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A learning pathway towards zero fatalities

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Abstract

Compulsory learning and development pathways towards obtaining a driving licence in Victoria have not been improved since the introduction of the Graduated Licensing System (GLS) in 2008. Crash statistics between 2006-2015 reveal that the numbers of crashes are increasing however the fatality rate is overall reducing. Recent statistics shows that in 2016 alone, 19% of drivers who lost their lives were aged between 18 and 25 years, with this age group only representing around 10% of Victorian licence holders. This paper explores whether providing additional official practical oversight (such as targeted 'risk training' in drive test) within the current Victorian licensing regime will invoke a reduction in crashes in addition to further reducing the fatality rate, especially among young drivers.

Initial data analysis revealed trends where the development of possible drivers looking to obtain their licence does not address. It was found that 100 km/hr driving, nose to tail, head on and peak environment crashes were all occurring however none of these factors are practically taught to reduce the chance of occurring. The licensing regimes of Sweden and Finland were then scrutinized which showed that their regimes included such 'risk training' component and both their crash and fatalities rates have been decreasing since 2006 with Sweden now having one of the lowest in the world.

To replicate the reducing crash trends of Sweden and Finland and to further decrease the fatality rate, this paper recommends building a development facility which aims to provide official practical oversight on the development aspects identified as missing from the current Victorian regime. The potential benefits of this proposal are the cost savings associated from the reduction of injuries and fatalities from the possible reduction in crashes.

Further, the exploratory insights provided by this paper could assist the licensing authority and the state government in further developing the Victorian licensing regime to possibly a learning pathway towards zero fatalities.

1. Introduction

Driving a car in today's society has seemingly evolved into a simple 'right of passage' where the complexities of handling a vehicle in addition to driving in an ever-growing traffic network are often getting overlooked. With a road toll year after year, it is critical that new methods are created and implemented to continually try to lower and hopefully eliminate this infamous toll.

Government campaigns such as "Towards Zero" is a partnership between the Transport Accident Commission (TAC), VicRoads, Victoria Police, the Department of Justice and Regulation and the Department of Health and Human Services where their ultimate goal is to achieve zero deaths and serious injuries on Victorian roads (Towards Zero 2017). The "Towards Zero" approach is based on the Safe System approach which involves a holistic view of the road transport system and the interactions among roads and roadsides, travel speeds, vehicles and road users. Key take outs from their explanation of this initiative are

that “we all make mistakes” and that we need “a system that protects us from of own mistakes”. Although both statements are very true, it could be suggested from this paper, that it will also be beneficial to develop a system where drivers looking to obtain their licence can make and learn from their mistakes, before they officially enter the road network solo.

As we currently stand, young drivers are not given the opportunity to make mistakes and learn from them while they are developing their driving skills consequently starving them of crucial driving development. It seems that a safe driver, is conceptually defined as a person that does not make any driving mistakes. Although this is possible, a person that does not make any mistakes cannot learn and gain a set of boundaries that will define what that person can and cannot do as well as a person who does make mistakes. Dr. Richard Curwin, an accomplished author and co-author of an estimated 20 books related to human behaviour and motivation states that humans often learn the most from their biggest mistakes and not nearly as much as their success (Curwin 2014). Curwin (2014) also states that it is critical to explain why the mistake occurred and how to rectify it if any meaningful development were to occur from it. This can therefore suggest that allowing driving applicants opportunities to make mistakes in a controlled driving environment under professional supervision and learn from them will potentially allow them to ascertain a hard set of boundaries as to what they safely can and cannot do when driving on a road network.

Existing studies of Victoria’s licensing regime show that the only time a driver is officially practically monitored is during the practical drive test. Since 1992, the two most recent systems were known as the Programmed Licence Observation Assessment (POLA) (Catchpole et al. 2008) where it was then superseded by the current Graduated Licensing System (GLS) that was implemented in July 1st, 2008 (Cavallo & Oh 2008). POLA only had a very basic practical assessment however the GLS had a revised test that aimed to provide a better picture of the applicant’s ability to drive in addition to the performance of the test being indicative of the applicant’s total learners experience (Cavallo & Oh 2008). Both systems however, had no official driving development associated with them. Although the GLS however, has an additional requirement where a learner must obtain 120 hours of supervised driving by a full licence holder (does not have to be a trained driving professional) and has been proven effective in research reports such as the paper by Senserrick and Williams (2015), a question might be asked if it would be more effective if a trained driving professional provided some sought of compulsory training.

A large number of studies have showed that one of the largest contributory factors to novice drivers’ crash involvement is their lack of experience (Gregersen et al., 2000; Elvik, 2010). The injury rate of the youngest car drivers is seen to be about 5–10 times higher than the rate for the safest age group in motorised countries (Elvik, 2010). The general philosophy behind extending the learner-driving period in Sweden, Norway, France, Belgium and other countries is to increase the experience of young drivers under supervision (Gregersen et al., 2000). It is assumed that a learner driver with extended practice before receiving a driving licence will be better off to utilise the mental resources required and thus become a safer driver. More realistic training will also increase actual experience in handling various traffic situations in everyday traffic situations (Gregersen et al., 2000). Given that in Victoria, more than 350 young drivers aged 18 – 25 lost their lives in the last 10 years (TAC, 2017), an improved licensing system that considers ‘risk training’ may assist in reducing crashes among young drivers in Victoria.

Our hypothesis is that inadequate ‘risk training component’, in the existing Victorian licensing system may be one of the confounding factors that may have resulted significant number of crashes and fatalities, especially among young drivers. One would need the crash data before and after the suggested ‘risk training’ component is implemented in Victoria to have an insight on the validity of the hypothesis. This could be studied in future. To have preliminary insights on our hypothesis, we compared Victorian driving licensing system with that of Sweden and Finland as they both include ‘risk training’ in their licensing systems and

have lower road fatality rates as stated by the World Health Organisation (WHO 2015). A detailed study in Sweden (Gregersen et al., 2000) showed a general reduction of an average 15% in accident risk (accidents per 10 million km) of young drivers through the intervention of lowering the age requirement for obtaining a learner licence and increasing the amount of supervised driving practice time prior to obtaining a driver's licence. In addition, the results show that the reduction of accident risk in the group who utilised the new age limit was approximately 40%, whereas those who did not utilise the prolonged training period did not benefit at all.

This exploratory paper aims to examine whether adding to the 'official practical oversight' components (such as the 'risk training' in drive test) of the current Victorian licensing regime will assist in reducing crashes and result in lower road fatalities, especially among young and inexperienced drivers. The meaning of 'official practical oversight' is a termed that will be used throughout this paper to describe a compulsory practical component of a licensing regime where a trained licensing professional or driving officer spends time with an applicant to oversee their driving.

This paper will draw upon crash statistics made publicly available by VicRoads (2017a) to initially gauge the past and current situation. Sweden and Finland produce two of the lowest fatality rates globally (WHO 2015). This paper will then analyse both countries using the same method and then compare the overall statistics with that of Victoria, as both Sweden and Finland conduct different methods in licensing, particularly in a practical sense. Key indicators that will define the scope of potential solutions revolve around decreasing crash and fatality rates. The findings of this study can therefore signify potential opportunities for the Victorian licensing regime to adapt to international leading standards to achieve a mutual objective of zero road fatalities in the near future.

This paper is constructed as follows. The next section provides information as to how crashes, injuries and fatalities are tracking from 2006-2015. Sub-sequent sections then present development gaps in the Victorian licensing regime, comparisons with the Swedish and Finnish licensing regime, followed by a cost discussion. The final section presents conclusions and recommendations for future research.

2. Crashes and fatalities – the story so far

The population of Victoria is continuously growing and due to the transport nature of Australia, the number of registered vehicles has also continued to grow. Data from the Australian Bureau of Statistics (ABS 2007), state that Victoria's population has grown from just above 5 million people in 2006 to just below 6 million people in 2015 (ABS 2015a) with an average annual growth rate of 1.7%. In the same period, the number of registered vehicles in Victoria has grown quicker from approximately 3.7 million in 2006 (ABS 2006) to just over 4.5 million in 2015 (ABS 2015b) with an average annual growth rate of 2.4% indicating a fast-growing state.

Road crashes and fatalities are a common occurrence on Victorian roads and according to data from VicRoads (2017a), there is on average 13,815 crashes (that incurred some sought of injury) and 286 fatalities per year over the past 10 years (2006-2015) which is equivalent to approximately 38 crashes per day. Over the same period, there is also a trend of increasing crashes coupled with decreasing fatalities overall.

It can be noted that within the 10-year period approximately 13,400 crashes occurred in 2006 with an estimated 14,400 crashes occurring in 2015 leading to an increase of approximately 1,000 crashes. This can be due to increased population which generally leads to an increased number of vehicles on the road leading to additional crashes.

In relation to fatalities, it can also be noticed that road fatalities have reduced from approximately 350 to an estimated 250 fatalities between 2006-2015 which equates to 100 less people dying on Victorian roads. This can be a result of better car design that focus

more on safety in addition to better medical responses and procedures. It also must be highlighted that there has been a recent rise in fatalities between 2013-2015 where the fatalities per year in the period have been 243, 248 and 252 respectively. In Victoria, more than 350 young drivers aged 18 – 25 lost their lives in the last 10 years (TAC, 2017). This represents one in four (25%) of drivers lives lost in Victoria in this period. In 2016 alone, 19% of drivers who lost their lives were aged between 18 and 25 years. However, this age group only representing around 10% of Victorian licence holders (TAC, 2017).

Injuries are a common occurrence when crashes occur and are often dictated based on the crash severity. Serious injuries are decreasing however minor injuries are increasing at relatively the same rate. Therefore, the resulting effect is that total injuries remain relatively the same through the 10-year period between 2006 to 2015 hovering just under 18,000 injuries.

3. The problem - practical development gaps

In the present day, the only official practical oversighted component is during the drive test by which the applicant will action the test for approximately 45 minutes alongside a VicRoads LTO (VicRoads 2017b). This essentially suggests that, driving in basic to slightly more challenging environments from speed zones anywhere between 20 km/hr to 80 km/hr for 45 minutes will render an applicant fully suitable to handle a vehicle in all probable conditions from best case to worst case scenarios. This of course cannot be the case likened with most aspects in life and therefore logically requires additional time spent in officially monitoring or testing the development of all applicants wanting to drive on Victorian roads. This section will outline developmental gaps which are not tested or not officially monitored by the Victorian licensing regime. Those development gaps are related to speeding, which is one of the fatal five behaviours of road crashes (the other four being impairment, distraction, fatigue and seatbelts, TAC 2016). Elvik (2010) states that higher risk of accident is likely to result from failures of rationality, which includes choice of a driving speed that deviates from the most preferred speed and erroneous perceptions of the impacts of driving speed on accident risk and stopping distance. The risk training component (e.g., braking capacity, evasive manoeuvres) as highlighted below are centred around concepts of stopping distances, turning speeds and what occurs when actions are not executed the correct way.

3.1 Freeways – highways – 100 km/hr roads

Driving at 100 km/hr is currently not regularly (if at all) tested on the VicRoads drive test. Documentation and information provided by VicRoads (2017c) in how to prepare for a test, does not state that this aspect is required on the drive test either and can therefore strongly suggest that 100 km/hr driving is not required.100 km/hr driving however, is the corner stone of Victorian driving. With such a vast area to cover to journey from A to B, in addition to the readily accessible freeways from most major arterial roads, driving on a freeway is highly necessarily for most Victorians.

Referring to crash statistics based on speed zones available publicly from VicRoads (2017a), it is clearly distinguishable that there is a high portion of crashes and fatalities occurring at this speed. It is very clear that crashes and fatalities at 100 km/hr have been and still are a prominent issue between 2006-2015. The 100 km/hr speed zone has consistently incurred just over 2,000 crashes within the 10-year period and has continuously ended more than 100 lives in the identical period. Although it can be noted that the fatality rate is slightly decreasing, it can be suggested that should the crash rate lessen as well, the fatality rate can be further reduced. Of the 29 young drivers who lost their lives in Victorian roads in 2016, 55% were killed in regional Victoria. Interestingly, 94% of these young drivers were killed on 100 km/hr or above speed (TAC, 2017).

It is therefore strongly suggested that test applicants are either officially monitored during their development of learning to drive at 100 km/hr or they are tested directly during their official drive test to ensure that they fully understand what is required to drive at such a speed.

3.2 Understanding vehicle dynamics – braking capacity

A true understanding of vehicle braking capacity is currently not developed, required or tested in the Victorian licensing regime. Although it is heavily mentioned in information provided by VicRoads (2016) that applicants must drive at a safe distance from the vehicle in front, this does not translate any long term meaning to the applicant once they pass the test.

Referring to VicRoads (2017a) crash statistics, nose to tail crashes are the most prominent and increasing type of crash occurring on Victorian roads which indicates that drivers are driving too close to the vehicle in front and not understanding whether they can stop in time. The number of nose to tail accidents have increased significantly from an estimated 1,600 to approximately 2,600 in a 10-year period while the other top four types of accidents have been roughly below 1,400 throughout the identical period.

This can therefore suggest that drivers of the present drive too closely to the car in front of them. It is also advised that all probable drivers about to obtain their licences are made to understand their vehicle braking capacity and how their vehicle behaves under adverse circumstances so that incidents described above can have a potentially lower chance of reoccurring.

3.3 Understanding vehicle dynamics – evasive manoeuvres

Understanding how an entity operates is a critical factor to using anything safely in life. Vehicle dynamics is one of those aspects, specifically when in the same conversation with driving. Understanding how your vehicle behaves especially in adverse circumstances is critically important as it gives the driver a true set of vehicle operability.

Referring to VicRoads (2017a) crash statistics, it is very indicative that head on collisions (while not overtaking) is the most prominent type of collision causing fatalities between 2006 to 2015 whilst driving off the road and into an object either left or right is a close second and third respectively in the identical period.

A head-on collision (while not overtaking) is where two vehicles travelling in opposite directions manage to hit each other. They typically occur due to one vehicle losing control and another failing to fully evade the oncoming vehicle that has lost control. More than 35 fatal head on collisions have occurred consistently between 2006-2015 with no clear indication of reducing. It can therefore be suggested that teaching potential drivers how to regain control of an out of control vehicle in addition to understanding the evasive ability a road vehicle could potentially lower this fatal statistic in the future.

3.4 Peak period environments

Peak periods are generally time periods that carry the most road traffic of a given working day and they are typically separated into the morning peak (7-9am) and the afternoon peak (3:30-5:30pm). Since they carry the most road traffic of a given working day, peak periods often have much more challenging driving environments then off-peak periods with many vehicles in close proximity to any one given vehicle.

Referring to VicRoads (2017a) crash statistics, it is very clear that the majority of crashes occur during the morning and afternoon peak periods with just under 1,000 and 1,200 occurring respectively between the years 2006 and 2015. The fatal statistics however, have more of an afternoon peak period trend where the majority of fatalities occur slightly more between 3pm and 6pm.

Currently, VicRoads testing hours are between 8:30am and 4:30pm (VicRoads 2017d). These testing hours only represent approximately 1.5 hours of peak hour testing and can be seen as insufficient when developing potential drivers to drive in peak periods. It is therefore suggested that new methods be put forward to simulate peak hour conditions to develop young drivers about to obtain their licence. The will result in every applicant experiencing the complex environments peak periods generate so that they can potentially better adapted to drive in these conditions.

4. International licensing regimes – Sweden and Finland

Licensing throughout the world is very different and unique to each country. Nearly every country in the world has slight to major variations in their licensing regimes when compared to one another. This section aims to explore the licensing regimes of Sweden and Finland as they both have lower road fatality rates as stated by the World Health Organisation (WHO 2015).

Sweden was chosen as they are currently the front runners to reaching “zero fatalities”. According to the World Health Organisation they currently have a fatality rate of 2.8 per 100,000 people per year (WHO 2015).

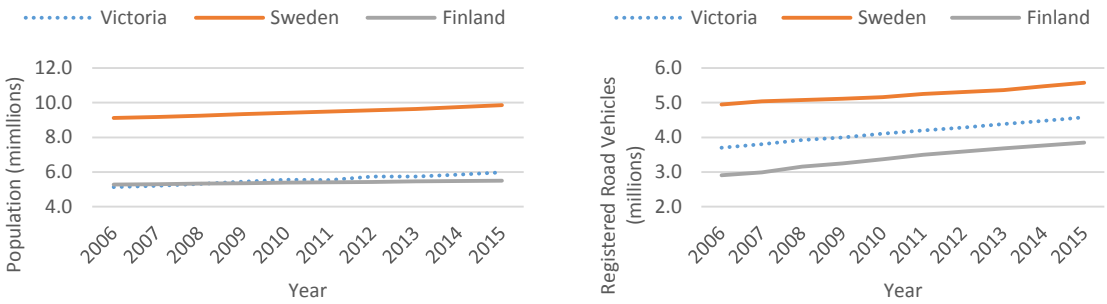
Finland was chosen as they have a similar population to Victoria in addition to being ranked similar by the World Health Organisation to Australia (5.4 per 100,000) with a fatality rate of 4.8 per 100,000 people per year (WHO 2015).

Also taken into consideration for this study was the countries standard of living, level of developed infrastructure and healthcare where membership of the Organisation of Economic Co-operation Development (OECD) provides a level of assurance for this aspect.

4.1 Population and registered vehicles comparison

The population of Sweden and Finland has generally been nearly double and similar to the population of Victoria respectively. In addition, it is also important to note that the number of registered road vehicles in Sweden and Finland is higher and slightly less than those in Victoria respectively. Figure 1 below compares the growth of Sweden’s and Finland’s population with Victoria’s between the years of 2006-2015.

Figure 1: Population (left) and registered vehicles (right) comparison between Victoria, Sweden and Finland



Source: Swedish data - Statistics Sweden (2016), Finnish data - Statistics Finland (2017)

4.2 Crashes and fatalities

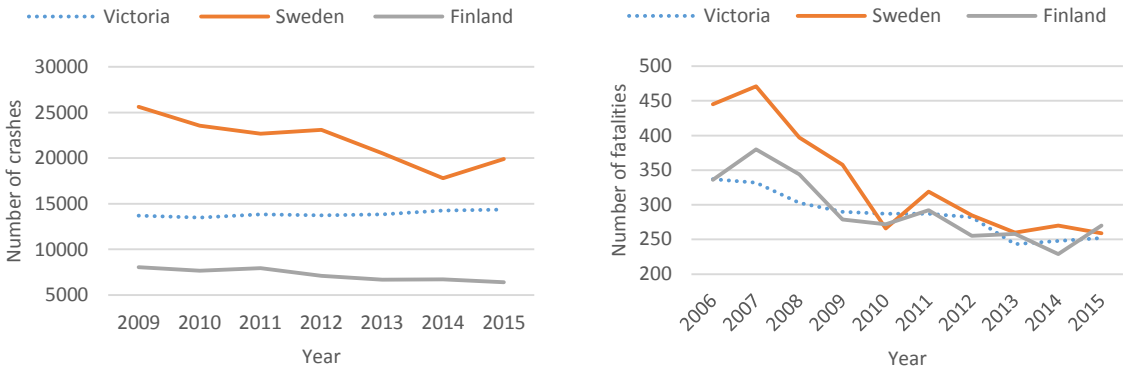
The number of crashes and fatalities that occur in Sweden and Finland have been steadily decreasing in recent years (see Figure 2). On average, Swedish crashes are decreasing by approximately 956 crashes per year and Finnish crashes are reducing by an estimated 241

crashes per year. In addition, Swedish fatalities are also decreasing by approximately 21 per year and Finnish fatalities are reducing by an estimated rate of 7 per year.

It is also critical to note that Sweden and Finland both have decreasing trends of crash rates when compared to those of Victoria. Sweden has also achieved a very similar fatality rate to Victoria which is remarkable given that it has nearly twice the population and approximately a million more registered vehicles on the road. The Finnish fatality rate is reducing slightly faster than that of Victoria's which is expected given that it has slightly less registered road vehicles.

Through these key indicators, it could be suggested that Swedish and Finnish licensing regimes have been producing safer drivers since 2006 than those of Victoria due to both countries achieving a decreasing trend in both crashes and fatality rates which is exactly the trends that are required should a zero-fatality rate be accomplished.

Figure 2: Number of crashes (left) and fatalities (right) comparison between Victoria, Sweden and Finland



Source: Sweden data from Transport Analysis (2016), Finland data from Statistics Finland (2017).
Note: Crashes are graphed from 2009 due to Sweden only having crash data available from 2009.

4.3 The Swedish licensing regime

The Swedish licensing regime can be summarised below in Table 1. In comparison to Victoria's licensing regime, the Swedish process is much more rigorous in relation to what is required to obtain a driver's licence. The risk training component, which forms a key part of this study, will be explored in the next sub section where this component provides the additional 'official practical oversight' needed to further develop potential Swedish licence holders.

Table 1: Summary of Swedish licensing regime

Phase	Time Frame	Description	Pass Achievement
Learners Permit (Korkorstillstand)	Processing time of up to 2 months.	• Must be at least 16 years of age • Apply from the Swedish Transport Agency. • Signed application form. • Required eyesight certificate. • Signed health declaration form. • Application fee ≈ 220 SEK.	Lerner's permit valid for 5 years.
Driving Practice (Ovningskora)	Up to Learner's permit expires.	• Practice the basics of driving with a supervised driver (handledare). • Can be done at a driving school as well.	

Phase	Time Frame	Description	Pass Achievement
Theory (Korkortsboken)	Up to Lerner's permit expires.	• Usually done while practicing. • Most applicants read a theory book known as the Korkortsboken.	
Risk Training (Riskutbildning)	8 hours	• Compulsory two-part training session. • Part 1 – Theoretical knowledge about the driving risks with alcohol, drugs and tiredness. • Part 2 – Practical session on speed and driving security (on extreme conditions as well). • ≈ 2,800 SEK for both sessions.	Risk Training certificate valid for 4 years.
Theory & Practical Tests	70 questions (theory) + 25 mins practical	• Must be at least 18 years of age. • Done with the Swedish Transport Administration. • Need to answer at least 52 questions to pass the theory test. • Required to show vehicle control. • Actions and reactions in different traffic scenarios. • Application of traffic rules. • Application of "eco driving".	Full Driving Licence granted.

Source: The Newbie Guide to Sweden (2016)

4.3.1 Official practical oversight in Sweden – Risk Training

One key aspect which is non-existent in Victorian testing (or development) is the incorporation of what the Swedish have termed "Risk Training". This stage, as described above, really ensures the applicant is fine tuned to the dangers of driving and is allowed to understand the "capability boundaries" of a vehicle through physically experiencing adverse circumstances and situations in a controlled environment.

This training is done at a dedicated training facility, one of which is Stora Holm (Trafikovningsplats) situated in Göteborg, Sweden and its facility is illustrated in Figure 3 below. It can also be noted that the training facility in Stockholm is provided by a company known as Gillinge, located in Vallentuna, Stockholm (Gillinge 2017).

In addition, Part 1 is face-to-face based learning and in an informative video developed by The Swedish National Association of Driving Schools (2016), it can be clearly seen that classes are designed to be small and interactive to ensure that every student participates to maximise information absorption.

In relation to Part 2, special modified vehicles are used for participants to exercise specific manoeuvres which aim to give drivers a stronger understanding of vehicle dynamics. These manoeuvres are centred around concepts of stopping distances, turning speeds and what occurs when actions are not executed the correct way, all of which are done on different controlled road conditions. The modified safety vehicle has additional wheels that take affect when they sense car control has been compromised giving confidence to both the participant and the instructor so that learning can be the main focus (The Swedish National Association of Driving Schools 2016).

Figure 3: Stora Holm dedicated driver training facility

Source: Stora Holm (2017)

4.4 The Finnish regime

The licensing process that any applicant must go through to obtain a Finnish licence is based on a three-phase driving school system. A category (B) licence is the licence type of licence that is issued for an ordinary car or van. Autokoulu Hakaniemi (2016), a driving school located in Finland and the Finnish Transport Safety Agency provides information about how this process is applied for a category (B) licence and is summarised in Table 2 below.

Like Sweden, when compared to Victoria's licensing regime, the Finnish licensing process is also much more intensive in relation to what is required to obtain a driver's licence. Additionally, and similar to Sweden, the advanced phase provides the additional official practical oversight needed to further develop potential Finnish licence holders and will be further explored in the next section.

Table 2: Finnish licensing regime

Phase	Time Frame	Description	Pass Achievement
Basic	3-6 months	• Must be at least 18 years of age. • Training at a driving school. • 19 hours of theory which are generally classroom based. • 18 hours of practical driving instruction. • Theory Test • Practical drive test (after theory). • ~ 1600 E (ESAMI International Driving School 2015).	Permanent Licence (as of 01/01/2016) however still need to complete Training (Practice) and Advanced Phase (ESAMI International Driving School 2015).
Practice	3-24 months after basic phase	• Considered time to practice on your own. • One hour of theory (to assess progress). • Two hours of practical driving instruction (to assess progress). • ~200 Euros.	Must be in the practice phase for at least 3 months before taking the advanced phase.
Advanced	8 hours	• Four hours of theory (indoor safety demonstrations). • Four hours of practical driving (slippery track). • ~ 350 Euros +Track fee.	Licensing completed.

Source: Autokoulu Hakaniemi (2016)

4.4.1 Official practical oversight in Finland – Advanced Phase

Parallel to Sweden, another significant aspect which is non-existent in Victorian testing (or development) is the incorporation of an “Advanced” phase of development which aims to teach the same factors as that of the Swedish “Risk Training”. This phase must be completed before a full licence (with no restrictions) is issued and is conducted at a training facility where one of which is known as the Vantaa Road Excellence Centre (VREC) (UAR Finland 2017) and is similar in nature to the Stora Holm (see Figure 3) in Sweden. This section will explore the key aspects which are developed within this phase.

A critical aspect of driving which is taught to all potential full licence holders is how the vehicle behaves on adverse road conditions. A short video made by MotorWeek (2012), where the host personally explores and participates in the training exercises shows how participants are required to do a series of manoeuvres alongside a driving professional on wet roads and icy roads to understand how the vehicle capability varies depending on the road condition. Should the participant perform a manoeuvre incorrectly, the vehicle may skid out, however due to the nature of this controlled environment, no damage or harm is inflicted. Reflecting upon Curwin (2014)‘s learning concepts, it is this type of situation where learning can best be achieved where the professional driving instructor provides advice after a mistake has occurred as is to what went wrong and can be done to avoid the situation in the future.

Vehicle braking capacity is another critical driving aspect that the VREC teaches to its participants. Understanding how long it takes a vehicle to stop at certain speeds and road conditions is essential to ensuring that drivers do not collide with the vehicle in front. In the video made by MotorWeek (2012), it also depicts a participant learning about a typical vehicle’s braking capacity where it can be suggested that the participant is instructed to apply full braking at certain locations to understand how long it takes the vehicle to stop. In the instance shown within the video, the participant was instructed to brake at a distance which does not give enough room for the vehicle to avoid hitting the dummy object in front therefore giving an understanding, along with advice from the driving professional, that the driver must leave more room in front to allow the vehicle to stop.

Night time driving is also officially over-seen at the VREC. This learning aspect uses state of the art driving simulators to simulate driving scenarios at night time. Within the video filmed by MotorWeek (2012), the host is depicted using the driving simulator as if he was a participant. It must be noted that when officially used, the room is in complete darkness to truly simulate the night time environment. This simulator therefore gives participants a strong understanding of how potential conflicting objects may look in the darkness whether it be a deer (as seen in the video) or a vehicle with no headlights on.

4.5 Comparison summary

A summary comparison between the Swedish, Finnish and Victorian licensing regimes can be seen below in Table 3. The regime comparison is based on the developmental factors identified as lacking in the Victorian regime (Section 5) in addition to those recognised in the international study (Section 6). It can be noted that Victoria has does not do any of the critical development aspects identified and has a great opportunity to improve.

Table 3: Comparison between the Swedish, Finnish and Victorian licensing regimes

Testing/Developmental Requirement	Sweden	Finland	Victoria
Compulsory Profession Lessons	✗	✓	✗
Theory	Comprehensive	Comprehensive	Basic
Practical Test	Similar to Victoria	Similar to Victoria	As current
High Speed – 100 km/hr	?	?	✗
Vehicle Braking Capacity	✓	✓	✗
Vehicle Dynamics & Evasive Actions	✓	✓	✗
Adverse Weather/Road Conditions	✓	✓	✗
Night Time Driving (official oversight)	?	✓	✗
Peak Periods	?	?	✗

Notes: ? denotes that the aspect is not confirmed. 'Tick' denotes the aspect is met or can be met based on available training infrastructure. 'Cross' denotes the aspect is not required in current regime.

5. Proposed dedicated development track

This proposed dedicated development facility will aim to provide a new age of targeted development to Victorian drivers. Similar to those currently being used in Sweden and Finland, these development tracks will provide the necessary development for people applying to get their driver's licence to ensure that they understand the concept of driving and the dynamics involved.

5.1 Targeted training

The concept track design will essentially align with the tracks in Finland, Sweden and any generic basic race track around the world. Key requirements of the track will need to be designed to ensure that critical driving aspects can be correctly taught in addition to allowing participants to safely make mistakes. Table 4 below summarises these key requirements.

Table 4: Targeted training and required infrastructure

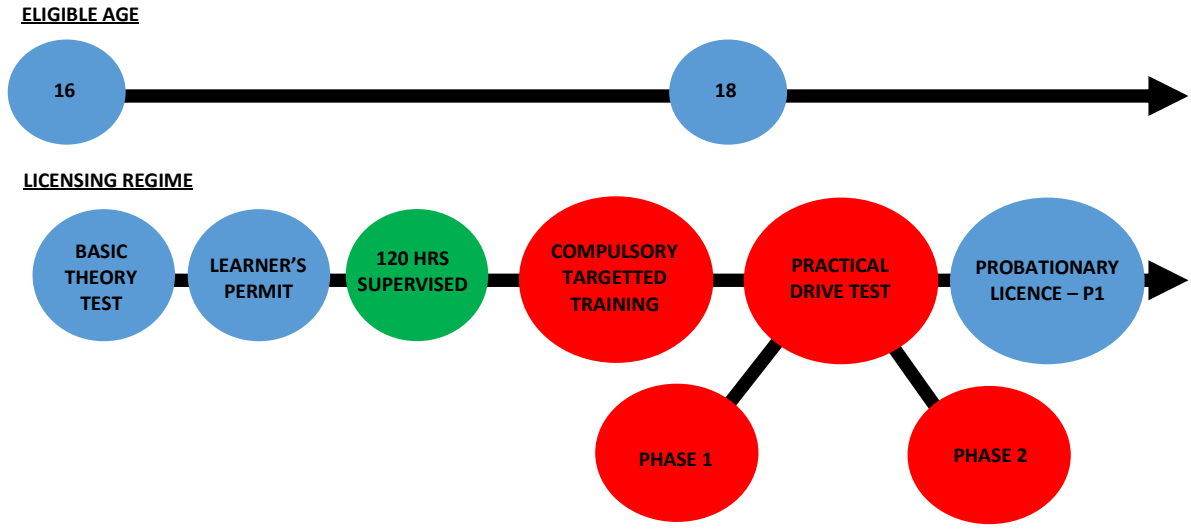
Developmental Requirement	Infrastructure Required	Targeted Manoeuvres
High Speed – 100 km/hr	• Multiple Lanes • Straight long enough to drive and sustain 100 km/hr for a short period of time. • Replica on/off ramps.	• Applicants will need to enter an on ramp and merge onto 100 km/hr traffic safely. • Change lanes at 100 km/hr with surrounding vehicles. • Exit a freeway safely.
Vehicle Braking Capacity	• Short section of track	• Apply full braking at specific points to develop an understanding of how long it takes a vehicle to stop.
Vehicle Dynamics	• Sharp curves • Long curves	• Enter curves at different speeds to understand the limitations of normal vehicles and tyres.
Adverse Weather/Road Conditions	• Slippery track • Icy track	• Apply full braking at specific points (identical to the dry tack) to develop an understanding of how long it takes a vehicle to stop on difference road conditions – consolidating the concept of leaving more room in front if it does that longer to stop.

Developmental Requirement	Infrastructure Required	Targeted Manoeuvres
		• Avoid objects that pop up in front of the vehicle to understand how sudden movements impact the vehicle dynamics.
Night Time Driving (Official oversight)	• Night time driving simulator	• To simulate driving at night and to ensure that probably situations are dealt with correctly such as identifying vehicles with no headlights. • Understanding the meaning of different coloured road reflectors.
Peak Periods	• Multiple lanes • Multiple testing vehicles	• To simulate the peak environments during the morning and afternoon peak periods. • Applicant will drive with surrounding vehicles and perform driving exercises such as lane changes. • Traffic will also be at mixed speed during freeway simulations.
Defensive Driving	• Multiple lanes	• Avoid objects that pop up in front of the vehicle to understand how sudden movements impact the vehicle dynamics. • Understand the strongest part of the vehicle to 'take a hit' if unavoidable.

5.2 Possible amended licensing regime

With the incorporation of targeted training, the current licensing regime will need to be varied. It is suggested based on international studies that the development facility should be used as a mandatory targeted training session as oppose to testing specific manoeuvres as part of the practical test. A possible revised licensing regime can be seen below in Figure 4 that incorporates the targeted training at the development facility.

Figure 4: Revised licensing regime



Notes: Blue denotes a stage, Green denotes a compulsory component however it is not officially overseen (anyone with a full licence can supervise), red denotes an officially overseen component.

Further examining the above regime, it can be noted that the compulsory training session at the development facility will be required after the current mandatory 120 supervised hours

and will replace the current hazard perception test. The hazard perception test essentially acts as an electronic and relatively basic form of actual practical development and therefore this concept of real driver development should supersede it. This will provide consolidation to the applicants 120 hours of learning experience in addition to the further understanding the development facility is designed to provide in relation to the concept of safe driving.

6. Economic discussion

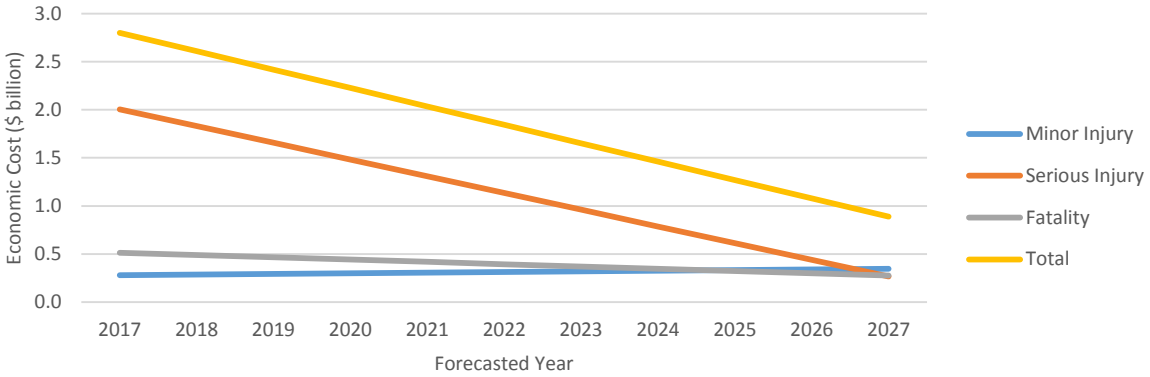
6.1 Cost of crashes

The cost of injuries from crashes is quite a burden due to the number of cost components associated with them and this can vary depending on how serious in nature the crash is. Cost values derived from the Transport and Infrastructure Council (2016) for the year 2013 separate the costs into three groups that are human, vehicle and general costs. A fatal, seriously injured and other injury cost equates to approximately $2.3 million, $0.5 million and $0.02 million respectively per person.

Using the inflation calculator available to the public from the Reserve Bank of Australia (RBA 2017), an initial 2015 cost could be estimated from the 2013 values. Then by using the injury trends discussed earlier in the paper, a ten-year cost forecast could be approximated. Cost values predicted (without inflation) to the year 2027 based on current fatality and injury rates can be seen below in

Figure 5.

Figure 5: Forecasted economic cost of crashes



From this forecast, it can be noted that due to the reduction of serious injuries, the total overall cost is reducing. However, based on the current trend, it is still costing Victoria approximately $900,000,000 in 2027 to deal with the consequences of crashes. It is therefore clear that reducing these costs even quicker will save the state a lot of funds which could be used to build a better future for Victoria, instead of tending to crash injuries and fatalities that keep occurring the same way.

6.2 Cost to build

The cost to build a development facility can be likened to the potential cost of the Mildura Motorsport and Community Precinct. A business case conducted by AECOM (2017) estimates the capital expenditure of this precinct to be approximately $50 million and includes features such as a three kilometre long bitumen racing circuit, pits area (800m^2), hard stand (350m^2), control tower, skid pan, basic office and facilities for administrative duties and a maintenance/wash down shed.

The driving development facility proposed to host the targeted training proposed by this paper will not need the full requirements of a racing circuit such as grand stands and control towers and can therefore suggest that the capital expenditure required will be less than that of $50 million.

In order to provide an advice on the financial and economic viability of a development track, additional factors must be considered such as the required number of facilities, the location, operating requirements, revenue models and potential expenses. These factors are not covered in this paper.

7. Conclusion

Learning and development pathways towards obtaining a driving licence in Victoria have not been improved since the introduction of the GLS. Statistics between 2006-2015 reveal that the number of crashes is increasing however the fatality rate is overall reducing with an increase between 2013-2015. In 2016 alone, 19% of drivers who lost their lives were aged between 18 and 25 years, with this age group only representing around 10% of Victorian licence holders. A key factor that could start reducing the number of crashes and further reduce the fatality rate with the aim of achieving “zero”, is the possibility to provide additional official practical oversight on critical aspects of safe driving to all new people looking to obtain their licence.

Our hypothesis is that inadequate ‘risk training component’, in the existing Victorian Licensing system may be one of the confounding factors that may have resulted significant number of crashes and fatalities, especially among young drivers. As such having adequate ‘risk training’ component, as in the Licensing Systems in Sweden and Finland in existing Victorian Licensing System, may have the potential to reduce crashes and fatalities among young drivers in Victoria. To have preliminary insights on this hypothesis, this study initially identified particular development gaps using crash data available from VicRoads where it was found that 100 km/hr driving, nose to tail crashes, head on crashes and peak environment crashes were all occurring however none of these factors are practically taught to reduce the chance of occurring. The licensing regimes of Sweden and Finland were then scrutinized and found that their regimes included such development and both their crash and fatalities rates have been decreasing since 2006 with Sweden now having one of the lowest in the world. Evidences from literature and Sweden’s experience suggest that the licence reform may be beneficial for the safety of young drivers.

To replicate the reducing crash trends of Sweden and Finland and to further decrease the fatality rate, this paper proposes to build a development facility which aims to provide official practical oversight on the development aspects identified as missing from the current Victorian regime. The potential benefits of this proposal are the cost savings associated from the reduction of injuries and fatalities from the possible reduction in crashes.

Future studies that can be done to further refine this concept are additional licensing regime comparisons with countries that have higher fatality rates then Australia within the OECD. This will provide a greater spectrum of research in relation to licensing regimes around the world and whether there are common aspects that occur with lower fatality rate countries when compared with higher fatality rate countries (when compared to Australia). In addition, a rigorous analysis of the crash statistics of newly licensed drivers and crash statistics by driver age should be compared across the selected jurisdictions to identify if there is any difference in crash outcomes.

Further, the exploratory insights provided by this paper could assist the licensing authority and the state government in further developing the Victorian licensing regime to possibly a learning pathway towards zero fatalities.

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