E-SKATEBOARD AWARENESS & SAFE INTEGRATION INTO THE TRANSPORT NETWORK

CRUISE EBOARDS

Research Report

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Authenticity Statement

I declare that this report is my own original work and has been prepared in accordance to QUT's academic integrity guidelines. All sources of information, data, and images have also been professionally cited and referenced.

AI Use Statement

I acknowledge that AI (ChatGPT) was utilised in the report only for assisting in minimising word count in minimal sections of the report and preparing interview transcripts.

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Word Count - 4203

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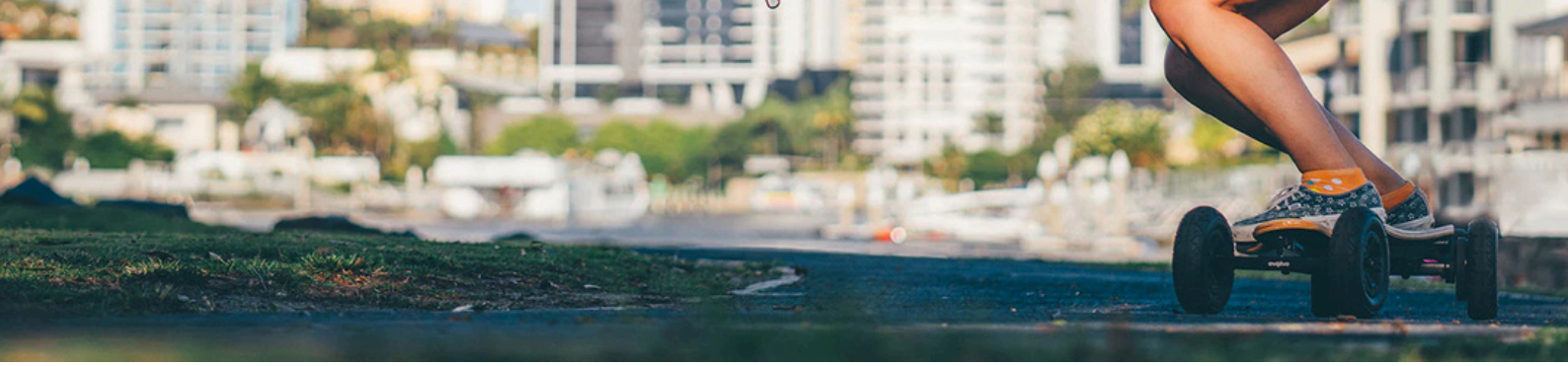
TERMINOLOGY

Micromobility	Transportation using lightweight vehicles such as scooters, bikes, and boards
Personal mobility device (PMD)	Small electrically powered vehicles made for single person use
Active transport	Human powered modes of transport like walking and cycling
Deck	A flat board like component that skateboarder riders stand on when riding
Trucks	Metal components used to connect a skateboards wheels to the deck



INTRODUCTION

With the rapid growth of micromobility in Australia there is an increasing need to address the safety of these devices within shared spaces and when used on the road. Currently e-skateboards are responsible for a large number of road related accidents and are commonly impacting young and mature adults. These individuals experience a range of injuries from fractures, concussions, and in more serious cases life threatening injuries which can impact the rest of the users life.

It is also apparent that current e-skateboarding lacks adequate protective and alerting equipment for riders. This limits their ability to effectively communicate or signal other road users and pedestrians while ensuring their own safety.

The purpose of this research project is to identify viable opportunities, overarching issues and stakeholders experiences relating to e-skateboarding. In particular, areas involving awareness and visibility as well as the safe integration of these devices will be thoroughly explored to ensure pedestrians, other road users, and the riders themselves feel a sense of safety and belonging in all environments. Insight into other aspects of micromobility is also welcomed.

The main goal through this research is to better understand how a more connected and aware environment for e-skateboarding can be created so that not only can it be enjoyed safely by the riders, it can also allow other road users and pedestrians to feel a sense of safety when sharing these spaces.

BACKGROUND

As micromobility continues to grow, e-skateboarding is progressively becoming a leading reason for road related accidents. In the span of one singular year Australian emergency services reported at least 100 emergency department presentations for individuals aged between 18 to 27 and 30 to 40. The Queensland Ambulance Service said, “We have people coming off them (e-skateboards) and hurting themselves, and pedestrians being hit by them.” (Cassidy & Young, 2022).

Figure 1: E-Skateboarding Accident Headline, (9 News Australia, 2022).

The most common injuries caused by e-skateboarding accidents include fractures, breaks, concussion, scrapes, cuts, bruising, swelling, and dislocation. These accidents usually occur due to rider fault or poor environment and infrastructure, but most of the time riders are caught by unaware road users, (Berecki-Gisolf & Hayman, 2025).

Since the introduction of these devices in 2010, not only has there been a significant injury toll there has also been serious and sometimes fatal injuries. A total of 6 e-skateboard related fatalities all caused by serious head trauma injuries were recorded worldwide, (Pinto, 2025).


Figure 2: E-Skateboard Fatalities, (Pinto, 2025).

Emergency Services provided details on these horrific fatalities revealing that most users passed at the scene of the accident further highlighting the extent of the situation, (Pinto, 2025). These unforeseen incidents were a result of the operators being at fault, and commonly from unaware road users striking the rider, (Lee et al., 2020).

Figure 3: Experienced E-Skateboarder, (Wise, 2021).

Research has shown that males are generally more likely to partake in e-skateboarding, seeing people aged between 18 to 25, and 26 to 30 having the most regular users. Although, a large portion of riders were also recorded as 45 years or older. Many of these users also ride their e-skateboards daily highlighting the experience most riders have. But still so many serious accidents happen.

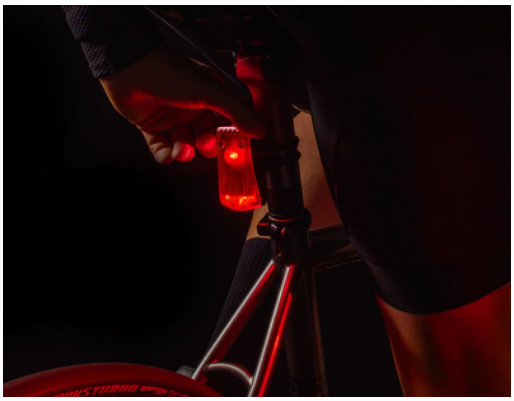


Figure 4: Flock Bike Concept, (Flock, 2025).

Currently on the market, e-bikes have access to innovative bike concepts that significantly increase bike rider visibility. This is through the implementation of bright LED lights and reflective elements which allow the riders to stand out at all times. Features like these could have major impact on e-skateboarding safety and have influence on reducing related road accidents, (Flock, 2025).

Through this understanding it is a priority to start establishing ways that support the awareness of e-skateboarders and increase visibility around the riders. Ultimately this is an attempt to promote safety for the future of micromobility as over 90% of experienced riders said they have experienced at least one accident involving their e-skateboard and another road user or pedestrian, (E-Skateboard End User Research Survey, 2025).

BENCHMARKING

The initial part of this section intends to outline existing products, methods, and systems used in protecting and keeping users who ride personal mobility devices (PMD's) visible at all times.

Micromobility experts, and experienced riders say it is imperative that all current and future riders should wear PPE at all times as statistics show how dangerous a crash can be to the riders physical welfare. Through research however, ratings have been developed and assigned to five key equipment pieces in order to compare each one. These items were assessed using criteria designed to benchmark their effectiveness and suitability for use when riding PMD's.

	Helmet	**Pads**	**High-vis Vest**	**Gloves**	**Wrist Guards**
Description	Light weight, breathable helmets made from high strength plastics, inner foam layers and a range of adjustable features. This includes versatile BOA fit systems, and straps. 	Shoulder, knee or elbow padding built for impact protection and reducing serious injury. Padding is made of high strength polymers, plastics, and rubber further providing durability. 	Designed to provide high visualisation when riding PMD's in various settings. Each vest features materials that are made to be light in weight and breathable. 	Semi-ventilated, impact protection gloves are made to reduce injury through strong polymer materials and layered rubber pads. Additional velcro strapping makes for greater ease of use. 	Ergonomic, adjustable, and impact protection wrist guards designed with flexible polymers that last. Great for learning to ride and riding with confidence. 
Protection	8	7	3	8	6
Durability	7	8	6	8	7
Ergonomics	7	6	9	9	7
Accessibility	8	7	8	7	6
Ease of Use	9	7	10	10	8
Awareness	6	3	10	2	2
Functionality	9	8	9	8	6

Table 1: PPE Benchmarking, (Dagg 2025).

The e-skateboard PPE table indicates that users are generally pretty well equipped when in a riding environment as they each scored around a 6 to 8 in terms of protection level. The ease of use and functional purpose each piece offers also contributes to the popularity behind wearing the equipment. E-skateboard riders say that they are more inclined to wear protective gear as majority had experienced an accident when riding their device.

Although, for e-skateboarders high-vis jackets and vests are currently one of the only accessible items on the market for making riders more visible.

This is particularly an issue when riding in shared spaces because while PPE is there to protect the rider from brief accidents there are no measures or pieces of equipment that are evidently there to increase the awareness and visibility.

Research shows that riders are inherently safer when standing out during riding as Forbes says, “You can communicate your intentions to drivers and people around you”. (Lumos, 2025).

Figure 5: After Market Bell, (Starpath, 2025).

Current e-skateboard riders are resorting to after market solutions to fill this gap but studies continue to show how insignificant these measures are in protecting the safety and wellbeing of all e-skateboard riders, (thyvo, 2020).

A prime example was shown through the use of a makeshift bell attached to a users hand. The after market solution proved to be ineffective as the rider injured themselves while using the equipment (Starpath, 2025).

Without proper implementation of effective visibility equipment or technology every rider, pedestrian and other road users remain vulnerable to serious injury.

Ratings have also been developed and assigned to five key bike concepts in order to compare and analyse their features. These items were assessed using criteria designed to benchmark their effectiveness and suitability for use when riding e-bikes and to explore the major gaps in bike technology compared to e-skateboarding.

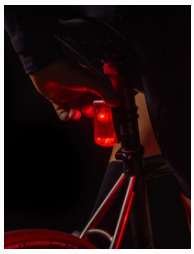
	Flock	Blaze	Beam Projector	Bike Zone	Lumos
Description	Flock allows bike riders to light up their legs and be seen sooner. This innovative bike design encourages safe bike riding and ensures that every rider can be seen by other road users. It uses LED lights to highlight the rider. 	A new, innovative bike concept that encourages bike riders and gives them a sense of safety. The design projects a bike symbol in the area in front of the bike giving other roads users indication of where the bike rider is heading. This is a design specifically for bikes 	A solution for increasing the visibility of bike riders in a fun, engaging way. This concept uses laser projection to emit pictures, videos, or information into the surrounding area. The intent is to give other road users indication of where they are. 	A laser projector design solution for increasing the safety of bike riders. This concept uses lasers to light up the area bike riders are travelling in giving other road users every indication of their whereabouts. 	An upper echelon bike product which is designed for mass customisation and the ability to stand out when used by riders in all environments. This product features turn signals, long range visibility, brake lights, and waterproof material. 
Usability	7	6	7	7	9
Functionality	9	5	8	8	9
Durability	8	6	7	7	8
Aesthetics	10	8	8	9	10
Ergonomics	8	6	6	7	9
Technology	10	7	8	9	10
Quality	10	6	7	8	10
Transferability	3	3	2	4	4

Table 2: Bike Concept Benchmarking, (Dagg, 2025).

When observing the benchmarking assessment for current bike concepts it has revealed outstanding results. In particular, each concept provides great functionality performing near perfect to what they are intended to do. This is in regard to keeping e-bike riders visible and other road users aware of their presence. Additionally, there is a high level of technology used within these concepts contributing to its high performance. The supreme technology also enables and ease of use when users are operating their e-bike.

Figure 6: Blaze Concept, (Brooke, 2014).

Figure 7: Bike Zone, (Keun Kwon, 2015)

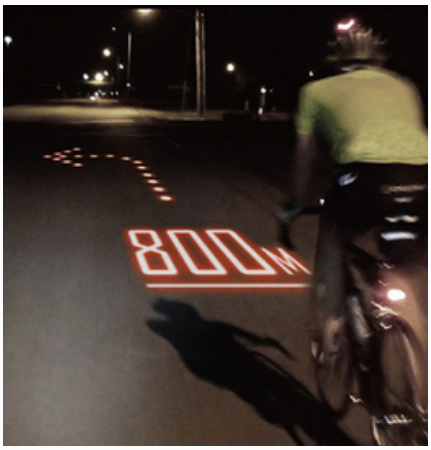


Figure 8: Beam Projector, (Burns, 2012).

While this is apparent there is evident limitation with the transferability of e-bike technology into other personal mobility devices.

The concepts like Flock, Blaze, and Lumos are all designed for bikes, and are therefore limited to bike accessibility only. E-skateboards are particularly restricted here as there are minimal concepts on the market which offer such great benefits to visibility and safety.

This following section intends to explore these concepts in further detail and demonstrate how in future each product could be integrated into an e-skateboard setup. In particular, Lumos will be observed here.

	Premium Helmet	Standard Helmet	Firefly LED's	Mini Firefly LED's	Rear Signal Mount
Description	An upper echelon bike helmet which is designed for mass customisation and the ability to stand out. This product features turn signals, long visibility, brake lights, and waterproof material.	A high range bike helmet designed to suit the everyday rider. The helmets integrated tech makes it highly usable on the roads and is a one size fits all product.	Small, versatile, and great for simple visibility. The Lumos firefly LED's are an attachable device that provide effective lighting and awareness.	Similar to the larger device, the firefly mini are a small alternative to its original counterpart. They are ideal for smaller mobility devices and are good for providing a visible lighting radius	The rear signal mounting system is a versatile and in most cases an easy to use device that is great for making it clear where PMD riders are positioned.

Table 3: Lumos Product Details, (Dagg, 2025).

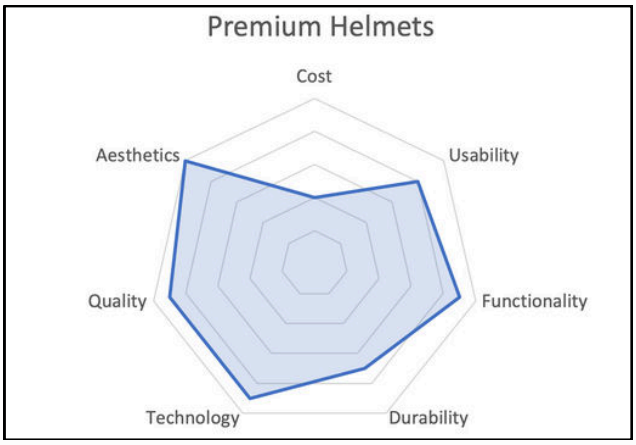


Figure 9: Premium Helmets Chart, (Dagg, 2025).

Figure 10: Premium Helmets In Use, (Lumos, 2025).

Lumos currently provides a high end helmet for e-bike riders featuring some of the best technology on the market for micromobility. This allows these helmets to produce a high working functionality and ease of use for users to seamlessly integrate into their riding setup. The only setback is that each individual helmet is significantly steep in price.

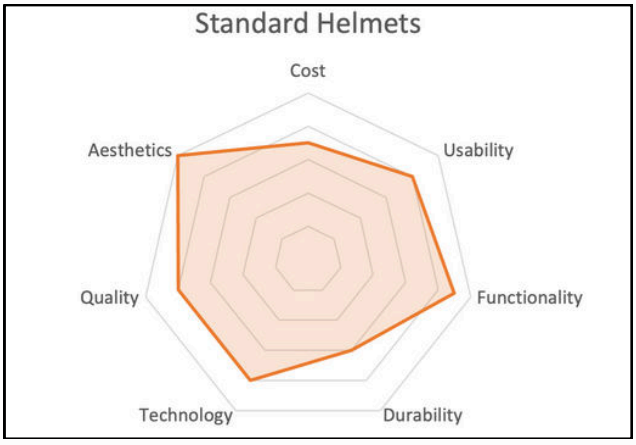


Figure 11: Standard Helmets Chart, (Dagg, 2025).

Figure 12: Standard Helmets In Use, (Lumos, 2025).

An alternative to the premium version, Lumos provides a more affordable helmet option which still has the capability to produce great functionality. The easy to use LED clips and the flashy aesthetic makes it a reasonable choice in terms of quality, while the price can easily be justifiable.

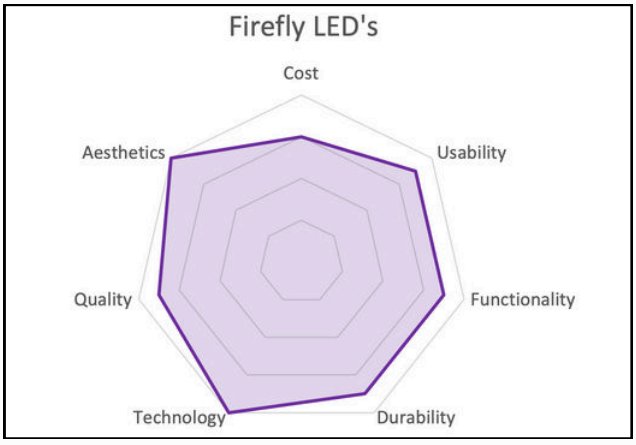


Figure 13: Firefly LED's Chart, (Dagg, 2025).

Figure 14: Firefly LED's In Use, (Lumos, 2025).

Easy to use, versatile, and unobtrusive the Firefly LED's can be partnered with any e-bike to provide great visibility around the rider. Each individual LED has impressive technology giving every rider a radiant glow. However, these lights are fairly steep in price making it a more premium product.

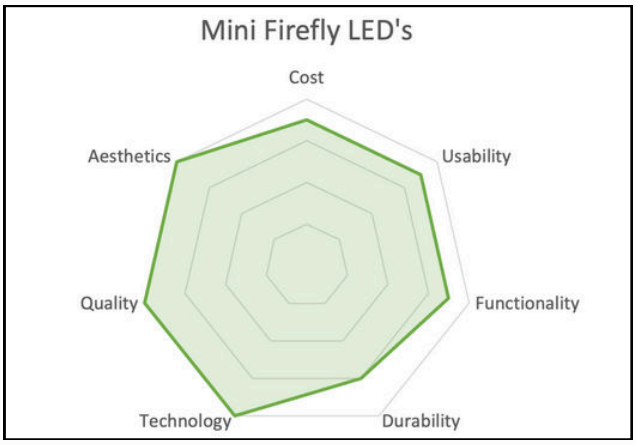


Figure 15: Mini Firefly LED's Chart, (Dagg, 2025).

Figure 16: Mini Firefly LED's In Use, (Lumos, 2025).

The Mini Firefly LED's provide a slightly more affordable way to light up bike riding. While they are smaller in size each light still provides a high level of functionality when being paired with e-bikes, clothing or even pet collars. The simple attachment method further highlights their ease of use and overall quality as a small active mobility product.

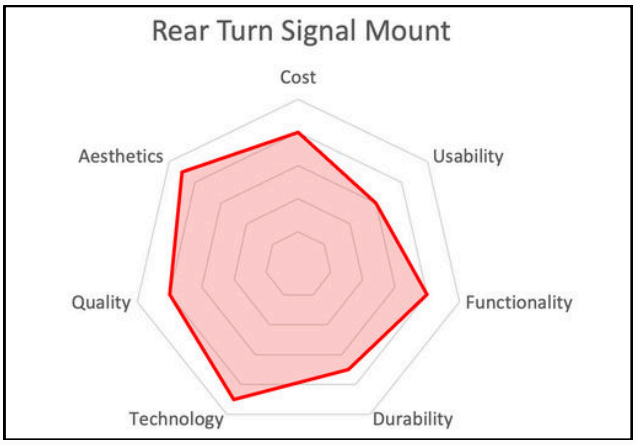


Figure 17: Rear Signal Mount Chart, (Dagg, 2025).

Figure 18: Rear Signal Mount In Use, (Lumos, 2025).

Another option to get the most out of the Firefly LED's is the rear signal device, an adjustable mount specifically designed for bikes. While it has been found to cause difficulty in the setup and mounting process the product generally provides great functionality. Bike users can have constant reassurance that their position is always being highlighted through the bright light technology.

When comparing these e-bike concepts to what is currently available for an e-skateboard it is obvious that e-bikes have a far greater range of products accessible to them. The purpose of these products are to provide comfort, and a way to stay visible when on the road riding a personal mobility device. Since e-skateboards have such limited accessibility to these devices it shows just how significant the gap in the market is for e-skateboard riders. Without proper implementation of innovative safety and awareness devices e-skateboarders are ultimately left vulnerable when using their device on roads, and other shared spaces.

RESEARCH

Data within this project was collected using a triangulation method using a mixed method survey, and semi-structured interviews. Additionally, a qualitative research approach was also followed within a handful of survey questions and throughout all interview questions to allow for free direction in participant responses. Ultimately, with this approach interviewees are able to provide more meaningful answers that can also unlock extra insight from participants own knowledge. Furthermore, this also creates an easy platform for probing and thus a far smoother flow of asking and answering questions.

The single survey was used to target potential participants who might use a personal mobility device, have experienced or perceived micromobility as a pedestrian, experienced an injury or incident involving a micromobility device, have their own insight or knowledge into the e-skateboarding field or know of other people who have insight into e-skateboarding. Interviews rather, focused on the experts within the micromobility field. In particular interviews targeted the academic researchers and designers who had knowledge and an understanding of micromobility and e-skateboarding.

Methodology

The survey tool was used in order to gather important information from participants who have experience with or an understanding of micromobility and e-skateboards. In particular the survey aimed to collect data that was based around demographic, experience, safety, awareness, technology, and also future thinking. The findings intend to inform the major circumstances which contribute to e-skateboarding accidents and help understand the current and potential preventative solutions available to skateboard riders. This ultimately provides great insight for informing the future design.

Interviews were also used as a tool to gain deeper understanding of specific details relating to e-skateboarding safety and awareness. In particular questions were aligned to the different interviewees experience and aimed to gain an understanding of the design of e-skateboards, how they were perceived by pedestrians and other road users, as well as how the riders themselves operate the device and perceive the environment around them.

Method - Survey

A survey consisting of 45 questions was developed using a range of question types such as multiple choice, checkbox, scale rating, and short answer. The survey was structured to be both semi-structured and non-structured with questions covering user demographic, experience, insights into safety and awareness, technology, future thinking, and also a space to provide feedback or participant contact information.

The questions formed within the survey attempted to answer the below research questions:

- What are the primary instigators for e-skateboarding accidents?
- What are the current limitations of e-skateboarding visibility and awareness and how does it affect other road users?
- What role does pedestrian and active transport awareness and communication play in the safe integration of e-skateboards devices?

To ensure the survey reached as many participants as possible the form was sent to an array of media modes, twice on my LinkedIn account, once through reddit, once through discord, and once on my personal Instagram account. These were effective methods for distributing the survey as my personal Instagram followers had the option to share the survey after filling it out themselves, while through LinkedIn, SurveyCircle reached out with information on where to further promote my survey. Figure 20 displays the formats used in contacting potential survey participants.

Method - Interview

Interview participants were recruited by researching micromobility clusters and contacting industry experts within QUT by email. Anyone who expressed interest was contacted in more detail using email where their interest was further gauged.

Initial contact involved distributing an interview participation information sheet which included valuable information on what the project thesis was, what the interview would involve and how their involvement would play out. A survey consent form was also distributed after the participant had agreed and shown interest in participating. Interviews lasted roughly between 20 to 30 minutes.

Interviews were started with an initial statement regarding the brief of the project, followed by a simple opening question about the interviewees experience. The semi-structured approach included pre-planned questions and room for follow up questions, ultimately covering topics around the interviewees experience with micromobility, safety and awareness around the devices, technology and future thinking. The participant also had the opportunity to ask any questions upon completion of the pre-planned questions.

Interviews attempted to answer the below research questions:

- How does the design of an e-skateboard impact user visibility and the awareness of other road users?
- How do current micromobility concepts compare to what is available for e-skateboards?
- What are the limitations with current e-skateboarding technology and the device itself?

Both interviews were conducted in a semi-formal setting one interview in person, and the other through a Teams meeting. Each conversation was also recorded using a transcription and recording tool either within teams or by phone.

This research highlights key insights in relation to the primary causes of e-skateboarding injuries, and measures around safety, awareness, and visibility. The methods for conducting research did well in terms of presenting an inclusive dataset involving age groups from 18 to 45 plus, and also including user responses from individuals across the globe. While this is apparent the dataset is limited in that a small sample size of 30 participants were reached. This only captures the opinion and perspectives of a handful of people where the issue is much larger. Despite the present limitations, the observed findings offer informative insights which are able to inform the research question based at the beginning of the project.

ANALYSIS & FINDINGS

This sections intends to present an analysis of important data gathered throughout the researching phase of the project. Key findings identified within both modes of sampling were analysed using a range of analysis types such as univariate, bivariate, and multivariate approaches. Additionally, the interview data was analysed through a thematic framework.

Survey Findings

After careful consideration and review of the results given by the 30 participants key findings were highlighted through graphs and tables. To appropriately represent this data a univariate analysis was applied to key statistical results, while a bivariate analysis was used to demonstrate relationships between user experience and trends found within participant responses. Additionally, the short answer results were best developed using a category and coding approach showcased within a clear table.

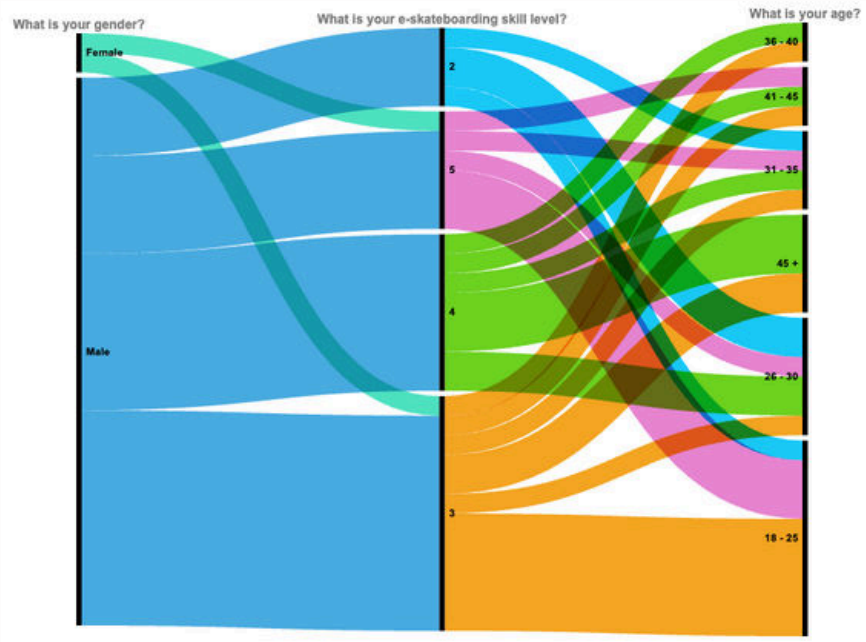


Figure 19: Relationship Between Gender, Age, and Experience - RawGraphs2.0, (Dagg, 2025).

The above graph represents the relationship between e-skateboarder age, gender, and skill level. Interestingly, males were recorded to have a far greater participation rate with 93.3% being male and 6.7% female. The data also revealed that e-skateboard riders rank their skill level most commonly within a level of 3 out 5. The most common age group was also found to be users between 18 to 25 years of age, followed by 26 to 30.

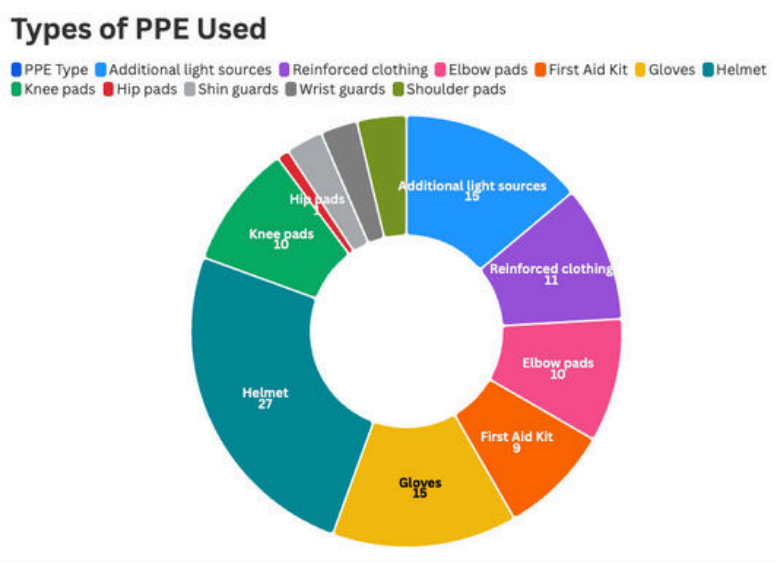


Figure 20: Types of PPE Used by Riders - Flourish, (Dagg, 2025).

This graph displays the most used PPE by e-skateboard riders when partaking in a ride. The dataset suggests that majority of users opted to wear some form of PPE with 27 people saying they wear a helmet and 15 suggesting they also wear gloves and carry an additional light source. This would indicate riders are using aftermarket gear to fulfil their riding needs.

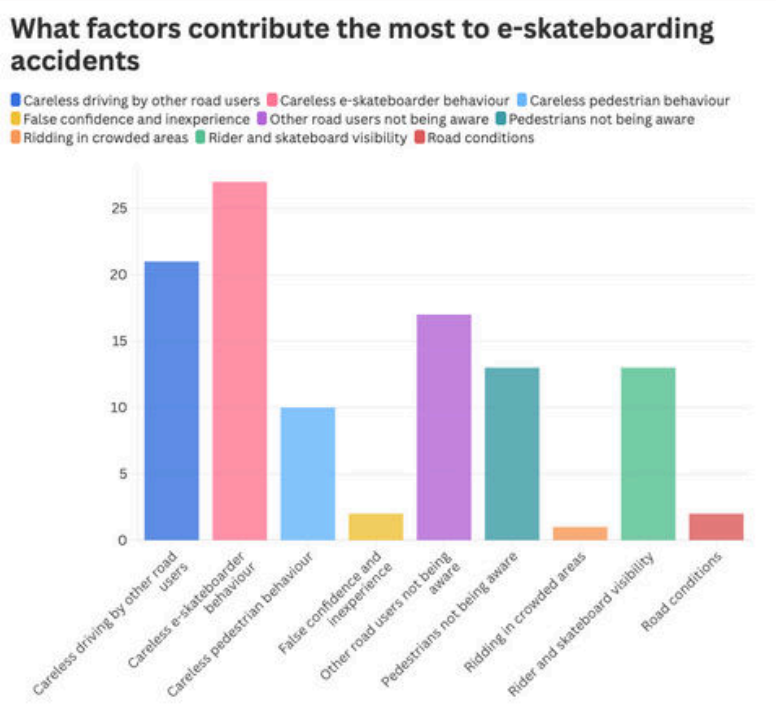
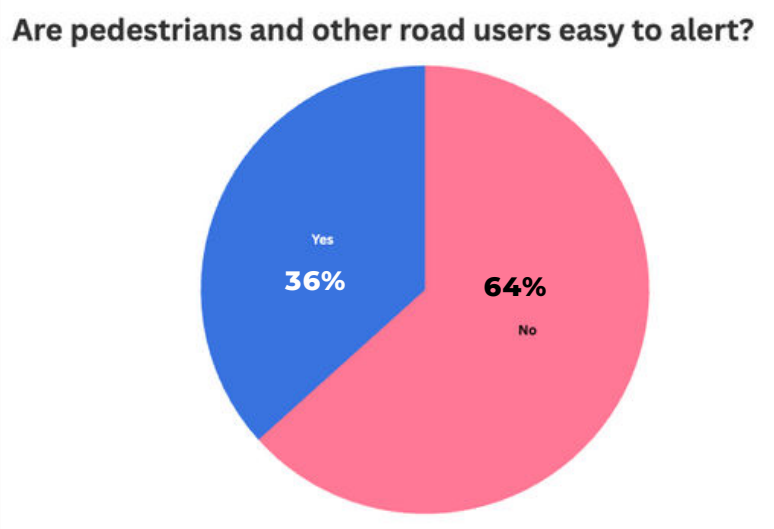


Figure 21: Most Occurring Factors Contributing to Accidents - Flourish, (Dagg, 2025).

Figure 23 displays the factors that contribute the most to e-skateboarding accidents. The dataset suggests that careless behaviour from both e-skateboard riders and the pedestrians and road users within the shared spaces are most commonly being found as primary instigators for accidents. The results reveal that 20 to 26 people suggest this to be true. Other factors like road users and pedestrians being unaware are also commonly occurring.

The following data found within the survey demonstrates whether or not e-skateboard riders feel like they can easily make their presence known around other road users and pedestrians. This would indicate as to how effective their alerting technology is, the quality of the surrounding infrastructure, and the ability of other people to remain aware in a shared space with e-skateboards and other active transport.



64% of survey participants indicate that they believe pedestrians and other road users are not easy to alert, also meaning that their presence is not easily made aware as well.

Figure 22: Are Other Road Users Easy to Alert - Flourish, (Dagg, 2025).

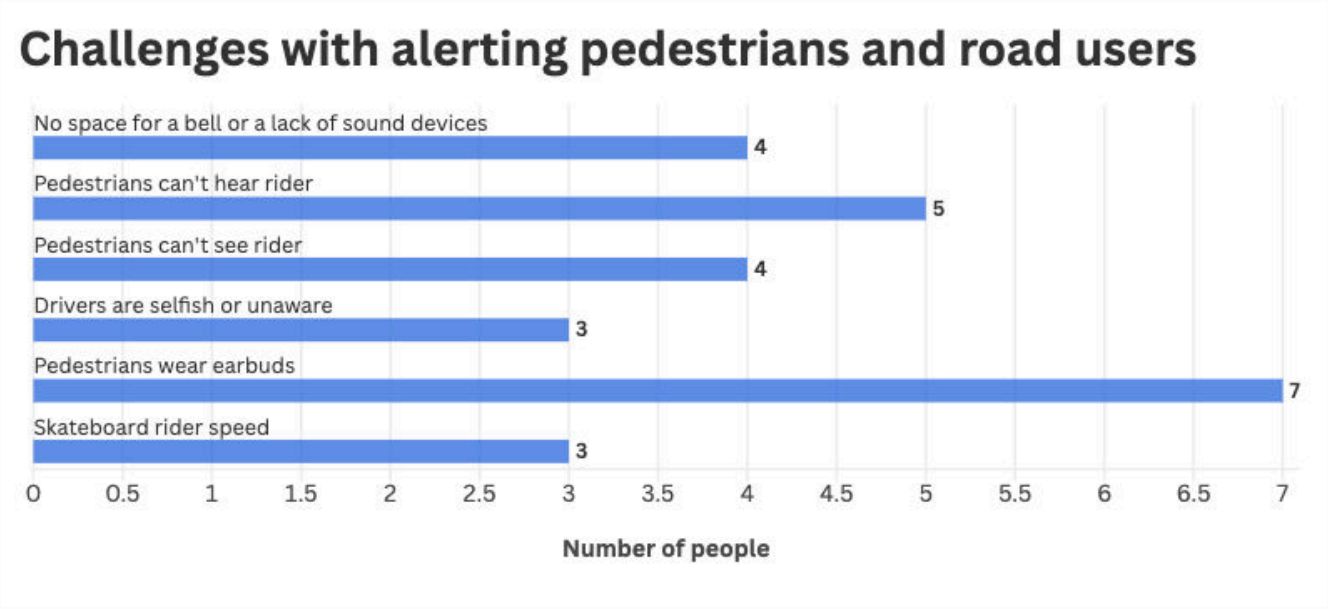


Figure 23: Challenges With Alerting Pedestrians and Road Users - Flourish, (Dagg, 2025).

Continuing on from the findings identified within figure 24, this graph displays the key reasonings behind e-skateboard riders finding it difficult to alert pedestrians and other road users.

The dataset shows that pedestrians wearing earbuds is the primary cause for not being able to stay visible with 7 people suggesting this. Another 5 people also say pedestrians cannot hear them for other reasons. Additionally, factors such as not being able to possess a bell or sound system, and pedestrians not being able to see the rider are also common occurring themes with 4 separate people in each category suggesting this.

Table 4 presents survey short-answer data, grouped into recurring themes: lighting, size, infrastructure, visibility and communication, equipment, education and law, and the skateboard rider. Importance and frequency were also noted, with equipment and visibility/communication being the most common with 6 each, lighting, infrastructure, and riders with 4 each, and size and education/law with 2 each. Findings show that riders feel their setups lack modular equipment like lights and sound, as well as suitable infrastructure, making it difficult to alert road users and pedestrians.

Theme	Primary challenges identified	Rate of occurrence
Lighting	Lights on the board itself won't be as effective as its down on the road and can easily be covered.	4
	Finding a way to have hands free lights and some form of reflectors. It has to be on the ridders because the boards are so low to the ground it won't be seen.	
	Just a good onboard light source	
	Getting riders to wear appropriate lights. Way unsafer in countries where it's still forbidden because riders will want to stay hidden	
Size	The fact that we want to be small and light, yet we want visibility that is achieved with size.	2
	Factor of size	
Infrastructure	Also, bad roads that are new to the rider, potholes, high curbs.	4
	Road infrastructure for anything non-vehicular (this includes bikes and other PEVs). Cycling infrastructure in the US is extremely poor.	
	Separated bike lanes, bike lane signals.	
	Safety is going to be an environment / skill problem	
Visibility and communication	Lack of visibility gear on rider – I think every board should come with at least some visibility equipment	6
	Having cars see you, especially from behind	
	Visibility is partly a communal awareness problem.	
	Riding in spaces that are not made for these kind of vehicles	
	Communicating with other vehicles and pedestrians without being too intrusive. While still being convenient for the rider.	
	Cars don't care about their surroundings	
Equipment	Availability of compatible attachments	6
	A horn built into the remote	
	Any type of integrated horn or high decibel sound that can be used when necessary	
	Form factor of any additional items	
	Board is low. To make it visible and prominent, alerting tech needs to be attached to the rider, not the board	
	Lack of standardisation between brands and equipment.	
Education and law	Probably education on what safety gear is available	2
	Make it legal so others get used to seeing more E-Skaters around.	
Skateboard rider	Lack of rider skill	4
	Age and wisdom of rider	
	Having everyone understand the way e-skateboarders ride.	
	Other operators ruin it for everyone. A road user will have a bad experience with one rider and run all others off the road	

Table 4: Primary Challenges Identified With Visibility and Connectivity, (Dagg, 2025).

Interview Findings

After observing the data collected in both interviews the key findings found throughout the transcripts were separated into 4 main categories and 12 primary codes. This was an effective way to represent the trends identified within the data and allows key information to be displayed in a cohesive manner. These codes were strategically made in order to have a direct link back to the initial research questions posed at the start of the research. This whole process was done using a thematic framework.

Category	Code	Example
Experience	Demographic	**(P1)** They're so, absolutely easy to use, for an e-skateboard, I think the normal person quite scared of using one of those. **(P1)** All the people that I see wearing are riding an electric skateboard around town. Those people are like, they look like they have like, a proper helmet that they purchased. And like, they've probably bought some of the gear, like they've committed to these things like it's a hobby. **(P1)** People, pedestrians are on sidewalks. They're not looking for people moving quickly. Sidewalks are a place for people to move slowly. **(P1)** And like, if you're a skateboarder, it's like, not cool to wear a helmet these days. **(P2)** If you're on a bike way and there's a pedestrian lane and you're alerting other bike users they prefer that you use a bell. I think where it could be negatively perceived is if you were riding on a footpath designated for pedestrian and you that's where it's received poorly and frowned upon.
	Legal aspects	**(P1)** You need to be wearing a helmet as a legal requirement
Safety	PPE	**(P1)** If you're one of these folks that has a full face helmet where it's kind of like full protective gear and has one of these more robust scooters, some people call them hyper scooters.
	Injuries	**(P1)** Still weighs like they don't have an athletic stance. Their knees aren't bent, and they're kind of staying quite upright, so something if they hit something then like they're not ready for it. **(P1)** Near misses is about like pedestrians. Like almost getting hit by someone which is not a great feeling, you're a pedestrian. And like you turn around and someone's just passing you at like a high speed. That's not a good feeling. **(P2)** One of the biggest accident problems with on E scooters is that if they have a small front wheel you hit something and that does this like.
	Rider factors	**(P1)** Without that handle, be able to brace yourself. It just adds another level of skill required. **(P1)** One of the things that makes them a bit dangerous is that when people ride them, they kind of stand really stationary with like locked knees and not really like in an athletic stance. I would imagine if you're on an E skateboard and you can't really do that at all. **(P2)** With a skateboard, you're just standing there, holding nothing, really high centre of gravity. And I think, definitely the skill level and the familiarity needed to provide it is more for a skilled person.
	Environmental factors	**(P1)** On a skateboard, it'd probably be even harder to navigate defects in the pavement. Compared to a bike that has big tyres so it can soak things up.
Awareness and Visibility	User visibility	**(P2)** When I commute or ride on my bike the bells really useful. Like if you're on the bikeway pedestrians walking side by side, or you're passing someone, I think you kind of need that because you don't know what person's doing in front of you and they certainly don't have any visibility.
	Integrated device features	**(P2)** It's fairly easy to build in, things like lighting, for awareness, particularly for e-skateboards. **(P2)** I think as long as it was within the space of a familiar, for instance, if you built in like a brake light into a helmet or something like that was connected to control. A vest, things like that, I would suspect probably not. **(P2)** So like a bell to alert your presents for other people can indicate your intentions, so that could, like you're talking about like lasers or indicators or things like that can be quite useful. **(P2)** If there was going to be a haptic system, I think it would be like a computer vis system to just know and there's a something coming up behind, for instance.

Technology	Benchmarking	**(P1)** E skateboards out of all the P and DS that are on the street are like very few like 5% or something like that. **(P1)** Some of the E skateboard riders that have been wearing these helmets that have the lights built into **(P1)** I think some of those ones do have integrated lights into them. But yeah, I don't know if the one wheel. Yeah, if they would be that much. **(P1)** Yeah, absolutely. I mean, we do it with electric cars. When electric cars are like at slow speed, it's the kind of same problem. But they, you know, they usually emit some sort of like fake. Vehicle noise. **(P1)** On campus at UQ a lot of our like our plant facility staff they use like these, little like a little electric. Golf CART type of things. **(P1)** Just like a noise that they emit so you can hear them. **(P2)** A bicycle is obviously a super familiar for most people. It's a seated position with handlebars. So, it's really stable to ride, the centre of gravity is also positioned kind of differently. It's more distributive across **(P2)** I suspect that it isn't a lack of equipment, but I suspect that its niche enough that it's not in the market. **(P2)** I've seen helmet designs with lighting in them.
	Features	**(P1)** The quietness of them doesn't help, especially if they're on the sidewalk with pedestrians. **(P1)** Having some sort of light, yeah, lights, front and rear lights, and sound. **(P2)** Where I think that's quite useful is for if you're riding on a you know, on a bikeway or something like that projects down, you know, maybe it gives cues to other writers about sort of clearances. I suppose there's also opportunities to present information, like indicating which directions. **(P2)** Yeah, I mean, bells are lame, I guess. But also, really useful, and effective. **(P2)** It probably has to be given in the hand, I don't think it's safe to have a foot operated bell, but it would have to be integrated into the remote. **(P2)** I don't know that I've seen one that has, like, turn signals up high. I think the signal light is still down low in the back. **(P2)** I guess like as a low profile vehicle, where everything is sitting, you know, probably within 200 mill of the ground or less, you know, the full visibility almost relies on the rider itself.
	Expenses	**(P1)** Get their transport needs fulfilled in a really, really cheap and can be an easy way. **(P2)** There's sort of entry level and reliable options. and probably when people are kind of looking at it is so cost and quality trade-offs **(P2)** I think some of the challenges are already that helmets can be quite expensive.
	Future thinking	**(P2)** If there is someone coming up behind you or looking to pass you, like a haptic system that alerts to potential dangers. **(P2)** Less about new technology and it's more just around the safe design, like how you make them more stable or more like depending on the use case for them, yeah, like how they can tolerate different types of surfaces.

Table 5: Interview Categories and Coding, (Dagg, 2025).

Table 5 revealed through its categories of experience, safety, technology, and awareness, it shows that e-skateboarding is an emerging mode of transport needing greater attention. Insights from two industry experts also signified trends consistent with the survey results. Compared to e-bikes and scooters, e-skateboards have fewer accessible products. Experts suggest new devices should be attachable, convenient, and compatible with existing boards or users.

DISCUSSION

Data analysed from both the survey and interview responses highlight the need for increased measures that improve visibility and awareness around e-skateboard riders and the pedestrians in the surrounding shared spaces. This is evident through the identified issues relating to skateboarding accidents, primarily seeing the incidents caused by a lack of road user awareness, minimal rider visibility, and improper use of active transport infrastructure.

Insights also revealed the limitation around accessible skateboard technology and devices that provide visibility and safety benefits to the riders. Benchmarking data highlighted this gap in the market and compared the findings to current products that are designed and readily available for e-bikes and scooters. These products have shown to positively benefit bike and scooter riders through their range of visibility, connectivity, and awareness based features allowing them to seamlessly integrate into active transport areas. But the limitation for e-skateboards remains present and the lack of accessible products is contributing to the unsafe environments these users are riding in.

Additionally, insights from e-skateboard riders suggests that incidents are more likely to occur due to factors relating to experience, safety, technology, awareness, and visibility. This aligns with the identified benchmarking, and accident data as predominantly skateboard riders are more likely to experience an accident from a lack of visibility devices, poor quality infrastructure, a lack of accessible equipment, and minimal communicative devices.

The significance and recurring theme of visibility, connectivity, and awareness also highlights the role each element plays in the long term benefits of safe device integration. Ultimately, implementing these features is essential in creating a safer and more accessible environment for all active transport users.

Through this understanding of the limiting factors found within the data, unsafe skateboarding environments will continue to remain present without careful consideration of future devices and technology. Industry experts emphasise that in this current position existing and developing technologies need to be implemented into e-skateboarding setups to have positive impact on the safe integration of every ridable device.

DESIGN IMPLICATIONS

The project extends its focus on the accidents involving e-skateboarders and surrounding road users or pedestrians specifically relating to the limiting factors of visibility, awareness, and connectivity. The prominence of these elements were highlighted throughout product benchmarking data, the survey targeted at e-skateboard riders, and the interviews with industry experts. Given the powerful and unpredictable nature of e-skateboards the need for practical, easy to use solutions that maximise safety and injury prevention is greater than ever.

While PPE contributes to the protection and prevention of e-skateboarding injuries it finds itself being challenged by adaptability to different environments and usability by the riders. There is significant limitation in regard to current PPE's ability to provide additional measures of safety like visibility and the ability to allow the users to stand out. However, to combat this, the design solution may integrate features like lighting, devices that produce sound, aesthetics, or reflective elements to increase the usability and appeal of the equipment. The solution would need to prioritise device attach-ability to existing equipment and ensure it does not further increase restrictiveness and the unappealing nature of PPE.

The condition and state of the rider must also be considered when providing a design solution as altering the way riders position themselves, the weight or composition of the board, or even how the rider operates additional features could have significant impacts on user safety. Due to this there is opportunity for a device to be implemented into existing e-skateboarding setups, on the user themselves or similarly to what was previously stated, the equipment the user is wearing. The solution would need to be easy to use to minimise the elements the rider has to consider, unobtrusive so the user does not become restricted, positioned accordingly to maintain the weight of the board, and able to provide elements of visibility in an ergonomic manner. This considers the placement of the solution so that it always remains visible to surrounding people and contributes to the riders safety and usability of the device.

With the lack of existing technology currently on the market for e-skateboards there is also opportunity to implement a solution that supports the rider in differing environments. Devices which contribute to standing out visually, keeping pedestrians aware with sound, and connecting the rider to surrounding pedestrians and road users through

communicative tools would significantly increase the safe integration of e-skateboards.

Finally, any design solution created in this space should adhere to the principles and guidelines associated with the surrounding infrastructure. Ensuring the implementation of a device that is unobtrusive, and respects the environment will contribute to maintaining a design aligned with the areas specific regulations. This would include a device that prioritises safe visibility and sound technology which isn't a disturbance to the public but can also achieve it's intended function of alerting people. The use of lasers, projection based products, or frustrating sound systems should be avoided in this space.

The design implications stated in this research report emphasises the need for a solution that seamlessly integrated into current e-skateboarding and shared space environments. Ultimately, the device must consider the gaps in current technology and how it can adapt to existing equipment while making it more effective to accident prevention. Overall, the design should maintain its position within regulations to ensure safe use in all environments and forms of skating infrastructure. In doing so, e-skateboard riders will become more visible, and connected while other road users and pedestrians will be more aware in shared environments.

CONCLUSION

To conclude, the data found within the researching phase of this project highlights the underlying need for a cost effective, user friendly, and modular design solution. This is to reduce the incidents caused by a lack of visibility and awareness around e-skateboarder riders when using shared spaces with pedestrians and other road users. The data demonstrates that while protective gear is there to provide basic benefits to riders like small collision or accident protection it does not contribute to making the user stand out or become more visible. When comparing current measures and forms of awareness based products the skateboarding market has significant gaps in comparison to the likes of what is readily available for e-bikes and scooters.

The idea of increasing visibility, awareness and connectivity plays a massive role in long term prevention of accidents and minimises the need for additional protective equipment. While it is beneficial to be wearing a full set of PPE, combining visibility and awareness centred solutions significantly benefits the long term safety of each e-skateboard rider and the other road users or pedestrians in the area.

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