



Forward Motion/Moving-Off Information Signal (MOIS) Systems Regulation

Consensus Document for Potential Regulatory
Approaches – Version 2

VRU-Proxi-12-10

November 2019

TRL Background



TRL Background

Vision

World leader in creating the future of transport and mobility, using evidence-based solutions and innovative thinking

320
engineers, scientists,
psychologists, IT experts
and statisticians




Providing world-leading research, technology and software solutions for surface transport modes and the related markets of automotive, motorsport, insurance and energy

Mission

Challenge and influence our chosen markets, driving sustained reductions (ultimately to zero) in:

- Fatalities and serious injuries
- Harmful emissions
- Barriers to inclusive mobility
- Unforeseen delays
- Cost inefficiencies

1000 clients in
145 countries

TRL Background...delivering impactful innovation

1950's/70's

The UK Motorway network



1969

The self-driving Citroën DS19



1997

NCAP launched



2014

TRL cycle infrastructure development



2015

Gateway driverless shuttles



2018

London Smart Mobility Living Lab



1960s

Early simulator



1972

The magic roundabout, Swindon



1980's

Deflectometer



2012

London Summer Olympics



2016

Electric double decker bus



2017

HGV Truck Platooning



Consensus Document Approach



Consensus Document Approach

Consensus Questions

- Regulation Scope
 - Q1 What shall the scope of the regulation be regarding vehicle categories?
 - Q2 What shall the scope of the regulation be regarding VRUs?
- System Functionality
 - Q3 What shall the scope of the regulation be regarding the functionality of the systems that it is trying to regulate?
- Vehicle Manoeuvres
 - Q4 What shall the scope of the regulation be regarding the motion of the vehicle during the collisions that the regulation is attempting to prevent?
 - Q5 What shall the scope of the regulation be regarding the maximum speed of the vehicle that the system shall be operational for?
- VRU Manoeuvres
 - Q6 What shall the scope of the regulation be regarding the motion of the VRU during the collisions that the regulation is attempting to prevent?
 - Q7a What shall the scope of the regulation be regarding vehicles with “good” direct vision?

Consensus Document Approach

Consensus Questions

- VRU Manoeuvres
 - Q7b/8 What shall the scope of the regulation be regarding the forward position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q9/10 What shall the scope of the regulation be regarding the lateral position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q12 What shall the scope of the regulation be regarding the crossing speeds of the VRU that the system shall be operational for when crossing?
 - Q11 What shall the scope of the regulation be regarding the testing for VRUs that are obstructed from view?
- False Positive Tests
 - Q13 What shall the scope of the regulation be regarding testing for false positives?
- Human Machine Interface
 - Q14 What shall the scope of the regulation be regarding the requirements for HMI?
 - Q15 What shall the scope of the regulation be regarding manual overrides for MOIS signals

Consensus Document Approach

Structure of MOIS Regulation Discussion


- VRU-Proxi Question
 - Statement of consensus question
- Summary of Options
 - Statement of potential options available to address consensus question
- Summary of VRU-Proxi-11 Discussion
 - Summary of key discussion points from VRU-Proxi-11
- Summary of Task Force Discussions
 - Summary of key discussion points from MOIS Task Forces
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements
 - Series of statements that provide the basis for reaching consensus on which options to take forward from the potential options available to MOIS Regulation
 - Consensus Discussion Outcome
 - Space for summarising consensus position
- Additional sections:
 - Summary of VRU-Proxi-10 Discussion
 - Initial VRU-Proxi Member Consultation Feedback:
 - Additional Evidence Required to Support Decision Process

Regulation Scope




Regulation Scope (Q1)

What vehicle categories shall be in scope?

- VRU-Proxi Question:
 - **Q1: What shall the scope of the regulation be regarding vehicle categories?** 
- Summary of Options:
 - M2/M3/N2/N3 only – linked to GSR requirements
 - All vehicle categories – i.e. including M1/N1 category vehicles too
- Summary of VRU-Proxi-11 Discussion:
 - EC position to include at least M2/N2/M3/N3 in scope of MOIS, M1/N1 may not be required in MOIS scope because of AEB (for EU initiated by GSR Phase 2). CPs agreed that M2+/N2+ shall be in scope.
 - Agreed direction: J and other CPs to decide whether they specifically wish to have optional M1/N1 requirements in scope. If yes, include optionality - if no, leave out.

Regulation Scope (Q1)

What vehicle categories shall be in scope?

- VRU-Proxi Question:
 - **Q1: What shall the scope of the regulation be regarding vehicle categories?** 
- Summary of Task Force Discussions:
 - Category of vehicle/s that are in scope very important to confirm, as different vehicle categories have different solutions and are involved in collisions with different characteristics
 - Important to also confirm in relation to GRVA intentions too – is the intention to introduce low-speed AEB solutions for M1/N1?
- Additional Evidence Required to Support Decision Process:
 - Collision characteristics of moving off/low speed forward moving collisions between VRUs and different vehicle categories

Regulation Scope (Q1): Evidence #1a

Contributory Factors Analysis: MOIS Target Population Definitions

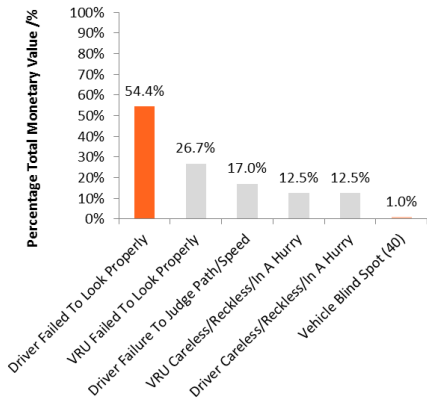
- Target population:

Pedestrian			Cyclist/PTW			
Vehicle Manoeuvre	Vehicle Impact	VRU Manoeuvre	Vehicle Manoeuvre	Vehicle Impact	VRU Manoeuvre	VRU Impact
Moving off Slowing or stopping	Front	Crossing from driver's n/s Crossing from driver's o/s In carriageway, not crossing Walking along back to traffic Walking along facing traffic	Moving off Slowing or stopping	Front	Moving off Slowing or stopping Waiting to go ahead Waiting to turn left/right	-
			OR			
			Moving off Slowing or stopping	Front	Going ahead LH bend/RH bend/other	Offside Nearside

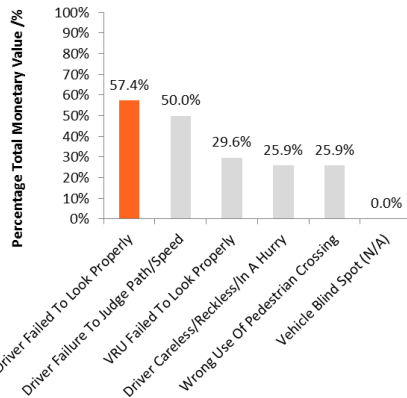
Regulation Scope (Q1): Evidence #1a

Leading Contributory Factors for MOIS Target Population Casualties (EU28)

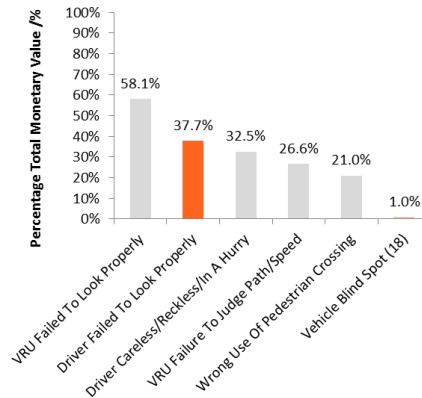
M1



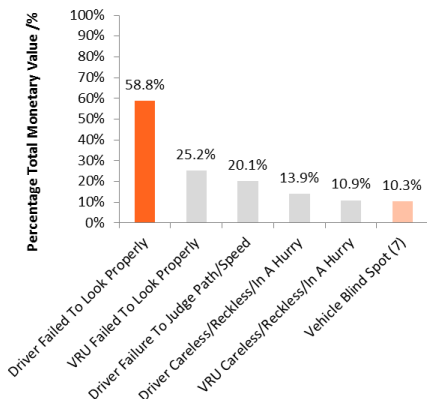
M2



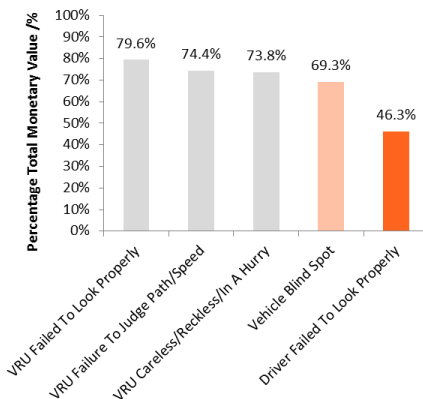
M3



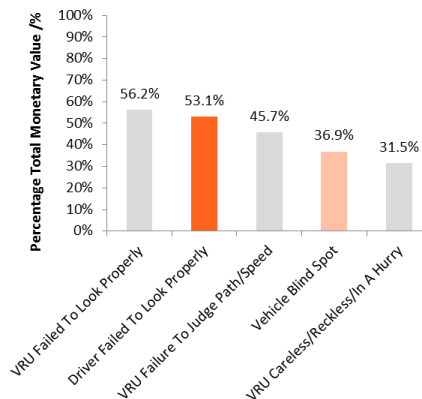
N1



N2



N3



Regulation Scope (Q1): Evidence #1a

Key Contributory Factor Definitions

405 Failed to look properly

A driver/rider either failed to look where they were going or they looked, but misinterpreted what they saw (looked but did not see). Code may be used where driver/rider was not paying attention to the road ahead.

710 Vehicle blind spot

This refers to cases where a driver is unable to see a pedestrian or another vehicle because of a blind spot caused by the design of the vehicle (eg. windscreen or door pillars) or inadequate coverage of the mirrors.

Includes restricted rear vision caused by vehicle loading and blind spots on left hand drive vehicles.

Regulation Scope (Q1): Evidence #1a

Conclusions Relating to MOIS Collision Landscape Contributory Factors

- “Driver Failed To Look Properly (405)”
 - Leading CF for M1/M2/N1 vehicle categories
 - Also top 5 CF for M3/N2/N3 vehicle categories
 - 35-60% of total societal costs associated with all vehicle categories
 - Solution alerts driver to VRU hazards when driver unaware of visible hazard
- “Vehicle Blind Spot (710)”
 - Very little effect on M1/M2/M3/N1(?) vehicle categories
 - 70%/37% of total societal costs associated with N2/N3 vehicle categories only
 - Solution alerts driver to VRU hazards when driver unable to see hazard
 - NB: without improvements in direct/indirect vision, MOIS may be less effective in these cases
- Proposed regulatory approach
 - Focus on information **systems to improve driver awareness of VRU hazards** during moving off and low-speed forward motion manoeuvres, *regardless of VRU visibility*
 - CF(s) to be included in future target population:
 - “Driver Failed To Look Properly (405)” for all vehicle categories

Regulation Scope (Q1): Evidence #1b

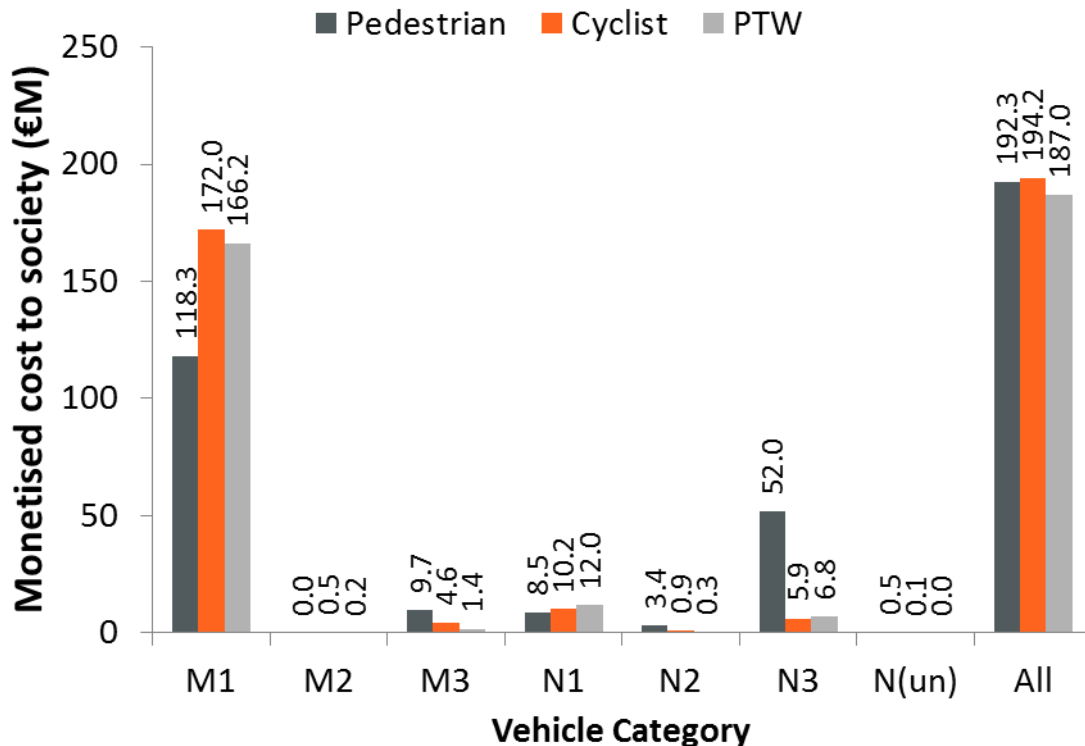
MOIS Target Population Definitions

Pedestrian			Cyclist/PTW				Contributory Factors
Vehicle Manoeuvre	Vehicle Impact	VRU Manoeuvre	Vehicle Manoeuvre	Vehicle Impact	VRU Manoeuvre	VRU Impact	
Moving off Slowing or stopping	Front	Crossing from driver's n/s Crossing from driver's o/s In carriageway, not crossing Walking along back to traffic Walking along facing traffic	Moving off Slowing or stopping	Front	Moving off Slowing or stopping Waiting to go ahead Waiting to turn left/right	-	Driver Failed To Look Properly (405)
			OR				
			Moving off Slowing or stopping	Front	Going ahead LH bend/RH bend/other	Offside Nearside	

Regulation Scope (Q1): Evidence #1b

VRU Casualty Share for MOIS casualties (EU28)

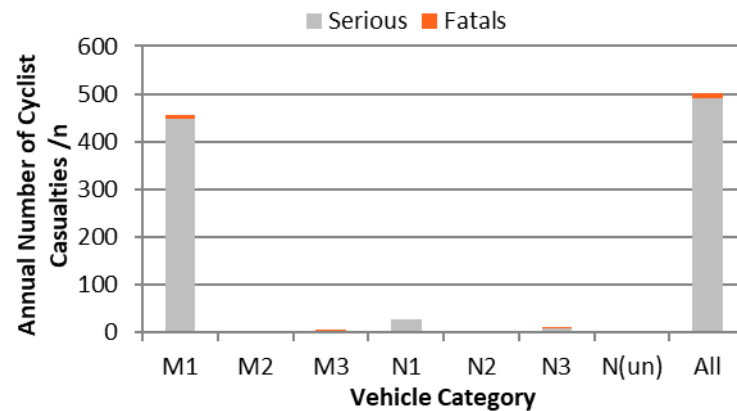
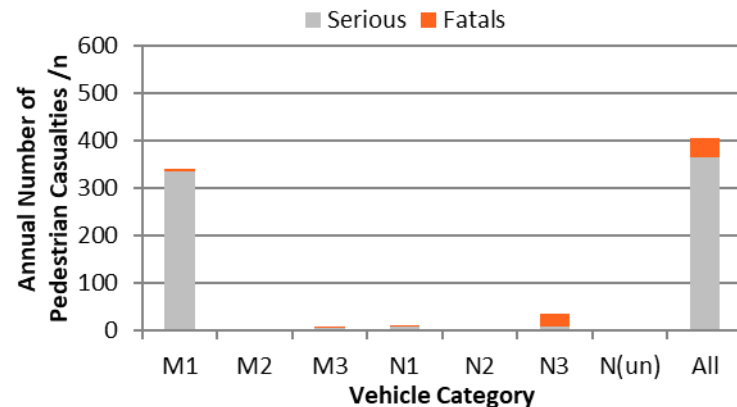
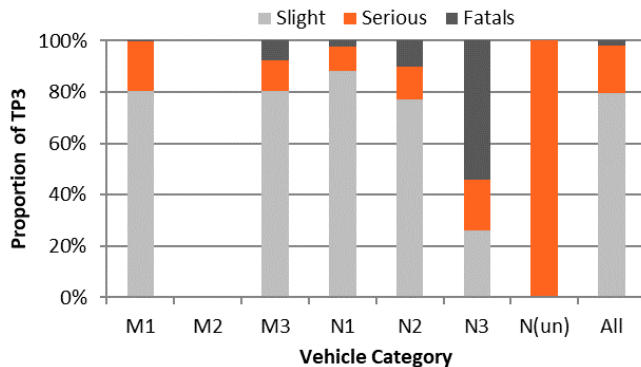
- MOIS Target Population
- Collisions between M1 vehicles and VRUs have highest societal costs
 - M3/N1/N3 also have significant societal cost
- VRU casualty share:
 - Pedestrians greater share for M2/M3/N2/N3 (particularly for N3)
 - Pedestrians/cyclists relatively equivalent share for M1/N1



Regulation Scope (Q1): Evidence #1b

VRU Casualty Share for MOIS casualties (EU28)

- MOIS Target Population
- Collisions between M1 vehicles and VRUs have greatest number of KSIs
 - For both pedestrian and cyclist collisions
- Considerably less KSIs for N3 vehicles, but more serious when occur



Regulation Scope (Q1): Evidence #2

Collision Characteristics of Low Speed Pedestrian Fatalities in Japan

- Fatal pedestrian collisions from IRTADA
 - Low speeds: ≤ 24 kph
 - Key vehicle manoeuvres relating to MOIS:
 - Initiating forward movement
 - Travelling straight ahead
- M1/N2/N3 greatest number of fatalities
 - **M1** (LPC/Sedan/SUV/MV): 176 \Rightarrow 17.6 /yr
 - **M2**: ?
 - **M3** (Bus): 22 \Rightarrow 2.2 /yr
 - **N1** (Box Van, LCV): 52 \Rightarrow 5.2 /yr
 - **N2** (<7.5t): 111 \Rightarrow 11.1 /yr
 - **N3/[N2]** (≥ 7.5 t): 103 \Rightarrow 10.3 /yr

Vehicle behavior	Vehicle types	Vehicle travel speed					
		Low speed			Higher speed		
		<i>m</i>	<i>M</i>	(A) <i>m/M</i> [%]	<i>n</i>	<i>N</i>	(B) <i>n/N</i> [%]
1) Initiating forward movement	GVW ≥ 7.5 t truck	91	313	29	1	255	0
	GVW < 7.5 t truck	56	626	9	2	893	0
	Bus	18	41	44	0	22	0
	Box van	2	41	5	0	47	0
	Minivan	18	176	10	1	232	0
	SUV	3	59	5	0	66	0
	Sedan	28	339	8	1	831	0
	LPC	25	254	10	0	516	0
	LCV	13	196	7	1	655	0
	Total	254	2,045	12	6	3,517	0
2) Traveling straight ahead	GVW ≥ 7.5 t truck	12	313	4	224	255	88
	GVW < 7.5 t truck	55	626	9	818	893	92
	Bus	4	41	10	21	22	95
	Box van	5	41	12	41	47	87
	Minivan	20	176	11	214	232	92
	SUV	7	59	12	60	66	91
	Sedan	42	339	12	797	831	96
	LPC	33	254	13	487	516	94
	LCV	32	196	16	618	655	94
		Total	210	2,045	10	3,280	3,517

Regulation Scope (Q1)

What vehicle categories shall be in scope?

- VRU-Proxi Question:
 - **Q1: What shall the scope of the regulation be regarding vehicle categories?**
- Summary of Options:
 - M2/M3/N2/N3 only – linked to GSR requirements
 - All vehicle categories – i.e. including M1/N1 category vehicles too
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - Category M1/N1 vehicles shall be considered within scope for the MOIS Regulation
 - Intention of the MOIS Regulation is to focus on information systems to improve driver awareness of VRU located in close-proximity to the front of the vehicle, regardless of VRU visibility
 - Consensus Discussion Outcome:
 - [To Be Completed]



Regulation Scope (Q2)

What VRUs shall be in scope?

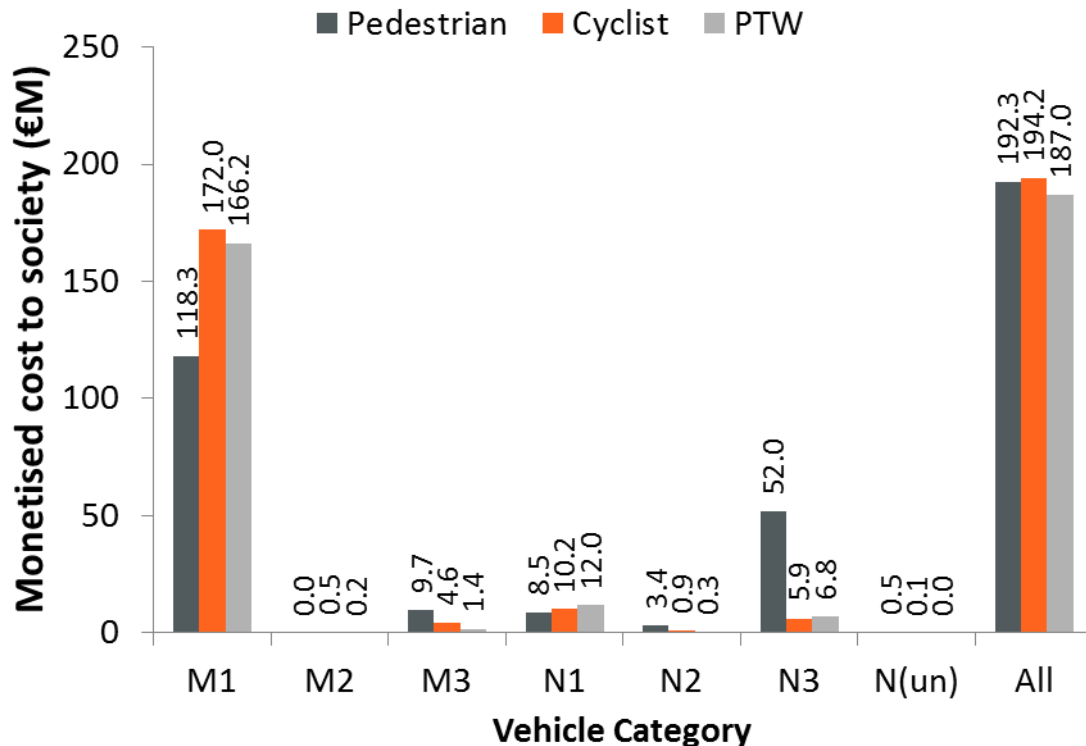
- VRU-Proxi Question:
 - **Q2: What shall the scope of the regulation be regarding VRUs?**
- Summary of Options:
 - Adult pedestrians, child pedestrians and/or cyclists
- Summary of VRU-Proxi-11 Discussion:
 - There were basically no objections to include adult and child pedestrians.
 - EC proposed to include cyclists and children cyclists. OICA explained it depends on the test scenarios and the technical feasibility as e.g. fast cyclists that cross the streets are hard to detect in time.
 - The group agreed to include children and children cyclist dummies (in line with BSIS) depending on the test scenarios. Consensus that PTWs shall not be included as there are no test targets under development and collision characteristics are supposed to be similar to cyclists.
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - The detection of both pedestrian and cyclist test targets shall be required by the MOIS Regulation
 - Pedestrian and cyclist test targets shall include child sized test targets
 - Consensus Discussion Outcome:
 - [To Be Completed]



Regulation Scope (Q2): Evidence #1

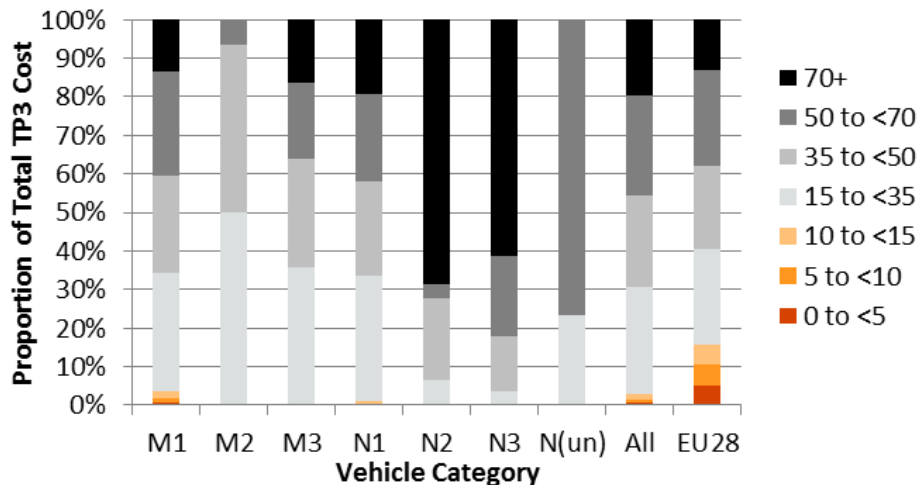
VRU Casualty Share for MOIS casualties (EU28)

- MOIS Target Population
- Collisions between M1 vehicles and VRUs have highest societal costs
 - M3/N1/N3 also have significant societal cost
- VRU casualty share:
 - Pedestrians greater share for M2/M3/N2/N3 (particularly for N3)
 - Pedestrians/cyclists relatively equivalent share for M1/N1



Regulation Scope (Q2): Evidence #2

Casualty Age as a Proportion of Total Annual Societal Costs of VRU Casualties



- Key Points:
 - Relatively smaller incidence of child (<15yo) casualties vs. proportion of EU28 population
 - Much higher risk of elderly (≥ 70 yo) casualties for N2/N3 vehicles vs. proportion of EU28 population

System Functionality



System Functionality (Q3)

What system functionality/ies shall be regulated?

- VRU-Proxi Question:
 - **Q3: What shall the scope of the regulation be regarding the functionality of the systems that it is trying to regulate?**
- Scope of Question:
 - The strategy for delivering the selected functionality/ies (i.e. HMI) is not considered within the scope of this particular question (covered in Q14)
- Summary of Options:
 - Moving off proximity information signal
 - Moving off collision warning signal
 - Moving off motion inhibit (i.e. no take-off)
 - Moving off AEB, low-speed AEB



System Functionality (Q3)

What system functionality/ies shall be regulated?

- VRU-Proxi Question:
 - **Q3: What shall the scope of the regulation be regarding the functionality of the systems that it is trying to regulate?**
- Summary of VRU-Proxi-11 Discussion:
 - ... according to the ToRs intervention is not in scope of IWG VRU-Proxi. The group agreed to regulate only information/warning signals. AEB and motion inhibit will be out-of-scope but MOIS regulation shall not prohibit active systems. GRVA to be consulted on motion inhibit/integration with AEB Reg.
 - There was consensus on the proximity informational signal. Regarding a collision warning signal OICA stated that this would be ok to include but technical feasibility shall be considered (esp. TTC) in test case scenarios where the speeds are low and the vicinity to the vehicle is small.
 - The group agreed to regulate information and warning signals but not require TTC based warnings at this stage. However, the option to regulate TTC based warnings may be considered if it is/becomes technically feasible.
- Summary of Task Force Discussions:
 - Important to establish the intent of proximity information and collision warning signals
 - Some concerns about the effectiveness of collision warning signals for moving off collisions
- Additional Evidence Required to Support Decision Process:
 - Effectiveness of collision warning signals in preventing close-proximity collisions



System Functionality (Q3): Evidence #1

How do other draft Regulations define signals?

BSIS Regulation

5.3.1. The BSIS shall inform the driver about nearby bicycles that might be endangered during a potential turn, by means of an optical signal, so that the vehicle can be stopped before crossing the bicycle trajectory.

It shall also inform the driver about approaching bicycles while the vehicle is stationary before the bicycle reaches the vehicle front, taking into account a reaction time of 1.4 seconds. This shall be tested according to paragraph 6.6.

The BSIS shall warn the driver, by means of an optical signal, acoustical signal, haptical signal or any combination of these signals, when the risk of a collision increases.
~~The BSIS shall warn the driver, by means of an optical, acoustic or haptic signal, when the risk of a collision increases.~~

2.10. "Information signal" means an optical signal with the purpose of informing the vehicle driver about a nearby moving bicycle.

5.5.3. The warning signal shall be activated at the earliest when the system detects a potential collision, e.g. by the intention of a turn towards the bicycle, e.g. by evaluating the distance between or trajectory intersection of vehicle and bicycle, direction indicator activation or similar. The strategy shall be

System Functionality (Q3): Evidence #1

How do other draft Regulations define signals?

Reversing Motion Regulation

17.2. Driver interface and information presentation strategy

17.2.1. [The system shall have at least two kinds of information signal selected from audible, optical, and haptics.]

17.2.1. The system shall have both audible and optical information.

17.2.2. Audible information

When an object is detected in the rear horizontal area as described in paragraph 2.1. of Annex 10., audible information in accordance with ISO 15006:2010 shall be given.

In presenting audible information, the distance may be identified at two or more levels. These zones may be indicated by changing the frequency of intermittent sound, and a faster intermittent sound or continuous sound shall be used as the distance becomes closer.

System Functionality (Q3): Evidence #1

How do other draft Regulations define signals?

AEB(M1/N1) Regulation

2.3. "Collision Warning" means a warning emitted by the AEBS to the driver when the AEBS has detected a potential forward collision.

5.2.2. Car to pedestrian scenario

5.2.2.1 [5.2.3. Car to bicycle crossing scenario

5.2.4. Car to bicycle longitudinal scenario

5.2.4.1. Collision warning

5.2.4.1.1. When the AEBS has detected the possibility of a collision with a cyclist at a constant speed of 15 km/h, a collision warning shall be provided as specified in Paragraph 5.5.1.

5.5.1. The collision warning referred to in paragraphs 5.2.1.1. and 5.2.2.1. [5.2.3.1. and 5.2.4.1.] shall be provided by at least two modes selected from acoustic, haptic or optical.

System Functionality (Q3): Evidence #1

How should the MOIS Regulation define signals?

- Summary of key points discussed in Task Force meetings:
 - Proximity information signal may be ineffective when vehicle is in motion, as close-proximity hazards develop in short timeframes meaning driver may not notice signal in time
 - Collision warning signal not required when vehicle is stationary
 - Collision warning signal effectiveness impacted by false positives affecting driver acceptance
- Proposed MOIS Regulation Definitions/Intentions:
 - Proximity Information Signal
 - *“A signal with the purpose of informing the vehicle driver of a VRU located in close-proximity to the front end of the vehicle”*
 - Only active when vehicle is stationary and non-intrusive, to avoid driver irritation
 - Collision Warning Signal
 - *“A signal with the purpose of warning the vehicle driver of a potential collision between the vehicle and a VRU located in close-proximity to the front end of the vehicle”*
 - Only active when vehicle is in motion and intrusive, to ensure driver reaction to signal
 - Need to control the false positive rate to maximise driver acceptance – perhaps by restricting lateral detection distances to avoid detecting VRUs on sidewalk/pavement

System Functionality (Q3)

What system functionality/ies shall be regulated?

- VRU-Proxi Question:
 - **Q3: What shall the scope of the regulation be regarding the functionality of the systems that it is trying to regulate?**
- Summary of Options:
 - Concerning the system functionalities to be considered in scope:
 - Moving off proximity information signal
 - Moving off collision warning signal
 - ~~Moving off motion inhibit (i.e. no take-off)~~
 - ~~Moving off AEB, low-speed AEB~~
 - Concerning the definition/intention of the different MOIS signals
 - Moving off proximity information signal
 - Moving off collision warning signal
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - Both moving off proximity information and collision warning signals shall be required by the MOIS Regulation
 - Moving off proximity information and collision warning signals shall be defined to fulfil proposed intentions
 - Consensus Discussion Outcome:
 - [To Be Completed]



Vehicle Manoeuvres



Vehicle Manoeuvres (Q4)

What motion is the vehicle undertaking?

- VRU-Proxi Question:
 - **Q4: What shall the scope of the regulation be regarding the motion of the vehicle during the collisions that the regulation is attempting to prevent?**
- Summary of Options:
 - Stationary vehicle, about to move off from rest by moving straight ahead
 - Vehicle moving slowly straight ahead
 - ~~▪ Stationary vehicle, about to move off from rest by turning to nearside/offside~~
 - ~~▪ Vehicle moving slowly by turning to nearside/offside~~
- Summary of VRU-Proxi-11 Discussion:
 - According ToRs the MOIS regulation shall only focus on straight ahead manoeuvres, not on turning manoeuvres. Turning manoeuvres should be addressed by BSIS.
 - A question was raised on the collision analysis regarding offside turns as these are particularly occurring with M3 vehicles. The Chair asked contracting parties to look into M3 turning accidents at the offside and consider if BSIS would also be needed for the offside.



Vehicle Manoeuvres (Q4)

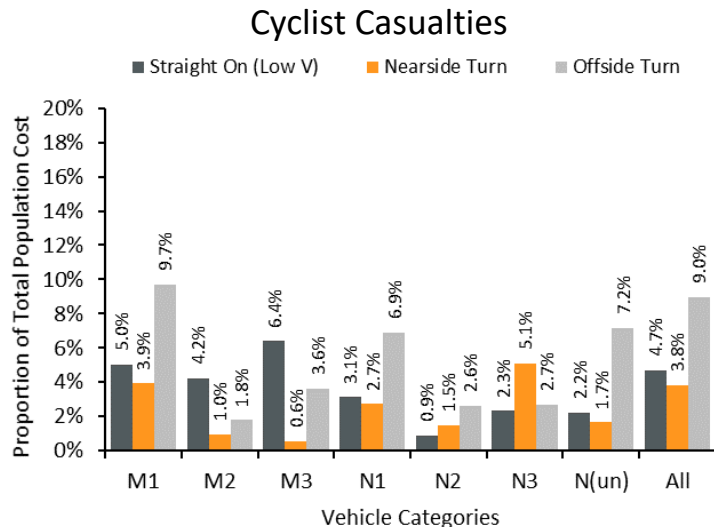
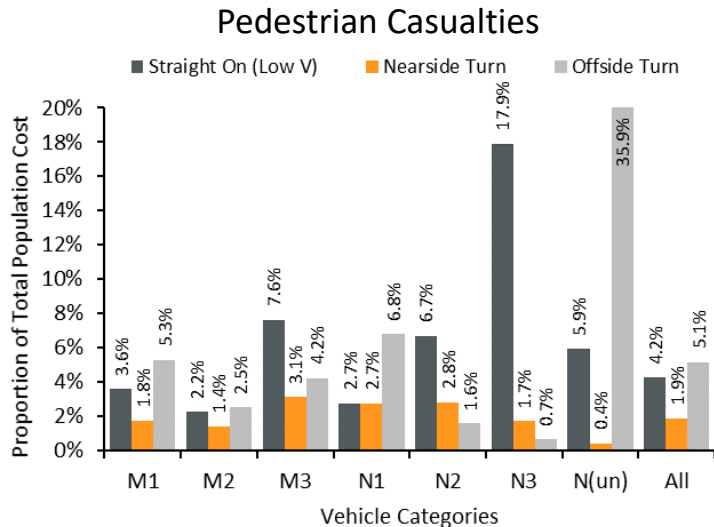
What motion is the vehicle undertaking?

- VRU-Proxi Question:
 - **Q4: What shall the scope of the regulation be regarding the motion of the vehicle during the collisions that the regulation is attempting to prevent?**
- Summary of Task Force Discussions:
 - Concerns regarding whether both moving off from rest and moving straight ahead slowly collisions scenarios should be covered by the scope of the MOIS regulation
 - Concerns linked primarily to vehicle speeds for each manoeuvre, which will be discussed in Q5.
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - The prevention of both moving off from rest collisions and low speed forward motion collisions shall be considered within scope for the MOIS Regulation
 - Consensus Discussion Outcome:
 - [To Be Completed]



VRU Manoeuvres (Q4): Evidence #1

Vehicle Manoeuvre when Front End Impacted as a Proportion of Annual Costs of Total Population



Key Points:

- Moving-off/slowing/stopping (straight on – low V) manoeuvre important for front end impacts
 - Across the board, but particularly for M3/N2/N3 vehicles that impact pedestrians with front end
- Offside turn manoeuvre important for front end impacts
 - Across the board, but particularly for M1/M3/N1 vehicles that impact pedestrians and cyclists with front end

Vehicle Manoeuvres (Q5)

What speed is the vehicle travelling at?

- VRU-Proxi Question:
 - **Q5: What shall the scope of the regulation be regarding the maximum speed of the vehicle that the system shall be operational for?**
- Summary of Options:
 - 0 kph to 10/20/30 kph
- Summary of VRU-Proxi-11 Discussion:
 - To tie in with operational speed requirements of the AEB Regulation, the group agreed to consider an operational speed range from 0 to max 20 km/h.
- Summary of Task Force Discussions:
 - Different vehicle speeds determine the forward detection boundaries required by MOIS Regulation
 - Different vehicle speeds present different technical challenges
 - Likely that shorter/longer range detection requirements of MOIS Regulation may need different solutions
 - Consider whether moving off from rest and low speed straight ahead manoeuvres are different
 - Can moving off from rest still be considered a moving off manoeuvre when the vehicle reaches 20 kph?



Vehicle Manoeuvres (Q5)

What speed is the vehicle travelling at?

- VRU-Proxi Question:
 - **Q5: What shall the scope of the regulation be regarding the maximum speed of the vehicle that the system shall be operational for?**
- Additional Evidence Required to Support Decision Process:
 - Vehicle speeds during moving off and low speed straight ahead collisions required
 - Establish whether intention of the MOIS Regulation is to prevent collisions occurring at speeds of up to 20 kph
 - Greater understanding of relevant forward detection boundaries and their technical feasibility
 - Further consideration of this given in Q7b-Q10 and Q12 regarding forward and lateral detection of VRUs



Vehicle Manoeuvres (Q5): Evidence #1

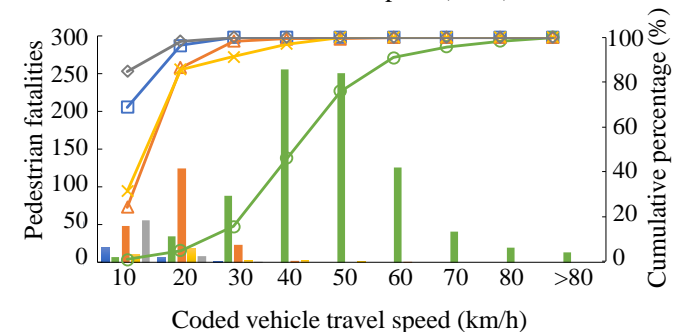
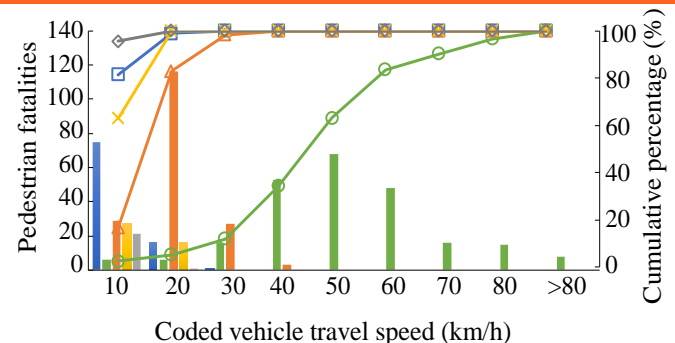
Collision Characteristics of Low Speed Pedestrian Fatalities in Japan

- Fatal pedestrian collisions from IRTADA

- Speed vs. number of collisions
- Key vehicle manoeuvres relating to MOIS:
 - Initiating forward movement
 - Travelling straight ahead

- Collision characteristics

- Moving off vehicle manoeuvre
 - 254 (98%) of fatals involved in collisions ≤ 24 kph
 - ~ 200 ($\sim 79\%$) involved in collisions ≤ 14 kph
- Straight ahead vehicle manoeuvre
 - 210 (6%) of fatals involved in collisions ≤ 24 kph
 - ~ 40 ($\sim 19\%$) involved in collisions ≤ 14 kph



- Initiating forward movement
- Turning left
- Turning right
- Moving backward
- Traveling straight ahead

Vehicle Manoeuvres (Q5)

What speed is the vehicle travelling at?

- VRU-Proxi Question:
 - **Q5: What shall the scope of the regulation be regarding the maximum speed of the vehicle that the system shall be operational for?**
- Summary of Options:
 - 0 kph to 10/20/30 kph
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statement:
 - The MOIS system shall be active at least within the vehicle speed range between 0 kph and 20 kph
 - Consensus Discussion Outcome:
 - [To Be Completed]



VRU Manoeuvres



VRU Manoeuvres (Q6)

What motion is the VRU undertaking?

- VRU-Proxi Question:
 - **Q6: What shall the scope of the regulation be regarding the motion of the VRU during the collisions that the regulation is attempting to prevent?**
- Summary of Options:
 - Crossing from nearside/offside
 - Stationary in road facing towards/away
 - Moving in road longitudinally towards/away to vehicle manoeuvre
 - Obstructed
- Summary of VRU-Proxi-11 Discussion:
 - Include pedestrians (adults and children) crossing/moving from nearside and offside with no obstructions;
 - Include cyclists crossing from the offside and nearside (as starting point, as concerns may be raised on technical feasibility);
 - Include cyclists standing in lane or moving forward in vehicle path;
 - Exclude pedestrians standing in lane or moving forward in vehicle path (not expected that a pedestrian is standing still in front of a vehicle).



VRU Manoeuvres (Q6)

What motion is the VRU undertaking?

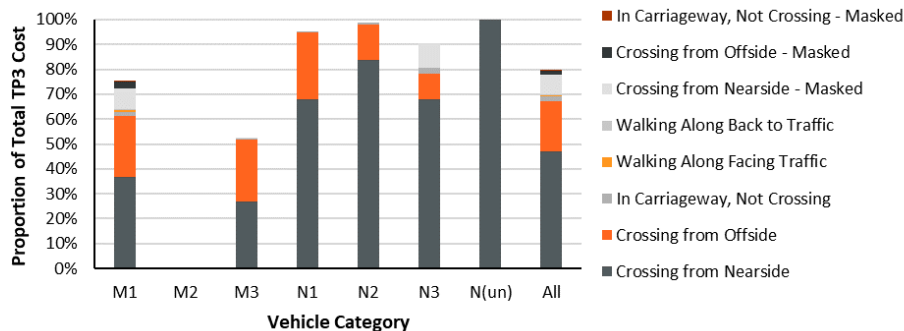
- VRU-Proxi Question:
 - **Q6: What shall the scope of the regulation be regarding the motion of the VRU during the collisions that the regulation is attempting to prevent?**
- Summary of Task Force Discussions:
 - Concerns remain over technical feasibility of detecting VRU motion at boundaries of system capability
 - Concerns primarily based on speed that VRU and vehicle are travelling relative to MOIS sensor fields of detection
 - Further discussion provided in Q7b-Q10 and Q12, where forward and lateral detection boundaries are discussed relative to VRU travel speeds



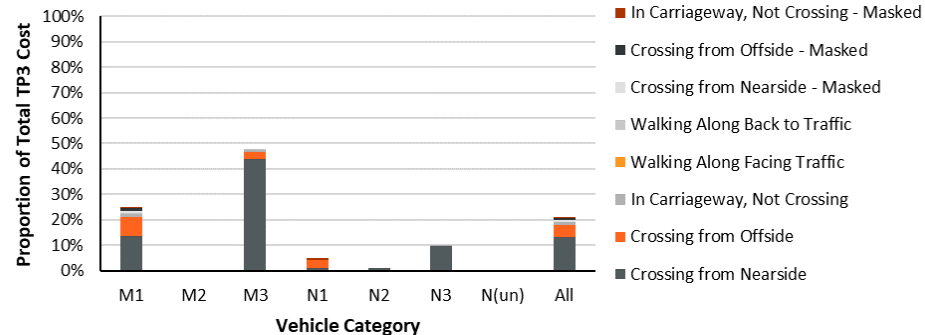
VRU Manoeuvres (Q6): Evidence #1

Pedestrian Manoeuvre as a Proportion of Total Annual Societal Costs of Target Population

Vehicle Moving-Off Manoeuvres



Vehicle Slowing/Stopping Manoeuvres



Key Points:

- Crossing from nearside/offside are leading pedestrian manoeuvres for all categories
- Crossing from nearside while masked (obstructed) also important for M1/N3 categories
 - Representative of a pedestrian crossing from behind a vehicle from the nearside of the carriageway
- Not very many collisions when stood in pathway of vehicle

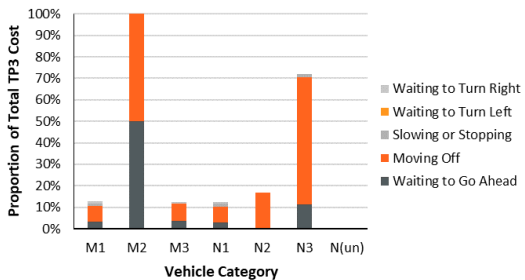
VRU Manoeuvres (Q6): Evidence #2

Cyclist Manoeuvre as a Proportion of Total Annual Societal Costs of Target Population

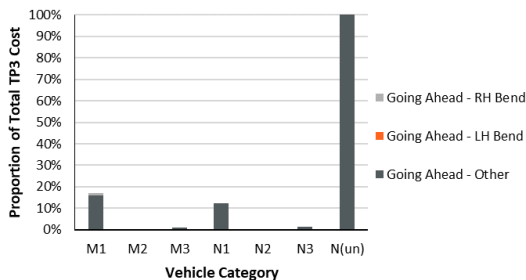
Vehicle Moving-Off
Manoeuvres

Vehicle Slowing/
Stopping Manoeuvres

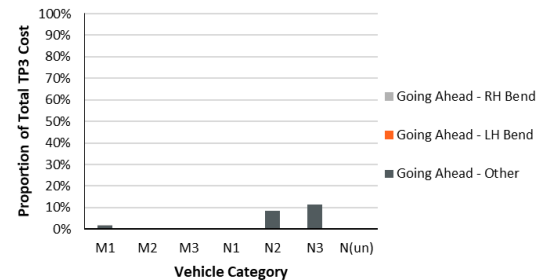
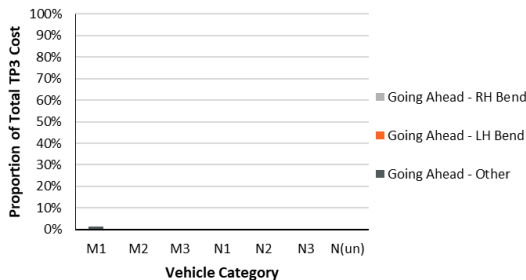
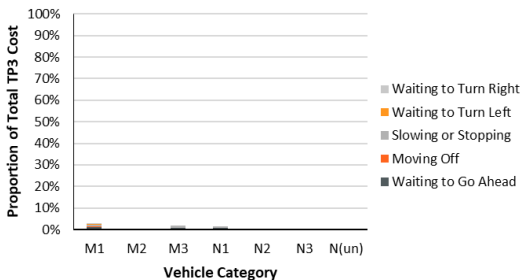
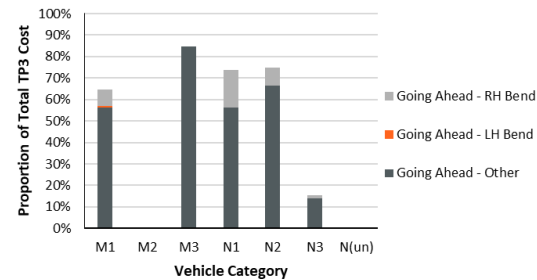
Cyclist Not Crossing



Cyclist Crossing from Nearside



Cyclist Crossing from Offside



Key Points:

- Cyclist crossing from offside is leading cyclist manoeuvre for M1/M3/N1/N2 categories
- Cyclist not crossing is leading cyclist manoeuvre for N3 category vehicles

VRU Manoeuvres (Q6)

What motion is the VRU undertaking?

- VRU-Proxi Question:
 - **Q6: What shall the scope of the regulation be regarding the motion of the VRU during the collisions that the regulation is attempting to prevent?**
- Summary of Options:
 - Crossing from nearside/offside
 - Stationary in road facing towards/away
 - Moving in road longitudinally towards/away to vehicle manoeuvre
 - Obstructed
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - The MOIS system shall detect pedestrians crossing from the nearside and offside of the vehicle
 - The MOIS system shall detect stationary cyclists facing away in front of the vehicle
 - The MOIS system shall detect cyclists facing away and moving off longitudinally in front of the vehicle
 - The MOIS system shall detect cyclists crossing from the nearside and offside of the vehicle
 - The MOIS system does not need to detect VRUs that are masked by obstruction
 - Consensus Discussion Outcome:
 - [To Be Completed]



VRU Manoeuvres (Q7a)

Should direct vision be taken into account?

- VRU-Proxi Question:
 - **Q7a: What shall the scope of the regulation be regarding vehicles with “good” direct vision?**
- Summary of Options:
 - Vehicles with “good” direct vision (i.e. M1/M2/M3/N1) included/excluded
- Summary of VRU-Proxi-11 Discussion:
 - Although answers were given in the direction that vehicles with good direct vision don’t need MOIS, TRL stated that driver failed to look properly is a leading contributory factor.
 - EC agreed to not exclude MOIS for vehicles with good visibility (for now).
 - OICA raised the issue that there is also no confidence that a distracted driver will notice the information/warning signal.
- Summary of Task Force Discussions:
 - Collision landscape (see Q1):
 - Failed to look properly leading causation factor in moving-off and low speed forward motion collisions
 - Vehicle blind spots only contribute to N2/N3 vehicle collisions
 - Driver acceptance:
 - Concern of the effect of providing true positive signals to drivers when driver already aware of VRU hazard
 - This may impact signal effectiveness, due to driver desensitising through over-exposure



VRU Manoeuvres (Q7a)

Should direct vision be taken into account?

- VRU-Proxi Question:
 - **Q7a: What shall the scope of the regulation be regarding vehicles with “good” direct vision?**
- Summary of Options:
 - Vehicles with “good” direct vision (i.e. M1/M2/M3/N1) included/excluded
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - Intention of the MOIS Regulation is to focus on information systems to improve driver awareness of VRU located in close-proximity to the front of the vehicle, regardless of VRU visibility
 - Different HMI requirements shall be considered for solutions where VRU is in vehicle blind spot and where VRU is visible to the driver but driver is unaware of VRU in close-proximity
 - Consensus Discussion Outcome:
 - [To Be Completed]



VRU Manoeuvres (Q7b-Q10, Q12)

How far away should the VRU be detected from the front/sides of the vehicle?

- VRU-Proxi Question:
 - Q7b/8: What shall the scope of the regulation be regarding the forward position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q9/10: What shall the scope of the regulation be regarding the lateral position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q12: What shall the scope of the regulation be regarding the crossing speeds of the VRU that the system shall be operational for when crossing?
- Summary of Options:
 - Min. forward detection distance to test target: 0.35 m
 - Max. forward detection distance to test target: 3.6 m, 5.55 m, 7.5 m
 - Max. lateral detection distance to pedestrian test target: 1.2-2.0 m from centreline, 25% width or full width
 - Max. lateral detection distance to cyclist test target: 2.0-5.9 m from centreline, 25% width or full width
 - Pedestrian speeds: 3 kph, 4kph, 5 kph; Cyclist speeds: 5 kph, 10 kph, 15 kph
- Summary of Task Force Discussion:
 - Detection distances options based on expected vehicle and VRU speeds, assumed driver reaction/braking times and previously agreed UNECE Regulation specifications
 - Concern regarding technical and cost-effectiveness of detecting within full range of field of detection
 - Concern that greater lateral detection distance requirements will result in increased false positives
 - This may reduce driver acceptance of the system, which may in turn reduce effectiveness
 - Different signals could have different requirements



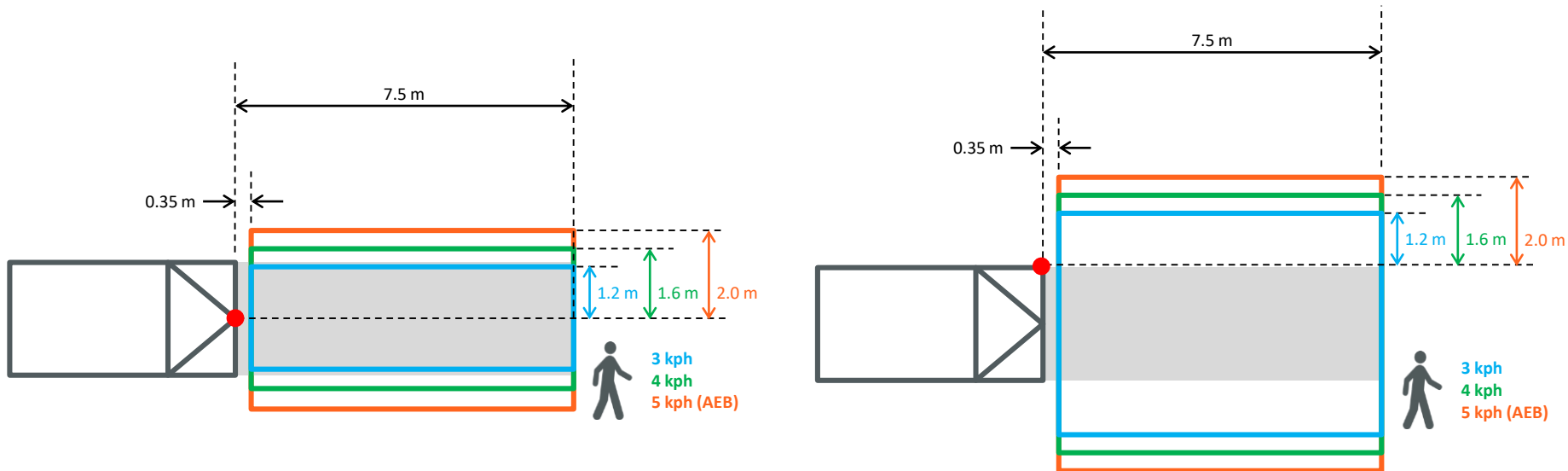
VRU Manoeuvres (Q7b-Q10, Q12)

How far away should the VRU be detected from the front/sides of the vehicle?

- Driver reaction/braking time assumption:
 - 1.4 seconds
- Maximum forward MOIS detection boundary
 - Maximum operational speed: 20 kph (5.555... m/s)
 - Maximum detection boundary for 1.4 s driver reaction time: 7.777... m
 - *Proposed that maximum forward test boundary: 7.75 m (7.5 m to edge of test target shoulder)*
 - Alternative boundaries for different maximum operational speeds: 10 kph: 3.888... m; 15 kph: 5.833... m
- Minimum forward MOIS detection boundary
 - Proximity signal may be active while stationary, thus min. distance is as near to vehicle as feasible
 - Minimum sensor clearance: 0.3 m
 - *Proposed that minimum forward test boundary: 0.6 m (0.35 m to edge of test target shoulder)*
- Maximum lateral MOIS detection boundaries
 - Pedestrian distance at LPI(@1.4s): 1.17 m (@3 kph), 1.56 m (@4 kph), 1.94 m (@5 kph [AEB])
 - *Proposed that minimum lateral test boundary for pedestrians: 2.0 m (to foremost point of test target)*
 - Cyclist distance at LPI(@1.4s): 1.94 m (@5 kph [BSIS]), 3.88 m (@10 kph), 5.83 m (@15 kph [AEB])
 - *Proposed that minimum lateral test boundary for cyclists: 5.9 m (to foremost point of test target)*
 - Lateral detection distance dependent on collision point assumption (centre/25% width/0% width)

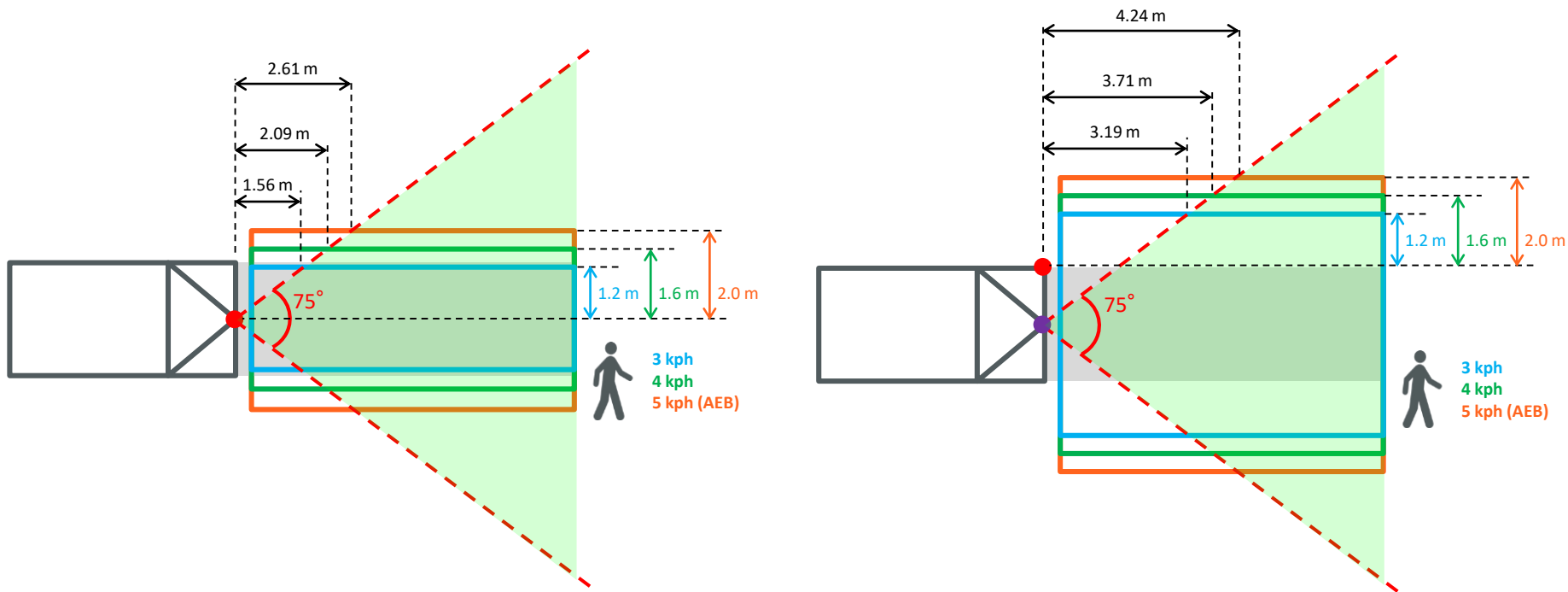
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1a

Potential Proximity Information Signal Detection Zone Requirements for Pedestrians



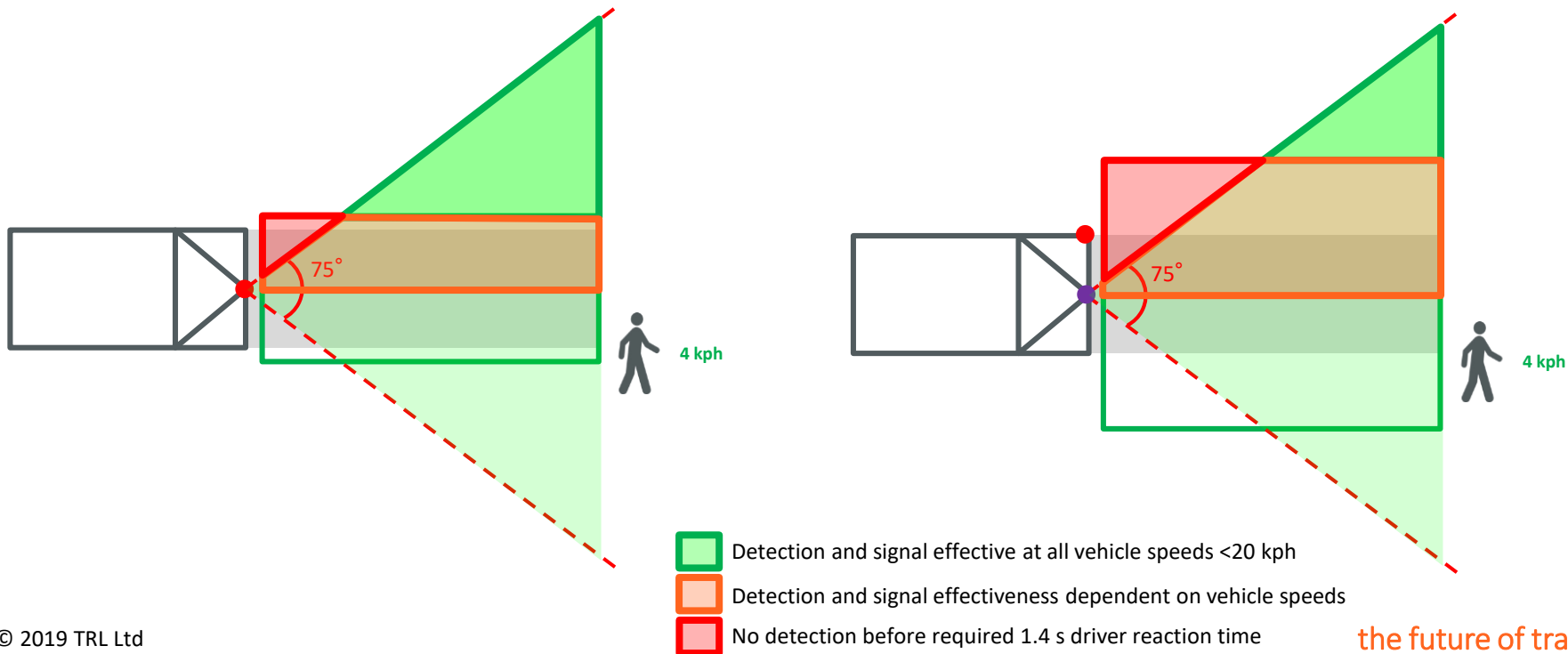
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1b

Proximity Information Signal Detection Zones for Pedestrians – Overlaid with Short Range Radar



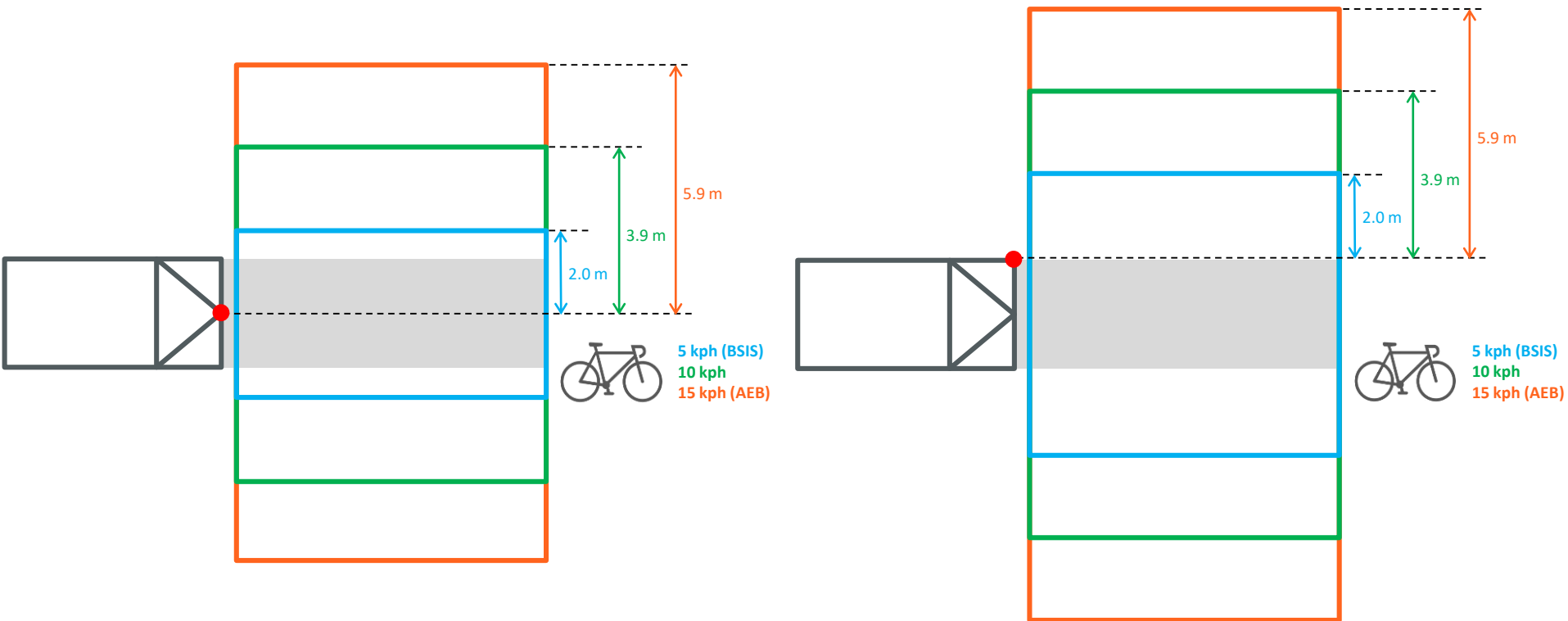
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1c

Short Range Radar Blind Spots for Pedestrian Detection



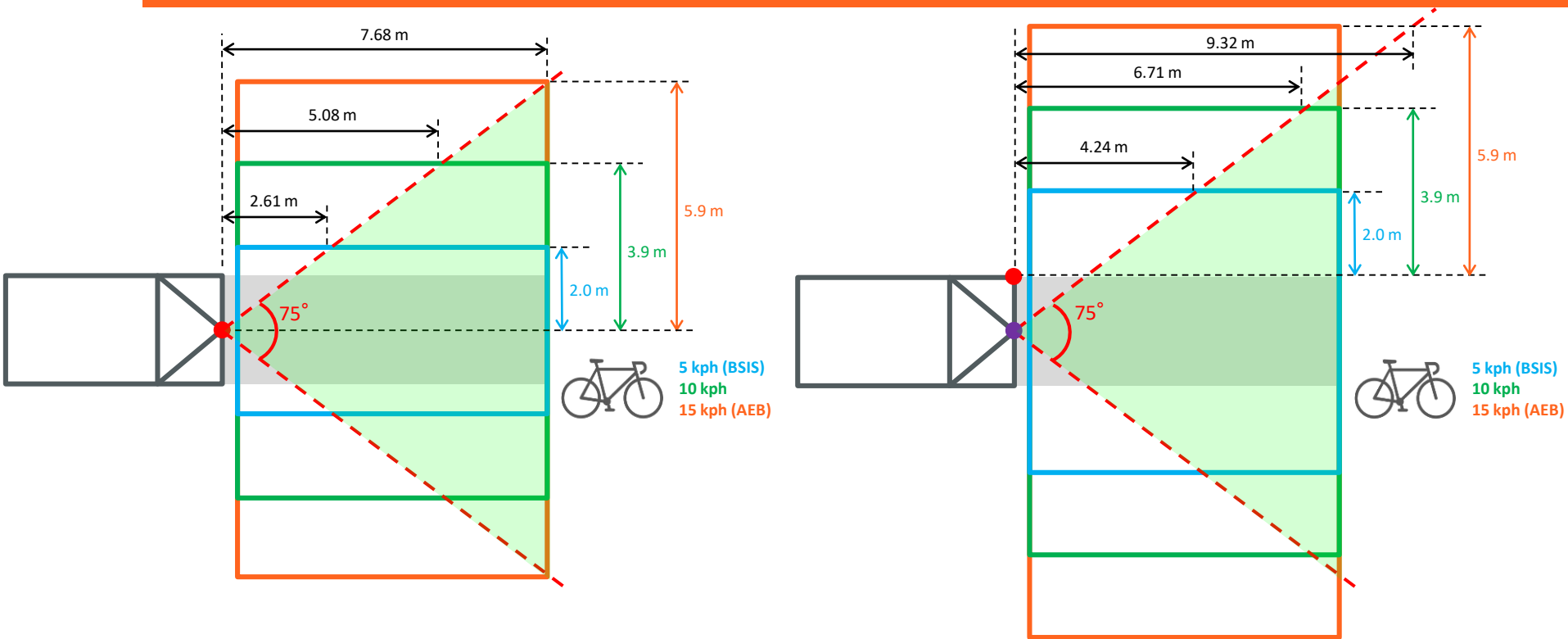
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1d

Potential Proximity Information Signal Detection Zone Requirements for Cyclists



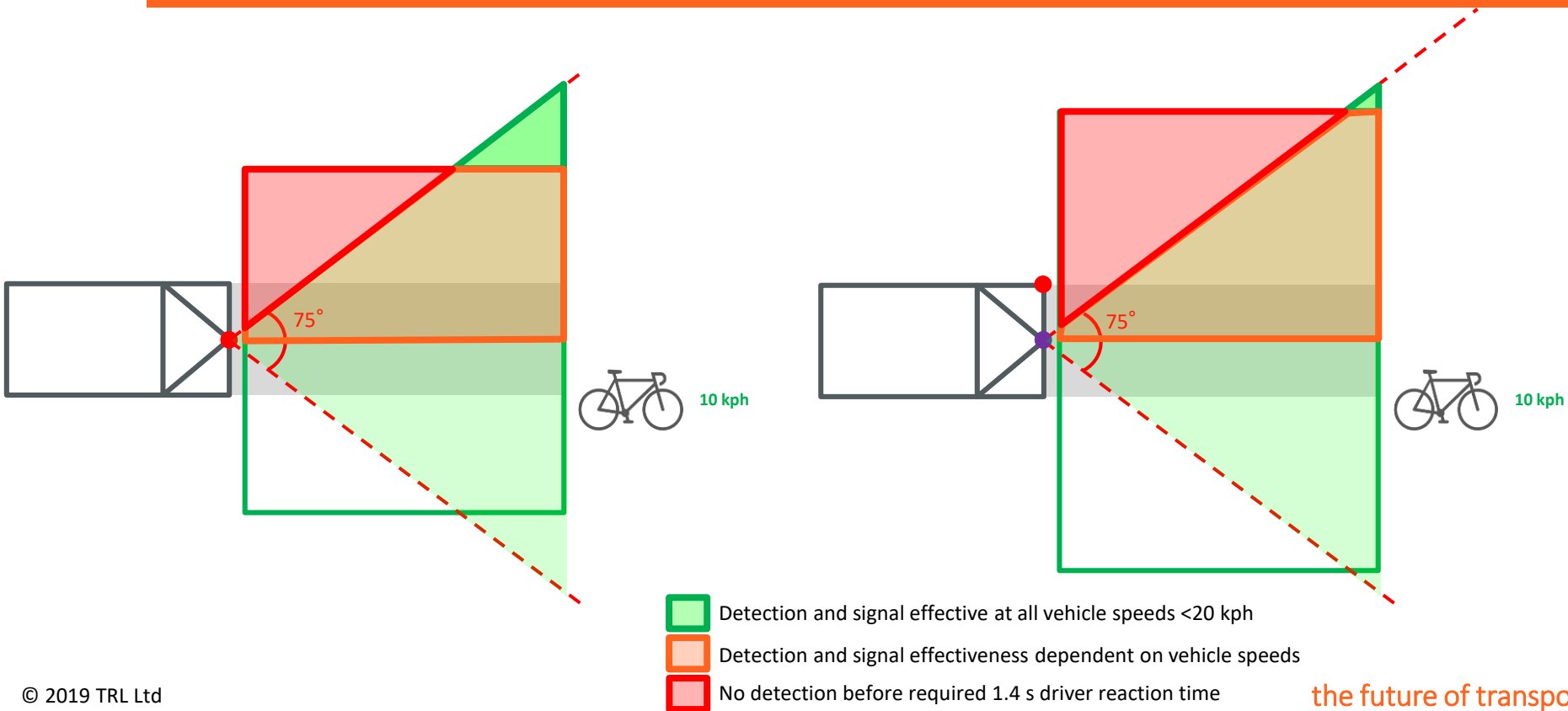
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1e

Proximity Information Signal Detection Zones for Cyclists – Overlaid with Short Range Radar



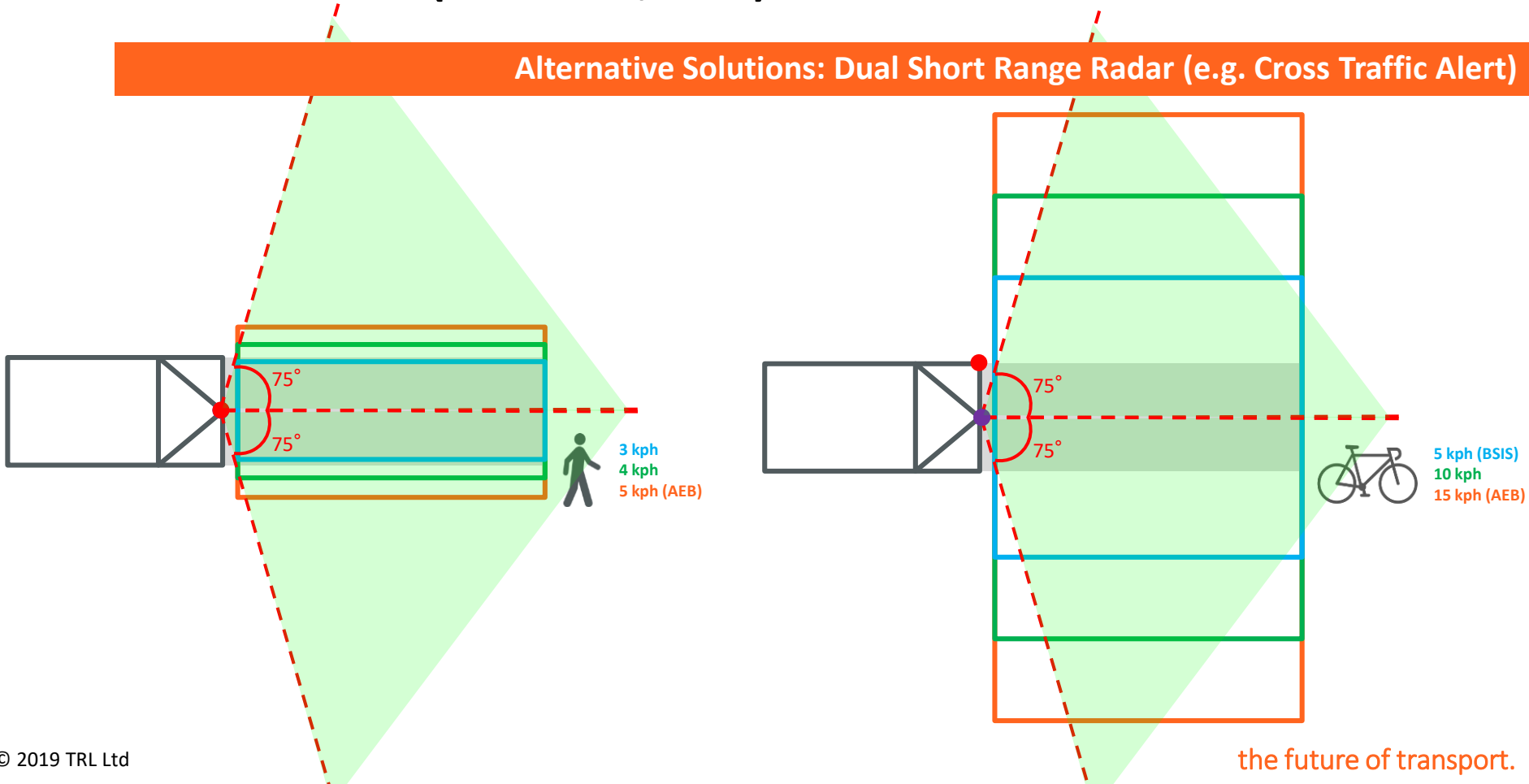
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1e

Short Range Radar Blind Spots for Cyclist Detection



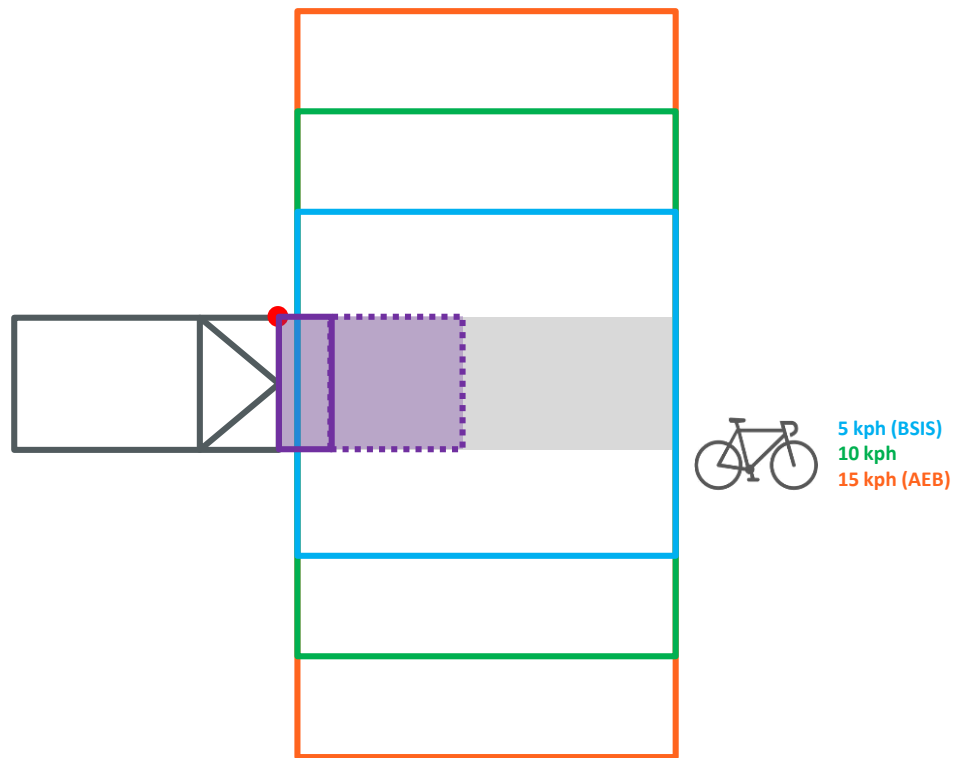
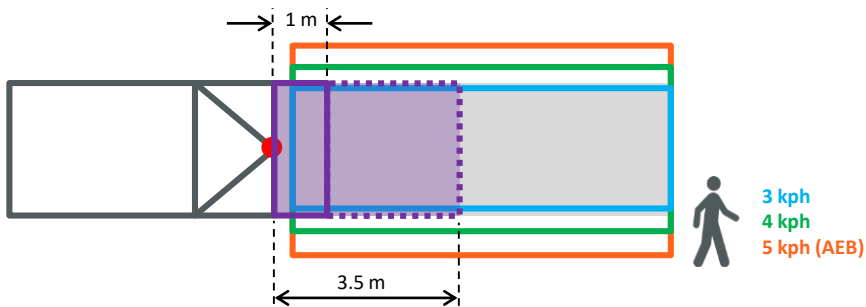
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1f

Alternative Solutions: Dual Short Range Radar (e.g. Cross Traffic Alert)



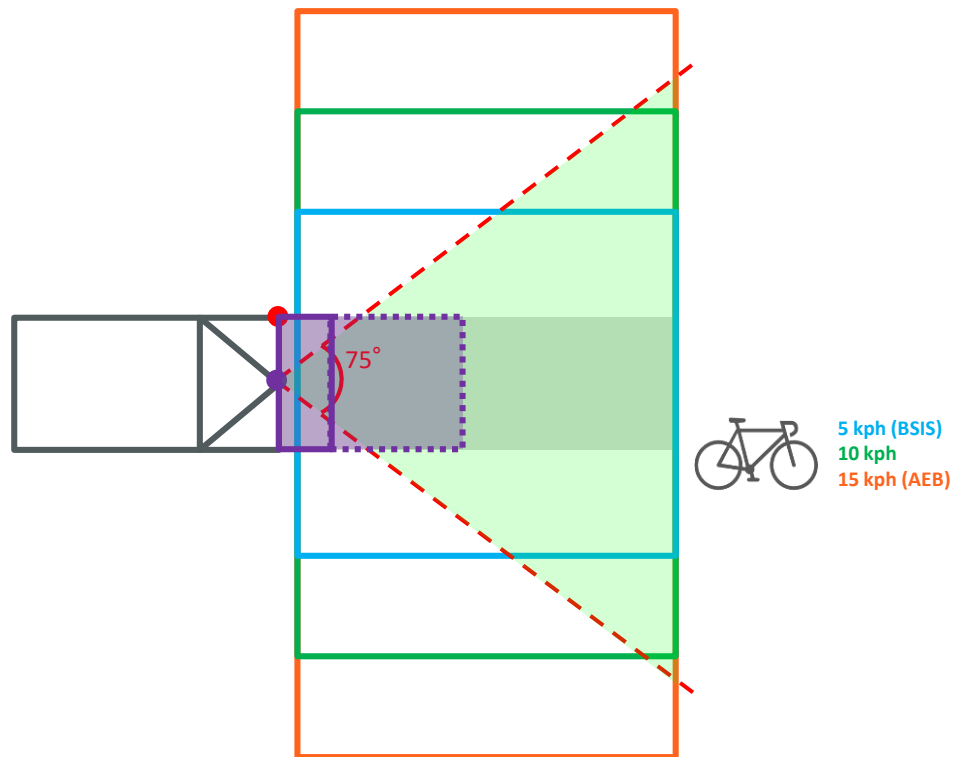
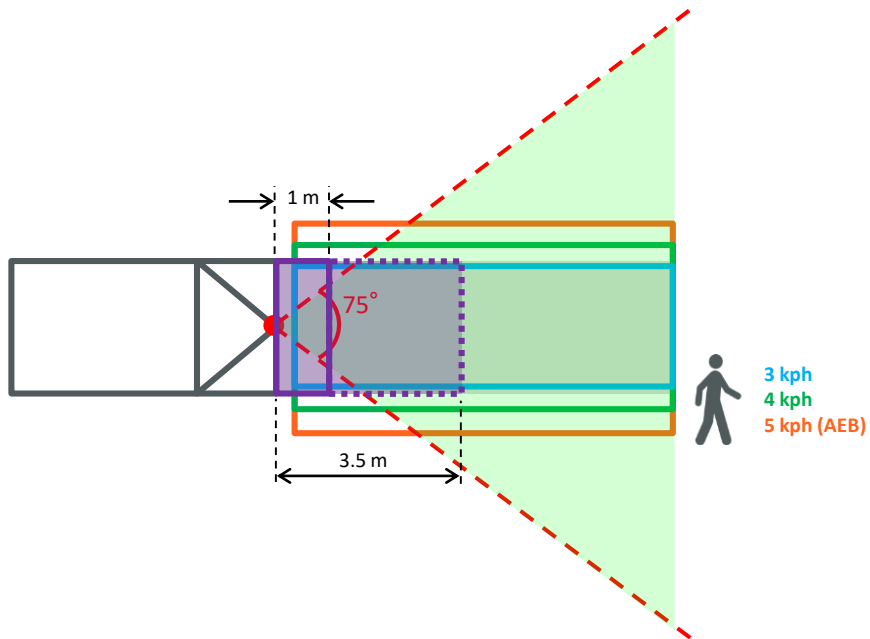
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1g

Alternative Solutions: Ultrasonic Detection Systems



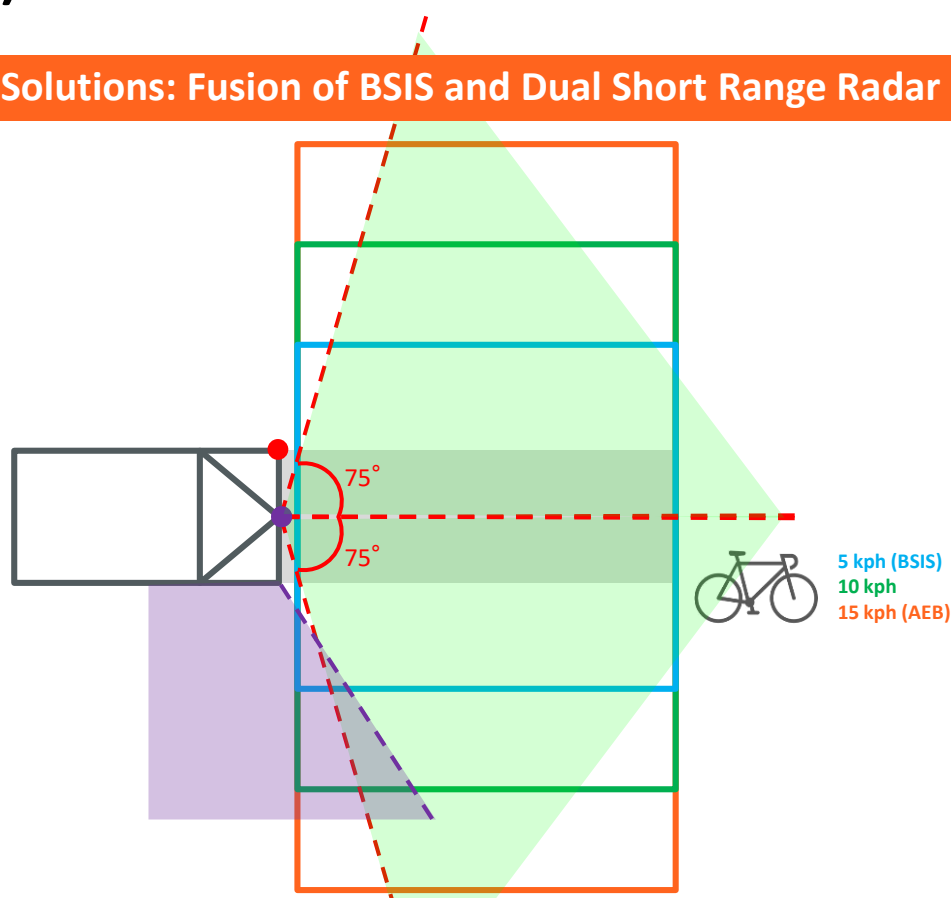
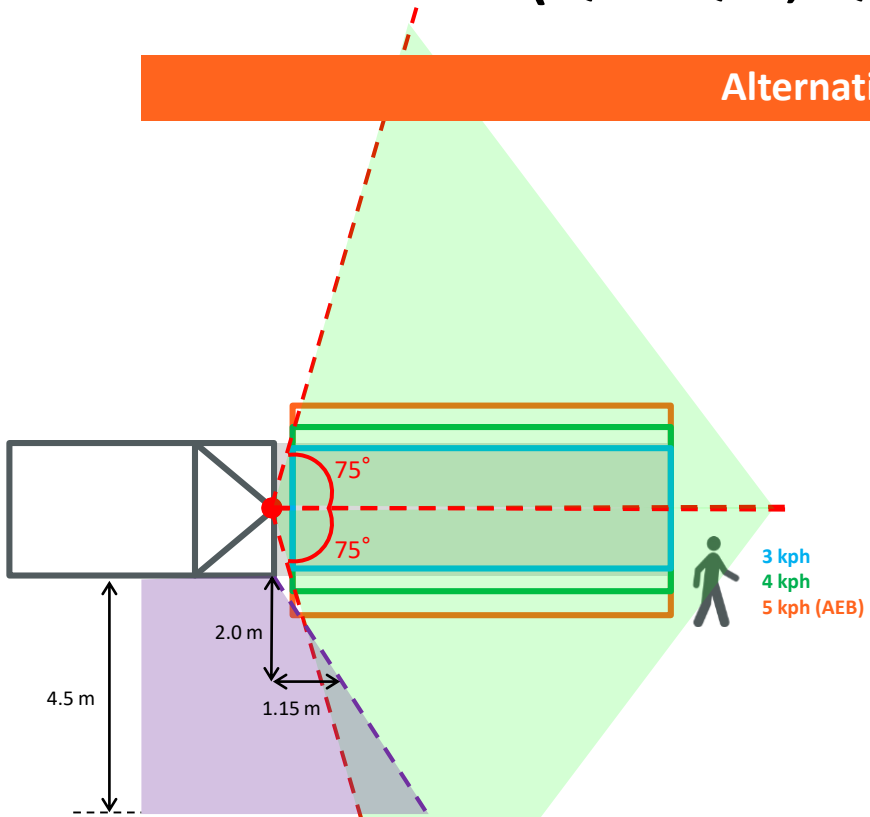
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1h

Alternative Solutions: Fusion of Short Range Radar and Ultrasonic Detection Systems



VRU Manoeuvres (Q7b-Q10, Q12): Evidence #1i

Alternative Solutions: Fusion of BSIS and Dual Short Range Radar



VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2a

Potential Collision Warning Signal Detection Zone Requirements

- Dynamic testing used to establish a last point of interest (LPI) for collision warning signal:
 - Vehicle accelerations during dynamic tests challenging to specify and control at low speeds
 - Propose target speed range required by a specified travel distance/s (i.e. average acceleration)
 - Target Speed Range @1m: 4-6 kph
 - Target Speed Range @4m: 8-12 kph
 - Guarantees average vehicle acceleration ranges of: 0.617-1.389 m/s²
 - As vehicle will still be accelerating when collision warning signals provided, this means the LPI for the signal may be across a range of travel distances depending on the actual vehicle acceleration
 - LPI tests ensure collision warning signal provided at least 1.4 seconds before conflict point
 - Knowing the actual vehicle speed at the specified travel distance/s means that the expected LPI may be back-calculated and compared to the time/distance when the signal was provided
 - *This provides a potential boundary condition for the collision warning signal requirements*
- Forward distance to conflict point during dynamic tests:
 - Maximum forward conflict point distance based on maximum forward detection boundary: 7.75 m
 - Minimum forward conflict point distance must allow enough time to accelerate/brake without colliding with test target
 - 2 m (1.75 m clearance to test target shoulder) allows vehicle to accelerate for 1 m, then brake for 0.75 m
 - Larger distances considered less representative of a “close-proximity” collision
 - Shorter distances means little discernible movement before LPI for greatest acceleration (1.389 m/s²)

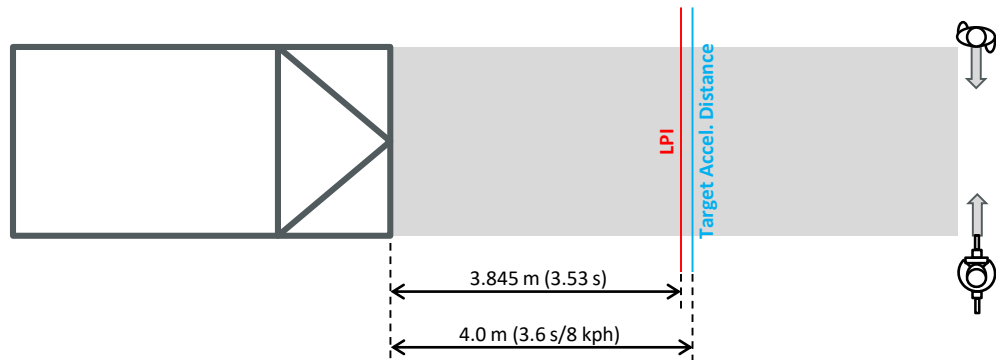
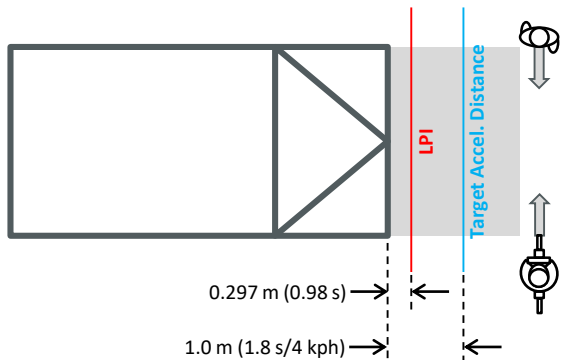
VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2b

Potential Collision Warning Signal Detection Zone Requirements

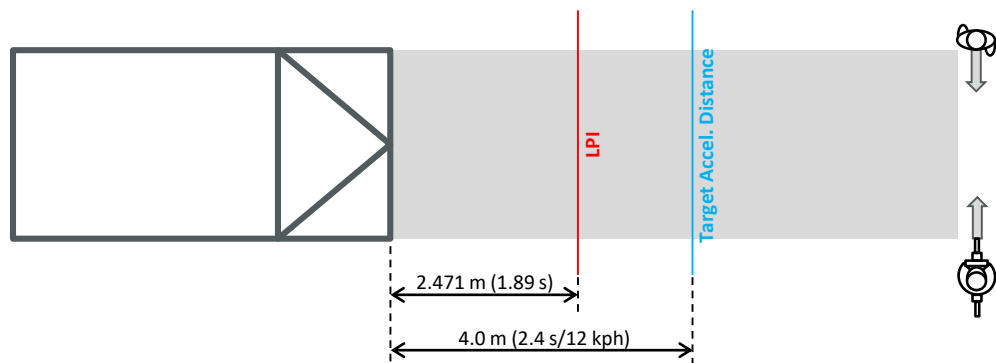
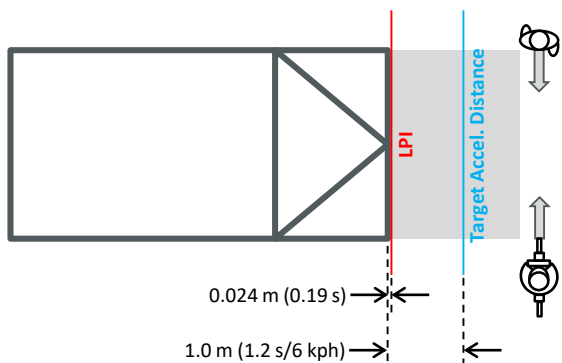
Minimum VRU distance (1.75 m clearance)

Maximum VRU distance (7.5 m clearance)

Min Accel.
(0.62 m/s²)



Max Accel.
(1.39 m/s²)



VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2c

Calculation of Collision Warning Signal LPI Requirements

- Key test parameters for dynamic tests:
 - Minimum close-proximity MOIS collision warning signal test parameters (1.75 m separation)

Av. Vehicle Acceleration	1.0 m Target Speed	1.0 m Target Time	Decel. Req. To Avoid Impact	Extrapolated 1.75 m Speed	Extrapolated 1.75 m Time	LPI Vehicle Distance	LPI Vehicle Velocity	LPI Time
0.62 m/s ²	4 kph	1.8 s	-0.82 m/s ²	5.3 kph	2.38 s	0.297 m	2.2 kph	0.98 s
0.96 m/s ²	5 kph	1.44 s	-1.29 m/s ²	6.6 kph	1.90 s	0.123 m	1.8 kph	0.50 s
1.39 m/s ²	6 kph	1.2 s	-1.85 m/s ²	7.9 kph	1.59 s	0.024 m	0.9 kph	0.19 s

- Maximum close-proximity MOIS collision warning signal test parameters (7.5 m separation)

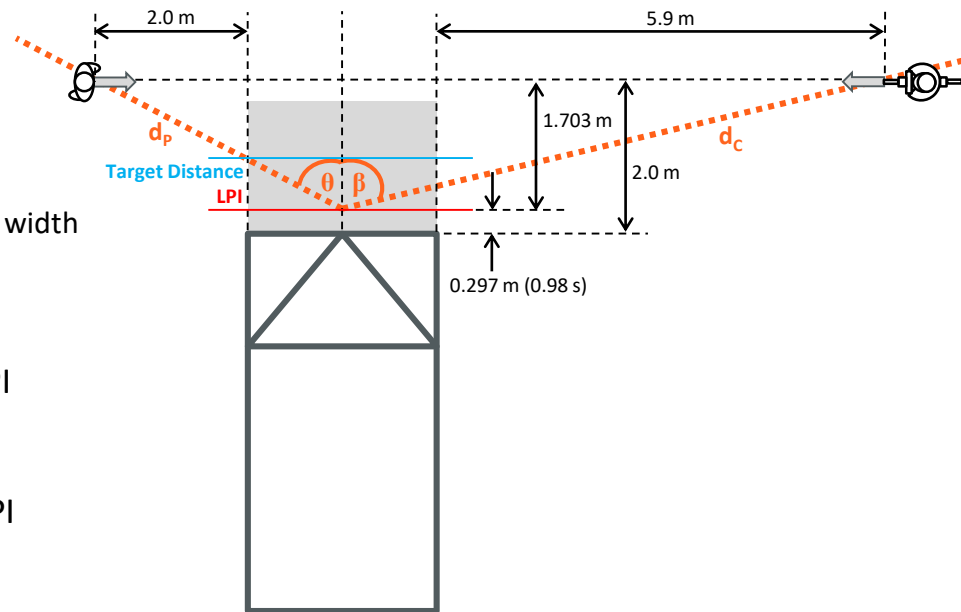
Av. Vehicle Acceleration	4.0 m Target Speed	4.0 m Target Time	Decel. Req. To Avoid Impact	Extrapolated 7.5 m Speed	Extrapolated 7.5 m Time	LPI Vehicle Distance	LPI Vehicle Velocity	LPI Time
0.62 m/s ²	8 kph	3.6 s	-0.71 m/s ²	11.0 kph	4.93 s	3.845 m	7.8 kph	3.53 s
0.96 m/s ²	10 kph	2.88 s	-1.10 m/s ²	13.7 kph	3.94 s	3.120 m	8.8 kph	2.54 s
1.39 m/s ²	12 kph	2.4 s	-1.59 m/s ²	16.4 kph	3.29 s	2.471 m	9.4 kph	1.89 s

VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2d

Proposed Collision Warning Signal Field of Detection Requirements at LPI

Worst-case field of detection required for collision warning signal:

- Worst case occurs for:
 - Minimum vehicle acceleration
 - Maximum proposed VRU speed
 - Most lateral VRU impact location
- Detection of VRU at LPI
 - LPI => 1.4 s before conflict point at 0% vehicle width
 - VRU positioned 1.4 s from conflict point
 - Pedestrian => 5 kph
 - Cyclist => 15 kph
- Required worst case field of view angles @LPI
 - $\theta = 62.3^\circ$
 - $\beta = 76.6^\circ$
- Required worst case detection distances @LPI
 - $d_p = 2.63$ m
 - $d_c = 6.14$ m
- All significantly larger field of view angles and detection distances than currently feasible for single sensor technology to achieve

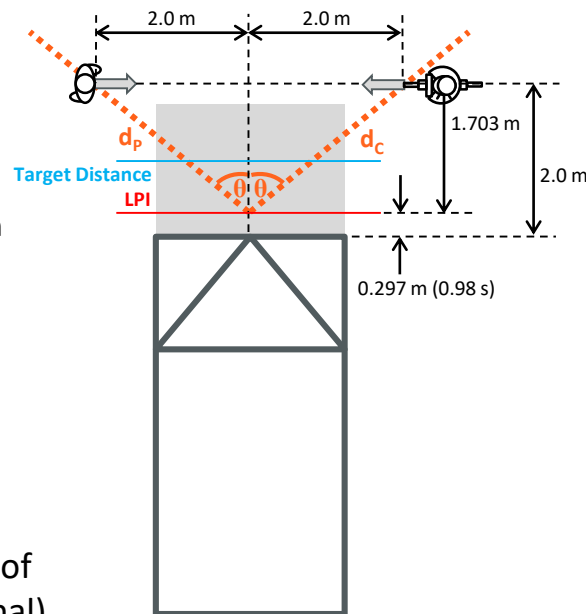


VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2e

Proposed Collision Warning Signal Field of Detection Requirements at LPI

Alternative #1 field of detection required for collision warning signal:

- Minimum vehicle acceleration
 - VRU speed 5 kph
 - Central VRU impact location
- Detection of VRU at LPI
 - LPI => 1.4 s before conflict point at 50% vehicle width
 - VRU positioned 1.4 s from conflict point
 - Pedestrian => 5 kph
 - Cyclist => 5 kph
- Required field of view angles @LPI
 - $\theta = 49.6^\circ$
- Required detection distances @LPI
 - $d_p = d_c = 2.63 \text{ m}$
- Still challenging detection angles, but combination of sensors (as discussed for proximity information signal) should be able to detect with confidence

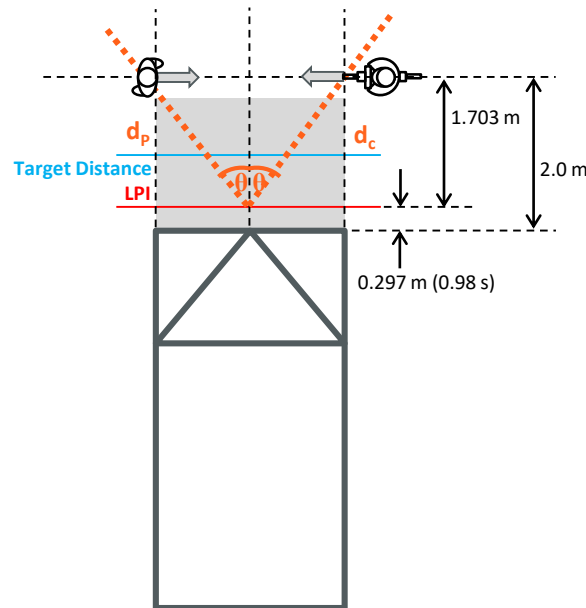


VRU Manoeuvres (Q7b-Q10, Q12): Evidence #2f

Proposed Collision Warning Signal Field of Detection Requirements at LPI

Alternative #2 field of detection required for collision warning signal:

- Minimum vehicle acceleration
 - LPI as VRU enters vehicle trajectory
 - VRU speed ≤ 5 kph (due to 2.0 m travel in 1.4 s)
- Detection of VRU at LPI
 - LPI \Rightarrow 1.4 s before conflict point at vehicle centreline
 - VRU positioned 1.4 s from conflict point
 - Pedestrian \Rightarrow 5 kph
 - Cyclist \Rightarrow 5 kph
- Required field of view angles @LPI
 - $\theta_{\max} = 21.3^\circ$
- Required detection distances @LPI
 - $d_{\max} = 2.11$ m
- For these requirements, the VRU will travel the full width of vehicle before being impacted



VRU Manoeuvres (Q7b-Q10, Q12)

How far away should the VRU be detected from the front/sides of the vehicle?

- VRU-Proxi Question:
 - Q7b/8: What shall the scope of the regulation be regarding the forward position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q9/10: What shall the scope of the regulation be regarding the lateral position of the VRU during the collisions that the regulation is attempting to prevent?
 - Q12: What shall the scope of the regulation be regarding the crossing speeds of the VRU that the system shall be operational for when crossing?
- Summary of Options:
 - Min. forward detection distance to test target: 0.35 m
 - Max. forward detection distance to test target: 3.6 m, 5.55 m, 7.5 m
 - Max. lateral detection distance to pedestrian test target: 1.2-2.0 m from centreline, 25% width or full width
 - Max. lateral detection distance to cyclist test target: 2.0-5.9 m from centreline, 25% width or full width
 - Pedestrian speeds: 3 kph, 4kph, 5 kph; Cyclist speeds: 5 kph, 10 kph, 15 kph



VRU Manoeuvres (Q7b-Q10, Q12)

How far away should the VRU be detected from the front/sides of the vehicle?

- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - Close proximity information signal and collision warning signal performance shall be evaluated through two different procedures (static and dynamic)
 - VRU test target speeds shall be 5 kph
 - **Static Testing**
 - Minimum forward detection distance for proximity information signal shall be 0.35 m to test target
 - Maximum forward detection distance for proximity information signal shall be 7.5 m to test target
 - Maximum nearside/offside lateral detection distance for proximity information signal shall be 2.0 m between the test target and 25% width of the vehicle
 - **Dynamic Testing**
 - Test vehicle shall accelerate forward towards collision point with an average acceleration of 0.617-1.389 m/s²
 - Last point of information (LPI) shall be 1.4 seconds before collision point
 - Collision point shall be at the centreline of the vehicle (worst case: VRU will be 2.0 m from vehicle centreline, vehicle will be 1.7 m from VRU test target shoulder)
 - Consensus Discussion Outcome:
 - [To Be Completed]



VRU Manoeuvres (Q11)

Should VRUs stepping out from behind an obstruction be saved?

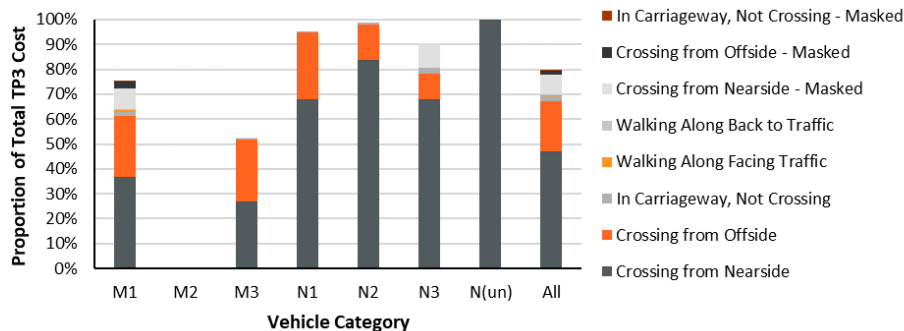
- VRU-Proxi Question:
 - **Q11: What shall the scope of the regulation be regarding the testing for VRUs that are obstructed from view?**
- Summary of Options:
 - Obstruction by environmental clutter/vehicle
 - Obstructed pedestrian crossing from nearside/offside
- Summary of VRU-Proxi-11 Discussion:
 - Discussed in Q6
 - Detection of VRUs masked by obstructions before stepping out to not be included
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - VRU masked by obstructions tests shall not be included in test cases
 - Consensus Discussion Outcome:
 - [To Be Completed]



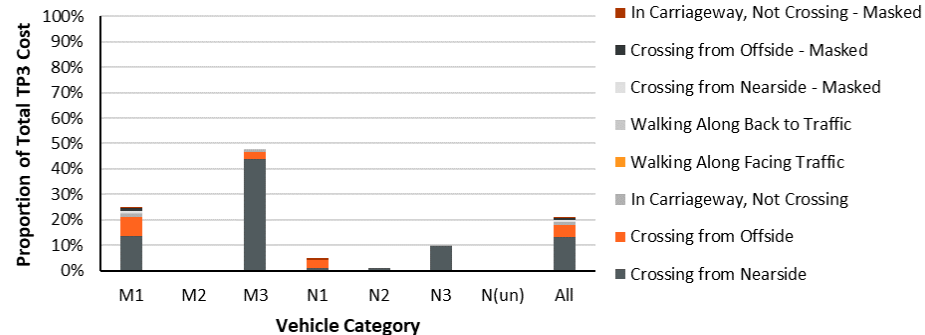
VRU Manoeuvres (Q11): Evidence #1

Pedestrian Manoeuvre as a Proportion of Total Annual Societal Costs of Target Population

Vehicle Moving-Off Manoeuvres



Vehicle Slowing/Stopping Manoeuvres



Key Points:

- Crossing from nearside/offside are leading pedestrian manoeuvres for all categories
- Crossing from nearside while masked (obstructed) important for M1/N3 categories
 - Representative of a pedestrian crossing from behind a vehicle from the nearside of the carriageway
- Not very many collisions when stood in pathway of vehicle

False Positive Tests



False Positive Tests (Q13)

Shall false-positive tests be included in the performance assessment?

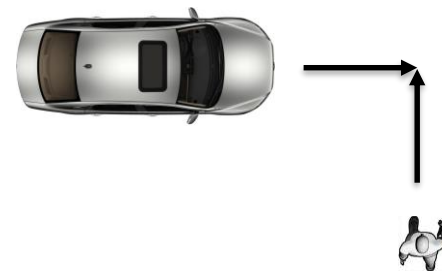
- VRU-Proxi Question:
 - **Q13: What shall the scope of the regulation be regarding testing for false positives?**
- Summary of Options:
 - No false positive test, false positive test in environmental clutter or false positive test when VRU not in path/due to cross path of vehicle
- Summary of VRU-Proxi-11/Task Force Discussion:
 - Not discussed
- Summary of VRU-Proxi-10 Discussion:
 - False positive tests should be included to ensure minimum performance regarding false positives
- Initial VRU-Proxi Member Consultation Feedback:
 - **J:** To be included **both scenes**.
 - **DE:** A false positive test would **require a clear definition** as to what is not a relevant situation. This is probably not possible.
 - **CLEPA:** It is **very difficult to establish a robust false positive test** which would certainly result in very burdensome procedures, therefore CLEPA does not support a false positive test.



False Positives (Q13): Evidence #1

Draft AEB Regulation for M1/N1 Detection of Pedestrians/Cyclists during Forward Motion

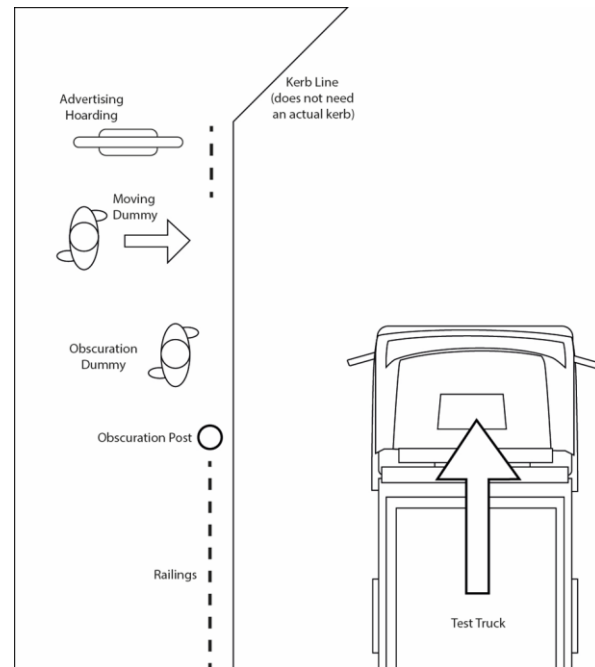
- Scope of regulation
 - Vehicles: M1/N1; VRUs: Pedestrians/[Cyclists]
- Test Scenarios
 - TP test: Forward VUT motion in straight line, at 20-60 kph speeds, with 6yo pedestrian target crossing at 5 kph from nearside with collision point at longitudinal centreline of VUT front end
 - Tested at 3 different specified speeds (+ other speeds at TS discretion)
 - FP test: As above, with pedestrian target stationary, facing VUT direction of travel and 1 m away from VUT nearside
 - Tested at 1 speed at TS discretion



False Positives (Q13): Evidence #2

TfL Blind Spot Warning Standards for M3/N3 Detection of Pedestrians during Forward Motion

- Scope of standards
 - Vehicles: M3/N3; VRUs: Pedestrians
- Test Scenarios
 - Proximity tests: Stationary VUT with pedestrian target crossing at 3-5 kph starting 2.2 m from nearside of VUT
 - Tested at combination of 2-3 VRU-VUT distances (0.3 m, [2.5] m & 4.0 m) and pedestrian targets (6yo and adult)
 - Collision warning/motion inhibit tests: Forward VUT motion in straight line from 0 to 10 kph with pedestrian target stationary in front of VUT between 25-75% width
 - Tested at combination of 2-3 VRU-VUT distances (0.3 m, [2.5] m & 4.0 m) and pedestrian targets (6yo and adult)
 - FP test: As above for proximity test, with environmental clutter & pedestrian targets stationary prior to movement



False Positive Tests (Q13)

Shall false-positive tests be included in the performance assessment?

- VRU-Proxi Question:
 - **Q13: What shall the scope of the regulation be regarding testing for false positives?**
- Summary of Options:
 - No false positive test, false positive test in environmental clutter or false positive test when VRU not in path/due to cross path of vehicle
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - A false positive test shall be included in test case
 - The false positive test shall relate to the collision warning signal only
 - The false positive test shall require the test vehicle to move off from rest in a straight line past a static pedestrian dummy located 1.0 m laterally from the vehicle trajectory
 - The false positive test shall require the test vehicle to move off from rest in a straight line past standardised environmental clutter located 1.0 m laterally from the vehicle trajectory
 - Consensus Discussion Outcome:
 - [To Be Completed]



Human-Machine Interface



Human Machine Interface (Q14)

Shall HMI requirements be considered in scope?

- VRU-Proxi Question:
 - **Q14: What shall the scope of the regulation be regarding the requirements for HMI?**
- Summary of Options:
 - No HMI requirements, HMI requirements for proximity information signal only or HMI requirements for proximity information and collision warning signals
- Summary of VRU-Proxi-10 Discussion:
 - Draft BSIS and AEBS(M1/N1) regulations provide precedent for defining proximity information and collision warning signal HMI, could also align with ISO 15006/15008
- Initial VRU-Proxi Member Consultation Feedback:
 - J: Only **timing and modality to be described like BSIS.**
- Summary of VRU-Proxi-11 Discussion:
 - Not discussed



Human Machine Interface (Q14)

Shall HMI requirements be considered in scope?

- VRU-Proxi Question:
 - **Q14: What shall the scope of the regulation be regarding the requirements for HMI?**
- Summary of Task Force Discussion:
 - HMI is important to effectiveness of MOIS system – as optimises driver interaction with system
 - Proposed MOIS Regulation Signal Definitions/Intentions:
 - Proximity Information Signal
 - *“A signal with the purpose of informing the vehicle driver of a VRU located in close-proximity to the front end of the vehicle”*
 - Only active when vehicle is stationary and non-intrusive, to avoid driver irritation
 - Collision Warning Signal
 - *“A signal with the purpose of warning the vehicle driver of a potential collision between the vehicle and a VRU located in close-proximity to the front end of the vehicle”*
 - Only active when vehicle is in motion and intrusive, to ensure driver reaction to signal
 - Signal criticality, as defined by PD ISO/TR 12204-2012
 - Proximity information signal: Level 1 Priority (*Level 3 criticality, Level 2 urgency*)
 - Collision warning signal: Level 2 Priority (*Level 3 criticality, Level 3 urgency*)
 - Different draft Regulations take different approaches



Human Machine Interface (Q14): Evidence #1

Draft AEB Regulation for M1/N1 Detection of Pedestrians/Cyclists during Forward Motion

- Signal scope
 - Collision warning signal
 - Signal mode/s
 - Two modes from optical/acoustic/haptic
 - Key requirements
 - Optical signal shall be visible in daylight
 - No requirements about flashing, dB, directionality
 - Activation on start up/check position
 - Failure warning signal to be provided as optical signal mode
 - Where failure warning signal and collision warning signal integrated, collision warning signal shall be flashing
- | | |
|--------|--|
| 5.5. | Warning Indication |
| 5.5.1. | The collision warning referred to in paragraphs 5.2.1.1. and 5.2.2.1.. [5.2.3.1. and 5.2.4.1.] shall be provided by at least two modes selected from acoustic, haptic or optical. |
| 5.5.2. | A description of the warning indication and the sequence in which the collision warning signals are presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report. |
| 5.5.3. | Where an optical means is used as part of the collision warning, the optical signal may be the flashing of the failure warning signal specified in paragraph 5.5.4. |
| 5.5.4. | The failure warning referred to in paragraph 5.1.4.1. shall be a constant yellow optical warning signal. |
| 5.5.5. | Each AEBS optical warning signal shall be activated either when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signals shown in a common space. |
| 5.5.6. | The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat. |
| 5.5.7. | When the driver is provided with an optical warning signal to indicate that the AEBS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant and yellow in colour. The failure warning signal specified in paragraph 5.5.4. above may be used for this purpose. |

Human Machine Interface (Q14): Evidence #2

Draft BSIS Regulation for N3 Detection of Cyclists during Nearside Turns

■ Signal scope

- Proximity information signal
- Collision warning signal

■ Signal mode/s

- Proximity information signal: optical only
- Collision warning signal: Any mode from optical/acoustic/haptic

■ Key requirements

- Optical signal shall be visible in daylight, noticeable and verifiable
- BSIS proximity information signal shall be located $>30^\circ$ towards nearside
- Collision warning signal shall be different in mode or activation strategy from proximity information signal

5.3.1. The BSIS shall inform the driver about nearby bicycles that might be endangered during a potential turn, by means of an optical signal, so that the vehicle can be stopped before crossing the bicycle trajectory.

It shall also inform the driver about approaching bicycles while the vehicle is stationary before the bicycle reaches the vehicle front, taking into account a reaction time of 1.4 seconds. This shall be tested according to paragraph 6.6.

~~The BSIS shall warn the driver, by means of an optical signal, acoustical signal, haptical signal or any combination of these signals, when the risk of a collision increases.~~
The BSIS shall warn the driver, by means of an optical; Information signal

5.4.

5.4.1. The blind spot information referred to in paragraph 5.3.1.1. above shall be an information signal that is noticeable and easily verifiable by the driver from the driver's seat. This information signal shall be visible by daylight and at night.

5.4.2. The device emitting the information signal shall be located at the near side at an horizontal angle greater than 30° towards an axis parallel to the longitudinal median plane of the vehicle and going through the ocular reference point. ~~If the driver's seating position is located on the near side of the vehicle, this value may be reduced.~~

5.5. Warning signal

5.5.1. The warning signal referred to in paragraph 5.3.1.2. above shall be a signal differing, e.g. in mode or activation strategy, from the information signal specified in paragraph 5.4.

5.5.2. It shall be easily understandable for the driver to relate the warning signal to the potential collision. ~~In case the warning signal is an optical signal this signal shall also be visible by daylight and at night.~~

Human Machine Interface (Q14): Evidence #3

UNECE guidelines on establishing requirements for high-priority warning signals

- Eight HMI principles in guidelines
 1. Noticeable
 2. Distinguishable
 3. Directional
 4. Informative about hazard priority
 5. Timely
 6. Multiple signals appropriately prioritised
 7. Minimise false positives
 8. System status shall be displayed
- Differences in signal HMI
 - Collision warning signal:
 - Shall follow all eight principles
 - Proximity information signal:
 - Shall be less noticeable and may have more false positives than collision warning signal

ECE/TRANS/WP.29/2011/90

23. A total of eight principles for high-priority warnings were derived from the literature on warnings research and guidelines. These principles are as follows:

- 1 High-priority warning should be noticeable in the driving environment;
- 2 High-priority warning should be distinguishable from other messages;
- 3 High-priority warning should provide spatial cues to the hazard location;
- 4 High-priority warning should inform the driver of proximity of the hazard;
- 5 High-priority warning should elicit timely responses or decisions;
- 6 Multiple warnings should be prioritized;
- 7 False / nuisance warning rate should be low;
- 8 System status and degraded performance of high-priority warnings should be displayed.

Human Machine Interface (Q14)

Proposed MOIS HMI compliance with UNECE guidelines

1. Noticeable

- Proximity information signal: proposed amber optical signal
- Collision warning signal: proposed at least two of optical/auditory/haptic modes, with optical mode differing in activation strategy (flashing/colour etc.)

2. Distinguishable

- Option #1 to integrate with AEB forward collision signal and BSIS information/collision warning signals
- Option #2 to ensure signals are kept separate from signals from other systems

3. Directional

- Option #1 to be located within the forward field of view of the driver
- Option #2 to be split depending on direction that the VRU is crossing from or located
 - E.g. Signal toward nearside if VRU is outside of vehicle path on nearside, signal toward front if VRU is in vehicle path, signal toward offside if VRU is outside of vehicle path on offside
- Option #3 no requirements

4. Informative about hazard priority

- Dual signal with progressive priority levels approach
- Proximity information signal: level 1 priority – less intrusive signal reflecting Level 2 urgency
- Collision warning signal: level 2 priority – intrusive signal reflecting Level 3 urgency

Human Machine Interface (Q14)

Proposed MOIS HMI compliance with UNECE guidelines

5. Timely

- Proximity information signal: provided before vehicle moves off from rest and provides information signal LPI at distances relating to a 1.4 second reaction time before VRU travelling at 5 kph reaches 25% width
- Collision warning signal: provided while vehicle is moving and provides warning signal LPI at distances relating to a 1.4 second reaction time before VRU travelling at 5 kph reaches centreline of vehicle

6. Multiple signals appropriately prioritised

- As discussed in (4)

7. Minimise false positives

- False positive tests proposed

8. System status shall be displayed

- System failure mode shall be optically displayed to driver

Human Machine Interface (Q14)

Shall HMI requirements be considered in scope?

- VRU-Proxi Question:
 - **Q14: What shall the scope of the regulation be regarding the requirements for HMI?**
- Summary of Options:
 - No HMI requirements, HMI requirements for proximity information signal only or HMI requirements for proximity information and collision warning signals
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - HMI requirements shall be provided for both the proximity information signal and collision warning signal
 - HMI requirements for proximity information signal shall be an amber optical signal and focused in direction of hazard
 - HMI requirements for collision warning signal shall be at least two of optical/auditory/haptic modes, with optical mode differing in activation strategy (flashing/colour etc.) from the proximity information signal, and focused in direction of hazard
 - MOIS system failure warning signal shall be provided as a permanently on optical signal
 - Consensus Discussion Outcome:
 - [To Be Completed]



Human Machine Interface (Q15)

Shall manual overrides be permitted?

- VRU-Proxi Question:
 - **Q15: What shall the scope of the regulation be regarding manual overrides for MOIS signals?**
- Summary of Options:
 - Manual override proposed for collision warning signals and proximity information signals
- Summary of VRU-Proxi-10 Discussion:
 - Manual override necessary for resolution of false positives
- VRU-Proxi Member Feedback:
 - J: **Yes**. It is 58 agreement.
 - **CLEPA**: The driver shall always be able to override any assistance system, therefore **CLEPA supports the manual override**.
- Summary of VRU-Proxi-11 and Task Force Discussions:
 - No discussions
- VRU-Proxi-12 Decision:
 - Proposed Consensus Statements:
 - Manual override shall be permitted for collision warning signal
 - Manual override shall be permitted for proximity information signal
 - Consensus Discussion Outcome:
 - [To Be Completed]





Questions?

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