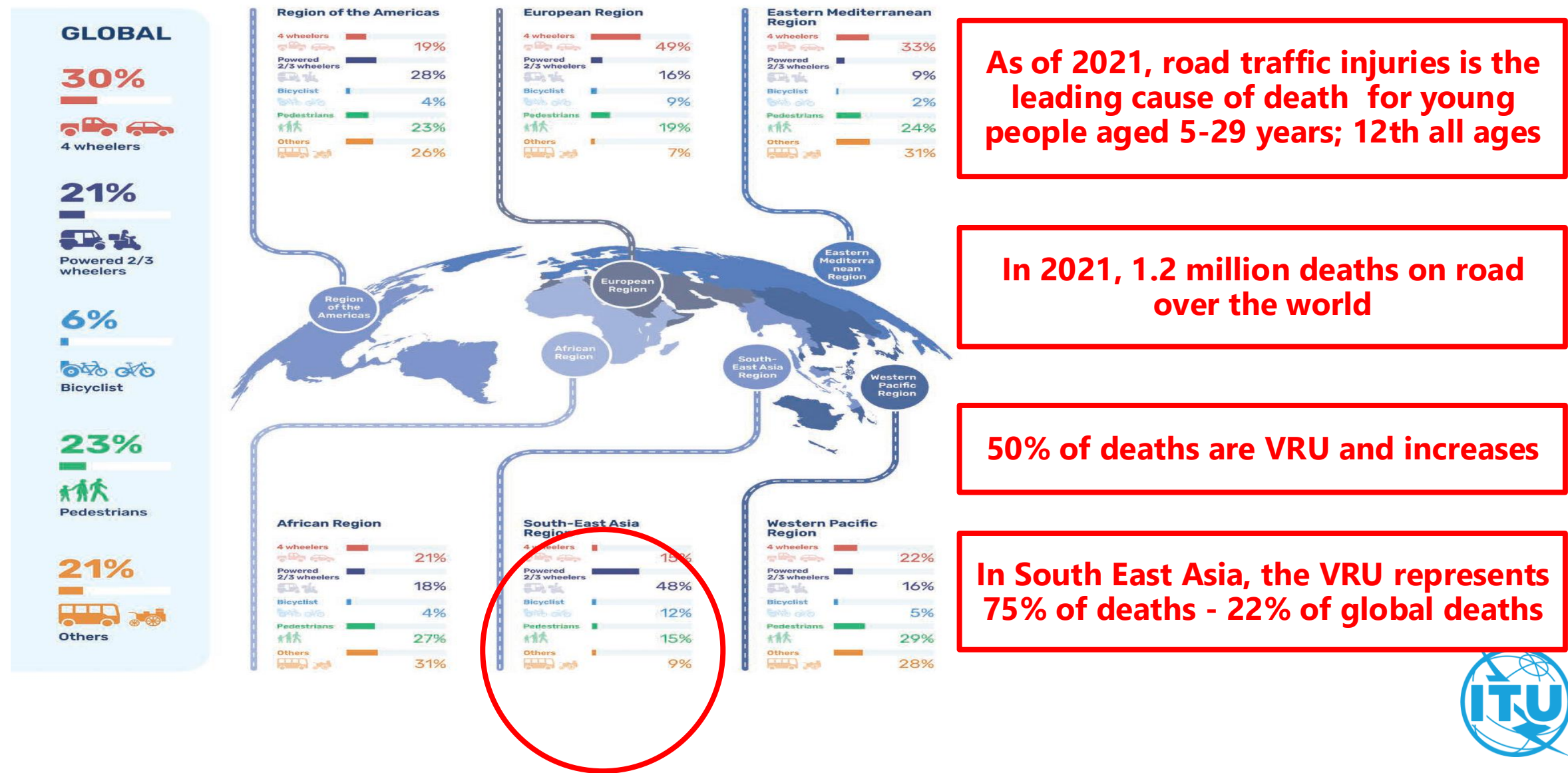


Vehicular communications for advanced emergency braking, including to protect VRUs

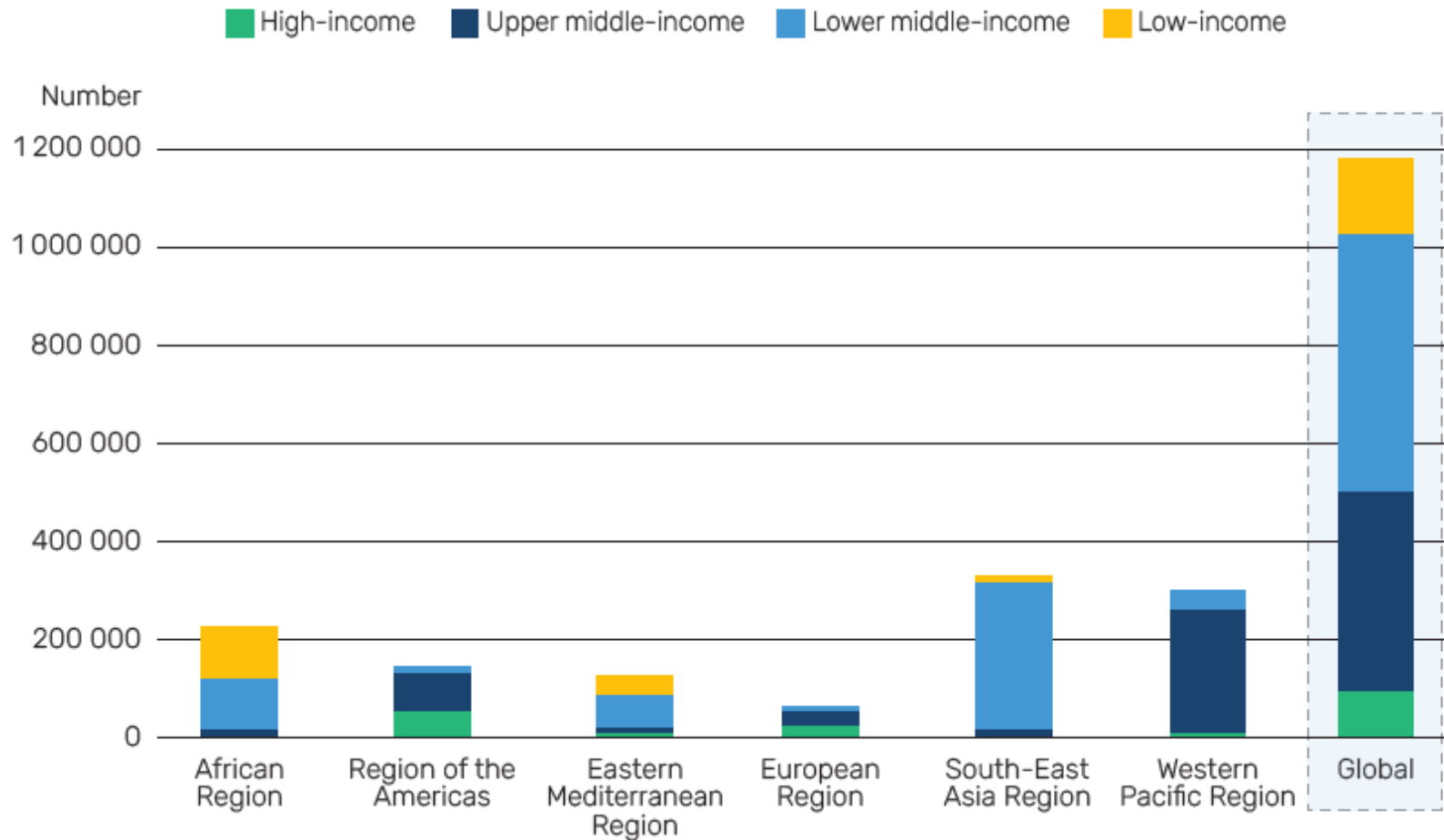
Stephane Buffat
LAB – ITU expert group



Road safety requires strong actions – WHO data



Fatalities per regions and income – WHO data



92 % of the road fatalities occurs in low and middle income countries

The risk of death in lower income countries is 3 times higher than in high ones, despite they have 1% of all motor vehicles



Description and Analysis of VRU Accidents around the world

The expert group benefits of experts from all the regions (China, India, Africa, USA & EU).

	USA	EU	China	India	Africa
total VRU	33%	47%	28%	71%	53%
pedestrians	18%	22%	1%	20%	40%
2 wheelers	12%	17%	17%	44%	9%
3 wheelers				4%	
bicycle	3%	9%	10%	3%	4%
	FARS 2023	SECUR 2020	FASS 2023	India gvt 2022	WHO 2023

As the traffic situation are far different, the countermeasures will be listed by region



WG2 : Chair: Stéphane Buffat (Renault Group/FISITA) & Vice-Chair: Hongye Mei (Changan Auto)

Achievements of WG2(until now):

➤ Defining Application Requirements and Needs:

- Discussing the importance of focussing on relevant scenarios according to accidentology data
- A drafting group dedicated to this task is being created

➤ List of Possible VRUs Scenarios:

- Reviewing accidentology data and driving rules, considering various jurisdictions to refine lane merging use cases

➤ Focus on Functional Safety perspective(FuSa):

- Examining trustworthiness, interworking of V2X messages, vehicle sensors, etc.

➤ Leveraging existing work and incorporating them as inputs:

- Presentations made or scheduled from experts on various countries, including two-wheeler perspective, aiming to enhance the collaborative expertise, and maintaining a list of relevant previous compliant publications

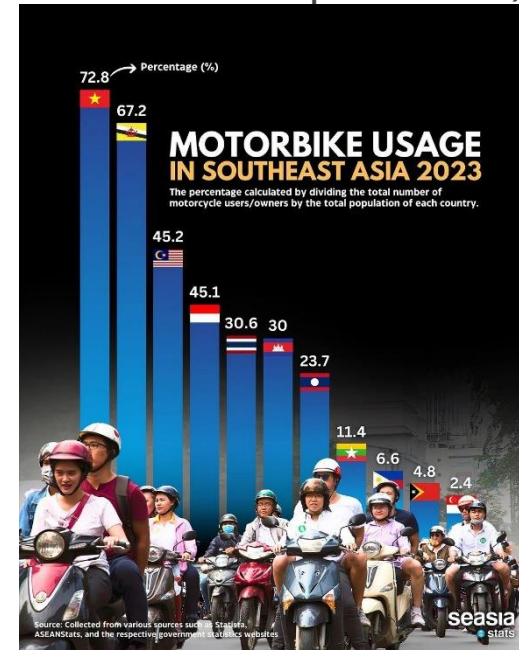
➤ Upcoming activities:

- Expanding prospective assesment scenario to challenge specificities vs. Generic solutions
- Detailing relevant VRUs scenarios by type/country
- Building the precise list of requirements
- Writing detailed parts of a draft technical report



Workplan and boundaries of WG2: Some key principles

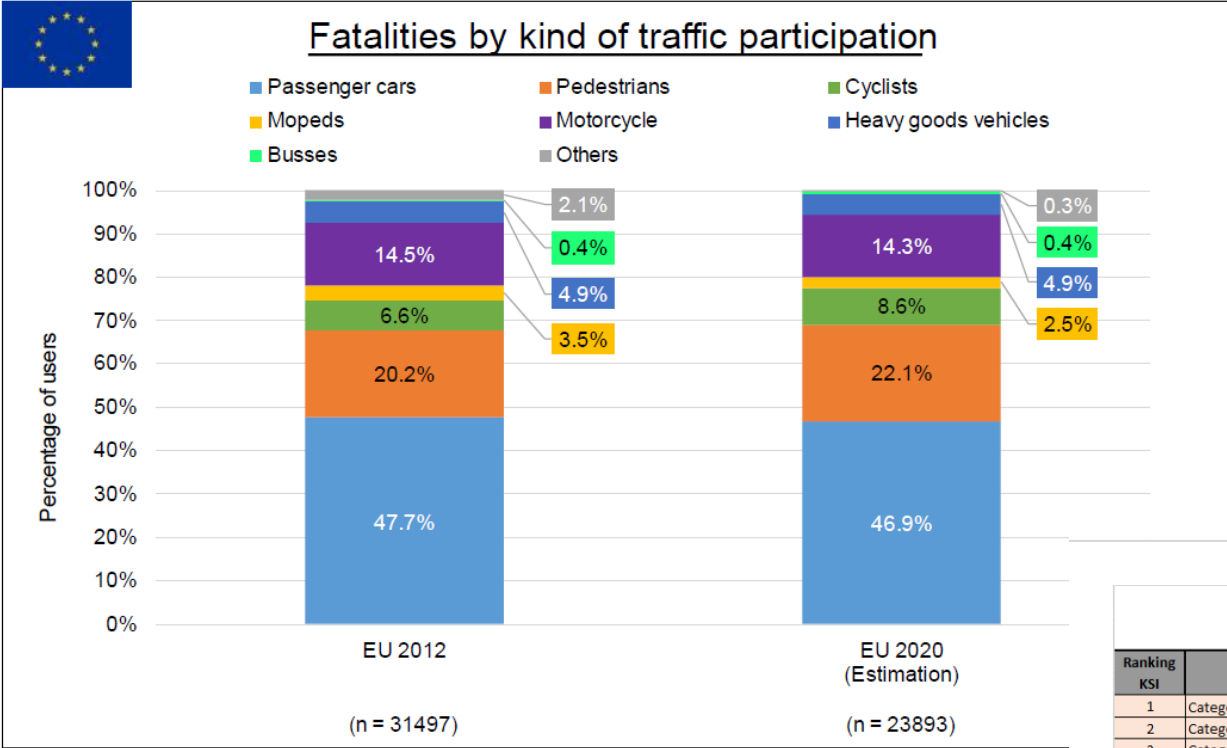
- When working on use cases across the world, consider the specificity of the countries/the traffic complexity and segregation, aka the **local road grammar**
- Keep in mind the **Human Factor**
- Consider **all actors** involved and their needs, dynamic and inertia (e.g. Pedestrian, low speed, low inertia/pedal bikes medium speed, higher inertia, minimum viable speed, etc.)



Safe System is the basic method



Accidentology analysis : the very first step



Source: SECUR Project

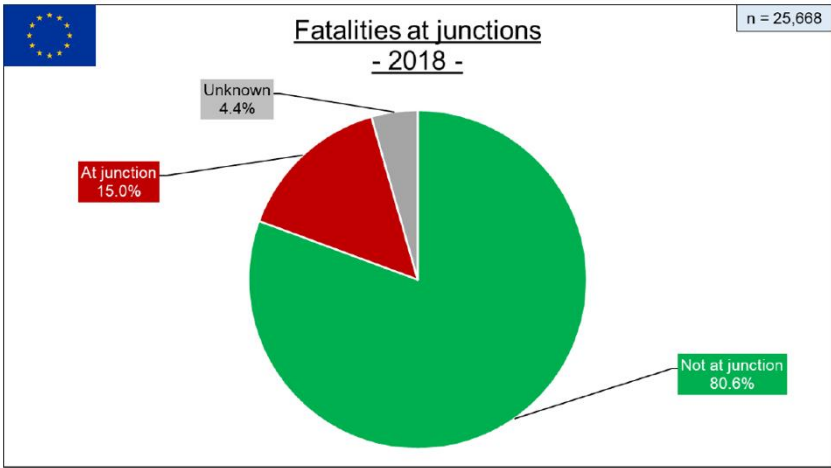


Table 103: Top 9 categories combined with kind of road usage – List of scenarios

				Total	Passenger Car	Powered Two-Wheeler	Bicycle	Pedestrian	Other kind of participation
Ranking KSI	Category			KSI	KSI	KSI	KSI	KSI	KSI
1	Category 13	SCP-RD	Straight Crossing Path - Right Direction	735	233	40	248	214	0
2	Category 14	SCP-LD	Straight Crossing Path - Left Direction	575	179	29	167	194	6
3	Category 9	Oncoming	Oncoming	377	332	24	14	4	3
4	Category 1	LTAP-OD	Left Turn Across Path - Opposite Direction	301	123	87	56	34	1
5	Category 15	RE-PV	Rear End - Previous Vehicle	201	154	39	6	0	2
6	Category 21	LOC-CU	Loss Of Control in Curve	190	190	0	0	0	0
7	Category 4	LTAP-LD	Left Turn Across Path - Left Direction	188	86	82	20	0	0
8	Category 11	RE-FV	Rear End - Following Vehicle	184	164	12	7	0	1
9	Category 20	LOC-SL	Loss Of Control in Straight Line	174	174	0	0	0	0



International road safety main VRU cases

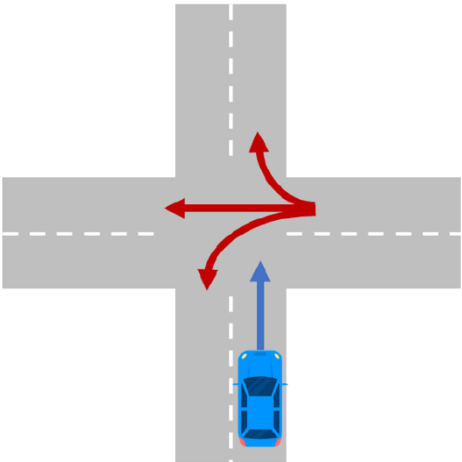


Figure 82: Pictogram – SCP-RD

Straight Crossing Path – Right Direction

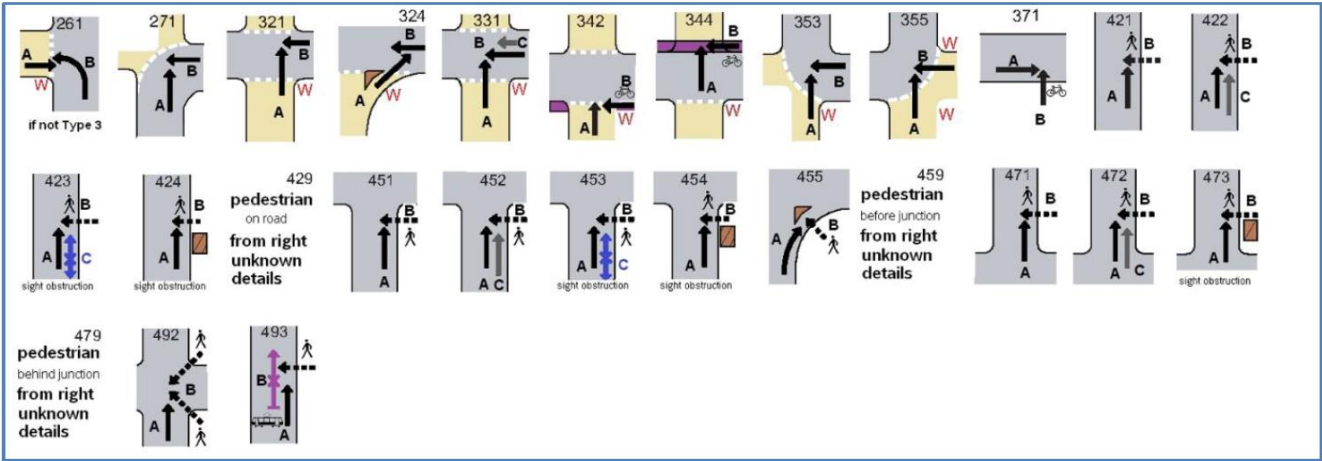
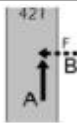
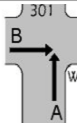
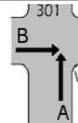
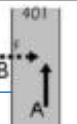
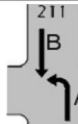
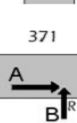
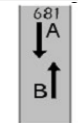
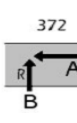
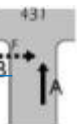
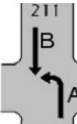
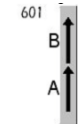


Figure 83: Accident types - participant A – SCP-RD



VRU data analysis -Accident morphology – case of China

Pedestrian accidents were mainly caused by straight crossing roads, while two-tricycle accidents occurred mostly at intersections

Pedestrian accident n=1056		Two/three-wheeled bicycle accidents n=897		Two/three-wheeled motorcycle accidents n=871	
UTYP	Proportion	UTYP	Proportion	UTYP	Proportion
	27.2%		11.6%		9.3%
	22.8%		8.5%		8.5%
	6.7%		5.8%		8.4%
	5.3%		5.7%		7.9%
	4.9%		4.6%		6.7%
total	67.0%	total	36.1%	total	40.8%

Pedestrians crossing the right side, accounting for 32.5%

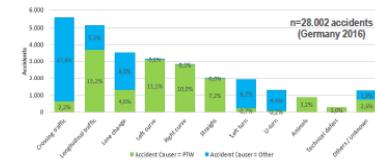
Pedestrians crossing the left side, accounting for 27.7%



Scenarios selection

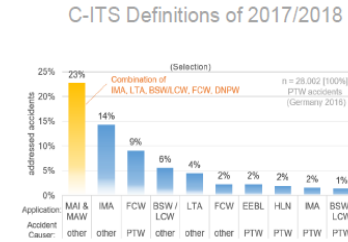
Source: CMC
presentation by Mr Hennes Fischer
YAMAHA MOTOR EUROPE
N.V.Senior Adviser

- 1. Accident analysis with representative accident data from Germany 2016



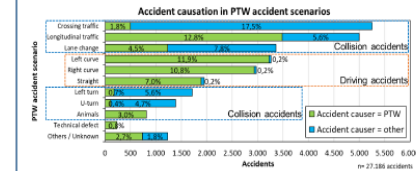
- Which scenario groups address how many accidents?
- What is the proportion of the main accident causer?

- 2. Assessment of C-ITS application potential



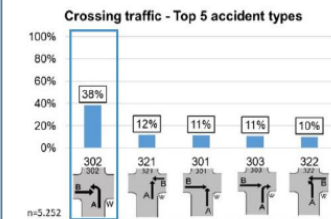
- What is the calculated potential of different C-ITS applications for PTW depending on the accident scenarios?
- Evaluation of the potential of 19 C-ITS applications

- 3. Updating the representative accident data from Germany to 2019



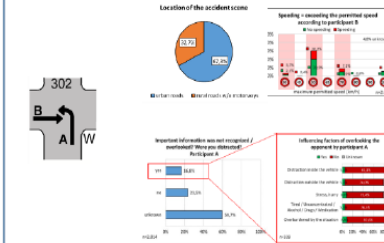
- Update to the latest accident data from Germany.

- 4. Definition of relevant use cases based on accident type



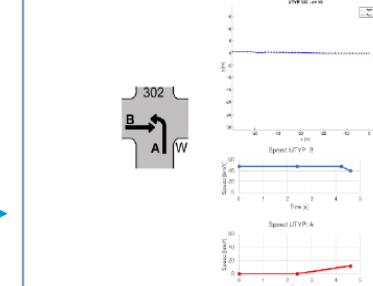
- Which use cases frequently occur in the scenario groups?

- 5. Research module (RM) 1: GIDAS-Analysis



- Why did the accident happen?

- 6. Research module (RM) 2: GIDAS-PCM Analysis



- What can a test scenario for this use case look like, based on reconstructed and simulated accident data?



Overview of the crash sequence and potential actions

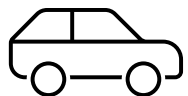
Interaction with Emergency Break Warning

Action taken could also include any of (or combination of)

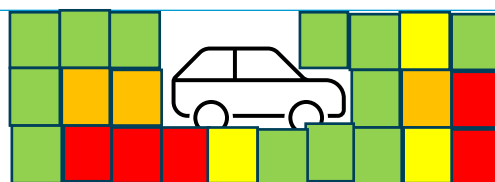
- Reduce speed action (brake, foot off accelerator, depress clutch, gear down)
- Abort lane change
- Abort acceleration
- Abort another maneuver
- Change lane

Navigation / Strategic

Vehicle // Sensor ODD

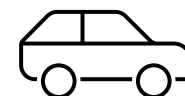


Maneuvering / Tactical



Prediction Dynamic map 2D/3D Space

Control / Operational



Action

Environment // Infra layout/ Sensor
masking elements/Interferences com
masking

Driver // Driving task
Info for the driver
Info for the « system »

Driver // Driving task
Info for the driver
Info for the « system »

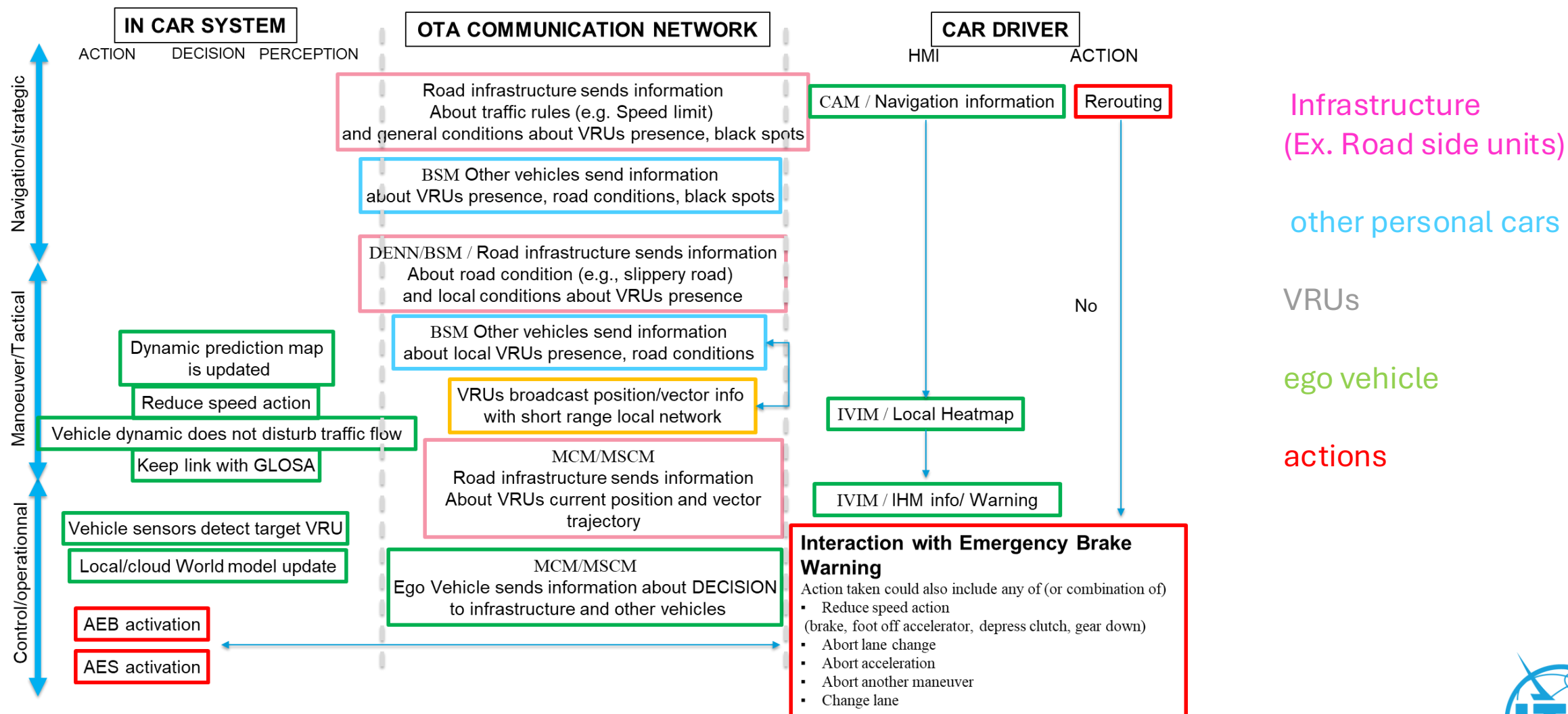
Communication //
Range/availability//trust/prediction

Communication //
Range/availability//trust/prediction

Communication //
Range/availability//trust/prediction

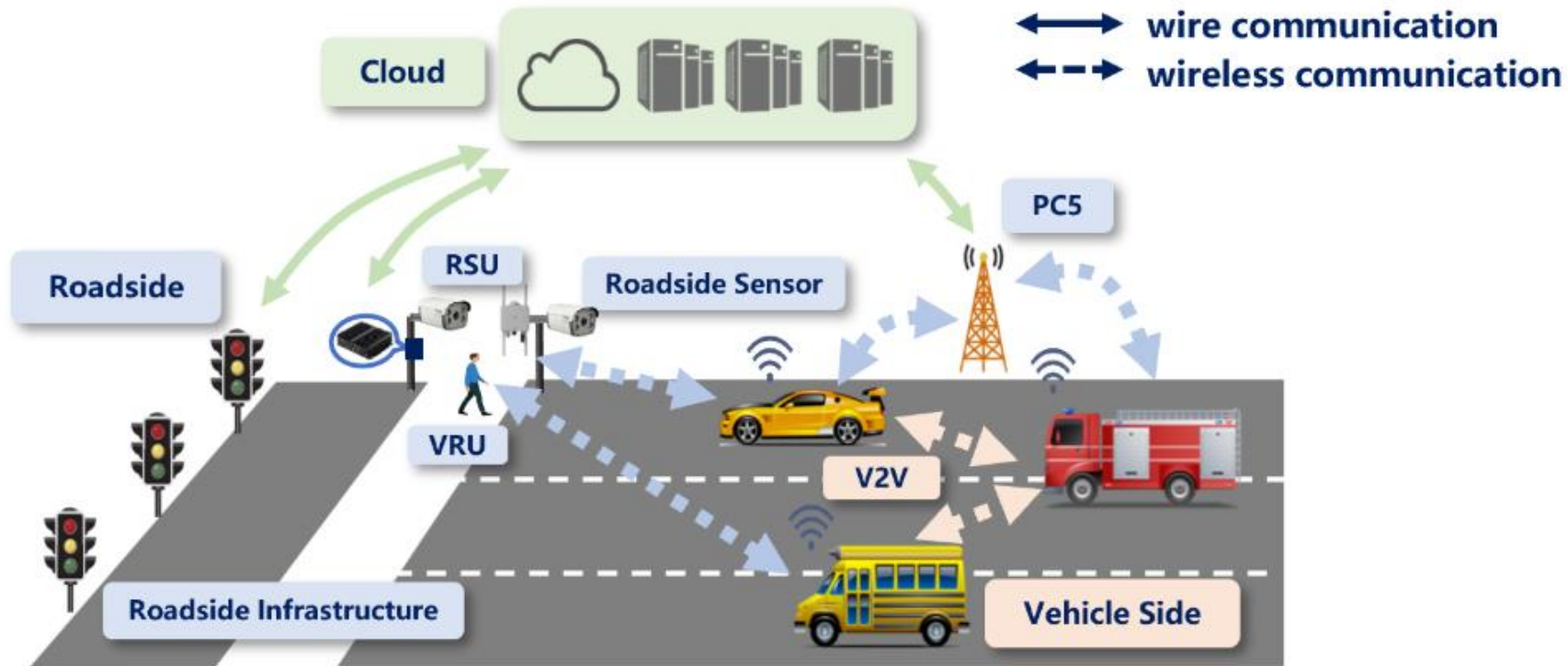


Sequential diagram with the different factors



Testing use cases

Pedestrian crossing scenario in urban areas. The overall architecture for the relationship between vehicular traffic and vulnerable road users using pedestrian crossings in urban areas is taken here as an exemplar use case.



Next steps and conclusion

- **VRU protection is a clear priority for WHO and V2X could play a role complementing actions on the vehicles, on the infrastructure and on the behaviour of the people**
- **FISITA and ITU are committed to work hard to allow the emergence of the right technologies to contribute to this key objective**
- **The ITU expert group 2 plans to issue a report by November 26 with a first set of recommendation for next gen V2X**



Thanks for your attention

