

Chapter 10. Developing and implementing an integrated road safety strategy for powered two-wheelers

This chapter outlines the need for a strategic approach to powered two-wheeler (PTW) safety to integrate effort and guide the allocation of resources toward initiatives that have proven benefits. It discusses motorcycle safety strategies in the context of a Safe System approach.

Introduction

This chapter outlines the need for a strategic approach to powered two-wheeler (PTW) safety to integrate effort and guide the allocation of resources toward initiatives that have proven benefits.

The structure of this chapter follows the recommended approach of the OECD's Towards Zero – Ambitious Road Safety Targets and the Safe System Approach (OECD/ITF 2008):

- Adopt a highly ambitious vision for road safety.
- Set interim targets to move systematically towards the vision.
- Develop a Safe System approach, essential for achieving ambitious targets.
- Exploit proven interventions for early gains.
- Conduct sufficient data collection and analysis to understand crash risks and current performance.
- Strengthen the road safety management system.
- Accelerate knowledge transfer.
- Invest in road safety.
- Foster commitment at the highest levels of government.

These principles will provide a test to determine the completeness of any final strategy but effort needs to be paid to the process of planning and developing a strategy to ensure that these principles are met. While drawing on these principles, the need for adaptation to the specific needs of motorcyclists is also discussed.

These principles can be re-ordered into a strategic planning process:

Situational analysis

- Conduct sufficient data collection and analysis to understand crash risks and current performance

Define strategic objectives

- Adopt a highly ambitious vision for road safety.
- Set interim targets to move systematically towards the vision.
- Develop a Safe System approach, essential for achieving ambitious targets.

Determine strategies and actions

- Exploit proven interventions for early gains.
- Invest in road safety.

Establish supporting arrangements

- Strengthen the road safety management system
- Accelerate knowledge transfer.

- Invest in road safety.
- Foster commitment at the highest levels of government.

Each of these sections is covered in this Chapter.

However, before the work to develop a strategy starts, planning the development activity and establishing commitment to undertake the strategy development is essential.

Planning a strategy

Planning the development and implementation of a strategy should take account of the benefits to be accrued from the development process and provide a balance between these benefits and the need for early actions to create quick benefits. Apart from the value of these benefits in themselves, they can also serve as valuable examples to engage stakeholders and garner support for further, perhaps more challenging initiatives.

Strategy development is an iterative process that can achieve commitment to change through a process that spirals in from broad discussion of the situational analysis and future trends, to overarching vision and objectives then to strategies and finally to the specific actions required to achieve the strategic goals. This process should provide the opportunity for stakeholder and broader community input to the key issues of concern and the key areas in which significant change in policy, practices or investment is required.

A key step in the planning process is the identifications of the lead agency, its roles and responsibilities and those of other agencies and non-government stakeholders. Relevant stakeholders will include user groups and commercial organisations, such as the motorcycle industry and equipment suppliers and retailers. One of the challenges in this process is to ensure that all stakeholders are considered and not just those who have the greatest capability or the loudest voice. For example, non-recreational riders are usually not represented to the same extent as recreational riders involved in club activity.

The capacity of lead agencies and other stakeholders needs to be recognised and, if necessary, actions taken to increase capacity and capability. In particular, the inclusive involvement of the motorcycling fraternity in the planning of a strategy will not only assist in the development of shared, agreed objectives, but may also identify areas in which capacity building and the sharing of information is required.

Agreement to the objective of the strategy and its interrelationships with other pre-existing, or planned strategies will provide a sound basis for a development process that achieves agreement and stakeholder buy-in. Demonstrated buy-in can be achieved in a number of ways:

- Agreement that a variety of motives for action are legitimate but all should contribute to any overall target of strategy objective.
- Acknowledgement that evidence-based measures should form the basis of the strategy.
- Commitment to the strategy and, ideally, agreement to incorporate the strategy into their own management systems.

A key issue in the development of a motorcycle safety strategy is the status of strategies covering road safety generally and covering motorcycles' role in the transport system. There needs to be

recognition that many actions under the umbrella of a general road safety strategy will have benefits for motorcycle riders. Conversely, there will be little chance of success in implementing measures addressing motorcycle safety if the necessary broader institutional frameworks are not in place.

Ideally, a motorcycle safety strategy would be one of a suite of strategies that, together, address the dominant road safety factors in each jurisdiction. There may also be benefit in developing comprehensive motorcycling strategies that include safety as a desired outcome alongside accessibility, mobility and environmental outcomes. This may provide justification for actions that contribute to a number of outcomes, where justification may otherwise be insufficient if safety alone is considered.

The link between planning a strategy and developing a strategy

Early engagement by all stakeholders in the process of strategy development will increase the opportunity that the strategy will address all key and emerging issues and will be accepted by all parties who will share the responsibility for its implementation and success. The key stakeholders in this process are the road users themselves – both riders and other road users. Their engagement in the process of planning a strategy can represent the start of the strategy development process.

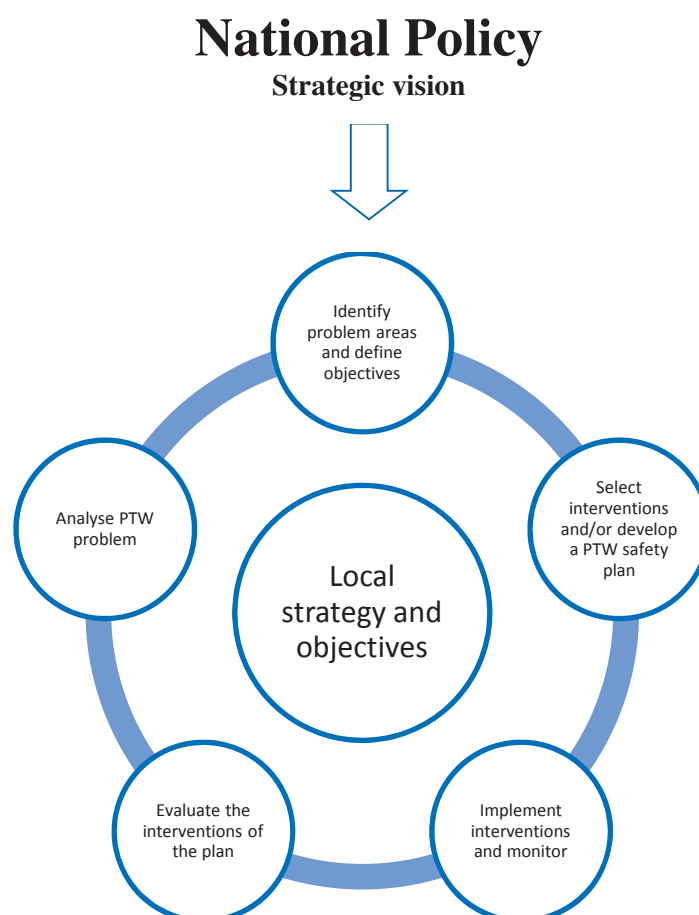
Key outcomes from this stage include:

- Consensus regarding the vision for motorcycling’s role in the transport system, and its safety, in particular. How are the sometimes competing demands of safety, mobility and personal freedom to be reconciled?
- Agreement to the scope of the strategy – its timelines, coverage.
- The level at which the strategy is aimed – national, regional or local and the linkages to existing or required strategies at the other levels or for road safety more broadly.
- Strengthening the social processes and individual or organisational capabilities to support their role in road safety management.
- Increasing community and media interest in the issue and the need for evidence-based solutions.

At the local level, an example is provided through the E-SUM Action Pack which is “...intended to provide an easy-to-use template to help municipalities better understand their own PTW road safety problems, and to develop and implement remedial measures in a practical way.” The process outlined in the E-SUM Action Pack is summarised below (Figure 10.1).

This statement emphasises the need for the complexity and scope of strategies to reflect their intended audience and the depth to which different strategies tackle the issues outlined in this chapter should depend on this overarching need – fitness for purpose.

Figure 10.1. Processes in planning and developing a strategy



The contents of the E-SUM Action Plan also provides a description of the recommended strategy development process – following the standard Plan-Do-Check-Act cycle (see Table 10.1).

Table 10.1. E-SUM Action Plan recommended strategy development process

1.	Identification and collection of data required for analysis of PTW casualty problems
2.	Data analysis
3.	Identification of casualty issues
4.	Using the Esum Good Practice Guide and Demonstration Projects to select interventions
5.	Setting up a monitoring framework for interventions
6.	Implementation of interventions
7.	Evaluation of effectiveness and reporting

Developing a strategy

The process of developing a strategy can provide significant benefits not only from the research and analysis necessary to inform the content of the document, but also from the stakeholder engagement required to obtain broad consensus to the actions that the strategy sets out.

A new strategy provides the opportunity for a review and testing of the assumptions underlying current policies and may provide a once in a decade opportunity to set new paradigms in relation to expectations of road user behaviour, resource commitments and legislative frameworks.

The development process will normally follow the strategy content as outlined at the beginning of this Chapter as it describes a process of problem definition, objective setting, agreement to strategies and actions and, finally, implementation mechanisms.

Situational analysis

These issues should inform the strategy development activity. Issues covered may include:

- Current and potential future trends in PTW use.
- The facts about risks and serious casualties by crash types; by location (urban/ rural); by type of PTW user – including scooters, mopeds, low powered motorcycles, higher powered motorcycles; commuter or recreational use; age category of user; speed and alcohol (and non-helmet wearing) involvement in serious casualty crashes, and comparing these to data for the balance of non PTW serious casualties by crash type.
- The role of other road users in PTW safety.
- The licensing requirements and practices in a jurisdiction for: (a) novices obtaining a riders licence for the first time; and (b) those returning to riding after a long absence – and reach an understanding of their implications for safety outcomes.
- Research advice which models the estimated impact of a number of individual interventions upon serious casualty outcomes.
- Areas where further research is needed.
- Current funding levels and funding options in a resource constrained environment.
- The different target segments of the PTW road safety market.

It can also be beneficial to define current coordination arrangements and the involvement of national, regional and local governments, and develop options for strengthening these.

As the role of stakeholders will be critical in the development and implementation of road safety measures, the context of this should be clearly stated, including:

- Understand, and effect, the “shared responsibility” concept – what it means and requires.
- Agreement by stakeholders around most of the issues identified in the planning stage.
- Identification of those issues where differences remain.

Defining strategic objectives

Setting a vision and targets

While a number of jurisdictions have established ambitious visions for road safety supported by aggressive targets, the level of ambition directed towards PTW safety is less common.

Sweden provides:

“The objective of this strategy is to demonstrate how the number of motorcycle and moped fatalities could be halved and the number of seriously injured riders reduced by 25 per cent by the year 2020, thus contributing its share to the 2020 interim goal.

The strategy is based on the management by objectives model for road safety based on Vision Zero – the Swedish Parliament’s long-term road safety plan.

The motorcycle and moped are a natural element in the transport system and thereby also in road safety operations.

Accident prevention measures are the most important element in making motorcycle traffic safe.

The most important element for safe moped traffic is to limit the consequences of accidents.”

(Trafikverket, 2010).

Whereas the statement from the Lillehammer conference is less explicit:

“It is a fundamental motorcycle safety requirement that motorcycles should have a place in overall transport policy and infrastructure policy/management.”

(OECD/ITF, 2008).

This seems to imply that the goals for motorcycle safety should be equal to those for other modes but this is not clearly stated.

The European Commission acknowledges the need for ambitious targets:

“Why set targets?

In the latest evolution of the road safety management system, key institutional management functions provide the foundation for system-wide interventions to achieve a range of results expressed as different types of quantitative targets (Bliss and Breen, 2009). Targets provide the focus for the national road safety strategy and the level of their ambition drive decisions about coordination needs, legislative needs, funding and resource allocation, promotion needs, monitoring and evaluation, as well as research, development and knowledge transfer.”

It includes ambitious overall reduction targets within its Strategic Plan to 2020 but the specific goals for motorcycling recognise the challenges in achieving targets:

“This ever-growing group of users is the one where it is the most difficult to attain a significant reduction in accidents and fatalities. In particular the reduction rate of fatalities amongst motorcycle riders is lower than for other road users.

The problem of motorcyclists’ safety should be addressed through a range of actions.”

(European Commission, 2010).

The Spanish plan recognises the need for a visionary approach but does not make this vision concrete through ambitious targets:

“It has been wished to base the preparation of the plan on a ‘shared vision’ among all operators intervening in the phenomenon of the accident rate regarding motorcycles.”

Similar to the Lillehammer statement, the Victorian PTW Strategic Action Plan recognises the need for improvement without defining any degree of ambition (Victorian Government, 2008):

“With such significant increases in the numbers of PTWs on Victorian roads, there is a need for greater consideration of PTWs in road use and transport policy development and planning. Those working in these fields need to become more aware of the needs of PTWs and the role they can play in the transport network.

In an environment where PTWs are an increasing component in Victoria’s transport mix, the plan seeks to identify initiatives and actions that will:

- significantly reduce the number of riders and pillion passengers killed or seriously injured
- ensure that PTWs are given appropriate recognition in transport and road use policy and planning.”

The UK followed a similar approach in its 2005 motorcycling strategy (DfT, 2005):

“The principal aim of our strategy is to ‘mainstream’ motorcycling.

The theme of this strategy therefore is to facilitate motorcycling as a choice of travel within a safe and sustainable transport framework.

Our aim is to make motorcycling a safe, enjoyable experience for those who choose this mode. This means taking account of the needs of motorcyclists, promoting safety measures and mainstreaming motorcycling, so that its needs are considered as fully as any other transport mode, in the development of transport policy.”

The United States document provides the answer to a much more fundamental question:

“The mission of the National Agenda for Motorcycle Safety is to point the way to the most promising avenues for future motorcycling safety efforts in the United States (U.S.).

The goal of the National Agenda for Motorcycle Safety is to enhance and improve motorcycle safety. The National Agenda simply attempts to answer the question, “What are the most important issues in improving motorcycle safety?”

The key issue to address in this matter is described in The Netherlands’ Sustainable Road Safety (SWOV, 2006):

“Do motorised two-wheelers actually fit into Sustainable Safety? The brief answer to this question is no, because Sustainable Safety speaks of achieving a considerable reduction of risks and of numbers of casualties. We could say that motorised two-wheelers (motorcyclists and moped riders) would fit within Sustainable Safety if the risks for this group were reduced to a similar level to that of car drivers and pedal cyclists. Currently, the risk is still 75 fatalities per billion person kilometres for

motorcyclists, and 91 for moped riders, whereas the risks for car drivers and pedal cyclists are respectively 3 and 12 fatalities per billion person kilometres. Such a sharp decrease in risk is inconceivable without draconian measures. It is difficult even to conceive of Sustainable Safety measures that could lead to a substantial reduction in the number of victims of crashes involving motorised two-wheeled vehicles.

Furthermore, the relatively high risk of motorised two-wheelers calls for a discussion concerning the acceptance of risk in a risk society ('How safe is safe enough?'); what should reasonably and responsibly be done to reduce risks ('As low as is reasonably achievable').

While this document was drafted by road safety practitioners within the Government, the result of this consideration is reflected in the Dutch strategic action plan for motorcycling (Rijksoverheid, 2011), which, as is recommended in this report, was prepared to reflect the consensus views of stakeholders:

"The aim of this action plan is to reduce the per kilometre risk of accidents faced by motorcyclists with a view to reducing the number of motorcycle casualties. Although the multi-year trend does reflect a reduction in the number of fatalities, the number of motorcyclists killed in road accidents has not decreased in the past three years, providing additional impetus for the introduction of this action plan.

This action plan is part of the Strategic Plan for Road Safety 2008-2010 (Strategisch Plan Verkeersveiligheid 2008-2010). The implementation of additional protective measures for vulnerable road users (including motorcyclists) is one of the cornerstones of this Strategic Plan, the guiding principle of which is that all measures must be proportional, i.e. increasing motorcycle road safety must not come at the expense of the freedom of motorcyclists to use the road in a responsible manner. The Ministry of Infrastructure and the Environment believes that this action plan will facilitate achieving the ambitious aims mentioned above, while adhering to this principle."

(Action plan for improving road safety for motorcyclists – Strategic approach)

Research and modelling

The development of an effective strategy implemented through sound actions depends on a solid research base to ensure that specific interventions are supported by evidence. Research can also inform the mix of strategies necessary to achieve desired outcomes.

These desired outcomes should include ambitious improvements in road safety as measured by fatalities and serious injuries. However, this work should also include the development of agreed safety performance indicators set at a level to allow continual monitoring of the factors it is possible to manage. The determination of strategies and actions should be driven by the desired intermediate and overall outcome targets that have been agreed.

A process to achieve to ensure an evidence-based strategy will include steps to:

- Obtain research advice which models the estimated impact of a number of individual interventions upon serious casualty outcomes and other safety performance indicators.
- Progressively refine the research-based modelling of estimated effects on serious casualties of a mix of initiatives to establish materiality awareness, (to lessen the tendency by senior bureaucrats and Ministers to discard potentially uncomfortable but substantially beneficial interventions) and to underpin target setting for the strategy.

- Set targets for fatality and serious injury reductions for the life of the strategy and key safety performance indicators and measure (and report publicly on) progress.

While this process has been exploited in a number of jurisdictions in the development of general road safety strategies, its application for PTW safety will be faced with greater sensitivity to research and modelling accuracy due to the relatively smaller number involved and the greater the impact of variability on the currently quite broad-brush estimates used in current modelling.

This demand for increased accuracy will remain a challenge to be gradually addressed as research improves the ability to predict the impact of future interventions.

For example, while the impact of infrastructure spending or speed enforcement may be relatively certain, the impact of changes to protective clothing or improvements in rider training or driver awareness are currently less amenable to predictive modelling.

Nevertheless, the Swedish Strategy for 2010-2020 indicates how modelling can inform the development of a suite of measures to meet a specific target (see table 10.2).

Table 10.2. **Potential of safety interventions – Results of modelling in Sweden**

Prioritised operational areas for motorcycles	Potential (Number of lives saved per year)	Present situation	Goal level	Effect
Anti-lock braking system (ABS)	31	30%	98%	15
Traction control	5	?	?	?
Speed limit observance	At least 15	?	80%	At least 9
Correctly used helmet + full-body protective equipment	4+3	-	-	?
Visibility of motorcycle / alertness of other road users + alertness of motorcycle rider	6+5	?	?	?
Sobriety	8	?	?	?
Safe intersections in built-up areas + urban areas	4+8	?	50%+?	2+?
Make existing guard rails appropriate to motorcycles	5	0%	?	?
Safe lateral reserves	6	?	?	?
Other operational areas	5	-	-	5
Total (lives saved per year)				31
Target: -50% reduction in motorcyclist fatalities by 2020 (Lives saved per year)				27

Source: Trafikverket (2010).

PTWs in the Safe System

The safe system is variously described in a number of jurisdictions but has a single core principle: a recognition that road users will make mistakes, or inappropriate decisions, and that the system, while also minimising errors, should accommodate these errors so that no individual road user is exposed to crash forces likely to result in death or serious injury.

This unacceptability of trauma is central to approaches such as Vision Zero in Sweden and Sustainable Road Safety in the Netherlands.

The Safe System approach assumes that road users will enter the system competent and will take measure to ensure that they remain compliant and alert. The system then ensures their safety by providing vehicles, road and roadside infrastructure and travel speeds that combine to ensure that any crashes that do eventuate result in crash forces that are below the level of human tolerance to physical harm.

Applying the Safe System to reduce general levels of road trauma will result in developments in vehicle occupant protection, protection from roadside hazards and separation from oncoming traffic on high speed roads with limited access and lower speed limits (e.g. 50 km/h) and intersection treatments such as roundabouts where traffic conflicts are inevitable. Where pedestrian and cycling traffic is introduced into the mix, there is a growing use of even lower speed limits (e.g. 30 km/h).

Another characteristic of Safe System approaches is consideration of the interactions between the different elements of the system and between the effects of different interventions. Some aspects of this are well recognised, for example, the influence of road design on chosen travel speeds. The challenge is to optimise the protection by combining the components of the road traffic system.

A potential area of future research would be to investigate such interactions in more detail to determine whether future road safety interventions and their underlying standards may need to be improved. For example, research (Berg et al., 2005) has indicated that the interactions between riders and roadside barriers are evenly split between riders and their vehicles sliding into barriers (separately or together) and others hitting the barrier on the motorcycle while in an upright, riding position. If loss of control due to braking leads to the former scenario, it could be hypothesised that an increasing uptake of ABS would lead to a relative reduction in such crashes. The most effective interventions to improve safety in impacts with roadside objects may therefore need to consider the rider/PTW system and also the potential protection that may be offered by the vehicle, as well as protective clothing or modifications to the roadside environment and furniture.

Inclusion of PTW riders into the Safe System yields two challenges. The first is the technical problem of providing protection from physical harm at the speeds at which collisions with other vehicles or fixed objects are likely. While this could be solved by ensuring travel speeds by, and in the vicinity of, motorcyclists are much lower, this then amplifies the second challenge. This is to ensure that any measures taken to improve PTW safety are supported both by the broader community and by PTW riders in particular.

This leads to consideration of whether the conventional Safe System approach should be modified by recognising that, in the short to medium term, use of PTWs will remain an inherently risky activity and that measures should be taken to reduce risk. This may result in, for example, strategies that focus more on avoiding crashes, rather than mitigating their effects, as outlined above in the Swedish strategy.

The risk mitigation approach then poses another challenge for jurisdictions. While the Safe System approach – for example as exemplified by Vision Zero – reinforces the unacceptability of trauma, a risk reduction approach to some extent confirms that some level of risk is acceptable.

In other words, in considering Reason's model of reducing trauma outcomes (Reason et al., 2006), the "Swiss cheese" model, the later interventions in the model will, for many years, contain large gaps that cannot be easily plugged. This leads to the conclusion that the most significant gains may derive from attention to the early parts – error and crash avoidance, rather than mitigating their effects.

However, as guided by Safe System thinking, strategies should not ignore the opportunities that are available to address the later stages of the causal chain – such as the promotion of improved protective clothing and equipment.

Decisions regarding resource allocation to road safety, the level of regulatory controls imposed on road users and other community costs will depend on agreement regarding the level of risk, or the reduction in trauma that is being sought over the life of a strategy. While the Swedish strategy spells this out, very few others do. This can lead to constant debate between stakeholder groups regarding the acceptability of proposals as there is seldom any objective target that any proposals are supporting.

The contrary view to the Safe System is that continued progress to reduce PTW risks is sufficient even if these reductions do not lead to reductions in overall levels of trauma, as the growth in PTW use outweighs the reduction in risk.

So, in the development of a road safety strategy for PTWs, while many jurisdictions recognise the need for broad stakeholder agreement to the content of the strategy, a shared commitment to a specific target will assist in subsequent determination of actions. Spain, in particular has put a strong emphasis on the need to achieve a shared vision (DGT 2007).

One of the factors in determining the appropriate level of risk, or the rate of risk reduction, is the proportion of traffic represented by recreational riding and the proportion of stakeholder input that is provided by that sector. While this will vary across developed economies, the domination of PTWs in emerging economies may provide different opportunities for interventions that may be unacceptable amongst the more recreationally-focused users in developed countries.

While this discussion has considered strategies for improving PTW safety as separate from general road safety strategies and their overall target, over time these two needs will merge. Growth in PTW use and improvements in safety for other road users are resulting in a general trend, across all countries, for PTWs to represent a growing proportion of road trauma. Achievement of overall Safe System goals will be increasingly difficult without close attention to PTWs.

Determine strategies and actions

Effective strategies will address the problem through a broad and integrated range of interventions that will exploit the synergies from multi-action programmes.

These should cover the full suite of Safe System interventions, subject to evidence of effectiveness and prioritised and targeted according the special needs of motorcyclists and the individual needs of each jurisdiction.

Some key questions can assist in the development of strategies and actions:

- What proven countermeasures can be implemented immediately – to provide immediate benefits and to provide visible evidence of commitment to action. Such commitment can then help garner broader stakeholder and community support for further, perhaps more challenging, actions.
- The development of what longer-term actions should be started now to address known or predicted future issues
- What work needs to be considered to develop greater understanding of motorcycle trauma, future trends and research findings to allow future countermeasures to be planned.

The development of countermeasures should also take into account that evidence about crash cause and driver culpability, although valuable input to the process, may not assist in the development of the most effective actions to reduce trauma that results from these factors. For example, while a proportion of crashes may be caused by other drivers not looking for – or seeing – PTWs, countermeasures that only tackle this root cause may be less effective than approaches that seek to modify car driver behaviour yet also recognise that other measures will be needed to cater for the limitations in any behavioural change programme.

The limitations in focusing on crash causation highlight the need for a combination of measures to be taken in many cases.

Safe System actions

The discussion of the Safe System, above, considered the applicability of the Safe System in relation to the setting of strategic targets that reflected the desire to move to, or towards, a Safe System, or whether a less ambitious, but more pragmatic, goal of risk reduction was more appropriate.

The Safe System also provides a framework to ensure broad consideration of a range of countermeasures that, together, provide a more complete system of protection.

Broadly, the Safe System components of road users, vehicles and infrastructure follow three well-established pillars of road safety, as described by models such as the Haddon Matrix. The Safe System goes further, by recognising that human error is inevitable and that the other components of the system should work together to prevent the outcome of these errors from being death or serious injury. This results in the fourth factor – speed – being introduced as a factor to mitigate harm, based on the known empirical relationships between impact speed and the probability of serious trauma. This approach is illustrated in the growing use of 30-40 km/h speed limits in areas of significant potential interaction between pedestrians and powered vehicles.

Similarly, data for passenger car crashes indicate that the potential for side impacts at speeds greater than 50 km/h and head-on impacts at greater than 70 km/h should be designed out of the system if the risk of serious injury or fatality is to be avoided

Similar empirical data for PTW riders is scant. However, the protection afforded by helmet and protective clothing would not approach that provided by a car's occupant restraint system, including the substantial structure around the occupant. The application of this approach to PTWs could lead to a conclusion that, as rider and driver error is inevitable, speeds should be managed so that impacts with other vehicles or infrastructure are below the level that would contribute to life threatening trauma. This speed would be increased through the use of frangible infrastructure, improved protective equipment and the physical separation from other vehicles. The difficulty in achieving these, in practice, and within the bounds of community acceptance, demonstrates the large gap between current practices and a Safe System.

In applying the Safe System to passenger cars, an assumption is made that drivers are competent and compliant and that the system of vehicles, infrastructure and speed working together has the potential to remove all risk of serious trauma. For PTWs, the speeds necessary to achieve these outcomes with the present performance and extent of use of protective equipment and forgiving infrastructure are likely to be so low that an alternative approach may need to be considered. That is to accept that a significant proportion of the gains to be made will be due to measures taken to improve the compliance, and competence of riders and other road users. So, while jurisdictions should select strategies and actions

appropriate to their needs and institutional and social environment, there may need to be a conscious decision not to follow the same balance of strategies that provide optimal outcomes for other road users.

The specific actions included in a strategy should build on the evidence-based countermeasures described in the previous chapters. This Section provides examples of important questions that a strategic process should answer in developing a suite of measures that work together to address the key issues identified during the problem definition process.

Road users

Ensuring safe entry of riders to the road system:

- What measures are necessary to ensure that riders enter the road system with adequate riding skills, hazard perception and responsible attitudes?
- Has the minimum age for riders been set with full consideration of the social and road safety impacts?
- Once on the road system, how do they develop skills through experience and what measures are necessary to manage the elevated risk during this period?
- What measures need to be taken to target specific rider groups, e.g. returning riders or off-road riders?
- What are the appropriate mechanisms to achieve desired capability and behaviours – off- and on-road training, mentoring etc. and how should these differ for different subsets of the rider population?

Ensuring compliant behaviour by riders in the road system:

- What are the key behaviours to be managed?
- How should enforcement, education, marketing and sanction schemes work together to achieve desired behaviour change?
- What innovative communication channels can be used to reach the target audience?
- What measures are necessary to improve the effectiveness of systems that prevent access to the road system by those who have demonstrated an inability or unwillingness to comply?
- What electronic or other systems are in place to reduce unlicensed riding?

Ensuring continuing alert and competent riders:

- Apart from those addressing the general road user population, should there be specific measures targeting PTW riders to reduce the influence of alcohol, drugs, fatigue, drowsiness etc.?
- What interventions are required to respond to the different segments of the PTW road safety market, with the style and tone of communications programmes which seek to encourage safe behaviours selected to gain the greatest traction with the identified sub-group?

Shared responsibility:

- What measures are necessary to reinforce the concept of shared responsibility for road safety and what are the specific behaviours these are seeking to influence?
- Are there opportunities to improve other road users' ability to look for, perceive and react to motorcycles?
- Segmentation.
- How should the above actions be tailored and priorities altered for different PTW groups? These may include:
 - Moped riders
 - Scooter riders
 - Commuters
 - Recreational riders
 - Returning riders
 - Off-road riders
 - Urban versus rural riding

PTW users can also be segmented according to attitudinal and motivational differences, leading to different attitudes to risk, use of protective clothing and riding styles.

Vehicles and equipment

Crash avoidance:

- What current or emerging technologies should be encouraged or required on PTWs to reduce the incidence of crashing due to rider error? These might include improvements to braking and/or stability systems, tyres, etc.
- What current or emerging technologies should be encouraged, or required, on PTWs or other vehicles to reduce the incidence of crashes due to other factors? These might include conspicuity aids, collision detection systems, v2v communications, etc.

Crash protection:

- What current or emerging technologies should be encouraged or required to reduce the risk of serious injury to riders in the event of a crash? These might include airbags, automatic crash notification.

Helmets and protective clothing

- What standards are set to define the required level of protection afforded by helmets and other protective equipment?
- What regulations are necessary to ensure the wearing of this equipment?
- Are these standards and regulations consistent with the physical and social environment?

- What programmes are required to increase compliance with these regulations and to encourage the use of additional protection?
- Are these actions tailored to different PTW groups, e.g. novice riders, off-road riders, scooter riders?

Infrastructure

Provision for motorcyclists in new road infrastructure:

- Has the impact of network developments on PTW trauma been taken into account in the determination of PTW road safety targets?
- What standards should be set to define required infrastructure design and performance?
- What guidelines are necessary to encourage motorcycle-friendly infrastructure?
- What procedures are necessary to define when investment in PTW-compliant infrastructure is required?
- What programmes are required to increase road authorities' and road designers' awareness of the needs of PTWs and their capability to design to these needs?
- Are road safety audits undertaken from the perspective of all road users, including PTW users?

Segregation:

- What measures can be taken to reduce the interaction between incompatible traffic streams, particularly between PTWs and heavier motor vehicles?
- Is it necessary to reduce the sharing of lanes by PTWs and other vehicles?

Specific motorcycle treatments:

- What innovative treatments should be trialled to investigate the potential to improve PTW safety?
- Are programmes in place to collect and analyse crash data to determine the locations of greatest PTW risk?
- Are programmes to address these risks in place and is the rate of investment consistent with the targeted reductions in PTW trauma?
- Do these programmes encompass blackspot/black length (reactive) and infrastructure safety risk reduction (proactive) investment programmes?
- Are effective practices for reporting (of on-road motorcycling hazards) and response arrangements in place by all road authorities including local government?
- Do road operations practitioners share experiences within/with other road authorities about good operating practices?

Speed management

- How much is the community (motorcyclists and the general community) prepared to support speed limits that are set at, or approaching, Safe System limits?

- What limits should be placed on the maximum speed, power or acceleration of all PTWs, or those ridden by certain riders, for example novice riders?
- What programmes are necessary to increase riders awareness of the role of low-level speeding?
- Should differential speed limits be applied for different classes of motorcyclist, e.g. novice riders, moped or scooter riders?
- How should speed limits, roads and roadsides and vehicles interact to optimise progression to a Safe System?
- Are there locations where speed limits should be reduced on winding recreational routes so motorcyclists are not encouraged to engage in legal but unsafe speed behaviours?
- What current or emerging technologies should be introduced to raise riders' awareness of speed limits or restrict vehicles to the speed limit?
- How should enforcement technologies, sanctions and licensing procedures work together to discourage speeding and remove irresponsible and recidivist speeders from the road system?

Establish supporting arrangements

Consideration of the questions above should result in agreed strategic actions that address the PTW safety issues that are the most critical for each jurisdiction. They define WHAT needs to be done to improve PTW safety. The following section of a strategy will define HOW these actions can be implemented and supported.

Resource allocation and prioritisation

Actions taken to address PTW safety need to be balanced against the competing demands for resources from other road safety actions and from unrelated programmes seeking support in a resource-constrained environment. In addition to funding for the delivery of interventions, there is also competition for support in areas such as research, policy development and legislative processes.

The establishment of quantitative outcome targets and the development of an understanding of the outputs required to achieve these targets will help inform the resource allocation process. Without these targets, there is a risk that competition for limited resources will result in resources being directed to other areas of road safety. The monitoring of performance to outcome and output targets should provide an objective process to help support the case for increased overall funding to cover this gap should this allocation to other areas occur.

There are three key decisions to influence the allocation of resources to PTW safety:

- How can existing programmes be shaped to enhance PTW safety?
- How much can be allocated to programmes that are specifically targeted at PTW safety?
- What processes should be used to prioritise effort, once a decision to allocate resources has been made?

While economic tools such as benefit cost analysis will help direct resources at the key problems, they carry the risk that some areas, such as PTW safety, may be less able to attract funding than other modes with greater traffic densities. Blackspot programmes can deliver outcomes with very significant benefit cost ratios, but crash types that are more dispersed in the network will not be able to compete against crashes at, typically, intersections.

PTW safety may therefore be enhanced by the application of road safety resources toward conventional initiatives that benefit the whole road user base, if these are targeted at locations or other demographic sectors that would otherwise not be supported. Indeed, the benefits for PTW riders may be less than for other road users, but they may be considered to be PTW programmes if they would otherwise not be funded under a process driven purely by benefits for the whole road user population.

On the other hand, the provision of infrastructure – or implementation of other measures – specifically for the benefit of PTW riders will be influenced by the benefits for PTW riders alone and the cost of providing these benefits. The lower the marginal cost of making provision for PTW riders, the greater will be the opportunities to make these provisions.

As an example, consider the case of roadside barriers. Policies to provide supplementary protection for PTW riders that increase the overall cost of barriers may result in fewer locations being able to be treated for the benefit of all road users and this could result in a net community cost. A challenge for the future is to minimise the cost differential to render the compromises that need to be made less significant. While this trade-off is particularly important for retrospective programmes that are treating existing locations with higher crash risk, it can be addressed in the provision of new infrastructure by the establishment of standards and policies to require improved performance in PTW crashes. However, in the allocation of scarce and limited resources, such policies will always result in trade-offs being required in other areas and these trade-offs may carry a net community cost.

An alternative approach, such as that adopted in Australia with the Victorian Motorcycle Safety Levy, is to dedicate a specific expenditure programme to PTW safety, without competition from other demands for road safety investment. In the Victorian case, this expenditure programme is funded by a specific levy on PTW owners (see Box 10.1).

Box 10.1. Australian Case Study: The Victorian Motorcycle Safety Levy

The Motorcycle Safety Levy (AUD 66 for 2012/13) is an addition to the compulsory personal injury insurance premium on PTWs with a capacity of 126cc and over. The levy is included with registration renewals.

Special purpose vehicles, recreation registered motorcycles, motorcycles used solely for primary production operations and veteran, vintage, or classic motorcycles with club permits are exempt from the levy.

The funds from this levy go directly to projects to improve the safety of riders.

From the start of the levy in October 2002 to the end of June 2012, approximately AUD 45 million was raised from the levy. To date, the funds raised have been allocated to over 148 road improvement projects and 54 other projects involving areas such as research and education.

Application of funds follows a Strategic Guide for Expenditure of the Motorcycle Safety Levy Funding to achieve the greatest benefits for rider safety.

This Strategic Guide defines four priority areas for projects to be considered for funding:

- Engineering, technology and Intelligent transport systems (ITS).
- Enforcement.
- Education.
- Enhanced information for decision making.

Benefit-cost analysis

Analysis of relative benefits and costs can be used in a number of ways to influence resource allocation and project prioritisation. Benefit-cost analysis can be used to help answer the following questions:

- How should resources be allocated between competing programmes; for example between a motorcycle blackspot programme, or a programme in another area of road safety, or a completely different area of government responsibility? In this case, the power of the analysis can be limited by the varying assumptions made about very different types of benefit. As discussed earlier, the most appropriate tool may be a more strategic analysis of overall resource needs to meet agreed performance targets.
- How should programme resources be allocated between competing projects? For example, which blackspot projects should be funded from a fixed resource source? In this case, the benefit-cost analysis should result in the optimal programme being developed with maximum road safety benefit resulting from the resource input. While this analysis should provide more useful results as the nature of inputs and outcomes should be the same, there is still a need to understand the role of uncertainty both in the underlying risk and in the effectiveness of the proposed treatment.
- Is an action worth doing? In other words, is the benefit-cost ratio above one, or above some predetermined level that has been set as a target return?

Role of stakeholders to promote consumer demand, community acceptance and participation

While much of the responsibility for implementing a PTW safety strategy will rest with governments and industry, no significant change will be possible without engagement with the community to ensure that they are aware of the shared responsibility for road safety. This extends beyond responsibility on the road to responsibility at other times.

Programmes such as New Car Assessment Programmes, now in place in many countries, have demonstrated the benefits in achieving improvements in safety performance driven by manufacturers' offers and consumer demand rather than the slower pace of regulatory change. The SHARP programme in the UK applies the same principle to motorcycle helmets to raise consumer awareness that they can provide themselves with a greater level of protection by making informed choices. This should then stimulate the market to provide improved performance in response to this demand.

The extension of this process to PTW protective clothing may provide similar benefits, but it would also benefit from an international approach.

Suppliers, clubs and other organisations have a role to play in promoting safe riding practices, safer clothing and equipment and safer bikes.

Economic incentives should be investigated to determine the extent to which safe choices and safe riding can be influenced by economic factors. These might include incentives for participation in effective training, offence-free riding, tax breaks for safety equipment. The source of these incentives may be government or insurers. The design and scale of these incentives are likely to vary considerably between jurisdictions due to differing economic conditions and financial systems in place.

Alternative mechanisms may include the imposition of insurance penalties; for example if PTW users are involved in a crash while not wearing protective gear.

One of the challenges of many road safety programmes is that the recipient of the benefits and the provider of the resources are often not the same organisation or group of individuals. Opportunities to create this link should be investigated.

Implementing a strategy

The implementation of a strategy starts with its development, and the process outlined in this chapter would lead not only to the creation of a strategy, but also to the engagement of all relevant stakeholders in the process.

Accountability for implementation will be a key factor in determining the success of a strategy. Through the situational analysis and development of strategic response to this, the desired key performance indicators should be developed to ensure that tracking of performance can be done.

There can be a benefit, through demonstration projects being developed, funded and implemented at local and regional level, to enable innovation and change to be progressed. This can not only provide early tangible benefits, but can also promote the strategy and increase awareness and knowledge.

Early achievement of tangible benefits can provide momentum for on-going effort by validating the direction of the strategy and strengthening the shared ownership.

Monitoring and evaluation

No strategies can provide a complete and accurate roadmap of the actions to be taken throughout its life. Limitations in data, uncertainty of effects, the development of new trends and the emergence of new technology all drive the need for flexibility in implementation. A safety performance framework, including responsibilities, monitoring, measuring, reporting and accountabilities will facilitate this process. This could be complemented by performance indicators for each stakeholder, measuring the output of each stakeholder's actions.

The "Plan-Do-Check-Act" cycle of continuous improvement documented in management systems, such as ISO 39001 will be both a relevant and helpful tool to support the systematic and continuous improvement for each stakeholder, both public and private, by ensuring establishment of effective management systems.

These systems will include input and output measures to determine whether the strategy is being implemented and intermediate and overall outcome measures to assess whether the strategy is producing the desired result. Tracking of these measures and regular reporting to practitioners and the community should prompt review of ways to improve implementation, as well as the need for adjustment of the strategy in the face of changing trends or unexpected variations in the road safety impacts.

In addition to on-going monitoring, the implementation plan should include regular reviews to check and report that implementation of the strategy is proceeding to schedule and whether the strategy itself needs to be adjusted in light of experience gained, emerging trends and technological developments.

The key outcome measure for the community, opinion leaders and policy makers will be trends in serious casualties, particularly fatalities. Owing to the random variation in some of these data, the

development of understanding of statistical significance will provide benefits in avoiding knee-jerk reactions to short-term trends that prove to be the result of no more than uncontrollable random variation. For PTWs as a subset of the total road safety situation, the smaller total numbers involved can increase the potential for this.

Conclusions and recommendations

Growing PTW traffic makes it imperative to adopt safety interventions targeting this mode of transport. A strategic plan to achieve the goal of a Safe System should be integrated with road safety strategies across all modes, as well as examining opportunities across society for the cultural and attitudinal changes that are required for significant and sustainable improvement.

As the economic costs associated with PTW crashes are significant, investing in PTW safety can bring important societal and economic benefits. These benefits are likely to amplify as growth in PTW usage increases the total cost the trauma imposes on the community.

Improving the safety of PTWs should be a shared responsibility. All relevant stakeholders need to be actively involved in the process of drawing up and implementing a shared road safety strategy which includes safer behaviour of all road users, safer infrastructure and vehicles with enhanced safety features. A toolbox of measures is required to improve the safety of PTW riders within the traffic system. These measures must take into account the specific challenges of PTWs traffic, and also consider the variety of PTW users, insofar as some segments may be addressed with particular measures. A strategic approach should consider the most effective combination of measures according to the specific needs of individual jurisdictions.

Additional research will provide a better understanding of current challenges related to PTW mobility and safety problems and help achieve a traffic system which better integrates and protects PTWs in a cost efficient manner. However, significant benefits can be achieved by applying current knowledge. A lack of complete understanding should not be an impediment to action being taken immediately. A robust strategic management process should ensure that on-going monitoring and evaluation are in place to adjust and improve strategies as new knowledge emerges.

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