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Title: **Human Impact Route Assessment - Identifying Risks to Vulnerable Roads Users along Construction Vehicle Truck Routes**

Summary

In 2016 VicRoads and the Melbourne Metro Rail Authority (MMRA) held the Vulnerable Road User (VRU) and Truck Forum, where it was identified that current processes for planning construction vehicle routes took no consideration of the risks to VRUs. In response to this a working group was formed to explore the issue, resulting in the development of The Human Impact Route Assessment (HIRA) tool. HIRA is a decision support tool and the application process aims to provide a framework to evaluate potential heavy vehicle routes with a focus on reducing the impact and interactions with VRUs.

HIRA has now been piloted with the Metro Tunnel Project (MTP) and the City of Moreland. Initial findings of the pilot study indicate that HIRA helps stakeholders identify risks to VRUs and encourages collaborative decision-making. However, further refinement of the process and language used within the tool is required.

1 Introduction

In December 2016, over 100 delegates converged on the Melbourne Town Hall for the Vulnerable Road User and Truck forum. The forum was held in anticipation of the unparalleled traffic disruption associated with the construction of Melbourne's Metro Tunnel Project (MTP). It is projected that over a five-year period, there will be one truck movement generated by the project every three minutes as spoil is carted from below Melbourne's Central Business District (CBD). This forum resulted in an exceptional collaboration between Victoria's transport and safety agencies, local government, contractors, and non-government agencies.

One of the four working groups formed at the forum was tasked with exploring how to prioritise Vulnerable Road User (VRU)[1] safety by improving truck route selection. This working group developed The Human Impact Route Assessment (HIRA) tool and process which has now been piloted with the MTP as well as a medium density residential/commercial development within the City of Moreland.

The purpose of this paper is to explain why the HIRA tool was developed, describe the initial findings of the HIRA Pilot Study and how the tool can be developed for use on other projects.

The outline of this paper is as follows:

Section 3 – Discusses the motivation behind the development of HIRA

Section 4 – Describes the HIRA process and tool

Section 5 – Explores the HIRA Pilot Study methodology and results

Section 6 – Considers the future development of HIRA.

[1] The term vulnerable road users generally refer to pedestrians, cyclists and motorcyclists however in the case of this paper vulnerable road users will refer to pedestrians and cyclists only.

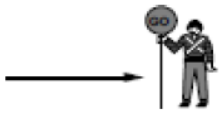
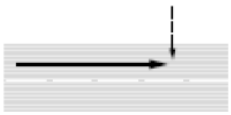
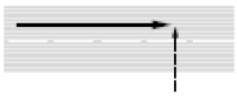
2 Background

2.1 Why focus on Vulnerable Road Users?

The Melbourne Metro Tunnel Project (MTP) is likely to generate around 500 additional truck trips per day in and around the Melbourne CBD. However, this project is not the only major construction project planned for Melbourne in the coming years, others include Westgate Tunnel Project, North East Link, and Level Crossing Removals to name a few. The cumulative effect of these construction projects will result in an unprecedented number of trucks sharing the road space with passenger vehicles, public transport, motor cyclists, pedestrians and cyclists.

Nationally the third most prevalent type of crash involving heavy vehicles and resulting in a fatality is Pedestrian Involved Crashes (12.3%) (BITRE, 2017). Of these crashes 4.2% occur when a person is playing or working on the carriageway and 4.8% occur when a pedestrian is crossing a road, as shown in Table 1. Of these types of crashes 60% occur where the posted speed limit is 50km/h or 60km/h (BITRE 2015), a typical speed limit in a built-up area.

Table 1 Pedestrian Crash Types (Source: BITRE 2017)

Crash type	Total (%)	Crash type (sub group)	Percentage
Pedestrians	12.3%	Pedestrian playing/working on the carriageway 	4.2%
		Nearside 	3.2%
		Far side 	1.6%
		Other	3.2%

The types of trucks likely to be used in the construction of the MTP include rigid heavy vehicle trucks and articulated trucks, both 19m truck and dogs, and semi-trailers. The high frequency haulage routes are likely to be serviced by articulated truck and dogs. Australia wide crash statistics, which consider both rural and metropolitan environments, indicate fatal crashes involving articulated trucks occur at 20 times the rate of passenger vehicles (BITRE 2016). In the case of the MTP which has sites located within the Melbourne CBD and in surrounding high activity zones, where pedestrian and cycle volumes are high, it is reasonable to assume that the risk of fatality or serious injury crashes involving these types of VRUs and heavy vehicles will be amplified.

In response to this amplified risk to VRUs, Melbourne Metro Tunnel Project (alongside Sydney Metro Rail Project) have signed a memorandum of understanding with Transport for London Construction Logistics and Community Safety (CLOCS) program to support the development of an Australian version of CLOCS (to be referred to as CLOCS-A) (NRSPP, 2018).

2.2 CLOCS

Between 2008 and 2013, 55% of cyclist fatalities in London involved a heavy vehicle, and a large proportion of these were construction vehicles. In response to this Transport for London (TfL) commissioned an independent review of the construction sector's transport activities to understand the causes of these collisions. The general findings of this investigation include (TRL 2012):

1. *Road risk is viewed as less important than general health and safety risk;*
2. *Although road casualty statistics make it difficult to identify industry sectors associated with collisions, construction traffic appears likely to be over-represented in collisions with cyclists.*

Some of the specific findings of this investigation were:

- *"There is a lack of ownership of road risk by clients and principal contractors in the construction industry";*
- *"Evidence suggest that there is a lack of awareness about road risk in the construction industry";*
- *"Route planning to avoid interactions with cyclists is especially difficult on construction projects due to the transitory nature of sites"*

Based on these findings, the Transport Research Laboratory (TRL) made numerous recommendations. Recommendation 9 includes:

"As part of the mandatory Construction Logistics Plans, principal contractors should define safer routes to their site (within a set local radius), where possible avoiding risky areas such as schools, cyclist 'hot spots', narrow roads and difficult junctions. In all cases consideration should be given to minimising exposure to vulnerable road users".

As there was no common standard for the construction industry to manage road safety, a CLOCS Standard was developed and first published in 2013. The standard includes requirements for both the construction logistics operators and construction clients. The requirements cover vehicle safety equipment, driver training and licencing, traffic routing, collision reporting and quality operations.

The CLOCS traffic routing requirements include that the:

- Construction client shall ensure that a **suitable risk assessed vehicle route** to the site is specified and that the route is communicated to all drivers, and
- Fleet operators shall ensure that any vehicle routes to sites or premises specified by clients are adhered to unless otherwise directed.

Many of these issues are applicable to Victoria and Australia.

2.3 Current Route Planning Practices in Victoria

Current standards and codes of practice referred to in the preparation of construction traffic management plans focus on traffic management at the approach of and alongside a work site. They do not provide guidance on how to select suitable heavy vehicle routes to and from the worksite. In Victoria, heavy vehicles up to 19m or less, are classified as general access vehicles and can use all roads (arterial and local) unless there is a load limit restricting its use. So, when all, or most roads, can be accessed by typical construction vehicles how do we decide which routes are most appropriate and generate the least level of risk to VRUs?

Route planners may refer to the gazetted heavy vehicle network maps for multi-combination trucks to guide their decision making. The VicRoads Heavy Vehicle Network Maps (all states and territories have similar mapping tools) inform the route developer of which roads are pre-approved, conditionally approved, restricted roads and the location of restricted structures with mass limits for trucks of various sizes. The guidelines used to develop these maps (Austroads 2000) indicate they have been developed with a focus on traffic volume and composition, road standards and structures as well as area of operation. Further to this the guideline recommends the use of local knowledge and judgement to determine the suitability of a route. However, once a road becomes a gazetted route for a multi-combination truck, the frequency of review of gazetted truck routes cannot keep pace with

changing traffic and local conditions. This is exacerbated by accelerated growth demands in many urban settings. For this reason, it is likely that a gazetted truck route in an urban environment may also be shared with various other road users, including pedestrians and cyclists. In urban environments there are multiple examples of gazetted truck routes mixing with high numbers of VRUs (examples in Melbourne include Arden Street, Royal Parade, Elizabeth Street, and St Kilda Road). Further to this, the maps provide no guidance as to the preferred route for general access vehicles on unapproved or local roads.

In Victoria the VicRoads SmartRoads Road User Hierarchy (soon to be updated to Movement and Place Network) provide some guidance as to which arterial or local roads, not highlighted on the VicRoads Heavy Vehicle Network Maps, may be suitable to operate as a truck route. However, these maps are aspirational maps; that is, they categorise roads according to a hierarchy of use for the operation of the future road network in specific locations and will inform land, transport and precinct planning, not temporary truck routes. If a road is identified as a “preferred traffic route” on these maps it is more likely to be approved by the relevant authority as a truck route and less likely to conflict with VRUs. However, in urban environments, particularly, city centres, the number of preferred traffic routes is often limited. Most roads have competing demands with public transport, cycling and pedestrians, all taking priority over vehicles. In these cases, it is very difficult to plan the safest and least disruptive heavy vehicle route without local knowledge and expertise.

The Human Impact Route Assessment (HIRA) tool aims to address this gap by providing a guiding framework and process to evaluate the risks to VRUs and promote collaboration when planning potential heavy vehicle routes through our cities.

3 Development of HIRA

3.1 The Intention

HIRA is a decision support tool. The tool and the application process aims to provide a framework to evaluate potential heavy vehicle routes through our cities with a focus on reducing the impact and interactions with VRUs. It does this by:

- Prioritising the safety of VRUs in construction vehicle route planning decision making;
- Creating an opportunity for stakeholders to exchange information about risks associated with VRU areas;
- Providing a platform of collaborative learning, where all stakeholders develop more insight into safety risks for VRUs;
- Creating a record documenting the potential risks to VRUs.

HIRA is designed to support and streamline decision making and risk identification. It is not intended to be used as a precise mechanism for route selection. For example, there may be an occasion when the HIRA process and tool may indicate a route scores poorly with respect to VRUs compared to an alternative route. However, the better scoring alternative route is not selected by the construction client, contractor and road authority as the ultimate route to be used on a project because of other reasons such as noise and road pavement quality. Nevertheless, as a HIRA assessment was undertaken the route will be used with the knowledge of the risks to VRUs. This allows for discussion and planning of mitigation measures, or at the least, information for truck drivers to consider when driving along this route.

3.2 The Process

HIRA uses a structured decision-making process (Burgman, 2016) drawing on the collective knowledge of local experts and stakeholders to identify risks to VRUs and then identify ways to manage, mitigate or eliminate these risks. The recommended step by step HIRA process is outlined in **Error! Reference source not found.**.

Once a set of potential construction vehicle routes has been identified by the contractor or client, a team of experts (preferably with strong local knowledge) is brought together in a workshop

environment to discuss and evaluate these routes against a set of specified attributes and elements defined in the HIRA tool. Refer to section 3.3 for a description of the tool and Appendix A for a list of all attributes and elements.

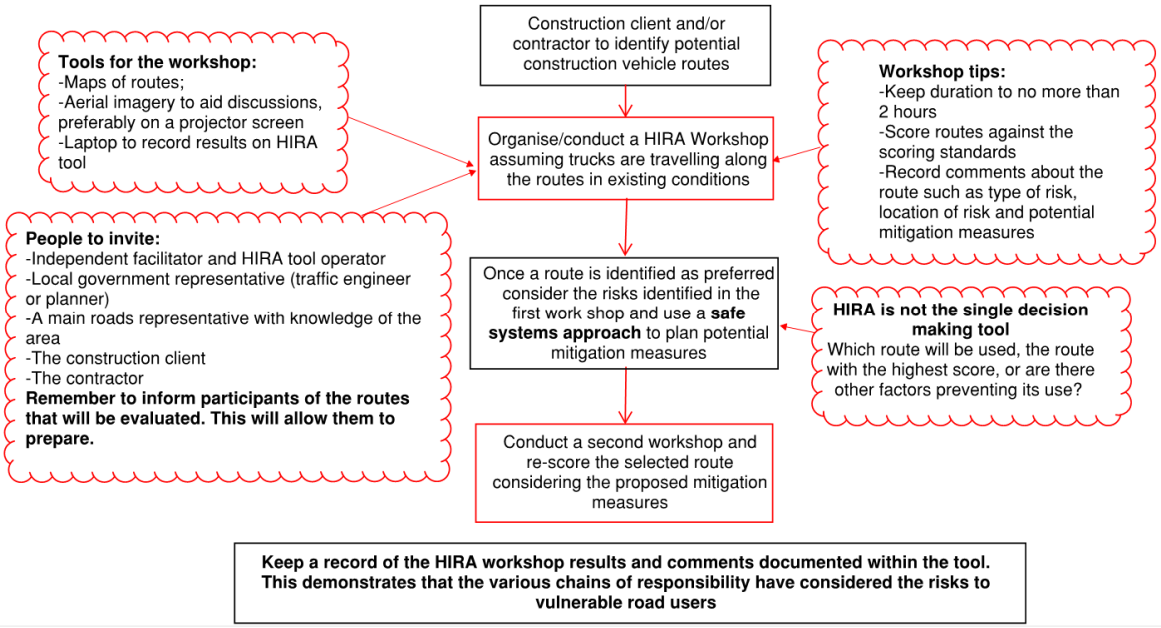


Figure 1 The HIRA Process

These local experts and stakeholders are likely to comprise, but not be limited to the following people:

- A local government representative (a traffic engineer and/or planner);
- A main roads authority representative with knowledge of traffic operations in the local area (VicRoads, RMS, Main Roads etc);
- The construction client (government authority or developer); and
- The contractor delivering the project.

It is recommended that the maximum duration of a HIRA workshop is two hours and it be facilitated by an independent person familiar with the tool. The role of the facilitator is to ensure conversations and discussions stay focused on the attribute being discussed and that all parties can voice their knowledge and understanding of how an area operates and the potential risks to VRUs. The group is required to reach a unanimous decision about the score to be given to an element based on the risks identified. The facilitator records the group's decisions in the HIRA tool against each attribute.

Apart from scoring a range of routes against various elements, an often underestimated and yet extremely enriching aspect of the HIRA route process is the conversation that occurs between the various stakeholders. Participants often discover previously unidentified issues in relation to the route or area being assessed. The facilitated workshop also promotes insight and understanding into the needs and challenges of each of the parties. The needs and risks confronting VRUs are also reinforced through participation.

Documentation of comments made in the discussion can be recorded within the tool. This allows for a record to be kept of why a route has been given a score. The record would include where the risks are located along a route, what form they take and what potential mitigations may be explored. Once all routes have been evaluated in the workshop, discussion needs to occur with the stakeholders as to which route or routes are preferred. This may align with the score from the HIRA workshop or it may not. Once a preferred route has been identified the construction client and/or contractor will need to identify reasonable and practicable measures that can be adopted to either remove or reduce the risk to VRUs.

To determine the suitability of mitigations the HIRA process recommends an additional workshop be conducted with the stakeholders and the HIRA tool be used a second time to revaluate the selected route. However, this time the route will be evaluated considering the mitigation measures being proposed. It is noted that the intention of this exercise is to identify reasonably practicable mitigation measures. Mitigations are not intended to result in permanent infrastructure changes to the road network, (although where appropriate such changes should be considered) but it is noted that the use of the tool may help inform/alert council or the state road authority of a section of road that requires attention.

Currently the HIRA process and tool does not recommend types of mitigation measures. Instead it recommends a safe systems approach (Austroads 2018) be adopted. That is, a holistic approach be given to mitigation measures including safer vehicles, safer speeds, safer roads and safer road users. In some cases, all members of the workshop group may agree that no physical measures are possible to mitigate against an identified risk at a location along a route. In this case, other types of measures may be adopted such as temporary speed reduction, the use of trucks along a route with underarm protection, communicating with a local school to inform them of changed conditions and warning truck drivers of the risks at particular locations. Although these measures do not reduce the exposure of trucks to VRUs they may reduce the likelihood and severity of crashes.

3.3 The Decision-Making Tool

The decision-making tool (rubric) has been developed by the route selection working group comprised of representatives from VicRoads, MMRA, City of Melbourne and private industry. Currently, the rubric is built into an Excel spreadsheet with prepopulated *attributes, elements, weighting and standard scores*. Additional columns allow for scores to be entered for each route being evaluated and a final score is provided at the bottom of the rubric for each route, refer to Appendix A for an image of the HIRA rubric.

The attributes in the tool have been designed to identify the potential presence of VRUs and the level of separation that currently exists between them and the general traffic lanes. A set of descriptors has been built into the tool to standardise the scoring of each element.

The attributes included in the tool are:

- Activity Hubs;
    - This attribute captures the potential level of pedestrian activity along the road side based on land use. Activity hubs considered elements such as hospitals, educational institutions; retail, entertainment, sporting and recreation venues as well as servicing.
- Route Dynamics;
    - Captures the potential operation of a route, its flexibility if a road is closed, directness, conflict with other construction projects, road type, alignment with active transport networks (bicycle lanes) as well as the potential for heavy vehicle staging areas.
- Public Transport;
    - Identifies any potential conflict with the public transport network including on road public transport routes and public transport stops
- Road Closures/Events;
    - This attribute requires the route planner to be aware of how the road space is used by the local community and the potential risk of disruption.

The standard descriptors developed for the tool guide the scoring for each element. Standards have been broken down into the following classifications and scoring ranges:

- Preferred - Score 9 to 10
- Good - Score 6 to 8
- Average - Score 3 to 5

- Less than average - Score 1 to 2

Scores between 6 and 10 indicate either limited interaction with VRUs or a level of separation between general traffic lanes and VRUs. While scores between 1 and 5 indicate a high risk of conflict between general traffic lanes/movements and VRUs due to a high number of VRUs and/or limited separation measures. Scorings standards for each element are shown in Appendix A.

Each element has been allocated a weighting which represents its level of importance within the tool as identified by the working group.

Higher priority was given to the following types of VRUs as they were perceived to move or function in a way that could expose them to a higher level of risk when mixed with heavy vehicles.

- Cyclists;
- People who are sick/infirmed or those visiting the sick/infirmed;
- Students; including the very young to tertiary level;
- People visiting entertainment precincts, as their behaviour may be affected by drugs and alcohol.

The weighting for each of the elements has been normalised to ensure the overall score calculated by the tool is representative of each element result.

The overall score calculated for a route is between 0 and 10. However this score is not communicated as a number. Instead the scoring ranges listed above (Preferred, Good, Average and Less than Average) are used.

4 HIRA Pilot Study

As part of the development of the HIRA tool, a pilot study was conducted with industry to determine any issues with the tool and process before wider release. The pilot study aimed to assess how HIRA performs in a real-world context. The study examined the process of using the tool, the appropriateness of the attributes and how the performance standard descriptions were interpreted by users.

4.1 Methodology

The HIRA tool was showcased to the industry to generate interest in its usage. At a second VRU and Truck forum held by MMRA in September 2017, each of the four working groups were invited to present to the forum about the work that they had done to date. The working group responsible for creating the HIRA tool took this as an opportunity to demonstrate the usage of the tool and to find organisations and agencies interested in being part of a HIRA pilot study in order to gain their feedback on the tool.

Organisations and agencies that were interested in participating were invited to use the tool in a workshop on projects of their choosing. With the guidance of the working group, the host organisation invited relevant stakeholders to the workshop to engage in the decision-making process. Participants new to using the tool were asked to complete pre and post-workshop questionnaires. These questionnaires aimed to determine how HIRA performed during the workshop based on three key evaluation questions (KEQ):

1. Did HIRA support and affect collaborative decision-making on route selection?
2. Can HIRA be of value to participants?
3. How can HIRA be further developed?

The questions asked, the relevant KEQs and the justification for each question can be seen in Table 2 and Table 3.

Table 2: Pre-Workshop Questionnaire

Question	Relevant KEQ	Justification
1. What is your usual role in the route selection process?	1	This question is used to determine the diversity of stakeholder's present
2. Which of the routes presented to you do you think is best? Why?	2	This question aims to capture any preconceptions about the route. This is to determine if HIRA can affect the participants' favoured route.
3. What benefits would you expect from using this tool to make it of value?	2	This question is used to capture what participants expected as benefits from HIRA.
4. From your introduction to the tool, do you believe that there are gaps in the attributes, and if so, where?	3	This question aims to capture initial concerns with HIRA that should be addressed during the introduction to HIRA

Table 3: Post-Workshop Questionnaire

Question	Relevant KEQ	Justification
1. Do you agree with the route suggested by HIRA? If not, what led to the wrong route being chosen?	2 and 3	This question aims to capture if participants agree with HIRA at the end of the workshop, and if not, which attributes caused issues.
2. If at all, how did HIRA help identify high-risk elements of the route? Will HIRA result in a commitment to address these high-risk elements?	2	If HIRA did not identify risk elements of the route or failed to address high-risk elements, even at a basic level, it would have failed and therefore not be of value.
3. What are the benefits from using the tool? How does this differ from your expected benefits before the workshop?	2	This question aims to capture any benefits that participants may only realise at the completion of the workshop. These benefits can be brought to the attention of potential users during their introduction to HIRA.
4. Do you believe there are gaps in the attributes, if so, where?	3	Workshops could present gaps in the attributes that may not have been identified in the development of HIRA.
5. What are the pros and cons of using HIRA over conventional route selection methods?	3	This question aims at capturing what participants liked and disliked about using HIRA.
6. How can the descriptors be improved to make the definition of the standards clear and accurate?	3	This question aims to determine how participants found using the standards and which descriptors need improving.
7. How did you find the process of using the tool? Are there any suggested improvements to the steps involved?	3	This question aims to collect feedback on the process of using the tool and recommended improvements.
8. Do you have any other suggestions to improve HIRA?	3	This question aims at collecting feedback on improving HIRA that may not fall under any of the above questions.

Supplementing the pre and post-workshop questionnaires, observational data was noted down during workshops. To maintain project confidentiality, and to benefit the usage of HIRA on other future projects, observational data was restricted to attribute interpretation and confusion, process, and scoring methodology.

4.2 Participants

The pilot study aimed to assess the tool in more than one context. Therefore, there was diversity within the participants selected for the study. The largest of the studies was done with the consortium responsible for the construction of the MTP. This consortium used the HIRA tool on three sites around the CBD over four different workshops with stakeholders specific for that site. Usually, the stakeholders involved were, local government, road agencies, and engineers from both the client and contractor.

A workshop was also conducted with a local city council on a large urban development. At this workshop, local government representatives were joined by contractors for the discussion (see Figure 2. Although still a relatively large construction project, this workshop was dealing with a smaller scale project compared to the MTP providing a comparison of how HIRA can be used by projects of different scales.

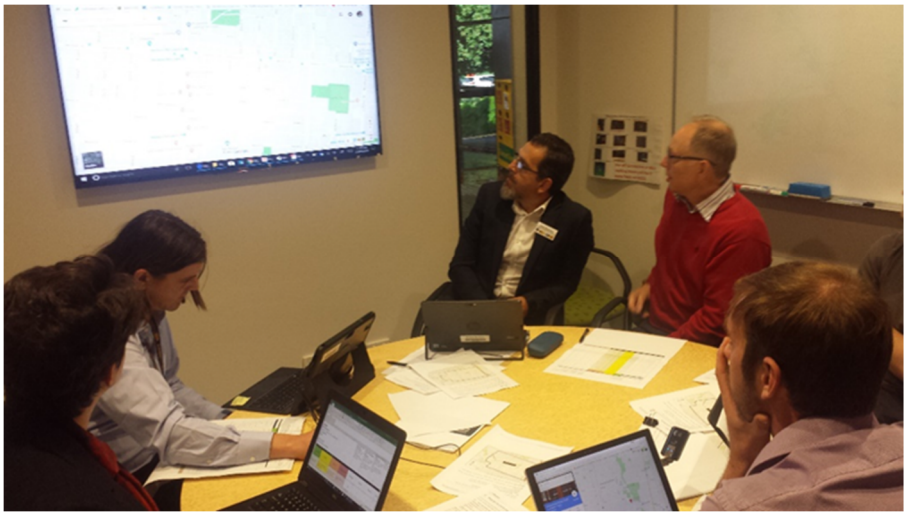


Figure 2 HIRA Workshop

4.3 Results

4.3.1 Questionnaire Results

Results collected from the pilot study participants are documented in Table 4 and Table 5

Table 4 Pre-Workshop Questionnaire Findings

Question	Key Findings
1. What is your usual role in the route selection process?	▪ Some participants were heavily involved with developing and approving traffic management plans in the business as usual case. ▪ Others had very limited influence in the route selection process.
2. Which of the routes presented to you do you think is best? Why?	▪ Participants who had seen the routes before the workshop all expressed a preference. ▪ Preferences were based on road geometry. ▪ Some participants expressed scepticism over the necessity of HIRA.
3. What benefits would you expect from using this tool to make it of value?	▪ Expectations depended on the participant's usual role in the route selection process.

Question	Key Findings
	▪ Meet community expectations. ▪ Provide risk information along routes. ▪ Provide evidence of risk assessment to speed the route approval process. ▪ Not all expectations were within the scope of HIRA, some expected HIRA to determine the most efficient route considering peak hour congestion and general road safety as well as VRU safety.
4. From your introduction to the tool, do you believe that there are gaps in the attributes, and if so, where?	▪ Most participants had not seen HIRA before and could not comment in it. ▪ Some expressed concern over lack of residential impacts and suggest local roads over arterial ones.

Table 5 Post-Workshop Questionnaire Findings

Question	Key Findings
1. Do you agree with the route suggested by HIRA? If not, what led to the wrong route being chosen?	▪ Most agreed that HIRA had suggested the most appropriate route. ▪ One participant agreed but acknowledged that the outcome could be influenced by personal opinion or interpretation. ▪ Some disagreed with the route suggested by HIRA as they believed that HIRA did not account for community expectations.
2. If at all, how did HIRA help identify high-risk elements of the route? Will HIRA result in a commitment to address these high-risk elements?	▪ Most participants stated that HIRA helped identify risks. ▪ However, most believed that HIRA would not result in a commitment as it was not a requirement of the construction contract. ▪ One contractor stated that they would inform drivers of risks identified in HIRA.
3. What are the benefits from using the tool? How does this differ from your expected benefits before the workshop?	▪ Collaboration was a strong theme among the responses about benefits of HIRA. ▪ The systematic review of the route forced participants to review the route in detail and identify risks.
4. Do you believe there are gaps in the attributes, if so, where?	▪ Most did not identify gaps. ▪ Differentiating between night and day (though HIRA was adapted during the workshop to accommodate this) ▪ Driving time and different lengths of the route. ▪ Special needs VRUs ▪ Community expectations (noise, residential areas) ▪ One participant commented that rather than missing elements, HIRA had too many.
5. What are the pros and cons of using HIRA over conventional route selection methods?	▪ HIRA aligned and supplemented conventional route selection methods. ▪ HIRA encouraged discussion on safety which is normally only conducted by local and state road authorities. ▪ Created a greater understanding among stakeholders as to why a route was selected. ▪ Proof of risk assessment.

Question	Key Findings
	▪ However, HIRA workshops were time consuming. ▪ Could result in mitigation that would be expensive for the contractor. ▪ It was proving difficult to change some participants preconceptions about which route was the best. ▪ Without proper facilitation, influences such as community complaints could remove focus from VRUs.
6. How can the descriptors be improved to make the definition of the standards clear and accurate?	▪ Some participants commented that the descriptors were too general and needed to be more specific. ▪ Others responded that descriptors should be made as more of a guide rather than being fixed. ▪ Examples should be provided to help users interpret. ▪ "Distance and Directness" should focus more on distance and less on left hand turns. ▪ The descriptors for "Distance and Directness" should make it clear that it focuses on the impacts on VRUs. ▪ The definition of mode separation in "Active Transport" should be clarified.
7. How did you find the process of using the tool? Are there any suggested improvements to the steps involved?	▪ Most found using HIRA too time consuming, with participants sometimes getting stuck on elements. ▪ It was difficult to get all relevant stakeholders in the room at the same time.
8. Do you have any other suggestions to improve HIRA?	▪ Participants would have liked to have seen more diversity in the stakeholders invited. ▪ One participant suggested showing maps with land use should be provided as part of HIRA.

4.3.2 Observational Findings

While HIRA helps identify risks along the routes, it does not determine who is responsible for resolving or mitigating these risks. This question of liability was raised at several of the workshops with contractors concerned that road authorities will use HIRA to force contractors to upgrade roads, making HIRA expensive, and thus, unattractive to contractors.

The time it took to complete a HIRA workshop depended primarily on the familiarity of the participants with the tool. Participants who had used HIRA previously mentioned that for the later workshops, they began to look at the road network as a place as well as a truck route. This was most observable with the MTP workshops, where a similar group of participants used HIRA over several workshops, and the time it took to complete a workshop dropped from two hours to one hour and fifteen minutes. Most of the workshop time was consumed scoring and discussing the Activity Hubs attribute (requiring up to an hour to complete). However, once Activity Hubs had been completed, the pace of the workshop would increase.

Wording of descriptors often caused confusion over how they should be interpreted. An example of this was the less than average descriptor for the "Retail Precinct" element which participants found vague and confusing. Participants also found that some of the descriptors did not seem to directly link the element to a VRU risk. For example, the element "On- Route Public Transport" focuses on the conflict with trams, buses and railways which does not directly impact VRUs. It was suggested that having construction trucks sharing the same roads as buses may not be a negative impact on VRU safety as VRUs would expect to encounter heavy vehicle traffic on those roads. The same point was brought up with the "Conflict with Other Construction Projects" element.

The involvement or exclusion of certain stakeholders was also discussed during workshops. Local community members and representatives from the public transport authorities such as Yarra Trams were suggested as recommended stakeholders at HIRA workshops. However, it was also observed that if there were too many participants in the workshop, it may be difficult to progress and complete a route review.

There were also several concerns about the scoring process itself. The most frequent of this was about how to account for the difference of exposure between routes. For example, if one route passed an educational institution with speed reduction and a signalised pedestrian crossing which would score as “good” and another route had two educational institutions with similar safety controls that would individually score as “good”, how should the scores for the two routes be compared? There were suggestions that scores should be considered based on exposure along the entire route while others suggested that scores should be given based on the worst-case scenario. For example, if a route has two schools, both with fully controlled crossings, speed reduction and traffic controllers it should score higher than a route with one school that is alongside a road with no speed reduction.

4.4 Discussion on Results

4.4.1 Collaborative Decision-making

Participants responded positively to the collaborative aspect of HIRA. Many responded that they learnt something new about the route. However, it was often competing interests between participants that slowed the process of HIRA. Involving local community members in the decision-making process could be beneficial as it will allow community members to be part of the decision-making process and help explain why particular truck routes are selected, but as Irvin & Stansbury (2004) note it can also prove challenging and unpredictable, and would need to be managed. The agency hosting the HIRA workshop ultimately decides who should and should not be involved in the decision-making process based on the project requirements.

4.4.2 Value of HIRA

Participants found that HIRA did enable them to formally identify risks as intended, making HIRA of value. However, HIRA also raised the concerns of contractors by increasing their awareness of the risks to VRUs along a route. HIRA was not designed to create additional liability, but rather be used as a preventative tool aimed at identifying risks on potential routes. It is recommended that further legal advice is required to better understand changes to liability and these be explained to HIRA participants. However, with the upcoming changes to the Chain of Responsibility legislation in Victoria, it is thought that conducting a HIRA workshop can be used to demonstrate evidence of stakeholders coming together to identify risks and discuss what reasonably practicable measures can be adopted.

After observing multiple HIRA workshops for the MTP, it was noted that contractors’ awareness of risks to VRUs changed. Contractors started identifying risks and potential mitigation measures prior to the workshops, demonstrating a change in awareness of the routes.

Although the decision to select a construction vehicle route did not always align with the preferred route identified by the HIRA tool. The use of HIRA ensured that the contractor, client and road authority were more aware of the risks to VRUs generated by the construction vehicle traffic. However, it is unclear at this stage of the projects what mitigations will be put in place.

4.4.3 *Areas for Improvement*

As users became more familiar with HIRA, the time it took for them to complete a route assessment for a site reduced. However, for first time users, the time it took to complete the “Activity Hubs” attribute was resulting in frustration and impatience. The working group has since discussed potential changes that to mitigate the frustration. The first is by informing the participants that the “Activity Hubs” attribute is the longest section of the workshop and that the pace of HIRA increases at its conclusion. The second change is to switch the order of attributes so that “Route Dynamics” are covered before “Activity Hubs”. This allows the engineers using HIRA to become familiar with the process by scoring elements considering route directness and geometry, typical to what they already consider, before reviewing elements aligned with land use and place.

Descriptors of the standards for various elements will need to be further considered to provide clarification. The descriptor for the less than average standard for the “Retail Precinct” element was often discussed as being too vague. The descriptors should not be worded in such a way that is so general that there is ambiguity in their interpretation, nor should they be worded too specifically to make them irrelevant when scoring various scenarios. Descriptors should also tie the element to VRU safety to ensure that HIRA remains focused on VRU safety. If descriptors cannot tie the element to VRU safety, the elements should be removed from the tool. This will help focus HIRA on VRU safety and save time during the workshops. Elements such as “On-Route Public Transport”, “Flexibility” and “Conflict with Other Construction Sites” should be reworded for VRU safety or removed.

During the pilot study, issues with the process of using HIRA were immediately addressed by members of the working group facilitating the workshop. However, as members of the working group cannot attend every HIRA workshop, a comprehensive set of instruction or some level of training is required to allow for self-facilitation in the future. The instructions should give a clear guidance as to how HIRA should be used. This includes how to interpret the descriptors and keep the scoring uniform and consistent. The intent of the HIRA process should also be made clear to all workshop participants. Decision makers should also be reminded that HIRA is only one element in deciding a construction vehicle truck route.

The majority of the feedback received about the use of HIRA has been positive, with many citing that that there is a place for HIRA in the heavy vehicle route selection process. However, initial findings of the pilot study suggest that there are aspects of HIRA that can be improved. These areas include the introduction to HIRA at workshops, descriptor wording and the time taken to use HIRA. Therefore, the following recommendations have been proposed:

1. During the introduction to HIRA, the intent of HIRA should be made clear, emphasising that the focus is solely on VRUs and that the result should be used to aid the decision-making process with due consideration to other factors and route selection methods. An approximate timeframe for each of the attributes should be given so that participants understand which sections will take the longest.
2. The working group needs to review the language used in the element descriptors and standard scoring guide to ensure they tie back to VRUs and are clear in their intent, examples could be used to assist in the understanding of the descriptor. Attributes that have been flagged in workshops, particularly those in ‘activity hubs’ should be carefully considered as these are the ones that have caused the most confusion. If the descriptors cannot be linked to VRU safety risks, the working group should consider removing the attribute from HIRA.
3. The order of attributes should be reconsidered so that the Route Dynamic attribute, which has elements that are typically considered in the route selection process, such as road geometry and directness, are evaluated first. This allows for participants to become familiar with the process of using HIRA before scoring attributes that are usually not considered during the conventional route selection process such as land use and place.

5 Future development of HIRA

5.1 The Process

Findings from the trial will inform refinements to the process used up to now to administer HIRA. This process includes the forum in which the tool is completed, the sequence of attributes assessment, the means of achieving collaboration between parties, and the tool’s integration into project requirements. An optimum process will shorten the time that route scoring takes and emphasise the collaboration between parties, particularly in identifying risk mitigation.

5.2 Tool Presentation

The working group is developing an internet-based interface for HIRA. The information architecture and design of the web platform will assist to sustain the fidelity of the tool’s administration. The step-by-step approach will be consistent with the decision support tool and will include illustrative or photographic examples of performance standard descriptions. Additional functionality will include

online collaboration and integration with geo-spatial information systems and relevant transport map layers. The working group is mindful that data collection is a highly sensitive issue and will be approached to ensure parties will confidently engage with the tool without fear of the tool data being used to proportion blame for any incidents that may occur.

5.3 Project governance

The working group continues to liaise with MMRA alliance membership to discuss its use for site specific assessments. Further understanding of the legal liabilities associated with use of the tool for various stakeholders will be researched.

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ppendix A HIRA Matrix

iption: Describe Project, Route Operation Times, Types of Heavy Vehicles, Number of Trucks per day:

Attributes		Weighting	Standards			
	Elements		**Preferred (9-10)**	**Good (6-8)**	**Average (3-5)**	**Less than Average (1-2)**
ubs	1. Hospital and emergency services access	8%	No hospital or medical facilities on route	Speed limit control and pedestrian separation (e.g. barriers, traffic islands, signalised crossings).	Pedestrian related activity near road site accompanied by appropriate speed limit control.	Pedestrian related activity near road side.
	2. Childcare, schools, education institutions	7%	No schools or education facilities	Schools on route with pedestrian separation, speed controls and signalised / assisted intersections.	Schools on-route with speed control only (no signalised crossings).	Route passes pedestria entrances with limited pedestrian protections
	3. Retail precinct	6%	No retail	Retail featuring separate dedicated off road parking and pedestrian access.	Retail environment with limited pedestrian separation and limited safe crossing facilities.	Neighbourhood strip shopping centre or loc store.
	4. Entertainment precinct (night time venue operation)	7%	No licensed venues / LGA designated dry area	Limited licensed venues with pedestrian protections such as speed restrictions and traffic calming.	Licensed venues and late night trading with limited pedestrian protections.	High level of entertainment and late night licensed venues.
	5. Sporting and recreational precinct / facility	6%	No sporting or recreational facilities on route	Facility with ample off street parking and signalised pedestrian access.	Facility with limited off-street parking and limited pedestrian protections.	Facility with on-street parking and limited pedestrian protections
	6. Service access and trader deliveries	5%	No traders requiring deliveries	Limited businesses with dedicated off-road or separated delivery areas (.e.g dedicated loading docks).	On-street loading / off-loading for mixed businesses.	Narrow street with on-street loading / off loading.
	7. Flexibility - ease of access to alternatives	5%	≥ 3 alternative routes available in the event of route disruption	1-2 alternative routes available in the event of route disruption	Alternative routes go through areas of high - pedestrian / active transport activity (see activity hubs)	No alternative routes available in the event o route disruption.
	8. Distance and directness (inc. number of turns required of trucks)	5%	No left hand turns required where traffic control to and from site is not provided. Last km access to site is arterial road/s.	Limited left hand turns required where traffic control to and from site is not provided. Last km access to site is mostly arterial roads.	> 3 left hand turns required where traffic control to and from site is not provided. Last km access to site is a combination of arterial and local roads.	> 5 left hand turns required where traffic control to and from sit not provided. Last km access to site is mostly local roads.
amics	9. Conflict with other construction projects	5%	No route overlapping exists with other construction / high truck traffic projects.	Limited route overlapping exists with other construction / high traffic projects.	Route overlapping exists at intersections and on route with other construction / high traffic projects.	Route overlapping exis with multiple construction / high tru traffic projects.
	10. Road type and function	7%	Route is an existing B-Double gazetted road.	Route predominantly compromises existing B-Double gazetted roads.	Route predominantly comprises High Mass Limit and Performance Based Standards vehicle approved roads.	Route predominantly comprises local roads that are only approved for general access heav vehicles (< 19m).
	11. Active Transport (cycling / skateboards etc)	9%	Limited bicycle (and other AT) traffic.	Bicycle route with mode separation.	Bicycle route with disconnected dedicated lanes.	High bicycle use, popul cycle route with or without on road infrastructure.
			En route holding / staging areas exists to	En route holding /staging areas exists to coordinate	Holding/staging area at	