Standardization Status and Future Procedure of ISO/TC204/WG14 'Vehicle/Roadway Warning and Control Systems'

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1. Introduction

ISO/TC204/WG14 is an International Leader in the Development and Production of Intelligent Transport Systems (ITS). WG14, in Which Japan Serves as Chairman Country, is Responsible for the Standardization of Driver Assistance Systems (Vehicle/Roadway Warning and Control Systems).[1]

The Driver Assistance System, Which is a Key Component of ITS, Aims to Reduce Driving Work Load, Improve Driver Convenience, and Assist With Alerting Drivers to Danger and to Avoid or Mitigate Collisions Using Advanced Technologies. Systems Such as the Adaptive Cruise Control (ACC) System) and the Forward Vehicle Collision Warning System (FVCWS) Have Already Been Introduced Into the Market.

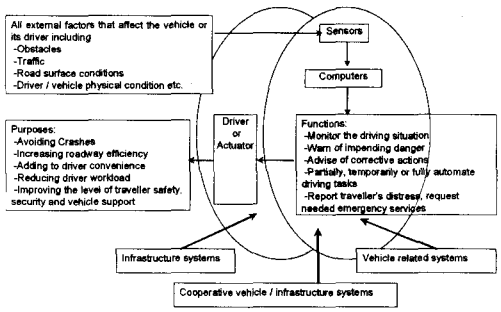
To Promote the Introduction of These New Technologies Into the Market, National Projects Such as the Advanced Safety Vehicle (ASV) and Advanced Cruise Assist Highway Systems (AHS) are Currently Underway in Japan. Moreover, Other Projects Such as the Intelligent Vehicle Initiative (IVI) in the United States and eSafety in Europe have Also Assisted With Promoting These Technologies, and it is Expected That Such Projects Will Lead to Further Improvements in Vehicle Safety and Road Traffic Efficiency in the Future.

In This Report, the Scope and Draft Standards That are Currently Being Developed by WG14 is Outlined. And Also Future Research and Possible Areas for Improving Vehicle Safety and Traffic Efficiency are Discussed.

2. Scope of WG14

〈Figure 1〉 Depicts the Scope of Standardization Carried out by WG14. The Primary Objective of the Group Involves the Standard Development of Systems That Increase the Driver's Attention to Danger, Systems for Avoiding or Mitigating Collisions, and Systems That Reduce the Drivers Work Load by Sensing External Factors That Influence Both the Vehicle and the Driver. Systems That Issue Warnings and That Assist With the Control of the Vehicle

are Also Included in the Scope of WG14, as are Technologies That Improve the Efficiency of Interactions Between the System and the Driver.

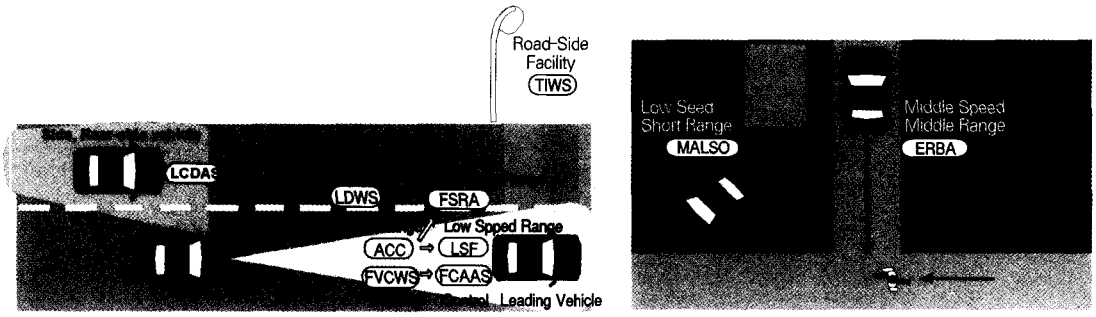


〈Figure 1〉 Scope of WG14

3. Activity Status

〈Table 1〉 Lists the Standardization Items. ACC and FVCWS Systems have Now Been Published as International Standards, and TIWS has Been Published as a Technical Specification. Discussions are Currently Underway Regarding the MALSO System for Which Japan has Contributed to the Acquisition of Basic Test Data. MALSO is Currently Awaiting ISO Publication. The LDWS System, Which was Developed Under Japanese Leadership, is Now at the Committee Draft (CD) Ballot Stage. The LCDAS System, Which is Also at the CD Draft Stage, is Currently Being Discussed in Detail. Moreover, FSRA, LSF, FCAAS and ERBA have Recently Been Introduced as Preliminary Work Items (PWIs) That have Resulted from Research Progress on ITS. As a Result of These Advances, WG14 has Remained Extremely Active.

〈Figure 2〉 Illustrates the Role of Standardization Items in a Simulated Driving Situation. Standardization Items are Composed of the Support Systems for Driving in all Directions, Including Those That are Not Easily Observable from the Vehicle.



〈Figure 2〉 Support Range of Each Standardization Item

〈Table 1〉 Standardization Items in TC204/WG14

Standardization Items	ISO No.	Outline
ACC	ISO15622	Systems That Keep the Clearance Between the Leading Vehicle and the Subject Vehicle. Classification Based on Whether the System has a Clutch Pedal, a Automatic Brake or Not, the Control Strategies, the Interaction Between the System and the Driver, etc. are Defined.
FVCWS	ISO15623	Systems That Issue the Warning to Promote the Driver to Apply the Brake, Preventing a Rear-end Collision. The Detection Range of Forward Vehicles, its Performance and the test Methods, etc. are Defined.
TIWS	TS15624	Systems That Recognize an Obstacle Behind a Curve Using Road-side Sensors, Informing the Driver of Situation Using a Road-side Variable Message Board.
MALSO	FDIS17386	Systems That Inform/warn the Driver of Obstacles of Rear and/or Corners When Backing and/or Cornering at Low Speed. Classification Based on the Detection Area, the System Operation, the Test Methods, etc. are Defined.
LDWS	CD17361	Systems That Promotes the Driver's Attention When the Vehicle Tends to Depart the Lane Due to Driver's Carelessness. The Definition of Terms Such as 'Lane Departure', the Warning Conditions, the System Operation, the Test Methods, etc. are Defined.
LCDAS	WD17387	Systems That Inform/warn the Driver of an Obstacle Vehicle in the Blind Spot of a Door Mirror and a Closing Vehicle from Rear. The Classification Based on the Detection Function, the Warning Conditions, the Test Methods, etc. are Defined.
FSRA	PWI	Systems That Follow a Moving Vehicle Ahead on the Same Path of Travel Excluding a Stationary Vehicle at Full Rang of Speed That is Extended from That of ACC. The Standardization Process has Just Started.
LSF	PWI	Systems That Follow a Vehicle Including a Stationary Vehicle on the Same Path of Travel Under Congested Traffic Where Vehicles Start and Stop Repeatedly at Low Speed. The Standardization Process has Just Started.
FCAAS	PWI	Systems That Issue the Warning When there is a Possibility of the Collision, and then Operate the Automatic Brake When the Collision is Not Avoided to Prevent/mitigate the Collision. Operation Concept, Target Obstacles, System Requirements, etc. are Now Under Discussion.
ERBA	PWI	Systems That Issue the Warning to Obstacles Such as a Child Dashing out, a Bicycle Crossing on the Pavement While Backing a Little Long Path. The Scope, Target Obstacles, Detection Area, System Requirements, etc. are Under Discussion Comparing MALSO Draft.

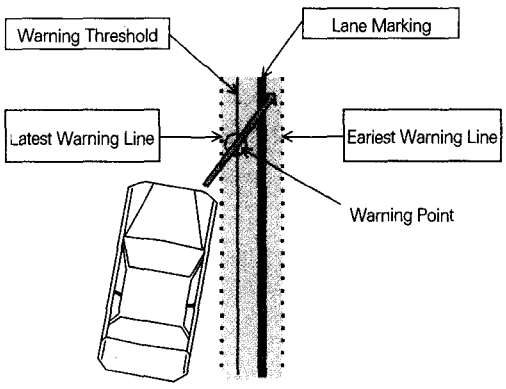
Note: Abbreviation
ACC: Adaptive Cruise Control
FVCWS: Forward Vehicle Collision Warning Systems
TIWS: Traffic Impediment Warning Systems
MALSO: Maneuvering Aid for Low Speed Operation
LDWS: Lane Departure Warning Systems
PWI: Preliminary Work Item
CD: Committee Draft
LCDAS: Lane Change Decision Aid Systems
FCAAS: Forward Collision Avoidance Assistance System
FSRA: Full Speed Range ACC
LSF: Low Speed Following Systems
ERBA: Extended Range Backing Aids
WD: Working Draft
FDIS: Final Draft International Standard

4. Standardization Items and Future Issues

4.1 Lane Departure Warning Systems

An LDWS is a System That Can Judge the Possibility of Departing a Lane from the Horizontal Position With Risk of Collision. Position Within the Lane is Measured With a Detection Sensor. The Range of Standardization Includes a Lane Departure Event and Judgment of the Possibility of Colliding With an Adjacent Moving Vehicle. Collision Evasion Control is Not Included.

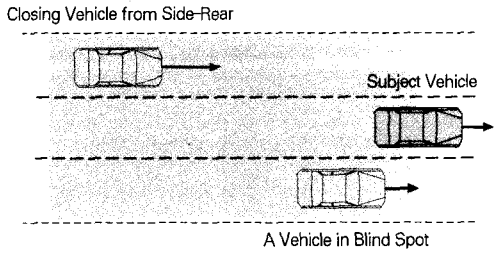
Some Problems have Been Encountered in the Standardization Process for This Item Relating to the Definition of Terms and Phrases Such as the Lane Marking and the Warning Threshold 〈Fig. 3〉. The Development of Test Methods and Appropriate Criteria has Also Delayed the Standard Development of This System. Japan has Served as a Leader in the Draft Design of the LDWS System That is Currently at the Draft International Standard (DIS) Stage.



〈Figure 3〉 Example of Term Definitions

4.2 Lane Change Decision Aid Systems

This System was Originally Named the Side Obstacle Warning System (SOWS). However, the Name was Changed to LCDAS at the TC204 Vienna Meeting Held in October 2003. LCDAS Issues a Warning of a Vehicle in the Blind Spot and a Vehicle That is Approaching from the Rear (Fig. 4). The Warning Requirements Such as the Range of Detection of the Obstacle, Details of the Warning Condition, and the Test Method are Currently Being Discussed. It was Agreed at the Vancouver Meeting Held in May 2004 That This System Should be Proposed for the CD Stage.



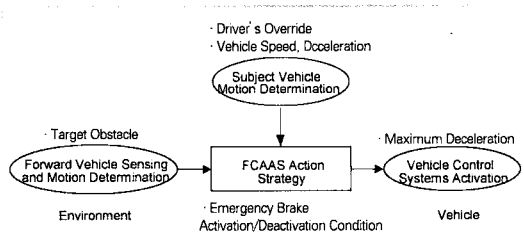
〈Figure 4〉 Functions of LCDAS

4.3 Forward Collision Avoidance Assistance System

FCAAS Issues a Warning When there is a Possibility of Collision. This System then Initiates an Automatic Brake if the Driver Does Not Take the Appropriate Action to Avoid the Collision. Although FCAAS is at the PWI Stage, there has Been Much Interest in the System Because of the Obvious Influence That This System Can have on Road Safety. There have Been Some Differences in the System Concept Put Forward by Several Countries. The US has Asserted That the System Should be a Collision Avoidance System, but Japan Asserts That the System

Should be a Collision Mitigation System When Considering the Restriction of the Technology and Human Factors.

At the TC204 Meeting Held in Vienna in October 2003, it was Agreed That the FCAAS Should be Standardized for Both Prevention and Mitigation Functions. It has Been Requested That Different Countries Propose Ideas on How to Best Design the Collision Reduction System.



〈Figure 5〉 Function of FCAAS

4.4 Extended Range Backing Aid Systems

The Purpose of the ERBA System is to Alert the Driver to Possible Obstacles Such as a Child Running onto the Road or a Bicycle Crossing the Pavement While the Driver is Backing Up (Such as out of a Driveway)〈Fig. 6〉. Japan has Proposed a Meeting Procedure to Discuss the System and its Usage. Our Group Plans to Examine the Feasibility of This System Based on Data Obtained from Actual Use Conditions in the US, and Data Obtained from the MALSO System.

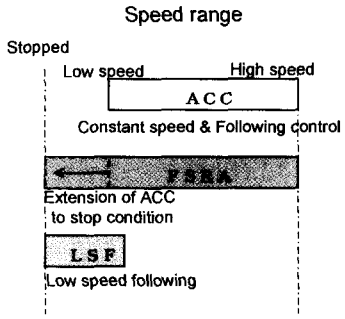
〈Figure 6〉 Example of ERBA Effective Situation

4.5 LSF: Low Speed Following Systems

A Low-speed Following System (LSF) Follows a Leading Vehicle on the Same Path of Travel Under Congested Traffic Conditions Where Vehicles Repeatedly Start and Stop. This System Aims at Reducing the Driver Workload and Reducing the Chance of Rear-end Collisions (Fig. 7). Japan is Serving as the Leading Draft Maker for This System, and is Actively Proposing Traffic Conditions Under Which This System May be Useful as Well as the Basic Control Strategies and Requirements of the System. LSF Can Effectively Reduce the Driver Workload. However, as a Possible Disadvantage, it May Lead to Over-reliance on the System if it has too Much Automatic Capability. Our Group is Currently Reviewing the Appropriate Level of Automation That the System Should have.

4.6 Full Speed Range Adaptive Cruise Control Systems

The Full-speed-range Adaptive Cruise Control (FSRA) Follows a Leading Vehicle on the Same Path of Travel Over the Full Range of Speeds and Represents an Extension to the ACC System 〈Fig. 7〉. With the FSRA System, the Vehicle Can Stop Behind an Already Tracked Vehicle, but Does Not Stop Behind a Vehicle in the Stationary Position. Japan Plans to Issue Comments Regarding the Functional Requirements for This System.



〈Figure 7〉 Comparison of Operating Speed Range of LSF and FSRA

5. Liaison Activities

The Driver Assistance Systems That are Currently Under Investigation by WG14 are Not Aimed at Complete Automation but Instead they Aim to Assist the Driver With Judging the Risk of Collision and Controlling the Vehicle. As a Result, the Improvement of Driver Assistance Systems Requires Improved Human Machine Interface (HMI) Between the Driver and the System. To Develop These Systems, We have Worked Closely With TC22/SC13/WG8 (Man Machine Interface) in Standardizing HMI Items. TC204/WG14 has Requested a Standard That Includes Classification, Definition of Information and Warnings in the Driver Assistance Systems, and Their Requirements. TC22/SC13/WG8 has Been Assisting With Standardization of Classification of Information and Warnings for the Driver Assistance Systems.

WG14 has Also Been Working in Close Collaboration With TC22/SC13/WG5 Concerning Symbols That are Necessary for Improved Driver-Assistance Systems.

6. Conclusion

The Standard Development of New Systems for Vehicle Safety and Road Traffic Efficiency Require Assessment of Consumer Demands and the Prediction of Future Market Trends Because the Development of New PWIs Requires Going Beyond Commercial Introduction. Standardization of the Process Aims to Produce Systems That are Both Effective and Realistic. To Satisfy This Position, the Draft Should be Substantiated by Comprehensive and Rigorous Test Data, and by Attempts to Gain a Consensus from Each Country Through Discussion and the Analysis of Data Obtained in an Unbiased Manner.

Cooperative Driver Systems That Include Vehicle-vehicle and Vehicle-infrastructure Communication are Currently Being Developed. Vehicle Infrastructure Integration (VII) in the US and eSafety in the EU Also Include Cooperative Systems. SWG, Which Includes Experts from the US, Korea and Japan, has Already Begun. Although Cooperative Systems have Several Nation-Oriented Influences, Each Country That Contributes to the Research and Development of These Systems Can be Expected to Make a Valuable Contribution to the Field.

References

(1)Kiichi Yamada, ISO/TC204/WG14 Standardization Status and Future Procedure of Driving Support Systems, JARI Research Journal, Vol. 23, No. 11 (January, 2001)