Overview of ACPE test method in JNCAP

March 2023

National Agency for Automotive Safety and Victims' Aid

New Car Assessment

Background

Table: Proportion of fatal traffic accidents caused by elderly drive

	2011	2012	2013	2014	2015
Proportion of fatal accident caused by the driver age of 75 and higher	10.3 %	11.8 %	11.9 %	12.9 %	12.8 %
Number of fatal accidents caused by the driver age of 75 and higher	429	462	460	471	458

Ministerial Meeting to address traffic accidents caused by elderly drivers (2016)

A) Facilitate spread of the safer vehicles equipped with safety devices already introduced in the market
B) Facilitate practical application and spread of safety technologies

→ ACPE to add to the JNCAP's evaluation item as one of safety technologies to be spread

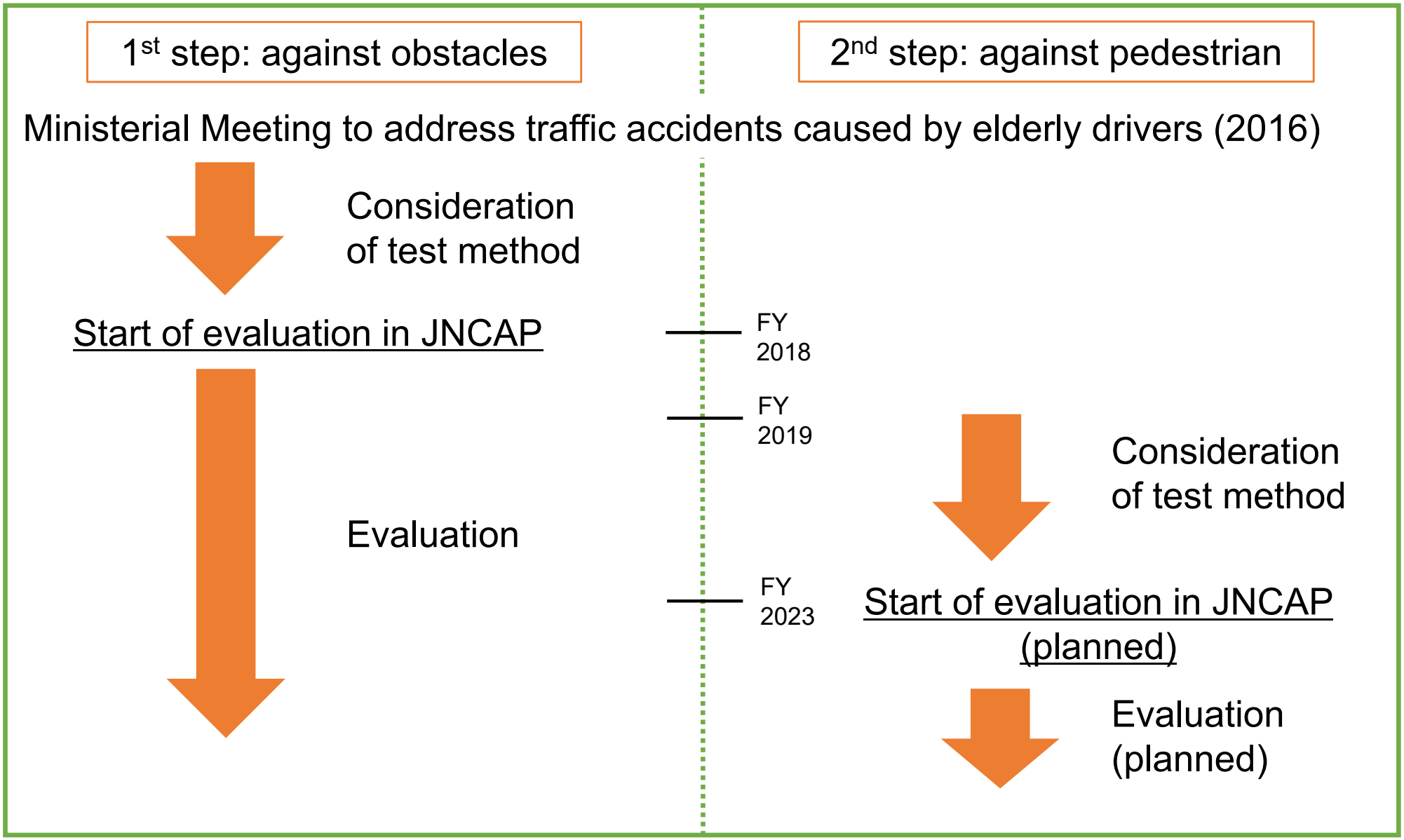
When adding ACPE to JNCAP…
Main purpose is to identify the vehicle equipped with a recommendable ACPE device. JNCAP started with a simple ACPE which is more likely to spread widely.

Pedal error accident data

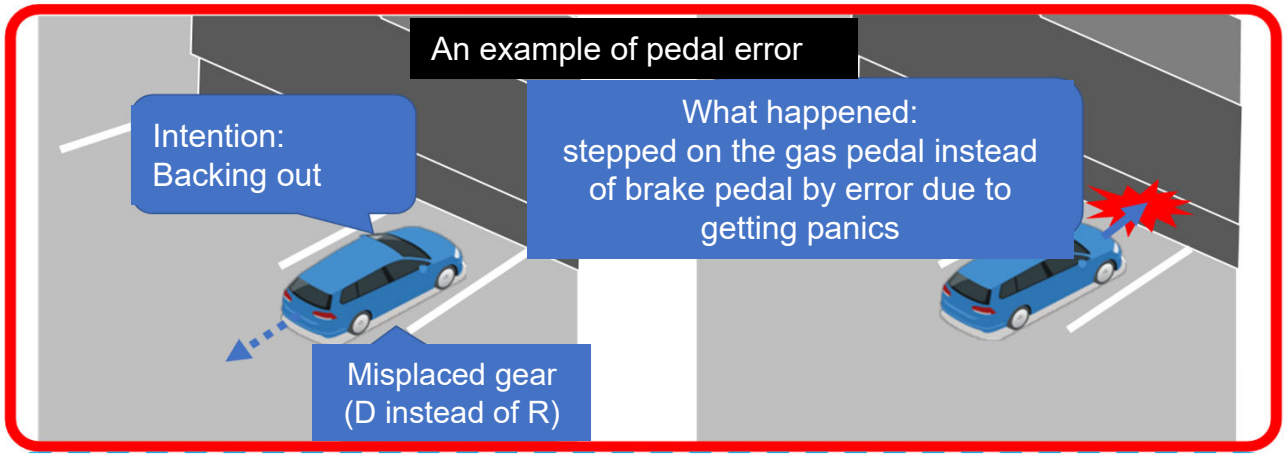
Trends in fatal traffic accidents with pedal error （number of events）

	2011	2012	2013	2014	2015
Over 75 years old	19	17	20	19	34
Under 75 years old	28	10	35	20	24
Total	47	27	55	39	58

Schedule of ACPE introduction into JNCAP



1st step: Features of ACPE and test method



Features of ACPE in Japan in 2017

Detect what?

Walls, vehicles: Most
Pedestrian : Nothing

Work in what speed?

Under 10km/h : Many
Under 15km/h : Some

Work in what situation?

Designed for departing from standstill: Most
Designed for travelling in low speed : a few

Distance to obstacles?

1m or more: Most, less than 1m: a few

Test method as 1st step

Test target

→ Balloon target same as the AEBS test CtoC scenario

Speed condition

→ No limitation in the speed

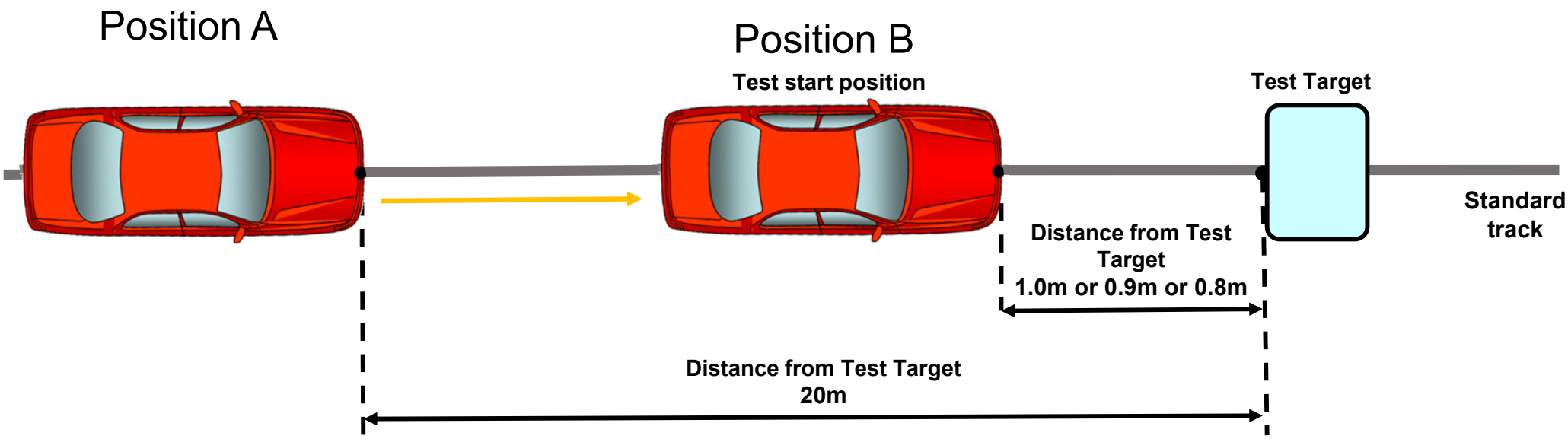
Testing situation

→ Departing from standstill (both of forward and rearward)

Distance from the test target

→ Manufacturer's choice from 1.0m, 0.9m and 0.8m with diverse score

1st step: Test method



[Test method]

- Start the engine of the test vehicle 20m before the test target (A). After that, the test vehicle roll to the test start position and stop (A -> B). The accelerator and brake operation shall be minimized as much as possible.

- Test start position shall be selected by the automobile manufacturer, etc. from among the positions where the distance from assumed collision point are 1.0m or 0.9m or 0.8m. (B)

- The driver quickly steps from the brake pedal to the accelerator pedal and holds it all the way down until the test car stops or exceeds the assumed collision point, maintaining the steering wheel in the neutral position.

- Number of test : Basically once (will be increased to 3 times if it differs from preliminary data submitted by manufacturer's own choice.)

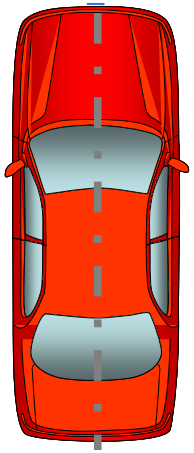
1st step: Diagram of the test methods

- Tests are conducted for both “Forward” and “Rearward” departure.
- In the test, the accelerator pedal is depressed at a speed of at least 400%/s (full throttle in 0.25 seconds) and no more than approx. 720%/s (full throttle in 0.13 seconds).

Forward

Test target：Balloon Target same as AEBS CtoC test

Distance from Vehicle Target（1.0m or 0.9m or 0.8m）



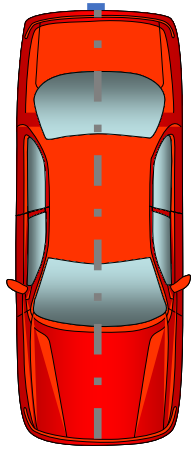
How to Pedal

From a stop (brake on), depress the accelerator pedal at a speed of 400%/s-approx. 720%/s

Rearward

Test target：Balloon Target same as AEBS CtoC test

Distance from Vehicle Target（1.0m or 0.9m or 0.8m）



How to Pedal

From a stop (brake on), depress the accelerator pedal at a speed of 400%/s-approx. 720%/s

1st step: Test target

Why was Balloon target chosen for ACPE test against obstacle?

- Traffic accident data showed that
  - +Vehicles collided to both of an another vehicle or an obstacle (a glass window, a wall, a fence) by a pedal error.
  - +Collision to glass windows caused less severe injuries.
  - +Fences with gaps were fixed on the black wall (0.5 m height).
    - #detecting fences with gaps itself was not necessarily required to stop collide to fences with gaps.

- Test against Balloon target is considered to be severer than testing against wall.

1st step: Evaluation (1)

[Evaluation method]

- Scores can be obtained by both of forward and rearward tests.
- The score obtained by the test is different depending on the “Velocity change rate” (test results) and the “Distance from the test target” (1.0m or 0.9m or 0.8m).
- Full point when 1.0 “Velocity change rate” (collision avoidance) and 1.0m “Distance from the target”. Partial scores are calculated using the “Distance from the target” and the Coefficient for acceleration suppression.

The total score shall be the sum of forward and rearward.

Scores (Forward)

* Revised to reflect changes from 2023

Score		Velocity change rate		
		1.0 (stop)	0.3 or higher, less than 1.0	Less than 0.3
Distance from the test target	1.0m	**1.0**	**0.650**	**0.0**
	0.9m	**0.9**	**0.585**	**0.0**
	0.8m	**0.8**	**0.520**	**0.0**

1st step: Evaluation (2) (Coefficient, Velocity change rate)

Calculation of "Velocity change rate" and Coefficient for Acceleration suppression

Velocity change rate : $(V_0 - V)/V_0$

Collision avoidance (full points)

Coefficient

(1-0.3)/2+0.3=0.65 *1

1

Acceleration suppression

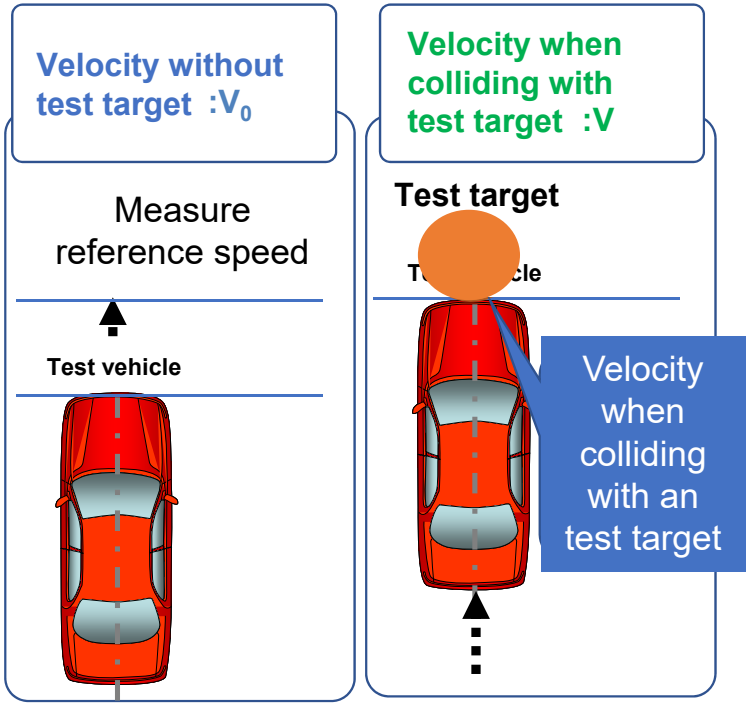
0.3 (threshold) *2

No effect (0 point)

0

*1 The coefficient was 0.55 from 2018-2022.

*2 The threshold was set at 0.1 from 2018-2022.



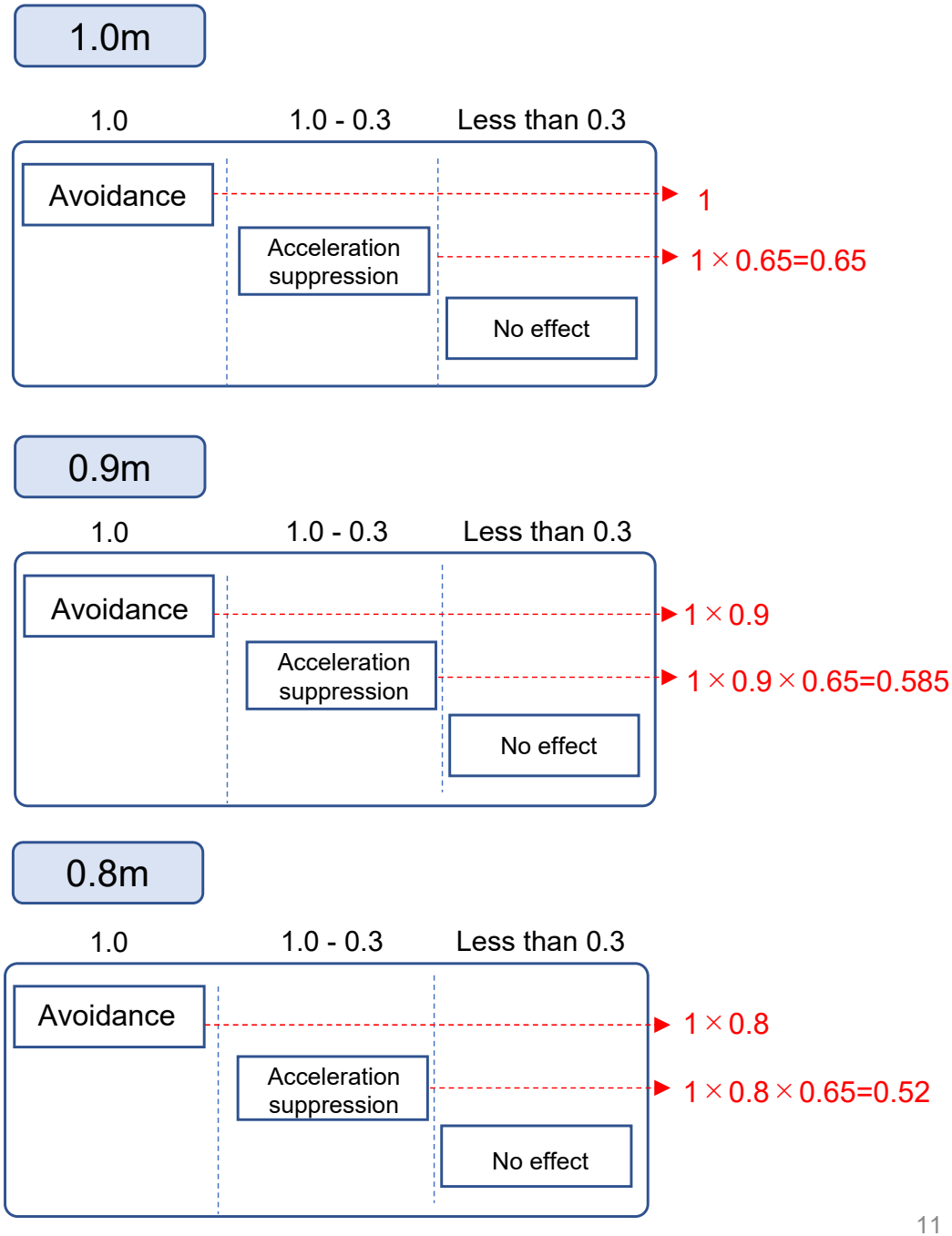
1st step: Evaluation (3)

Calculation

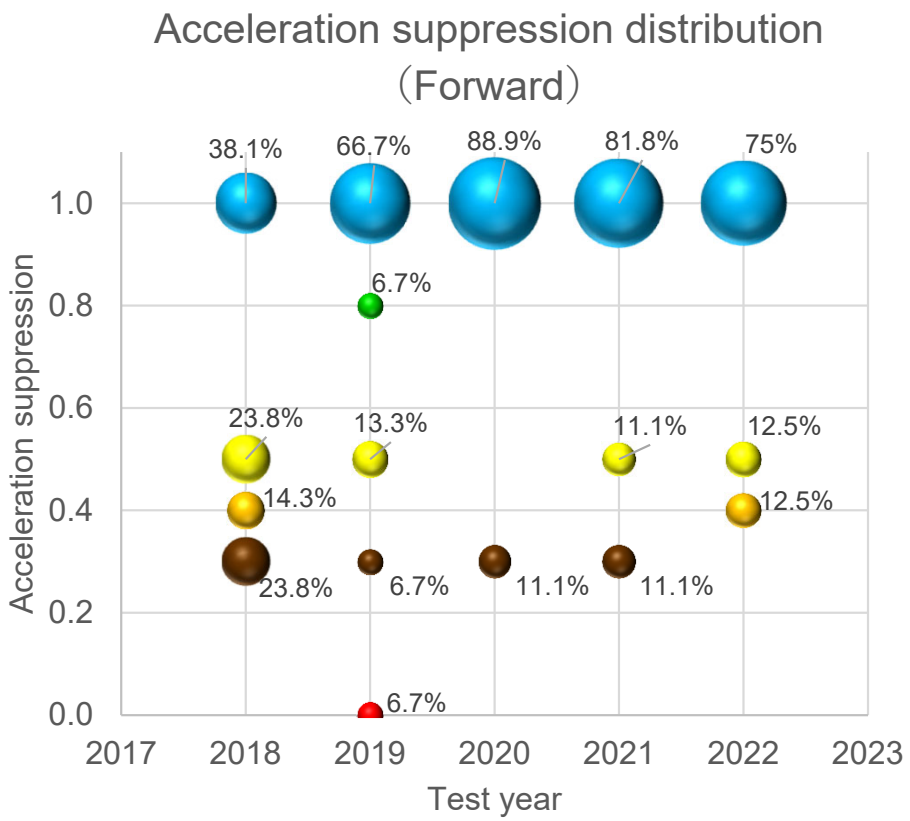
Multiply the "full points" by the coefficient for acceleration suppression by the distance coverage ratio according to the “Distance from the test vehicle”.

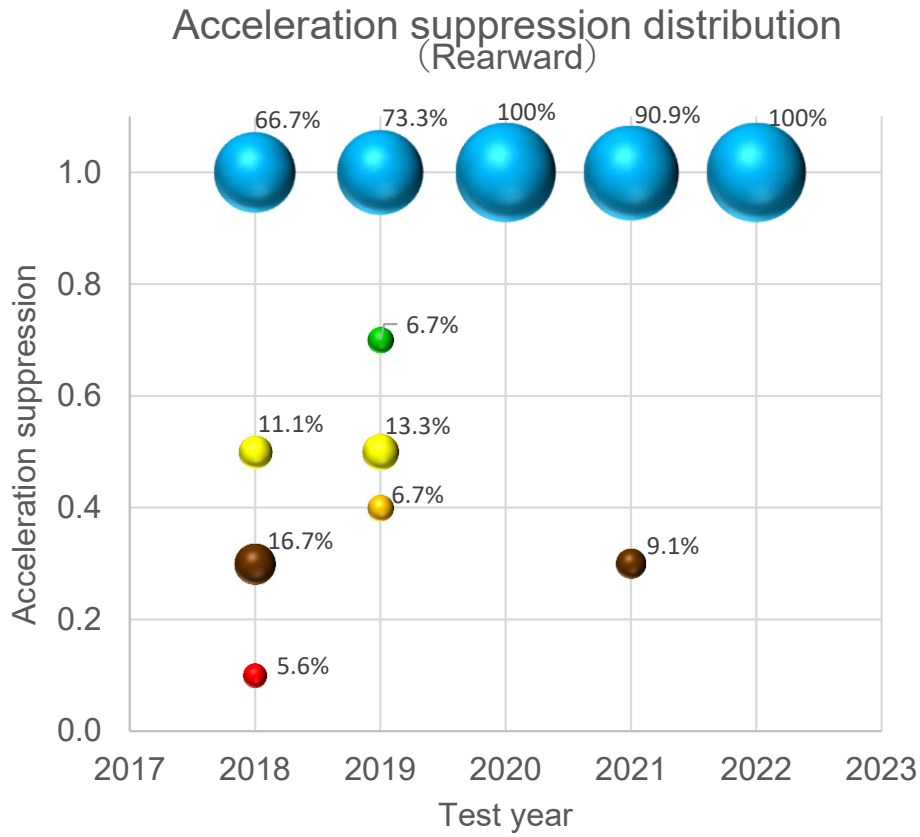
Scores (Forward) * Revised to reflect changes from 2023

Score		Velocity change rate		
		1.0	1.0 - 0.3	Less than 0.3
Distance from the test target	1.0m	**1.0 (1×1)**	**0.650 (1×0.65)**	**0.0 (1×0)**
	0.9m	**0.9 (1×0.9)**	**0.585 (1×0.9×0.65)**	**0.0 (1×0)**
	0.8m	**0.8 (1×0.8)**	**0.520 (1×0.8×0.65)**	**0.0 (1×0)**



1st step: Test results in JNCAP



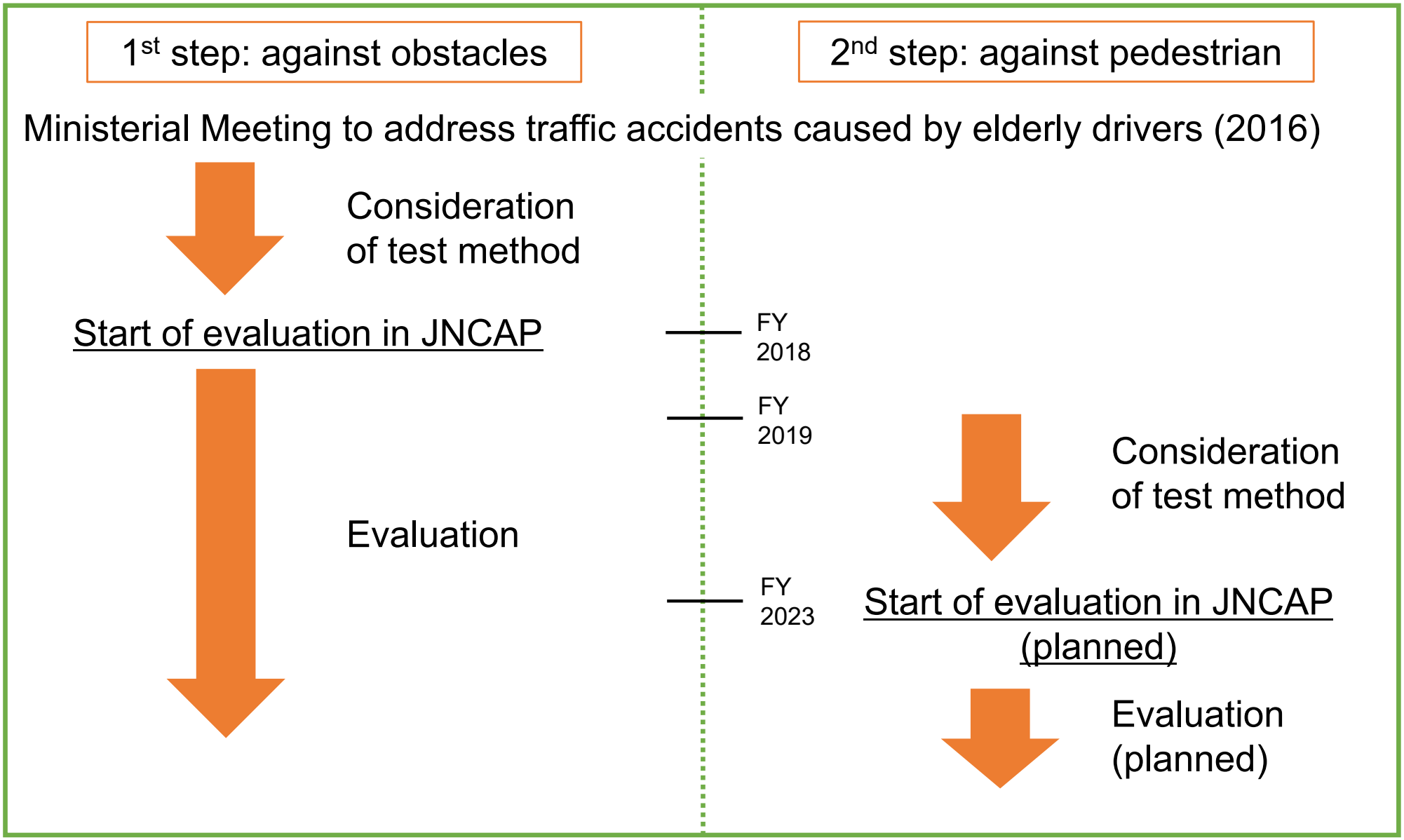


Ratio of full point

	Forward		Reverse	
2018	38%	(8 vehicles / Total 21 vehicles)	61%	(11 vehicles / Total 18 vehicles)
2019	67%	(10 vehicles / Total 15 vehicles)	73%	(11 vehicles / Total 15 vehicles)
2020	89%	(8 vehicles / Total 9 vehicles)	100%	(9 vehicles / Total 9 vehicles)
2021	82%	(9 vehicles / Total 11 vehicles)	91%	(10 vehicles / Total 11 vehicles)
2022	75%	(6 vehicles / Total 8 vehicles)	100%	(8 vehicles / Total 8 vehicles)

In JNCAP, the percentage of vehicles with perfect scores has increased since the start of the evaluation.

Schedule of ACPE introduction into JNCAP



Test method for 2nd step (against pedestrian)

Accident data

Situation on the road?

- In response to an serious accident occurred in Japan in 2019*, JNCAP started consideration for 2nd step a year ahead of planned schedule.
- As many accidents as CtoC, CtoO
- Most of fatalities/Casualties are Adult.
- Most of them were hit when Standing still
- No clear trend in their facing direction (forward, rearward, right, left).

Test method as 2nd step

Test target

-It's the same with Adult pedestrian target for AEBS CtoP test scenario.

-Pedestrian target keeps standstill during the test. (no leg movement)

-Pedestrian target faces rearward against vehicle.

*Other testing situation and Distance are the same as the 1st step test

*Details in next slide

Japan New Car Assessment Program JNCAP

MLIT

2. Japanese situation (an actual accident in Japan)

- A serious accident involving 2 fatalities and 8 injuries happened in central Tokyo in 3 years ago.
- This accident caused big social discussion for such accident.

2 dead, 8 injured after elderly driver plows

Two people are feared dead and eight others injured on Friday (April 19) after a car plowed into them at a busy intersection in Tokyo, police said.

The vehicle, driven by a man in his 80s, struck the pedestrians at a crosswalk and then hit

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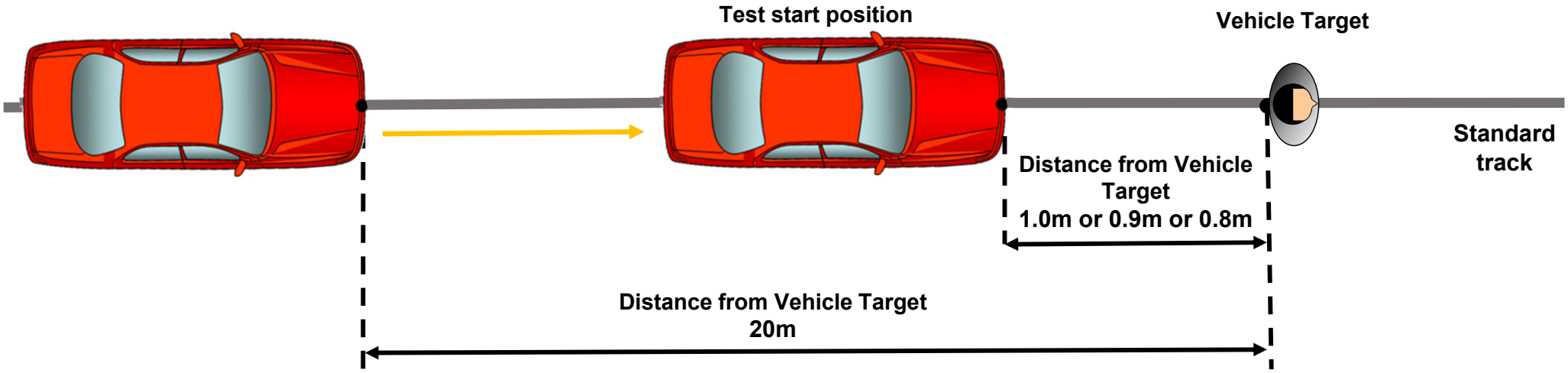
Extracted from informal document GRVA-14-14 14th GRVA, 26-30 September 2022

2nd step: Test methods for pedestrian



【Test method】

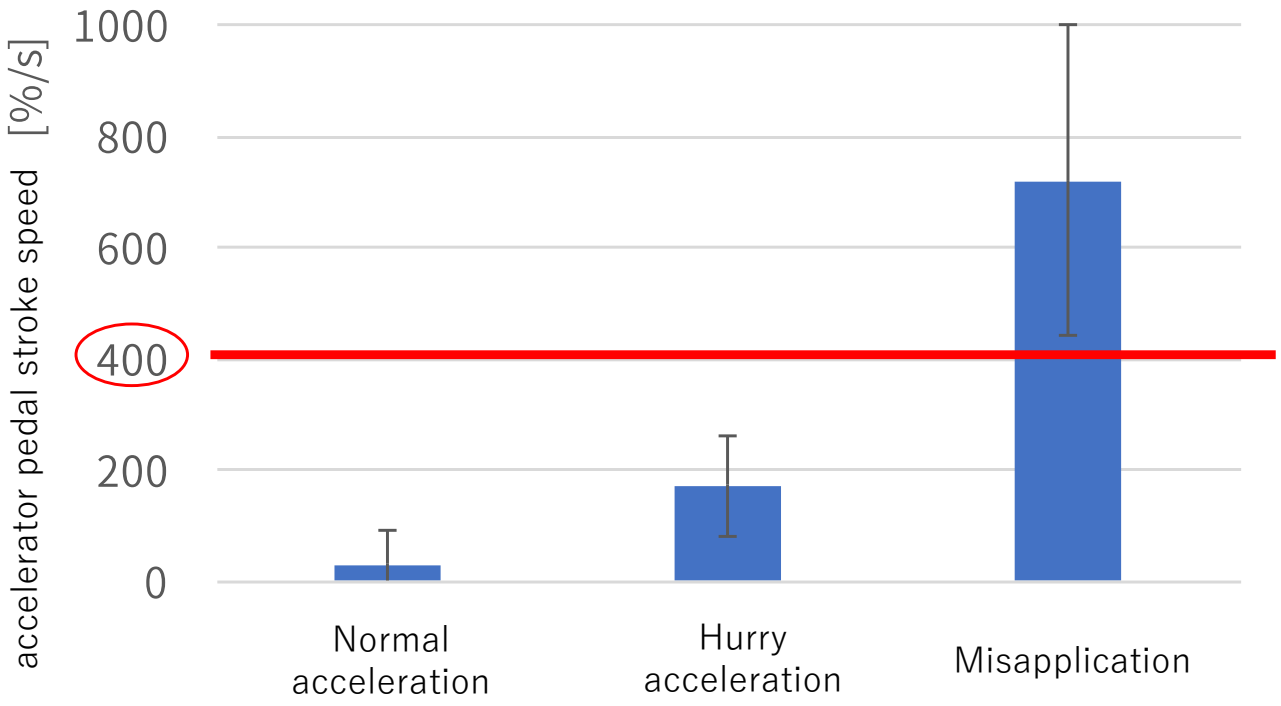
- The same test method as ACPE against obstacles apart from the test target.

  + Adult dummy (same as the AEBS CtoP test)
  + keep standstill during the test. (no leg movement)
  + faces rearward against vehicle

Thank you for your attention.

(Reference) How to pedal

Considering the pedal operation of elderly drivers, the lower limit of the standard deviation of the accelerator pedal operation speed (400[%/s]: maximum reached in 0.25 seconds) at the time of the misstep (participant experiment results) shall be used.



Accelerator pedal speed at misstep