MLIT
Ministry of Land, Infrastructure, Transport and Tourism

Japanese Activities on Approaching Vehicle Audible System for HEVs and EVs

4 May, 2010

MLIT, JAPAN

NTSEL

JASIC

MLIT Activities

- The MLIT announced the guideline on quiet vehicles for the Approaching Vehicle Audible System based on the report of its Study Committee.
- This guideline makes the installation of the system which meets certain requirements possible, in order to make quick penetration of the system.
- This guideline is also designed for the retro-fit system for in–use vehicle to accelerate its penetration as well.

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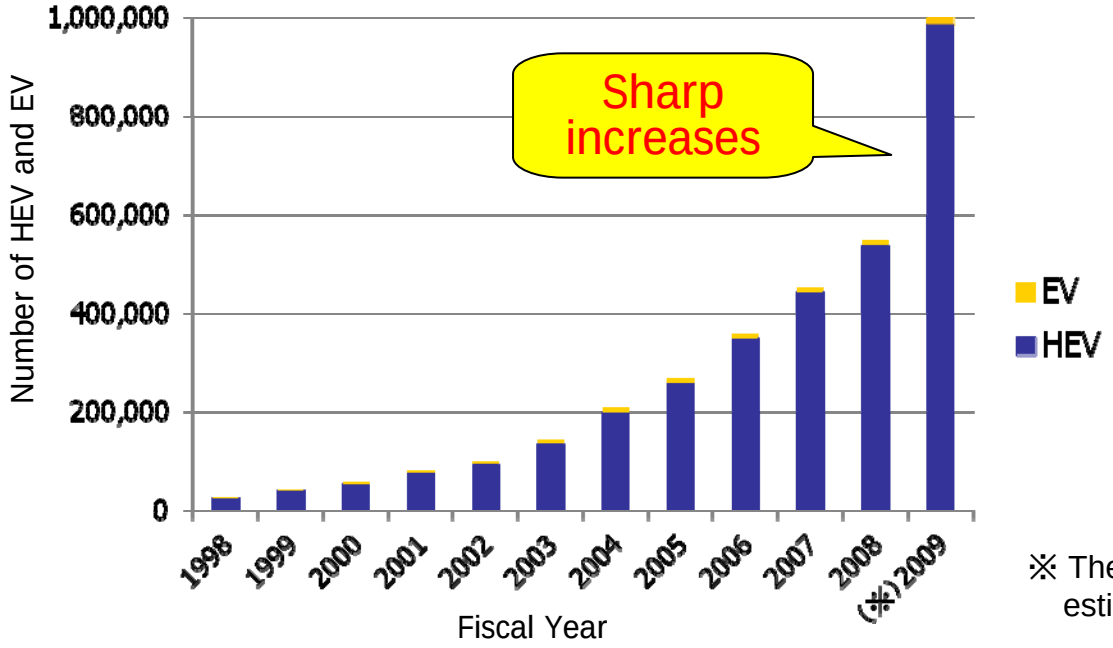
Definition of terms

ICE : Internal Combustion Engine vehicle
HEV : Hybrid Electric Vehicle
EV : Electric Vehicle
FCEV : Fuel Cell Electric Vehicle

Background

- Number of Hybrid Electric Vehicles (HEVs) and Electric Vehicles (EVs) increasing in Japan;



※ The number in fiscal year 2009 is an estimate value.

- Those vehicles are very quiet and difficult to be noticed by pedestrians

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Study Committee Members

- 3 members from government
  (MLIT, National Police Agency, Cabinet Office)
- 4 members from academic/research institutions (Experts of Human Engineering, Visual Defect, Noise and Vibration Engineering and Automobile Engineering)
- 3 members from automobile-related associations (JAMA, JAPIA, JAIA)
- 1 member from Japan Federation of the Blind
- 2 members from consumer/user organization
  (Japan Association of Consumer Affairs Specialists, JAF)

Process of the study

- 1st Meeting (July 2, 2009)
- 2nd Meeting (August 5, 2009)
  * The committee held the experience among blind people and presses to compare with quiet vehicles, gasoline engine vehicles and new sounds.
- 3rd Meeting (October 15, 2009)
- Public Comments (Nov. 5, 2009 – Dec. 4, 2009)
- 4th Meeting (Dec. 25, 2009)
- Jan 29, 2010
  * Announcement of the results of the study committee's discussions.

Points of the Study (1)

The committee figured out following items.

- the number of HEVs and EVs in use
- condition of accident about quiet vehicles by hearing from Japan Federation of the Blind and automakers
- condition of accident about quiet vehicles based on the actual accident data

Points of the Study (2)

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Basic Concepts

- The problem of quietness of HVs is that the sound will disappear. The sound is one of the most important communication tools between vehicles and pedestrians. So, even if a driver pays attention to pedestrians, it cannot be solved.
- Especially, it is necessary for visually-impaired people to gain a sense of safety by the noise when a vehicle is approaching as well as departing.
- Most of the measures using communication devices are still under study, and there are issues of infrastructure such as installation of communication terminals.
- After the above considerations, a realistic measure is to emit a sound from vehicles.

Points of the Study (3)

The committee made the report regarding the following points about the measure.

A) Scope
B) Situations where the measure is necessary
C) Types of the sound
D) Means to generate the sound
E) Volume of the sound

A) Scope

(1) HEVs with EV-mode and EVs

(2) HEVs without EV-mode

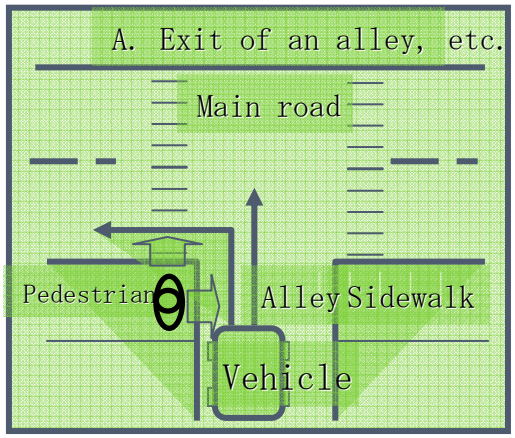
(3) ICEs with idling stop system

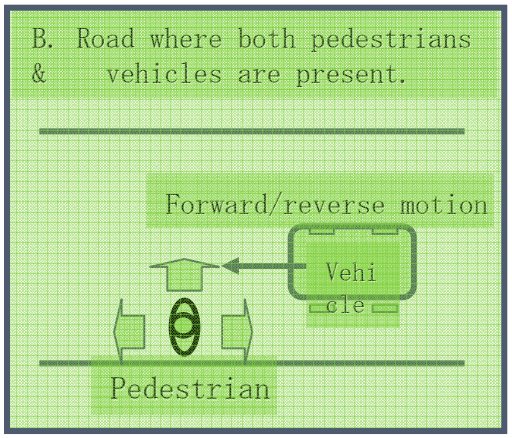
(4) Quiet general ICEs

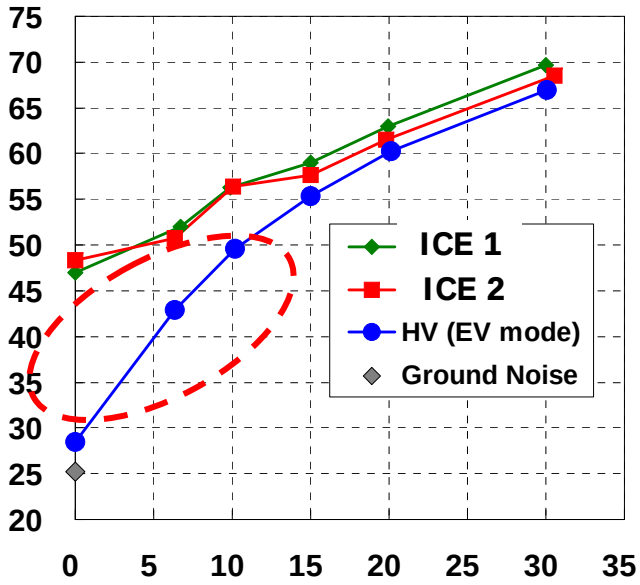
- ICEs were noticed by most participants of workshop even when it run at low speed.
- Vehicles where the engine is activated at the start (ex. Insight) had been found to be as noticeable as conventional ICEs by the workshop.

Conclusion: HEVs with EV-mode and EVs

B) Situations where the measure is necessary







•According to experiments of visually-impaired people where the quietness becomes a problem (above A, B).
• And maximum noise level of HV (EV mode) and ICE are difference under 20km/h.

Conclusion : Speed range from start to 20 km/h and in reverse motion

C) Types of the sound

*** Chime * Melody * Single tone**

*** Sound associated with running vehicles (simulated engine sound, simulated motor sound, etc.)**

- Sounds emitted vehicles, regardless of the types of sound, had been found to be noticeable equally to conventional ICEs or any more by the workshop.
- But vehicle's presence/behavior (approaching, departing, etc.) should be noticed naturally and effortlessly, even if the sound is not widely promoted in society.

Conclusion: Sound associated with running vehicles

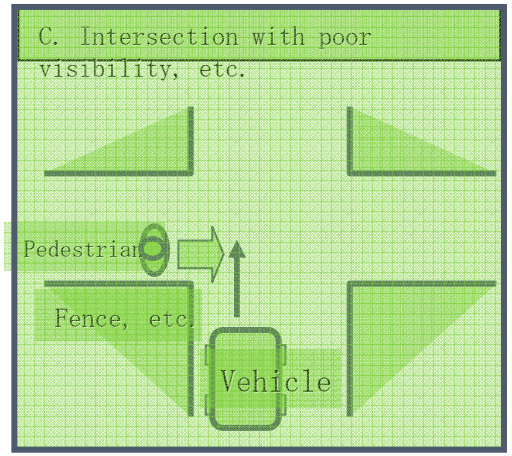
D) Means to generate the sound

(1) Automatic sound-generation system, permanently ON

(2) Automatic sound-generation system, with temporary OFF switch

(3) Automatic sound-generation system, with manual ON/OFF selection

(4) Manual sound-generation system



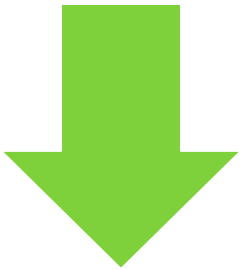
•(4) is not effective in case (C), where the driver is unaware of the pedestrian.

•Temporary OFF switch is needed at the cases like unfrequented residential area of midnight.

Conclusion : System that generates the sound automatically in response to the vehicle speed. It should be kept ON as default. The installation of a temporary OFF switch will be allowed, but the system shall not be remain suspended.

E) Volume of the sound

- It needs to be sufficient for the pedestrians including visually-impaired to notice approaching vehicles
- It should not be the one to make the environmental noise worse.



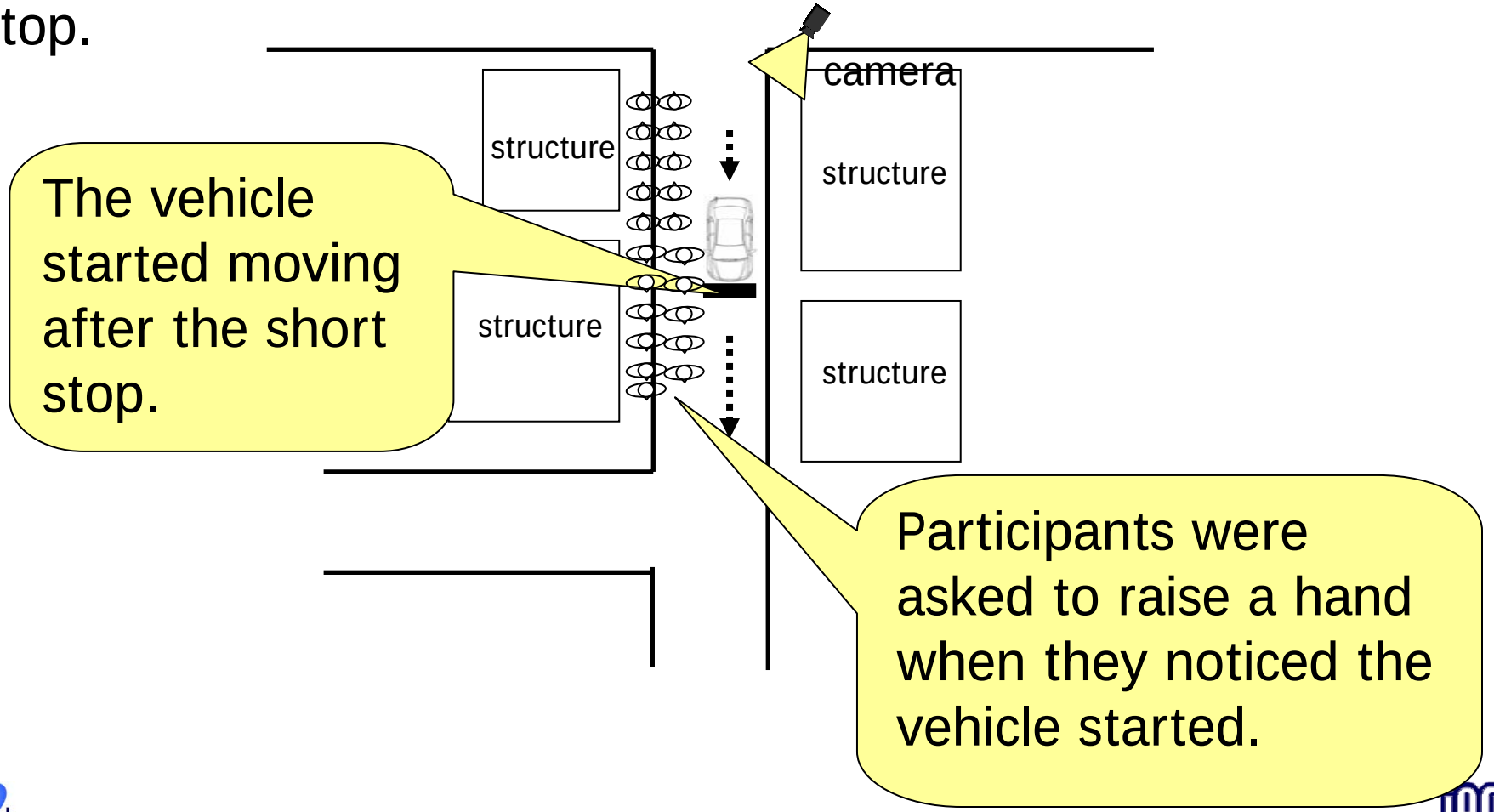
Conclusion : Volume that is around the same as general ICEs

Details of the Workshop

- Place: Private road within the premises of NTSEL
- Test vehicles: 5 vehicles (ICE, Prius, Insight, Altima HEV, iMiEV)
- Participants: 40 people (include 15 visually-impaired people)
- Test contents
  ① Stopped/started test without sound
  ② Running test at 25 km/h without sound
  ③ Running test at 10 km/h or less without sound
  ④ Running test at 10 km/h or less with sounds
  ⑤ Stopped/started test with sounds
- Background noise level: 53 dB(A) – 56 dB(A)

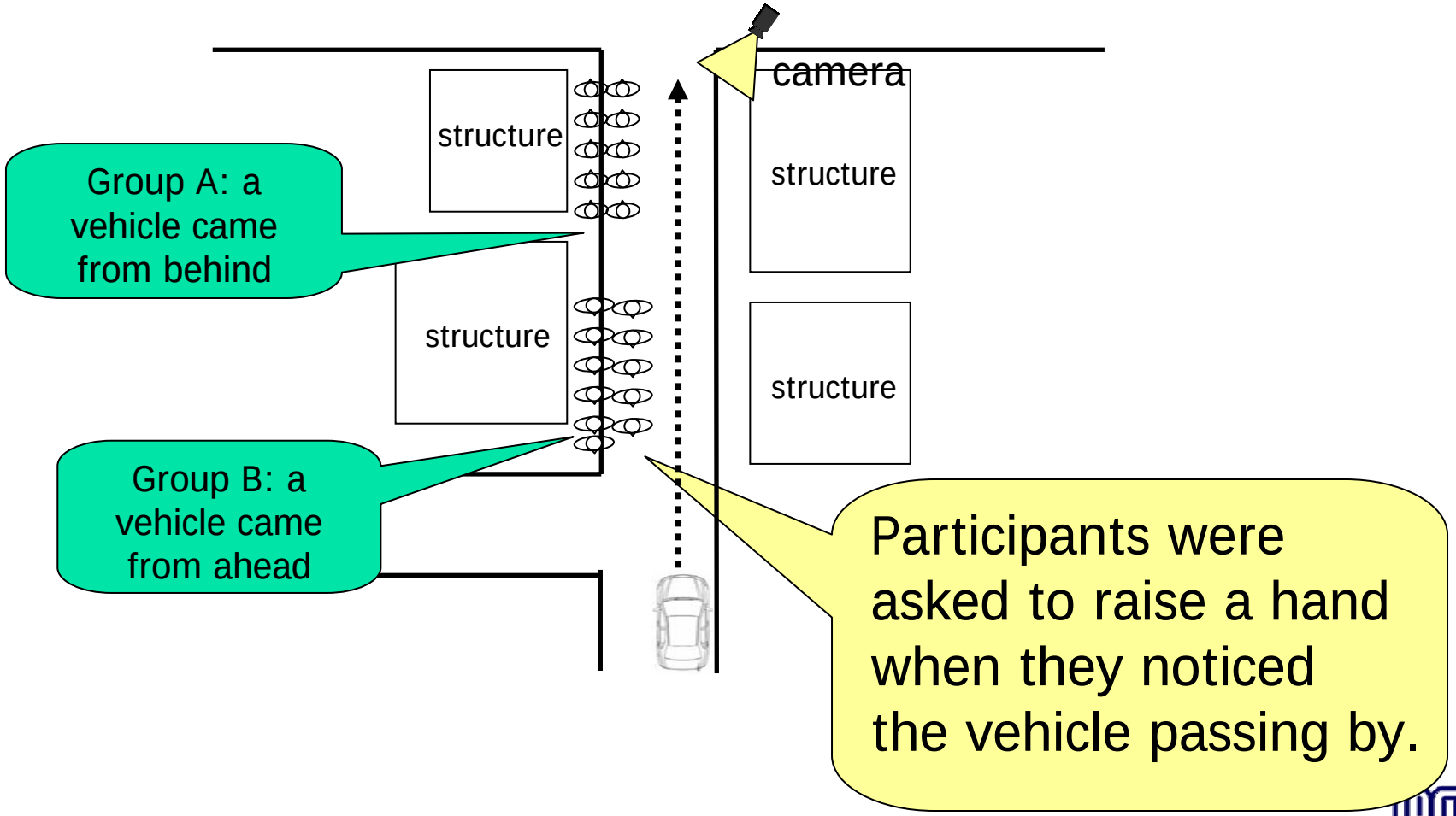
① Sounds emitted from Stationary Vehicle

Each Vehicle went down a lane（width 3.75m) on one side of which participants were standing and stopped for a short period in the middle. The vehicle started moving after the stop.



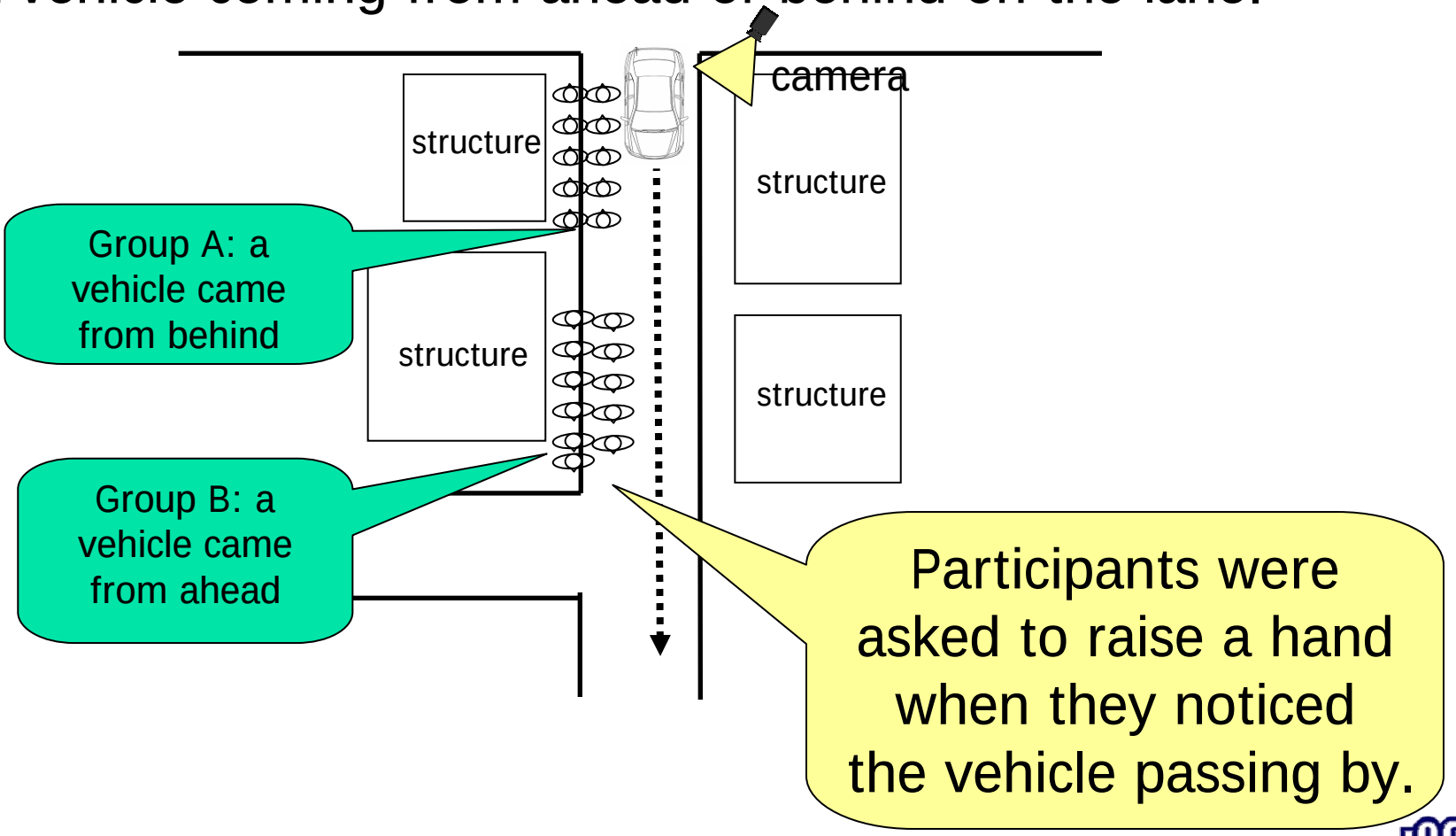
② Vehicles running at 25km/h (ICE,HEV,EV)

Two groups of participants were standing back to back to feel a vehicle coming from ahead or behind on the lane .



③ Vehicles running at 10km/h or less （ICE,HEV,EV)

Two groups of participants were standing back to back to feel a vehicle coming from ahead or behind on the lane.

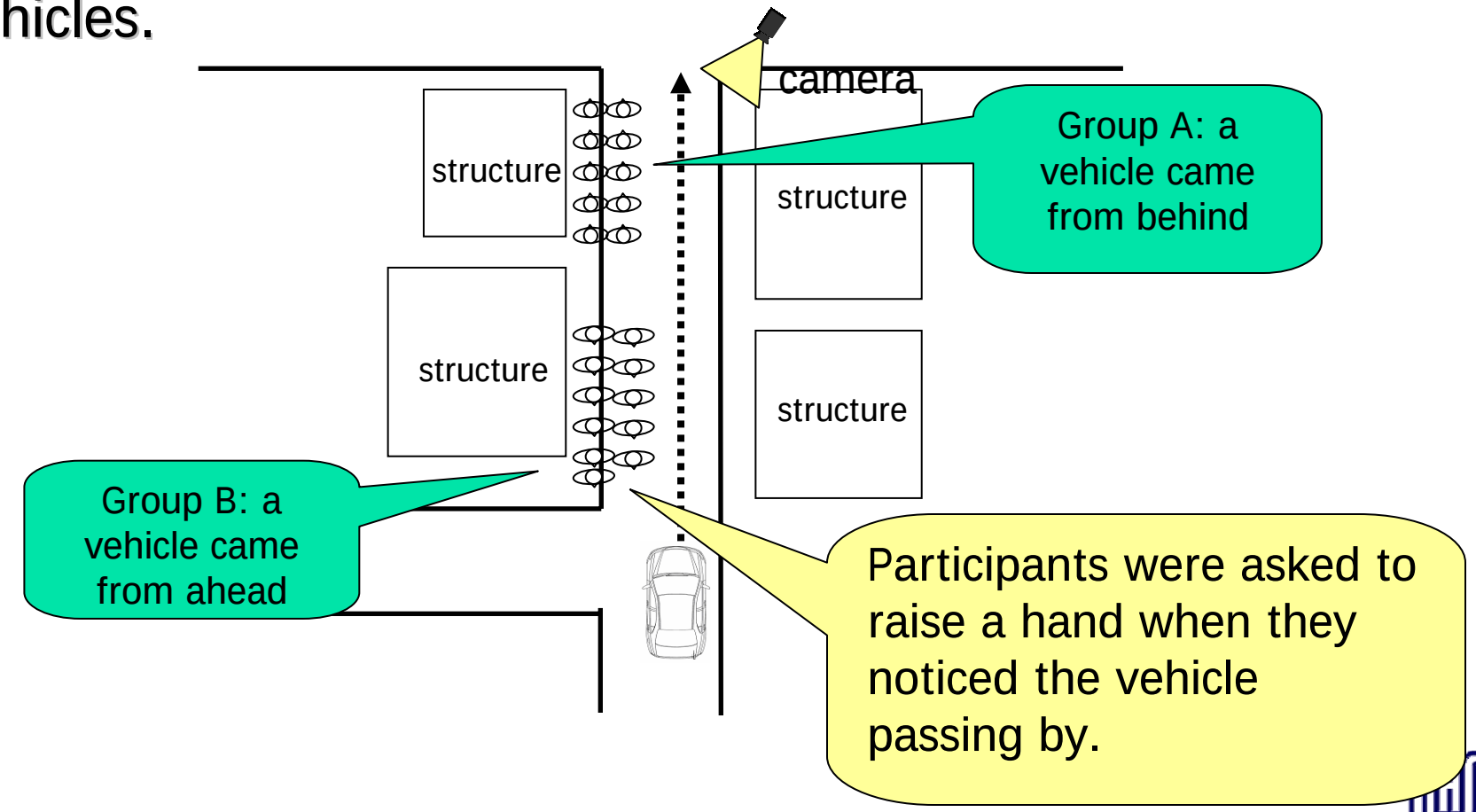


Workshop Scene (ICE running at steady speed)

Workshop Scene (EV running at steady speed)

④ Sounds emitted Vehicle running at 10km/h or less

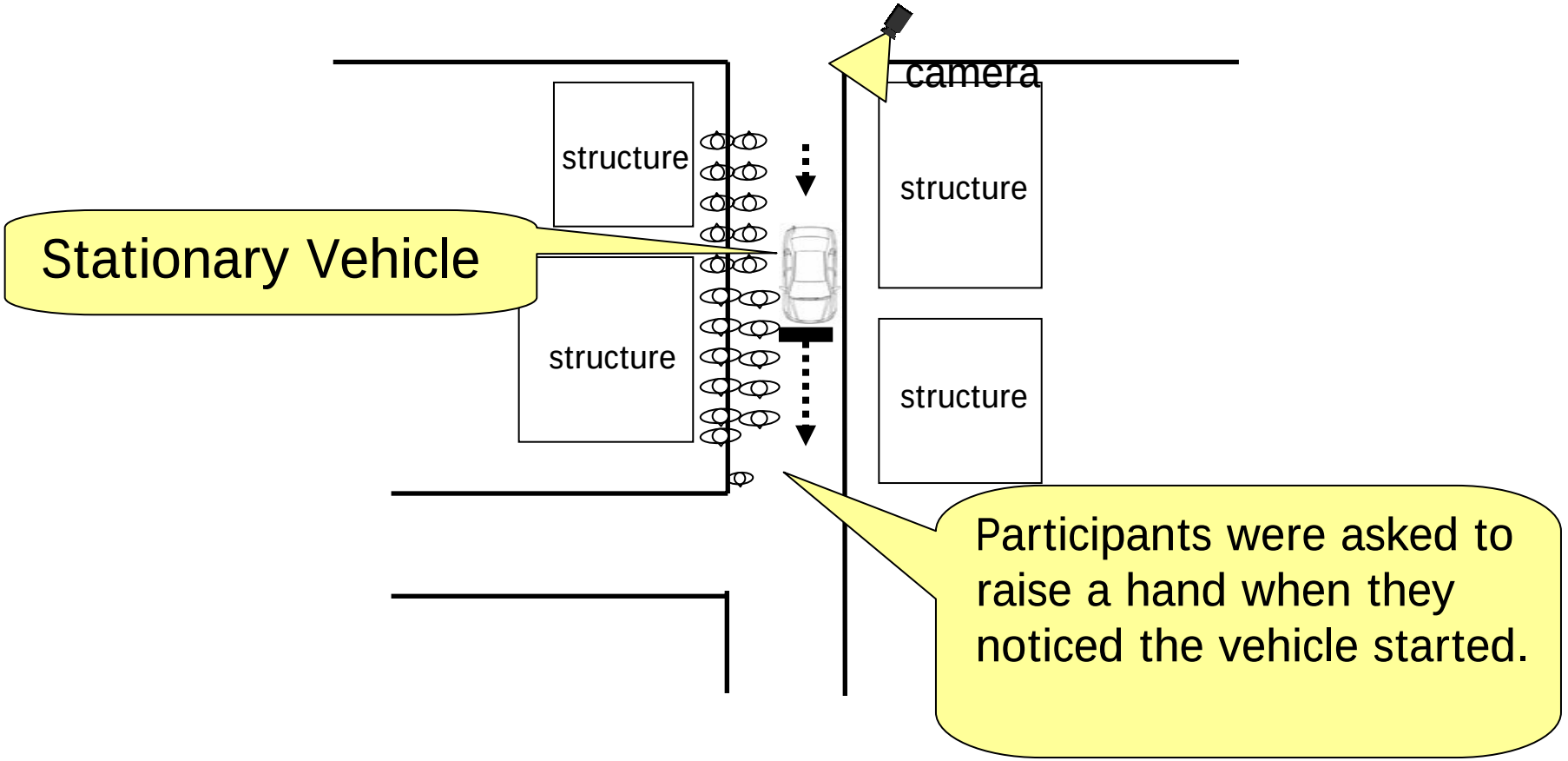
Two groups of participants were standing back to back to feel a HEV or EV, which was emitting sound, coming from ahead or behind. Sounds were chime, melody, single tone and 4 kind of sound associated with running vehicles.



Workshop Scene (EV running at steady speed and emitting sound)

⑤ Sounds emitted from Stationary Vehicle

A HEV or EV with approach audible system started after a short stop. Sounds were chime, melody, single tone and 4 kind of sound associated with running vehicles.



Results of the workshop (1)

AVAS	Vehicel type	Stationary	10km/h	25km/h
without	ICE	Detect	Detect	Detect
	HEV without EV-mode	Detect	Detect	Detect
	HEV with EV-mode	Not detect	Not detect	Detect
	EV	Not detect	Not detect	Detect
with	HEV with EV-mode	Detect	Detect	
	EV	Detect	Detect	

Results of the workshop (2)

- When stationary vehicles started:

  ICE and HEV where the engine is activated at the start were noticed when it started by most people. But many people did not notice EV and HEV which start only by motor even when standing near the vehicle.

- When vehicles were running at 10 km/h or less:

  ICE and HEV where the engine was operating were noticed by most people. But many people did not notice approaching HEV in EV-mode. And Most people did not notice approaching EV.

- When vehicles were running at 25 km/h:

  Most people noticed all vehicles.

- AVAS Sounds emitted:

  All of seven sounds demonstrated were noticed approximately as quickly as ICE.

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Outline of Guideline (1)

Requirements of the Approaching Vehicle Audible Systems (AVAS) to be installed in HEVs that can run only on electric motors , EVs and FCEVs.

(1) Definition

"Approaching Vehicle Audible Systems" shall meet certain requirements described in (2) and (3) below in order to let pedestrians be aware of approaching vehicles.

(2) Activation Conditions

・The systems shall automatically generate sound at least in a speed range from the start of a vehicle until reaching 20km/h and when moving rearward.

・The systems may be equipped with a "Pause Switch." Even when the system is suspended by the Pause Switch, a setup shall be provided so that the Device will not remain suspended.

Outline of Guideline (2)

(3) Types and Volume of Sound Generation

(a) The sound shall be continuous sound associating with motor vehicles. Siren, chime, bells, melody, horn sound, etc. are not allowed.

(b) The sound generated shall be automatically altered in volume or tone depending on the vehicle speed for easier recognition of the move of the vehicle.

(c) Sound volume shall not exceed a level of the sound generated when vehicles driven by internal combustion only run at speed of 20km/h.

Outline of Guideline (3)

Requirements of simplified AVASs for penetration among vehicles in use

(a) In light of quick penetration among vehicles in use, a sound generation device may be installed as simplified systems.

(b) The simplified AVASs do not meet every requirement for AVASs but at least meet requirements of (3)-(a) and (c).

(c) The sound shall be generated continuously for five seconds or longer.

Positioning of Guideline

Issue

Visually-impaired pedestrian are unaware of EV/HEV due to the quietness.

Rapid penetration of HEVs

Voluntary

Guideline

Measures against the issue are needed ASAP.

Don't disturb the promotion of the development for new technology.

Assessment

Penetration for measure systems in voluntary

Revise

- Assess social acceptability and status of developments on AVASs.
- Develop test method and requirements of sound volume.

Mandatory

Technical requirements

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MLIT Future Activities

- Demonstration of AVASs which are developed by automotive manufacturers in accordance with the guideline will be held at 10th May
- Further study will be conducted to develop a Regulation on the AVASs, through assessing this guideline.
- Japan expects this guideline will be base of a global regulation in WP29.

Thank you for your attention!

Answers to Public Comments

- In road space where pedestrians and vehicles are passing through at the same time, drivers should drive with utmost vehiclee to prevent pedestrians from feeling in danger.
- But, it could be possible that HVs and EVs are so quiet because of their structure that pedestrians do not perceive an approaching vehicle and take unexpected action, and then an accident will occur.
- The number of HVs tends to increase sharply, and thus we have to take urgent measurements.
- We regarded a measurement by sound as the most realistic at the moment, after careful discussion on measurements for making pedestrians notice the approaching vehicle.

Answers to Public Comments

- This proposed measurement was considered based on the viewpoint how to keep the great merit of quietness of HVs and EVs as much as possible.
- We predicted the environmental noise from road in actual traffic conditions.
- It was confirmed that the level of environmental noise from road stayed about the same even if vehicles emitted sounds.
- Thus, we believe the sound has a very small influence on the level of environmental noise from road.

Answers to Public Comments

- Through communication from sound, visually-impaired people perceive not only the existence of vehicle but also the behaviour from approaching to departing.
- Then, it is necessary for them to gain a sense of safety when departing.
- The sound should be that people can naturally recognise the existence or behaviour of vehicle such as approaching or departing, even if the sound is not widely promoted in society.
- Thus, we propose the sound that reminds people of vehicle in running condition.