Ireland's Road to Vision Zero

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Introduction

The evolution of road safety strategies in Ireland unfolds a dynamic narrative, marked by successes, setbacks, and ongoing challenges. This literature review explores the impact of successive strategies, international models, emerging technologies, and the pivotal role of data analytics in shaping road safety.

Over the past two decades, Ireland has implemented four distinct Road Safety Strategies, leading to a substantial 70% reduction in road fatalities. The current strategy, the nation's fifth, aspires to achieve a remarkable 50% reduction within the next decade with the primary goal in eliminating all road deaths on Irish roads by 2050, which has been named 'Vision Zero.'

The purpose of this literature review is to critically assess the feasibility of Ireland's pursuit of the 'Vision Zero' mission, which aims to eliminate all road deaths by 2050. The review explores the effectiveness of past road safety strategies in Ireland, examines international models, explores emerging technologies, and emphasizes the role of data analytics in problem identification and solution development. The objective is to provide a comprehensive understanding of the successes and shortcomings of previous strategies, analyze global approaches to road safety, investigate what the future might hold, and highlight the importance of data-driven insights in shaping Ireland's future road safety initiatives.

Evolution of Road Safety Strategies in Ireland

Road Safety Strategy(1998-2002) In the mid-1990s, Ireland was in the middle bracket when compared with other member states of the European Union for road fatalities [15]. In 1998, to improve the situation, a strategy was developed which was the first of its kind. The aim of this strategy was to reduce road fatalities by 20% from the 1997 figure of 472, with a target to achieve this by 2002. They succeeded with road fatalities reaching 376 (a reduction of 20.3%) in 2002, the lowest figure since 1965. The reduction in road deaths and

serious injuries resulted in estimated savings of £1.032 billion. Astonishingly, this figure was nearly six times the total expenditure of £169 million allocated for the implementation of the strategy [10]. The main strategy that played a pivotal role in bringing about this reduction was the introduction of penalty points for speeding which was scheduled to be introduced in 1999 but got delayed until 2002 but it still had a desired impact. Additionally, other key measures were put in place, including on-the-spot fines for non-wearing of seat belts, which was introduced in July 1999. There were a total of 53,522 detections in 2002. Furthermore, the issue of drink-driving received heightened attention, as evidenced by a 60% increase in the analysis of blood, urine, and breath samples, with 12,668 samples analyzed in 2002 compared to 1998. This multifaceted approach, combining legislative interventions and rigorous enforcement, exemplifies the strategy's comprehensive nature and its profound impact on Ireland's road safety landscape. [3]

Road Safety Strategy(2004-2006) Following the resounding success of the initial strategy implemented by the Road Safety Authority (RSA), the organization set its sights on an even more ambitious target in early 2004. Their aim was to achieve a remarkable 25% reduction in road collision fatalities by the end of 2006 compared to the average annual number of fatalities recorded between 1998 and 2003, which stood at 400. This new target represented a substantial challenge, given the scale of the objective. However, by the end of 2006, the results showed a reduction of only 8.75% from the average annual fatalities recorded between 1998 and 2003, with 365 road fatalities in that year. This outcome fell significantly short of the Road Safety Authority's original target. The two main strategies undertaken in 2004 were in relation to seat belt wearing and speeding. In 1999, drivers and front seat passengers only wore their seat belts 57% of the time, this increased to 72% by 2002 and the aim was to get this to 90% by 2006 but a 2006 seat belt survey carried out by the RSA showed front seat belt compliance rates were only at 86%. On 20 January 2005, Ireland adopted metric speed limits with 35,000 existing signs replaced and a further 23,000 new signs erected bearing the speed limit in kilometers per hour[17]. This period highlights the intricate challenges faced in maintaining and surpassing the momentum set by the preceding strategy, emphasizing the need for adaptability and targeted interventions to meet evolving road safety goals. [4]

Road Safety Strategy(2007-2012) Ireland's third Road Safety Strategy was aiming to build on the progress made by the first two strategies. The primary objective this time was to reduce deaths below 252 per annum, which would be a 42% reduction from the 2006 level of 365. This was achieved very comfortably with there being 163 road fatalities (a reduction of 55% on 2006 levels) in 2012. Compliance rates in seat belt wearing for front seat passengers in 2012 rose to 94% which is a vast improvement to the 57% just 13 years ago. The strategic success can be attributed to several factors, including the completion of the major inter-urban network, now predominantly designated as motorways, proving to be remarkably effective. In 2010, An Garda Síochána introduced a pivotal tool – speed cameras strategically placed in designated hot spots. The impact of this intervention is evidenced by the issuance of 2.2 million speeding tickets between 2010 and 2022, showcasing the effectiveness of enforcement in curbing excessive speeds [11]. [5]

Road Safety Strategy(2013-2020) The most recent strategy introduced aimed to close the gap in road fatalities between Ireland and countries like Norway and Sweden, aiming to reduce the number to 25 per million population (124 road fatalities) by 2020. Unfortunately, this number was never reached as we recorded 29 road fatalities per million population (147) in 2020. The strategies introduced in 2013 mainly involved awareness especially around fatigue while driving or driving while using a mobile phone. A survey published in February 2019 showed that 8% of drivers were observed with their mobile phone in hand or at their ear while operating their vehicle [2]. This observation underscores a persistent issue that might be contributing to the stagnation in road safety progress. [6]

Despite a downward trend in numbers since the preceding Road Safety Strategy (2007-2012), the decline has not occurred at the requisite pace to achieve the ambitious target of 72 road fatalities a year by 2030. This target translates to 13 road fatalities per million populations, emphasizing the need for more effective interventions and sustained efforts to meet the upcoming milestones

International Models for Road Safety Innovation

Vision Zero originated in Sweden and the policy was approved by the Swedish parliament in October 1997. Even though Sweden had one of the lowest fatality rates from road accidents, Vision Zero was implemented because they argued any death was too high of a price to pay for mobility [8].

Australia has introduced a system which they call 'Safe System'. This system looks at anticipating human errors and limiting crash force hence making more road collisions survivable. It works on the basis that even though our aim is to reduce the number of road crashes, that if the force at which these crashes occur is reduced there is a much greater survivability rate. The work of Tingvall and Haworth [14] shows that cars can tolerate a maximum speed of 70 km/hr for frontal impacts and 50 km/fr for side impacts. Another study [1] illustrates how pedestrian survival rate is high when they are hit below 30 km/hr. This approach has since been adopted in the UK and New Zealand.

Wegman [16] recognised that as countries are maturing in their approaches to road safety, traditional policies are becoming less effective. These interventions are coming to the end of their life cycle and they are subject to the law of diminishing returns. This, along with the fact that the road transport system puts so much faith in the driver, unlike the rail or aviation system which are designed from a safety perspective is why Netherlands have adopted a different approach. Their approach is called 'Sustainable Safety' [13] which is similar to the 'Safe System' and incorporates the same ethos that humans are fallible and prone to making errors and instead of just accepting that, its aim is to try and change their behaviors consciously and subconsciously. It aims to do this by separating roads into different

categories, one to move a large volume of cars efficiently and safely, another which can be used by both cyclists and road users but the cyclists are protected by raised cycle tracks or barriers and then access roads which use various traffic calming techniques and speed limits of 30 km/hr. It is designed based on the understanding that the roads are consistent, so the road user knows how to act and can predict in a split second how other users will use the space. Importantly, these roads are forgiving, acknowledging human fallibility and creating an environment where human errors are unlikely to result in serious injury.

Uncertainties and Challenges in Future Road Safety

The future of road safety is uncertain argues Wegman [16] for two reasons. The first one is distractions. Dingus et al. (2016)[7] found that drivers are engaging in distracting activities more than 50% of the time while they are driving, resulting in a crash risk that 2.0 times higher than model driving. This includes interacting with another passenger, and applying makeup but the most common one is cell phone usage. They argue that cell phone usage while driving is probably the single factor that created the greatest increase in crashes across the US in recent years. The second factor is that we cannot predict the safety impact of system innovations and drastic technological changes such as automated or semi-automated vehicles.

Automated vehicles look like they will take over in the coming years but how will this affect road safety? According to Giuffré et al. (2017) [9] cameras used for driver assistance systems which are used for lane departure warnings and forward collision warnings have reduced crashes significantly. Automated vehicles have made a drastic improvement to road safety, but autonomous vehicles could be the next step to drastically reducing road deaths. The Insurance Institute for Highway Safety published a study in 2020 [**iihs**] that reported 94% of road accidents are caused by human error. The future is uncertain for road safety but if Ireland plans to reduce road deaths by 50% this decade and by 100% by 2050, autonomous vehicles could play a crucial role in achieving these ambitious goals.

The Role of Data Analytics in Road Safety

Data analytics has played a crucial role in problem-identification and problem-solving when it comes to road fatalities. It enables the identification of patterns and trends including historical incident records. By analysing these patterns, analysts can uncover recurring issues such as contributing factors or accident hotspots. This helps in understanding the root causes of accidents and areas that require targeted interventions. This allows policymakers to make informed decisions and introduce interventions by aligning them with specific challenges identified through data analytics.

Data analytics also plays a pivotal role in problem-solving. Advanced data analytics has been used to power many driver-assist features such as traction control, cruise control, electronic

brakes, and automatic lane-changing systems which have been shown to reduce the risk of accidents. Automobile manufacturers are also using data analytics to identify limitations in their safety features and build safer vehicles that minimise damage in the event of an accident [12].

Conclusion

In conclusion, previous road safety strategies in Ireland demonstrate a noteworthy reduction in fatalities over the past two decades, thanks to the implementation of four distinct Road Safety Strategies. However, the current 'Vision Zero' strategy, with its ambitious goal of eliminating all road deaths on Irish roads by 2050 and achieving a 50% reduction within the next decade, presents a lot of challenges.

International models provide valuable insights into alternative approaches. These models emphasize the importance of acknowledging human fallibility and implementing measures to mitigate the impact of errors on road safety. Looking towards the future, uncertainties and challenges, such as increasing distractions and the integration of automated and autonomous vehicles, highlight the need for adaptive strategies. While automated vehicles show promise in improving road safety, the unpredictability of safety impacts poses challenges that warrant continuous monitoring and assessment. Crucially, the role of data analytics emerges as a cornerstone in shaping effective road safety initiatives. By identifying patterns, uncovering contributing factors, and informing targeted interventions, data analytics empowers policy-makers to make informed decisions.

In navigating the future of road safety in Ireland, it is imperative to strike a balance between technological advancements, legislative measures, and an understanding of human behavior. This literature review's comprehensive exploration of past strategies, global models, emerging technologies, and the role of data analytics serves as a foundation for informed decision-making in the pursuit of safer roads in Ireland and hopefully achieving the target of 'Vision Zero.'

1   References

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