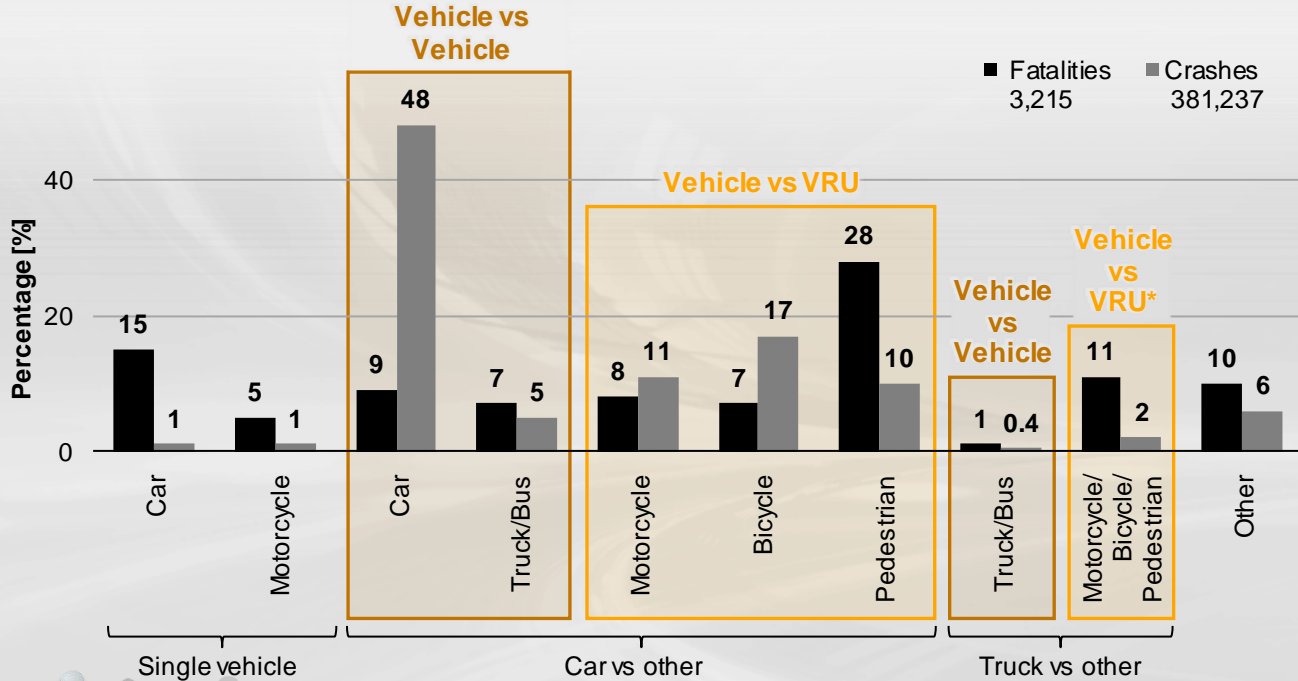




## Importance of Collective Perception and V2X spectrum needs

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)



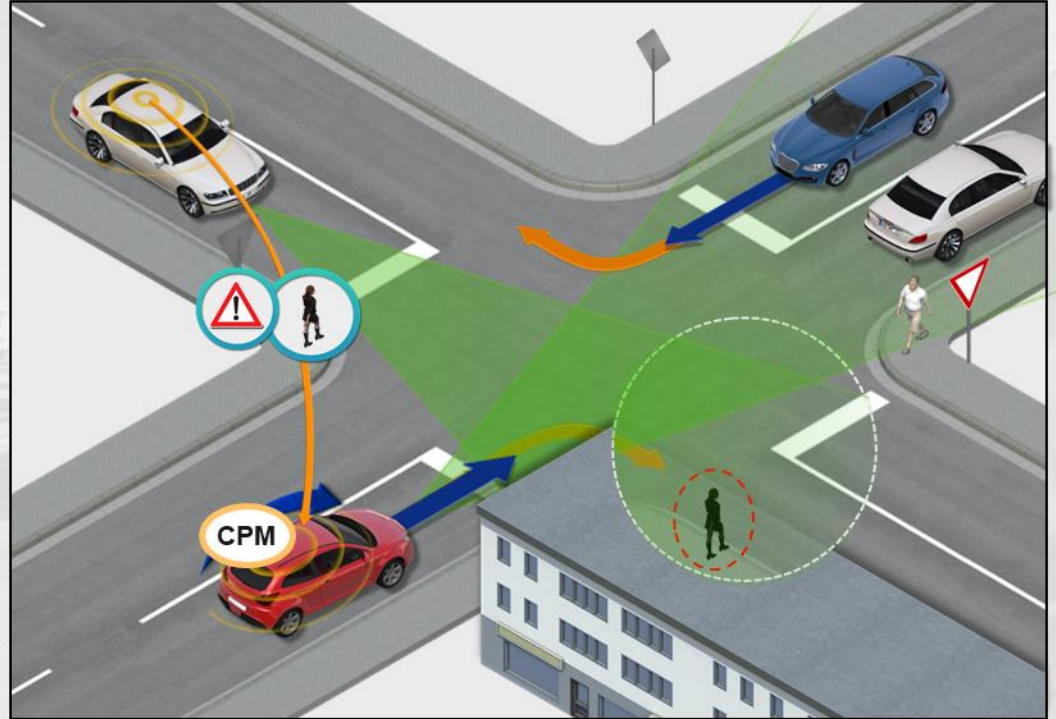
# Collective Perception Messages (CPM) protect VRUs

## ”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



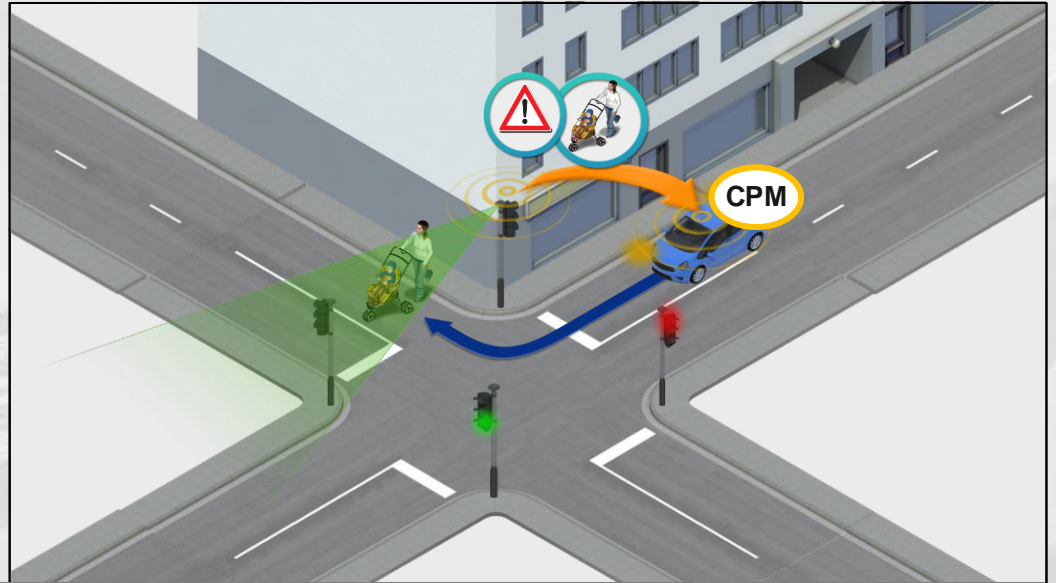
# Collective Perception Messages (CPM) protect VRUs

## ”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

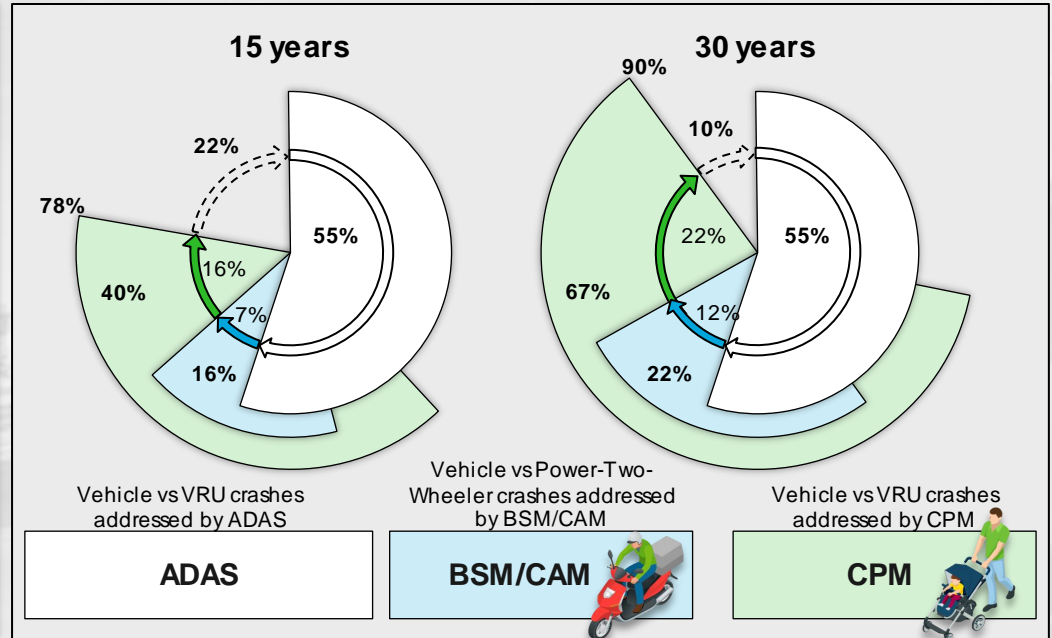
Vehicle vs VRU crashes in Japan  
1,706 fatalities, 147,690 crashes

## 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
<b>Total needed bandwidth in 5.9 GHz</b>			<b>63 MHz</b>	<b>70 MHz</b>	<b>70 MHz</b>
3. Phase	Cooperative automated driving	+ critical communication needs duplication in redundant spectrum in <b>760 MHz</b>	<b>+ 9 MHz</b>	<b>+ 9 MHz</b>	<b>+ 9 MHz</b>

## 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](https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf)

**Thank you for your attention**

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