Document Information

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Chapter:	Forward Collision Warning (FCW)
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Disclaimer

3.4 Forward Collision Warning (FCW)

3.4.1 General description

The Forward Collision Warning (FCW) application is intended to warn the rider of a PTW in case of an impending front collision caused by suddenly appearing obstacles, very slow vehicles ahead, crossing or wrong way driving vehicles. The system shall detect situations where the vehicle may run into a forward collision if the rider does not immediately reduce his speed or initiate an emergency break. If the system predicts a front collision it shall indicate the danger using an appropriate warning method.

3.4.2 Use case description

The FCW can operate on any kind of road, like highways, country roads and urban environment. The FCW is mainly based on CAM, in some cases DENM will be used. According to the information received from messages, the surroundings of the vehicle will be calculated. A possible accident will be detected by processing the received messages and, if necessary, the rider will be warned. The example scenario shows a PTW approaching an obstacle blocking the road, this could be a barrier because of roadworks (Figure 1). Due to the received CAMs (or RWW DENMs) the C-ITS System recognizes the gap between PTW and barrier becoming smaller. That’s why the PTW receives a FCW. There are several different use cases to consider, a view of those are explained hereafter.

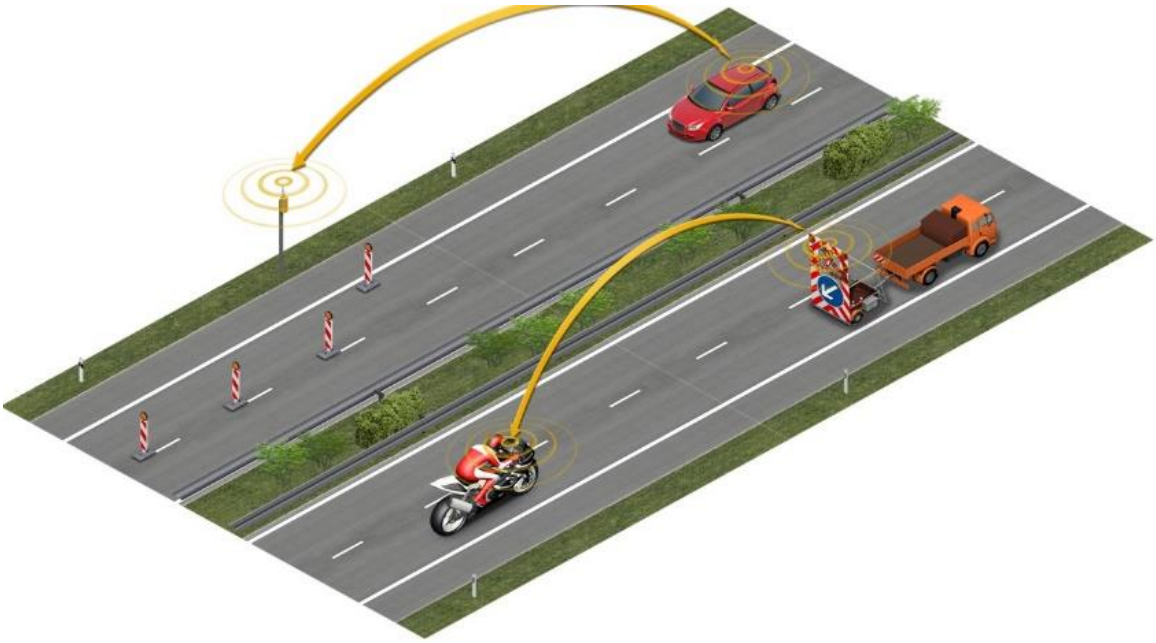

Figure 1: General overview

Moreover, there are three scenarios for this use case to consider.

PTW receive DENM where the PTW performs the calculation on the ego vehicle receiving DENMs. It will act as the vehicle approaching an obstacle and warn the rider, when a collision is likely to occur.

PTW transmit CAM where the PTW continuously sends CAMs. In that scenario the PTW will be the vehicle occupying the lane of a fast approaching vehicle. There is one case where ’PTW transmit CAM’ will act as ‘PTW receive CAM’ as well, wrong way driving.

PTW receive CAM where the PTW performs the calculation on the ego vehicle receiving CAMs. It will act as the vehicle approaching an obstacle and, when a collision is likely to occur, warns the rider.

3.4.2.1 Scenario description: PTW receive DENM

In this scenario, the PTW receives DENM from another object. Those are processed by the PTW and if necessary a Forward Collision Warning is provided to the rider.

Lane Barrier by Roadworks

One lane of the highway is blocked by a barrier and a slow-moving maintenance vehicle. A PTW is approaching the obstacle with a much higher velocity. The maintenance vehicle is sending CAMs and in that special case RWW DENMs in addition. By processing the received Messages, the PTW should notice the distance between itself and the obstacle is becoming smaller. If the rider does not react and a collision is likely a Forward Collision Warning is provided.

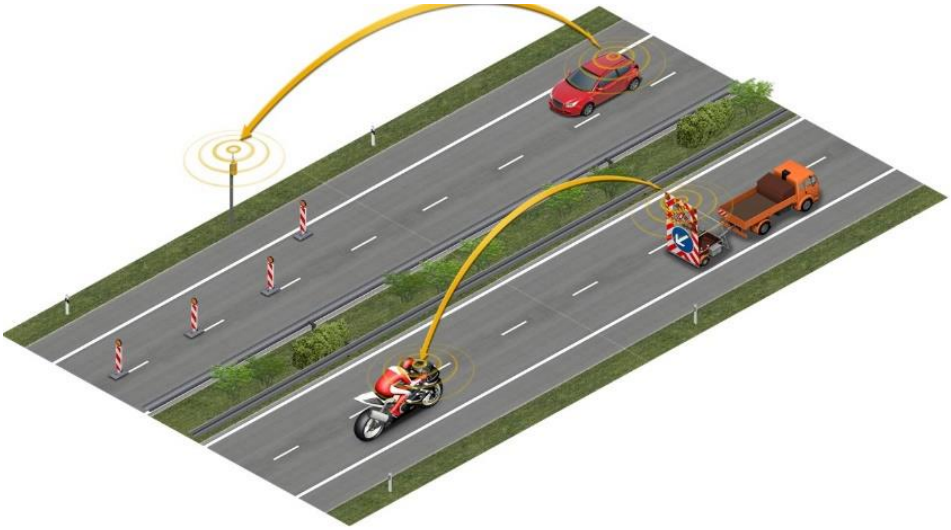

Figure 2: PTW approaching a slow-moving maintenance vehicle

3.4.2.2 Scenario description: PTW transmit CAM

In this scenario, the PTW sends CAMs and causes another vehicle to show a Forward Collision Warning. That happens, if the PTW is moving slower than the approaching vehicle and they are sharing the same lane and roadway. Nothing is processed on the PTWs side, all calculations are done by the approaching vehicle.

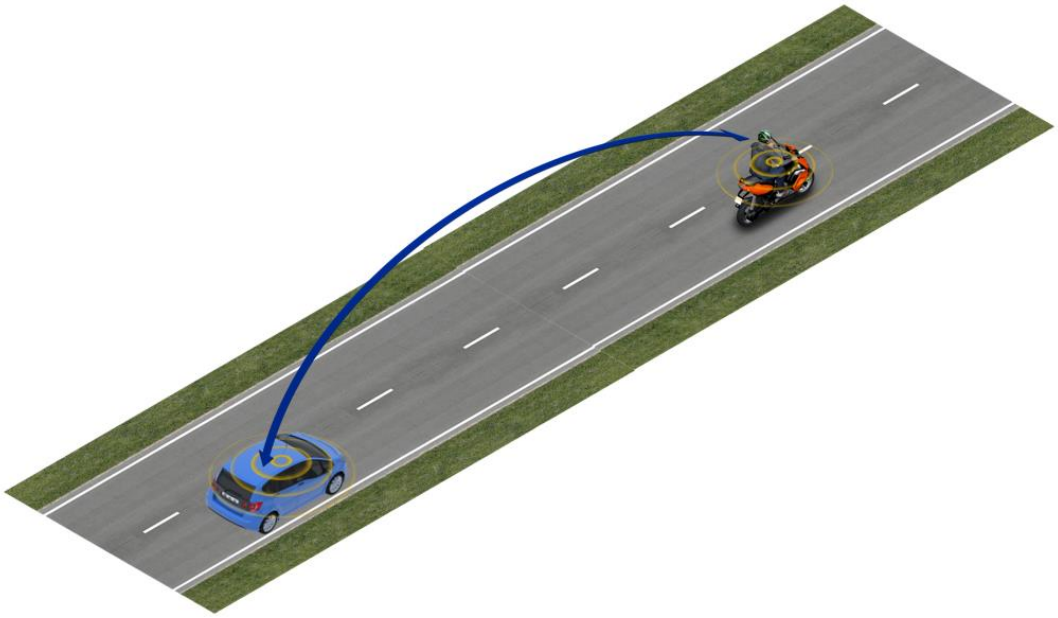

Figure 3: Slow PTW being approached by another vehicle

Another scenario for this scenario might be traffic lights, causing the PTW to slow down or even stop driving. The PTW would still send CAMs, which are processed by the upcoming vehicles that will show a Forward Collision Warning in case of an impending collision.

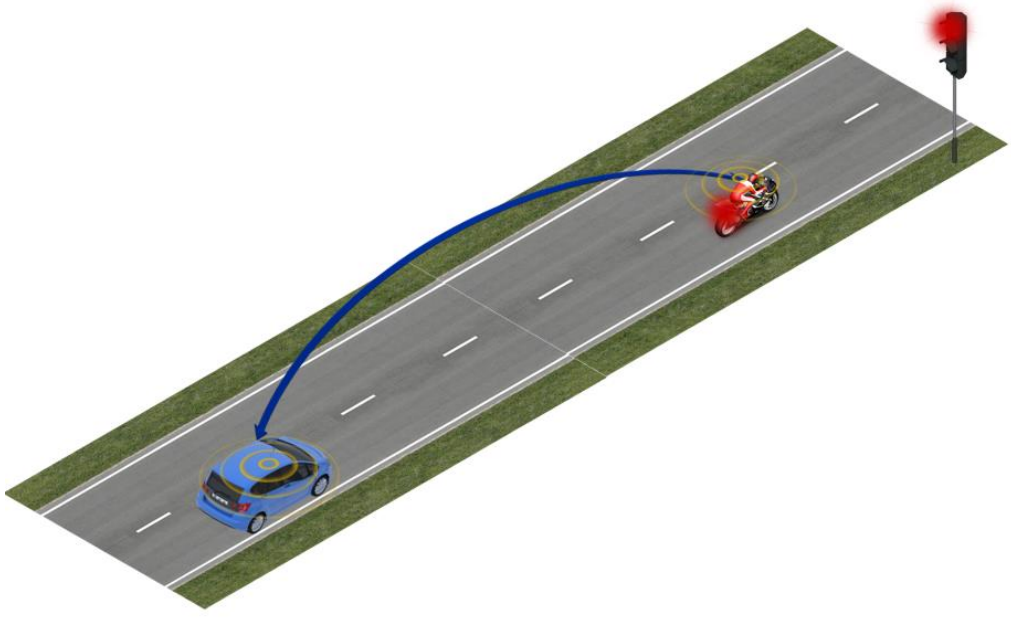

Figure 4: Slowing-down PTW being approached by another vehicle

3.4.2.3 Scenario description: PTW receive CAM

In this scenario the PTW receives CAMs from another object. Those are processed by the PTW and if necessary a Forward Collision Warning is shown to the rider.

Some examples are stated below:

Opposite traffic at a blind bend

In this scenario, the PTW is driving on a curvy road. At a blind bend, a vehicle in the opposite traffic is overtaking. The overtaking vehicle should have received a Do Not Pass Warning, but maybe the PTW was out of range, when the process of overtaking started. As soon as the PTW calculated the other vehicles CAMs and the distance/time-to-contact value is below a certain threshold, it will provide a FCW to the rider to prevent an accident. The overtaking car might also process the PTW's CAMs and if the overtaking distance is not enough to change the lane after the maneuver it shall provide a Forward Collision Warning to the driver.

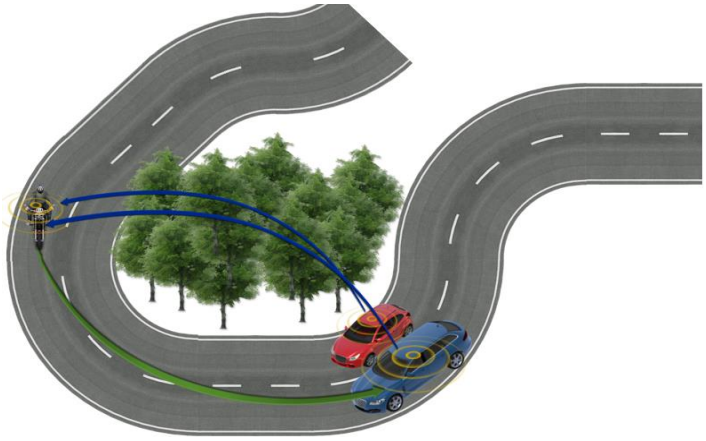

Figure 5: Vehicle in contraflow overtaking at blind bend

Stopping traffic because of traffic lights

The PTW is driving through an urban environment and the traffic in front of the PTW is slowing down because of red traffic lights for example. The rider haven´t noticed that and doesn't slow down. The PTW receives the CAMs of the other vehicles, processes it and detects that they are slowing down. The PTW provides a Forward Collision Warning to the rider to caution against the upcoming obstacles.

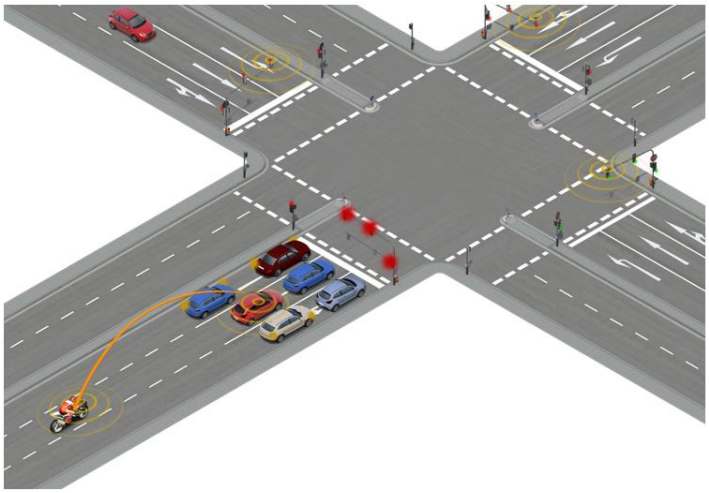

Figure 6: Traffic stopping because of red traffic

Abbreviations

Please refer to the abbreviations in Preamble document.