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Safe System in road safety public policy: A case study from Victoria, Australia

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ABSTRACT

Safe System has been the dominant approach to road safety in Victoria for over fifteen years, guiding the development and implementation of policy. Limited attention has been paid to the development and application of Safe System in a public policy setting. The aims of this research were to describe the intentions of Safe System in Victoria, and analyse how well this aligns with models of successful public policy. Using a qualitative approach, semi-structured interviews were undertaken with Australian and international experts ($n = 10$). These experts represented a range of organisations and leadership levels that were either directly involved in the development or had a detailed understanding of the development of Safe System in Victoria. The interview results were analysed using a policy success model. The findings suggested that Safe System can provide a framework to address road safety in Victoria, however successful public policy needs to ensure that the development of policy addresses the identified problem and that the results are maintained for some time. Safe System meets some of these requirements, but principally lacks explanation for how its overarching approach is meant to be understood and utilised. Practically, road safety professionals need to clarify the purpose of the Safe System concept in order for it to be successfully integrated into public policy. Whilst Safe System requires additional clarification, it has garnered additional interest and debate in road safety and from this perspective has advanced public policy.

1. Introduction

Road fatalities and serious injuries are a public health problem that is both preventable and treatable. In Australia, road safety has been treated as a priority at both a federal and state level [1,2]. Victoria, is one of Australia's most densely populated states, with a population of 6.7 million people in 2020 [3] and 4.8 million registered vehicles in 2018 [4]. Australia's political system and division of power results in individual jurisdictions taking responsibility for significant components of the development and delivery of road safety policy [1,5]. The State has been recognised as a leader in road safety, particularly through its management approach, policy and introduction of evidence-based legislation such as compulsory seat belt usage laws and random breath testing [6,7]. Historically, Victoria's approach to road safety concentrated on legislating unsafe actions and having strong enforcement mechanisms in place [8], yet in more recent times a new approach has been dominant.

In Victoria, road fatalities have been reported from 1905 [9], and peaked in the 1970s. Recognising the significance of the problem, major efforts were implemented to reduce fatalities, leading to the emergence of road safety research [10]. 'Traditional' approaches to road safety viewed the driver as the cause of crashes. As such, the driver was responsible for ensuring a crash did not occur and when a crash did occur, the driver was responsible for the ensuing injuries [11,12]. While strategies to reduce road fatalities and serious injuries focused on enforcement, education and engineering (the 3Es) [13,14], there was a prevailing view and acceptance that fatalities and serious injuries were a fundamental component of the transport network [15]. In effect, the strategies that were applied meant the individual should adjust to the road network as opposed to the network being tolerant of the individual [16].

Faced with stagnating road fatality figures in Europe, a new way of thinking about road safety began to emerge by the late 1980s [17]. Led by the Scandinavians and influenced by the pioneering work of Haddon and Gordon, a move towards treating the road network and its component parts as a system was underway [16,18]. These approaches recognised that fatalities and serious injuries could be prevented and instead sought to improve road safety by including elements of injury prevention approaches. Notably, these shifts took the focus from blaming

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the vehicle operator and instead reframed road safety to a more holistic systems-based approach, congruous to models operating in occupational health and safety [19,20]. This approach advocates that there are multiple parties responsible for reducing road trauma and that all parties need to work in harmony to ensure that the entire road transport system is safe [16,21,22]. By the 1990s these approaches to road safety began to manifest [23] with the adoption of a 'forgiving' system, where crash energies do not result in fatalities or serious injuries [24]. It also led to the notion that a target of zero fatalities is achievable [17]. In Sweden, this new approach was labelled Vision Zero and sought a scientific methodology towards human tolerances, a cohesive view of the road network, an ethical approach to the management of road safety and a vision for road safety [23]. Alternatively, the Sustainable Safety approach was developed in the Netherlands, which, when compared to Vision Zero aimed to reduce crashes but where this was not possible, reduce the severity of those crashes. Infrastructure changes to the road network would be supported through enforcement and education [25,26].

While the traditional approaches to road safety had been successful in reducing fatalities and serious injuries in Victoria, these reductions plateaued in the late 1990s and early 2000s, prompting the government to seek enhanced approaches. This led to interest within Australia to new thinking towards road safety. Inspired by the Swedish Vision Zero and the Dutch Sustainable Safety, Australia began developing the 'Safe System' approach [27]. Safe System advocates that it is not acceptable or inevitable to have fatal or serious injuries on roads. It recognises that people make mistakes and crashes will occur (human fallibility), there are limits on the amount of force the human body can tolerate before it is injured (crash tolerances) and that the road network should ensure that where a crash does occur, the forces should not exceed the limits of human tolerance [28]. Originally, Safe System had four elements (or pillars) working together in order to create a safe operating system – roads, vehicles, people and speeds [29]. A fifth pillar, post-crash care, was subsequently added in recognition that the events following a crash play an important role in reducing the prospect of fatality or injury. Victoria was an early adopter of Safe System, having recognised that the approach could improve road safety within the state [30]. In 2004, the Australian Transport Council - Australia's then peak road safety body - ratified Safe System. It has now become a mainstay in Australia, guiding national, state/territory and local government road safety practices [28,31].

Internationally, the Organisation for Economic Co-operation and Development (OECD) recognised Safe System as road safety best practice in 2008 [32]. The OECD, World Bank and World Health Organisation (WHO) encourage all nations to follow Safe System and many nations have and continue to implement Safe System principles [32]. Notwithstanding this recognition, and in spite of Australia having adopted Safe System 16 years ago, the forecasted reductions in the road toll and other key indicators have not been met [33]. A review of the Australian National Road Safety Strategy in 2018 identified a failure to meet the targets set out in the Strategy, and suggested potential failures of Safe System implementation [34].

Woolley and Crozier [34] report a lack of will to pursue the changes required to adopt Safe System within Australia. This is supported by Muir, Johnston and Howard [35] who reported that the implementation challenges of Safe System are political and social, rather than technical. Whilst these challenges could be overcome, research by Mooren, Grzebieta, and Job [30] identified that each of the Australian jurisdictions they examined interpreted Safe System differently and seek to apply it in different environments. While there has been systematic examination of implementation issues, the concept and intentions of Safe System have not been considered in existing research.

Both Vision Zero and Sustainable Safety have received detailed analysis considering whether the zero target is achievable [36], its impact on public health [37,38], how it is interpreted and applied [39] and its effects on public policy [40]. However, in Australia, and in particular Victoria, there has been limited analysis of the policy cycle and implementation of Safe System, and a lack of systematic investigation of the role of public policy to determine where the opportunities and challenges lie. The primary objective of this paper is to therefore identify the purpose of Safe System in Victoria and explore Safe System from a public policy perspective. The focus is an examination of the role of the Safe System approach in public policy. For the purpose of this research, the definition of Safe System first articulated by the Australian Transport Council was used [41] which describes Safe System as a "the way different elements of the road transport system combine and interact with human behaviour to produce an overall effect on total road trauma" (p. i).

2. Method

To identify the factors associated with the role of public policy on Safe System design and implementation, a qualitative approach was applied, utilising a series of semi-structured interviews with key informants. This approach was selected as it was considered the most appropriate for exploring a range of perspectives on Safe System, by allowing participants to describe their experiences and perceptions of the initial conceptualisation, development and implementation of Safe System. A qualitative descriptive approach was used for this study, as this approach is a valuable tool for policy and implementation professionals [42,43].

The focus of the interviews was to obtain a detailed understanding of the adoption and development of Safe System in Australia, the decision-making processes, and challenges and opportunities for implementation. The key informants were Safe System experts, and included individuals with a strong understanding of road safety management and practices and detailed knowledge of Safe System's development in Victoria. As road safety has a variety of stakeholders, it was considered important to select a sample of individuals from different organisations, who have held/continue to hold positions at different managerial and leadership levels, in Australia and internationally. The opinions and perceptions of these individuals are fundamental in determining how the original cohort of developers identified the intentions of Safe System. These views were corroborated with existing literature.

An initial list of experts was constructed, drawn from a group of individuals who represented a range of organisations, including academia and government. A purposive sampling technique was used with the aim of capturing individuals who had a range of experiences and were involved in the development of Safe System. Participants were recruited through existing professional networks within the Victorian road safety community. No incentives were provided to participants.

A snowball sampling approach was employed, as a deliberate technique to counter any self-selection bias and to ensure the views of those with the requisite knowledge were captured. Snowball sampling involves the process of engaging a small sample group, who, through referral recommend other individuals who meet the participant requirements [44,45]. In order to reduce any bias or influence, limited information about the project scope was presented to participants outside of what was contained in the explanatory statement.

A semi-structured interview proforma was developed, and included six questions and a series of prompts. All interviews lasted approximately 60 min. A combination of face-to-face and internet-based video conferencing (Zoom) were conducted. Interview recordings were replayed and compared to the notes taken by the interviewer during the interviews. Manual content analysis was undertaken of the recordings (computer software was not used). As noted by Saldaña, non-computerised content analysis enables researchers to have greater control and ownership of the analysis [46] and can allow a researcher to be fully immersed in the data [47]. Thematic analysis, using inductive open coding, resulted in a number of themes. Initially, the lead author replayed and reread the interview recordings in order to code the interviews and identify potential themes. The codes were developed by

Table 1
Research topic guide.

Topic/Theme	Explanation
What is Safe System?	Defining the concept
Development of Safe System: How and why	History of Safe System and its impetus
Vision Zero, Sustainable Safety and Safe System	Comparison between the three concepts
Implementation in Victoria	How Safe System was applied
Changes in Safe System	Evolution of Safe System
Key successes and failures of Safe System	Implementation accomplishments and failures

examining frequency of responses and then combined to form themes. Having been informed of the process used by the first author, the second and third authors then reviewed and refined the initial themes. Due to the interpretative nature of the research intercoder reliability was not deemed appropriate [48], however, the six phase framework outlined by Braun and Clarke [48] was applied. The themes were then triangulated against academic and grey literature.

The results were analysed using the interview questions as themes (see Table 1 for topic guide). To provide a means to report on and compare the results, two interlinked policy models were used (the public policy cycle and the policy success framework). In Victoria, road safety is typically developed and implemented through public policy [49] so these models were deemed appropriate.

Some of the oldest policy analysis models include the heuristics based public policy cycle models or frameworks [50]. Public policy cycle models are varied, usually ranging between 5 and 8 'stages' [51,52]. They describe public policy as a process, that involve a series of steps that is linear in fashion. For this reason, they have been criticised [53], however they provide scholars means to analyse how policy is development and whether a policy has addressed the requisite components outlined in the stages [54]. The Centre for Disease Control and Prevention (CDC) policy process (see Fig. 1) provides one example of these models and has been cited across the public health literature [55–57].

Whilst policy cycle models identify how a policy should be developed and implemented, they do not provide a way to objectively determine if a policy will be successful. Policy success models provide a holistic means to assess policy and policy measures as they review how policy was designed and implemented [59]. Initially developed by Bovens and Hart [60] and later expanded on by McConnell [61] and Luetjens, Mintrom and Hart [62], these models provide an opportunity to analyse Safe System at a policy level. These models are typically comprised of four key attributes – a process assessment, a programmatic assessment, a political assessment and a temporal assessment. The policy cycle is represented within these models at both the process and temporal stages. These models are both relevant and applicable as they have both been applied within an Australian context and within road safety [62,63].

Ethics approval was granted through the Monash University Human Research Ethics Committee.

3. Results

3.1. Participants

Of the twelve requested interviews, one participant was unable to be contacted and a second declined to be interviewed (see participant details in Table 2 below). Participants were categorised as either having a background in government policy ($n = 6$) or having experience in both academia and public policy ($n = 4$). Six of the participants were located outside Australia, but had worked extensively in Australia, with seven having worked or studied in Victoria. All of the participants were male and each participant was actively involved in road safety at the time of initial implementation of Safe System in Victoria. All of the participants have/continue to hold senior positions within their respective organisations.

3.2. Theme 1: What is Safe System?

One of the key factors in analysing Safe System is to determine how it is understood by a range of actors.

Half of the participants described Safe System through the lens of a holistic road safety system. They indicated that Safe System described the parameters around how the system should operate – using a set of principles that accepts that humans make mistakes (human vulnerability) and that humans have vulnerable physiology (human tolerances). Six participants (three with experience in both academia and public policy and three with experience more directly in government) noted that, for Safe System to work, all parts of the system need to work in harmony to ensure the outcome of no fatalities or serious injuries (i.e., a shared responsibility).

Five participants described Safe System as an evolution or revolution of road safety, moving from a traditional approach that focused on education, enforcement and engineering into a new moral and ethical approach. Participants who held this view were from a variety of backgrounds, both academic ($n = 3$) and senior public service roles ($n = 2$). Participants noted that Safe System was an attempt to redefine the approach to road safety to one that does not accept fatalities and serious injuries on the road network. Two international participants said that balancing trauma against mobility is unacceptable under Safe System.

In addition to examining descriptions of Safe System, it is important to examine the terminology used in these descriptions which provides a level of insight into how participants interpret Safe System. Participants used a broad range of terms to describe Safe System including 'framework', 'vision', 'principles', 'approach', 'strategy', 'goal', 'mindset', 'structured model', 'elements' and 'tools'. Three of the ten participants used only a single term, with the majority variably describing Safe System using different terms throughout the interviews. The most commonly used term was 'approach' which was used by five participants followed by 'strategy' ($n = 4$) and 'vision' ($n = 4$). Those participants who viewed Safe System from a 'systems' perspective were more inclined to describe Safe System as a strategy or set of principles, whilst those who viewed Safe System as an 'evolution' used the term approach. As one participant stated "In my view, there is always a combination of three elements when you talk about Safe System. It's a vision, it is a set of principles and it is a set of tools. In that respect you can call it an approach." [P7].

3.3. Theme 2: Development of Safe System: How and why

Exploring the intentions of Safe System provides insight into whether it has achieved what was intended. Two broad perspectives on the intentions were observed.

One group of participants viewed Safe System intentions through its outcomes – namely to reduce fatal and serious injuries to zero. Six participants identified this as the principal aim, noting that this aim refocuses road safety away from crashes and towards fatal and serious injury.

Another group of participants viewed the intentions of Safe System as a redefining of road safety management, by treating the network and road safety as operating as a system. These participants noted that Safe System identifies how the system itself should be designed and how it shifts from traditional approaches to road safety.

A common response amongst the participants was that the genesis of Safe System in Australia began with changes that occurred in Scandinavia. These changes brought the concepts of a shared responsibility, human tolerances and systems approaches to the fore and began to influence road safety practices around the world. These changes reflected a need to overcome stagnating road fatality totals both within Australia

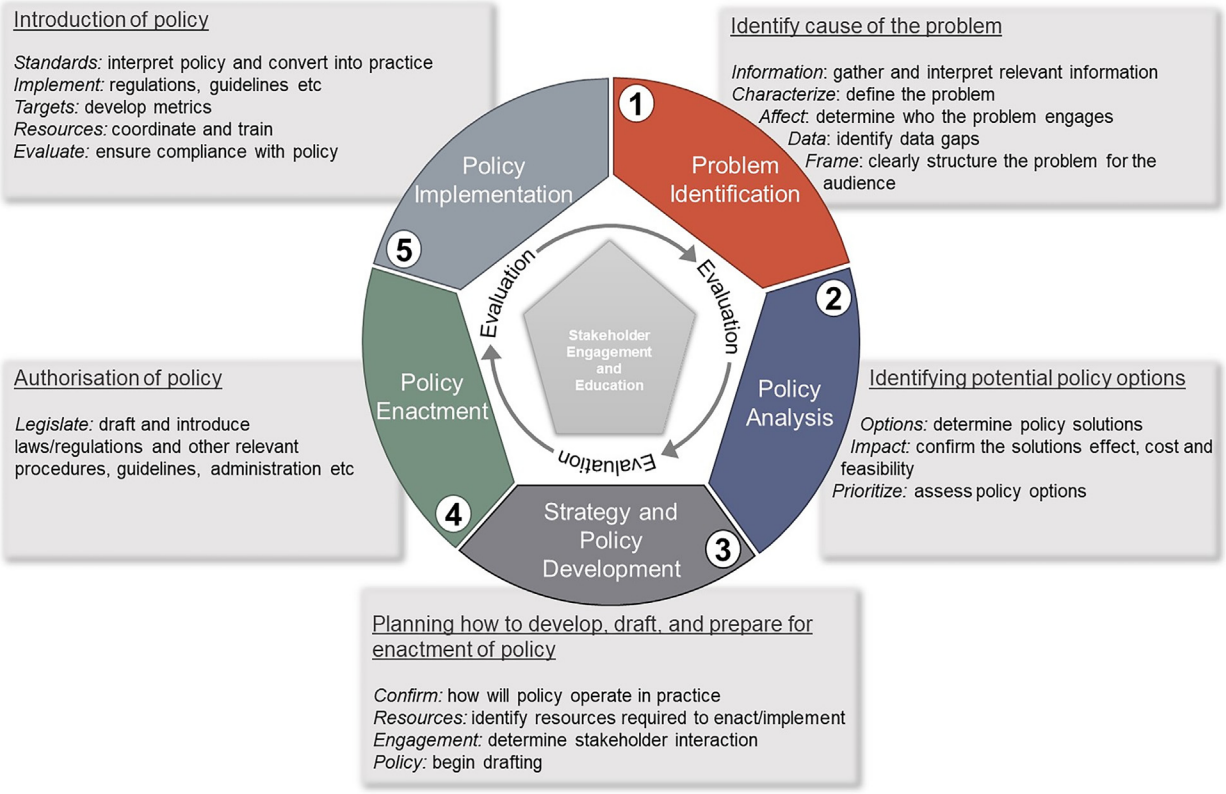

Fig. 1. The public policy cycle (adapted from Centre for Disease Control and Prevention [58]).

and internationally. As one participant, with the benefit of hindsight noted "It became so striking that we got it all wrong" [P4].

Participants noted that changes in the 1980s in Sweden, followed by changes in the Netherlands in the 1990s, were evidence that traditional approaches to road safety had reached their end, and instigated the development of what was to become Safe System in Australia. The change in thinking from Sweden and the Netherlands was seen in Victoria as not only practical, but identified that there were areas for improvement. As one participant stated: "Sweden had shown the world that road authorities could do better" [P9]. In sum, half of the participants noted that these international developments had a direct bearing on road safety in Victoria.

All of the participants with direct experience in the development of Safe System reflected on the input of a small number of key individuals in academia and the public service as having a key role in its development. The timing of the new approach was also mentioned by participants as aligning with the end of existing road safety strategies as well as an open-mindedness at the political level to reassess how road safety was approached. This development was seen as positive by the majority of participants; Scandinavia had demonstrated that road safety improvements were possible by rethinking the way road safety is viewed and managed.

A more critical view was held by a small number of participants, who reported that the development of Safe System was a search for a panacea to fatal and serious injuries, or as one participant described, a road safety "magic bullet" [P3]. Based on participants' responses and confirmed and enhanced through academic literature, a timeline of the development of Safe System in Victoria has emerged (see Fig. 2).

Table 2
Participant details.

Participant id	Type	Location	Gender
P1	Public policy	Australia	M
P2	Public policy	International	M
P3	Public policy	Australia	M
P4	Public policy and academia	International	M
P5	Public policy and academia	International	M
P6	Public policy	Australia	M
P7	Public policy and academia	International	M
P8	Public policy	Australia	M
P9	Public policy and academia	International	M
P10	Public policy	Australia	M

3.4. Theme 3: Vision Zero, Sustainable Safety and Safe System

Participants were asked to describe the three approaches, their similarities and differences. Overall, participants reported that Safe System was an approach designed for the Australian context based on the evidence generated in other countries. However, there were some differences in opinions regarding the similarities/differences between the approaches. Participants believed either: that Safe System and Vision Zero represented the same approach but Sustainable Safety was different ($n = 4$); Safe System, Vision Zero and Sustainable Safety were all different approaches ($n = 3$); or that there was no difference between any of the approaches ($n = 3$). This highlights a range of divergent views about what Safe System represents. The participants who suggested there was no difference between the three approaches held a variety of roles at both a state and national level in academia and the public service. Each noted there was a common focus on reducing silos and encouraging institutions to cooperate and coordinate (shared responsibility). They argued that in effect the intent of all three approaches were the same, although branding and emphasis may differ. In this regard, each of these participants held the view that the focus of Safe System, Sustainable Safety and Vision Zero may be slightly different, but they were all seeking a similar outcome.

Safe System and Vision Zero were seen as synonymous by four participants. These participants noted that Safe System and Vision Zero were fundamentally consistent in their approach and aim, in terms of

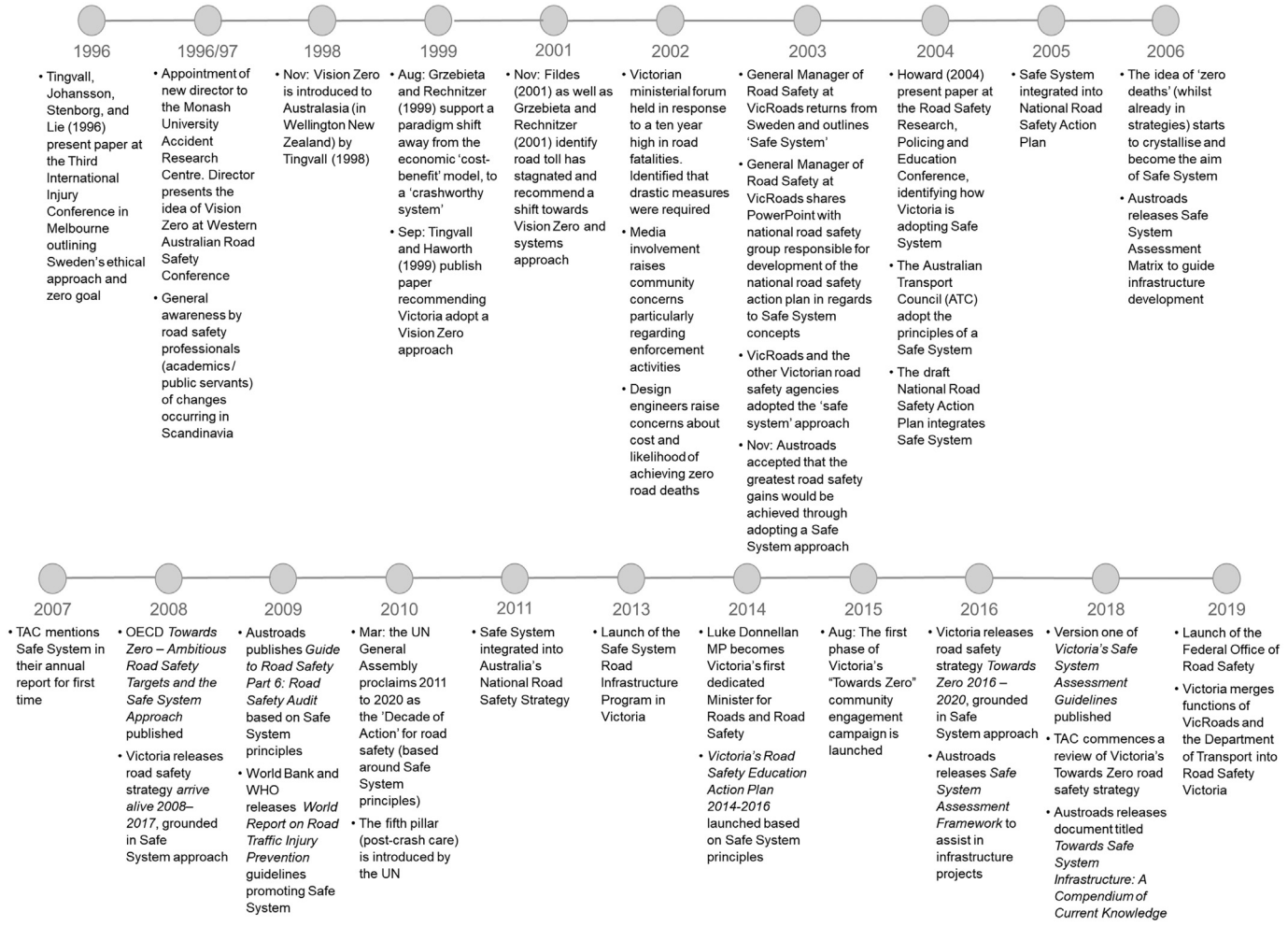

Fig. 2. Timeline of Safe System development in Victoria [85,89,90,91,92].

achieving reduced road fatalities and focusing on road safety as a system. Sustainable Safety on the other hand was viewed not only as starting from a different premise but having a different focus on road design and environmental concerns. Sustainable Safety was therefore seen as broader in context than Safe System, encompassing concepts such as 'movement and place' and environmental targets.

The remaining participants viewed the approaches as different. One participant [P3], with a background in roads policing described Vision Zero as aspirational, Sustainable Safety as being broader than just road safety and Safe System as a "reincarnation" of Vision Zero. Another participant [P5], whose background is in international public policy, viewed Vision Zero as revolutionary – reshaping road safety by accepting that individuals will not necessarily follow laws and the system would need to compensate. In contrast, this participant noted that Safe System views its citizens as law abiding and therefore could incorporate more traditional interventions for road safety. A third participant [P7], with a background in international research and policy explained that, in their view, Safe System was a broad term to describe systems-based approaches to road safety. Vision Zero and Sustainable Safety represent two different methods of achieving improvements in road safety using systems, although they each have different emphasises.

3.5. Theme 4: Implementation in Victoria

All participants highlighted the important role of collaboration that occurred during the development and implementation of Safe System in Victoria. This collaboration occurred primarily between road safety agencies and research groups, but also at times included parliamentarians. These relationships were seen as pivotal in ensuring new ideas, such as Safe System, received sufficient attention by decision makers.

Participants highlighted a number of key drivers in the development and implementation of Safe System in Victoria, including:

- Significant evidence had already been generated in Scandinavia;
- A limited number of actors were involved in the development, allowing for streamlined decision making;
- There was sufficient support within public service to adopt a new 'approach' (both at a jurisdictional and national level);
- There was alignment between Victoria's ministers and public servants in a new 'approach';
- Previous road safety strategies and approaches were coming to an end; and
- There was sufficient promotion, inclusion, and acceptance of Safe System at a national level (particularly in national action plans).

Participants noted that the development of Safe System was not systematically planned, but rather reflected international developments and new evidence being generated in road safety: "The success of Sweden in getting deaths down dramatically really had a big influence …. The visuality of some of the things Sweden did was also incredibly important to showing in a very conceptual simple sense that you could redesign a road in a way that made it actually quite difficult for

you to kill yourself" [P9]. This enabled Australia to proceed straight to strategy development rather than focus on the moral and ethical questions that had been discussed at length in Sweden and the Netherlands. The principles drawn from Vision Zero and Sustainable Safety provided a rationale and a structure for addressing road safety in Victoria. However, whilst inclusion in the national road safety strategy assisted in crystallising Safe System's place in Victoria and in articulating the design of Safe System, participants noted that there were some challenging elements in engaging with key decision makers within road safety, to explain what was required to implement Safe System.

Two participants with experience of the journey in Scandinavia noted that, while there were initial attempts to engage with the Australian community and with wider stakeholder groups, these had largely been unsuccessful. Safe System development was therefore seen by three participants (former road safety managers) as not sufficiently involving the community, with one participant claiming it was not until 2007 that community consultation was truly effective (although this was in Western Australia). Another participant explained that the limited community involvement in Victoria was largely due to an historical trend of public service empowerment through parliamentary enquiries.

3.6. Theme 5: Changes in Safe System

To examine the evolution of Safe System in Victoria, participants were asked if they believed that Safe System had changed over time. Five participants believed it had changed over time, four did not believe it had, and one participant was uncertain. Two participants did note that the original Safe System pillars had expanded (from four pillars to five), although this did not necessarily influence their views on whether broader changes had occurred.

Participants' interpretations of whether Safe System had changed over time, were influenced by their views on what constituted change. Participants' responses differed depending on their views of whether changes to policy tools and interventions reflected a change to Safe System. Two participants (one with expertise in roads policing and the other with international academic and public policy expertise) believed that Safe System had remained stable in its philosophical approach (i.e., unchanged), yet at the same time Safe System interventions had changed. In contrast, three former road safety managers described Safe System as changing, in part due to a greater understanding by road safety agencies of Safe System, but also due to the nature of the interventions that were being introduced.

Of the five participants who viewed Safe System as changing over time, they principally attributed the change to an improved understanding of Safe System. In contrast, a participant with international policy expertise believed that while Safe System had evolved over time, there was a poor understanding of what Safe System means. One former road safety manager suggested that Safe System had reverted back to more traditional approaches to road safety of attributing blame on the user: "It has drifted back to the … (3E) silos" [P6]. The remaining four participants highlighted that the underlying principles (human fallibility, kinetic energy, shared responsibility etc) had remained the same.

3.7. Theme 6: Key successes and failures of Safe System

Participants were asked their views on the success and failures of Safe System. The majority of participants ($n = 9$) identified that the primary success of Safe System has been to shift the collective mindset by providing a new way to view road fatalities and serious injuries and more generally road safety. In particular, this shift is evident in the way road authorities now view the road network, and safety as an integral part of the system. Participants formed the view that the system provided leadership and order to road safety with four participants (two former road safety managers and two international policy experts) identifying that Safe System provides the structure and approach to achieve zero fatalities. Three participants also attributed increased levels of investment in road safety, with a particular focus on road infrastructure changes, to Safe System. The idea of shared or shifted responsibility was also reported by a number of participants ($n = 5$).

Participants also reported where Safe System had been less successful. The majority ($n = 7$) held the view that road authorities had been slow to adapt, noting that Safe System implementation had been protracted. One participant stated "I think your (Australia) is still struggling somehow to get things going" [P5]. This implementation challenge was attributed to the inherent complexity of achieving a Safe System ($n = 6$), with one participant suggesting that a "true" Safe System had not been achieved in Victoria [P2]. This complexity encompassed terminology and messaging, application, resistance to change (from both local/state government and the community), and the challenges in building community support. One former road safety manager noted that the scale and scope of Safe System implementation requires significant time to achieve, which can result in institutions being slow to enact change [P10].

4. Discussion

This paper sought to investigate how Safe System was designed and implemented in Victoria, with the aim of determining how well it aligns with principles of public policy. Public policy has been described as decisions and actions governments take to address a problem [64]. However, research into how Safe System has been integrated into the formulation and implementation of public policy is limited. The following discussion compares the findings against a policy success model.

4.1. Process assessment

Process assessment examines the policy development process and seeks to answer if the policy has addressed the relevant elements within the policy making cycle. The policy cycle is typically described as a stage-based process consisting of between five and eight steps depending on the model, and includes problem identification, policy analysis, strategy and policy development policy enactment and policy implementation [58]. There are a range of questions that need to be addressed as part of this analysis including, but are not limited to, whether the policy has been developed with inclusive views; whether legislation passed expediently; has the appropriate mix of policy instruments been applied; and whether contextual constraints have been addressed. The process evaluation is therefore determining the policies effectiveness and efficiency and if it is socially appropriate.

Safe System identifies the root cause of the road safety problem as human fallibility resulting in human tolerances being exceeded. This highlights the problem that requires addressing and frames what needs to be actioned. Baumgartner and Jones [65] note that this problem identification process can occur as new actors bring fresh perspectives to an existing issue which they referred to as 'punctuated equilibrium'. The result in the case of road safety is relative policy stability from the 1970s through to the late 1980s and a rapid change in thinking that resulted in Safe System. Punctuated equilibrium is supported through the findings of this research, where changing approaches to road safety in Scandinavia saw a dramatic shift in reframing how fatalities and serious injuries were viewed, with some authors subsequently referring to Safe System as a paradigm shift [66].

The policy analysis stage of the policy cycle seeks to identify potential policy options, using a systematic approach. Safe System was formulated from international experience, with speed and a zero road safety target playing a critical role in policy development. Mooren, Grzebieta and Job [30] notes that there were discussions amongst road safety professionals regarding the adoption of Vision Zero, however a less extreme approach emerged. As such, there was some limited analysis of policy options, although perhaps not using a systematic method. Once Safe

System was developed it became the dominant approach. Responses from interview participants indicate that the problem identification and policy analysis stages merged, with John [53] noting that the policy process is not always linear and this merging can be expected. The result was Safe System became the only 'option' that was considered.

The third stage of the policy cycle seeks to make the policy implementable (strategy and policy development). Safe System addresses fatalities and serious injuries that occur on the road by integrating the various parts of road safety (the pillars) into a system and by expanding responsibility so that it is shared across the system. As participants in the current study noted, Safe System also attempts to highlight a vision of road safety of zero fatalities and serious injuries. However, whilst the strategy and policy are framed as actionable, the results of this study have shown that the descriptions provided by experts are not consistent. Hughes, Anund and Falkmer [19] have also noted that Safe System has numerous descriptions, which makes the development of a cohesive strategy and policy difficult. Without a shared understanding of Safe System, strategy and policy development are subject to interpretation and do not provide enough structure to produce actionable policy. This may explain in part the development of additional frameworks, theories and standards (such as ISO39001, Towards Zero, Sustainable Development Goals and Systems thinking) that provide an additional source of knowledge by which to interpret Safe System.

Following the development of a strategy and policy, the fourth stage of the policy cycle endorses the policy. In regards to enacting the policy, Safe System has been included in a number of road safety strategies at both the local (Victoria) and national (Australia) level. These strategies point to Safe System as an underlying framework for road safety [2,28] and a number of authors have suggested that Safe System is being applied through these mechanisms [67,68]. This implies that policy has been successfully ratified.

The final stage of the policy cycle is implementation. There are some reports that the implementation of Safe System policy has been challenging which indicates a degree of failure in the policy process. Turner, Tziotis, Cairney and Jurewicz [69] indicate that what needs to be implemented is less evident than the 'approach' itself. This is echoed by Fleisher, Wier and Hunter [70] who report that there is limited research to explain how to implement Safe System or what it is trying to achieve. Depending on how the aims of Safe System are interpreted it can be seen to be having some success. For example, Johnston [71] claimed that there have been improvements in shared responsibility across road safety agencies, although Turner [72] notes that silo thinking still permeates the road safety community and that it may well have become worse under the Safe System approach. Some of these complications may be explained through the fragmented interpretations of Safe System's intentions, providing limited clarity on what and how to implement the approach.

4.2. Programmatic assessment

The programmatic assessment seeks to measure the performance of a policy [73]. In particular, it asks whether the costs and benefits of the policy have been weighed and if the intentions and outcomes of that policy have been met. In the case of Safe System, this relates to whether it has been implemented as per its objectives and if it has met its intended outcomes. Impact assessments provide one means of measuring this success [73], however in the case of Victoria, other than evaluations of road safety strategies [74], an assessment of Safe System itself has not been undertaken.

The current findings can provide some explanation regarding the lack of evaluation of Safe System policy. The findings demonstrate that the original intentions and outcomes of Safe System are not uniform across road safety experts. Other studies have also noted the difficulties in defining Safe System's purpose [35]. Further, what Safe System intends to achieve for road safety and the outcome are viewed from a wide variety of perspectives with no single, homogenous explanation. The inability to accurately determine the objectives or outcomes of Safe System make it near impossible to accurately undertake a pragmatic assessment. Therefore, the public value proposition and the theory of change which Luetjens, Mintrom and Hart [62] identify as being fundamental to this assessment cannot be undertaken (as noted in Table 2).

4.3. Political assessment

The political evaluation assess how a policy is perceived by stakeholders [73]. Bovens, T'Hart and Peters [75] provide indicators to measure this perception and suggest 'political upheaval' can be measured through media reporting, investigations etc. while 'political legitimacy' can be measured through public approval of the policy or faith in authorities actions.

Politically, Safe System has been supported with its inclusion in road safety strategies at both the State and National level. The current findings and a number of research papers have noted the political commitment to Safe System [35,67]. There has however been some suggestion, that politicians have not accepted Safe System, but have accepted the politically palatable initiatives that have been derived from it [71]. Andersson and Pettersson [76] described Vision Zero as an approach that is impossible to object to as its goals are potentially unreachable and as a concept it is overtly romanticised. This also holds true to Safe System and provides a politically acquiescent method to dealing with road safety, as much of the terminology is non-descript and therefore mouldable to multiple audiences and situations.

With regard to broader stakeholder groups, Johnston [71] argues that the understanding of Safe System principles in the community and media is lacking at best – with the community agreeing on the one hand, that the road 'system' should ensure their safety and cater for human fallibility [77], whilst on the other hand continuing to attribute blame on the vehicle operator (this is supported in the findings of the current study). Howard [78] echoed study participants' comments that failure in community acceptance relates to the lack of engagement from road safety authorities with those communities. Further, while the development of Safe System did not include community consultation, it did involve a partnership between academia and public policy officials. Road safety management best practice, public policy cycle frameworks and Luetjens, Mintrom and Hart [62] policy success map all suggest that stakeholder engagement within the policy development process is imperative.

The lack of engagement may be explained by the reluctance by some parts of the public service to actively accept Safe System [71,79]. Based on this political assessment, Safe System does hold some legitimacy and has caused some upheaval, however additional engagement is required.

4.4. Temporal assessment

Temporal evaluation is a relatively new addition to the assessment of public policy success. Luetjens, Mintrom and Hart [62] state that policy should be assessed through an examination of how it was established and subsequently functioned over time. In addition, they argue that the context in which the policy was formulated can change and therefore policy must be evaluated within these changing environments. Similarly, Australia's Public Service Commissioner recognises the role that time plays on evaluating policy, and implores public servants to be mindful of changing community expectations over time [80]. Luetjens, Mintrom and Hart [62] recommend an evaluation of the process, programmatic and political assessments over time.

The current study identified that the implementation of Safe System has been protracted and this is consistent with previous studies reporting that implementation has failed altogether [34,66]. Safe System has been noted as being notoriously difficult to implement [78], largely for non-technical reasons [30]. Muir, Johnston and Howard

[35] argue this is partly attributed to the basic failure to understand what Safe System aims to accomplish. This indicates that the process assessment has not been particularly successful over time. Other parts of the policy cycle have been more successful over time, including engagement with stakeholders.

In regards to the programmatic assessment, it is difficult to ascertain whether Safe System has achieved its objectives. Study participants reflected on Safe System adapting although this was noted by some as regression to prior approaches to road safety. They noted that the underlying ideas surrounding Safe System have not changed but what is being implemented in the name of Safe System was changing. Concepts relating to Safe System have remained relatively static (other than the inclusion of the fifth road safety pillar), however road safety interventions continue to evolve. Luetjens, Mintrom and Hart [62] report that the ability for policy to be malleable at both an operational and programmatic level is a sign of successful public policy. In this regard, Safe System has been partially successful.

In regards to the political assessment, Safe System still forms a part of the political landscape and continues to be integrated into road safety strategies and policies. Road safety agencies have also taken steps to inform stakeholders of Safe System principles and take a more active engagement approach. This has changed over time, from the limited engagement when Safe System was created to the current status within road safety.

A final consideration for assessment are spillover and transboundary effects of policy [81]. These external effects are often viewed through the prism of time (ie the effects before or after an intervention) [82]. Unintended transboundary effects were not identified by participants or within the literature and are expected to be limited due to a demarcation of road safety management to within Australia's States and Territories. In contrast, whilst the existing literature has not identified spillover effects as a concern on or as a result of Safe System policy, as the approach is intended to be holistic and engaging multiple policy areas, spillover effects are almost certain. Australia's road safety legislative agenda is established at the national level, yet individual States and Territories are responsible for implementation, which may not always be consistent, potentially resulting in further effects. While at this time it is not possible to clearly articulate policy spillover effects, it is possible that they may become more prominent as the challenges of policy implementation are addressed.

Table 3 provides a summary of the alignment of Safe System with a policy success framework and the overall assessment score.

5. Limitations

The results collected in the study were limited to the experiences of those participants who were interviewed, therefore it is possible that other road safety experts may take a different view of the intentions of Safe System. Additionally, the sample size for this study was small, however, it is in line with the descriptive qualitative methodology approach [43,83,84]. Both of these factors impact on how generalisable the results are. Recall bias is possible as the researcher was seeking data on historical events, however the participants responses were compared and confirmed with other data sources (other participants, academic research and grey literature). As all of the study participants were male, this may also influence the perspectives of road safety that were reported. However, this should be viewed in light of the overwhelmingly male dominated environment of road safety in Victoria in the 1990's.

6. Conclusion

From a process perspective, Safe System has successfully identified the root cause of the road safety problem. A systematic review and analysis of policy options did not occur, with Safe System becoming the singular method for addressing fatal and serious injuries in Victoria. While the strategy and policy development phases have had some successes in highlighting a vision for road safety, it is significantly limited by not having a shared, consistent understanding of how Safe System is to be actioned. Endorsement of Safe System policy has been widespread, however what is required to be implemented is unclear. In spite of the lack of clarity of what is required to be implemented, some gains have been made, including a move away from a user focused approach to acknowledgement of a shared responsibility (although this is disputed depending on the author).

The programmatic assessment identified that Safe System has not been evaluated. The purpose of Safe System is unclear, stemming from multiple, differing perspectives on the intended intentions, outcomes and objectives. The result is that it is not possible to undertake a programmatic assessment and determine the public value proposition and approaches to change.

There is political commitment as evidenced by the adoption of Safe System in road safety strategies, however the generalised description of Safe System can also be used to appeal to differing audiences without committing to a singular course of action. Community support for Safe

Table 3
Assessment of safe system aligned with a policy success framework.

Process assessment (evaluation against policy cycle)	Programmatic assessment (evaluation of performance)	Political assessment (evaluation of perception)	Temporal assessment (evaluation over time)
• Safe System identifies the root cause of the road safety problem through a punctuated equilibrium process • In developing Safe System, the problem identification and policy analysis stages merged • Whilst the strategy and policy are framed in literature as actionable, Safe System has numerous descriptions, making the development of a cohesive strategy and policy difficult • Safe System has been successfully enacted (ie endorsed) in road safety strategies • Implementation has been challenging which indicates a degree of failure in the policy process	• In Victoria an assessment of Safe System has not been undertaken • The original intentions and outcomes of Safe System are not uniform across road safety experts • There are multiple and sometimes differing perspectives of Safe System's purpose • What Safe System intends to achieve for road safety is unclear • A pragmatic assessment cannot be undertaken due to the ill-defined outcomes that Safe System seeks	• Safe System has achieved success through its presence in road safety strategies • Political class has shown a commitment to Safe System • Safe System provides a means to address road safety in a politically acceptable form • Understanding of Safe System principles in the community and media is deficient • There has been limited community engagement surrounding Safe System	• Parts of the policy cycle have been less effective, which has been demonstrated over time • Safe System is conceptually static, however interventions continue to advance • Safe System continues to be politically engaging
Process Assessment: partial success	Programmatic assessment: unsuccessful	Political assessment: partial success	Temporal assessment: partial success

System is more mixed with acceptance of a forgiving road safety system but a continued reliance on the attributions of blame. In part this is explained through poor engagement and a reluctance in some parts of government to adopt Safe System, resulting in limited legitimacy towards Safe System. While community engagement has been lacking, Safe System has been successful in linking government agencies with academia in addressing the road safety problem.

Finally, the temporal assessment has found that Safe System has changed over time, in part to address some of the initial weaknesses. Road safety agencies have renewed their efforts in improving community engagement and understanding of Safe System. Viewing the process, programmatic and political assessment over time suggests some adaptability, although Safe System continues to be impeded by a fundamental differing of views in what it intends to achieve and how it is meant to achieve stated objectives.

This research has therefore shown that Safe System can provide a framework to address road safety in Victoria. Successful public policy needs to ensure that it is not only effective but the development of the policy addresses the identified problem and results are maintained for some time. Safe System meets some of these requirements, but principally lacks explanation for how its overarching approach is meant to be understood and utilised. Whilst Safe System requires additional clarification, it has garnered additional interest and debate in road safety and from this perspective has advanced public policy.

Research contribution and practical implications

This research has examined the conceptual origins of Safe System in Victoria and importantly sought to uncover how the concept is intended to be understood. Prior research has accepted Safe System as a fit for purpose concept, yet this research has shown that there was no uniformity of perceptions amongst road safety experts. This provides challenges for the practical integration and application of Safe System. A clearly articulated shared understanding of what Safe System seeks to achieve is required for integration into public policy and strategy.

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Ethics approval

The research was approved by the Monash University Human Research Ethics Committee (ethics project number 23338).

Declaration of Competing Interest

None.

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