Transmitted by the expert from Japan

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agenda item 4.2.)

Investigation of available range for operating hand controls

GRSG, 91st session

Geneva, October, 2006

1. Background and Objective

(1) At present, GRSG members are discussing a new draft Global Technical Regulation Concerning Hand Controls, Tell-Tales and Indicators Present on Category 1 and 2 Vehicles.

(2) For the location of hand controls, this draft GTR and R121 has qualitative requirements only. It is not appropriate as a regulation since the Contracting Parties must determine the location on their own.

(3) The Japanese regulation states that “the devices enumerated in each Item of Article 10 of the Safety Regulations, which are necessary for operating a motor vehicle, shall be located within 500 mm to the right and left of the centre of the steering wheel and be constructed so that the driver in his normal driving position may easily operate them” (Safety Regulations, Article 10).

(4) GRSG is using the following regulations, including a draft regulation, in the discussion.

(a) R121 : S5.1.1

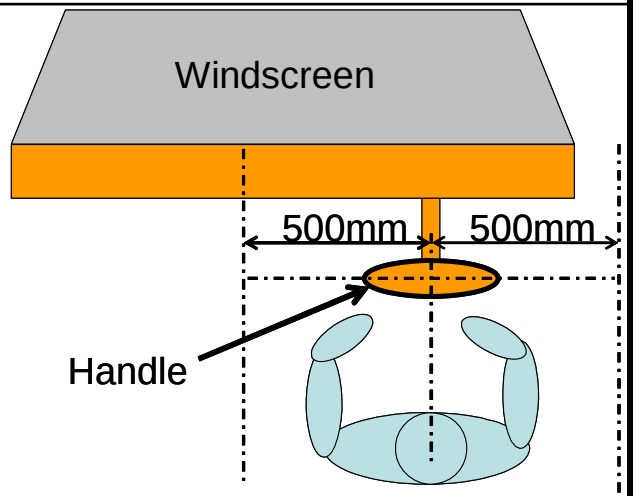
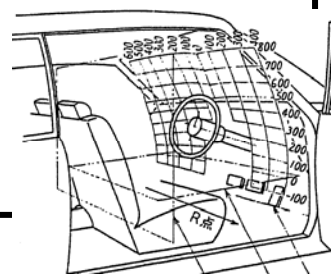
(b) Draft GTR : GRSG-89-19, S4.6.2

(c) ISO 3958 : Passenger cars--Driver hand control reach

OBJECTIVE

To collect technical data and information to discuss quantitative requirements for the uniformity of the type approval procedures

2. Contents of Each Regulation and Draft Regulation

	Contents
Japanese regulation (Safety Reg.,Art. 10)	・The devices, which are necessary for operating a motor vehicle, shall be located within 500mm to the right and left of the centre of the steering wheel ・For the fore-and-aft range, it states that "... so that the driver in his normal driving position may easily operate hem [the devices]." 。 
R121	・The controls to be used by a driver while driving the vehicle shall be located so that they are operable by this driver restrained by the installed crash protection system
Draft GTR, GRSG-89-19	・Proposes to add the 50th percentile male driver specification to the R121 provision
ISO3958	・The operating range is defined as a 3D surface. ・A variety of types of the driver's body build are concerned. ・The driver's physical characteristics are taken into account. 

3.1 Viewpoint

a. Four methods for specifying the location of hand controls were compared from a perspective of the driver's physical characteristics while considering actual type approval procedures.

b. Since R121 does not provide a quantitative requirement for setting the location, the hand control reach was measured in this investigation using actual drivers as subjects.

c. Because the draft GTR does not specify what to use as the 50th percentile male, a dummy (Hybrid III) was used in this investigation for trial measurements.

d. This report discusses the subject from a perspective of the driver's physical characteristics.

3.2 Outline

(1) **Vehicle test**: Measuring the range of hand control operation during driving

(2) **Simulated seat test**: Measuring the range of hand control operation from a perspective of the driver's physical characteristics

(3) D**ummy test**

(4) **Advantages and disadvantages of each method**

3.3 Vehicle test conditions (1)

＜Test vehicles＞ M1: Passenger car (3,000 cc)
N1: One-box car (2,000 cc)

＜Driving position conditions＞

The subject drivers were orally instructed to reproduce the following three driving positions:

(a) Normal Position (for operating controls near the steering wheel)
Driving while leaning back on the seatback and keeping this position

(b) Changed Position
Enabling the driver to easily operate switches on the instrument panel

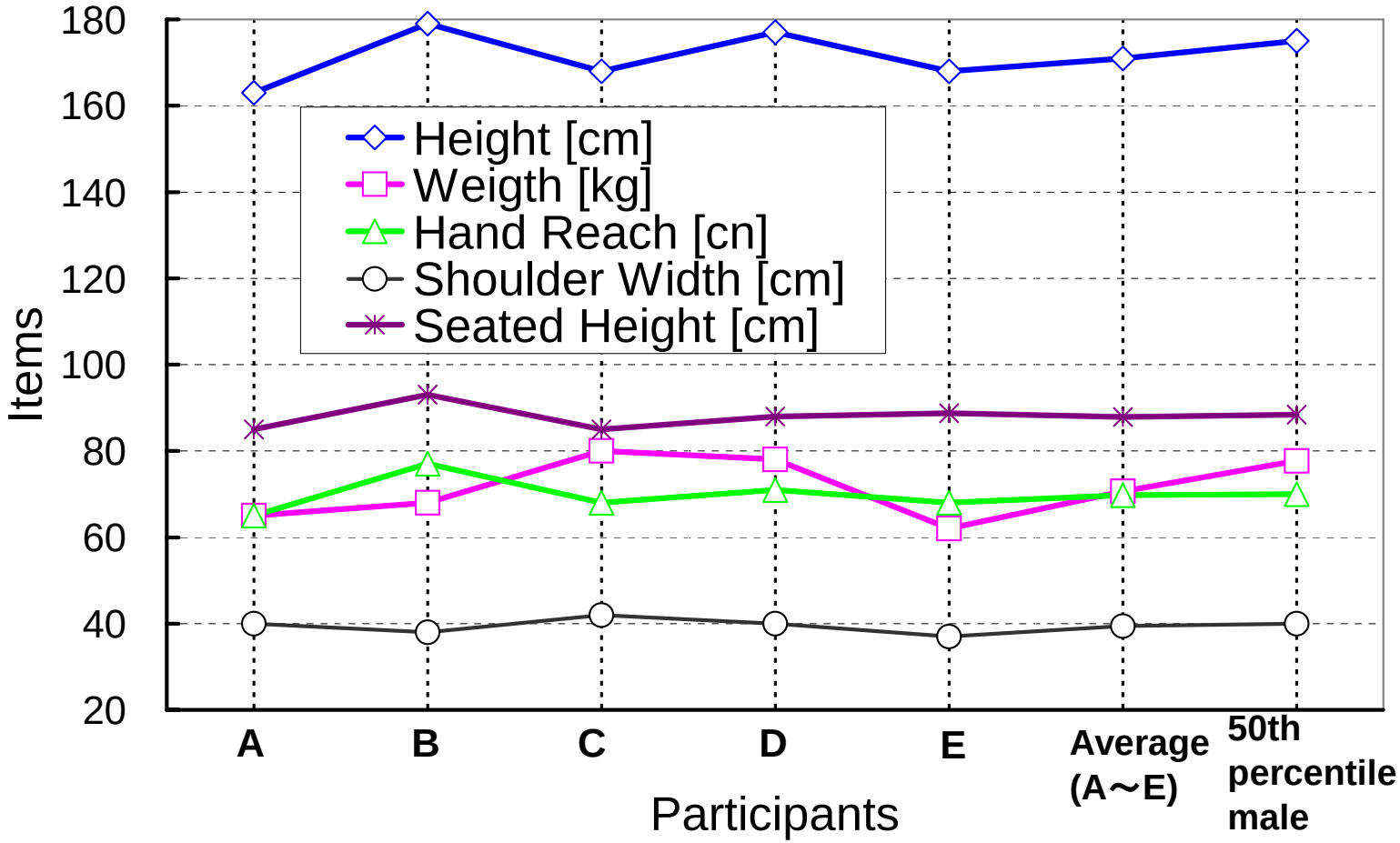
(c) Limited Position
Reaching the hand to the limit of driving safety

＜Measurement items＞

① The subject points the finger on a line extending horizontally from the steering wheel center.

② The distance between the fingertip and the steering wheel center is measured.

3.3 Test conditions (2) <Subject conditions: Five adult males>



Items	Participants					Average	Hybrid III
	A	B	C	D	E		
Height (cm)	163.0	179.0	168.0	177.0	168.0	171.0	175.0
Weight (kg)	65.0	68.0	80.0	78.0	62.0	70.6	77.7
Hand Reach (cm)	65.0	77.0	68.0	71.0	68.0	69.8	70.0
Shoulder Width (cm)	40.0	38.0	42.0	40.0	37.0	39.4	40.0
Seated Height(cm)	85.0	93.0	85.0	88.0	88.7	87.9	88.4

4 Vehicle Test

＜Test procedures ＞

① The subject sits in the driver's seat of M1 and N1 vehicles.

② The subject drives the vehicle at 40 km/h.

③ The subject reproduces the three driving positions as orally instructed and point the finger on the measure.

④ The distance between the fingertip and the steering wheel center is measured.

＜Test results ＞

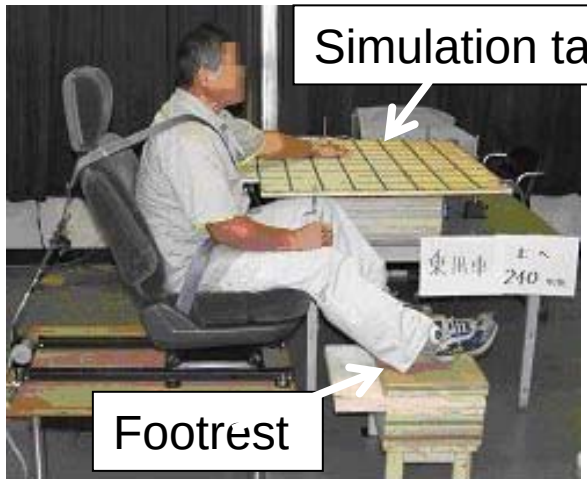
Average of five subjects

Driving position*	M1 Vehicle	N1 Vehicle
Changed Position	562 mm	584 mm
Limited Position	704 mm	684 mm

All more than 500 mm

5.1 Simulated Seat Test (1)

(a) Normal Position



(b) Changed Position

(c) Limited Position

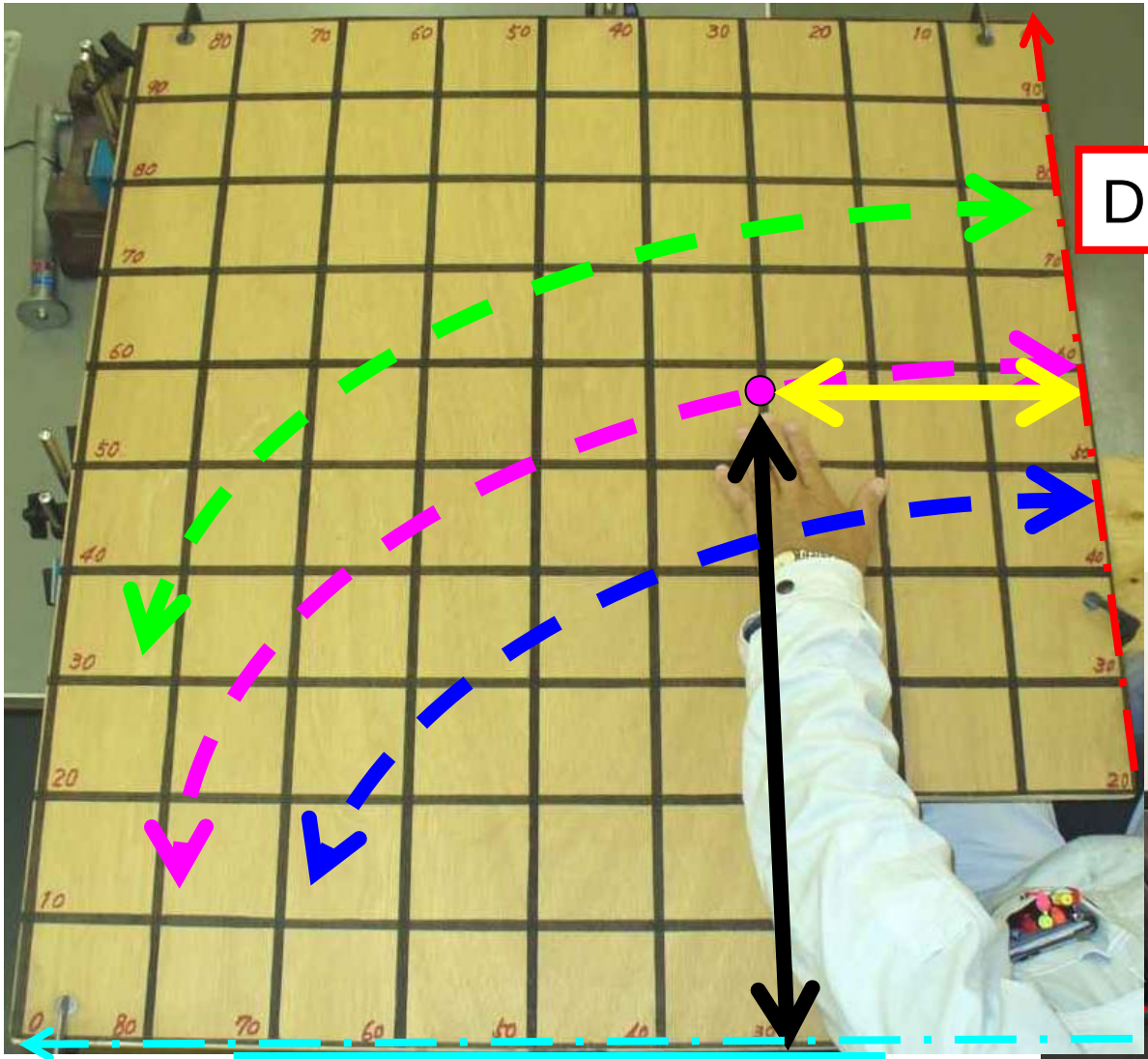
＜Test procedures ＞

① M1 and N1 vehicles are simulated by adjusting the seat height, seat angle, seat location in fore-and-aft directions, and simulation table height (with the footrest height as the reference).

② The subject is orally instructed to point his index finger on the table at 10 cm-intervals for each of the three driving positions.

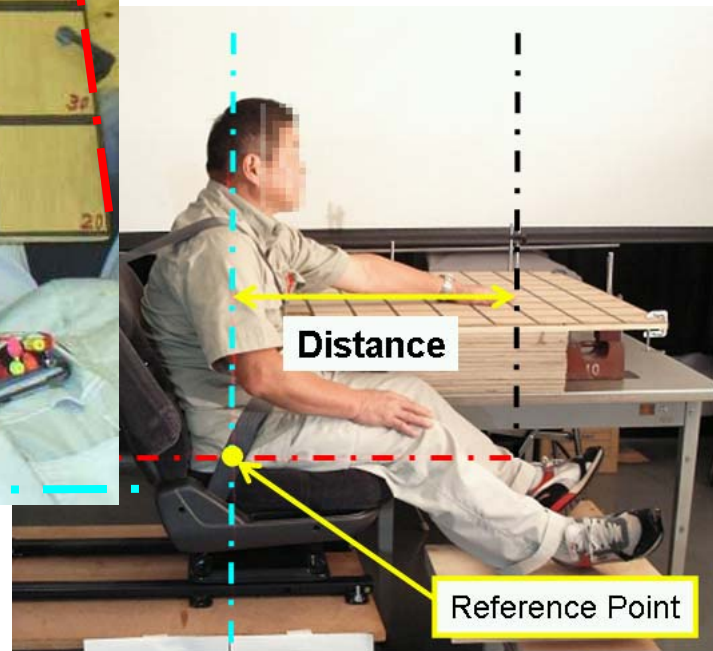
③ The location of the fingertip is measured.

5.1 Simulated Seat Test (2)

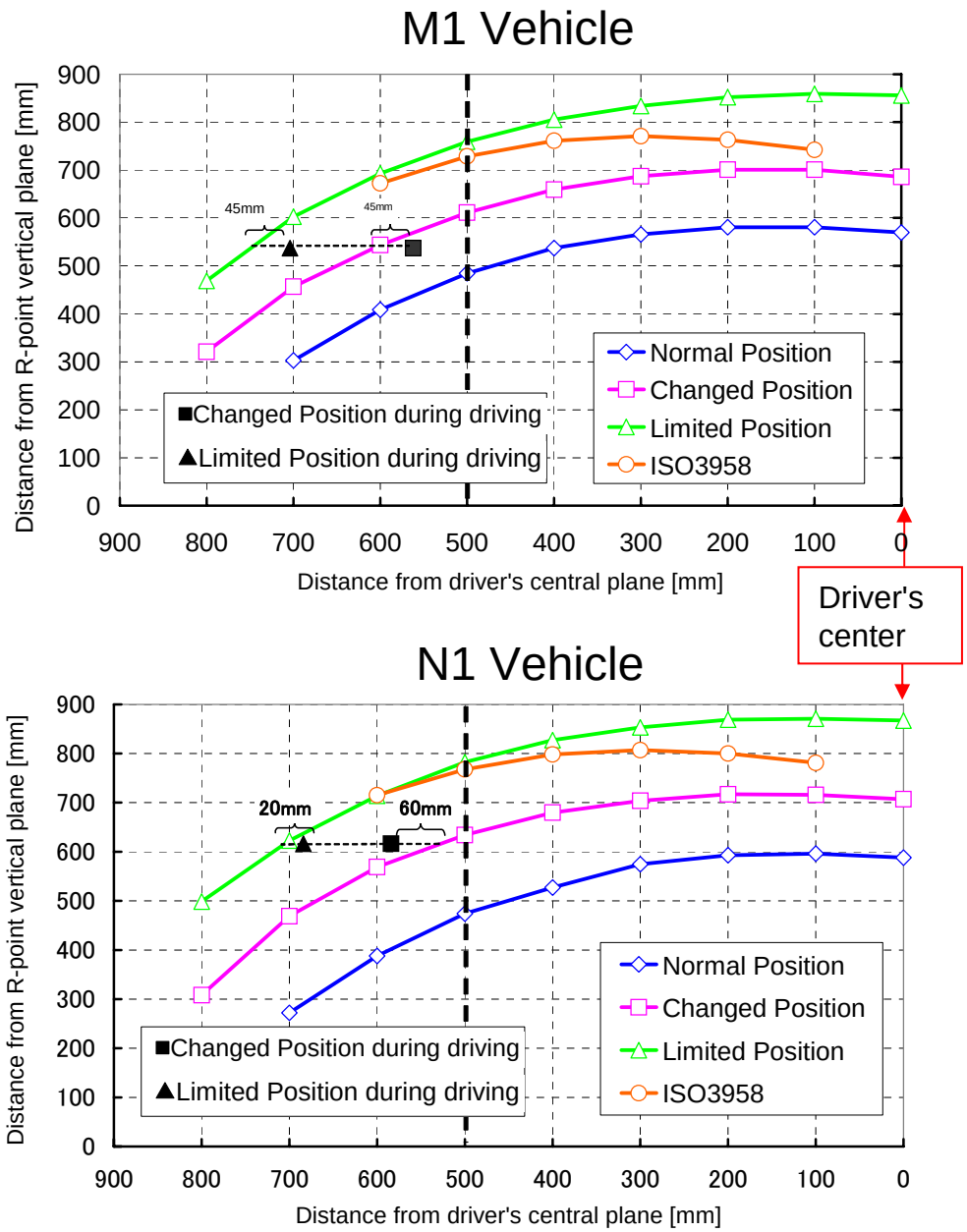


Driver's central plane

R-point vertical plane



5.4 Test Results Operating range (1)



Results of the simulation test and the driving test compared

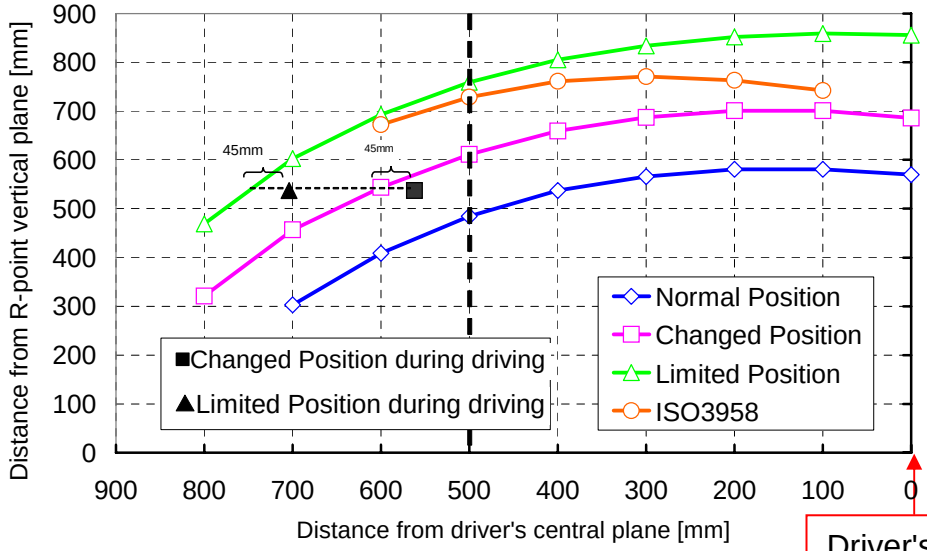
Difference of about 20-60 mm

The driving positions reproduced in the simulation test are not so different from the actual driving positions.

Results for M1 and N1 vehicles were similar.

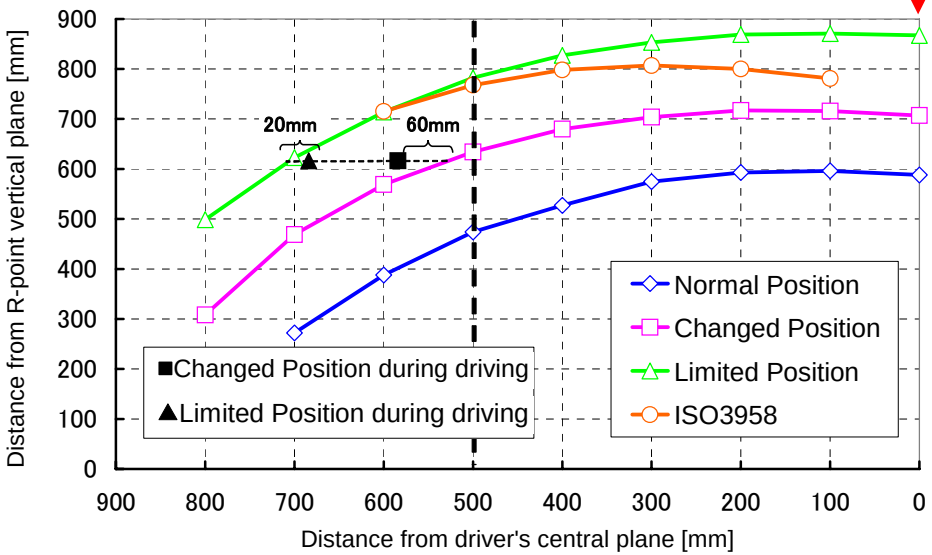
5.4 Test Results Operating range (2)

M1 Vehicle



Driver's center

N1 Vehicle



Relation between these test results and ISO 3958

Positioned between Changed Position and Limited Position

ISO 3958 includes a part of the Limited Position range

Relation between changed Position range and 500 mm

Even in the range of more than 500 mm, the hand can reach the target easily if the distance from the vertical plane decreases.

6.1 Test Using a Dummy

A dummy (Hybrid III) used as the 50th percentile male

Considering actual type approval reviewing procedures, the dummy was installed in M1 and N1 vehicles.

- Difficulty in changing positions
- Little flexibility in joints

The resulted range was smaller than the human subject's operating range.

Using dummies in the type approval procedures is not feasible.

What to use as the 50th percentile male in the type approval is not clear.

7 Comparison of the Four Methods

	Advantages	Disadvantages
Japanese regulation	・A numerical value is provided, so type approval testing are more specific. ・It requires 2D measurement, so type approval testing is easier.	・The range cannot exceed 500 mm. ・No numerical value is specified for fore-and-aft directions.
R121	・Type approval testing is easier. ・The driver's physical characteristics are concerned.	・Since no numerical value is given, judgment criteria vary among type approval testing officials.
Draft GTR : GRSG-89-19		・What to use as the 50th percentile male in the testing is not clear. ・Dummies cannot be used as such.
ISO3958	・Detailed conditions are provided, so specific and strict testing is possible.	・Type approval procedures will be complicated. ・The ranges specified include near impossible ranges for Japanese drivers.

8 Current Conclusion

In this investigation, for the uniformity of the type approval procedures, we collected technical data and information necessary to discuss quantitative requirements for the range of operating hand controls, one of GTR discussion items.
Specifically, we looked at the four methods that are given in the current regulations or proposed in a draft regulation. We compared these methods from a perspective of the driver's physical characteristics and found the following:

ISO 3958 includes a part of the Limited Position range.

Even in the range of more than 500 mm, the hand can reach the target easily if the distance from the vertical plane decreases.

It is not appropriate to use a dummy as the 50th percentile male in actual type approval testing.

Each of the four methods has advantages and disadvantages in terms of simplicity and clarity of type approval procedures.