side-barrier[21]	✓	✓	✓	✗	✗	✗	n/a	n/a	✓
Wide tactile centre-line	✗	✓	✓	✗	✓	✗	n/a	n/a	✗
Tactile centre-line	✗	✓	✓	✗	✓	✓	n/a	n/a	✓
Tactile edge lines	✓	✓	✓	✗	✓	✓	n/a	n/a	✓
Sealed shoulders	✓	✓	✓[22]	✗	✗	✗	n/a	n/a	✗
Short lengths of safety barrier	✗	✓	✓	✗	✓	✓	n/a	n/a	✓
Reduced speed limit[23]	✓	✓	✓	✓	✓	✓	n/a	n/a	✓

[18] Speed limits of 80 km/h and higher are not considered appropriate for Activity Streets & Boulevards

[19] *See previous note.*

[20] In general, flexible mid- and/or side-barriers should be provided continuously over entire routes exhibiting the same or similar levels of risk. Short sections should be limited to localised hazards along an otherwise low risk route

[21] In general, flexible mid- and/or side-barriers should be provided continuously over entire routes exhibiting the same or similar levels of risk. Short sections should be limited to localised hazards along an otherwise low risk route

[22] Sealed shoulders are not considered a Safe System countermeasure and their effectiveness in lower zones may be lower than in higher speed zones.

[23] Reduced speed limits are potentially applicable to all scenarios but may be deemed undesirable for roads that serve a high movement function (e.g., M1 or M2 within the M&P framework)

Table 3. A guide to indicative Safe System-aligned mid-block designs for pedestrians and/or cyclists by M&P Family and speed limit.

M&P Family/Speed Limit	Connectors			Local Roads			Activity Streets and Boulevards		
	>80	80	<80	>80	80	<80	>80[24]	80[25]	<80
30 km/h speed limits[26]	✗	✗	✓	✗	✗	✓	n/a	n/a	✓
with Zebra crossings	✗	✗	✓	✗	✗	✓	n/a	n/a	✓
with medians or pedestrian refuges	✗	✗	✓	✗	✗	✓	n/a	n/a	✓
with on-road cycle lanes	✗	✗	✓	✗	✗	✓	n/a	n/a	✓
Wombat crossings (raised zebra crossings)	✗	✗	✓	✗	✗	✓	n/a	n/a	✓
Car-free streets[27]	✗	✗	✗	✗	✗	✓	n/a	n/a	✓
Pedestrian malls	✗	✗	✗	✗	✗	✓	n/a	n/a	✓
Shared space[28]	✗	✗	✗	✗	✗	✓	n/a	n/a	✓
Footpaths	✓	✓	✓	✓	✓	✓	n/a	n/a	✓
Grade-separation	✓	✓	✓	✗	✗	✗	n/a	n/a	✗
Fully segregated cycle paths	✓	✓	✓	✓	✓	✓	n/a	n/a	✓
Intersection with protected pedestrian and bicycle facilities	✗	✓	✓	✗	✓	✓	n/a	n/a	✓
Reduce speed limits, where >30 km/h[29]	✓	✓	✓	✓	✓	✓	✓	✓	✓

[24] Speed limits of 80 km/h and higher are not considered appropriate for Activity Streets & Boulevards

[25] *See previous note*

[26] Reduced speed limits are potentially applicable to all scenarios but may be deemed undesirable for roads that serve a high movement function (e.g., M1 or M2 within the M&P framework)

[27] Potentially time-based

[28] With raised textured pavements and 10 km/h speed limits

[29] Reductions in speed limit should be regarded as a default treatment alternative, as they reduce risk for all road users, especially pedestrians, cyclists and motorcyclists (and other unprotected road users). However, they are not Safe System aligned unless travel speeds are 30 km/h or lower

Motorcyclists

The loss of life and health for motorcyclists is unacceptable both within the Shire, and across Victoria and Australia. Motorcyclists made up 13% of all FSIs on Peninsula roads during the five years to mid-2018. These crashes were distributed primarily across Connector Roads (48%) and Local Roads (41%).

Given a major reason for choosing motorcycling as a mode of transport or as a form of recreation is the pleasure and freedom offered from riding at today's speeds and with high acceleration, it is unlikely that riders will readily accept riding at lower speeds, which have intentionally been matched to their vulnerability to death and severe injury when a crash occurs. However, while it will be necessary in the future to invest heavily in Safe System-aligned infrastructure on high movement routes and implement speed moderation on roads deemed not to be economically vital to the Shire or state, motorcyclists who use these less significant roads will undoubtedly benefit from the lower travel speeds. Notwithstanding these safety gains, motorcycling is likely to continue to operate beyond the biomechanical tolerance of riders to severe injury.

Generally, in Victoria motorcyclist fatalities and serious injuries commonly involve single-vehicle or head-on collisions on high speed roads, and collisions with motor vehicles at intersections[30]. In the latter instances, car drivers commonly fail to give way to riders when making turns at traffic signals or when crossing a main road or turning into a main road. While there are few design forms aligned with the Safe System principles for motorcyclists, mainly because motorcycle and other vehicle travel speeds are today too high for safe outcomes, some design forms are effective in reducing death or serious injury risk to riders in these common crash types. They include:

- roundabouts, which have a similar level of effectiveness for riders as for all road user types – around 80 to 90%;
- fully controlled right turns at traffic signals, where the motorcyclist is the through vehicle – an approximate halving in motorcyclist-involved casualty crashes (Scully, Newstead, Corben and Candappa, 2009);
- centre and median barriers, which have been found to prevent head-on collisions involving motorcyclists. International studies have demonstrated a 40-50% reduction in motorcyclist fatalities where centre barriers had been installed in Sweden (Carlson, 2009). Experience in Victoria revealed an estimated 74% reduction in fatal and serious injury crashes involving motorcyclists, where barrier protection programs have been implemented (Cairney et al., 2015);
- lower speed limits – a statistically reliable reduction in motorcyclist-involved casualty crashes in reducing speed limits from 100 to 80 km/h (Scully *et al.*, 2009).

3.5 Supporting and facilitating initiatives

The combination of human-centred speed limits and Safe System infrastructure is the mainstay of this road safety strategy; however there are several supporting initiatives from the other Safe System cornerstones that are also important in supporting the most effective operation of Safe Speeds and Safe Roads & Roadsides.

[30] On the Mornington Peninsula, 48% of motorcyclist FSI are single vehicle loss-of-control (including 21% loss-of-control on carriageway), 18% at intersections (including right-turn-against oncoming vehicle), 11% rear end, 6.5% head-on and 6.5% crashes while overtaking (mostly DCA 152, 'pulling out').

The Council has an unprecedented opportunity to demonstrate leadership by purchasing only affordable, five-star fleet vehicles and municipal transport services. This fleet should also be operated in accordance with best-practice safe use policies. Council should consider the fitment of Intelligent Speed Assist (ISA) to regulate vehicle travel speeds and alcohol interlocks to ensure maximum compliance. In adopting such a forthright role, Council will be well-placed to lead by example in promoting safe vehicle purchase and use among local industries, businesses and the general community. Where appropriate, Council could also consider offering itself as a testbed for trials of new vehicle technologies including advanced driver assistance systems (ADAS), connected vehicle trials or semi- and fully automated vehicle trials.

To strengthen its understanding of and commitment to low risk use of roads on the Peninsula, Council will continue to support full take-up of Towards Zero programs targeting safe road use, especially but not solely for high-risk groups. Ongoing liaison with the TAC will be important to ensure that the selected suite of programs remains current and relevant. Safe road use programs and initiatives that could be considered for adoption, continuation or expansion include:

- **Supporting road users to comply** – work collaboratively with Victoria Police to conduct enforcement on high-risk roads and for high-risk behaviours, and to reinforce compliance at locations where speed limits have been reduced. This should be supported by advertising in advance in municipal press and social media channels. The Slow Down Kids Around program should be considered for use in conjunction with reduced speed limits to improve its impact, while the portable post-based and trailer-mounted speed feedback signs are potentially of benefit (particularly to reinforce recently-altered speed limits) and would also be amenable to a simple evaluation based on vehicle speed measurements to gauge their effectiveness;
- **Safe vehicle use** – develop/adapt a Safe Driving Policy for Shire staff that can also be adapted for businesses within shire boundaries. This policy should be endorsed formally by Council (funding potentially available from the Commonwealth Road Safety Innovation Fund[31]);
- **Safe vehicles** – develop/adapt a Safe Vehicle Purchase/Lease Policy for promotion among businesses within the shire and post results of audit (refer to Commonwealth Road Safety Innovation Fund). Local Chambers of Commerce may be willing to assist with encouraging local businesses to adopt this initiative;
- **Safe vehicles** – liaise with car show rooms to focus on five-star cars and to enable sales staff to speak with confidence with regard new technologies and their benefits;
- **Alcohol use in the community** – review and set appropriate alcohol licensing conditions for council-owned venues and related activities, such as for sporting facilities, functions attended by children and adults, Council meetings, dinners and functions, and separating drinking from driving as a condition of driving council-owned/leased vehicles (refer to Australian Drug Foundation Good Sports initiative[32] for further guidance). Public breath testing machines in licensed premises could be a condition for alcohol service, or at least of benefit to patrons;
- **Community education** – conduct one or more Municipal Road Safety Forums with advance notice to all households on issues such as protecting the most vulnerable road users and vehicles, technologies and safety (refer to Commonwealth Road Safety Awareness and Enablers Fund[33]);

[31] See: https://www.officeofroadsafety.gov.au/programs

[32] See: https://adf.org.au/programs/good-sports/

[33] See footnote 31.

- **Family-focused education** – promote tailored age-specific information to families with children aged up to 10 years, with information including level of development, suitable restraints, availability of restraint checking, supervision as a pedestrian and vulnerability etc. (refer to Commonwealth Road Safety Awareness and Enablers Fund[34]);
- **Early childhood safety** – provide tailored information to and meet with childcare centres and kindergartens to provide age appropriate information for both parents and their children. For children under five years of age, explore options to use policy templates[35] developed by the Early Learning Association of Australia (ELAA)[36] to address road safety for Council-operated or supported kindergartens/family day care/childcare centres, including professional development for early childhood educators. ELAA also offers information on child restraints, as does Kidsafe[37], which also run programs on child restraint-fitting. Maternal child health care centre nurses can provide ongoing advice on restraints and other issues for children under five years of age. The currently unfunded child restraint checking program is strongly encouraged to be considered for reintroduction;
- **Secondary student education** – promote in secondary schools the Road to Zero[38] exhibition at the Melbourne Museum, as well as current approved resources for integrating road safety within subject areas. Implementation of Fit2Drive[39] for year 11 students and informing schools of Victoria's Road Smart[40] driving program for year 10 students are noted specifically. The annual TRAG (Teenagers Road Accident Group) presentations could be reassessed, as they may not be the most effective way to engage this road user group;
- **Learners to probationary licence holders** – actively pursue the L2P Program[41], aimed at young people without access to a car or supervising driver;
- **Older people** – promote the RACV 'Years Ahead' Program[42] and consider the potential for Council home care services (particularly for home cleaning services) to assess client abilities to continue safe driving and/or safe use of roads as a pedestrian, on a mobility scooter or similar. Also consider using Council occupational therapists to develop safe walking/safe mobility routes for older residents, an initiative which could be supported by apps such as Walk this Way[43]. The current Senior Driving Expo and Wiser Driver programs are worthy of retention.

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[34] See footnote 31.

[35] See Starting Out Safely: https://childroadsafety.org.au/.

[36] See ELAA Free Policies for the Early Childhood Sector: https://elaa.org.au/resources/free-resources/free-policies-early-childhood-sector/.

[37] See Kidsafe, Car and Road Safety: https://kidsafe.com.au/car-road-safety/

[38] See "Road to Zero: Road Safety Experience": https://museumsvictoria.com.au/melbournemuseum/learning/school-programs-and-resources/road-to-zero-road-safety-experience/

[39] See: https://www.f2d.com.au/

[40] See: https://www.vicroads.vic.gov.au/safety-and-road-rules/road-safety-education/secondary-schools/road-smart

[41] See TAC L2P Program: https://www.vicroads.vic.gov.au/licences/your-ps/get-your-ps/preparing-for-your-licence-test/l2p-learner-driver-mentor-program

[42] See: https://www.racv.com.au/on-the-road/driving-maintenance/road-safety/older-drivers.html

[43] See: https://www.peninsulahealth.org.au/wp-content/uploads/Walk-this-Way-app-available.pdf

While the primary focus of these initiatives is on safe road use within the Shire, Council is also concerned to ensure that its residents enjoy safe mobility when travelling beyond Shire boundaries. Contributions to this aim can be achieved in several ways:

- The leadership role adopted by Council when becoming a Towards Zero municipality will serve to inform and inspire others in local government to build capacity and commit to eliminating serious road trauma. The overall effect should be to extend the benefits of safe mobility to places where Shire residents and visitors travel outside of the Shire;
- To help to promote ambitious approaches to trauma elimination, working closely with surrounding municipalities through which Shire residents commonly travel can be expected to build stronger advocacy to government—especially on speed management—and lead to a broader, more rapid deployment of safety improvements. Such alliances also facilitate the sharing of experiences and expertise of benefit to all partners;
- Council's willingness to serve as a demonstration municipality for innovative safety measures aligned with the Safe System and for streamlined approval processes for innovation will accelerate the process of finding solutions to long-standing problems. Such solutions can then be used not just within the Shire, but more widely by state government to address systemic risk across the network.

3.6 Implementation of the strategy

Over the next five years, road safety actions will be prioritised based on reducing the highest crash risks in line with the objectives, goals and recommendations of the Mornington Peninsula Towards Zero 2020-2025 Road Safety Strategy, to drive significant reductions in road trauma over this period and in the long term. To help implement this ambitious road safety strategy, the Shire proposes forming a 'Towards Zero Leadership Team' with its road safety partners. This team will be quickly established and aims to be:

- Agile and enabled
- Autonomous and innovative
- Responsible and strategic

The team will develop new and streamlined procedures to allow high-impact, strategically significant trials and demonstrations to be undertaken on the roads of the Peninsula. Already, the team successfully implemented the 'Safer Speeds' trial, which involved a speed limit reduction on thirty-eight high risk rural roads from 100 km/h to 80 km/h. The effectiveness of trials and demonstrations conducted should be evaluated to demonstrate the extent of their impact and to assist with propagating them throughout the Peninsula and across Victoria.

Safe infrastructure investment would be targeted at those projects predicted to yield the maximum trauma reductions in the short term. The Towards Zero Leadership Team would also work to lay the foundations for a sustainable longer-term program to reduce deaths and serious injuries across the more challenging, diverse or spatially dispersed road trauma crash types.

To provide some overall context for the strategy implementation process, Figure 3 shows an overview of the levels of priority that should be assigned to the high-level implementation tasks of the road safety strategy. As will be discussed later in this section, the key action categories involve matching speed limits with infrastructure quality on municipally-managed roads, as well as advocating for the same on state-managed roads within the Shire. Working towards ensuring safer

vehicles and their use is also considered a Level 1 priority, with effective behaviour change at the next level, operating to support the higher level priorities.

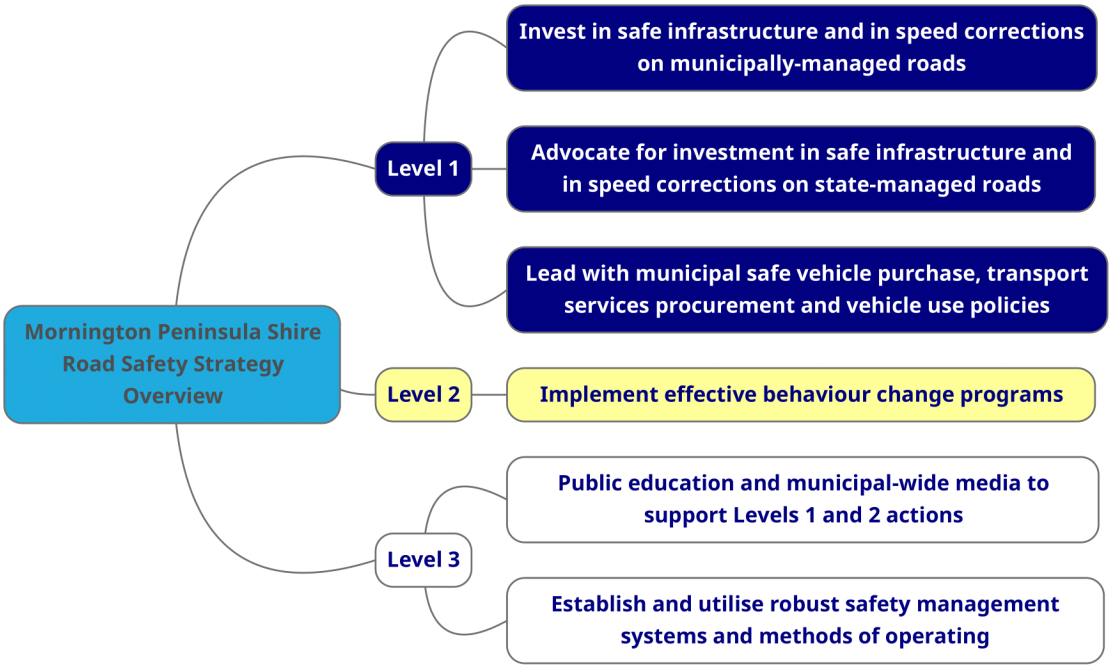

Figure 3. Mornington Peninsula Shire Road Safety Strategy Implementation overview.

3.6.1 The role of leadership

Mornington Peninsula Shire understands the fundamental role of genuine leadership in road safety. For more than a decade, the Shire has sought to be a courageous leader, not only among municipalities, but also in relationships with state agencies and our local community.

Taking on the responsibility of being a Towards Zero municipality involves commitment both to taking positive action at Council level, as well as engaging in active advocacy among the state road safety stakeholders and neighbouring municipalities. The Shire strives to eliminate death and serious injury from its roads through the adoption of the Safe System philosophy and principles, with the long term aim that all journeys on the Peninsula are both safe and feel safe for all road user groups, including cyclists and pedestrians.

Safe System principles and aspirations are already being progressively applied to projects across the Shire. Nevertheless, in the short term the demonstrable benefits of this approach are limited (as they are across Victoria) due to the spatially dispersed nature of road crashes. Furthermore, infrastructure projects are currently subject to long approval timeframes, limited funding and lack of a coordinated system and risk-based approach. The Shire is committed to leading the way in Victoria in finding successful strategies to address these issues.

3.6.2 Partnerships and collaboration

Road safety is a complex issue with a shared responsibility. Given that the direct authority of Council to effect change is limited in many areas, the creation of robust partnerships is vitally important. The Shire recognises the need to strengthen its working relationships with Victoria's road safety partners: the Transport Accident Commission (TAC), Department of Transport, Road Safety Victoria, Victoria Police, the Department of Justice and Community Safety and the health sector. A restructured approach to collaboration between authorities and sectors will assist in modernising the approach to addressing the current road trauma crisis.

The Shire will lead in driving and supporting innovation and ambition aimed at eradicating death and serious injury on the Peninsula, with levels of support aligned with Victoria-wide priorities. For their part, the road safety partners will need to make strong and lasting commitments to rejecting the status quo and implementing meaningful change. Successes and improvements from the rest of Victoria need to be transferred to the Shire and supported with targeted resources, funding and expertise in accordance with Victorian priorities and the upcoming Victorian road safety strategy, as detailed in Section 2.3 (p. 15).

Fundamentally important to success are activities such as the enhanced mobile speed camera program, alcohol breath testing, ongoing improvements to and expansion of random drug testing, the Safer Roads road infrastructure investment and trials, ongoing promotion of safe road use and enhancements to post-crash response and care.

To achieve 'Zero by 2050', the Victorian government will need to modernise and streamline the approval processes that currently need to be negotiated for the design, implementation and evaluation of innovative, Safe System aligned measures. The setting of appropriate, Safe System speed limits is fundamental to system-based design, yet responsibility for approval of speed limit changes on all classes of road resides at state level. The procedures are currently cumbersome, can involve delays of 18 months or more to implementation and will need to be more agile and streamlined if the vision of this road safety strategy is to be fully realised. The Towards Zero Leadership Team will therefore propose that authority for approving changes to speed limits and innovative infrastructure design be delegated to Council.

Innovative treatments need to be subject to comprehensive and scientifically robust evaluations to demonstrate their benefits, limitations and range of applicability. Funding support for those treatments of relevance beyond the Peninsula would be sought from Road Safety Victoria or the other state road safety partners. The Towards Zero Leadership Team would take on the responsibility of developing short and longer term works packages for the allocation of funding.

3.6.3 Application of Safe System principles in infrastructure design and speed limit setting

Below is a process that can be followed by MPS to apply Safe System principles in infrastructure design and speed limit setting, over the next three decades to bring the Shire's network safety performance close to zero by 2050.

1 Review, and either affirm or reset M&P classification for all roads and streets in the Shire;
2 Determine appropriate speed limit for each agreed M&P classification;
3 Invest in infrastructure and/or speed moderation to close gaps between existing conditions and those needed to reach zero by 2050 (refer to Tables 1, 2 and 3 in Section 3.4.2);
4 Undertake trials or demonstrations of innovative combinations of speed and infrastructure to add to the array of Zero 2050 solutions available;

5 Implement the results of successful trials to more comprehensively close gaps;
6 Share knowledge on successes (and failures if applicable) widely to accelerate progress across Victoria.

Note the importance of enforcement and promotional support of the above measures to enhance their safety outcomes. Successful community engagement will serve to build understanding of, and support for, the measures being introduced.

The adoption of appropriate key performance indicators (Section 3.6.5) will drive progress on the application of Safe System principles.

As funding for improving the safety of roads and streets is always going to be limited, transformation to a Safe System will take time and the roads and streets with the highest levels of systemic risk prioritised in order to achieve the largest reductions in the risks of deaths and serious injuries, for the funding available. These important considerations for the prioritisation of future investments are now discussed as part of the Shire's Implementation Plan.

3.6.4 Implementation plan

The key road safety priorities on the Peninsula have been identified through an analysis of fatality and serious injury data. The analysis focused on identification of systemic problems by street family, road geometry, crash type and speed limit. These outcomes provide guidance into the priority areas for proactive risk reduction towards zero fatalities and seriously injured persons by 2050.

To achieve the ambitious long-term goals targeted by this strategy, a coordinated, holistic approach is required coupled with the willingness to show flexibility to fine tune processes as practical experience is accumulated under this new approach.

The implementation plan will include the following elements:

- Establish the Towards Zero Leadership Team. The team will comprise key MPS road safety champions and representatives of the TAC, Department of Transport, Road Safety Victoria, Victoria Police, Department of Justice and Community Safety along with any other relevant organisations as needed. The roles and responsibilities of the Towards Zero Leadership Team will be formalised through a Memorandum of Understanding or similar.
- Identify packages of measures capable of being implemented as demonstration projects on the Peninsula within the first **six to 24 months** of the road safety strategy. Packages will be chosen to address local priorities (as highlighted by the problem analysis), but also for their potential for accelerating the delivery of strategically valuable solutions around the rest of Victoria. Treatments aligned to the Safe System may include:
    - Construction of compact, cost-effective roundabouts at approximately 30 high-speed rural intersections and at up to 50 local street intersections in urban neighbourhoods (external funding would be required to treat this number of intersections). An initial plan for the construction of compact roundabouts is included in Appendix A (p. 67);
    - Implementation of 80 km/h speed limits on more than 45 km of state-managed low volume high-risk rural roads;
    - Establishment of permanent 80 km/h speed limits on the Shire-managed high-risk rural roads, subject to a successful outcome of the two-year Safer Speeds trial in December 2021;
    - Establishment of 40 km/h or lower speed limits, accompanied by supporting low cost traffic calming infrastructure, in all commercial areas with high pedestrian activity

and in local neighbourhoods (of which there are around ten areas). In the case of neighbourhood streets without footpaths, a 30 km/h speed limit should be considered;

- In collaboration with the Victorian road safety partners, develop an action plan and implementation schedule for trials and/or demonstrations able to be undertaken in the medium term (**two to five years**) and longer term (**five to ten years**). The action plan would integrate evaluation of the trials, including internal and external funding requirements. Treatment priorities should be guided by the FSI analysis depicted in Figure 17. Some examples include undertaking trials of:
    - Alternative cross-sections for roads, along which an 80 km/h speed limit is appropriate, to assess the design elements needed to achieve Safe System risk levels;
    - '2+1' safety barriers (on both sides of roads and in the centre of the road), or '1+1' safety barriers (on both sides of the road) for any undivided 100 km/h Connectors where the current speed limit is desired to be retained;
    - Lower speed limits on unsealed rural Shire-managed road that are currently at the 100 km/h default speed limit;
    - Safety platforms at signalised intersections (or other innovative intersection designs) along major routes such as the Nepean Highway/Point Nepean Road;
    - Alternative design forms to existing wide median treatments;
    - 50 km/h speed limits on those roads categorised as 'Local Streets' in the M&P framework (historically known as 'collector' roads), which are currently set at 60 km/h;
    - 30 km/h speed limits on local urban streets without footpaths;

  These treatments are also likely to be of interest Victoria-wide, which will enhance the opportunities for funding and the contribution to reduced trauma beyond the Shire;

- Progress initiatives already proven effective, especially within the Shire, and maintain readiness to rapidly implement proven Safe System treatments in the event of economic stimulus packages or similar (**six to 24 months**).

3.6.5 Key Performance Indicators

Across government and private industry, Key Performance Indicators (KPIs) are widely used to drive performance and report outcomes. In the road safety context, KPIs can assist in supporting and focusing achievement within all the Safe System pillars, particularly with regard to the implemention of system-based design principles. Each indicator should be selected to set an achievable goal, the timeframe for its achievement and be causally linked with the desired overall outcomes.

KPIs are often divided into four main categories:

- Outcome Indicators: achievement measures for the reduction or elimination of death and serious injury, the primary goals of a road safety strategy;
- Intermediate Safety Performance Indicators (SPIs): strategically chosen indicators that are scientifically and causally linked to outcomes. This means that the achievement of SPIs should lead directly to positive and significant changes in the desired outcome indicators;
- Output Indicators: measure program, project and service delivery in pursuit of the SPIs and therefore flow through to the above-mentioned positive impacts on outcomes;
- Input Indicators: measure the physical, human and financial resources directed at achieving the Output Indicators, with the benefits flowing up the chain to the final outcome indicators.

Mornington Peninsula Shire needs to develop a set of Safe System-aligned KPIs with relevant targets to help ensure this road safety strategy is implemented effectively. The KPIs need to be embedded in the organisation to maintain focus and—where appropriate—to engage personnel from outside of road safety, including other divisions, executive management and councillors. The KPIs will need to cover all the Safe System cornerstones, including those for which the Shire may not be directly responsible except in an advocacy or collaborative role. For those where MPS is responsible, well-chosen KPIs will help direct resources ('Inputs') to deliver the required outputs with the confidence that high level targets will be met. It is necessary to support the adoption of KPIs with strong leadership and clearly defined lines of accountability to support and reinforce their importance throughout the organisation.

During the strategy period, progress against the targets of all indicators should be tracked regularly and shared periodically, with a key subset of the most important presented at executive level and to the community. Those goals that are dependent upon collaboration with the road safety partners of the Shire (such as Police and the Department of Transport) should be communicated with the partner organisations to reinforce the importance of the strategy and its success among their representatives. This will help to build the required leadership and commitment within the organisation to the goal of eliminating deaths and serious injuries by 2050.

Some examples of relevant KPIs are shown in Figures 4(a) to (e) below.

Figure 4(a) depicts the four categories of KPI, as described above.

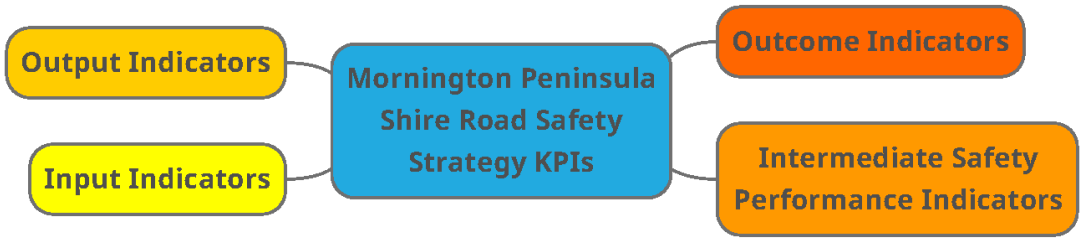

Figure 4(a). Key Performance indicator categories for Mornington Peninsula Shire.

Figure 2(b) shows a typical set of the highest level outcome indicators. These are designed to track the highest level measures of strategy success, namely the progress of road deaths and serious injuries in Mornington Peninsula Shire.

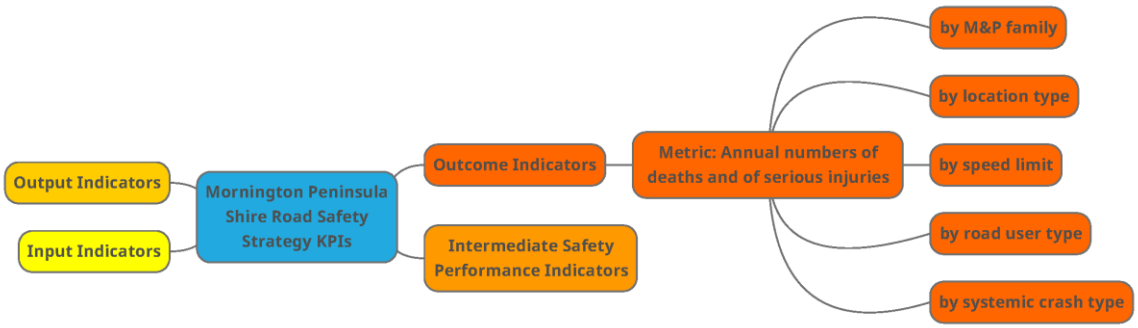

Figure 4(b). Outcome indicators.

Figure 4(c) to 4(e) provide examples of safety performance indicators (SPIs) for roads and roadsides and speed limits (combined), road use and vehicles respectively. Note that these SPIs need to be assessed for the ability to be measured and consequently tweaked in order to be applied successfully in quantifying strategy progress. As mentioned previously, it is clear that a number of them are not the direct responsibility of the Shire and will be therefore important for Shire officers to work with the other road safety organisations and stakeholders to encourage their adoption and regular reporting.

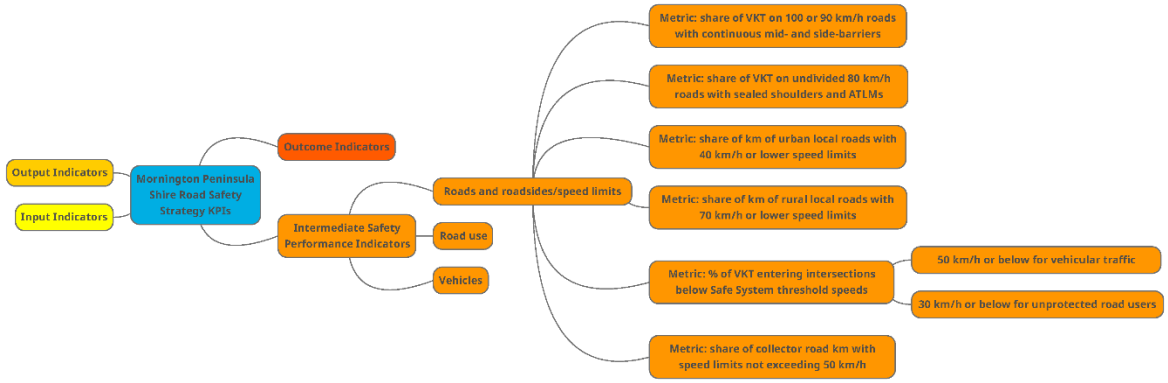

Figure 4(c). Safety Performance Indicators for roads and roadsides, and speed limits.

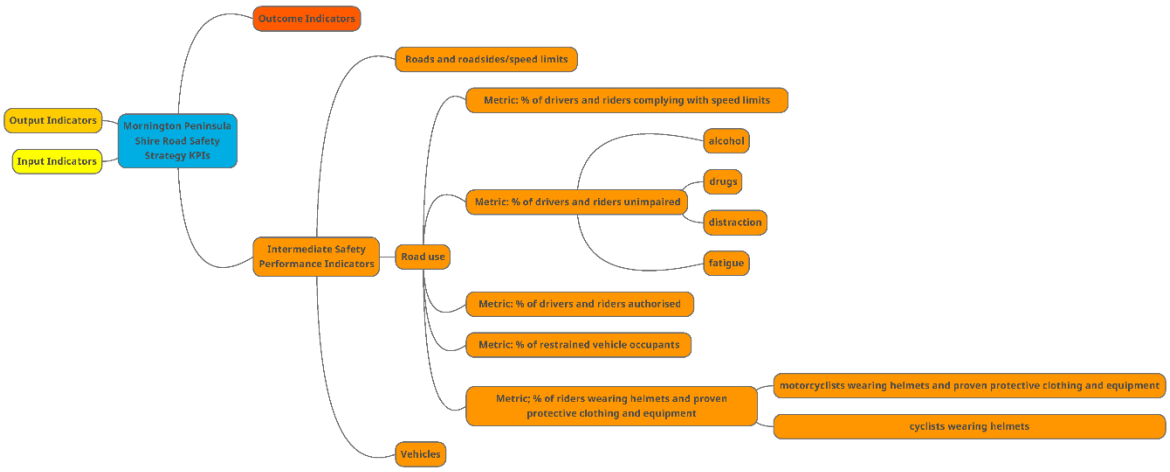

Figure 4(d). Safety Performance Indicators for road use.

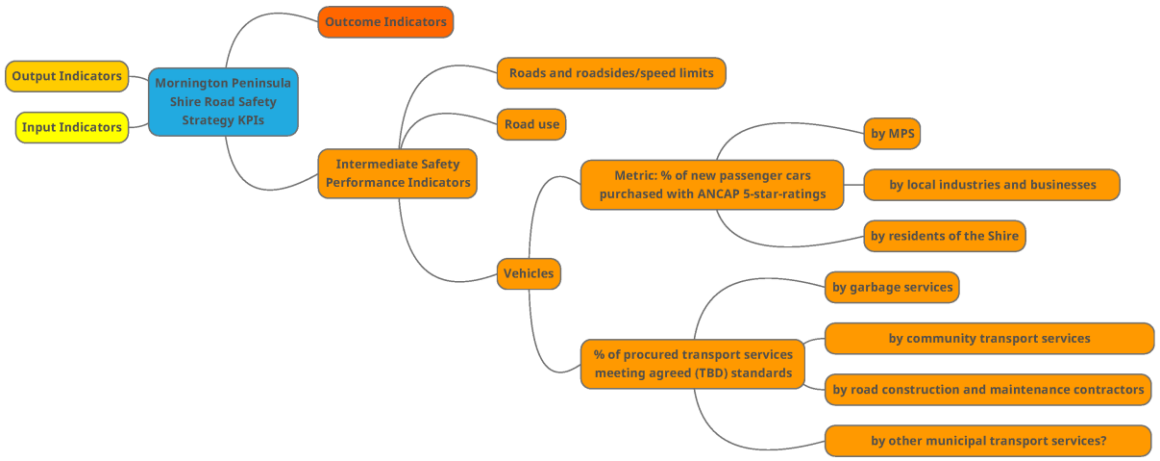

Figure 4(e). Safety Performance Indicators for vehicles.

3.6.6 Identification of capacity building needs

The following priority areas for capacity building have been identified:

- The critical role of strong and courageous **leadership**, especially from state and federal government levels, Councillors and senior executives in local government;
- The need for **strong technical knowledge** of the **Safe System** philosophy and principles and **translating** them into real-world practice;
- A deep and fundamental knowledge of **the role of speed** in crash and injury risk, and how **speed management** can be allowed to play its vital role;
- The need for **major culture change** in the road and traffic engineering professions in the commitment to **innovation** in creating and maintaining an inherently safe road transport system. Culture change must generate **high ambition** and a **strong sense of urgency** in transforming the road system, as rapidly as possible, to achieve **Safe System performance**;
- An ability to formulate, operate and maintain a **comprehensive set of Safe System aligned KPIs** and targets across all road safety partners to enable the Shire to define and navigate its path to near zero serious road trauma over the next 30 years;
- The ability to work in new and better ways, through **collaboration, partnerships and alliances**, with a '**can do' attitude**. **Strengthened partnerships** will be vital to ensuring effective road policing, speed management, safe procurement practices and innovation in **system-design** for roads and roadsides.

3.6.7 Community consultation and engagement

While the prescription of a detailed community consultation program is beyond the scope of this technical strategy document, the Mornington Peninsula Shire has taken on a pivotal role in achieving the aspirational long-term goals of Towards Zero including extensive community engagement, as part of the development of this road safety strategy.

Ongoing community empowerment and engagement is an important aspect of road safety.

To help ensure success of the road safety strategy and ultimately the long term goal of Towards Zero, it is critically important to regularly engage with the community to help build confidence in the

approach through (a) being informed of what it will involve and (b) having an understanding of the benefits that could be realised despite the perceived inconvenience some community members may express initially.

3.6.8 Embedding Safe System into the Shire

In conjunction with the Mornington Peninsula Shire team, the following list of actions was proposed for embedding Safe System thinking into key activities. Together with those featured in Section 3.6.3 (which fall under 'Practical actions' below), they can be considered a guiding list of tasks that need to be integrated, at a foundational level, into road safety and related activities within the Shire.

Road safety leadership and capacity building

- Maintain a high level of road safety commitment and leadership;
- Continually embed road safety into everything that the Shire does;
- Keep up to date with the latest Safe System thinking;
- Regularly engage with the community and our road safety partners.

Maintaining the impact of the road safety strategy

- Develop annual action plans to focus attention and resources on high priority actions;
- Reassess road safety problems at least every 5 years;
- Evaluate progress of the strategy against goals and targets.

Practical actions

- Identify systemic road safety risks and prioritise high impact systemic treatments;
- Identify lower cost quick-win road safety improvements that can be implemented in the shorter term;
- Implement and promote supporting measures under the Safer Road User and Safer Vehicles pillars;
- Advocate for arterial road improvements and other state government support.

4 ROAD SAFETY PROBLEM ANALYSIS

Fundamental to the development of a relevant road safety strategy is the acquisition of a clear understanding of the size and nature of the current problems so that the subsequent strategy can be targeted at the key issues as far as possible. While Corben Consulting has had extensive previous involvement in road safety on the Mornington Peninsula, data analysis was undertaken using the most up-to-date dataset available of fatalities and serious injuries.

4.1 Data sources

The fatality and serious injury dataset for Mornington Peninsula Shire spanned the most recent fully validated five-year period available at the time of the strategy development, from 1 July 2013 to 30 June 2018. Supplied by the TAC, it comprised police-reported fatalities and seriously injured persons (validated against TAC records), supplemented by several additional fields developed by the Victorian Department of Transport and the TAC. The additional severe injury metric of MAIS3+ was also included. The Abbreviated Injury Scale (AIS)[44] is commonly used to express injury severity more objectively than through a hospital admission criterion. MAIS3+ represents a maximum single injury severity value of three or greater and is increasingly being utilised to represent the more severe injury levels[45]. While a five-year period was used for the detailed analysis, data back to 2010 were included to examine longer term trends. The dataset was supplied in text format then converted and analysed using Excel for Office 365 (v16.0.12325.20280). It should be noted that the publicly available police RCIS dataset (Road Crash Information System), from which the TAC-validated data are derived, will record different numbers of fatalities and seriously-injured persons due to corrections made during the validation process. Furthermore, the dataset used for this project ends in mid-2018, with more up-to-date data not available at the time access was obtained. This should not be of concern as: (a) it is unlikely that the outcomes of the data analysis would change from the 18-month shift in the five-year data period and; (b) the strategy philosophy prescribes addressing road safety in a systemic way, independent of short-term variation in numbers.

Restrictions on crash data fields available to MUARC and Corben Consulting did not permit location details to be extracted. The data analysis emphasised the need for a system-based approach rather than one 'chasing' individual crash locations or clusters.

Population data were obtained from the Australian Bureau of Statistics online database where data were retrieved for Mornington Peninsula Shire comprising estimated population by age at 30 June 2018[46].

[44] See: https://www.aaam.org/abbreviated-injury-scale-ais/ (20/01/2020)

[45] Injuries up to AIS level 2 include simple fractures (to the arms and lower limbs), bruises, abrasions and low-level internal injuries. Brain and more severe internal organ injuries are AIS3 or higher. The relationship between maximum AIS level (MAIS) and mortality is a complex one, depending on the age, sex and pre-existing conditions of trauma patients, however having at least one AIS3+ injury is characteristic of longer hospital admissions and higher TAC claim costs.

[46] Accessed at: http://stat.data.abs.gov.au/Index.aspx?DataSetCode=ABS_ANNUAL_ERP_LGA2018# (25/11/2019)

4.2 Overall characteristics

4.2.1 Fatal and serious injury trends

Numbers of fatalities are subject to considerable variability from year to year, even within a jurisdiction the size of Victoria. Fatality numbers state-wide were uncharacteristically low in 2018 and very much higher in 2019. According to TAC official statistics[47], there were two fatalities during 2018 on the Mornington Peninsula, but 14 in 2019[48]. Taking a simplistic view, the average of these two extreme years is identical to the preceding five-year period, highlighting this variability. Nevertheless, it is expected that the results presented in this section will be reflective of long-term trends, particularly with regard to seriously injured persons, which are subject to much less variability. Regardless of this statistical variability, the loss of life and health experienced on Peninsula roads is unacceptable and will be vigorously addressed through this strategy.

Figure 5 shows annual fatalities, as recorded in the Vicroads (now Department of Transport) Road Crash Information System (RCIS) for the period 1987 to 2019[49]. Consequently, there will be some discrepancies between this figure and Figure 6(a). The graph indicates a general downward trend over time, albeit with considerable year-to-year variability (which is normal with fatality data).

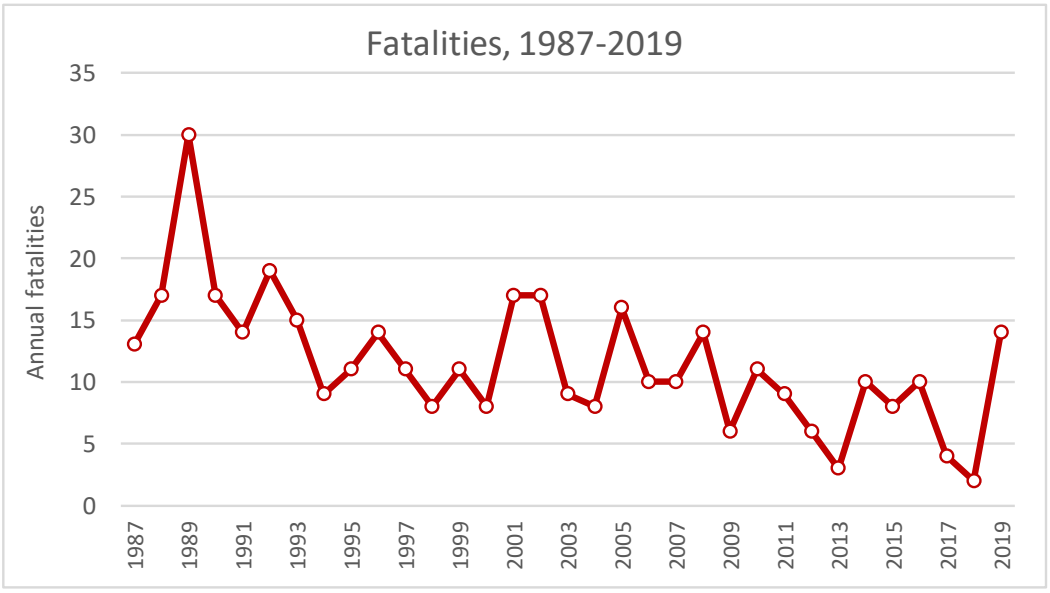

Figure 5. Fatalities for Mornington Peninsula Shire, 1987-2019. *Source: RCIS data via Mornington Peninsula Shire*.

Figure 6(a) shows annual calendar year fatalities on the Mornington Peninsula for 2010-2019 inclusive, based on RCIS data. The average for the ten years is 7.3 fatalities annually and, despite the year to year variability, there is no discernible trend either upward or downward. Note that some

[47] Accessed at: http://www.tac.vic.gov.au/road-safety/statistics/online-crash-database (03/02/2020)

[48] See footnote 1, p. 7.

[49] Note that Mornington Peninsula Shire was established at the end of 1994 by merging the then Shires of Flinders, Hastings and Mornington. Figures for 1994 and earlier are therefore based on the current boundaries.

sources suggest that there were 11 people killed in 2010, with the discrepancy at least partly due to two fatalities occurring on roads forming the boundary with adjacent municipalities.

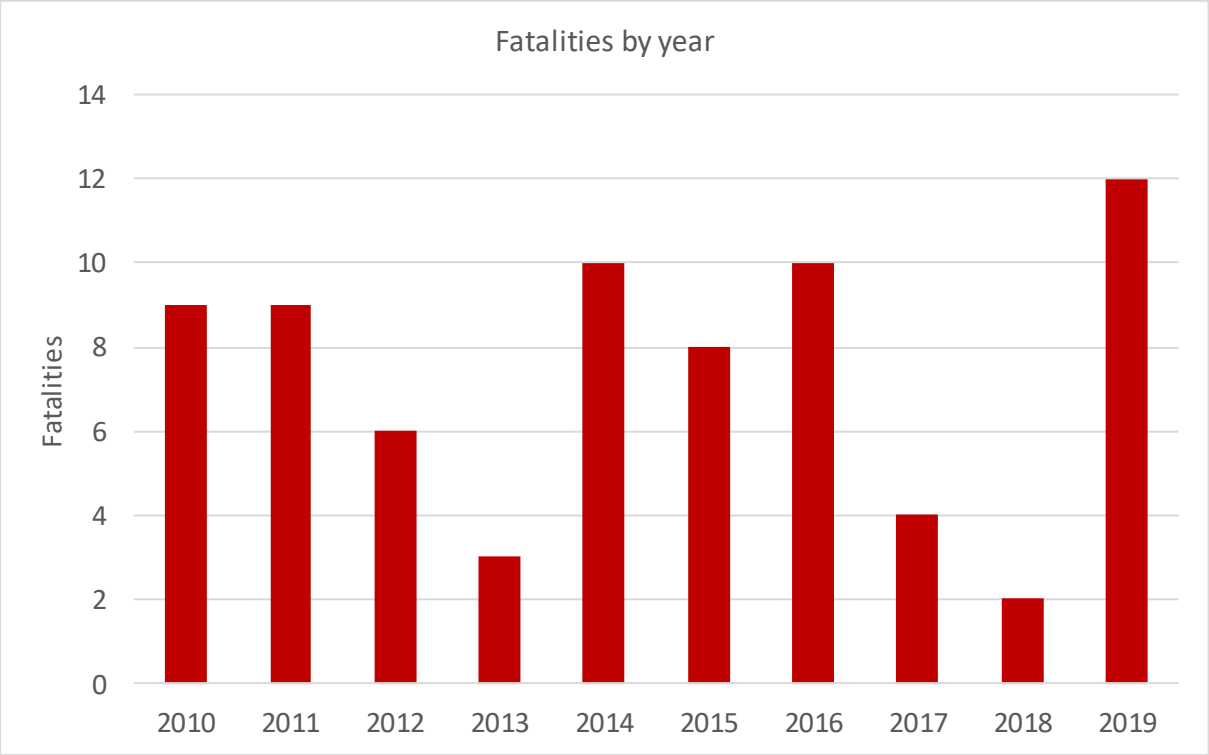

Figure 6(a). Annual fatalities, calendar years 2010-2019 within Mornington Peninsula.

To show long-term trends, numbers of seriously-injured persons back to 1987 are shown in Figure 7. Note that the numbers shown here may differ from those from the more recent TAC-validated dataset, since the figures in the RCIS are as recorded by the attending police officer and the status of follow-up to confirm hospital admission status has varied throughout the years depending on a variety of organisational factors. Consequently, RCIS-reported numbers are generally lower than validated figures.

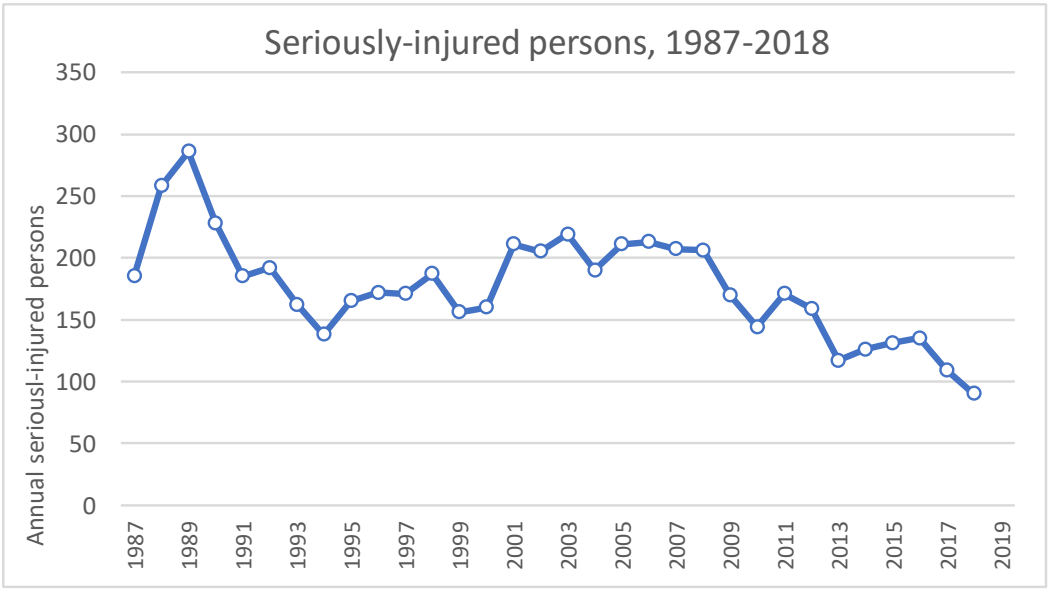

Figure 7(a). Seriously-injured persons for Mornington Peninsula Shire, 1987-2018. *Source: RCIS data via Mornington Peninsula Shire*.

TAC-validated seriously-injured persons (i.e. admitted to hospital) and numbers of more severely injured persons (based on the MAIS3+ scale), are graphed in Figure 7(b). Note that the category, 'seriously-injured' persons, includes those with MAIS3+ injuries. Over this timeframe there is little sign of a decreasing trend in either all seriously-injured or those with more severe injuries.

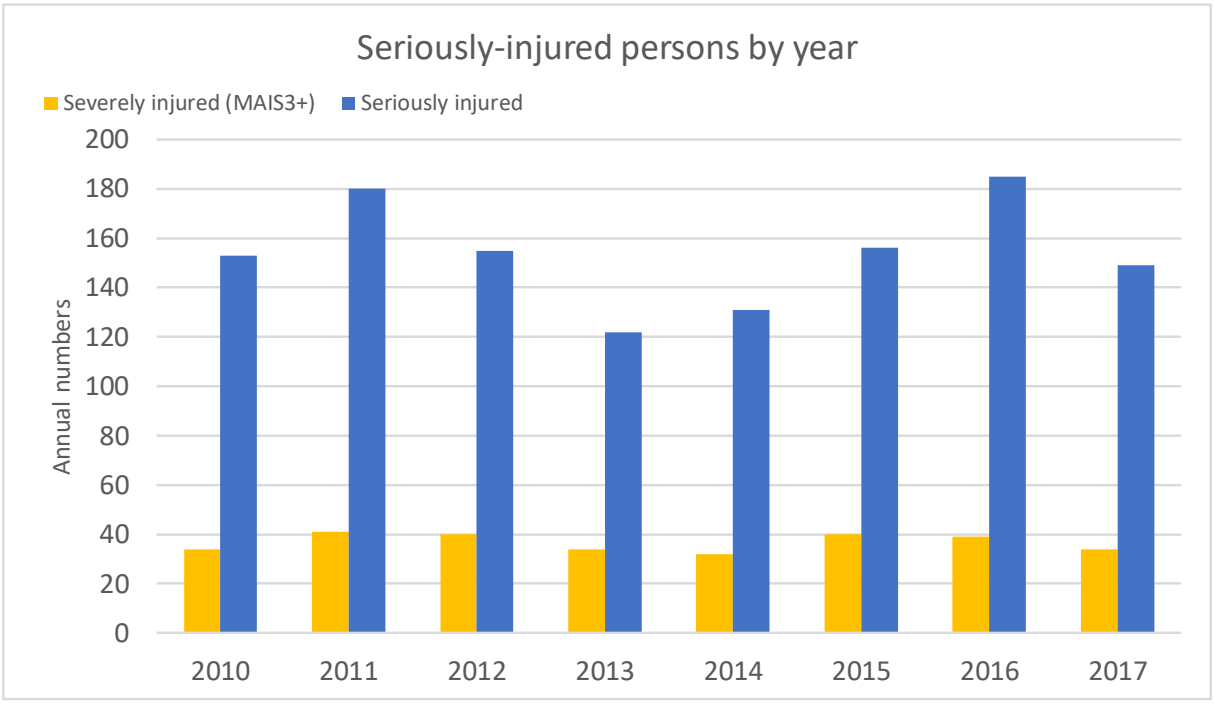

Figure 7(b). Annual seriously- and severely injured persons, calendar years 2010-2017 within Mornington Peninsula.

There is a common misconception that crashes within the Mornington Peninsula involve tourists and visitors who are unfamiliar with the Shire's roads. However, based on information supplied by the TAC, from 2014 to 2019 Mornington Peninsula residents made up 59% of those who lost their lives and 77% of those who suffered serious injuries[50].

As with most Melbourne local government areas, Mornington Peninsula Shire (MPS) is experiencing continuous population growth but also has over seven million annual visitors, with increasing exposure to road safety risks naturally driving fatality and serious injury numbers upwards. The average fatality rate for the most recent five years is 4.7 per 100,000 population (see Figure 8(a)), about double that of metropolitan Melbourne (excluding the CBD), but comparable with other outer urban municipalities[51].

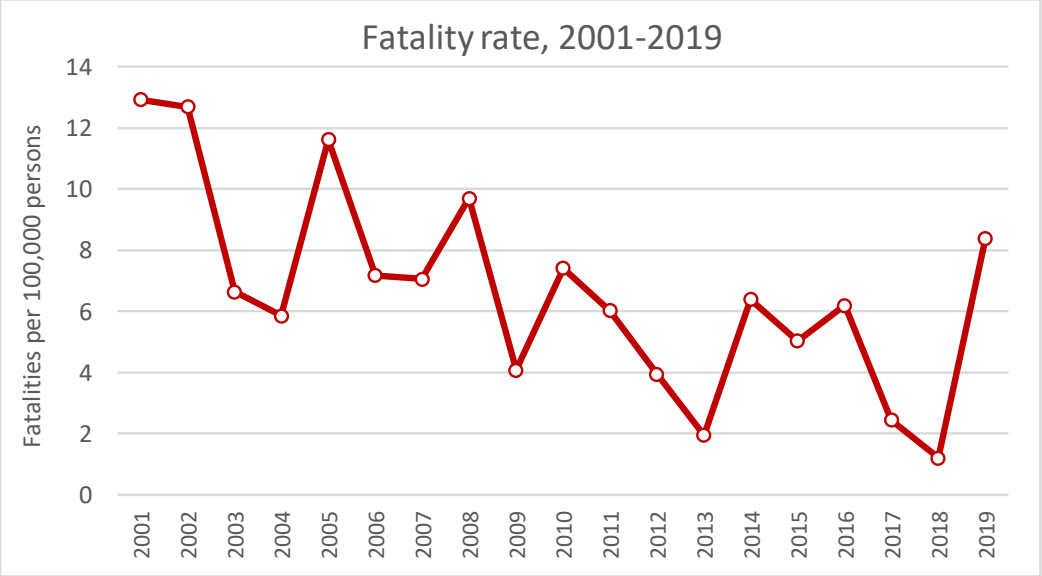

Figure 8(a). Annual fatality rate, calendar years 2001-2019 within Mornington Peninsula.

The historical serious injury rates shown in Figure 8(b) average 99.0 persons per 100,000 population and lie between metropolitan Melbourne (80 per 100,000) and the outer metro areas (112 per 100,000) (Newstead, Logan, Budd and Allen, 2017). There is a mathematical trend downward of around 1.4% per annum for hospitalisations and 1.8% for more seriously injured (MAIS3+) persons, but it is not regarded as statistically reliable due to year by year variation.

[50] From TAC via Mornington Peninsula Shire.

[51] Namely: Wyndham, Melton, Hume, Whittlesea, Casey and Cardinia.

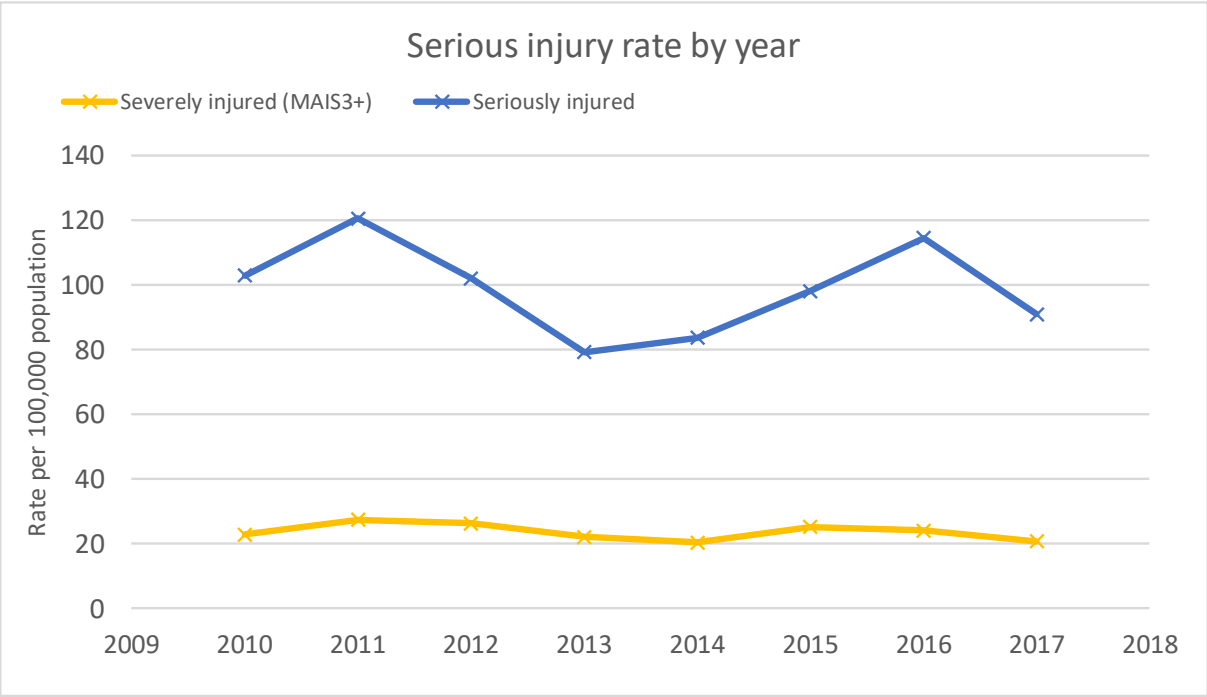

Figure 8(b). Annual serious injury and MAIS3+ rates, calendar years 2010-2017 within Mornington Peninsula.

4.2.2 Fatalities and serious injuries by age group

Figure 9 shows proportional FSI by age group (blue bars), with the proportion the corresponding age group makes up of the residential population of the Shire (in 2018). For example, the two 15-years and under age groups are under-represented in FSI, together comprising 19% of the population but only 4% of FSI. This situation reverses strongly for the three age groups 18-20, 21-25 and 26-29 and—to a lesser extent—the 30-39 age group. The oldest age group (70 years and older) experiences a shift back to being over-represented compared with their population proportion, primarily due to their increasing frailty leading to more severe outcomes in the event of a crash.

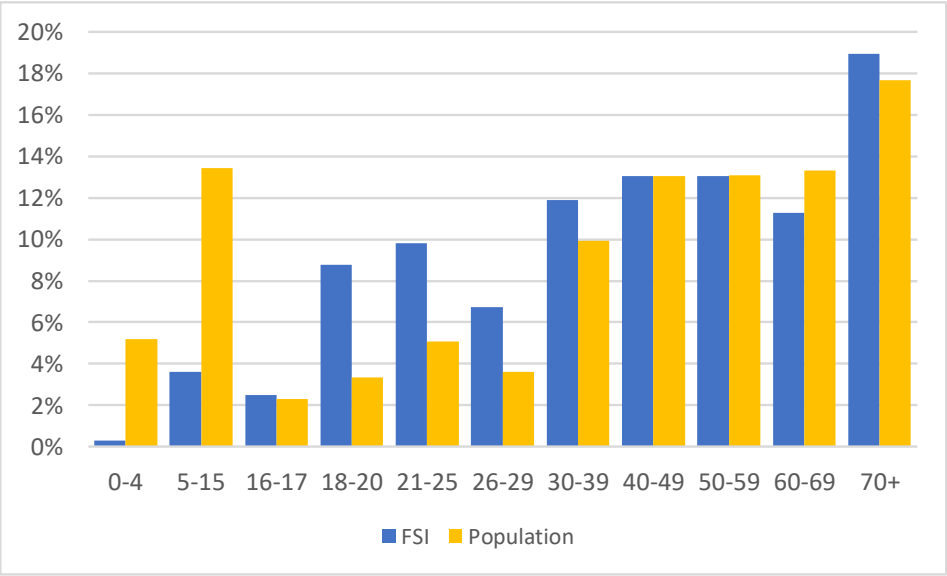

Figure 9. Proportion of fatalities and seriously injured persons (over five years) compared with residential population in 2018.

4.3 Safe Speeds, Safe Roads & Roadsides

This section focuses on analysing fatal and serious injury (FSI) data according to variables describing two of the Safe System pillars that have the potential to make large and lasting reductions in FSI risk. Over the full five-year analysis period there were 36 fatalities and 931 seriously injured persons (SI), including 169 people with more severe injuries (MAIS3+ category). This equates to annual averages of 7.2 fatalities and 186 people seriously injured including 34 with more severe injuries. The following sections will focus on FSI only, expressed as an average per annum over the five-year period.

4.3.1 Fatalities and serious injuries by speed zone

Figure 10 shows the distribution of total fatalities and seriously injured persons by speed zone on the Peninsula. Compared with Victoria as a whole, the region has a lower proportion of FSI in 40 km/h speed zones (2% vs 5% respectively) and 60 km/h zones (25% vs 31%) and a higher proportion in 90 km/h speed zones (4% vs 0.4%) and 80 km/h speed zones (28% vs 17%). It is likely that the differences are primarily related to exposure, with there being a much higher proportion of low-standard 80 km/h speed zones on the Peninsula compared with much of the rest of the state.

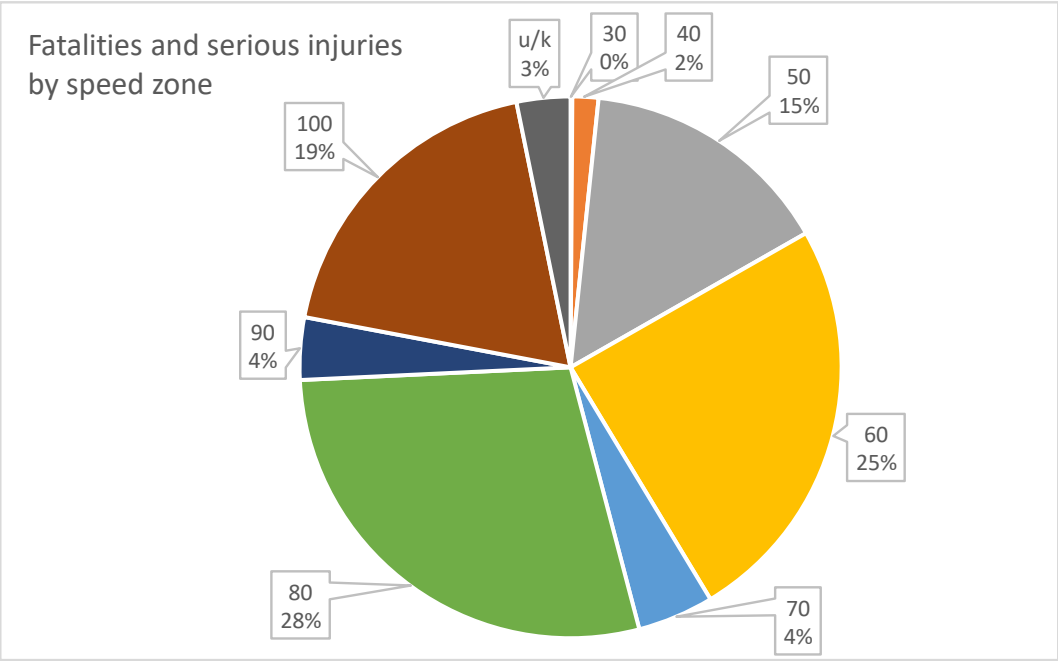

Figure 10. Distribution of fatalities and serious injuries by speed zone

4.3.2 Fatalities and serious injuries by street family

All the fatalities and 87% of SI occurred on two of the five Movement and Place road categories, namely Connectors (4 fatalities per annum, 49% of SI) and Local Streets (3 fatalities per annum, 38% of SI), with Activity Streets and Boulevards recording just under 9% of SI.

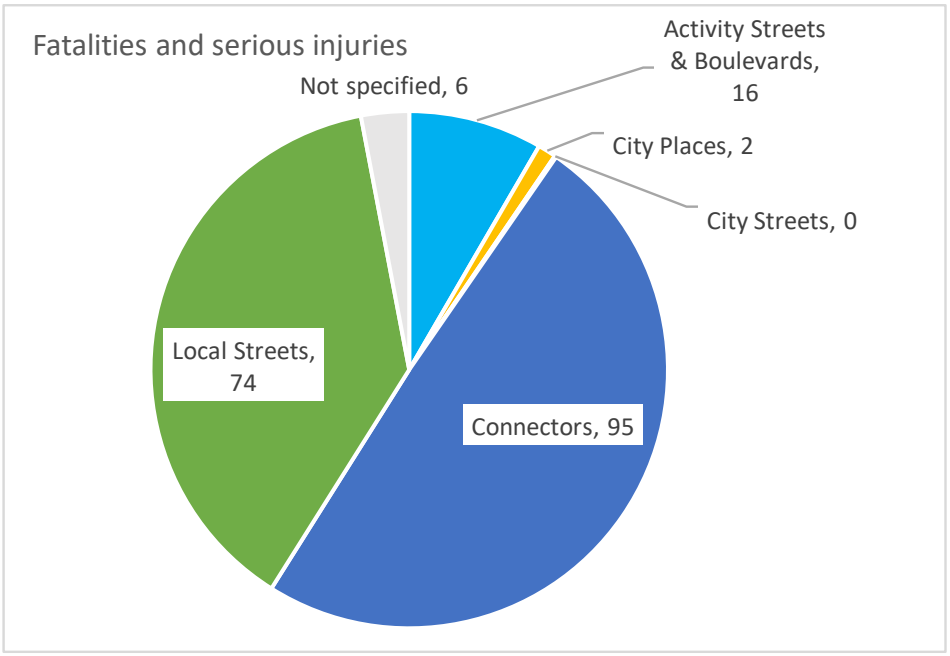

Figure 11. Distribution of fatalities and serious injuries by M&P street family. Mornington Peninsula Shire, average per annum for five years ending 30/06/2018.

Within Connectors, the majority of FSI (68%) occurred in speed zones of 80 km/h and higher, with most of the remaining 32% in speed zones under 80 km/h occurring in 60 km/h speed zones alone. On Local Streets by contrast, 63% of FSI were in lower speed zones, evenly distributed between 50 and 60 km/h roads. Higher speed zones (80 km/h and above) were dominated by FSI in 80 km/h, comprising 17 of 27 annual FSI.

4.3.3 Fatalities and serious injuries by road management

Local government has direct responsibility for roads under council administration only, with the remainder managed by the state road authority (until recently, VicRoads, now the Department of Transport). Council is, however, limited in the range of measures it can introduce without the approval of the state road authority. In MPS, Shire managed roads account for an average of 3 fatalities and 81 hospitalisations annually, representing 43.5% of the total (Figure 12). Of this serious trauma, 78% (66 FSI per annum) occurred on the Local Street M&P family and 15% on Connectors (Figure 13). On the state-managed roads, the majority of FSI (78%, 83 per annum) occurred on Connectors and the remainder largely on Activity Streets and Boulevards.

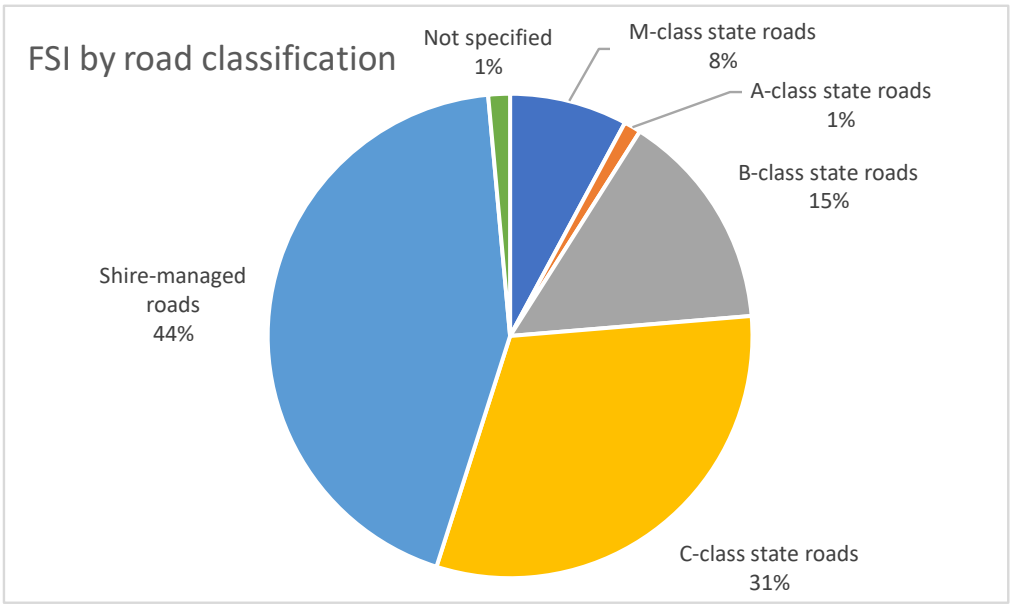

Figure 12. Distribution of fatalities and serious injuries by road class. Mornington Peninsula Shire, percentage for the five-year period ending 30/06/2018.

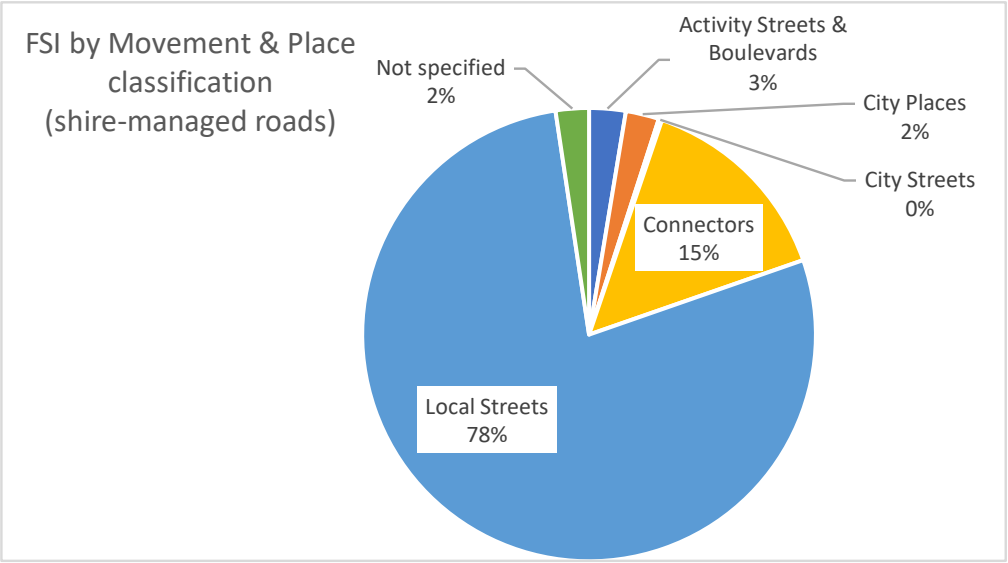

Figure 13. Distribution of fatalities and serious injuries by Movement & Place street family on municipally managed roads. Mornington Peninsula Shire, percentage for five years ending 30/06/2018.

4.3.4 Fatalities and serious injuries by crash type, speed zone, street family

The two predominant crash types in MPS are 'side impacts' (representing adjacent direction crashes) and 'run-off-road into fixed object', contributing 46% of annual serious trauma. Combined with 'run-off-road other', probably largely comprising rollover crashes, this proportion rises to around 52%. Table 4 provides further detail. Of the 186 serious injuries each year, 34 of these are 'more serious' (MAIS3+)[52], with just under half of these from side impact and 'run-off-road into fixed object' crashes.

[52] See footnote 45.

Table 4. Fatalities and serious injuries by TAC-defined crash category. Mornington Peninsula Shire, average per annum for five years ending 30/06/2018. Note that all figures have been rounded to the nearest whole number.

Crash type	Fatalities (p.a.)	Serious injuries (p.a.)	Total fatalities and serious injuries (FSI) (p.a.)	Percentage of total FSI
Side impact	1	49	50	26.2%
Run-off-road into fixed object	2	35	37	19.0%
Rear end	0	27	27	13.9%
Head on (not overtaking)	1	14	15	7.7%
Pedestrian	1	13	14	7.1%
Run-off-road: other	1	9	10	5.3%
All others	1	39	40	20.9%
Total	**7**	**186**	**193**	**100.0%**

Each of the crash types in Table 4 were broken down by speed zone. For the top four crash types by FSI incidence (side impact, run-off-road, rear end and head-on crashes), higher speed zones (80 km/h+) contributed between 57% and 66% of FSI. Pedestrian FSI were recorded mainly in lower (70 km/h and below) speed zones (68%), although there was a high proportion of FSI where the speed zone was not recorded (19%) for this crash type.

It is also interesting to look at the distribution of fatalities and serious injuries by crash type and speed zone, as shown in Figures 14(a) to 14(e).

Side impact crashes contribute an average of one fatality and 41 hospitalisations each year in the Shire, with almost 60% of these (57%) occurring in speed zones of 80 km/h and above, reflecting the inability of even the best-performing modern vehicles to protect its occupants from the high energy levels involved.

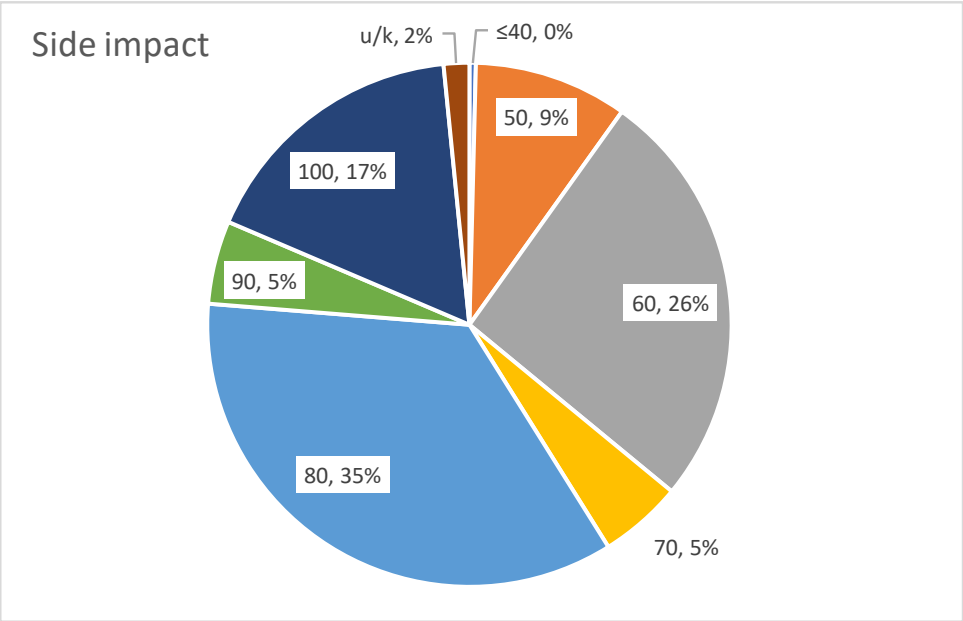

Figure 14(a). Fatalities and serious injuries by speed zone for side impact crashes.

Single vehicle run-off-road crashes into fixed objects lead to an average of around three deaths and 39 hospitalisations annually on the Mornington Peninsula. Similar to side impact crashes, the majority of these occur in 80 km/h and higher speed zones (61% in total), with around one-third in 100 km/h speed zones. It is also worth noting that even 50 km/h speed zones contribute 13% of run-off-road FSI.

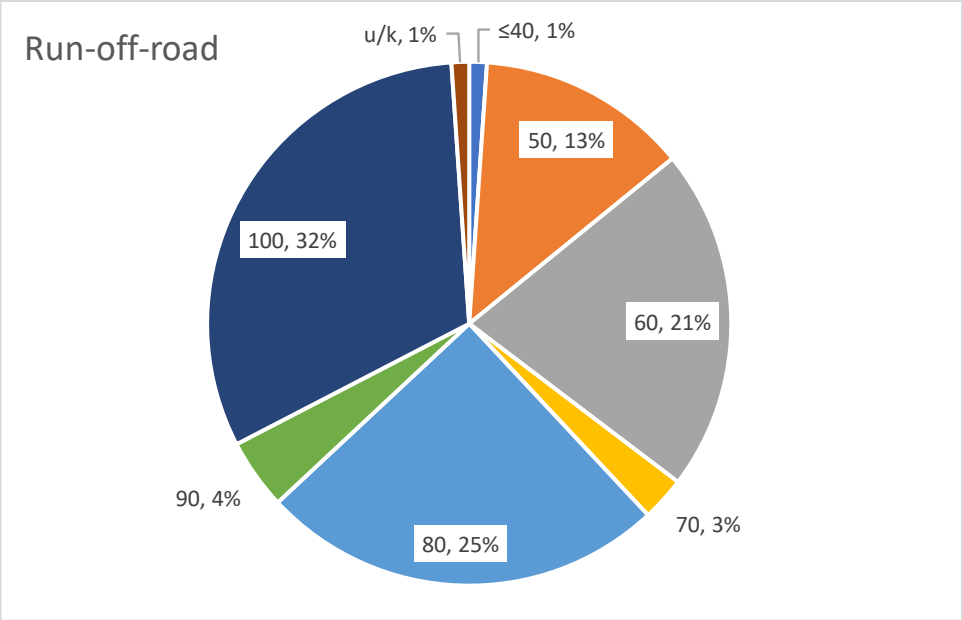

Figure 14(b). Fatalities and serious injuries by speed zone for run-off-road crashes.

Rear end crashes lead to 21 hospitalisations annually, primarily occurring in 80, 60 and 100 km/h speed zones across the shire.

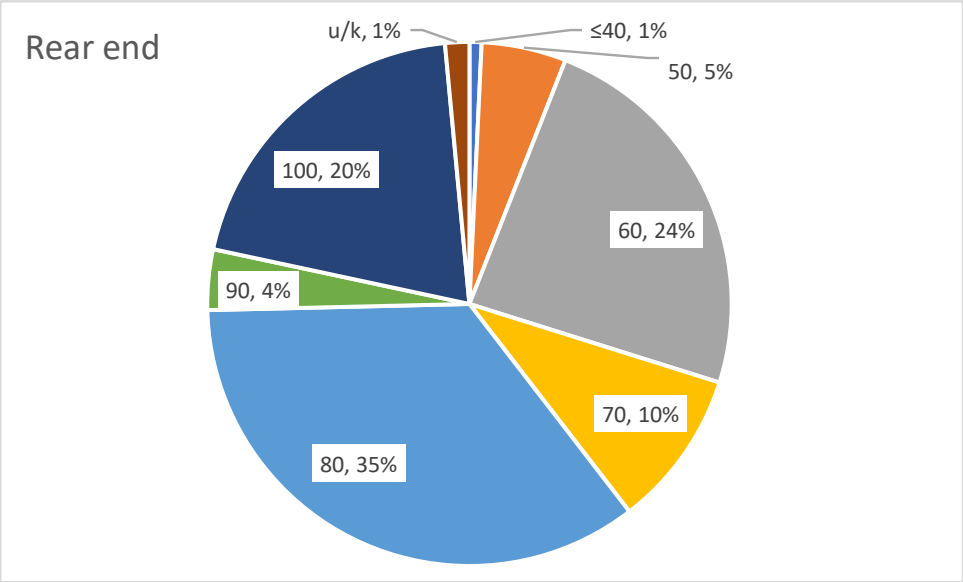

Figure 14(c). Fatalities and serious injuries by speed zone for rear end crashes.

Head-on crashes result in one death and 12 serious injuries annually, with more than half in 80 and 100 km/h speed zones. A large proportion of these are in 80 km/h speed zones.

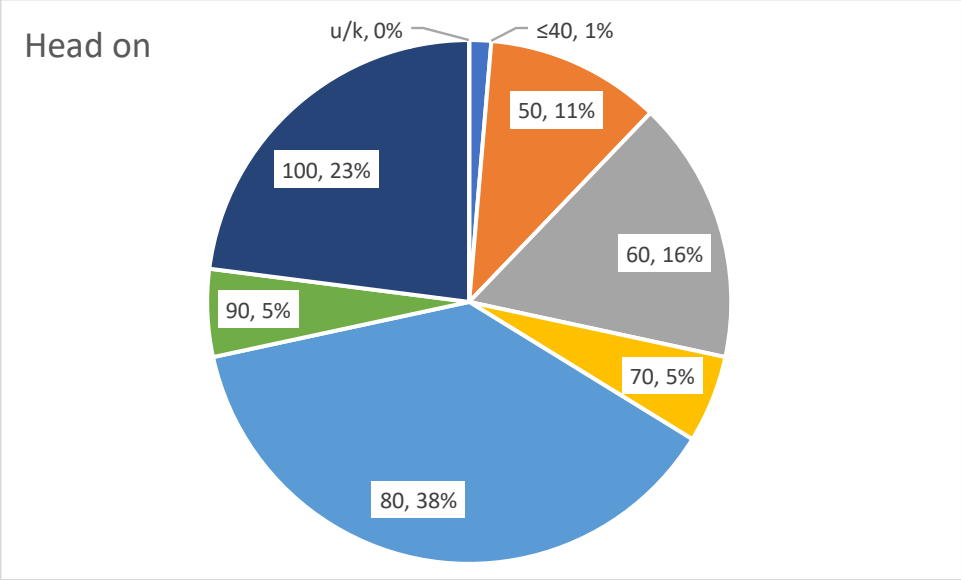

Figure 14(d). Fatalities and serious injuries by speed zone for head-on crashes.

The fifth biggest contributor to deaths and hospitalisations on the Peninsula is pedestrian impacts with motor vehicles (14 FSI annually). In contrast to the vehicle occupant crash types, pedestrian FSI mainly occur in 50 and 60 km/h speed zones, reflecting the number of road environments with pedestrian activity with posted speeds in excess of the 30 km/h considered the maximum acceptable for pedestrian impact.

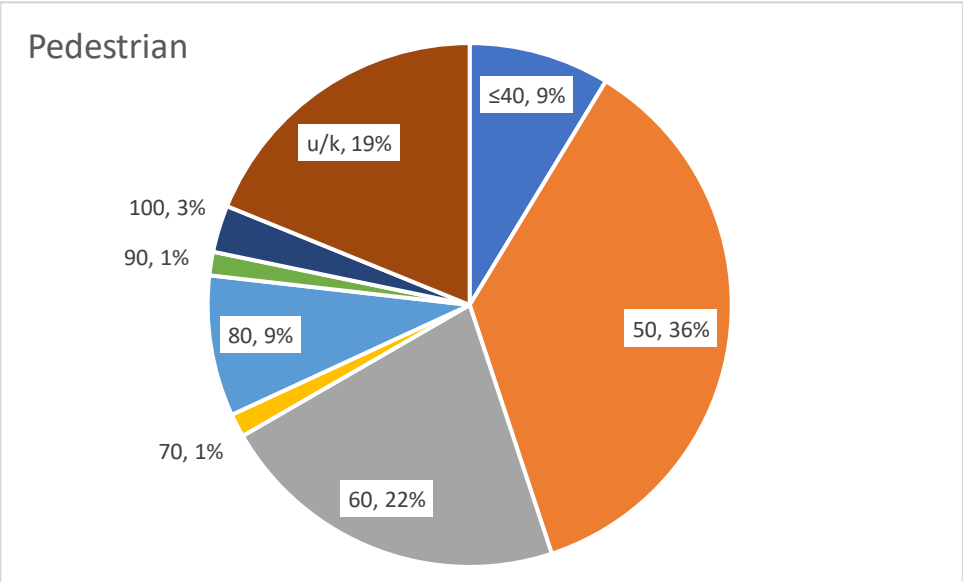

Figure 14(e). Fatalities and serious injuries by speed zone for pedestrian crashes.

4.3.5 Intersection and mid-block fatalities and serious injuries

Overall, FSI were distributed approximately evenly between intersections (43%) and mid-block sections (52%), with 4% where intersection/mid-block was not recorded. Broken down by M&P street family, the highest proportion of intersection FSI (43 of 91, 48%) occurred on Connectors and the highest proportion of mid-block FSI (51 of 101, 51%) on Connectors.

Figure 15 shows the overall average FSI distribution between mid-block and the various intersection types as used in the police-reported data. Just over half the deaths and serious injuries are away from an intersection, while just over 40% are at cross and T-intersections.

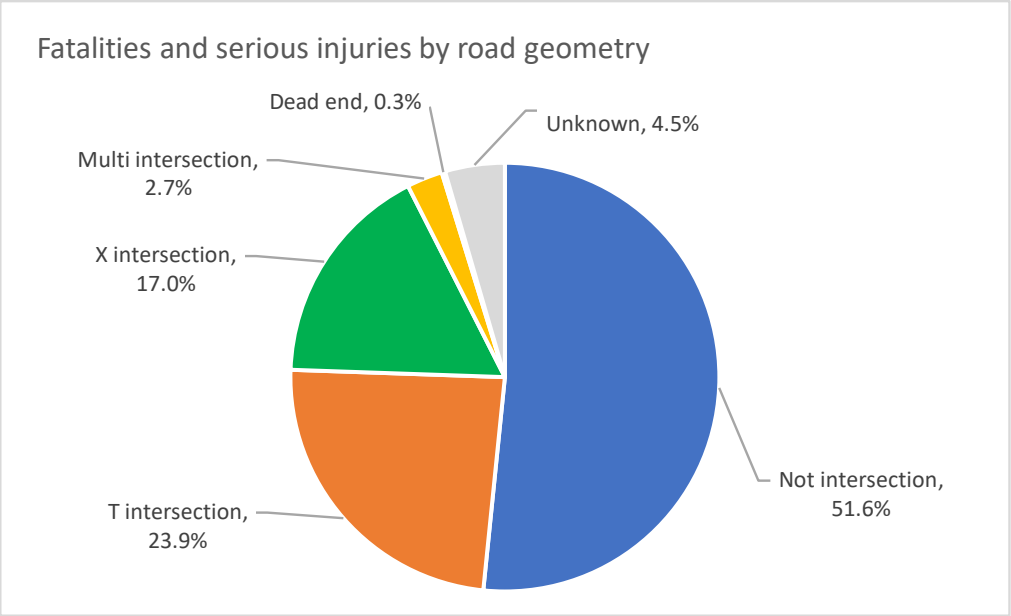

Figure 15. Fatalities and serious injuries by mid-block, intersection type.

Intersection fatalities and serious injuries

Disaggregated by speed zone, intersection FSI was split evenly between lower and higher speed zones, as shown in Table 5. The highest proportion occurred on Connectors in higher speed zones, making up 33% of all intersection FSI. Within the lower speed zones, half the trauma occurred in 60 km/h speed zones. Note that over the five-year period, seven FSI (1.7 p.a.) were unable to be categorised as mid-block or intersection and therefore are not included in the tables below.

Table 5. Number and proportion of fatalities and serious injuries by Movement and Place street family and speed zone category at intersections. Mornington Peninsula Shire, average for five years ending 30/06/2018. *Note: figures are derived from five-year averages and have been rounded.*

M&P street family	Lower speed zones[53] (70 km/h and below)	Higher speed zones (80 km/h and above)	Speed zone not specified	Total
Connectors	13 (14%)	30 (33%)	1 (1%)	44 (48%)
Local Streets	23 (25%)	12 (13%)	0	35 (38%)
Activity Streets & Boulevards	8 (9%)	<1 (1%)	<1 (0.5%)	9 (10%)
City Places	1 (1%)	0	0	1 (1%)
Street family not specified	1 (1%)	1 (1%)	0	2 (2%)
Total	46 (50.4%)	43 (47.8%)	1 (1.8%)	91 (100%)

Mid-block fatalities and serious injuries

Mid-block FSI were more common in higher speed zones, with Connectors contributing 39% (40 FSI annually) of mid-block trauma. Within the lower speed zones, just over half of trauma occurred in 60 km/h speed zones. Details are provided in Table 6.

[53] Where the speed zone is not the same for the two intersecting roads, the higher speed zone is the one used here.

Table 6. Number and proportion of mid-block fatalities and serious injuries by Movement and Place street family and speed zone category at mid-block locations. Mornington Peninsula Shire, average for five years ending 30/06/2018. For 6% either street family or speed zone was not able to be determined. *Note: figures are derived from five-year averages and have been rounded.*

M&P street family	**Lower speed zones (70 km/h and below)**	**Higher speed zones (80 km/h and above)**	**Speed zone not specified**	**Total**
Connectors	11 (11%)	39.5 (39%)	<1 (0.5%)	51 (51%)
Local Streets	23 (22.5%)	14 (14%)	<2 (1.5%)	38.5 (38%)
Activity Streets & Boulevards	6 (5.5%)	<1	<1 (0.5%)	6.5 (6.5%)
City Places	1 (1%)	0	0	1 (1%)
Street family not specified	1 (1%)	1.5 (1.5%)	1 (1%)	3.5 (3.5%)
Total	42 (42%)	55 (55%)	4 (4%)	101 (100%)

4.4 Safe road users

This section focuses mainly on analysing FSI data according to variables describing the road user pillar of the Safe System. Measures directed at road user behaviour can be effective and cost-effective but often require an *on-going commitment* to their implementation, rather than making lasting reductions inherent FSI risk as achieved by Safer Roads and Safer Speeds. Figure 16 shows the distribution of FSI by road user across MPS. Vehicle drivers and passengers make up nearly three-quarters of the total, comparable with Victoria as a whole (72% vs 68%), with motorcyclists (13% vs 16%) and pedestrians (7.4% vs 9.1%) comprising a slightly lower proportion than the Victorian average over a similar period.

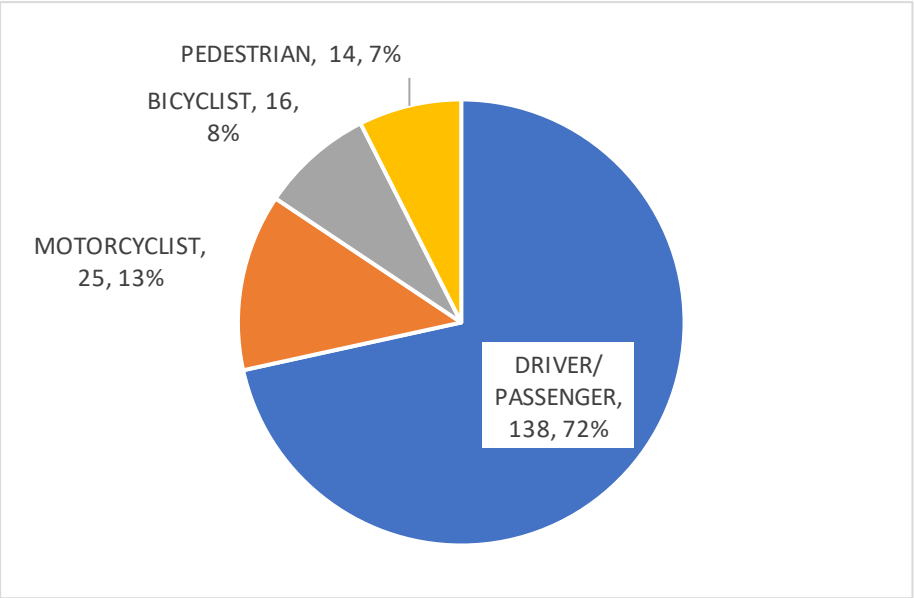

Figure 16. Distribution of fatalities and serious injuries by road user. Mornington Peninsula Shire, average per year and percentage for five years ending 30/06/2018.

Some of the key data insights for individual road user groups are:

Drivers/passengers (138 average FSI per annum)

- 54% on Connectors
  - Majority are run-off-road, side impact, rear end and head-on (91%)
- 36% on Local Streets
  - Majority are side impact, run-off-road, rear end and head-on (76%) plus overtaking and emerging from driveway/lane
- Around 21% are aged 70+ (compared with 13% for the whole of Victoria), while 10% are drivers 18-20 years of age (compared with 8.5% across Victoria).
- During the five-year period under consideration, there have been no fatalities and only three serious injuries involving vehicle occupants aged four years and under

Motorcyclists (25 average FSI per annum)

- 48% on Connectors
  - Majority are loss-of-control, run-off-road, side impact, rear end and head on (90%)
- 41% on Local Streets
  - Majority are loss-of-control, run-off-road, side impact, overtaking[54] (73%)
- Just over half (56%) of motorcyclist trauma involves persons aged between 30 and 59 years old, while an additional 23% are aged 18-25 years, both figures comparable to the rest of Victoria.

[54] This includes all head-on while overtaking, loss of control while overtaking and collisions with the vehicle being overtaken during the manoeuvre (DCA group 150-159)

Cyclists (16 average FSI per annum)

- Evenly split between Local Streets (38%), Connectors (32%) and Activity Streets & Boulevards (29%)
- Most are side impact (of which nearly half were right-turn-against oncoming vehicle) and side swipe/lane change (61%) plus rear end and loss-of-control on carriageway[55]
- About half (49%) of fatally and seriously injured cyclists are aged between 50 and 69 years, compared with just 24% across the whole of Victoria

Pedestrians (14 average FSI per annum)

- 49% on Local Streets
- 21% on Connectors
- 13% on Activity Streets & Boulevards
- Around a third (35%) of pedestrians are 70 years old or more, significantly more than the 20% across Victoria as a whole.

General

Illegal drug involvement was attributed to 11% of FSI (21 annually) across the five years, with the proportion for motorcyclists at 13%. By comparison, the average throughout Victoria is 8.4% for all road users and 7.1% for motorcyclists. Illegal levels of alcohol were recorded in 13 FSI per annum, a proportion of less than 7% which is comparable to the rest of Victoria. Crashes involving younger drivers aged 18-25 comprised 26% of FSI (27% for Victoria), while crashes involving drivers aged 75 and older constituted 16% in MPS compared with 8% Victoria-wide. Given the vulnerability of older people, this highlights the importance of adequate infrastructure and appropriate speeds across the Shire. It also highlights the importance of ensuring this vulnerable road user group travels in the safest affordable/available vehicles. Crashes where the police judged excessive speed was a factor made up 5% of total FSI (and 42% of the fatalities), comparable with the whole of Victoria (4.6% of FSI, 32% of fatalities). Distraction was stated as a factor in 4% of FSI (11% for Victoria) and fatigue in 2% (9.5% for Victoria). Finally, heavy vehicles were involved in 4% of all FSI and 8% of cyclist FSI. These figures are much lower than the 16% of all FSI (and 27% of cyclist FSI) recorded for the whole of Victoria.

4.5 Analysis summary – systemic crash types

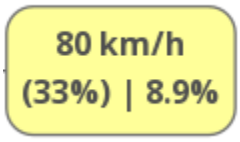

Figure 17 maps the priority road safety issues in MPS, arranged as a three-level hierarchy. Level 1 is Street Family; Level 2 represents mid-block or intersection crash types and Level 3 the speed zone in which the serious injury or fatality occurred. In each box, the first percentage value represents the proportion the issue comprises of its parent, while the second value on the right-hand side quantifies the proportion the box is of the overall FSI problem. In the sample to the right, '33%' represents the proportion of FSI occurring in 80 km/h speed zones within mid-block crashes on Connectors. The figure of 8.9% describes the proportion that this is of total FSI in MPS. This allows both the relative and absolute problem sizes to be understood. Furthermore, to highlight the key issues, boxes in Level 2 and Level 3 are colour-coded according to the magnitude of the problem they represent. Red-shaded boxes indicate that the issue in question contributes greater than 15% of total FSI, orange shading indicates 10-15%, yellow shading 5-10% and a grey background indicates

[55] This category is normally used by the police for single-vehicle bicycle crashes.

that the issue contributes less than 5% of total FSI. It should be noted that around 12% of all FSI were missing one or more of Movement & Place category, road geometry or speed zone in the TAC dataset. These FSI will fall within one of the other categories and are therefore unlikely to remain unaddressed.

The schematic diagram indicates that the four main issues on Mornington Peninsula roads are mid-block crashes on Connectors (27% of total FSI), intersection crashes on Connectors (21% of total FSI), mid-block crashes on Local Streets (19% of total FSI) and intersections in Local Streets (17%). These four make up well over three-quarters (84%) of all FSI. Accordingly, addressing them at the lowest practical cost should be a primary focus of the strategy.

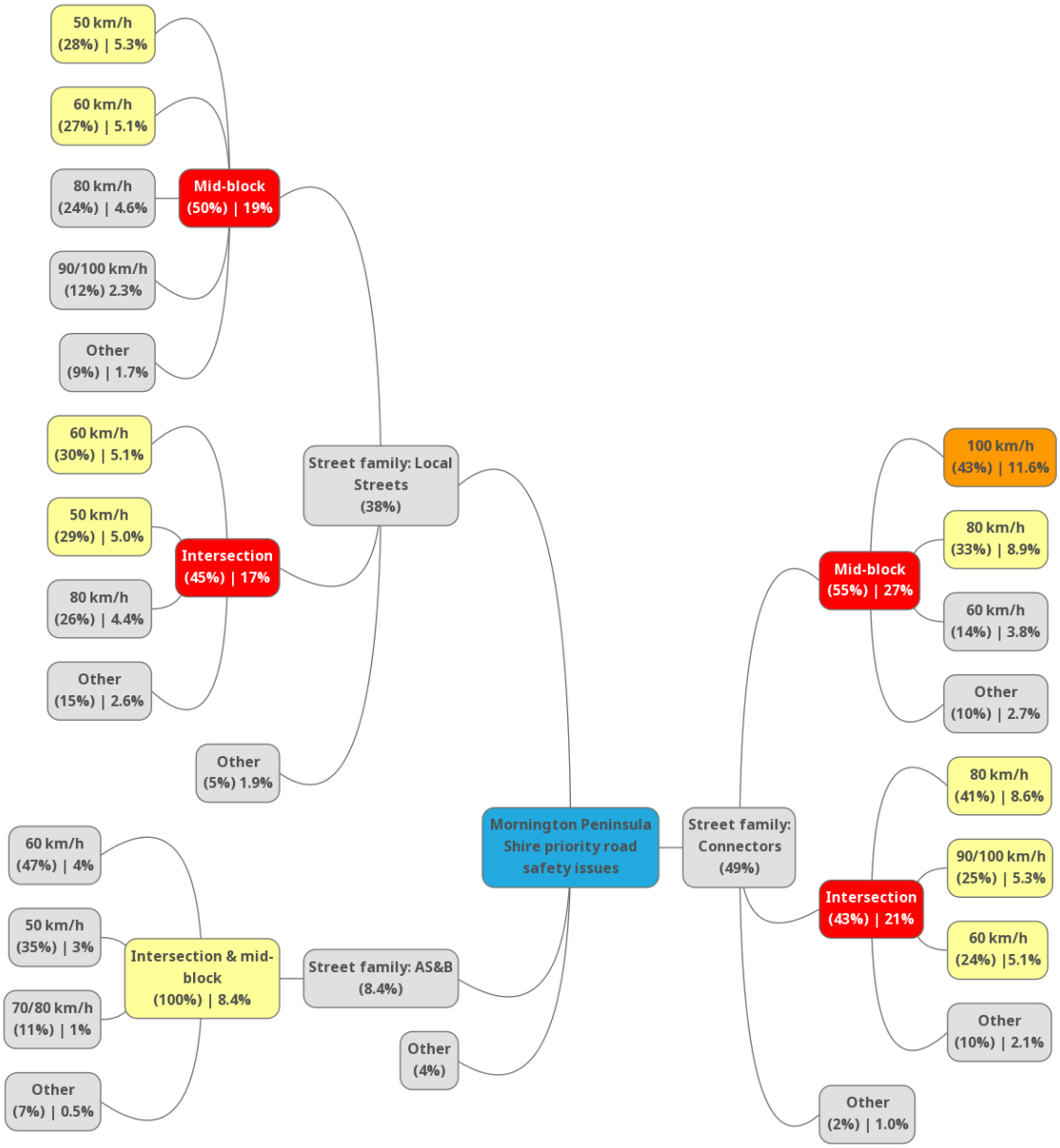

Figure 17. Schematic of priority road safety issues in Mornington Peninsula Shire. Key: red-shaded boxes indicate 15% or greater of total FSI; orange-shaded 10-15% and yellow-shaded 5-10% of total FSI.

4.6 A focus on systemic crash types

Based on the analysis of deaths and serious injuries for MPS, it is concluded that the new strategy should address the following systemic[56] crash types:

- Lane departures, comprising:
  - Run-off-road to left or right;
  - Head-on crashes;
- Intersection collisions, comprising:
  - Side impact;
  - Right-turn-against oncoming traffic;
  - Rear-end;
- Pedestrians, comprising:
  - Crossing between intersections;
  - Crossing at intersection;
- Cyclists, comprising:
  - Struck from behind;
  - Struck by left or right-turning vehicles at intersections;
- Motorcyclists, comprising:
  - Single rider loss of control;
  - Side-impact and right turn-against oncoming traffic at intersections.
- Rear-end collisions.

Because these six main crash types account for around 90% of all deaths and serious injuries on the Peninsula, addressing them successfully will make a strategically important contribution to preventing severe trauma over coming years. In the coming decade, vehicle safety technology and the moderation of travel speeds will also contribute to overall reductions in deaths and serious injuries.

For each of the six main crash types, it is necessary to understand more precisely the prevailing speed environment and the classes of road on which each of the key crash type predominates. Breaking the problem down into speed and road classes was done using the Movement and Place Framework, as described in Section 3.2.

The main systemic crash types are now described in terms of their predominant road design and speed limit features.

[56] Systemic risk is defined here as any risk that is characteristic of the road system, or specific generic elements of the system. There are several crash types that recur on a large-scale, and are more common along certain road types and in higher speed environments.

4.6.1 Lane departure crashes

Lane departure crashes
10 deaths in 5 years, 59 FSI p.a.
52% on Connectors

Run-off-road and head-on crashes over the past five years have predominated on state managed high-speed roads, particularly the Mornington Peninsula Freeway (MPF), Moorooduc Highway and Westernport Highway. During the last 12 months, the MPF has been treated with continuous barriers on both sides of the median and along both roadsides. Based on evaluations of barrier performance from overseas and Victoria, a reduction of some 80 to 90 percent in lane departure deaths and serious injuries can be expected. The State Government recently announced that Moorooduc Highway will be treated with continuous barriers, which will allow this key route to operate at high speed and low risk. A number of other similar routes will require this treatment.

While the above projects represent a positive step, there are other routes along which run-off-road crashes are systemic and will also need to be addressed as part of the new road safety strategy. A detailed analysis will need to be conducted by the Shire to identify these routes, as restrictions on crash data fields available to MUARC and Corben Consulting do not permit location details to be extracted.

In some instances, the treatments will involve more barriers to allow high travel speeds to continue, while in many cases, speed limit reductions to 80 or 70 km/h will be required to address the run-off-road and head-on crash problems. These routes may also require shoulder sealing to complement vehicle technology in today's modern vehicles (e.g., Lane Keep Assist (LKA), Electronic Stability Control (ESC) and Auto Emergency Braking (AEB)).

4.6.2 Intersection collisions

Intersection crashes
13 deaths in 5 years, 55 FSI p.a.
59% on Connectors

Intersection collisions are another systemic source of deaths and serious injuries on MPS roads. They typically involve side-impact, right-turn-against oncoming traffic, pedestrian or rear-end impacts. Side-impacts pose the greatest threat to vehicle occupants, principally those in the struck vehicle, while pedestrians, cyclists and motorcyclists are at even greater risk at an equivalent impact speed with a vehicle. For vehicle-to-vehicle impacts, the risk of at least one fatal injury to an occupant begins to rise rapidly at impact speeds of about 50 km/h, even lower when there is a marked difference in the masses of the colliding vehicles. While not a specific problem on the Peninsula, routes with higher proportions of trucks, buses and other larger vehicles pose additional risk to the occupants of vehicles struck by larger vehicles. This problem is especially acute for side-impact and narrow offset frontal collisions.

For crashes involving unprotected road users (pedestrians, cyclists and motorcyclists), the risk of a fatal outcome rises rapidly from around 30 km/h, even lower if the vehicle is large and/or the unprotected road user is older (e.g., 70+ years of age), a child or experiencing a mobility impairment.

For these reasons, any design or operational changes to intersections will need to explicitly consider basic injury biomechanics of humans. It is common for braking to occur in only about half of all fatalities, indicating that the travel speed is often the impact speed.

In rural settings, where speed limits are higher and pedestrian activity is limited, intersection design speeds should not exceed 50 km/h and potentially lower where heavy vehicles can be expected. However, in urban settings where more pedestrians are present, intersection design speeds of 30 km/h are required to make crashes unlikely and severe injuries of low risk (including for pedestrians) should crashes occur. Lower travel speeds in urban settings are entirely compatible with and, indeed, supportive of the broader goals of liveable and sustainable cities, towns and small communities, environment and population health.

There is a broad class of roads and settings which are neither strongly rural nor strongly urban. Intersections located along these roads present a greater challenge as the case for lower travel speeds will be less intuitive to road users and therefore lower levels of public support may be experienced. Particular attention to solutions for these road and intersection types will be needed, as they tend to carry high vehicle volumes at comparatively high speeds, and experience moderate pedestrian and/or cyclist numbers. Some routes, such as Nepean Highway and Point Nepean Road have substantial pedestrian activity across, and cycling activity along, these highly trafficked routes. In holiday periods, pedestrian and cycling activity levels are extremely high and coincide with correspondingly high numbers of motor vehicles, including motorcyclists and vehicles towing caravans, boats or jet skis. As part the transition to transformational treatments, incremental safety improvements are possible from providing clear delineation, minimising conflict points, providing safe pedestrian and cycling facilities, and implementing lower speed limits in targeted areas where needed.

4.6.3 Motorcyclist collisions

Motorcyclist crashes
6 fatalities in 5 years, 25 FSI p.a.
48% on Connectors

Fatal and serious crashes involving motorcycles make up around one-sixth of road deaths in MPS. Motorcyclists are the most vulnerable of unprotected road users, travelling at speeds well beyond the tolerance of the human body to serious injury, even with high quality protective clothing. Investment in proven infrastructure and speed reductions will help to reduce the incidence of death and serious injury to motorcyclists. Other countermeasures for motorcyclists are listed in Section 3.4.2, on page 28.

4.6.4 Cyclist collisions

Cyclist crashes
3 fatalities in 5 years, 16 FSI p.a.
38% on Local Streets
32% on Connectors

Cyclists are similarly vulnerable to severe injury or death as pedestrians. Their crash risks differ, however, largely because cyclists operate on roads in a similar manner to motorised traffic. By way of contrast, pedestrians usually move across the flow of traffic, except for some movements at intersections. For cyclists, deaths and serious injuries occur on both urban and rural roads in MPS. Along urban roads and at urban intersections, it is more realistic to address risk through speed moderation, brought about by speed limit reductions, infrastructure design or both. For higher speed roads, which may include some urban roads, cyclists should be provided with physical separation wherever practicable. If this is not feasible, at least in the short-term, lower speed limits and other supporting measures will be necessary to create low risk conditions on roads prioritised for cyclists. The Shire is currently developing a new Ridesafe cycling strategy that will assist to identify necessary cycling safety improvements.

4.6.5 Pedestrian collisions

Another of the systemic crash types occurring on MPS roads involves pedestrians being struck crossing both at intersections and mid-block. Pedestrian collisions are generally more severe than other major crash types involving vehicle occupants.

Pedestrian crashes
3 fatalities in 5 years, 14 FSI p.a.
49% on Local Streets

These crashes occur mostly in urban settings, although they also occur on high speed rural roads, but much less commonly. A previous analysis by one of the authors of the locations of pedestrian deaths and serious injuries indicated that the Nepean Highway/Point Nepean Road, town centres and shopping strips, and local streets are the most common locations in MPS for severe pedestrian trauma.

The risk of a pedestrian fatality rises rapidly when impact speeds exceed about 30 km/h. For older and child pedestrians, or when the striking vehicle is a truck, bus or other large vehicle, the threshold impact speed above which risk rises steeply is considerably lower than 30 km/h.

In places where pedestrians are a priority travel mode, either because of their prevalence or a desire to support walking as a healthy and sustainable mode of travel, it will be important to find ways of limiting impact speeds to not more than 30 km/h in conjunction with reducing traffic volumes where feasible. In practice, this means travel speeds of 30 km/h achieved through reduced speed limits, expressly designed infrastructure or both[57].

By achieving these conditions in appropriate parts of the MPS road network, the safety of cyclists, motorcyclists, vehicle occupants and virtually all other types of road user will also be secured.

Pedestrian FSI systemic risk exists in MPS in the following settings:

1. Commercial areas, busy with people and cars – examples include Mornington, Mt Eliza, Rye, Sorrento, Rosebud, Dromana, Hastings and Flinders;
2. Neighbourhood streets, with relatively low vehicle movements but where many people are living in or visiting houses, attending schools, playing in parks, using buses, walking dogs, going to local shops, riding bikes, using community facilities, etc.;
3. Crossing busy roads such as Nepean Highway, Point Nepean Rd, etc.;
4. In car parks, like those located in Mornington, Sorrento, Balnarring, Flinders and the larger town centres.

Commercial areas will require comprehensive area-wide speed management and supporting infrastructure treatments, while neighbourhood streets should be rezoned to speed limits of 40 km/h or 30 km/h in the longer term. A speed limit of 30 km/h is appropriate for areas around schools, kindergartens, aged care facilities, parks and playgrounds, selected community facilities and where footpaths yet to be constructed. At busy road crossings traffic calming infrastructure can be created, using vertical deflections, gateway treatments and the like to both actively slow vehicles at crossing points as well as emphasise the presence of pedestrians. Car parks should be designed or retrofitted to provide pedestrian share spaces and clearly delineated walkways wherever possible, even at the expense of vehicle capacity. Finally, it is also important to accommodate motorised scooters,

[57] This recommendation was strongly supported by the Roadsafe Sweden Academic Expert Group (AEG), released at the 3rd Global Ministerial Conference on Road Safety 19-20 February 2020.

wheelchairs and prams to facilitate access for these unprotected road users. Where there is a high number of these users, dedicated facilities should be provided.

4.6.6 Rear-end collisions

Rear-end crashes
1 fatality in 5 years, 27 FSI p.a.
58% on Connectors

While relatively common, rear-end collisions tend to produce less severe injuries than other systemic crash types. Interrupted traffic flow is common along busy urban roads, resulting in an increased risk of rear-end collisions. The presence of intersections, especially those controlled by traffic signals, sets up the conditions for rear-end collisions, principally because motorists are required to stop, often from high speeds, to comply with a red signal typically displayed every 1-2 minutes. Rear-end conflict is concentrated on the immediate approach to signals, as well as further upstream.

When presented with a closing yellow or red signal, some drivers try to get through to avoid being delayed, while others attempt to stop safely. When incompatible combinations of these driver tendencies arise at a point in time, the potential for read-end impacts is heightened. Heavy vehicles are over-represented in red light running, resulting a higher risk of severe injuries. Many other factors and incidents can lead to rear-end collisions along roads and streets, especially in urban areas where roadside activity is generally higher than in rural settings.

Eliminating severe injuries and deaths resulting from rear-end collisions will likely require a combined focus on several of the Safe System elements:

- vehicle safety features:
    - structural crashworthiness;
    - geometric compatibility;
    - crash avoidance technology;
    - injury mitigation technology;
- reduced speed limits, potentially supported by geo-fencing, where the systemic risk of rear-end collisions is elevated, and;
- changes to the way in which some elements of the road system are designed and operated.

Vehicle safety features, currently available in modern vehicles, such as active cruise control, intelligent speed assist and autonomous emergency braking, have the potential to avoid rear-end crashes or mitigate injury risk through lower impact speeds. Lower speed limits, especially in areas and along routes of high systemic risk (e.g., highways with speed limits of 60 km/h and higher, traffic signals and/or a significant proportion of heavy vehicles), will certainly reduce crash and injury risk in rear-end collisions. Modifications to traffic signal operation, in combination with lower travel speeds on the approaches to signalised intersections, will also address rear-end collisions, but require shifts in current standards to allow them to become modern-day practice. Other vehicle-based technologies may emerge in future to broaden the options available to address rear-end injury risk.

5 CONCLUSION

In 2016, Mornington Peninsula Shire Council became the first municipal council in Australia to formally commit to the eventual elimination of deaths and serious injury from its roads. This report, constituting the strategic and technical platform for the road safety strategy for the next five years, has been developed with the goal of marking a significant step towards the eradication of loss of life and long-term health for all road users on the Peninsula roads, whether they be there for work, education, leisure or to live.

While every road crash has its unique features, the same limited number of types of crash types continue to occur in numbers that, while implicitly accepted in the past, should no longer be regarded as the price to pay for mobility.

On the Shire's rural roads, people in vehicles leave the road at high speed or collide with an approaching vehicle, also at high speed. Even at legal speeds and in modern, safe vehicles, impacts with trees, poles, other vehicles or in single vehicle rollovers are almost certain to lead to hospitalising injuries and sometimes death. Crashes at intersections and private property driveways are another common source of risk. On urban roads, serious injury crashes are also common at intersections, particularly those with traffic signals. Neighbourhood streets across the Shire, both at and between intersections, also account for a significant burden of severe and sometimes fatal injury.

Growth in active, healthy and sustainable travel modes is important to health and wellbeing. It is critical, however, that unprotected pedestrians and cyclists are prevented from being struck by vehicles at anything more than 30 km/h. Children and older people are at even higher risk, and in need of greater protection than has been generally afforded them in past. The new generation of innovative devices (known as micro-mobility), including e-scooters, e-skateboards, e-bikes, and the more familiar scooters for the mobility-impaired (and an assortment of others) also leave their users unprotected in traffic and need special attention in the years ahead.

This technical report has laid out combinations of road infrastructure matched with appropriate speeds to create a road system that, by 2050 and with the majority of vehicles manufactured after 2025, aspires to the Zero by 2050 approach being pursued not only at state level, but increasingly around Australia and other parts of the developed world. A range of other supporting initiatives will also be required in the interim including police enforcement for compliance with speed limits, encouragement of unimpaired driving and ensuring all drivers are correctly authorised to drive. Programs to accelerate the take-up of proven vehicle safety features will need to continue to ensure that the important combinations of infrastructure and speed described above will be effective in eliminating the systemic crash types in each of the settings present on the Mornington Peninsula.

Finally, the key to a successful strategy is implementation. Actions are critical and, without inherent safety actively introduced onto Peninsula roads and into the minds of road users, road trauma will continue to occur and likely increase as population pressures are felt.

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APPENDIX A: PROPOSED COMPACT ROUNDABOUTS

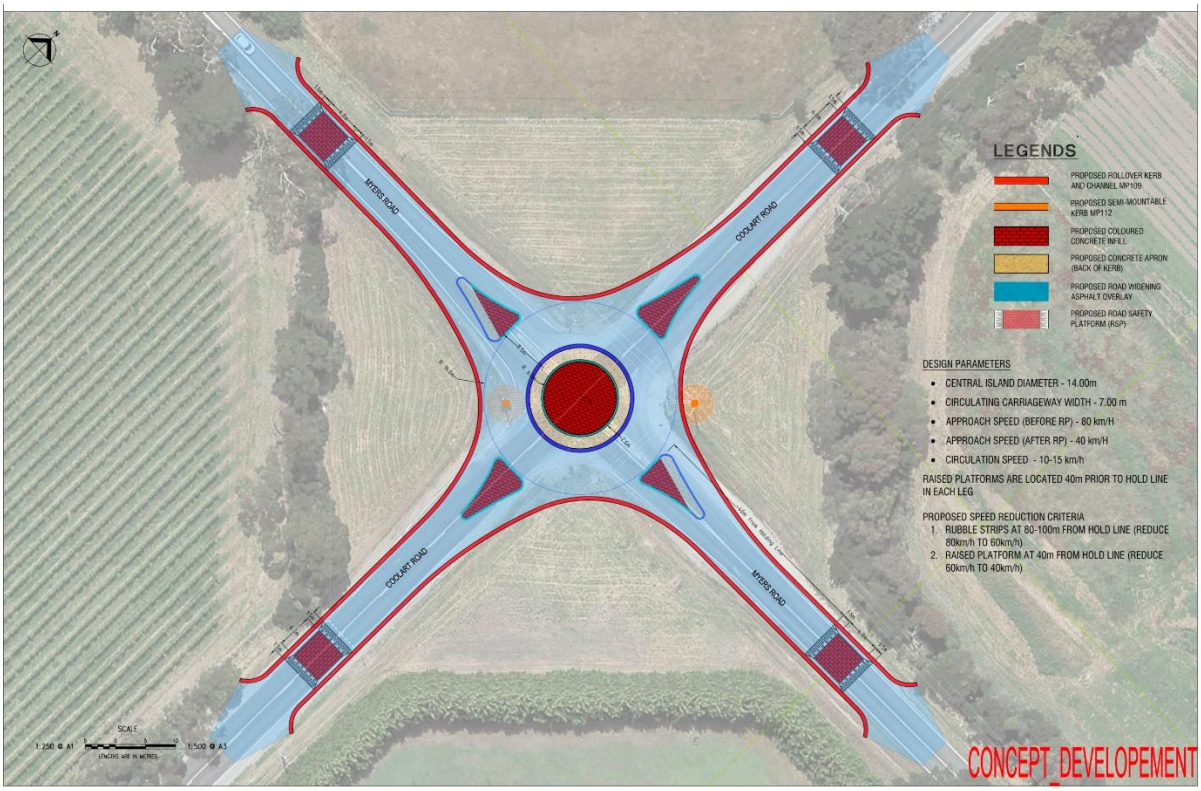

Figure 18(a). Proposed compact roundabout for arterial road intersection.

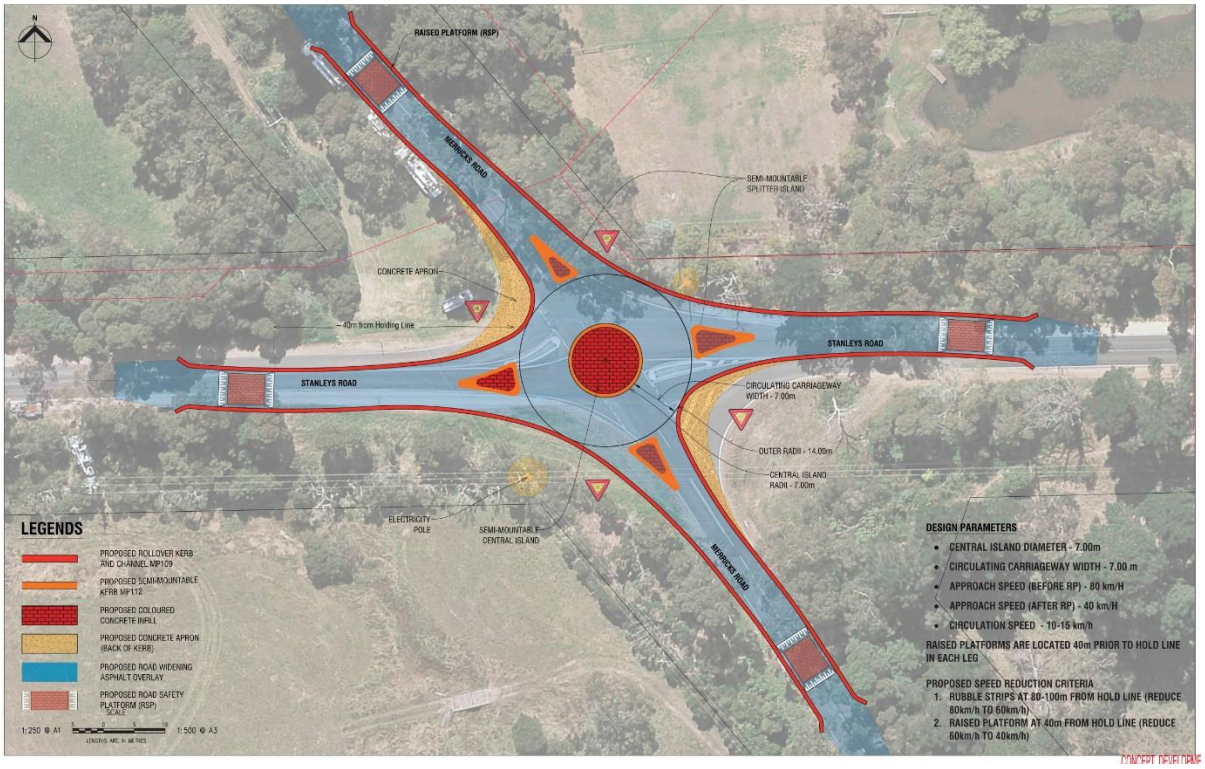

Figure 18(b). Proposed compact roundabout for high speed local rural road intersection.

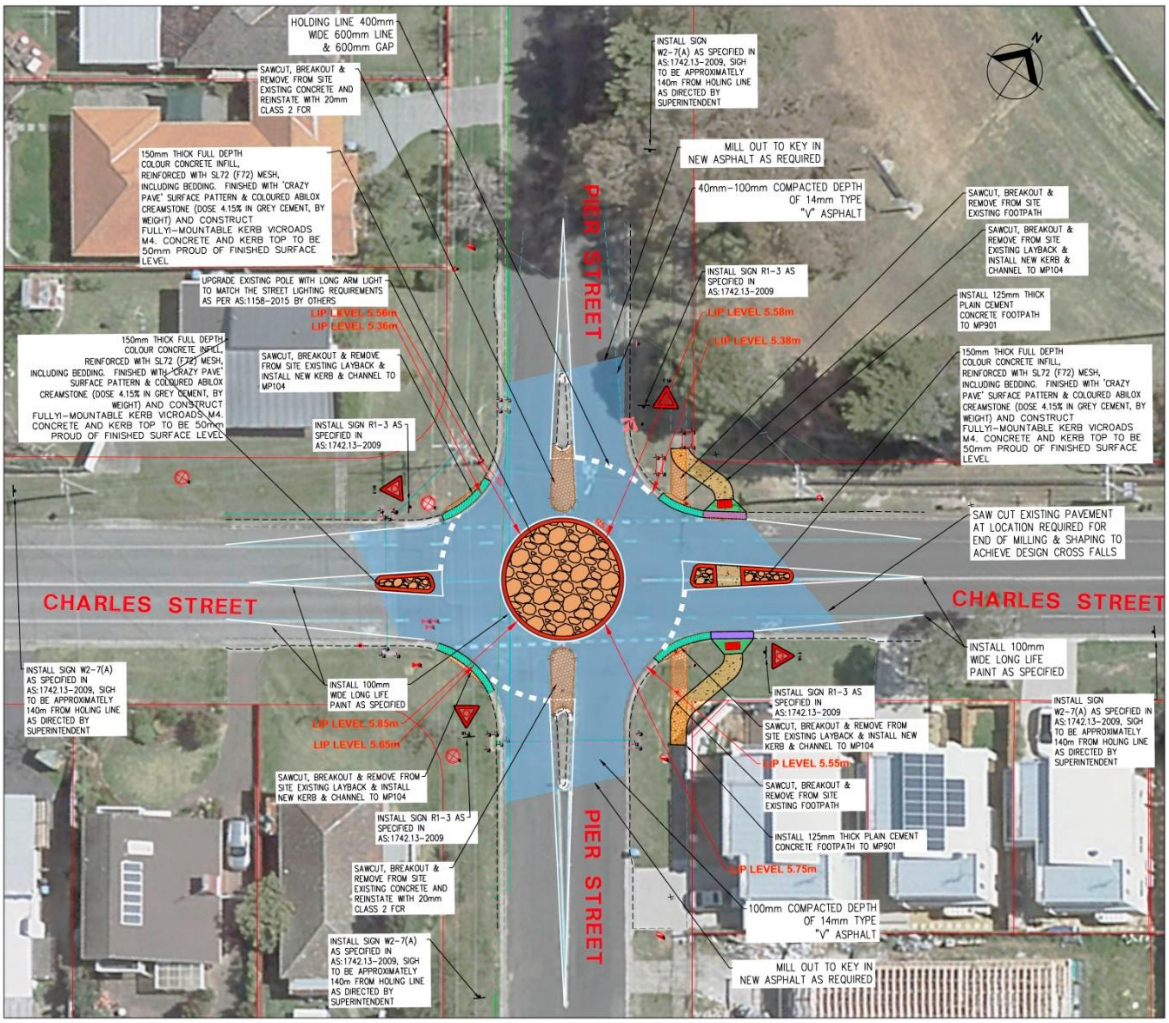

Figure 18(c). Proposed compact roundabout for urban local rural road intersection.

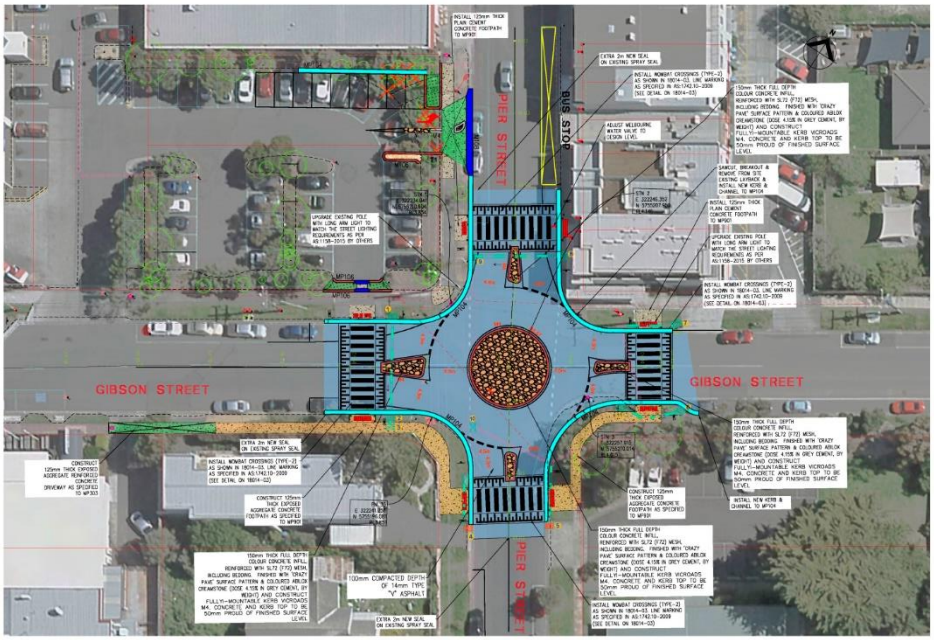

Figure 18(d). Proposed compact roundabout for local residential road intersection, type 1.

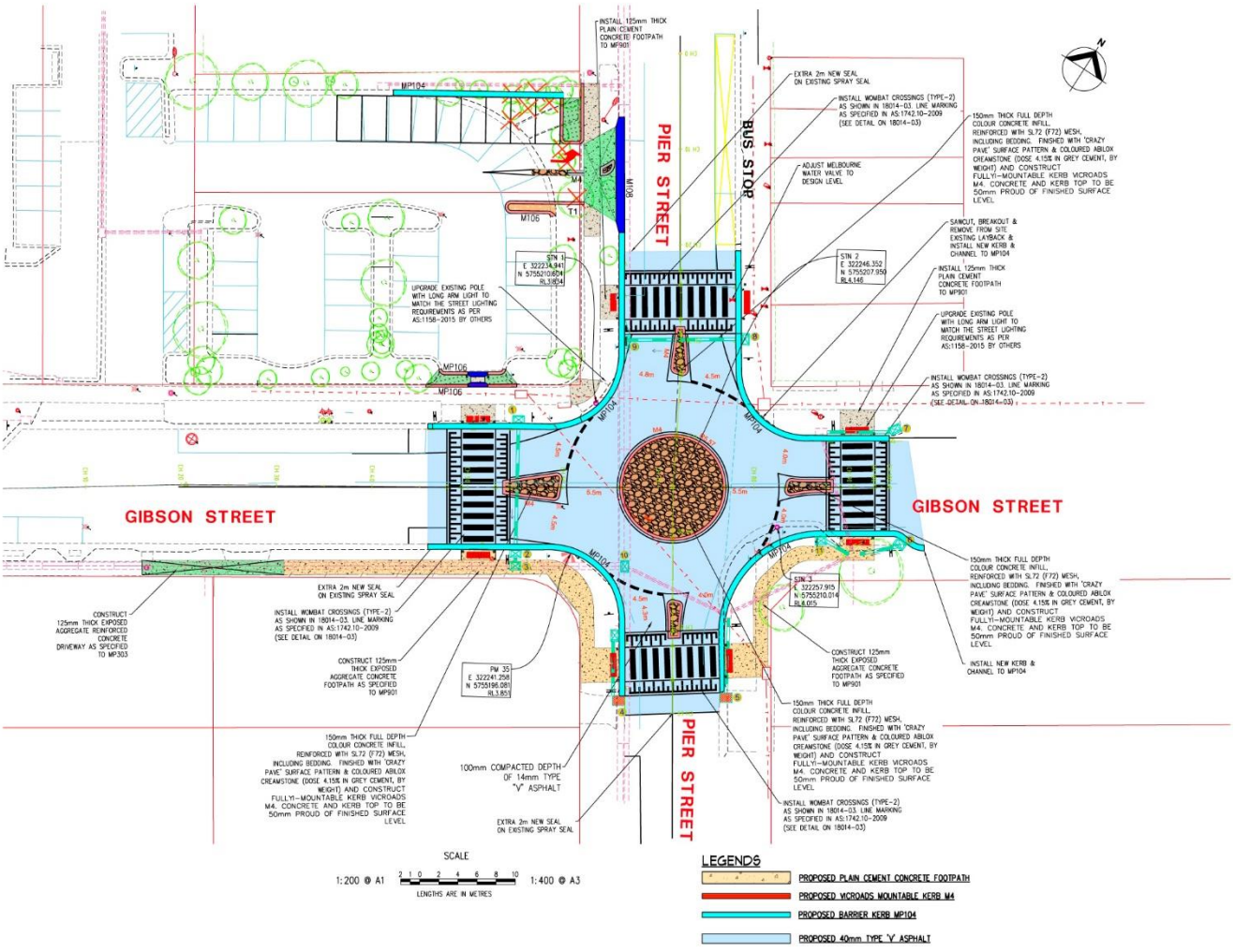

Figure 18(e). Proposed compact roundabout for local residential road intersection, type 2.

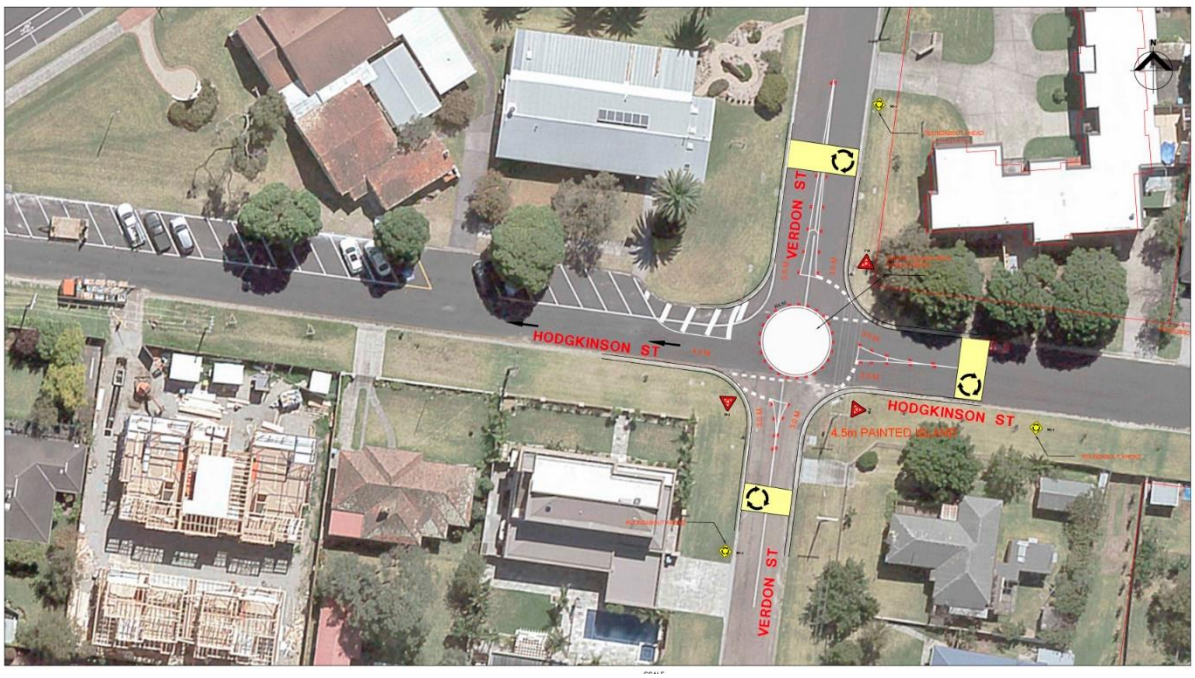

Figure 18(f). Proposed compact roundabout for local residential road intersection, type 3.

Figure 18(g). Proposed compact roundabout for local residential road intersection, type 4.

APPENDIX B: SAMPLE INNOVATIVE INTERSECTION DESIGNS

Figure 19. Proposed innovative signalised intersection design with cut-throughs: 'Soccerball'.

Figure 20. Proposed innovative signalised intersection design with cut-throughs: 'Squircle'.