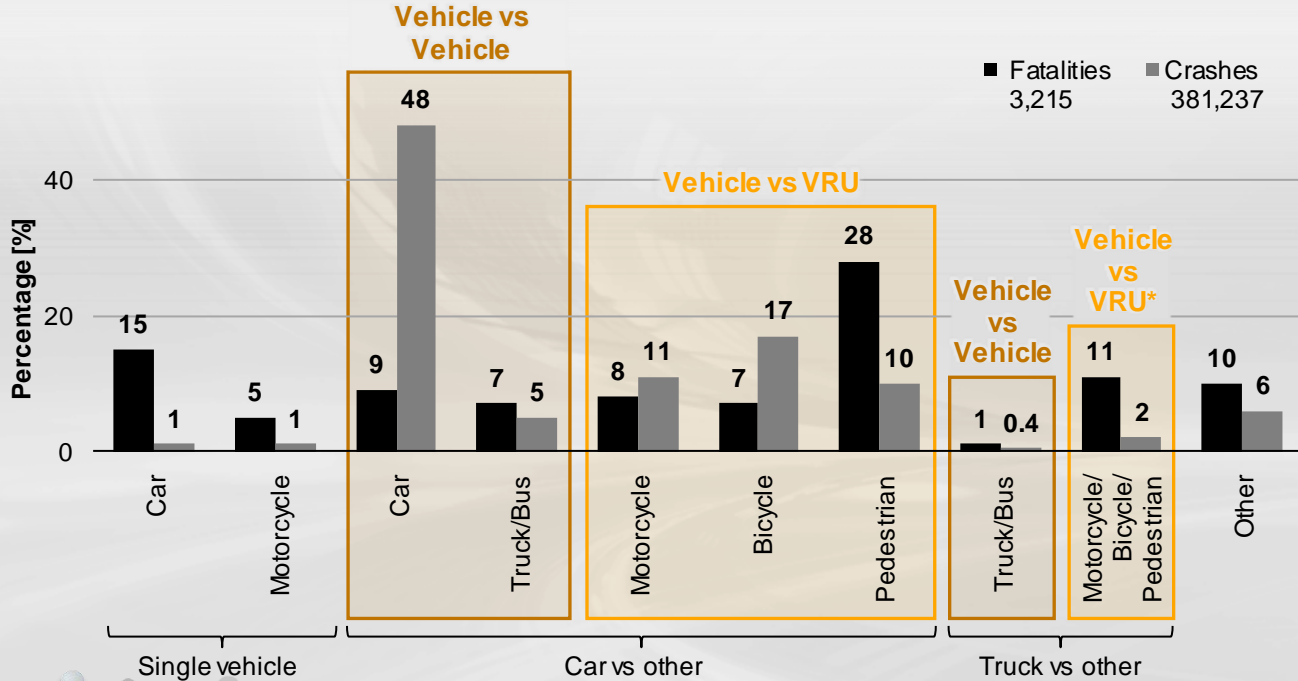




Importance of Collective Perception and V2X spectrum needs

Bettina Erdem, Market and Strategies/Market & Business Entry Strategies

Japan Traffic Crashes



Vehicle vs Vehicle:
 > 537 fatalities
 > 201,766 crashes

Vehicle vs VRU*:
 > 1,706 fatalities
 > 147,690 crashes

*Vulnerable Road Users

54% of all fatalities in Japan involve Vulnerable Road Users (VRU)



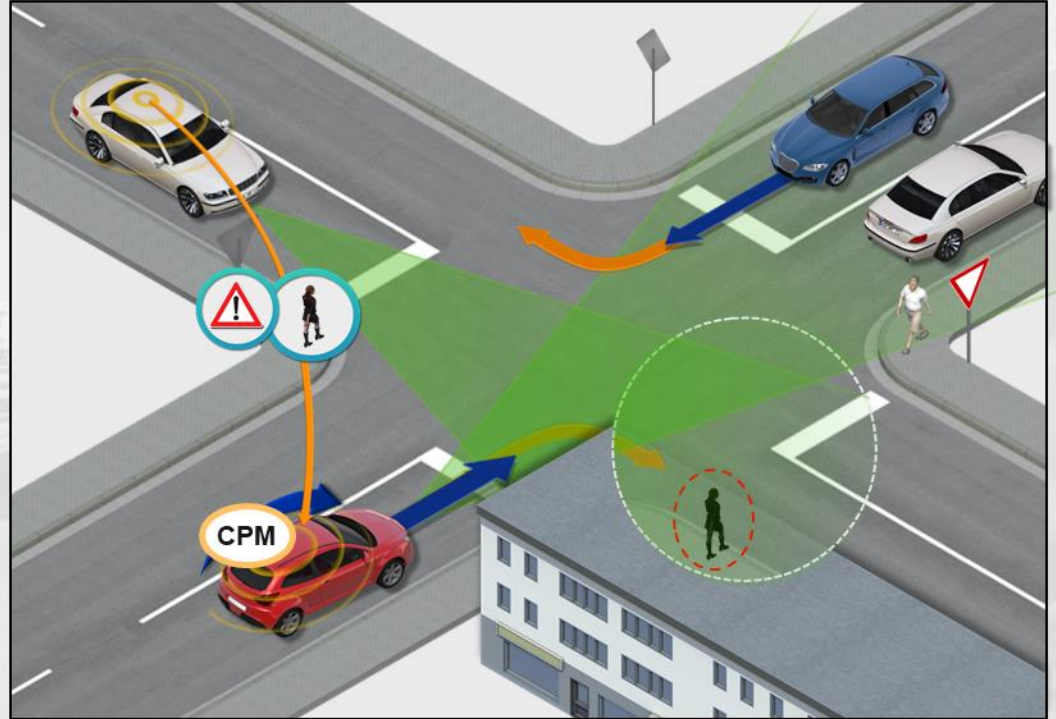
Collective Perception Messages (CPM) protect VRUs

”Seeing through the Eyes of Others”



vehicle-to-vehicle (V2V) communication in cities and at intersections:

- › The white car detects the hidden pedestrian
- › The white car sends information about the pedestrian to the red car
- › The red car can warn the driver about the pedestrian
- › V2V with CPM can leverage the different perspectives from each of the traffic participants to provide a more complete environmental view



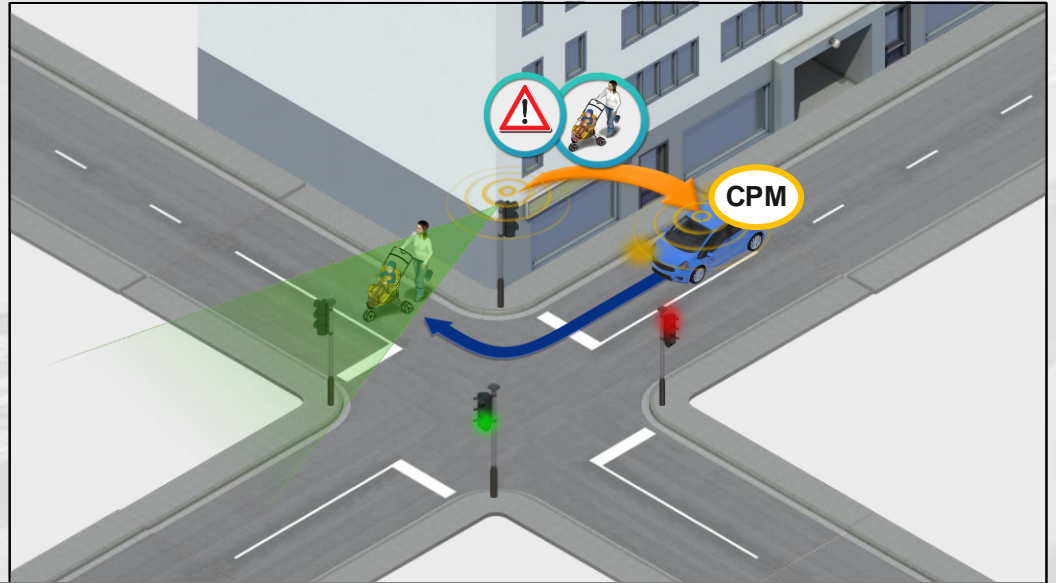
Collective Perception Messages (CPM) protect VRUs

”Smart Intersection for VRU Protection”



Using vehicle-to-infrastructure (V2I) communication to make intersections safer:

- › Intelligent infrastructure uses its sensors, such as camera or radar, to detect VRUs
- › The intelligent infrastructure transmits position and movement information of the VRUs
- › V2I with CPM can protect VRUs even when no other vehicles are present



Smart Intersections with CPM can convert accident hotspots into safety zones for V2X vehicles

Smart intersection & CPM sending vehicles are the only available technology to protect VRU in NLOS situations

Protecting Vulnerable Road Users (VRUs) By combining different technologies

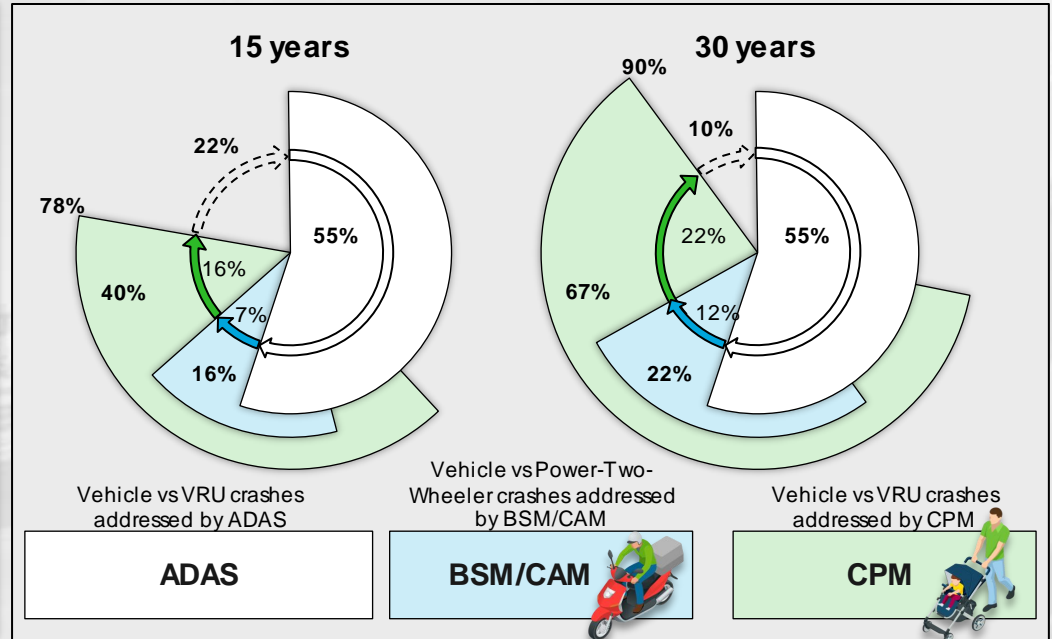
Vehicle vs VRU crashes in Japan
1,706 fatalities, 147,690 crashes

Mid-Term (15 years) VRU protection:

- › Advanced Driver Assistance Systems sensors like camera, radar, or lidar 55%
- › BSM alone protects in addition about 7%
- › ADAS, BSM/CAM, and CPM can protect together 78%


Long-Term (30 years) VRU protection:

- › ADAS protects 55%
- › BSM/CAM still only protects Power-Two-Wheeler 12%
- › ADAS, BSM/CAM, and CPM in combination can protect VRU together 90%



CPM (Collective Perception Message) can close the safety gap for Vulnerable Road Users

Spectrum needs in 5.9 GHz in MHz

V2X implementation phases		V2X message types acc. to SAE and ETSI	Urban	Suburban	Highway
1. Phase	Awareness driving	BSM or CAM/DENM, SPaT, MAP, IVI, VAM	14	12	12
2. Phase	Sensing driving	CPM for “Collective Perception” 	23	26	24
3. Phase	Cooperative automated driving	PCM for “platooning”, MCM for “Maneuver Coordination”	26	32	34
Total needed bandwidth in 5.9 GHz			63 MHz	70 MHz	70 MHz
3. Phase	Cooperative automated driving	+ critical communication needs duplication in redundant spectrum in 760 MHz	+ 9 MHz	+ 9 MHz	+ 9 MHz

Summary:

- CPM protects Vulnerable Road Users like pedestrians
- V2X needs 70 MHz in 5.9 GHz plus 9 MHz in 760 MHz spectrum band for Cooperative Automated Driving and Vulnerable Road User protection

Source in chart 6: [C2C-CC position paper](https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf) on “Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Cooperative Automated Driving” see
https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf

Thank you for your attention

Bettina Erdem

Markets and Strategies / Market & Business Entry Strategies

Continental

E-mail: bettina.erdem@continental-corporation.com