



CMC Basic Specification

Application Specification

This document defines the specification of C-ITS applications including important use cases for powered two-wheelers. It is important for the safety of powered two-wheelers to cooperate with other road users. Therefore, this application specification need to be aligned and enhanced in the future with relevant stakeholders.

Document Information

Document Title:	Application Specification
Chapter:	Preamble
Version:	1.0
Release Date:	11/12/2020

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5.3 Lane Merge Assist (LMA)

1 Structure and notes of CMC Application Specification

The term Powered Two Wheeler (PTW) is used to refer generically to motorised two-wheeled road-going vehicles, commonly called motorcycles or scooters. The CMC Basic Specification use the term PTW which follows this definition.

The application specification developed by CMC is called “Application Specification”. Application Specification is composed of 3 categories.

- See and Be Seen by others
 - As numerous studies show, the primary cause of PTW accidents is being overlooked in the traffic. Therefore, the first and the most important category “See and Be Seen by others” embodies collision alert applications.
- Be Aware of the unexpected
 - Well-directed information can assist the rider to adjust riding behaviour and set their focus on potentially upcoming peril points. Therefore, applications that allows “Be Aware of the unexpected” are summarised in this category.
- Ride with Less Stress
 - The category “Ride with Less Stress” represents applications that mainly transmit useful information, such as traffic guidance data. These applications do not focus on enhancement of safety directly, but will definitely have a positive effect, although it is hard to measure the side effects to accident statistics by influencing the stress level of the riders and drivers decisively.

Table 1: List of CMC applications

Abbreviation	Application	Category
IMA	Intersection Movement Assist	See and Be Seen by others
LTA	Left Turn Assist	
LCW / BSW	Lane Change Warning / Blind Spot Warning	
FCW	Forward Collision Warning	
DNPW	Do Not Pass Warning	
EEBL	Electronic Emergency Brake Light	Be Aware of the unexpected
HLN	Hazardous Location Notification	
AEVW	Approaching Emergency Vehicle Warning	
AWW	Adverse Weather Warning	
RWW	Road Works Warning	
SVW	Stationary Vehicle Warning	
TJW	Traffic Jam Warning	
DCW / CSW	Dangerous Curve Warning / Curve Speed Warning	
WWD	Wrong Way Driving	
SSVW	Stop Sign Violation Warning	
TLVW	Traffic Light Violation Warning	

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GLOSA	Green Light Optimal Speed Advisory	Ride with Less Stress
IVS	In-Vehicle Signage	
LMA	Lane Merge Assist	

The chapter title of each application document is described in Table 2.

Table 2: Chapter title of each application document

Chapter title	Explanation
General description	Description of the application basic functions.
Use case description	Description of the application use case regarding PTW transmit message and/or PTW receive message.
Technical description	State Flow, Preconditions, Activation and deactivation requirements and so on. Basically, Technical description is written about ITS phase I applications shown in the Application Roadmap.

The subject of each application document is basically PTW. If CMC has the request for consideration of the PTW specific issues to car OEMs, use case description is described by dividing it to two parts, "Use case description at PTW side" and "Use case description at car side".

In addition, each application document is written on the assumption that a map is not used. However, some applications may require map or high definition map and/or high accurate localisation function. These are challenges for the future and so those applications are not mentioned here.

Each application document is written assuming right-hand side driving. In the case of left-hand side driving, the right and left are switched. For example, 'Left Turn Assist' becomes 'Right Turn Assist' in left-hand side driving country / area.

Furthermore, CMC Application Specification may include riding not following local/actual traffic regulations in some countries and regions. Obviously, CMC does not recommend such riding if regulation do not permit, but the safety for riders is the first priority.

2 MAI and MAW

As mentioned in the previous chapter, the subject of each application document is basically PTW. On the other hand, the primary cause of PTW accidents is being overlooked in the traffic. Therefore, it is very important for PTWs to be detected by other vehicles, especially by cars. Before explaining each application documents, CMC promotes Motorcycle Approach Indication and Motorcycle Approach Warning (MAI/MAW) for the integration in the automobile Vehicle-to-Everything (V2X) development.

2.1 Definition of MAI/MAW

MAI/MAW are generic terms for applications that provide information/warning of approaching PTW. MAI/MAW consist of Vehicle-to-Vehicle (V2V) applications that support PTW use cases. Application use cases and implementation methods of MAI/MAW are at the discretion of each OEM, however, CMC makes proposals of applications and use cases which have high potential to enhance rider's safety.

MAI provides information to the car driver to indicate the presence of an approaching PTW which may grow into imminent collision risk.

MAW provides a warning to the car driver, so that the driver takes action for avoiding an imminent collision with an approaching PTW.

2.2 Concept of MAI/MAW

Table 3 shows comparison of MAI/MAW.

Table 3: Comparison of MAI/MAW

	MAI	MAW
Role	Provides information to the car driver to indicate the presence of an approaching PTW, even if the risk of a collision is not high.	Provides warning to the car driver, so that the driver takes action for avoiding an imminent collision with an approaching PTW.
Assumption of Implementation method	Calculates 'critical time' from the speed, heading and relative distance between the car and the PTW. 'critical time' is similar with the TTC mentioned on right but not as accurate as TTC.	Calculates the collision point and the time to collision, in other words 'Time-To-Collision (TTC)' accurately. Therefore, a high accuracy GNSS system and/or a high definition map may be required.

The combination of MAI and MAW is also possible as below.

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1. MAI is provided when a collision risk is detected.
2. MAW is provided when the collision risk reaches higher and critical level.

MAW is a generic term for group of applications which consists of LTA/IMA/BSW/FCW/DNPW.

MAI is also a generic term which covers limited use cases of MAW and provides “Information”.

Figure 1 shows the general idea of MAI/MAW.

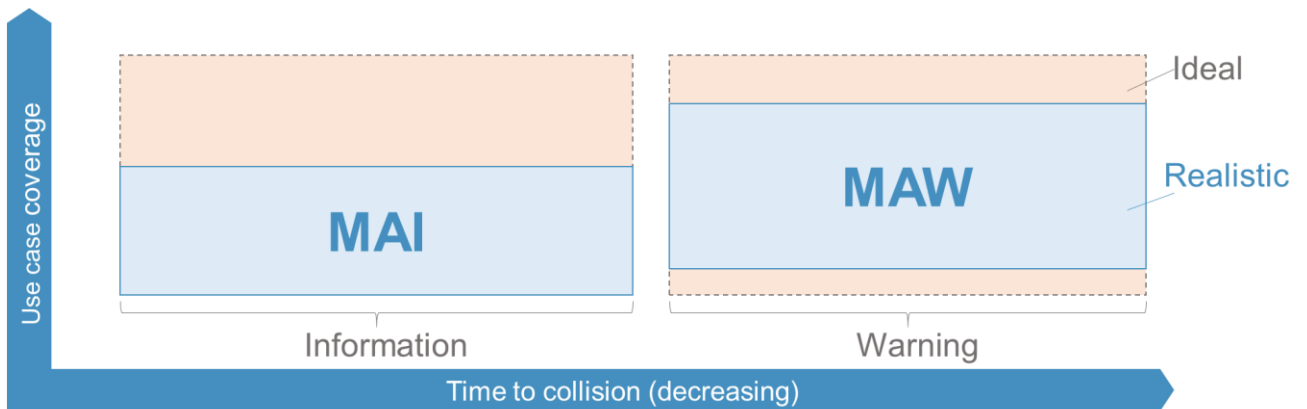


Figure 1: General idea of MAI/MAW

“Information” of MAI may be rephrased as an Advisory Warning (AW). “Warning” of MAW can be rephrased as an Imminent Collision Warning (ICW).

In CMC accidentology study, MAW is treated as IMA+LTA+BSW/LCW+FCW+DNPW and this study assesses its potential, both for overall accident prevention and cases limited to Killed and Seriously Injured (KSI). In this study, MAI is not calculated alone but is treated as MAI/MAW as a whole.

Figure 2 and Figure 3 show the result of CMC accidentology study briefly.

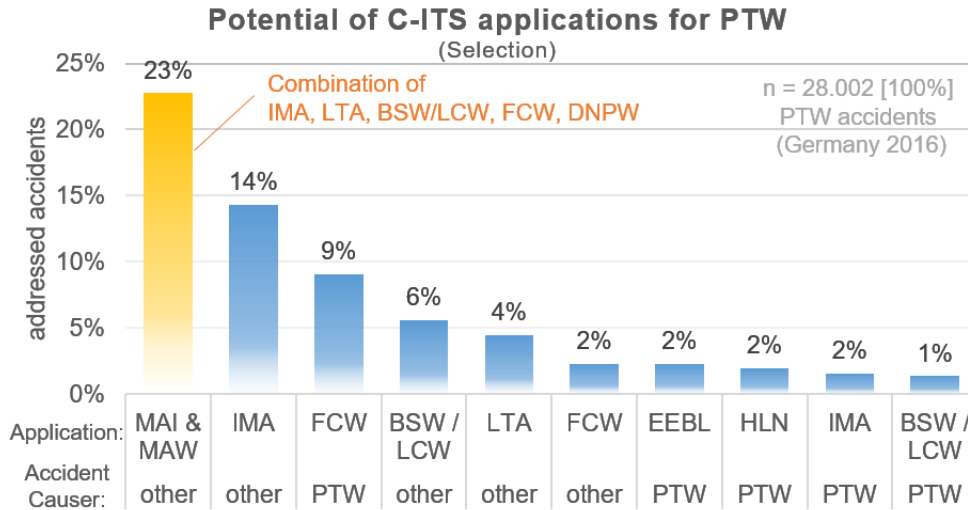


Figure 2: Top 10 addressed accidents per applications

Figure 2 shows that 23% of the crashes happened in Germany in 2016 with the involvement of a PTW are caused by the accident opponent and are addressed by MAI/MAW. From the study, those accidents could have been avoided if the driver had been warned by MAI/MAW.

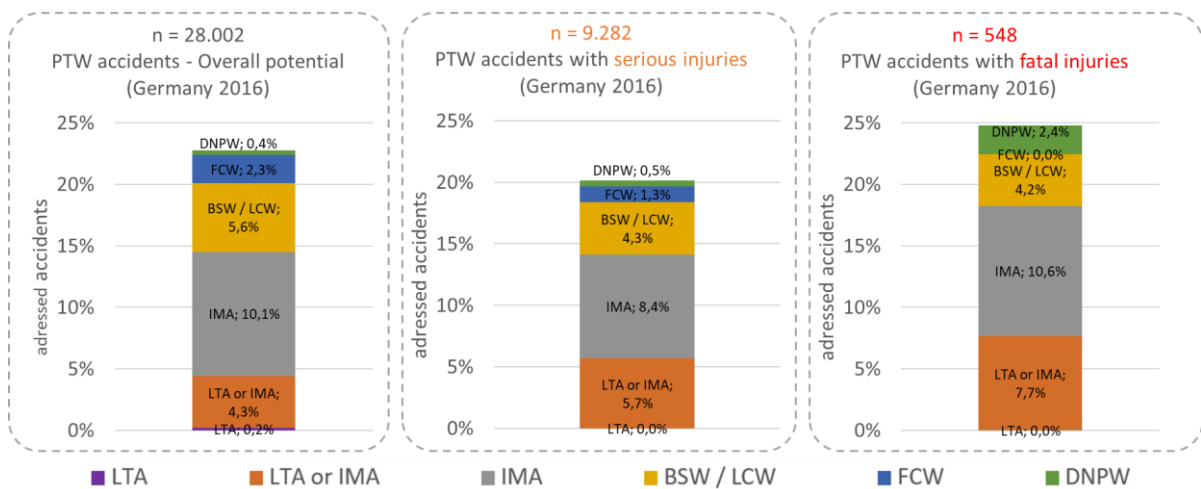


Figure 3: MAI & MAW detailed analysis of the individual applications

It can be seen in Figure 3, that the application with the highest number of incidents is IMA, followed by LTA and BSW/LCW. There are accidents that address both IMA and LTA are considered by the orange bars in the charts.

Abbreviations

The abbreviation list described here can be used for whole application specification including each application document.

AEVW	Approaching Emergency Vehicle Warning
AW	Advisory Warning
AWW	Adverse Weather Warning
BSW	Blind Spot Warning
C2C-CC	CAR 2 CAR Communication Consortium
CAM	Cooperative Awareness Message
CMC	Connected Motorcycle Consortium
CSW	Curve Speed Warning
C-ITS	Cooperative Intelligent Transport Systems
DCW	Dangerous Curve Warning
DENM	Decentralized Environmental Notification Message
DNPW	Do Not Pass Warning
EEBL	Electronic Emergency Brake Light
ETSI	European Telecommunications Standards Institute
FCW	Forward Collision Warning
GIDAS	German In-Depth Accident Study
GLOSA	Green Light Optimal Speed Advisory
GNSS	Global Navigation Satellite System
HLN	Hazardous Location Notification
HMI	Human-Machine Interface
I2V	Infrastructure-to-Vehicle
ICW	Imminent Collision Warning
IMA	Intersection Movement Assist
IVI	In-Vehicle Information
IVS	In-Vehicle Signage
IVIM	Infrastructure to Vehicle Information Message
KSI	Killed and Seriously Injured
LCW	Lane Change Warning
LMA	Lane Merge Assist
LTA	Left Turn Assist
MAI	Motorcycle Approach Indication
MAPEM	MAP (topology) Extended Message
MAW	Motorcycle Approach Warning
OEM	Original Equipment Manufacturer

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PTW	Powered Two Wheeler
RLVW	Red Light Violation Warning
RSU	Road Side Unit
RWW	Road Works Warning
R&D	Research and Development
SPATEM	Signal Phase And Timing Extended Message
SSVW	Stop Sign Violation Warning
SVW	Stationary Vehicle Warning
TJW	Traffic Jam Warning
TLVW	Traffic Light Violation Warning
TCC	Traffic Control Centre
TTC	Time-To-Collision
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Everything
VMS	Variable Message Signs
VRU	Vulnerable Road Users
WWD	Wrong Way Driving