TRUCK WISE

VIRTUAL REALITY INTERACTION

Truck Wise Stage 2

Final Report

Road Safety is a shared responsibility

Executive Summary

The Truck Wise Pilot involved the development of virtual-reality (VR) experiences for young people to facilitate safer interaction with heavy and light vehicles in a regional/rural setting and focused on delivering the experiences to Bendigo region.

The Truck Wise Stage 2 project focused on enhancing the impact and reach of the program by increasing the range of scenarios where the user can 'virtually' experience heavy-light vehicle interactions from both light and heavy vehicle perspectives. The project expanded its focus to encompass the metropolitan context and other heavy vehicle-related safety issues (e.g. blind spots, and overtaking trucks with heavy loads). It also broadened the experiences ensuring relevance of the scenarios to other jurisdictions in Australia (i.e. scenarios are applicable to other states). The newly developed VR experiences (Season 3 and 4) focus on heavy vehicle topics around challenges associated with overtaking and blind spots, this also include reference to vulnerable road users.

The project engaged with prospective educational partners to explore integration of the experiences into existing educational programmes and initiatives. While strong interest was shown from educational providers challenges associated with resources to integrate the program were identified. As a result, the project team have made the Truck Wise VR experiences (Seasons 1-4) publicly available via an online repository which can be used in combination with resources from the Truck Wise website (The Hub) and educational resource package for those interested. Truck Wise Stage 2 project also increased awareness about the project and its resources by attending several community engagement and public events including Deakin Open Day, Australian International Airshow, Bound Tomorrow Careers Expo and Laval Virtual International Conference.

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Introduction

Project Overview

Truck Wise Stage 2 focused on the development of an extended suite of virtual reality (VR) experiences aimed at providing increased awareness around light and heavy vehicle interactions for younger drivers. These experiences build on those that were developed as part of an initial Truck Wise pilot project (Stage 1).

The extended VR experiences developed as part of Stage 2 educate younger drivers on heavy vehicle blind spots and the challenges faced when overtaking heavy vehicles. These experiences take place in both metropolitan and regional environments to ensure that they are widely applicable to all younger drivers across Australia.

Several educational providers were engaged as part of the project (e.g. Fit to Drive and Melbourne Museum) who showed interest in using the Truck Wise VR experiences and accompany resources as part of existing education projects. Truck Wise VR experience is now freely available online with accompany website (The Hub) and educational resources.

The Truck Wise project —

- Is an alternative to commonly metro-centric road safety initiatives
- Employs the latest in immersive technology
- Involves Deakin University's CADET VR Lab, a high-profile research and development group
- Applies the latest in behavioural science and research, as guided by the TAC and education experts

Truck Wise Objectives

Truck Wise Stage 2 project continued to focus on objectives aimed at addressing the lack of practical and effective information available to younger light vehicle drivers that better prepares them for safe interactions with heavy vehicles on our roads and help to reduce the likelihood of collisions between them.

1. ENHANCE

Enhance awareness of the physical constraints and challenges heavy vehicle drivers face

2. IMPROVE

Improve understanding of safe behaviour when interacting with heavy vehicles

3. FOSTER

Foster empathy for heavy vehicle drivers and the challenges they face

4. RAISE

Raise the freight and logistics industry profile

Truck Wise Pilot (Stage 1)

In late 2017, the City of Greater Bendigo completed the *Bendigo Freight Study: How goods are moved around Greater Bendigo* in order to better understand freight issues and increase robustness, productivity, and responsiveness to innovation and change. The study also aimed to provide guidance on improving sustainability of the sector and achieving a safer, cleaner and more efficient city. Road safety was identified as an important issue with freight operators involved in the study highlighting the need for urgent attention. Freight operators felt that other road users appeared to not adequately understand the road rules applicable to their interaction with heavy vehicles and were concerned that safety related challenges such as the ability for a truck to stop quickly or the extent of blind spots were not appreciated.

Figure 1. Material Testing Workshop as part of Truck Wise pilot

Discussions with accredited driving instructors, the Australian Trucking Association (ATA), and the Transport Accident Commission (TAC) confirmed these concerns. There is limited educational material and practical instruction on how to improve driving skills, develop good habits and improve driver awareness around heavy vehicles. While government agencies and industry bodies across Australia have established road safety regulations and programs designed for heavy vehicle drivers, there has been far less effort on light vehicle drivers and their interactions with heavy vehicles.

In response to this report the City of Greater Bendigo proposed a pilot project to the National Heavy Vehicle Regulator (NHVR) that used VR technology to engage younger drivers and increase their awareness around safe interactions between light and heavy vehicles. Funding for the pilot project (Stage 1) was awarded under Round 3 of the Heavy Vehicle Safety Initiative (HVSI). The City of Greater Bendigo collaborated with Deakin University to develop the initial Truck Wise VR experiences that focused on heavy vehicle braking distances and the need to multiple lanes when turning. As part of the initial pilot project Bendigo students evaluated the experiences with results showing strong levels of engagement and increased awareness around safe interactions between light and heavy vehicles.

Truck Wise Stage 2

Truck Wise Stage 2 built upon the success of the initial Truck Wise pilot project. This was achieved by enhancing the impact and reach of the Truck Wise VR experience through the inclusion of two additional scenarios. The opportunity for VR to enable young drivers to 'virtually' experience the same scenario from both the heavy and light vehicle perspectives, something not possible in real-life, was retained. In order to ensure that the scenarios covered in the experiences well represent high-priority heavy vehicle safety challenges workshops were held with key stakeholders to determine the most appropriate scenarios. Recall that Truck Wise, the pilot, focused on challenges associated with heavy vehicle braking distance and the need for trucks to often use multiple lanes when turning. The selected safety scenarios for Truck Wise are explained in the below sections.

Figure 2. VR environment from Truck Wise Stage 2

Project Contributors

The Truck Wise Stage 1 pilot project involved a range of stakeholders and project contributors spanning three levels of government, secondary and tertiary education providers and the freight and logistics sector. Truck Wise stage 2 continued to involve a range of stakeholders to support the extension of the suite of VR experiences. Truck Wise Stage 2 contributors included —

TAC Transport Accident Commission	TAC provided guidance and support in evidence-based expertise for road safety education that assisted in the design of new Truck Wise VR experiences. TAC also assisted in promoting the project by linking the team to potential education partners.
DEAKIN UNIVERSITY / CADET Virtual Reality Training and Simulation Research Lab	Deakin University's CADET VR Lab, experts in virtual reality training as Lead Contractor, designed and developed the virtual reality experiences.
LINFOX	Linfox provided subject matter expertise that assisted in the design of new Truck Wise virtual reality experiences by providing their vast expertise in logistics and heavy vehicles.
NHVR	The National Heavy Vehicle Regulator (NHVR) provided project funding via Round 6 of the Heavy Vehicle Safety Initiative (HVSI).
VICTORIA State Government Department of Transport	Victoria Department of Transport (DoT) provide guidance and support that assisted in the design of new Truck Wise VR experiences.
SWINBURNE UNIVERSITY OF TECHNOLOGY	Swinburne University of Technology contributed their expertise in virtual reality experiences to the design of the different scenarios.
LA TROBE UNIVERSITY	La Trobe University contributed their expertise in human factors in virtual reality to the design of the different scenarios.
Powers country express BENDIGO	Powers Country Express provided subject matter expertise that assisted in the design of new Truck Wise VR experiences by providing their real-life expertise. Powers Country Express also assisted in promoting the project to high school students.
AGRI-TRANS	Agri-Trans provided subject matter expertise that assisted in the design of new Truck Wise virtual reality experiences by providing their real-life expertise.

Project Outline

Project Scope

The Truck Wise Pilot project involved the development of virtual-reality experiences for young people to facilitate safer interaction with heavy and light vehicles in regional and rural settings.

Truck Wise Stage 2 enhanced the impact and reach of the program by increasing the range of scenarios where young drivers can 'virtually' experience the interactions between light and heavy vehicles from both perspectives. The project expands the focus of these experiences by encompassing the metropolitan context and includes new virtual reality experiences focused on the challenges that heavy vehicle drivers faced related to blind spots and overtaking heavy vehicles. The project promoted an uptake of the experiences by widening the applicability of the scenarios that would be suitable at a national level. The project also engaged with educational partners to explore integration the Truck Wise virtual reality experiences into existing educational programmes and initiatives.

Project Milestones

Table 1 provides an overview of project milestones and delivery dates. The project delivery schedule was extended based on discussions with educational providers about the integration of Truck Wise VR experiences into existing programs taking longer than expected. While educational providers showed solid interest in the Truck Wise VR experiences feedback highlighted the lack of existing resourcing to integrate the content into their existing programs in the short term. As an alternative, the project team have provided these virtual reality experiences on a public repository online so they can be accessed by anyone to be utilised as required.

Table 1. Project milestones and completion dates (original dates prior to adjustment provided in italics).

ITEM	MILESTONE	COMPLETION DATE
Milestone 1	Execute Agreement	29th November 2021
Milestone 2	Phase 1 — Activity 1 *Planning of Virtual Reality Experiences*	31st May 2022
Milestone 3	Phase 1 — Activity 2 *Development of Virtual Reality Experiences*	31st December 2022
Milestone 4	Phase 2 — Activity 1 *Identification and Engagement with Educational Partners*	31st December 2023 *(30th June 2023)*
Milestone 5	Phase 2 — Activity 2 *Delivery and Integration of Virtual Reality Experiences*	17th April 2024 *(31st January 2024)*
Final Report	Delivery of Final Report	22nd July 2024 *(28th February 2024)*

Phase 1 — Planning and Development

This phase extended the existing Truck Wise VR experiences realised during the pilot project by increasing the diversity of the scenarios within the suite of virtual reality experiences aimed at foster empathy and awareness around safe interactions between light and heavy vehicles. This also included a focus on ensuring applicability of the scenarios to other jurisdictions in Australia (i.e. other states and territories) which also saw the inclusion of an experience that covered a metropolitan context. This was achieved by undertaking the two activities as outlined in this section.

ACTIVITY 1 – PLANNING OF VIRTUAL REALITY EXPERIENCES

As part of the planning process for developing the extended suite of Truck Wise VR experiences the following tasks were undertaken —

- Workshops were held with project stakeholders including the TAC, Victorian Department of Transport, RACV, Swinburne and La Trobe Universities, Linfox, Power's Country Express and Agri-Trans to define scenarios for the expanded VR experiences. The outcome of these workshops resulted in heavy vehicle blind spots and overtaking heavy vehicles being the focus of the two new VR experiences.
- Detailed design of two VR scenarios aimed at increasing awareness around heavy vehicle blind spots and overtaking heavy vehicles. The design process took into account both immersive headset based virtual reality and 360-degree video versions of the experiences. This included details of how the virtual reality experiences would be visually designed, the types of user interactions required, and other considerations needed to be specified before the development of the experiences could began. The designs were structured as two additional 'seasons' to the Truck Wise series. The first of these was scenario where a light vehicle is attempting to overtake a long heavy vehicle at the base of a hill. The second season related to a scenario where a heavy vehicle is challenged with vulnerable road users (i.e. cyclists) situated within the heavy vehicle's blind spots. In maintaining consistency with the early Truck Wise virtual reality experiences, each season included four episodes comprised of an induction, the scenario from the light vehicle perspective, the scenario from the heavy vehicle perspective, and then the debrief of the scenario with key safety messages.

ACTIVITY 2 – DEVELOPMENT OF VIRTUAL REALITY EXPERIENCES

The collection of digital assets and resources required for development of the expanded virtual reality experiences was undertaken. These digital assets included the acquisition of relevant models and other elements needed to develop the virtual reality experiences (e.g. vehicles, environments and avatars), audio

for the experiences (e.g. vehicle sounds, spoken voices, and other sound effects), motion libraries for avatars within the scenes, and logos and branding files.

Development of the VR experience then involved building two separate types of VR applications, the first being a fully immersive and interactive VR experience to be deployed on Oculus VR headsets with accompanying laptop and the second a series of 360-degree videos that can be accessed online and without the need of an Oculus VR headset. The 360-degree video experiences complement the fully immersive headset-based virtual reality experiences and are accessible to the public via the Truck Wise website (The Hub).

Figure 3. Images of virtual environments under development in Unity3D.

Phase 2 — Engagement and Delivery

The second phase focused on establishing partnerships with educational partners with the aim of utilising the Truck Wise VR experiences in existing programmes and initiatives. This project phase included two activities as outlined in this section.

ACTIVITY 1 — IDENTIFICATION AND ENGAGEMENT WITH EDUCATION PARTNERS

This project activity involved the project team and stakeholders strategically identifying and engaging with possible education partners that could benefit from utilising the Truck Wise VR experiences in their ongoing activities. A list of educational partners contacted about the opportunity to utilise the Truck Wise VR experiences is provided in Table 2 later in the document. While there was a strong amount of interest in the Truck Wise VR experiences by educational partners there were also challenges identified including resourcing challenges in utilising the experiences. As an alternative the project team made the resources publicly available allowing educational providers and other interested parties the ability to access to the Truck Wise virtual reality experiences free of charge.

ACTIVITY 2 — DELIVERY AND INTEGRATION OF VR EXPERIENCES

This project activity focused on providing identified education partners with access to the developed suite of virtual reality experiences (and accompanying resources) so that they can be utilised by existing initiatives and programs. Given that suitable educational partners could not be brought on board, in consultation with the HVSI team, the virtual reality experiences were made available to download from an online repository. These can be accompanied with the Truck Wise education content available via the Truck Wise website (The Hub). The 360-degree video versions of the Truck Wise virtual reality experiences are published on YouTube and are available on the Truck Wise website, this offers an opportunity to those educational providers who lack access to the required virtual reality hardware to still utilise a non-interactive virtual reality version of the experience. Deakin and the project team has continued to maintain the Truck Wise webpage/hub.

Deliverables and Outcomes

Stakeholder Engagement

The Truck Wise Pilot resulted in the development of two seasons of Truck Wise virtual reality experiences focussing on safe stopping distance and turning left from the right lane. These virtual reality experiences were developed in two formats – one being interactive virtual reality within an Oculus VR headset, and the other 360-degree video-based virtual reality. Truck Wise Phase 2 focused on expanding the suite of virtual reality experiences to include two new seasons. As part of the design phase for extending the virtual reality experience two workshops were conducted with a series of project stakeholders to help guide the virtual reality development.

PROJECT STAKEHOLDER PLANNING AND DESIGN WORKSHOPS

WORKSHOP 1 – RECAP ON TRUCK WISE STAGE 1 AND MAPPING OUT SCENARIO TOPICS

The project team ran Workshop 1 on March 18th, 2022, and included stakeholders from TAC, Victorian Department of Transport, Linfox, Swinburne University, La Trobe University, Power's Country Express and Agri-Trans. Stakeholders were provided with an overview of the Truck Wise Stage 2 project including objectives, timeframes and activities.

The focus of the workshop was to first provide a recap on the initial Truck Wise virtual reality experiences developed as part of the pilot project. Those initial experiences provided awareness around heavy vehicle braking distance and the need for heavy vehicles to use multiple lanes when turning. Discussion provided an overview on how Truck Wise focuses on fostering empathy allowing younger drivers to experience interactions between light and heavy vehicles from both driver perspectives using the virtual reality experiences. This also included an overview of the virtual reality technology used to deploy the virtual reality experiences both as immersive experiences on virtual reality headsets and as 360-degree videos.

The second part of the workshop then took advantage of the stakeholder group's significant combined expertise in heavy vehicles, transport, and education to brainstorm new heavy vehicle safety challenges, and related scenarios, that could leverage virtual reality to support increased awareness for younger drivers. The group considered valuable information relating to different possible safety challenges that heavy vehicle drivers face such as environmental conditions, vehicle constraints (e.g. length and mass), weather and load types. The group also provided ideas on how to expand Truck Wise to ensure national applicability with discussion covering topics such as different state laws and driving environments. Notes from the first workshop are shown in Figure 4 below.

Scenarios

Figure 4. Brainstorming notes taken during Workshop 1 held on March 18th, 2022.

Outcome 1

Truck Wise Stage 2 project objectives were provided to stake holders as well as project timelines and expected outcomes. The group were also provided with a recap on the Truck Wise pilot project (Stage 1) and how the resulting virtual reality experiences aim at fostering empathy and increase awareness around safe interactions between light and heavy vehicles for young drivers.

Outcome 2

The group identified heavy vehicle blind spots as a topic that that could benefit from greater awareness amongst younger drivers. Discussion included location of blind spots, the impact of weather on blinds spots, and how other vehicles on the road can avoiding sitting within a heavy vehicle's blind spot. The group provided several suggestions on how blinds spots could be conveyed using virtual reality such as using visual overlays alongside a virtual truck that shows the size and scale of the blind spots.

Outcome 3

The group identified heavy vehicle loads as a topic that could benefit from greater awareness amongst younger drivers. Discussion included heavy vehicle factors such as the length and overall mass of the vehicle as well as the type of load it carries. Types of lines included oversize (e.g. mining), static and dynamic loads (e.g. fuel and livestock). A particular focus on overtaking trucks was ultimately selected.

WORKSHOP 2 – BRAINSTORMING SCENARIO SPECIFICS AND OPPORTUNITIES FOR HIGH IMPACT ENGAGEMENT

Workshop 2 was held by Deakin University on April 6th, 2022, and included stakeholders from TAC, Victorian Department of Transport, Linfox, Swinburne University, Power's Country Express and Agri-Trans. The stakeholders were provided with an overview of the outcomes from the first workshop including the significant attention given to heavy vehicle blind spots and overtaking heavy vehicles as important scenarios that could benefit from greater awareness. The group was also provided with an overview of how previous Truck Wise virtual realityVR experiences were structured with each scenario being represented as a season and each season having four episodes. The group were informed that the four episodes included a heavy vehicle induction and safety check, light vehicle perspective, heavy vehicle perspective and debrief.

The workshop then focused on a brain-storming session to further developed the specifics required to develop Truck Wise virtual reality scenarios that best presented the heavy vehicle challenges associated with blind spots and overtaking heavy vehicles. The group provided valuable information on specifics related to both topics as well as ideas on how they could be implemented using virtual reality.

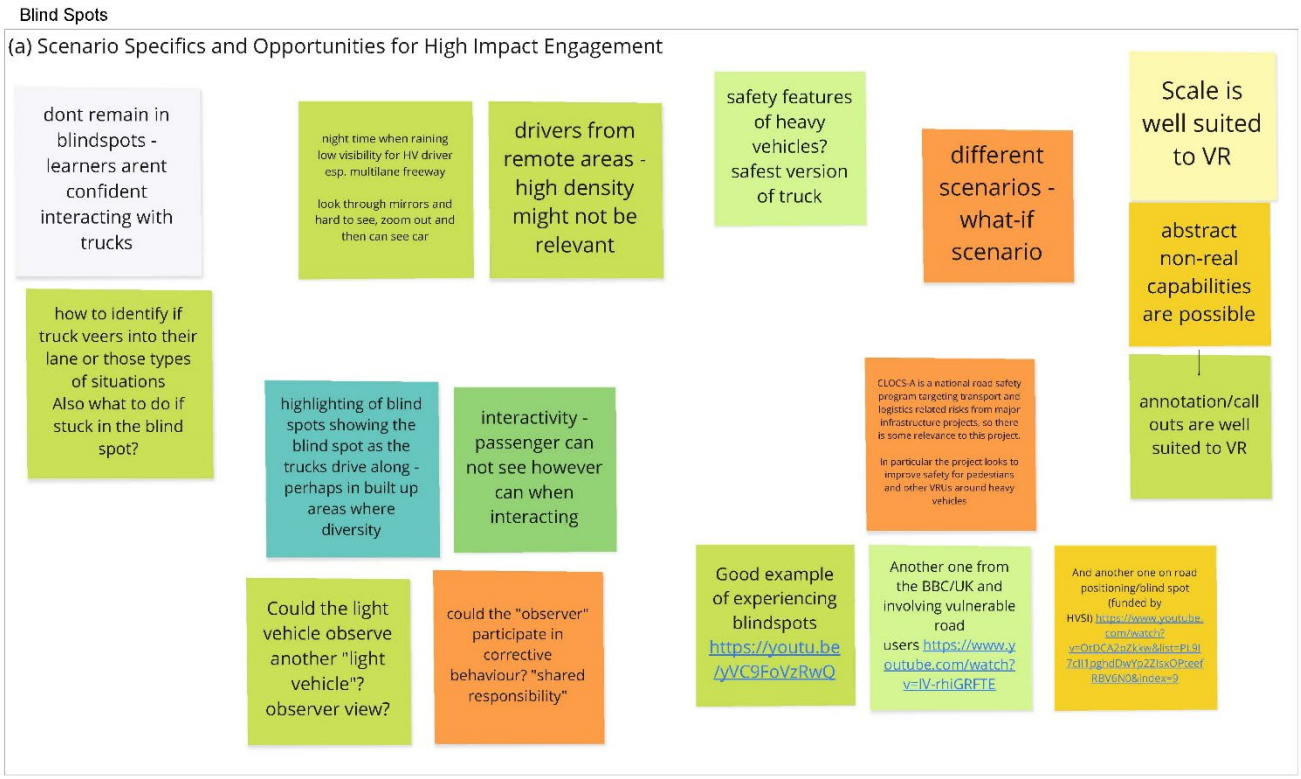

Figure 5. Brainstorming notes on heavy vehicle blind spots taken during Workshop 2 held on April 6th, 2022.

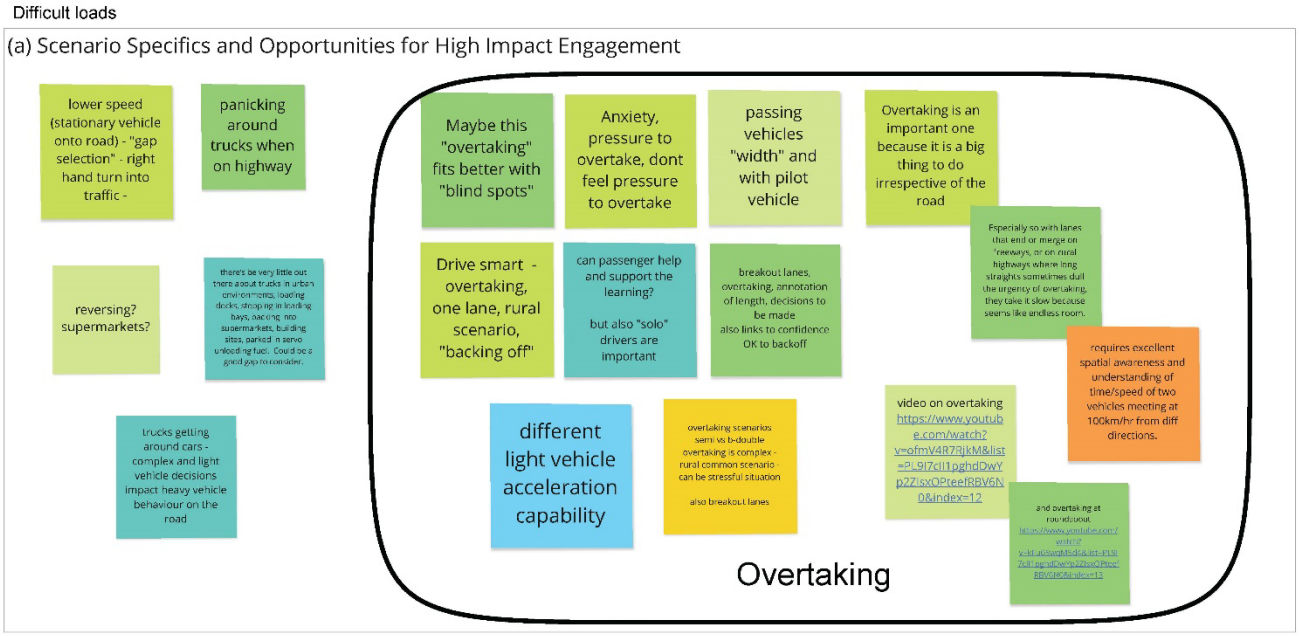

Figure 6. Brainstorming notes on difficult loads with a focus on overtaking taken during Workshop 2 held on April 6th, 2022.

Outcome 1

Truck Wise stake holders were informed about the outcomes from the first workshop including the decision to focus on the topics of heavy vehicle blind spots and overtaking for the Truck Wise Stage 2 project. The group were also informed on how Truck Wise virtual reality experiences would be developed with each topic representing a season that included four episodes that covered a heavy vehicle induction, light vehicle perspective, heavy vehicle perspective and debrief.

Outcome 2

The group provided a range of different specifics and opportunities for high impact engagement with wealth of ideas on how the challenges related to heavy vehicle blind spots could be best portrayed in virtual reality. These included visual annotations that represented blind spots around a heavy vehicle, the use of virtual mirrors to communicate the challenges related to blind spots and how a light vehicle perspective may be used to inform younger how they can avoid these blind spots.

Outcome 3

The group also identified a range of different specifics related to heavy vehicle loads and how they could be presented using virtual reality. The challenge of overtaking heavy vehicles was highlighted as an important topic for younger drivers that could benefit from increased awareness. Discussion included factors such as overtaking longer vehicles, overtaking conditions (e.g. on hills or merged lanes) and the need for light vehicle drivers to be confident to abandon an overtake if it is deemed unsafe.

COMMUNITY ENGAGEMENT AND PUBLIC EVENTS

The Truck Wise virtual reality experiences were showcased at several community and public events providing exposure to the project promoting the value of the experiences as an educational tool for younger drivers. Feedback from the events saw strong engagement with the experiences and excitement from attendees around the opportunity for their experiences to be part of future educational curriculum. The following provides a list of events that the project team participated in —

- 2022/2023 Deakin Open Day
- 2023 Laval Virtual Conference
- 2023 Bound Tomorrow Expo
- 2023 Australia International Airshow

Figure 7. Truck Wise Virtual Reality Experiences at the Tomorrow Bound event.

Figure 8. Truck Wise Virtual Reality Experiences at the Laval Virtual Conference.

Figure 9. The Truck Wise Virtual Reality Experiences at Deakin Open Day

Figure 10. Senator Sarah Henderson using Truck Wise virtual reality experiences at the 2023 Avalon Australian Internation Airshow.

Social media was also used to communicate how the Truck Wise project aims to improve the awareness young drivers have around safe interactions between light and heavy vehicles through a unique set of virtual reality experiences.

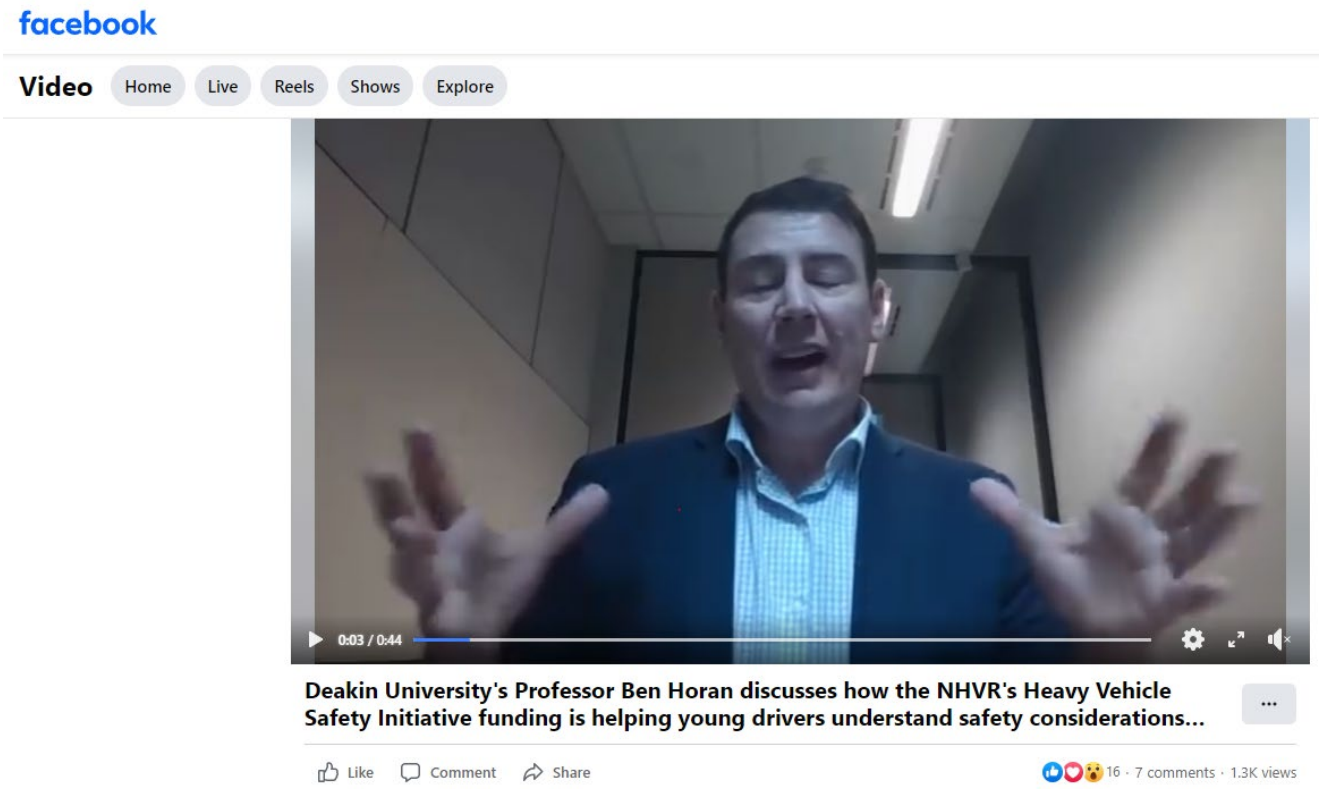

Figure 11. Facebook video featuring Dr. Ben Horan from Deakin University discussing the Truck Wise Project.
https://www.facebook.com/nhvrofficial/videos/deakin-universitys-professor-ben-horan-discusses-how-the-nhvrs-heavy-vehicle-saf/714359977333031

EDUCATIONAL PROVIDER ENGAGEMENT AND PROGRAM INTEGRATION

A list of educational partners contacted about the opportunity to utilise the Truck Wise virtual reality experiences is provided in Table 2. While educational partners showed strong interest in utilising the Truck Wise virtual reality experiences a common challenge was the lack of immediate resources to support new educational content into existing programs within the project's timeline. As such the project team decided to make the resources publicly available (Figure 12) allowing education providers or other interested parties access to the Truck Wise virtual reality experience free of charge.

Table 2. List of education partners approached about the utilisation of Truck Wise virtual reality experiences into existing programs.

Organisation/Entity		
TranSafe WA, Western Australia	Fit to Drive, Victoria	Swinburne University's Factory of the Future, Swinburne University, Victoria
Transport Accident Commission (TAC), Victoria	Marist College, Bendigo, Victoria	"Tomorrow Bound" expo, Bendigo, Victoria
Department of Transport (DoT), Victoria	iMove, Hawthorn, Victoria	Royal Automotive Club, Western Australia
Melbourne Museum, Melbourne, Victoria	National Wool Museum, Geelong, Victoria	

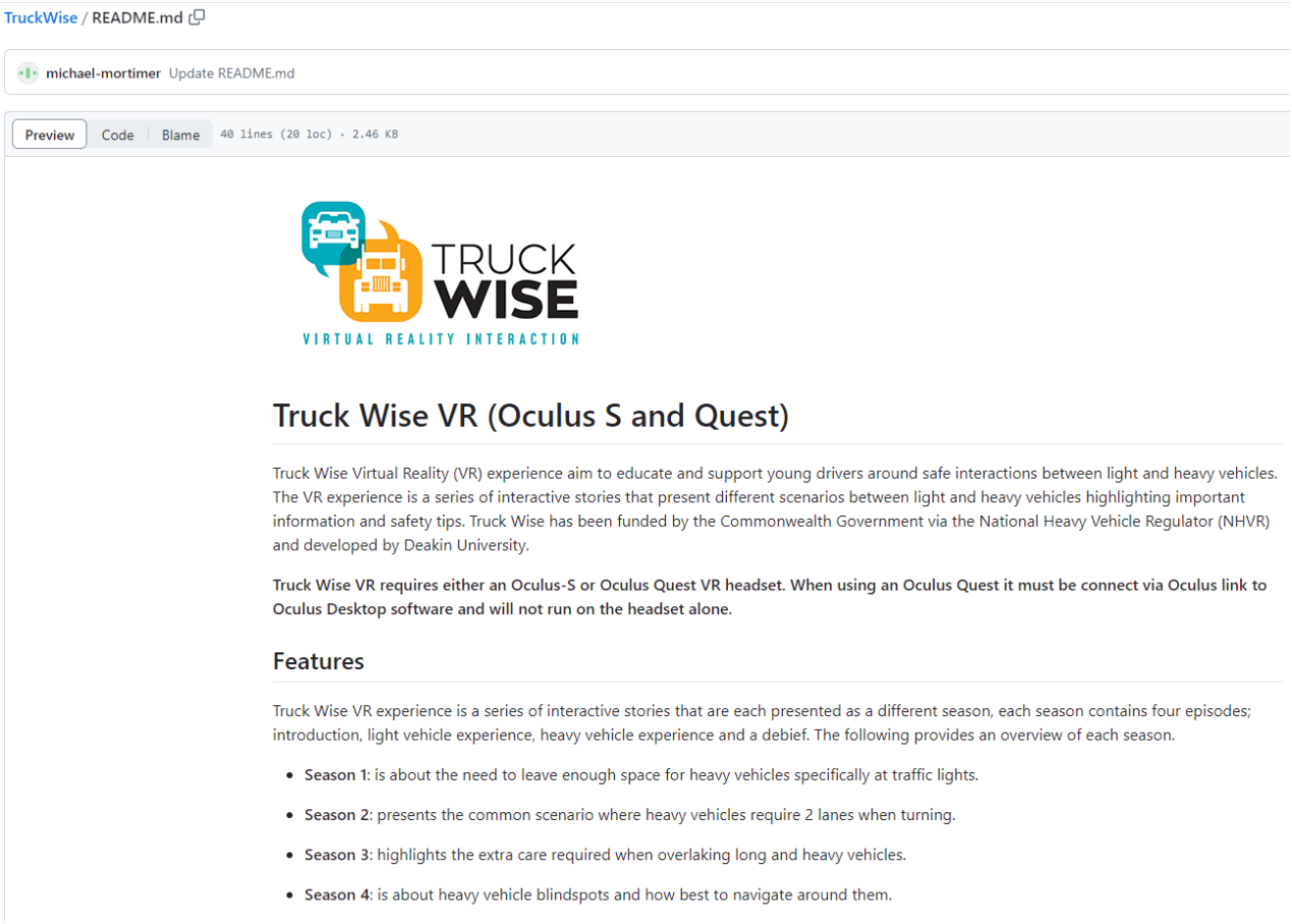

Figure 12. Truck Wise virtual reality experiences are freely available via public repository (link)

Virtual Reality Experiences

The Truck Wise Virtual Reality experiences have been extended to include four seasons each representing a different scenario with two new seasons (Season 3 and Season 4) being added in Stage 2 of the project. The two new scenarios focus on improving awareness around safe interactions between light and heavy vehicles with heavy vehicle blind spots (Season 3) and overtaking (Season 4). The new Truck Wise virtual reality experiences continue to provide —

- A focus on empathy as opposed to a shock.
- A focus on awareness as opposed to driver training.
- An interactive desktop Virtual Reality experience accessible via compatible Oculus Virtual Reality headsets that provides a suite of fully immersive and interactive experiences.
- A suite of 360-degree videos for each season with the ability to be deployed to anybody, anywhere, through a standard internet web browser.

Truck Wise virtual reality experiences continue to use the innovative method that fully leverages the capabilities of virtual reality to provide young drivers with experiences that would not be possible in the real world. The method involves experiencing the same on-road interaction from both light and heavy vehicle perspectives. This approach allows users to experience each scenario as a passenger of both a light vehicle (sedan) and heavy vehicle (truck) as difference episodes within the seasons. This approach aims to build empathy between both drivers of each vehicle to improve overall understanding of each scenario. The virtual reality experiences were also strategically designed to cover both a highway and urban driving environment.

HEAVY VEHICLE AMBASSADORS AND VIRTUAL AVATARS

The Truck Wise Stage 2 project stakeholders Marla Stone and Damien Power, who were ambassadors for the pilot project continued their ambassador role. Both Marla and Damien provided continued to provide their expertise and real-world experience about heavy vehicles that contributed to design of the virtual reality experiences in a way that builds empathy for both heavy and light vehicle drivers. They also feature as virtual reality avatars continuing their role as key characters in each of the seasons.

- Marla Stone and Damien Power are two “real life” Truck Wise ambassadors from the trucking industry.
- Damien and Marla are avatars that were scanned by Mark Ruff, a well-known 3D scanning expert in the film and TV industry, and then turned into virtual reality avatars by the Deakin team.
- The avatar ambassadors accompany the user throughout the virtual reality experiences and aid in fostering empathy towards heavy vehicle drivers.

- The avatars employ advanced artificial intelligence technology to talk to the users with realistic facial motions along with Damien and Marla's real voices.

Figure 1313. Damien Power (left) and Marla Stone (right) as virtual avatars who appear as main characters in the Truck Wise VR experiences.

VIRTUAL REALITY LEARNING OUTCOMES

The virtual reality experiences take place over four seasons (scenarios) each with four episodes. Season 1 focuses on safe braking distances, Season 2 on needing two lanes to make a tight turn, Season 3 on overtaking and Season 4 on blind spots.

Truck Wise Stage 2 project designed and developed Season 3 and 4 virtual reality experiences that aligned with the approach taken for Season 1 and 2 in the pilot project. The first episode of each Truck Wise season introduces the user to the scenario and the truck drivers. The two seasons have a different truck driver, i.e. Damien and Marla. After the introduction there are two episodes which take the user through the particular scenario (safe braking distance or tight turns) from two distinct perspectives. In the fourth and final episode of each Truck Wise season the truck driver (virtual ambassador) de-briefs the user on the learnings from the experience, each season runs for approximately 5 minutes.

S1

SEASON 1 — WE NEED OUR SPACE

Tackles the common challenge of leaving a safe braking distance for heavy vehicles.

S2

SEASON 2 — WHY TWO LANES?

Tackles the common challenge of tight turns in a truck and the need to sometimes use two lanes.

S3 **SEASON 3 — ALLOW MORE TIME TO OVERTAKE**
Tackles the common challenge of overtaking long heavy vehicles.

S4 **SEASON 2 — WHAT IS HIDING IN THE BLIND SPOTS?**
Tackles the common and unique challenges associated with heavy vehicle blind spots.

Figure 1414.Overview of Seasons 1 and 2 Truck Wise virtual reality experiences developed as part of the pilot project.

Figure 15 provides a visual overview of each Truck Wise season with each image in the row representing a different episode for that particular season. The columns represent the same episode number in each season. For example, the first column represents episode 1 for seasons 1-4. This shows how each season is structured with a heavy vehicle induction and safety check, vehicle perspectives and a debrief session.

Season 1 — We need our space

Season 2 — Why two lanes?

Season 3 — Allow More Time to Overtake

Season 4 — What is Hiding in the Blind Spots

(a) (b) (c) (d)

Figure 1515. The four seasons of the Truck Wise virtual reality experiences (a) heavy vehicle induction, (b) initial vehicle perspective (light or heavy vehicle), (c) opposing vehicle perspective (d) debrief reiterating the key safety messages

Truck Wise Season 1 — *We Need Our Space*

Season 1 comprises four episodes that tackle the challenges heavy vehicle drivers face in maintaining a safe braking distance. Season 1 occurs on a country highway.

- Episode 1 — Introduction at the truck depot with truck driver Marla Stone to conduct vehicle safety check. Safety check includes checking the coupling pin, rear trailer doors are closed, and wheel nuts are tightened.
- Episode 2 — Light vehicle perspective where the user is a passenger of a light vehicle whose driver of changes lanes just prior to a set of traffic lights causing a challenging scenario for the heavy vehicle driver behind.
- Episode 3 — Heavy vehicle perspective where the user is a passenger of a heavy vehicle alongside Marla Stone is able to accommodate the light vehicle driver due to her experience on the road.
- Episode 4 — Debrief on keeping a safe braking distance at the truck depot with truck driver Marla Stone.

Truck Wise Season 2 — *Why Two Lanes?*

Season 2 comprises four episodes that tackle the challenges heavy vehicles have when needing to sometimes make tight turns using multiple lanes. Season 2 occurs in a regional urban setting.

- Episode 1 — Introduction at truck depot with truck driver Damien Power to conduct vehicle safety check. Safety check includes checking that brake lights and indicators are operating correctly.
- Episode 2 — Light vehicle perspective where the user is a passenger of a light vehicle whose driver changes lane in an attempt to overtake the heavy vehicle ahead.
- Episode 3 —Heavy vehicle perspective where the user is a passenger of a heavy vehicle alongside driver Damien Power is required to use two lanes in order to perform a tight turn.
- Episode 4 — Debrief with truck driver Damien Power at the truck depot about the need for heavy vehicles to use multiple lanes when performing a tight turn.

Truck Wise Season 3 — Allow More Time to Overtake

Season 3 comprises four episodes that tackle the challenges heavy vehicle drivers face when driving a long vehicle with a heavy load. Season 3 occurs on the country highway.

- Episode 1 — Introduction at the truck depot with truck driver Marla Stone to conduct vehicle safety check. Safety check includes check that signs are clean and visible, check vehicle specs (e.g. weight and size) and confirm whether the vehicle load is within limits.
- Episode 2 — Light vehicle perspective where the user is a passenger of a light vehicle whose driver changes it attempting to overtake a long load heavy vehicle as it slows down to climb a hill.

- Episode 3 — Heavy vehicle perspective where the user is a passenger of a heavy vehicle alongside driver Marla Stone who sees the light vehicles driver's attempt to overtake and praises them for abandoning the manoeuvre after seeing a vehicle coming in the other direction.
- Episode 4 — Debrief on keeping overtaking heaving vehicles at the truck depot with truck driver Marla Stone.

Truck Wise Season 4 — What is Hiding in the Blind Spots?

Season 4 comprises four episodes that tackle the challenges heavy vehicle drivers face with heavy vehicle blind spots. Season 4 occurs in a metropolitan area.

- Episode 1 — Introduction at the truck depot with truck driver Damien Power to conduct vehicle safety check. Safety check includes checking both side mirrors and the front of truck for blind spots.
- Episode 2 — Heavy vehicle perspective where the user is a passenger of a light vehicle alongside driver Damien Power who is concerned about cyclists (vulnerable road users) who are in the heavy vehicle's blind spots at a set of traffic lights.
- Episode 3 — Light vehicle perspective where the user is a passenger of a light vehicle whose driver shows concern for the cyclists who are alongside the heavy vehicle while at a set of traffic lights.
- Episode 4 — Debrief on avoiding heaving vehicles blind spots at the truck depot with truck driver Damien Power.

DESKTOP VIRTUAL REALITY EXPERIENCES

The desktop virtual reality experiences are developed for the Oculus Rift S and Quest (via link cable) virtual reality headsets that requires either a high-end desktop or laptop to run. Having a dedicated desktop virtual reality headset is important to provide users with a high quality fully immersive virtual reality experience that allows users to interact with the virtual environment using tracked hand controllers rather than just being a passive viewer. The Truck Wise interactive virtual reality experiences include the following interactions.

Desktop Virtual Reality User Interactions

- Point and click interaction while conducting safety checks around the truck (e.g. trailer coupling pin to ensure connected correctly to truck).
- Left and right trigger controller button interaction to check indicators and brakes to ensure lights working correctly.
- Virtual Reality User Interface (UI) elements that allow users to interact side mirror controls, make decisions (e.g. whether to overtake) and complete a vehicle safety form.
- Trigger button interaction for light vehicle radio for song selection.
- Trigger button interaction to make phone call with friend while passenger in light vehicle.

Figure 16. Oculus Rift S VR headset and laptop which can be used to run desktop VR experiences.

The 360-degree virtual reality experiences are specifically designed videos that allow users to control the camera view of the virtual environment as if they were residing within it. Truck Wise 360-degree videos are hosted on YouTube and accessible via the Truck Wise website (The Hub), direct access to videos can be gained upon request for local viewing. Truck Wise 360-dgree videos can be viewed with using several different methods depending on a user's hardware configuration.

360-DEGREE VIDEO VIRTUAL REALITY EXPERIENCES

Truck Wise 360-degree Video Viewing Methods

- Standard desktop with mouse where the mouse controls camera viewpoint within virtual environment.
- Modern smartphone with built-in sensors were rotation of smart phone controls camera viewpoint within virtual environment.
- Modern smartphone and Google cardboard (or similar) as a low-cost mobile virtual reality experience, user's natural head rotations controls camera viewpoint within virtual environment.
- Dedicated mobile or desktop virtual reality headset, user's natural head rotations controls camera viewpoint within virtual environment.

Truck Wise Season 1

Truck Wise Season 2

Truck Wise Season 3

Truck Wise Season 4

Figure 1717. Truck Wise 360-degree videos available on the Truck Wise website (The Hub) and on YouTube.

The Hub Website

Deakin University continues to maintain the Truck Wise website (The Hub) as a key component of the Truck Wise project aimed to engage with the target audience, project stakeholders and the wider community. The website includes access to the 360-degree videos including the recently developed Season 3 and 4 virtual reality experiences. The website also includes educational fact sheets, a quiz, safety videos and the education resource package (available on request). The website also includes Truck Wise ambassador profiles (Marla Stone and Damien Power), project FAQs and reciprocal links to existing road safety programs already on the market which avoids duplication of existing information and resources.

Truck Wise website (The Hub) can be accessed at www.truck-wise.com.au

Figure 18. Truck Wise website (The Hub) home page.

EDUCATIONAL FACT SHEETS

Truck Wise educational fact sheets are downloadable from website and provide great educational information ideal for classroom environments. Education fact sheets include information on heavy vehicle blind spots, safe braking distances, merge safely with heavy vehicles, space required for heavy vehicle turning, trucks carrying livestock and even the different types of trucks you might encounter on the roads. A summary of each of the educational fact sheets is given below —

- Blind spots — explains heavy vehicle blind-spots and their position relative to the vehicle.
- Distances — explains the safe braking distance needed by trucks.
- Turning — explains the challenges of turning a heavy vehicle including the “do not overtake a turning vehicle” rule.
- Merging — explains the challenges of merging with heavy vehicles.
- Livestock — explains the challenges of transporting livestock.
- Risk — highlights the statistical risks of being a probationary driver.
- Truck Types — provides an overview of the different types of common heavy vehicles.

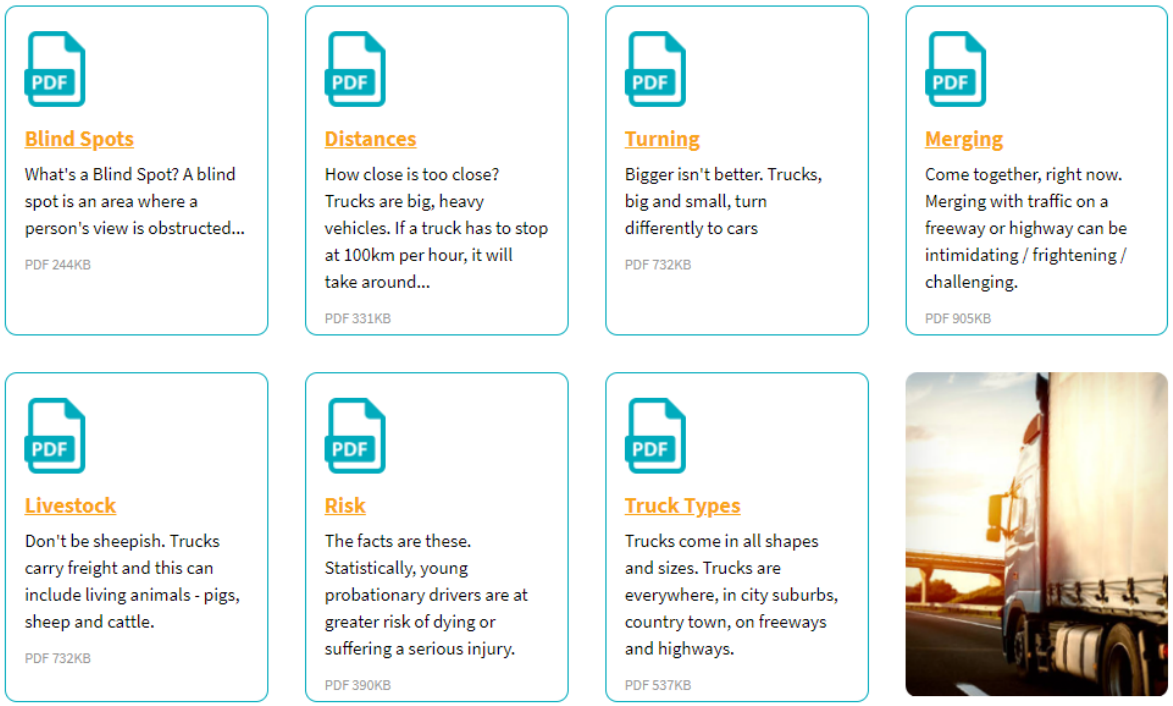

Figure 19. Truck Wise "The Hub" website page containing educational fact sheets.

EDUCATIONAL QUIZ

Truck Wise education quiz in an interactive quiz available on the website ideal for classroom environments. The quiz includes 15 true or false questions that are listed below —

- When turning at a roundabout, a truck is allowed to driver over the shoulder of the roundabout to turn.
- When a truck indicates to turn right, it is safe to pass on its left-hand side.
- It's safe for a driver to check their phone when they get a message as long as they don't answer it.
- The "B" in B-Double stands for 'Big'.
- Trucks of different sizes behave differently when on the road.
- Red P Plate drivers are the highest risk group for road trauma.
- The safest blind spot to be in is at the front of the truck.
- When a truck turns it can legally use two lanes to do so.
- Livestock trucks only travel to farms and never in towns or cities.
- Trucks have 'super brakes' and can easily stop suddenly.
- You should allow at least two seconds between your vehicle and the back of a truck.
- Trucks have four main blind spots.
- When merging into traffic on a freeway, it's always safer to merge in front of a truck rather than behind.
- Trucks can be more vulnerable to glare from high beam headlights than other vehicles.
- Livestock presents no additional complications or challenges for a truck driver.

SAFETY VIDEOS

Truck Wise safety videos are presented by Truck Wise ambassadors Marla Stone and Damien Power. The safety videos are hosted on YouTube and available on the website. Marla and Damien provide key safety messages from personal experiences about the challenges that heavy vehicle driver's face daily.

Marla Stone

Damien Power

Figure 20. Truck Wise ambassadors Marla Stone (left) and Damien Power (right) safety videos.

The Truck Wise project has been designed to complement existing road safety programs and truck awareness initiatives. The website provides several links to external road safety resources about other road safety programs, truck interactions and driver awareness.

ROAD SAFETY RECIPROCAL LINKS

Road to Zero

Victorian road safety strategy which Transport Accident Commission (TAC) and its road safety partners aim to achieve the vision of no road deaths and serious injuries – a future where every journey is a safe one.

http://www.roadtozero.vic.gov.au

myLeaners

Outlines the various stages a young driver will encounter as they progress through the Victorian Graduated Licensing system.

https://www.mylearners.vic.gov.au

NHVR — *We need space campaign*

Promotes truck safety awareness through videos, posters and factsheets aimed at giving Australia's truck drivers the space they need to keep drivers safe.

https://www.nhvr.gov.au/we-need-space

Road Safety Education Victoria

The Road Safety Education Victoria website contains a wealth of educational resources relating to road safety in Victoria. This includes Road Smart a highly interactive road safety education program that is free for all Victorian Secondary Schools. Road Smart Interactive is targeted at Years 9, 10 and 11 and those undertaking the VCE Vocational Major.

https://www.roadsafetyeducation.vic.gov.au

F2D (Fit to Drive)

The Fit to Drive program website has information on road safety programs and resources. The program's objective is to engage with young people to deliver road safety messages that will empower and support young road users (aged 16-25) to achieve zero deaths on Victorian roads.

https://www.f2d.com.au

Linfox Truck Safety Series

In a four-part truck safety series launched by the TAC, Linfox truck drivers provide insight into their working life on our roads. They talk candidly about road safety and share their thoughts on everything from fatigue and speed through to interacting with other road users and coping with stress.

Part 1 – https://www.youtube.com/watch?v=vfxFPsvXIi8

Part 2 – https://www.youtube.com/watch?v=dTvjFCKwFiw

Part 3 – https://www.youtube.com/watch?v=KpRAfYpOVjg

Part 4 – https://www.youtube.com/watch?v=MP8b0u7Ptx4

EDUCATIONAL RESOURCE PACKAGE

The education resource pack is aimed at supporting students and increase awareness around safe interactions between light and heavy vehicles. The range of activities in the resource pack engage students, encourage participation and build knowledge. The pack is designed in line with best practice in terms of student learning and teaching. The education resource pack provides curriculum outline and suggested alignment with VCE subjects, it also uses resource available via the website (e.g. safety video and quiz) and is available to interested schools upon request.

Short Videos – Setting the Context

The education resource pack includes two short videos available on Truck Wise website (The Hub) featuring truck drivers and their stories on the road. Short videos are one of the most highly used education tools today. Videos immediately engage students and hold their attention. Beginning the program from a truck drivers perspective establishes why the students are here and why the program is necessary. It also positions them early to empathise with the truck drivers and the difficulties they face in their workplace (i.e. on our roads).

Deakin Presentations: Connecting with Experts

This pre-recorded presentation from Virtual Reality researchers at Deakin University involves outlining their experiences designing and working with emerging technologies. By providing project examples from a range of areas, such as Health, Design and the Truck Wise program, key questions relating to the use and ethics of technology are addressed. In schools' technology is an area that all teachers need to support their students to use and understand. One of the most valuable ways teachers are encouraged to do this, especially at the VCE level is to provide opportunities for students to connect with experts and investigate real- life situations and projects.

Virtual Reality — Learning through Experience

Following discussion about technology students have the opportunity to experience immersive technology for themselves. Using the Truck Wise 360-degree video or desktop VR experiences, students virtual experience driving from both a light and heavy vehicles. These VR experiences aim to better support young drivers in making safe choices when sharing the road with heavy vehicles.

Students today have grown up with technology. This activity engages students as most view technology as an essential and positive aspect of their lives. They are keen to explore and embrace new technology.

Surveys and Safety Quiz — What do I Know?

Surveys and safety quiz available on the website (The Hub) provide students, teachers and the Truck Wise team with an understanding of the level of knowledge students gain in regard to interactions between light and heavy vehicles. They also help to reinforce student knowledge and provide feedback on what learning has taken place during the session.

Conclusion

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The Truck Wise Stage 2 project resulted in the development of two additional virtual reality experiences (Season 3 and 4) focusing on overtaking heavy vehicles and blind spots which also involves vulnerable road users. The fully interactive virtual reality experiences have been made available to download by anyone via an online repository. The fully interactive virtual reality experiences are accompanied by 360-degree video versions that are able to be accessed on the Truck Wise website (The Hub) or YouTube.

The Truck Wise Stage 2 project built on the success of the Truck Wise pilot project and further developed the existing educational resources. The project was awarded to Deakin University which officially began in November 2021. Phase 1 of the project focused on the design and development of two new VR experiences, this included stakeholder design workshops (Activity 1) being held in March and April 2022 that resulted in the new experiences having a focus on heavy vehicle topics overtaking and blind spots. Development of the VR experiences (Activity 2) was undertaken in the second half of 2022.

Phase 2 began in early 2023 which saw the engagement of several educational partners (Activity 1) seeking opportunities for Truck Wise VR experiences to be integrated into existing educational programs. While educational partners showed strong interest in the Truck Wise VR experiences feedback highlighted a lack of immediate resources were available to integrate these experiences into existing programs within the project's timeline. As such the Truck Wise project team sought an extension to continue discussions with educational providers which was approved by NHVR. As a result, the Truck Wise project team decided to make the VR experiences freely available to download by educational providers via a public repository. These experiences can now be used in combination with resources available via the Truck Wise website (The Hub) by educational providers. The Truck Wise project now has several educational resources available to the public including the following —

- Four fully interactive virtual reality experiences presenting common and challenging interactions between light and heavy vehicle drivers, the experiences show both light and heavy vehicle driver perspectives.
- 360-degree video experiences, similar to those above but, able to be accessed by anyone anywhere using either the YouTube app or web browser. These can be viewed using compatible 360-degree hardware such a Google Cardboard offering a low-cost alternative to the full interactive virtual reality experiences that require a dedicated laptop or desktop computer.
- An online website (The Hub) which includes safety videos by Truck Wise ambassadors, 360-degree videos, educational fact sheets, FAQs, external road safety links and the education resource pack.

- Education resource pack that provides curriculum outline and suggested alignment with VCE subjects to assist educational providers in delivering the Truck Wise content.

Throughout the Truck Wise Stage 2 project the team continued to increase awareness about the Truck Wise VR experiences and associated resources. This was done through a series of community engagement and public events including Deakin Open Day, Australian International Airshow, Tomorrow Bound Career Expo and Laval Virtual International conference.