

JAMA

(Japan Automobile Manufacturers Association)

Guideline for In-vehicle Display Systems — Version 3.0

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1. Basic Concepts

Traffic congestion information and navigation are among the functions of in-vehicle display systems the functions which contribute to the enhancement of traffic safety, smoothing of the traffic flow, and preservation of the environment. However, for drivers, trying to read such information from the display systems installed inside vehicles constitutes extra work in addition to their driving work. Accordingly drivers have been found to show a tendency to refrain from scanning and operating their display systems when the driving workload is heavy as compared to when the driving workload is light.

This sparing of scanning and operating the display systems is believed to be a defensive behavior inherent in human beings. Therefore, it is important to prescribe the content of information to be displayed, method of display system operation, and location of display systems in order to make use of the beneficial functions of in-vehicle display systems, while at the same time allowing the defensive behaviors of drivers. For this purpose the following four principles are established, according to which the specific requirements for in-vehicle display systems are stipulated in section 3 onward of this Guideline:

- (1) Preferably, a display system is so designed that its adverse effect on safe driving will be kept to a minimum.
- (2) Preferably, a display system is installed in such an in-vehicle position that the driving operation and the visibility of forward field will not be obstructed.
- (3) Preferably, the types of information to be provided by a display system are such that the driver's attention will not be distracted from driving; for example, entertainment types of information need to be avoided.
- (4) Preferably, a display system can be operated by the driver without adversely affecting his or her driving work.

2. Scope

- (1) This Guideline applies to display systems (whether factory-installed, or installed by a dealer who has been designated by the vehicle manufacturer) that are installed in vehicles but not including motorcycles and are located at a position visible from the driver.
- (2) A "display system" in this Guideline means a system capable of displaying diagrams, letters, numbers and/or images that have been stored in memories in advance or are received through broadcasting or telecommunication.

- (3) Auditory information provided by a display system is also subject to this Guideline.

3. Installation of Display Systems

3.1. Installation Positions of Display Systems

- (1) A display system shall not interfere with the operation of the steering device nor limit the visibility of the various meters from the driver.
- (2) A display system shall not obstruct any part of the driver's visual field that is necessary for driving.
- (3) The operating section of a display system shall not be located at a position that causes the driver to be substantially displaced from driving posture when operating the display system.
- (4) In case of retrofit display systems, vehicle manufacturers shall take measures to ensure that such display systems be installed at proper positions inside their vehicles.

3.2. Installation Positions of Display Monitors

The display monitor of a display system shall be located at a position that can provide a sufficient visibility of the forward field even when the driver is looking at its screen. Detailed requirements are as stipulated in Annex 1 of this Guideline.

Furthermore, the display monitor of a display system shall be so located that its reflection on the windshield does not obstruct the visibility of the forward field.

4. Functions of Display Systems

4.1. General Display Function

- (1) A display system shall not present the kind of information that impairs the safety and smooth flow of road traffic.
- (2) It is desirable that a display system be designed, where possible, to comply with an internationally agreed standard respecting readability, audibility, icons, symbols, letters, abbreviations, and other factors relating to the manner of information display.
- (3) The luminous intensity, contrast, colors and other display conditions of a display system shall be such that the driver is not dazzled by the display at night.

4.2. Display and Content of Visual Information

- (1) The visual information to be displayed shall be sufficiently small in volume to enable the driver to comprehend it in a short time or shall be presented in portions for the driver to scan them in two or more steps.

- (2) The content of visual information to be displayed while the vehicle is in motion shall relate exclusively to driving, but shall not necessitate the driver gazing at it continuously. Detailed requirements are as stipulated in Annex 2 of this Guideline.

4.3. Presentation of Auditory Information

- (1) A display systems shall be equipped with a means of controlling auditory information, but not including alarms, for the driver who may find auditory information distracting or irritating.
- (2) A display system shall not be capable of generating an uncontrollable volume of sound that may cancel out alarms sounded from inside or outside of the vehicle.

5. Display System Operation While Vehicle in Motion

Importantly, while operating the display systems of their vehicles, drivers must be able to shift their visual attention to the forward field whenever necessary; also, drivers' visual attention to display systems in response to displayed information must be confined within the time allowance given by confronting traffic situations. Furthermore, as one of their behavioral characteristics, drivers have been found to show a tendency to complete a whole series of display system operations when it is disrupted midway or to repeat the same operation when the response of the display system is slow, even though the surrounding situation demands full attention to driving.

For these reasons, the following nine requirements should be fulfilled with a view to enabling drivers to perceive and process displayed information with an adequate time allowance and mental poise and to complete the display system operation tasks without obstructing the attention to driving:

- (1) The operation of a display system shall not cause the driver to remove both hands simultaneously from the steering wheel.
- (2) The operation of a display system shall not result in a marked obstruction of forward field visibility.
- (3) Information to be presented by a display system shall not cause the driver to gaze at the screen continuously.
- (4) Preferably, the visual information to be displayed is sufficiently small in volume or is presented in portions so that the display system can be operated in separate steps.

Detailed requirements respecting the above (2), (3) and (4) are as stipulated in Annex 3 of this Guideline.

- (5) Preferably, a display system is so designed that its display of information can be discontinued by the driver.
- (6) Preferably, when its display of information is discontinued, a display system is

capable of resuming the display from the point of discontinuation or a point enabling the understanding of the displayed information as a whole.

- (7) A display system's functions that are not presumed to be used by the driver during driving operation shall be inoperative by the driver while the vehicle is in motion.
- (8) When the driver is to input data into a display system, the display system shall not demand immediate responses from the driver.
- (9) Information, such as the reporting of system state and operation that is displayed in response to the data inputted by the driver shall be quickly and easily comprehensible.

6. The Presentation of Information to Users

- (1) The importance of safe driving shall be appealed to the users of display systems through pamphlets and operation manuals and by fully educating the vehicle dealers and the sellers of retrofit display systems.
- (2) Safety information to be presented to the users of display systems shall be accurate, simple and clear.
- (3) The operation manuals of display systems shall be so written and graphically designed as to be easily comprehensible by display system users.

Annex 1: Display Monitor Location

1. Passenger cars with a seating capacity of 10 or less occupants, trucks derived from such passenger cars, and vehicles shaped similarly to such trucks.
 - (1) The upper end of the display monitor shall conform to the lower boundary requirements of the driver's 180° forward visual field stipulated in 90/630/EEC on the visual field of drivers.
 - (2) The screen of the display monitor shall be located within the 30° inclination range from the straight line which is the projection of the straight line connecting the JIS eye point and the center of the screen onto the Y-plane of the vehicle's three-dimension coordinate.
2. Vehicles not specified in the above section 1
 - (1) In the case of vehicles with the eye point measuring less than 1,700 mm from the ground, the upper end of the display monitor shall conform to the lower boundary requirements of the driver's 180° forward visual field stipulated in 90/630/EEC on the visual field of drivers.
 - (2) In the case of vehicles with the eye point measuring equal to or higher than 1,700 mm from the ground, the upper end of the display monitor shall conform to the lower boundary requirements of the critical zone A stipulated in ADR 15/01 on demisters.
 - (3) The screen of the display monitor shall be located within the range of inclination from the straight line which is the projection of the straight line connecting the JIS eye point and the center of the screen onto the Y-plane of the vehicle's three-dimension coordinate, provided that the angle of inclination is derived from the following formula:

$$\text{Inclination [deg]} = 0.013 \times \text{eye point from ground [mm]} + 15$$

Annex 2: Content and Display of Visual Information While Vehicle in Motion

1. Map display function
 - (1) Maps to be displayed for navigation purposes shall not show minor roads in urban areas. However, if the indication of such roads causes the driver neither to gaze continuously at nor to look for shortcut routes on the screen, minor roads in urban areas may be shown in navigation maps on the following conditions:
 - a. Those minor roads deemed important in the entire network of roads may be shown.
 - b. In maps more detailed than a 1:20,000 scale, minor roads may be shown only while running on narrow roads. However, when the map on the screen is manually scrolled (including improved and simplified scrolling operations),

minor roads shall not be shown.

c. In maps of a 1:5,000 or more detailed scale, minor roads may be shown while the vehicle is in motion. However, when the map on the screen is manually scrolled (including improved and simplified scrolling operations), minor roads shall not be shown.

(2) The display of navigation maps shall be prohibited if the driver is confused when the maps are automatically scrolled in keeping with the speed of the vehicle.

2. Information display to be prohibited

(1) The display of addresses and telephone numbers as guiding information shall be prohibited while the vehicle is in motion. However, images that do not contain such addresses and telephone numbers and are to appear in the searching process may be displayed while the vehicle is in motion.

(2) The display of information describing restaurants, hotels and other similar facilities shall be prohibited while the vehicle is in motion. However, images that do not contain such information on restaurants, hotels, etc. and are to appear in the searching process may be displayed while the vehicle is in motion.

(3) Static images that are useful for driving and are quickly comprehensible may be displayed while the vehicle is in motion.

3. Treatment of broadcasted information

(1) The display of motion pictures including broadcasted television pictures and replayed video and DVD pictures shall be prohibited. (However, traffic information and other similar motion pictures specially simplified for driving use may be displayed.)

Among the literal information available through FM multiplex broadcast, the "Major supplemental programs", "News", and "General information programs" shall not be displayed.

(2) Among the literal information available through FM multiplex broadcast, the "Table of contents/top page", "Emergency information", "Traffic information", "Program information", and "Weather information" may be displayed, as they all are the type of information relating to driving and are arranged for existing equipment.

4. Dynamic display function

(1) When congestion information and other dynamic information are superimposed on a road map, the total information volume in the screen shall be optimized.

(2) Information for warning purposes shall be easily distinguishable from other information.

(3) Travel time information shall be quickly comprehensible without requiring the

driver to perform complex calculation.

- (4) If dynamic information is to be displayed in letters, the following conditions shall be observed, provided that the names of information suppliers (broadcasting corporations, etc.) titles of the programs, and time of display are not deemed to be dynamic information:
 - a. The scrolling of letters shall be prohibited.
 - b. The number of letters (e.g., characters, kana, alphabets) displayed at a time shall not exceed 31, provided that a number such as "120" or a unit such as "km/h" is deemed to be a single letter irrespective of the number of digits. Punctuation marks are not included in the count of letters.

Annex 3: Operation of Display Monitors While Vehicle in Motion

The operation of a display monitor is prohibited if the driver's operation task fails to comply with the following standard:

- (1) The total time of the driver's looking at the screen between the start and completion of operation task shall not exceed 8 seconds.
- (2) When the above total time is measured by a bench test using the occlusion method, the total of shutter opening time shall not exceed 7.5 seconds.

APPENDIX

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Explanation of the Guideline for In-vehicle Display Systems

1. Introduction

In view of the ‘Performance Objectives on Human-Machine Interface for In-vehicle Display Systems’ issued in the March 2002 report by the study group for formulating a standard for in-vehicle display systems organized by the Road Transport Bureau of the Ministry of Land, Infrastructure & Transport and consisting of other related authorities and industry organizations including the Japan Automobile Manufacturers Association (hereafter called "JAMA"), the third version of this document defines requirements which automotive manufacturers must consider when developing human-machine interface for display systems. One of the preconditions for the Guideline is that display systems be so designed as to prevent tampering by users for their own particular uses.

In Japan, it is required to conform to established laws and regulations to prevent the use of the in-vehicle display system from interfering with safety and smooth flow of road traffic, e.g., section 5-5, article 71 of the Road Traffic Law prohibiting drivers from gazing at a display for a sustained period and section 2-3, article 109 of the said law relating to provision of traffic information (notice from the National Public Safety Commission).

2. Method of Stipulation

Where it is not possible to stipulate requirements and conditions in quantitative terms, lists of prohibitions are given in the Guideline. Consequently, each item and function not stipulated needs to be judged separately building on the ideas outlined in the section 1 - Basic Concepts of the Guideline. The requirements and conditions of the Guideline are subject to change, depending on future progress in technologies.

3. Explanation

(1) Scope [2. Scope]

The Guideline applies to display systems that are installed in vehicles, including large trucks and buses but excluding motorcycles, either by vehicle manufacturers at their factories or by dealers approved by vehicle manufacturers. However, the Guideline does not apply to display systems that dealers install on their own initiative. Devices for enhancing the driver's visibility are not subject to the Guideline.

(2) Effective Date

The aim is that this version of the Guideline will be applied to systems and vehicles developed or modified after 1 Jan. 2007. The Guideline, however, may be effective as far as possible prior to this target date.

Note: For display systems and vehicles not applicable to the above provision, the current version of the Guideline (refer to 00 Jigihatsu No.96, 2 Feb. 2002) shall be used.

(3) Installation Location of Display System [Annex 1]

1) Lower limit

- a. The lower limit location of a display system's screen is determined based on a Japan Automobile Research Institute experiment commissioned by JAMA. In this experiment, stationary tests and running tests were performed to quantify driver perception of approaching a vehicle in front while the driver is gazing at the screen. The lower limit was then derived from the test results on the relationship between screen location and the headway distance at which the driver perceives the preceding vehicle.
- b. Previous studies have indicated that the relationship between screen location and the headway distance at which the driver perceives the preceding vehicle varies according to the height of eye point from the ground in an unloaded vehicle (as defined in JIS D0021 and D1702 Standards). Consequently, an approximation formula was obtained to correct the screen location according to eye point.
- c. Based on the above lower limit, the inclination of the screen is prescribed in the Guideline for passenger cars with a seating capacity of 10 or less occupants, trucks derived from such passenger cars, and vehicles shaped similarly to such trucks [Annex 1, sect.1] and for other vehicles [Annex 1, sect.2]. The first group includes passenger cars, vans derived from passenger cars, recreational vehicles and their derivatives including "pick-up trucks", and vehicles legally modified to simulate any of group-1 vehicles. The second group consists mainly of trucks and buses.
- d. For group-1 vehicles [Annex 1, sect.1], the lower limit of screen location is set at 30 degrees without providing correction by eye point. This angle is defined as the inclination between horizontal line and the straight line which is the projection of the straight line connecting the JIS eye point and the center of the screen onto the Y-plane of the vehicle's three-dimension coordinate as prescribed in JIS D0030 Standard.
- e. For recreational vehicles and other similar vehicles with a relatively high eye point in the first group of vehicles, experimental results have suggested a need to provide correction by eye point. However, since it is difficult to draw the line between the vehicles requiring correction and those not, a uniform limit of 30 degrees is adopted in the Guideline. For the second group of vehicles, however, a formula for correction is given.

2) Upper Limit

- a. Since the objective of setting an upper limit to screen location is to prevent the display monitor from obstructing the forward visibility, the Guideline provides an upper limit that is in agreement with the visual field requirements in other countries rather than to introduce a new limit value.
- b. For group-2 vehicles [Annex 1, sect.2], the Guideline sets down two different upper limit values according to eye point. The upper limit taken from EU Directive 90/630/EEC is applied to vehicles whose eye point is lower than 1,700 mm from the ground, and that taken from Australian Regulation ADR 15/01 on demisters is applied to vehicles whose eye point is equal to or higher than 1,700 mm.

(4) Display of Minor Road Information [Annex 2, sect.1]

- 1) Since the ultimate goal of navigation systems is to guide the vehicle door to door, the Guideline allows displaying all the roads, including minor ones, when they are selected either manually by drivers or automatically by navigation systems. As this is combined with the requirement that prohibits displaying minor roads that are not selected manually or automatically, it is believed that the information volume on the screen will not be overly large and that drivers will be prevented from looking for shortcut routes on the screen during driving.
- 2) In maps more detailed than a 1:20,000 scale, the Guideline permits displaying minor roads only while the navigation system guides the driver from narrow roads to the trunk road. However, to prevent the driver from looking for a shortcut route in the map, the system must discontinue displaying minor roads whenever the driver scrolls the map manually.
- 3) Provisions of maps of a 1:5,000 or more detailed scale, i.e. urban area maps, are also included in this Guideline. Since only a small area is covered by a single frame for urban area maps, it is unlikely that these urban maps are used in search of shortcut routes. However, drivers may still try to look for a shortcut route by scrolling the map; therefore, the Guideline prohibits the display of minor roads when the map is scrolled manually.

The above features of the Guideline can be summarized as follows, where "O" means Permitted and "X" Not permitted:

Scale of map	1:20,000 or less detailed	More detailed than 1:20,000	1:5,000 or more detailed
Driving conditions			
Important roads in road network	O	O	O
Driving on minor road	X	O (X when scrolling)	O (X when scrolling)
Driving on other roads	X	X	O (X when scrolling)

(5) Display of Static Images While Vehicle in Motion [Annex 2, sect.2]

Due to technical advances of vehicle-mountable large memories like new navigator systems using cell-phone data networks and DVDs it has become possible to supply drivers with graphic information. Accordingly, the Guideline allows the display of the following types of static images while the vehicle is in motion:

Category	Content		Vehicle in motion	Condition	
Static image	Traffic information	Camera picture	O	Promptly comprehensible	
		Map	O	VICS level-2 image	
	Weather information	Symbol	O		
	Facility information	Map (route)		O	VICS level-2 image
		Exterior image		O	
		Indoor image		X	
		Product image		X	

Note: Icons and indicators may also be displayed while the vehicle is in motion, provided that they do not adversely affect the driver in obtaining information from the display system.

(6) Display of FM Literal Information [Annex 2, sect.3]

In acting on a request, ARIB (Association of Radio Industries and Businesses) standardized the program identification numbers which helps insure safe use of literal information during driving. The Guideline defines that literal information other than "Table of contents/top page", "Emergency information", "Traffic information", "Program information", and "Weather information" on in-vehicle display systems be avoided by utilizing the identification number while the vehicle is in motion.

The "program information" refers to information for certain programs that are selected and displayed in parallel with the radio broadcast, and that are relatively easy to read, e.g. artist names and song titles. Selection criteria are decided by each broadcasting station. The display and non-display of programs can be summarized as follows:

	Program code	Display while stationary	Display while in motion
1) Table of contents/top page	0	Permitted	Permitted
2) Emergency information	255	Permitted	Permitted
3) Major supplemental programs	254	Permitted	Prohibited
4) News	1-19	Permitted	Prohibited
5) General information programs	20-39	Permitted	Prohibited
6) Traffic information	40-79	Permitted	Permitted
7) Program information	80-99	Permitted	Permitted
8) Weather information	100-149	Permitted	Permitted
9) Others	150-249	Permitted	Prohibited

(7) Optimization of Information Volume on Screen [Annex 2, sect.4]

If information on road congestion and traffic controls is simply superimposed on a map, the volume of information displayed on the screen increases, resulting in taking too much time for the driver to read the necessary information. Therefore, it is advisable to use a number of methods for optimizing the volume of information on the screen as follows:

< Examples >

- a. For indicating traffic congestion information, delete symbols and letters from the original map.
- b. Indicate only the traffic congestion and controls information relating to routes to the destination.

Since, unfortunately, current technologies do not allow quantitative definition of optimum volume of information, the Guideline defines this optimization in qualitative terms.

(8) Display of Warning Information [Annex 2, sect.4]

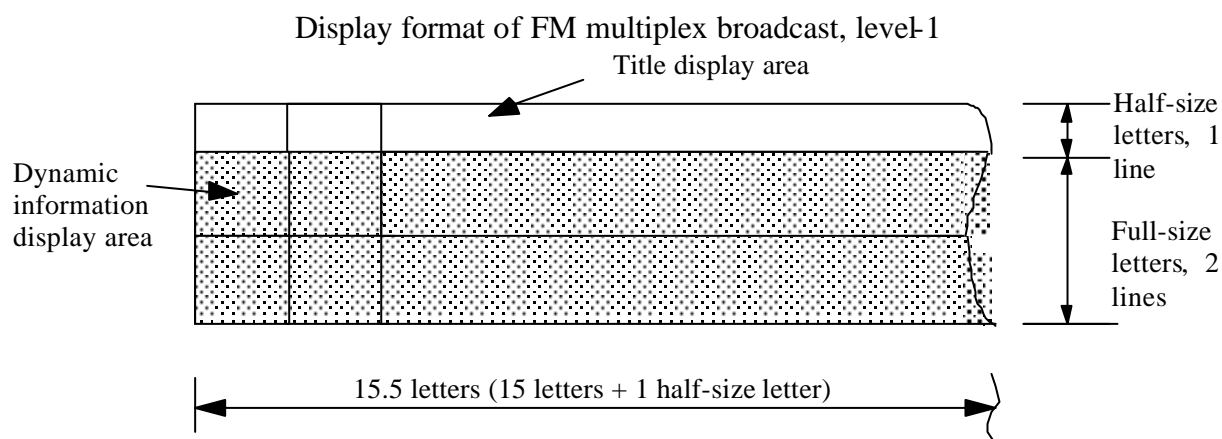
VICS supplies emergency information such as earthquake reporting. Since this type of information appears on the display monitor abruptly regardless of the driver's wishes, such information is recommended to be easily and quickly comprehensible by drivers.

(9) Display of Traveling Time [Annex 2, sect.4]

VICS presents traveling time information between links and between specific points, and such information needs to be quickly comprehensible. Consequently, it is not recommended that, for example, drivers have to add time taken to access each point to determine the total hours for reaching a destination.

(10) Display of Dynamic Information by Letters [Annex 2, sect.4]

The Guideline presumes the display of dynamic information at the level-1 of FM multiplex broadcast.



In the level-1 display, the information provider name (broadcasters), title, and

information providing time are to be displayed in the first line, using half-width characters. These items are not considered as dynamic information because they are not constantly changing even though received from outside source. Also, the Guideline excludes the constantly-changing information providing time on the ground that a clock display is already available in vehicles.

The Guideline prohibits the scrolling of letters while the vehicle is in motion, so as to prevent the driver from gazing at the screen. The display of 31 or more letters at a time is also prohibited while the vehicle is in motion, for the following reasons:

- a. The results of a test conducted in 1992 suggested that 30 is the maximum number of letters that drivers can read without feeling rushed.
- b. The maximum number of letters contained in the level-1 dynamic information display is 30 per screen. To harmonize communication between level-1 FM multiplex broadcast and in-vehicle display systems it is necessary to set the maximum number of letters on in-vehicle display system screen at 30.

The letters are counted as follows according to the Guideline:

- a. A number such as "120" or a unit such as "km/h" is deemed to be a single letter irrespective of the number of digits.
- b. Punctuation marks are not included in the count of letters.

(11) Supply of Auditory Information [Guideline, sect.4.3]

As there have been increasing opportunities to supply auditory information thanks to the advance of voice synthesizing technologies, the Guideline recommends display systems to be equipped with a sound volume control function.

(12) Display System Operation While Vehicle in Motion [Annex 3]

The Guideline in its new 3.0 Version incorporates some quantitative judgment criteria. Given below are examples of complex operations of a display system which fail to meet the quantitative judgment criteria: and are therefore recommended to be eliminated from display systems.

- a. Setting and changing a destination using the cursor key
- b. Scrolling
- c. Selecting area maps
- d. Map searching from addresses and facility names
- e. Pressing car phone ten keys
- f. Inputting personal information such as phone numbers
- g. Searching for general information (address, phone number, etc.) on restaurants, hotels and other facilities
- h. Selecting display area for dynamic information

Total gazing time is the most suitable indicator to evaluate the driver's display system gazing behavior during driving, and the Guideline permits bench tests using the

occlusion method to perform such evaluation. Gazing time is as defined in ISO 15007, Measurement of the Driver Visual Behaviour with Respect to TICS. The occlusion method is yet to be standardized by ISO, and the study group for formulating a standard for in-vehicle display systems, which proposed the basic ideas for the Guideline, applies the following procedures to the occlusion method:

- 1) The task completion time to be evaluated is from the start of operation by the driver to the display of the desired information or the initiation of the desired action by the display system. Consequently, the time for the display system to respond to the driver's final operation is not included in the task completion time.
- 2) The shutter pattern of the occlusion method is 1.5 second open and 1.0 second close.
- 3) In the case of operations entailing a long response time like route search, or connection to a traffic information center, any response taking 1.5 seconds or longer is counted as 1.5 seconds, provided that the display system can indicate the start of a "wait" period and can inform of a "ready" state without the driver looking at the screen. If the start of a "wait" period can be indicated without the driver looking at the screen, the response time for this operation is considered to be 0 second.
- 4) The total gazing time standard [Annex 3] is applied also to where car air conditioners and car audio systems are operated via in-vehicle display systems.
- 5) Since a feedback function using sound or vibration enables drivers to operate their display systems without looking at them, the Guideline permits the use of non-visual feedback while the vehicle is in motion.
- 6) Regarding the control of screen brightness and the like, the time needed to reach the center value from the maximum or minimum value must be within a prescribed limit.
- 7) To minimize inter-subject deviations, the following conditions are provided:
 - a. Employ 10 adult subjects 20 to 49 years old, and use the average value of their operation time to judge compliance with the total gazing time standard.
 - b. Fully train the subjects in advance. If they show a difference of 4 or more in the number of shutter opening in the test, retrain the subject who has recorded the maximum number or redo the test after changing the subjects.

4. Software Provided by Third Parties

For display systems having a structure described below, the supplier of such display systems must ensure that third parties who supply display system software observe the Guideline:

- 1) A structure having software stored in memories such as CD-ROMs, and be easily replaced with or added to another software stored in identical memories sold by third

parties.

- 2) A structure enabling connection with a network to browse or download the contents provided by third parties.

5. Definitions in the Guideline

- (1) "Minor road" means a road less than 5.5m wide, excluding major trunk roads such as national highways, major regional roads, and prefectural roads.
- (2) "Important road in the road network" means a road that is less than 5.5m wide, linked to a non-minor road, and deemed to be contributing to the smoothing of traffic flow. A non-minor road that has narrow sections less than 5.5m wide is treated as an "important road" if the deletion of these sections from display causes confusion to drivers.
- (3) "Scroll" means the display of information in continuous motion, including the display of letters in motion.
- (4) "Scrolling" means the continuous moving of the displayed information by operating a key.
- (5) "Dynamic information" means the types of information, including traffic congestion information, which the display system receives from the outside through a telecommunication or broadcast network and whose content constantly changes. For example, information on engine speed which constantly changes is not dynamic information because it is not obtained from the outside.
- (6) "Task" means a series of operations performed by the driver to start the desired action of a display system or to have the desired information displayed.
- (7) "Occlusion method" means the technique of controlling shutter opening/closing time, often using a liquid crystal shutter, in order to measure the total shutter opening time between the start and end of a task.
- (8) "Improved and simplified" operation means a display system operation whereby the screen image is changed according to memorized conditions so as to prevent the driver from gazing at the screen continuously.