

# Vulnerable Road Users in C-ITS

**ETSI STF 565 Vulnerable Road Users  
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# Personal ITS subsystem and VRU definition

- ❑ **Personal ITS subsystem** defined in ETSI ITS Communication Architecture<sup>1</sup> as one of four ITS subsystems - Personal, Vehicle, Roadside, Central
- ❑ Provides application and ITS communication functionality in hand-held devices e.g. PDAs, mobile phones
- ❑ Personal ITS station may complement vehicle ITS subsystem
  - User context knowledge
  - Communication redundancy – V2X functional safety
- ❑ C-ITS safety benefits linked to V2X market adoption rate but On-Board Units (OBU) to be initially installed in new vehicles – need to address aftermarket vehicles
- ❑ **Today 3GPP C-V2X is mature and commercially available – extend C-ITS system architecture to**
  - **3GPP Cellular-V2X support in personal ITS sub-system**
  - **Handheld device used as OBU / Vehicle ITS subsystem to enable or complement vehicle V2X**
- ❑ **'Vulnerable Road Users'** means non-motorised road users, such as pedestrians and cyclists as well as motor-cyclists and persons with disabilities or reduced mobility and orientation<sup>2</sup>
- ❑ VRU device can be
  - Standalone e.g. smartphone
  - Vehicle integrated e.g. motorcycle
  - Tethered e.g. cable, Bluetooth or Wi-Fi connected
- ❑ Proposals to consider motorcycle as vehicle but
  - Motorcyclists vulnerability higher than vehicle occupant
  - Support for ADAS limited e.g. cooperative adaptive cruise control or platooning
  - Is motorcycle covered already in CAM / PSM messages ?
  - How about electric bikes or pedal electric cycles (pedelecs) ?
  - VRUs would need to be supported by Personal and Vehicle ITS sub-systems in ETSI standard
- ❑ **Consider review of VRU and V2P definitions in specifications**

(1) EN 302 665 V1.1.0 (2010-07)

(2) Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport

# VRU safety service challenges

- ❑ **Radio resource management – spectrum usage, capacity and congestion control**
  - VRU activity detection - dynamic V2P service deactivation when not active road user
- ❑ **If ITS-G5 and C-V2X coexistence in EU market required, integration of both in VRU device may be challenging**
  - Increased cost
  - Power limitations more critical than in vehicle OBU – Tx / Rx only radio design may help but limits functionality
  - Form factor design constraints e.g. wearable devices
  - Global VRU safety service roaming – ensuring ITS-G5 VRU enabled device from EU also works in regions with C-V2X VRU service e.g. China ?

- ❑ **High accuracy positioning to detect road or sidewalk VRU location**
  - ETSI ITS defined GNSS level accuracy of 1.0 m not enough (0.5 m desired) – could be improved by cellular system correction data
- ❑ **VRU safety may be compromised if excluded from future services currently under ETSI ITS development**
  - Manoeuvre Coordination Service
  - Collective Perception Service
- ❑ **Security**
- ❑ **Human - Machine Interface**

# Samsung C-V2X V2P projects



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## ❑ At CES 2019 Harman showcased market-ready demo of motorcycle communicating using C-V2X

- 3GPP compliant PC5 modem with dual antenna TX/RX diversity

## ❑ South Korea 5G V2X C-ITS project 2019-2020 in Seoul

- 121 km urban expressway roads and urban test site for autonomous driving
- 5G V2X base stations and 5G OBU for buses, taxis developed by Samsung
- V2P use cases with smartphone sending PSM
  - Pedestrian cross-walking warning
  - Cyclist collision warning
  - Roadworks warning
  - VRU location information sharing

# Conclusions

- ❑ Samsung interested in VRU safety services implementation in personal devices and required standardisation – 3GPP C-V2X based V2P trials ongoing
- ❑ ETSI C-ITS system architecture should consider C-V2X based VRU services and relevant device design constraints
- ❑ ETSI work should take into account related 3GPP and 5GAA VRU requirements and use cases<sup>1</sup>
- ❑ Need for global harmonization to enable VRU safety services roaming
- ❑ Consider prioritisation of VRU safety requirements in V2X standard to reflect higher vulnerability level
- ❑ Personal ITS subsystem used in vehicle sub-system “mode” to enable or complement vehicle V2X services
- ❑ Decision to consider motorcycles as vehicles not obvious – need to review definitions



(1) See Annex for details

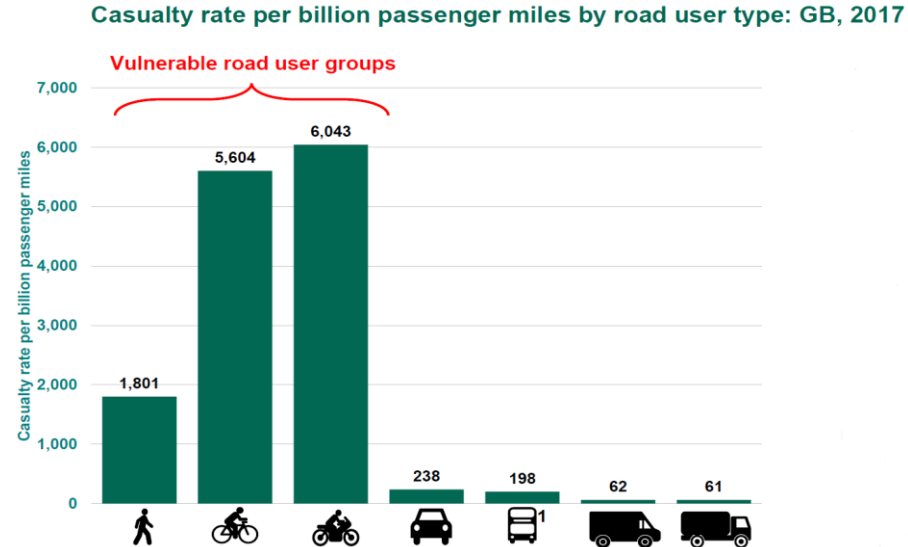
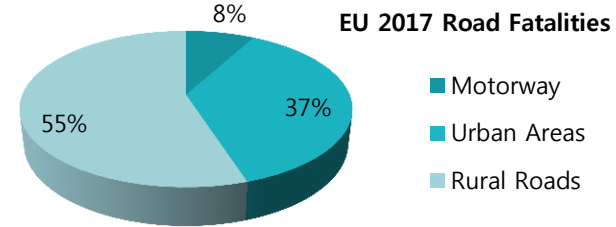
# Annex



# How vulnerable are you on the road ?



- ❑ VRU fatalities proportion comparable to car occupants - based on total EU fatalities in 2017<sup>1</sup>
  - 43% VRUs<sup>2</sup>
  - 46% car occupants
- ❑ High exposure especially in non motorway areas
  - 92% fatalities in urban or rural
- ❑ Slower yearly decrease trend in VRU fatalities than others
  - 9% motorcyclists and 5% pedestrians fatalities increase since 2016 in GB<sup>3</sup>
- ❑ Much higher VRU casualty rates per mile travelled
- ❑ **Considering higher vulnerability level than vehicle occupants how to prioritise VRU safety requirements in V2X standard ?**



(1) Road Safety in the European Union Trends, statistics and main challenges Apr 2018  
(2) Pedestrians 21%, cyclists 8%, motorcyclists 14%  
(3) Reported road casualties in Great Britain: 2017 annual report

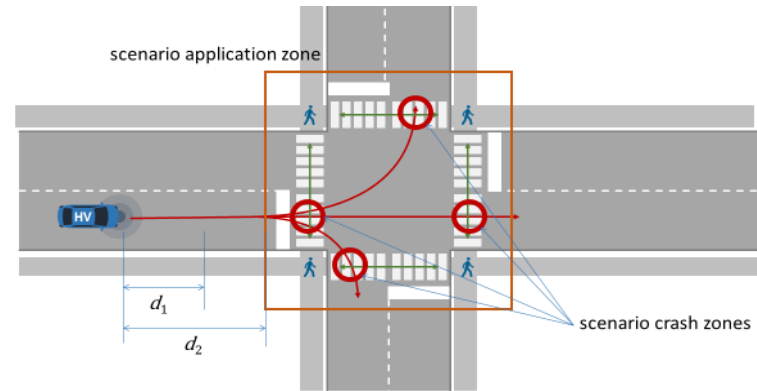
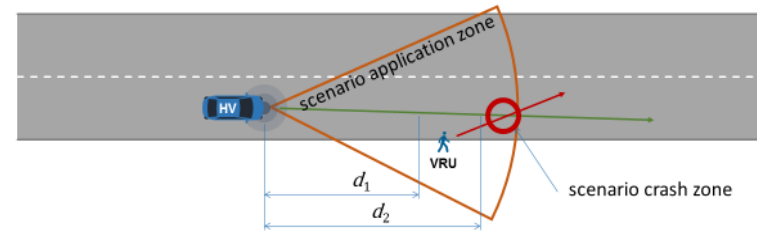
# Use cases



Vulnerable Road User

In Road

- ❑ **3GPP and 5GAA defined global scope**  
**Vulnerable Road User use case<sup>1</sup>**
- ❑ **Warns Host Vehicle of collision risk with VRU in two scenarios**
  - In road
  - Intersection crossing (road infrastructure support)
- ❑ **Defined performance requirements include**
  - Latency
  - Data rate
  - Communication range
  - Reliability
- ❑ **ETSI VRU work should consider those developments**



(1) - For details see 3GPP R2-1812975