Vehicle experimental test report

National Traffic Safety and Environment Laboratory

The 10th session of ACPE IWG

Overview

The following three experimental tests were carried out using actual vehicles

1. Experiment to perform forward obstacle avoidance by steering

Purpose of the experiment :

- To confirm whether it makes sense to accelerate the vehicle rapidly when avoiding a forward obstacle (assuming a passenger car) by steering at the timing when the AEBS starts to operate.

2. Trial of ACPE performance evaluation at steady creeping speed

Purpose of the experiment :

- Concerning the method of accelerator pedal application after reaching steady creeping speed proposed by UK, to compare the accuracy of the test in the method of accelerator pedal application after driving for a predetermined time and after driving a predetermined distance.

3. ACPE performance evaluation with offset placement of the child pedestrian target

Purpose of the experiment :

- To understand the ACPE performance of the current vehicles when the test is carried out with the offset placement of the child pedestrian target proposed by UK.

Experimental vehicles

- The following 3 vehicles were used.
- Vehicle A and B are same as the ones which were introduced in the previous reports.

		Vehicle A	Vehicle B	Vehicle C
Powertrain		3.5 litre petrol engine and motor (Hybrid system) 7 speeds automatic transmission	1.8 litre turbo charged petrol engine CVT transmission	1.5 litre petrol engine CVT transmission
Driven wheels		Rear	Front & Rear (AWD)	Front
Sensing system	Front	3 Cameras, Millimeter wave radar and sonars	Camera (Stereo type)	Sonars[*2]
	Rear	Sonars	Sonars[*1]	Sonars

[*1] Regarding backward direction, acceleration control (not including braking control) is activated for a few seconds by sudden accelerator pedal application even if there is no obstacle.

[*2] Pre-crash Safety system which uses Monocular camera and Radar as the sensors is activated depends on some kinds of objects.

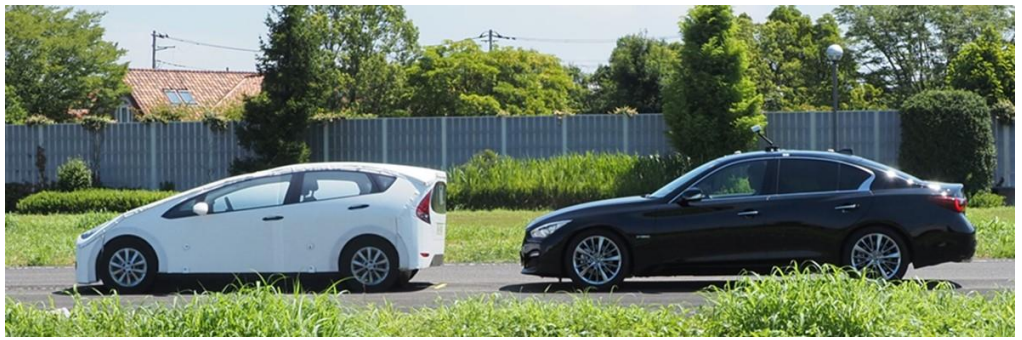
1. Experiment to perform forward obstacle avoidance by steering

1) Preliminary investigation (start timing of AEBS activation)

- To investigate the AEBS activation timing of the experimental vehicle, move forward toward the target and activate the AEBS.
- The results obtained in the preliminary study (AEBS activation start point) is used as the steering start point in the experiment of forward obstacle avoidance by steering.

<Experimental conditions>
Target：3D type vehicle target (ISO 19206-3)
Vehicle speed：10 km/h, 30 km/h, 40 km/h
The number of trial：3 times in each speed condition

<Measurement data>
Deceleration start point by AEBS for each car*



* The point where the deceleration exceeds 0.3 m/s^2 is defined to be the deceleration start point by AEBS (regardless of whether it is warning braking or emergency braking control)

Result of preliminary investigation

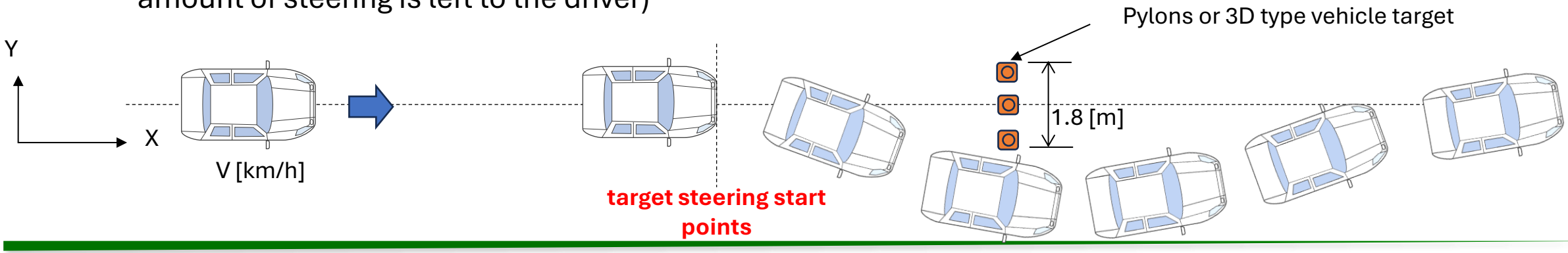
		10 [km/h]				30 [km/h]				40 [km/h]			
		1st	2nd	3rd	average	1st	2nd	3rd	average	1st	2nd	3rd	average
Vehicle A	AEBS deceleration start point Distance to the target [m]*	2.48	2.4	2.66	2.51	10.77	14.68	12.45	12.63	19.9	19.49	18.1	19.16
	Conversion to TTC [s]	0.89	0.86	0.96	0.9	1.29	1.76	1.49	1.51	1.79	1.75	1.63	1.72
Vehicle B	AEBS deceleration start point Distance to the target [m]*	1.87	1.85	1.93	1.88	9.37	9.12	8.44	8.98	12.95	14.25	13.33	13.51
	Conversion to TTC [s]	0.67	0.67	0.69	0.68	1.12	1.09	1.01	1.07	1.17	1.28	1.2	1.22
Vehicle C	AEBS deceleration start point Distance to the target [m]*	1.29	1.52	1.49	1.43	7.87	6.05	7.83	7.25	12.05	12.57	13.25	12.62
	Conversion to TTC [s]	0.46	0.55	0.54	0.52	0.94	0.73	0.94	0.87	1.08	1.13	1.19	1.14

*Distance to target when deceleration exceeds 0.3 m/s^2

- At all speed conditions, the deceleration start points for AEBS were Vehicle A, Vehicle B, and Vehicle C in order of distance from the target
- The values in the red box in the table were the **target steering start points** in the steering avoidance experiment.

2) Experiment to perform forward obstacle avoidance by steering

- The test vehicle approaches a forward obstacle at a speed of V km/h (controlled tolerance of +/- 1 km/h and lateral position of +/- 0.1 m from the point where TTC = 6 seconds to the obstacle to the start of steering).
- Steering to the right at the target steering start point and try to avoid obstacles.
- After avoiding the obstacle, steer to the left and return to the original lateral position.
- Vehicle decelerates and stops when it returns to its original lateral position
- Instructs the driver (professional driver) to return to the original lateral position as soon as possible after avoiding an obstacle (steering speed and amount of steering is left to the driver)



<Experimental conditions>
Target : 3D type vehicle target or pylons
Vehicle speed : 10 km/h, 30 km/h, 40 km/h
The number of trial ： 3 times in each speed condition
Accelerator control operation after start of steering: see table at right
Status of AEBS ON/OFF : see table at right

Experimental conditions	Accelerator pedal operation after start of steering	Status of AEBS	Forward obstacle
Case 1	**Rapid and sudden operation（sudden acceleration）**	OFF	Pylons
Case 2	**Accelerator OFF**	OFF	Pylons
Case 3	**constant**	ON	3D type vehicle target

<Measurement data>
- Trajectory of the vehicle (X- and Y-directional trajectory at the center of the front end of the vehicle body)
- Lateral (Y-direction) acceleration*

*It is acceleration in the Y direction, which is different from the lateral acceleration generated by the vehicle body

＜ Subjective rating ＞
- Rating for ease of avoiding obstacles and returning to the original horizontal position

Questions
Q1 : Was it easy to avoid the obstacle or not?
Q2 : Could you easily return to the original lateral position?

Options
1. Difficult (or could not)
2. Slightly difficult
3. Can't say either way
4. Slightly easy
5. Easy

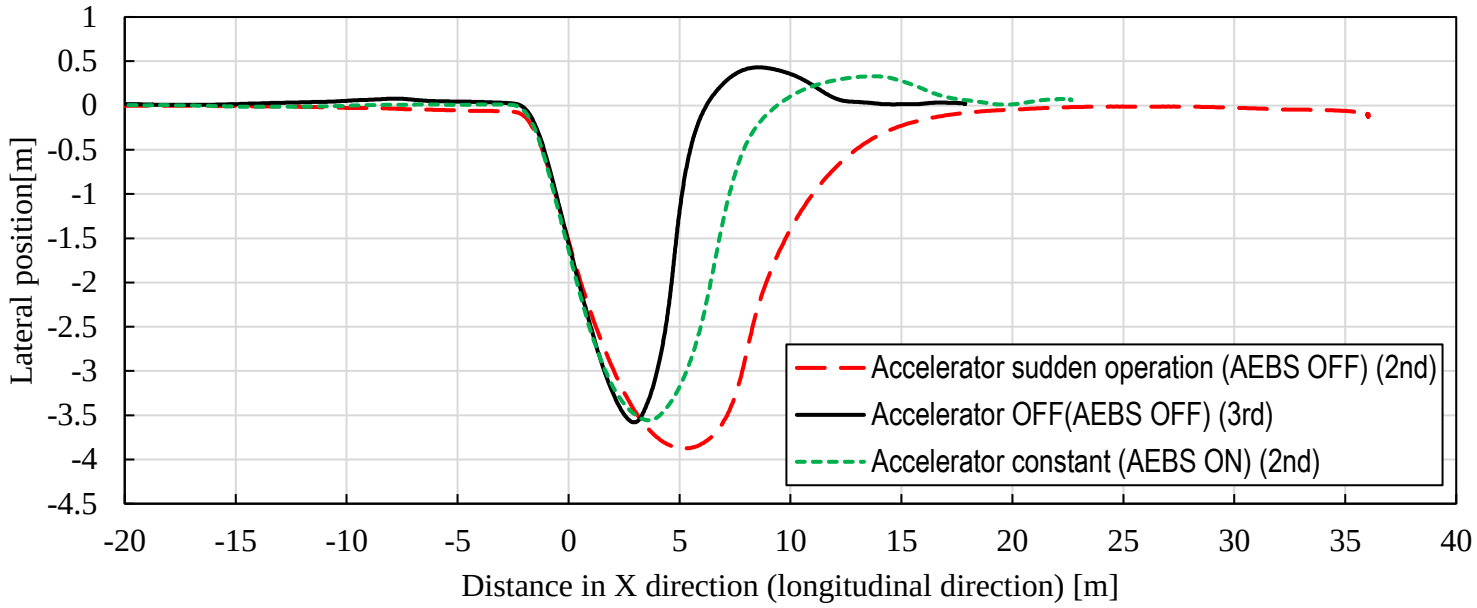
Experimental result

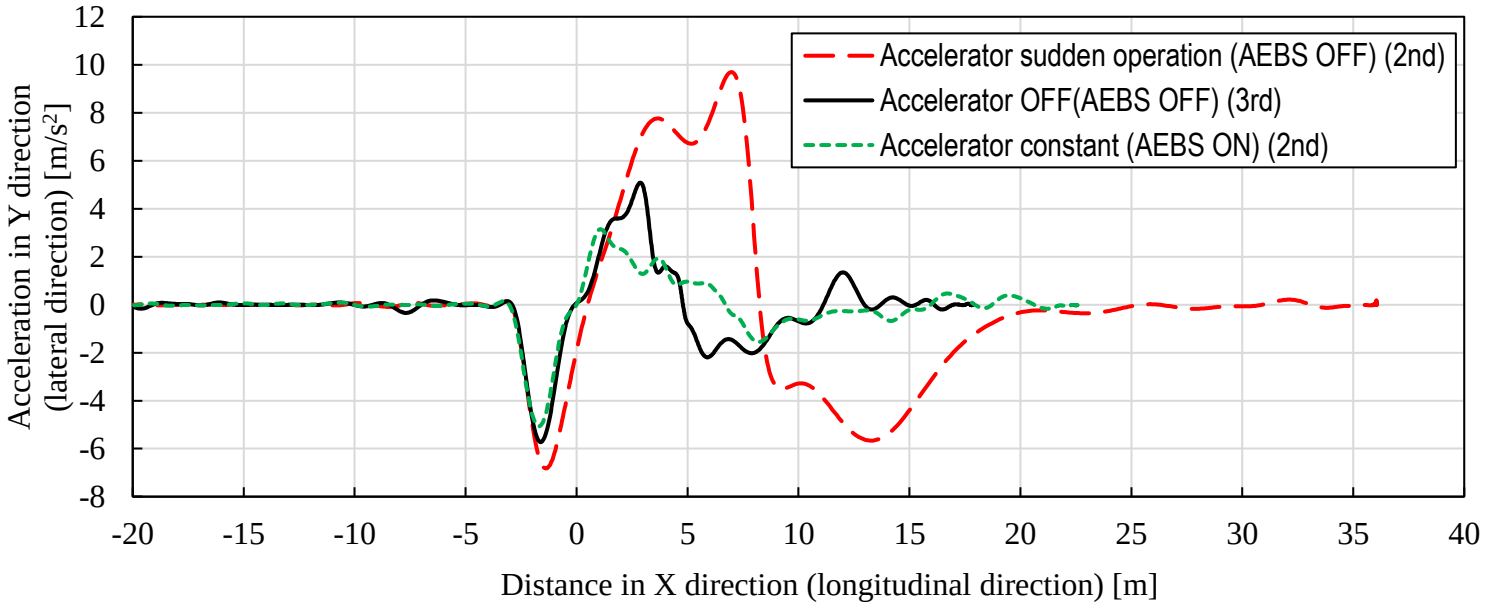
Vehicle A　10 km/h

- The “Accelerator rapid and sudden operation” has the largest amount of lateral movement when avoiding obstacles (the trajectory is bulging).
- “Accelerator rapid and sudden acceleration” has the greatest lateral acceleration when returning to the original lateral position.
- **It is assumed that steering avoidance at a speed of 10 km/h was extremely burdensome for the driver under all conditions.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	1	Close proximity to obstacles and large amount of steering operation
	Accelerator OFF （AEBS OFF）	1	Close proximity to obstacles and large amount of steering operation
	Accelerator constant （AEBS ON）	1	Close proximity to obstacles and large amount of steering operation
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	1	Difficult to correct vehicle behavior
	Accelerator OFF （AEBS OFF）	2	large amount of steering operation
	Accelerator constant （AEBS ON）	2	large amount of steering operation

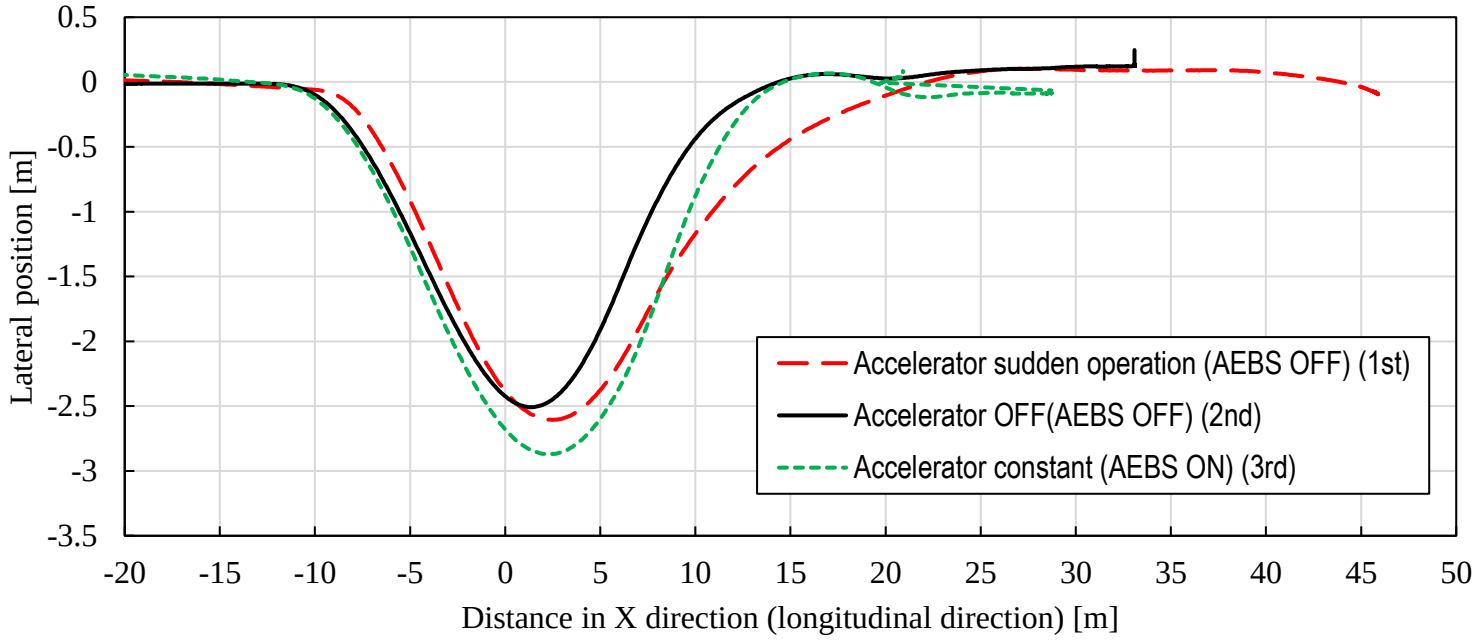


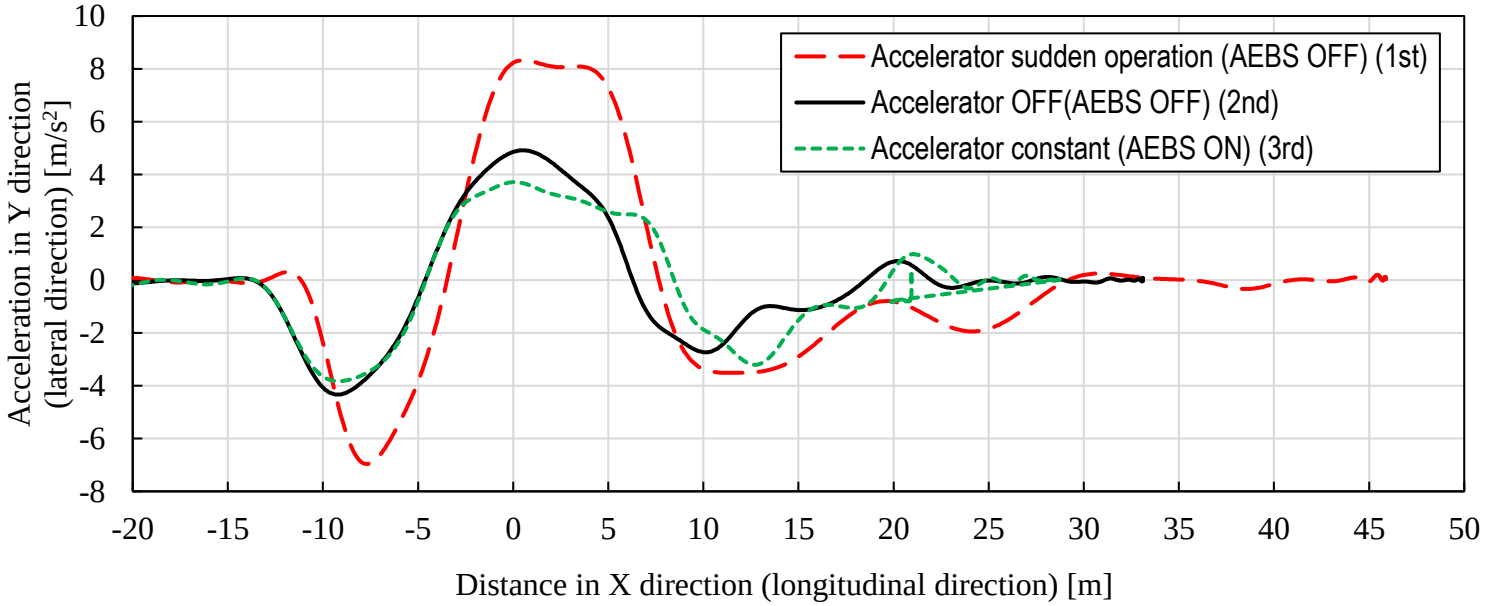


Experimental result

Vehicle A　30 km/h

- "Accelerator rapid and sudden acceleration" has the highest lateral acceleration both when avoiding obstacles and when returning to the original lateral position.
- **In all conditions, steering avoidance at a speed of 30 km/h was not a particularly difficult operation for the professional driver.**





Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	4	
	Accelerator OFF (AEBS OFF)	5	
	Accelerator constant (AEBS ON)	3	
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	4	
	Accelerator OFF (AEBS OFF)	5	
	Accelerator constant (AEBS ON)	4	

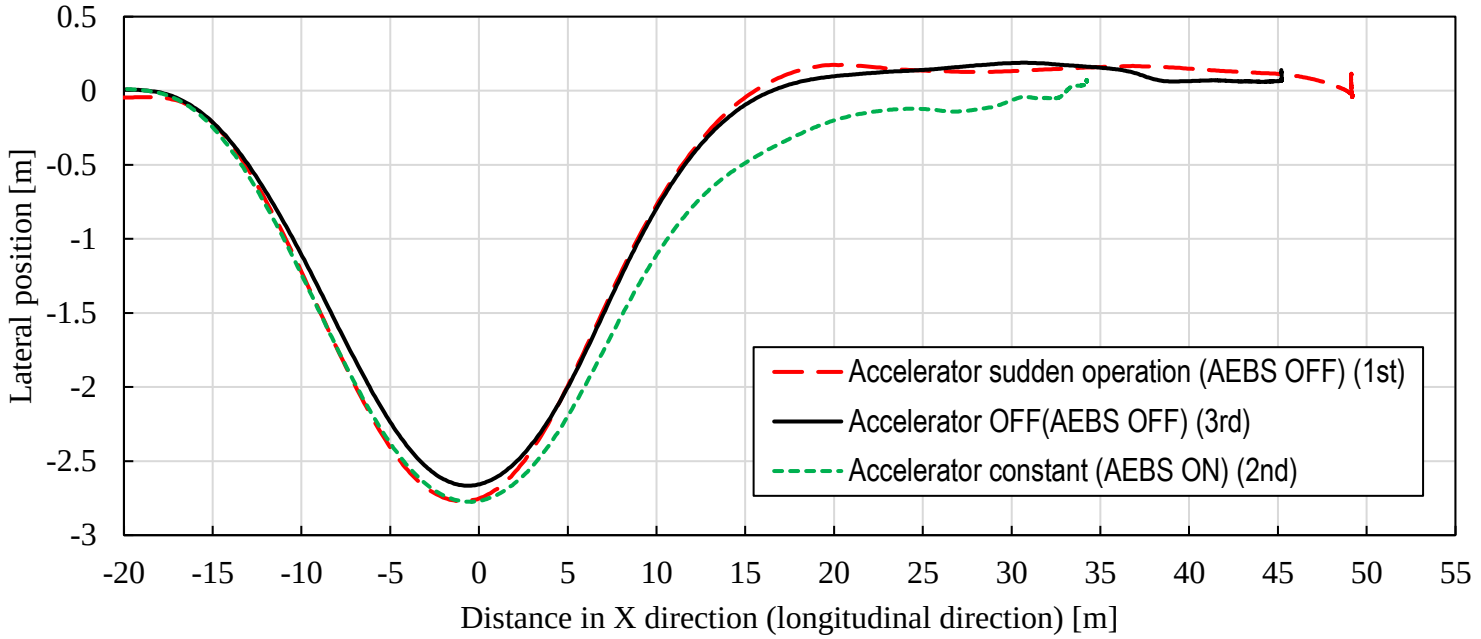
Experimental result

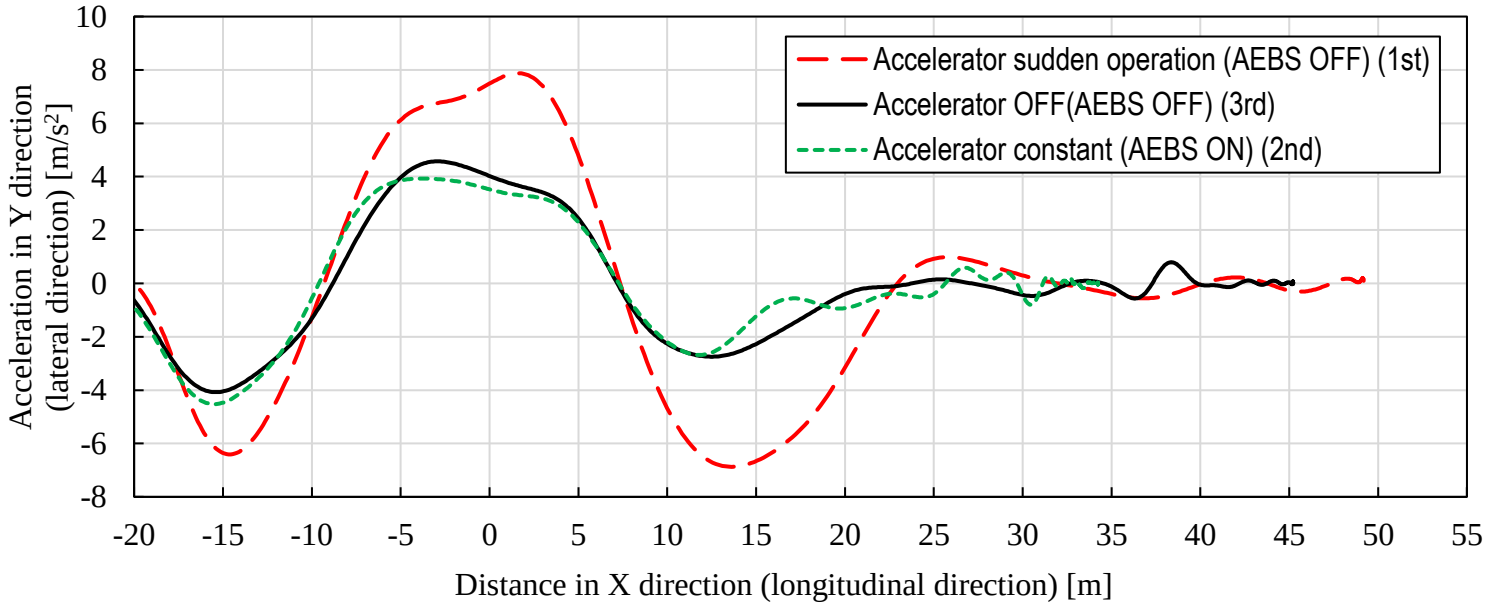
Vehicle A　40 km/h

- "Accelerator rapid and sudden acceleration" has the highest lateral acceleration both when avoiding obstacles and when returning to the original lateral position.
- **In all conditions, steering avoidance at a speed of 40 km/h was not a particularly difficult operation for the professional driver.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	5	
	Accelerator OFF (AEBS OFF)	5	
	Accelerator constant (AEBS ON)	5	
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	4	
	Accelerator OFF (AEBS OFF)	5	
	Accelerator constant (AEBS ON)	5	





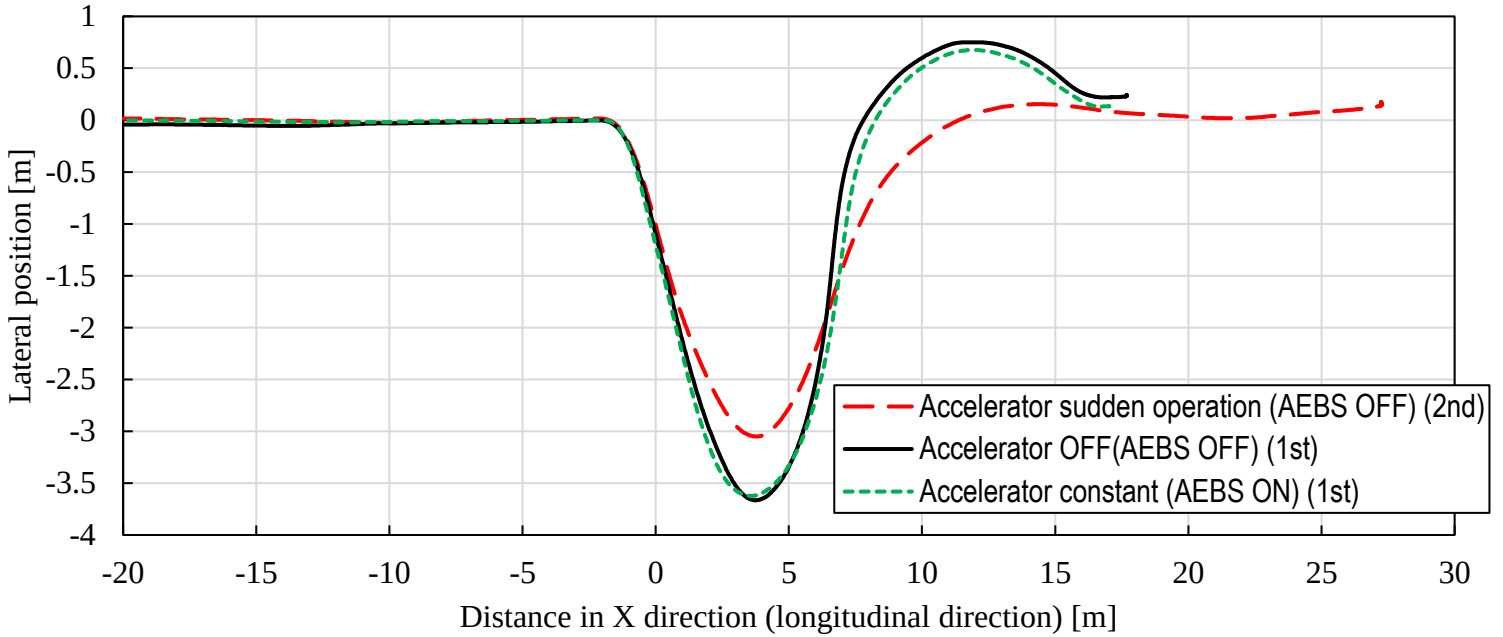
Experimental result

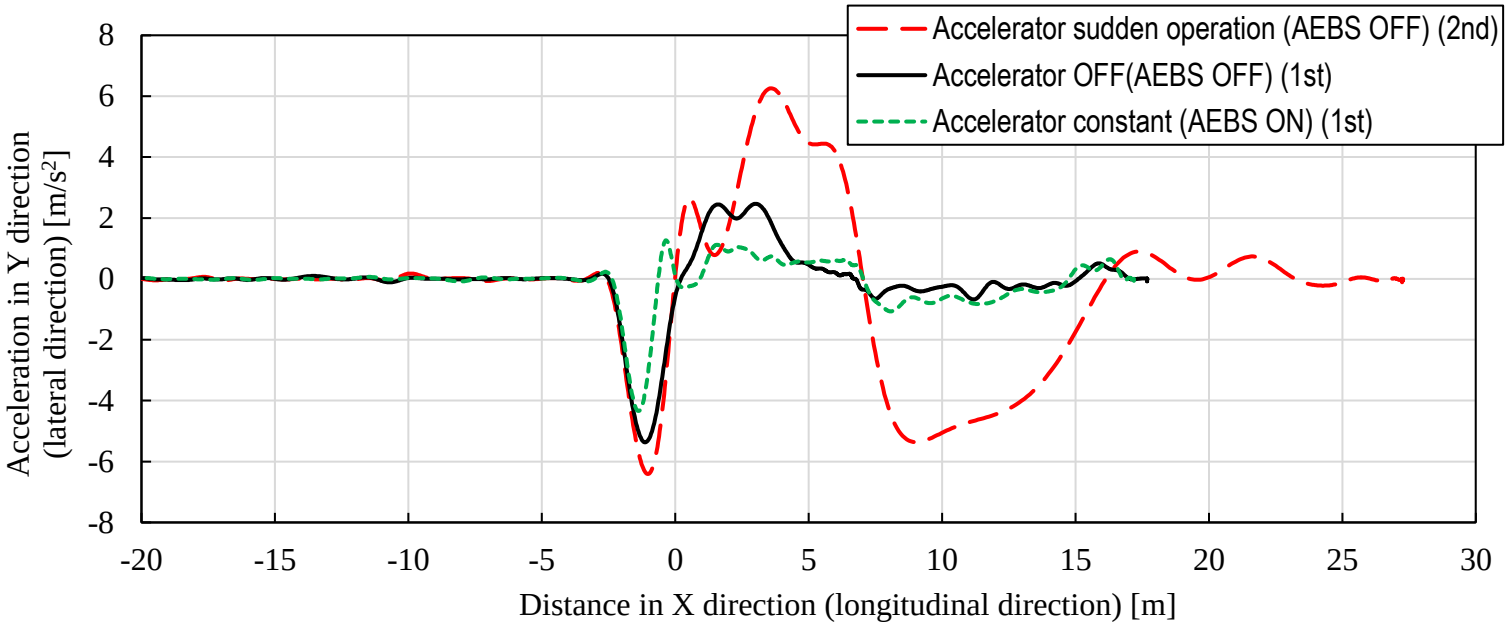
Vehicle B　10 km/h

- “Accelerator rapid and sudden operation” has the highest lateral acceleration when returning to the original lateral position.
- **It is assumed that steering avoidance at a speed of 10 km/h was extremely burdensome for the driver under all conditions.**
- **“Accelerator rapid and sudden operation” was more burdensome when returning to the original lateral position.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	1	There was time between rapid and sudden accelerator operation and rapid rapid acceleration, so I could operate the steering.
	Accelerator OFF （AEBS OFF）	1	Even with the fastest and biggest steering operation, it was not enough to catch up.
	Accelerator constant （AEBS ON）	1	Close to obstacles and large amount of steering operation, and high steering speed.
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	1	At when returning to original lateral position, rapid acceleration had begun.
	Accelerator OFF （AEBS OFF）	2	There was no need to panic, but there was large amount of steering operation was needed on the way back to the original lateral position.
	Accelerator constant （AEBS ON）	2	There was no dangerous sense of impending collision.





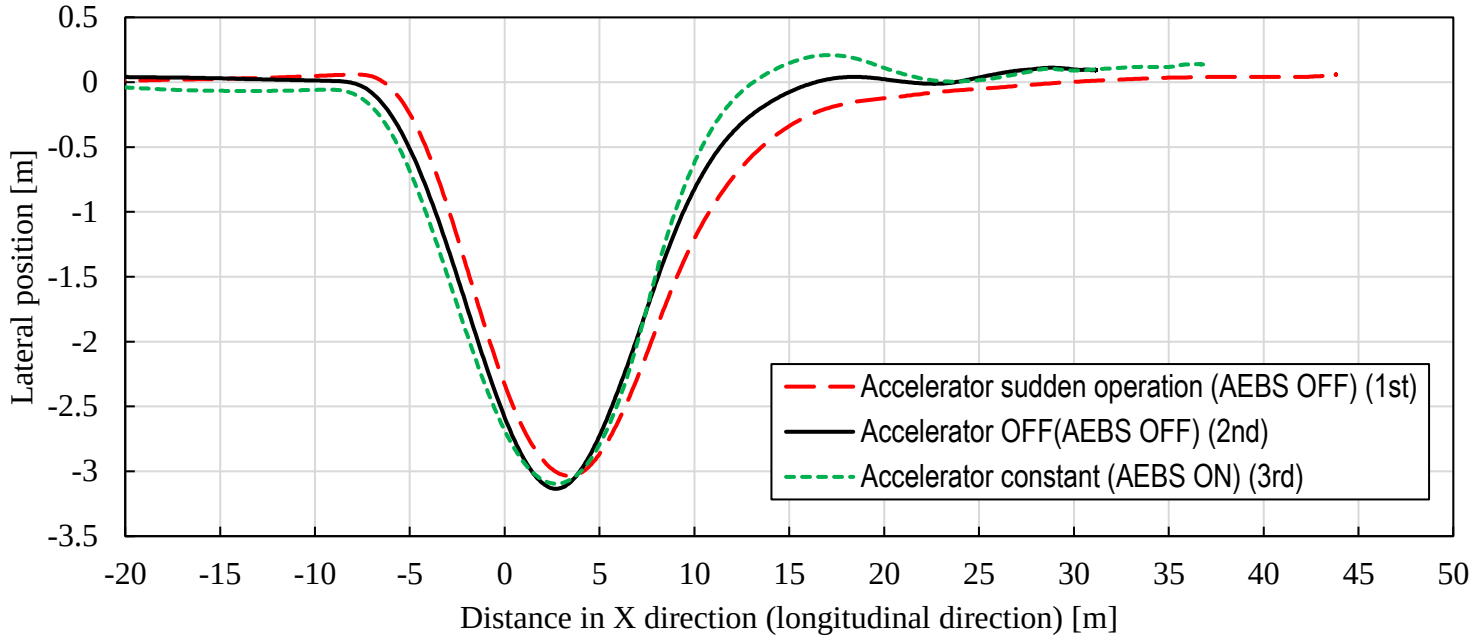
Experimental result

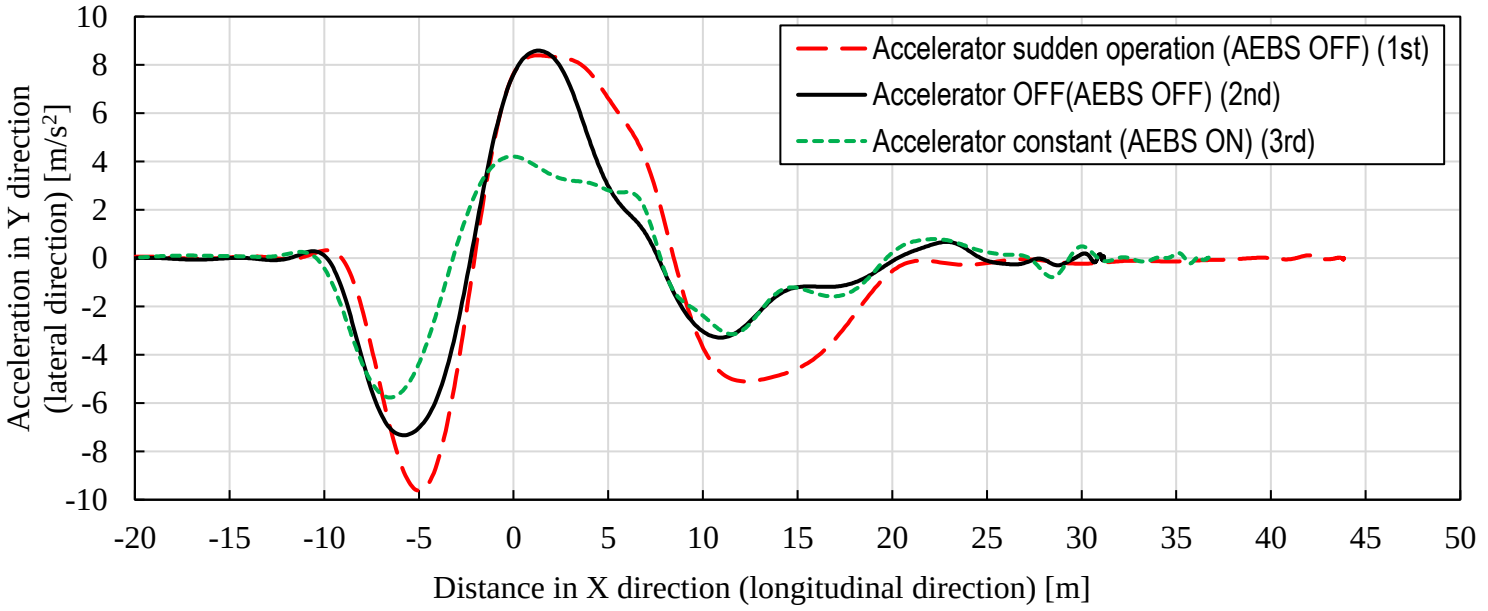
Vehicle B　30 km/h

- "Accelerator rapid and sudden operation" has the highest lateral acceleration when avoiding the obstacle.
- "Accelerator constant (AEBS ON)" has the smallest lateral acceleration when avoiding and returning to the original lateral position.
- **In all conditions, avoiding steering at a speed of 30 km/h was slightly more burdensome for the driver, although not as much as at a speed of 10 km/h**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	2	Rapid steering operation was required.
	Accelerator OFF (AEBS OFF)	2	Rapid steering operation was required.
	Accelerator constant (AEBS ON)	2	Close proximity to obstacle resulted in rapid steering, AEBS activation did not interfere.
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	3	Vehicle behavior was somewhat more stable than in the accelerator OFF condition.
	Accelerator OFF (AEBS OFF)	2	ESC intervened immediately after steering to the original lateral position, which was uncomfortable.
	Accelerator constant (AEBS ON)	3	





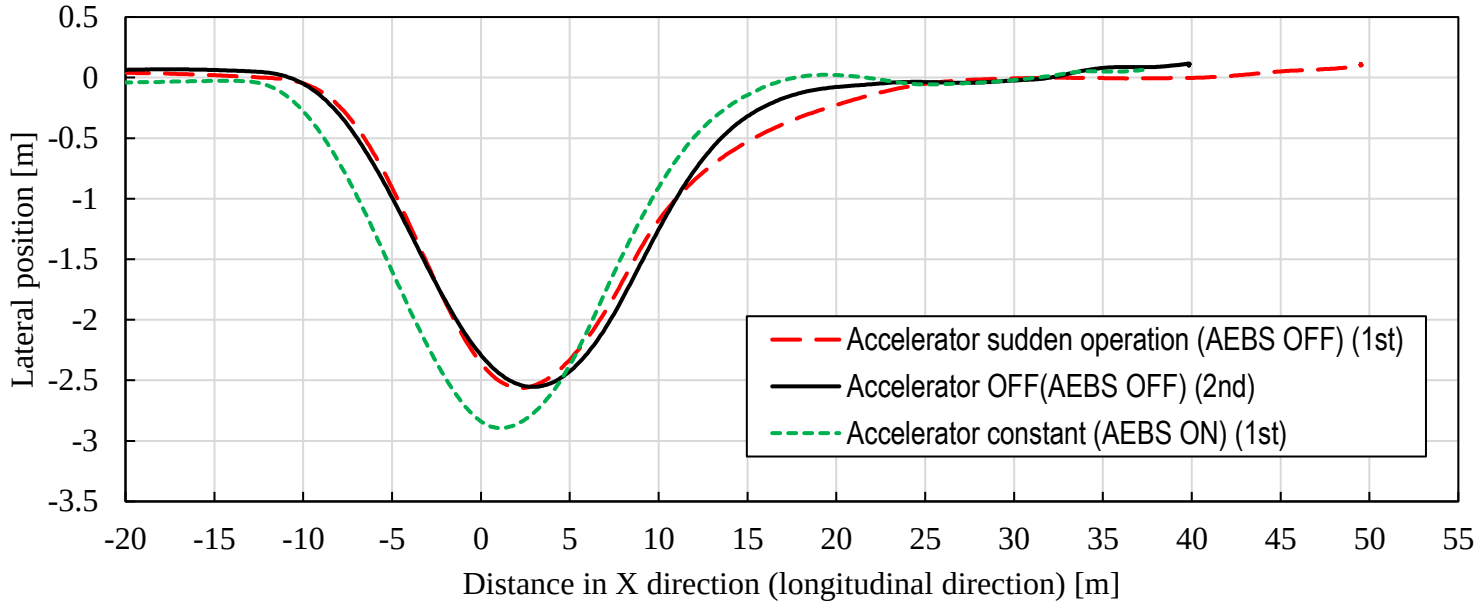
Experimental result

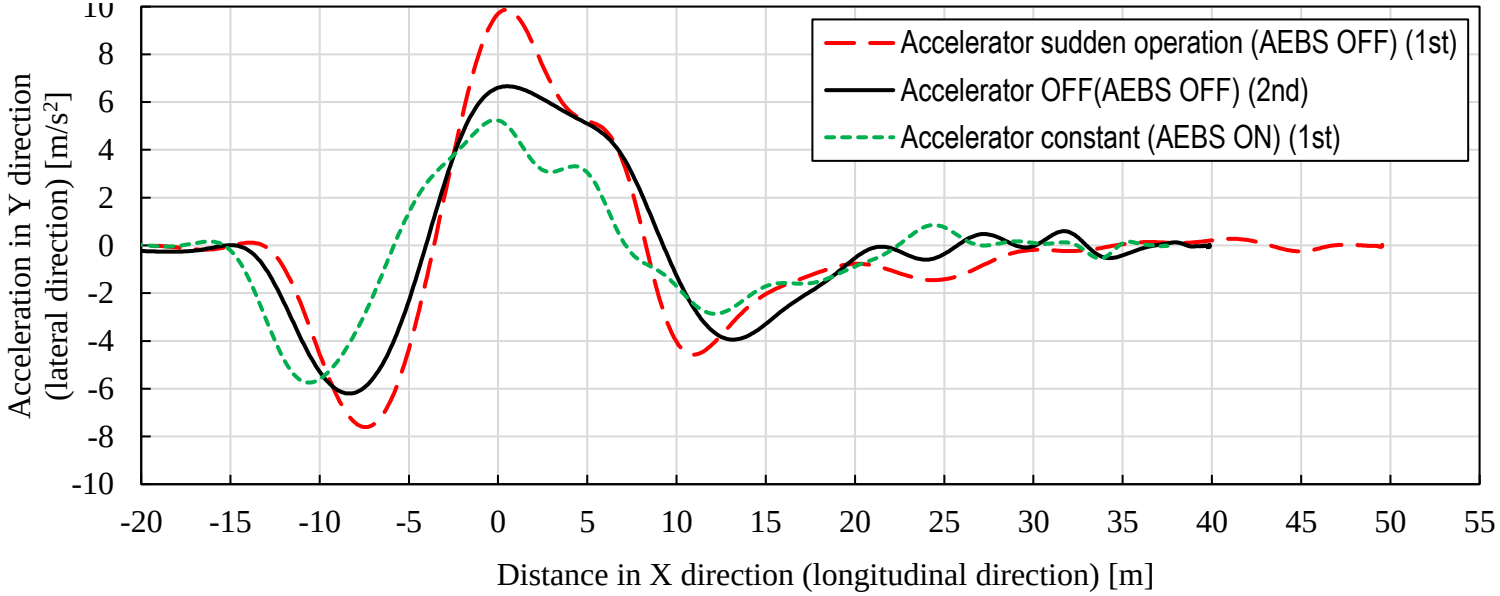
Vehicle B　40 km/h

- "Accelerator rapid and sudden acceleration" has the highest lateral acceleration both when avoiding obstacles and when returning to the original lateral position.
- **In all conditions, steering avoidance at a speed of 40 km/h was not a particularly difficult operation for the professional driver.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	3	
	Accelerator OFF （AEBS OFF）	3	
	Accelerator constant （AEBS ON）	2	AEBS operation interfered with smooth steering operation.
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	3	ESC was intervened at when returning to the original lateral position, but no discomfort.
	Accelerator OFF （AEBS OFF）	3	
	Accelerator constant （AEBS ON）	4	





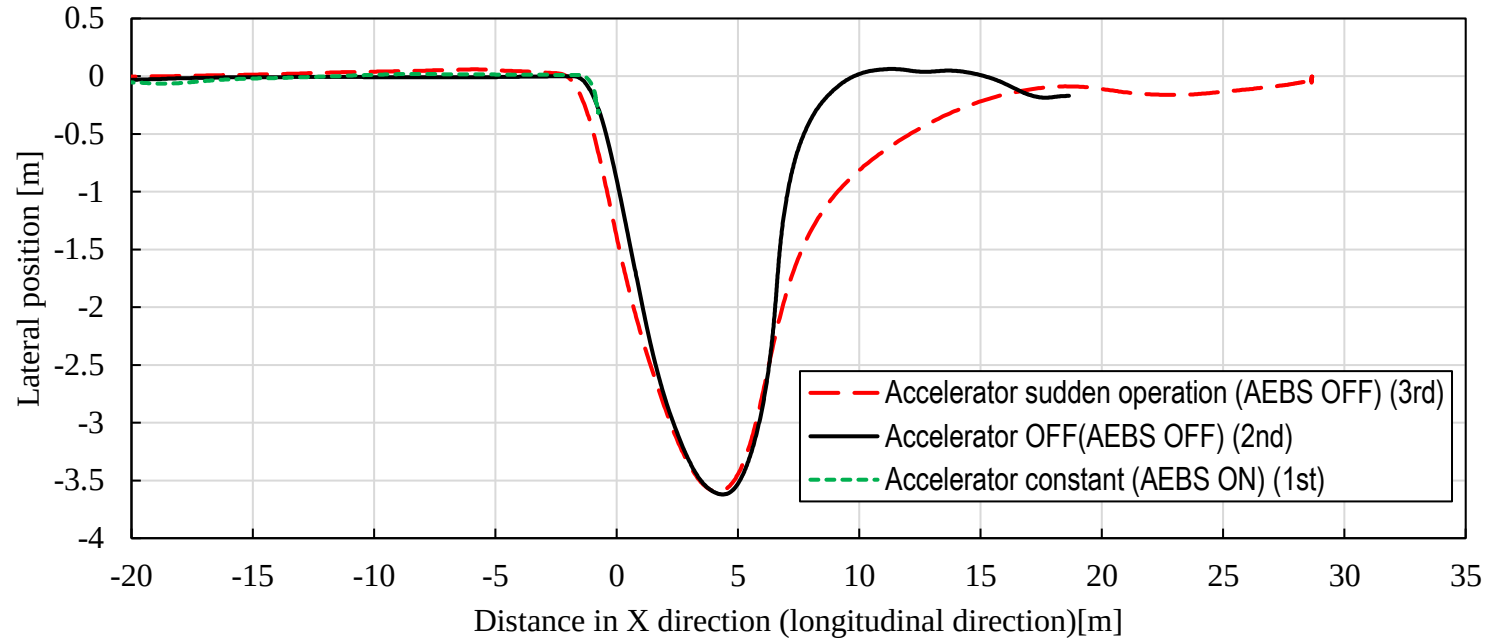
Experimental result

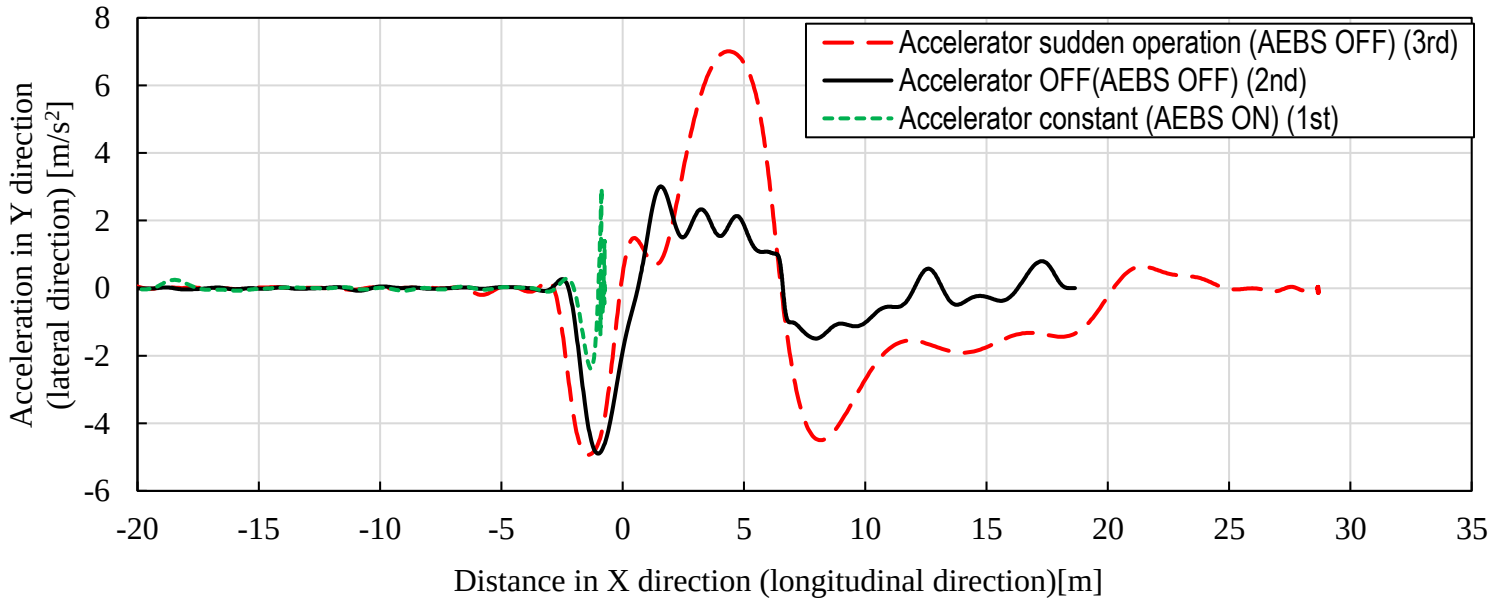
Vehicle C　10 km/h

- “Accelerator constant (AEBS ON)" was not avoided the obstacle because the vehicle stopped due to AEBS activation.
- "Accelerator rapid and sudden operation” has the highest lateral acceleration when returning to the original lateral position.
- **It is assumed that steering avoidance at a speed of 10 km/h was extremely burdensome for the driver under all conditions.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	1	The amount of steering operation near obstacles is too much to keep up with operation.
	Accelerator OFF (AEBS OFF)	1	The amount of steering operation near obstacles is too much to keep up with operation.
	Accelerator constant (AEBS ON)	1	(Vehicle stopped due to AEBS activation before avoided)
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	2	Due to a lot of steering to avoid, large amount of operation to get it back.
	Accelerator OFF (AEBS OFF)	1	Due to a lot of steering to avoid, large amount of operation to get it back.
	Accelerator constant (AEBS ON)	—	—





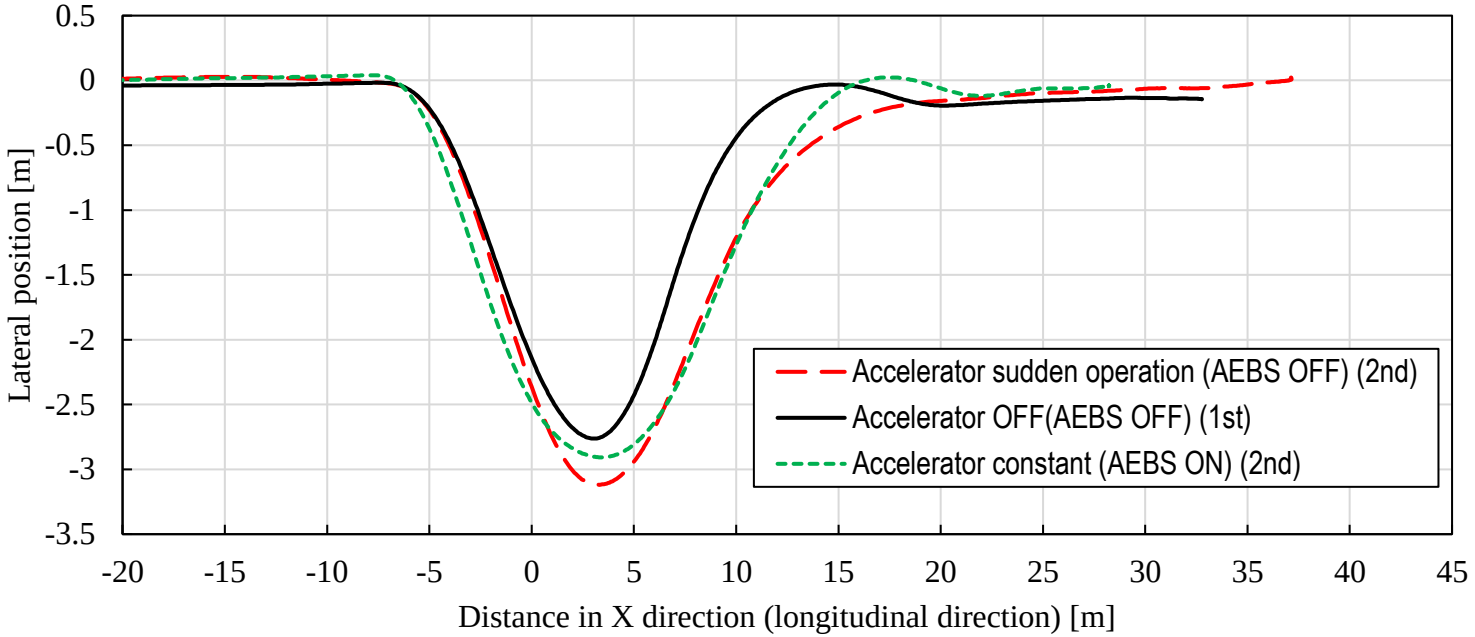
Experimental result

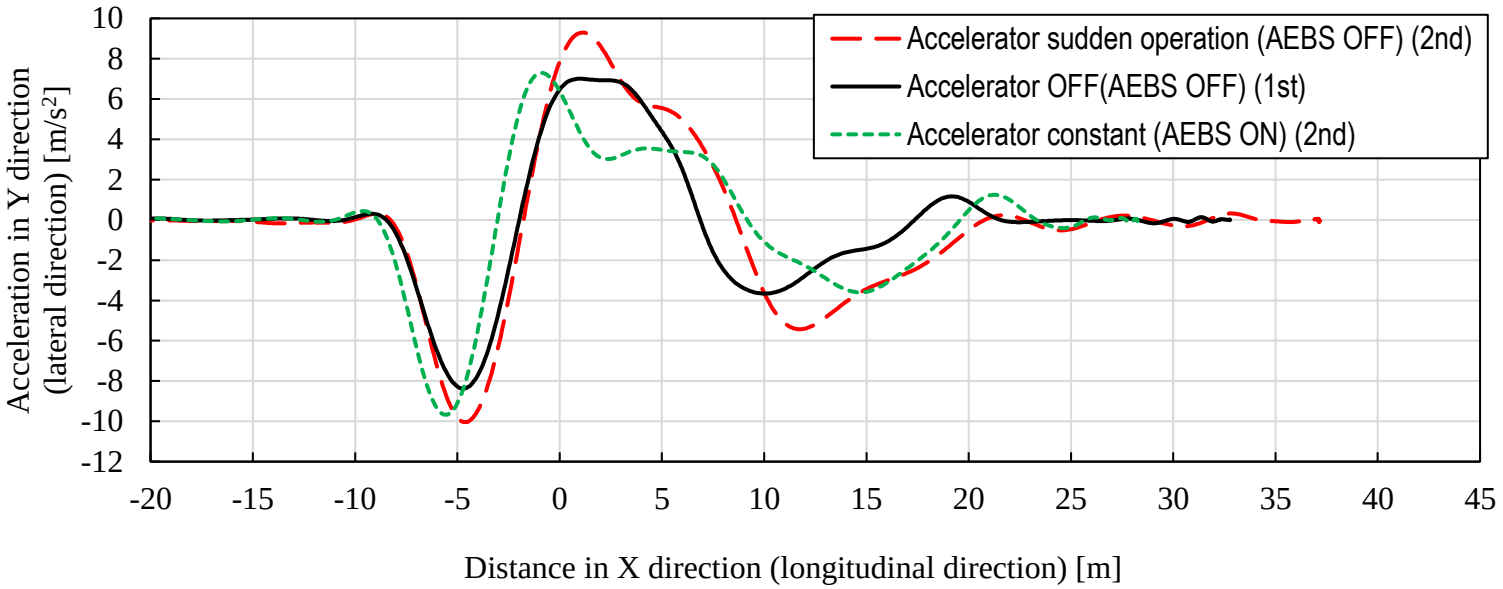
Vehicle C　30 km/h

- “Accelerator OFF” has the smallest amount of lateral movement during evading, and returns to the original lateral position quickly.
- "Accelerator rapid and sudden operation” has the greatest lateral acceleration when returning to the original lateral position.
- **In all conditions, avoiding steering at a speed of 30 km/h was slightly more burdensome for the driver, although not as much as at a speed of 10 km/h**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	3	
	Accelerator OFF （AEBS OFF）	2	The obstacle was close to the start of steering and just on the edge.
	Accelerator constant （AEBS ON）	2	Steering was operated too large amount. (1st)
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	3	
	Accelerator OFF （AEBS OFF）	3	
	Accelerator constant （AEBS ON）	2	Due to a lot of steering to avoid, large amount of operation to get it back.





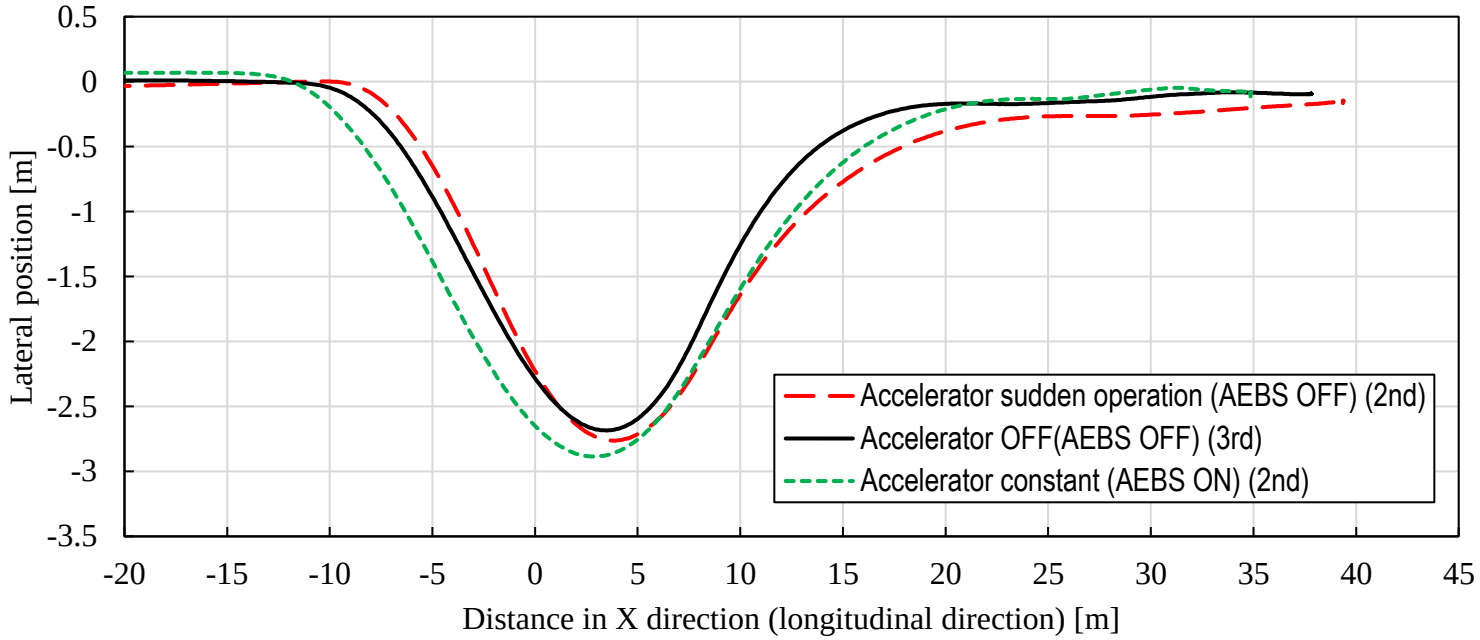
Experimental result

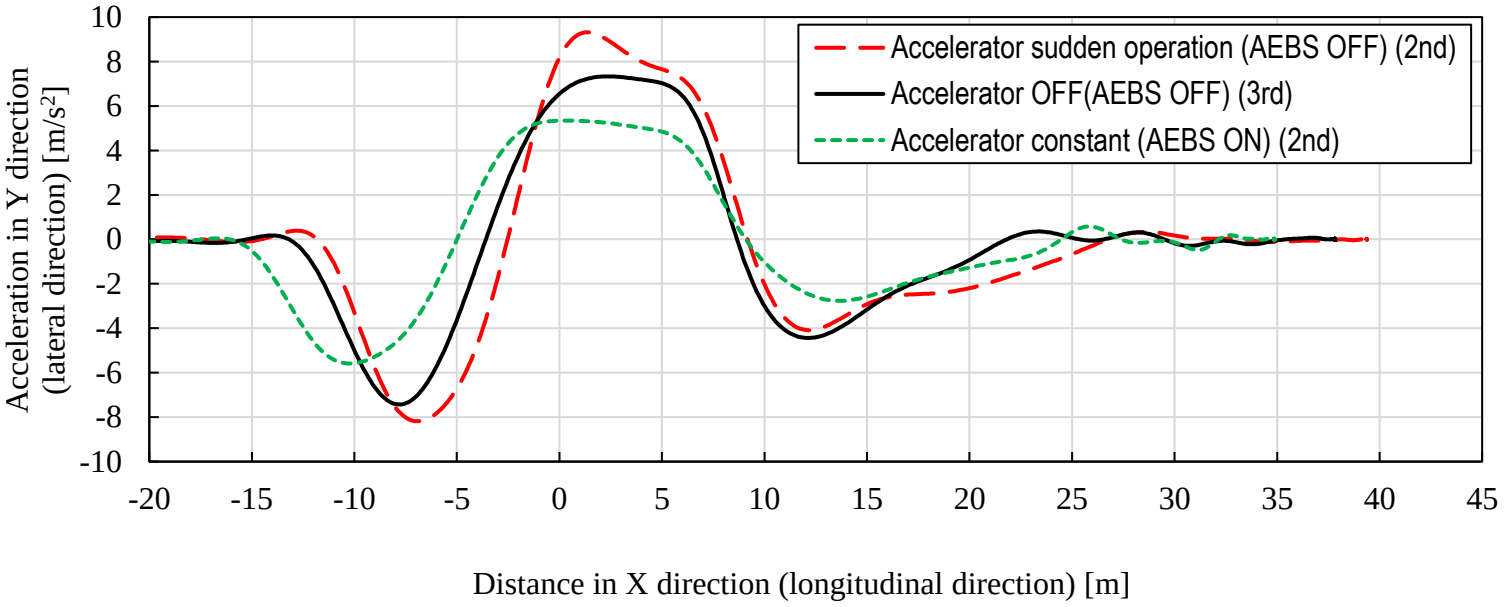
Vehicle C　40 km/h

- No noticeable difference in driving trajectory due to differences in conditions
- "Accelerator rapid and sudden operation" has the greatest lateral acceleration when returning to the original lateral position.
- **In all conditions, steering avoidance at a speed of 40 km/h was not a particularly difficult operation for the professional driver.**

Subjective rating

Questions	Condition	Rating	Comment (if 2 or less)
Q1 : Was it easy to avoid the obstacle or not?	Accelerator rapid and sudden operation (AEBS OFF)	3	
	Accelerator OFF （AEBS OFF）	3	
	Accelerator constant （AEBS ON）	3	
Q2 : Could you easily return to the original lateral position?	Accelerator rapid and sudden operation (AEBS OFF)	3	ESC intervened momentarily, which made me feel a little uneasy.
	Accelerator OFF （AEBS OFF）	4	
	Accelerator constant （AEBS ON）	4	





Summary of experiment to perform forward obstacle avoidance by steering

- Conducted a steering avoidance experiment by investigating the AEBS activation start timing for each vehicle and using it as the target steering start point.
- At a speed of 10 km/h, regardless of the accelerator operation conditions, the amount of steering operation is very large, confirming that avoidance is difficult.

  ⇒It is not practical to steer around an obstacle at a speed of 10 km/h in the situation when the obstacle is close enough to activate the AEBS.
- In the “Accelerator rapid and sudden operation” condition, the vehicle is more likely to travel an extra distance before the trajectory returns to its original lateral position than in the “Accelerator off” or "Accelerator constant" condition.
- In the “Accelerator rapid and sudden operation” condition, the lateral acceleration is higher than in the “Accelerator off” or "Accelerator constant" condition (especially when returning to the original lateral position).

From the above results, no particular reason (advantage) was found to accelerate the vehicle rapidly when avoiding obstacles by steering.

2. Trial of ACPE performance evaluation at steady creeping speed

1) Preliminary investigation (Investigation of time and distance to reach steady creeping speed)

- After releasing the brake pedal of the experimental vehicle, the vehicle creeps along until reaching the steady speed,
  - Time and speed
  - distance and speed

  are measured.

- Direction of the vehicles,
  - Forward direction
  - Backward direction

- The number of trials is 3 times, but increase the number of trials if the variation per trial is large.

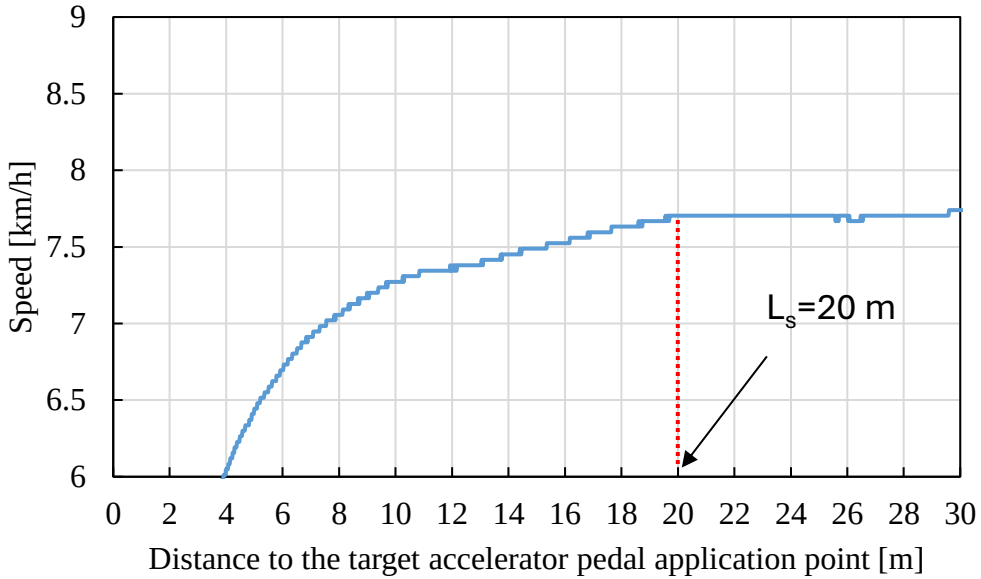
<Measurement data processing procedures>

① Read the distance to reach a steady speed (L_s in the figure) for each trial.
② The value obtained by adding 2 m to Ls* shall be used as the distance (L_1) for evaluating ACPE performance by accelerator pedal application after traveling a predetermined distance.
③ From the numerical data of time and distance, determine the travel time (t_1) at the point when the distance traveled reaches L_1.
   ➢ The value t_1 shall be used as the time for evaluating ACPE performance evaluation by accelerator pedal application after traveling for a predetermined time.
④ Obtain L_1 and t_1 for the number of trials and average them (use the averaged t_1 and L_1 for ACPE performance evaluation)

*Addition of 2m is taken from 6.7.2.2. of ACPE-09-06 (UK proposal)

6.7.2.2. **The vehicle shall be driven in a straight line for at least 2m at its steady state creep speed.**

Example of distance and speed in creep traveling (vehicle C, 1st)



In the above example, L_s reads 20 m
-> L_1=22 m
From numerical data on time and distance,
Obtained t_1 = 12.86 s (time to travel 22 m)

Result of preliminary investigation

Vehicle	Direction	L_1 (Average) [m]	t_1 (Average) [s]
Vehicle A	Forward	25	16.81
	Backward	24	16.75
Vehicle B	Forward	11.33	9.18
	Backward	9	7.91
Vehicle C	Forward	22	12.94
	Backward	26	13.82

2) ACPE performance evaluation by the method of accelerator pedal application after traveling for a predetermined time and accelerator pedal application after traveling for a predetermined distance

① The method of accelerator pedal application after running for a predetermined time

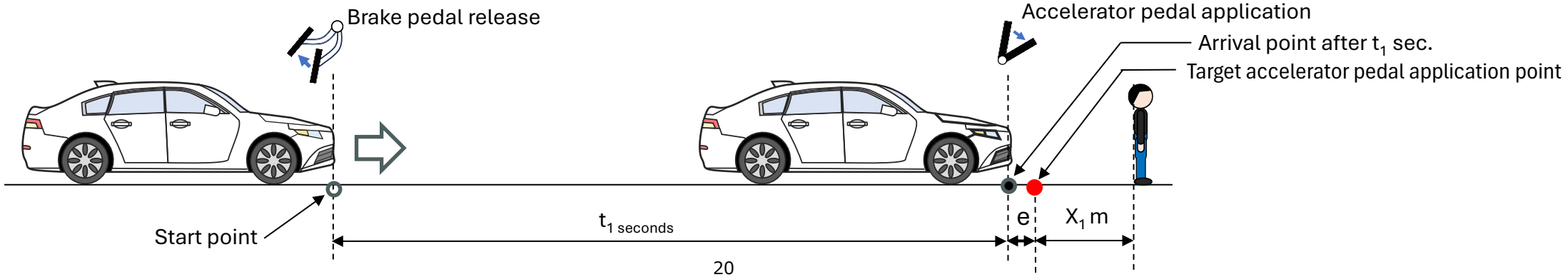
- Apply the accelerator pedal after t_1 second of creep traveling after releasing the brake pedal
  (Guidance of t_1 seconds to the driver uses a periodic metronome sound)
- Distance from target accelerator pedal application point to the target (X_1)
  - 1.25 m[*1]
  - 1.75 m[*2]

  (Vehicle B was only available at 1.75 m)

  [*1]Set as an intermediate value between 1.0 and 1.5 m

  [*2]Set as an intermediate value between 1.5 and 2.0 m
- Child pedestrian target (ISO 19206-3) was used.
- Carried out only in the forward direction
- The number of trials was 10.
- Carried out for two vehicles, Vehicle A and Vehicle B

e in the figure is the error relative to target accelerator pedal application point.
Error factors are the following two points.
- Variation in creeping speed relative to preliminary investigation
- Variation in driver's accelerator pedal application timing

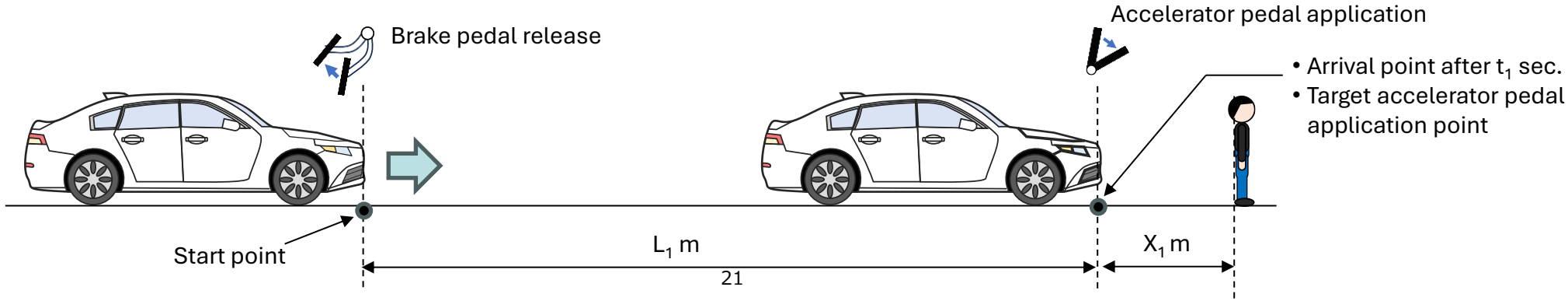


② The method of accelerator pedal application after traveling for a predetermined distance

- Apply the accelerator pedal after L_1 m of creep traveling after releasing the brake pedal
  （L_1 m guidance to drivers with real-time display of longitudinal distance, and positioned a pylon to serve as landmarks）
- Distance from target accelerator pedal application point to the target (X_1)
  - 1.25 m[*1]　　[*1]Set as an intermediate value between 1.0 and 1.5 m
  - 1.75 m[*2]　　[*2]Set as an intermediate value between 1.5 and 2.0 m

  (Vehicle B was only available at 1.75 m)
- Child pedestrian target (ISO 19206-3) was used.
- Carried out only in the forward direction
- The number of trials was 10.
- Carried out for two vehicles, Vehicle A and Vehicle B

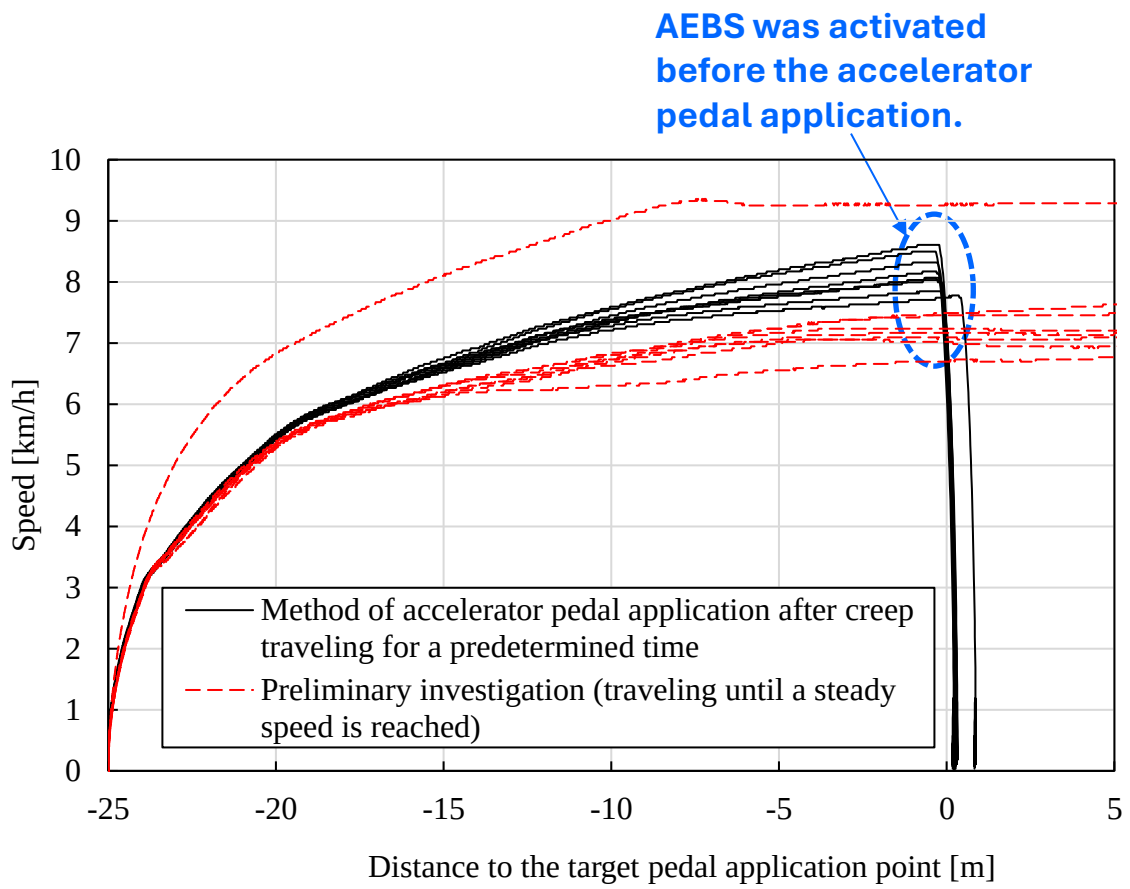
In this method, the driver starts from a point L1 m behind the target point, so the only error factor is
- Variation in the actual accelerator pedal application position by the driver



Experimental result

Vehicle A

a. In the method of accelerator pedal application after creep traveling for a predetermined time, AEBS was activated before accelerator pedal application all 10 times and the vehicle came to a stop.
b. In the method of accelerator pedal application after creep traveling for a predetermined distance, in 2 out of 10 cases, AEBS was activated before accelerator pedal application and the vehicle came to a stop.
c. Creeping speeds varied by up to approximately 1 km/h between trials
d. Creeping speed in the experimental tests were higher than speed in the preliminary investigation.

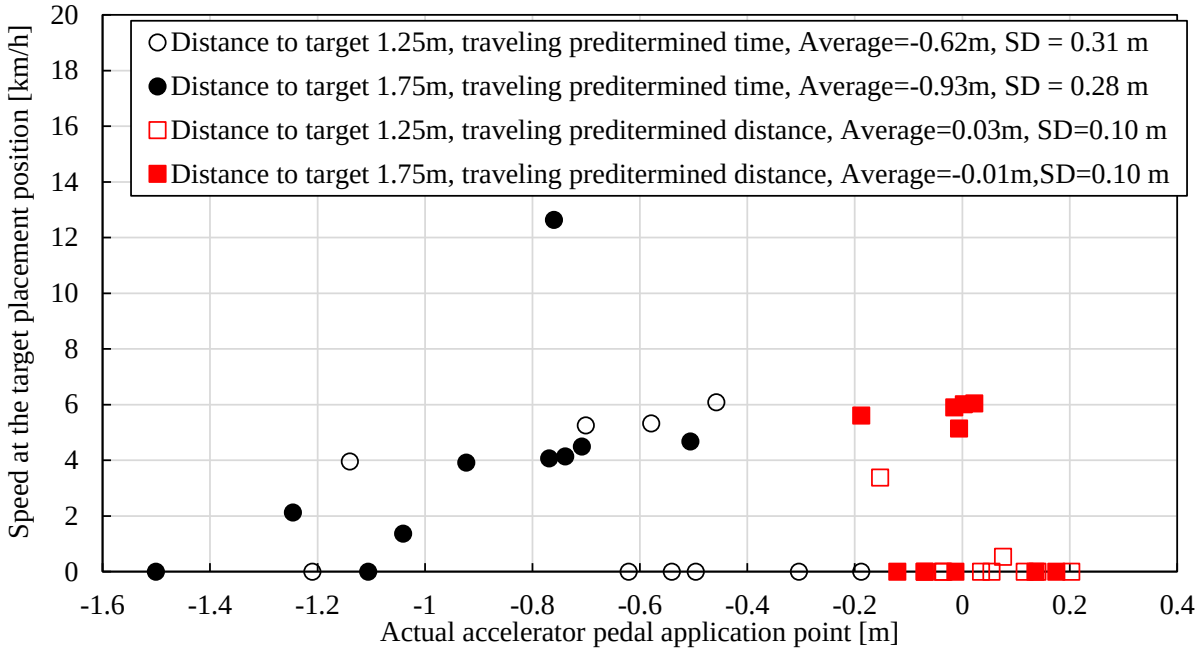


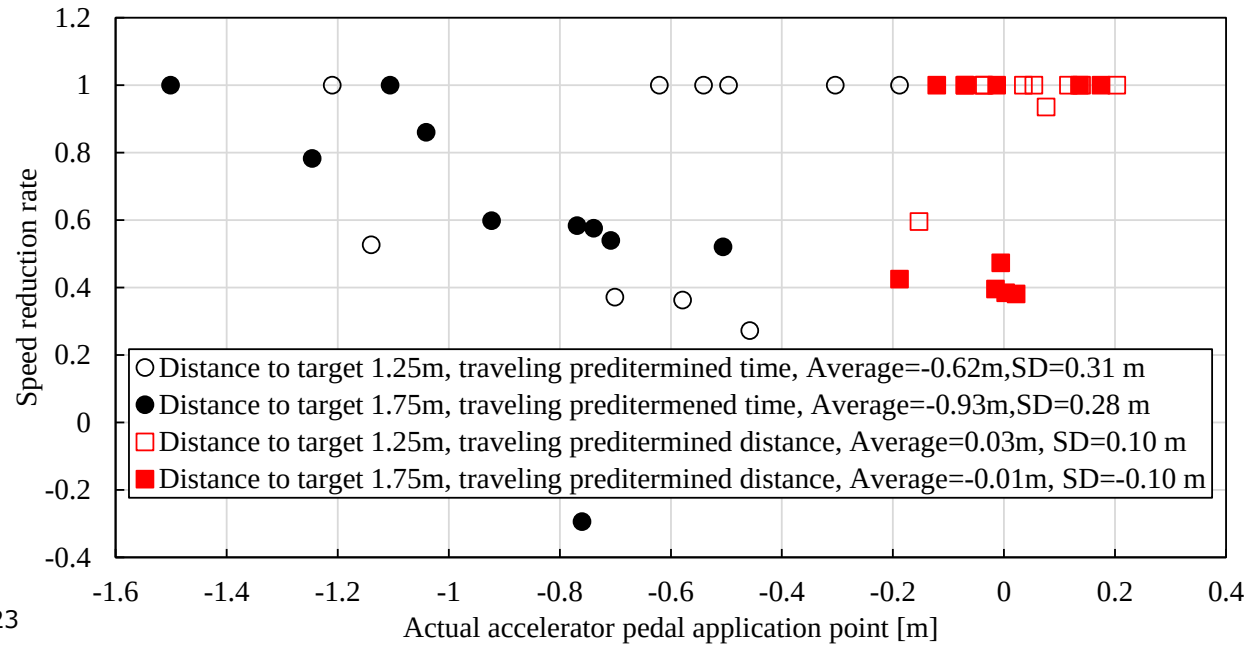
The results of a. and b. above, it was not possible to compare the amount of the error in the accelerator pedal application point in the method of accelerator pedal application after traveling a predetermined time and after traveling a predetermined distance.

Experimental result

Vehicle C

- From the distribution of values on the horizontal axis in the graph below, **the error with respect to the target accelerator pedal application point is larger for the method of accelerator pedal application after traveling a predetermined time than for the method of accelerator pedal application after a traveling predetermined distance**.
- From the distribution of values on the vertical axis in the graph below, in the method of accelerator pedal application after a predetermined time, there is a variation in performance that seems to be influenced by the fact that the actual accelerator pedal application point was before the target accelerator pedal application point .
- In the method of accelerator pedal application after traveling a predetermined distance, the error with respect to the target accelerator pedal application point is within about +/-0.2 m (standard deviation is 0.1 m).

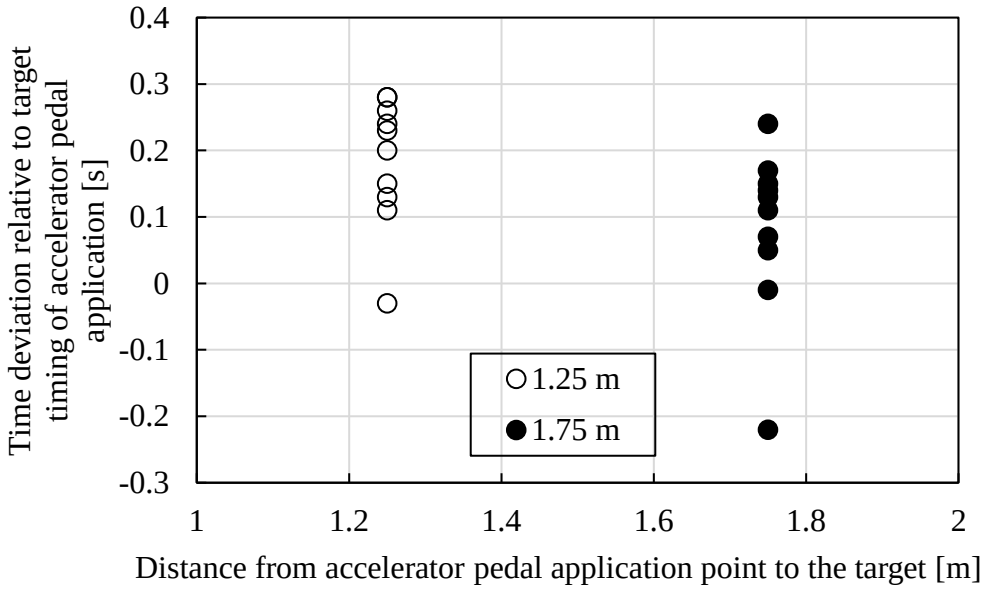


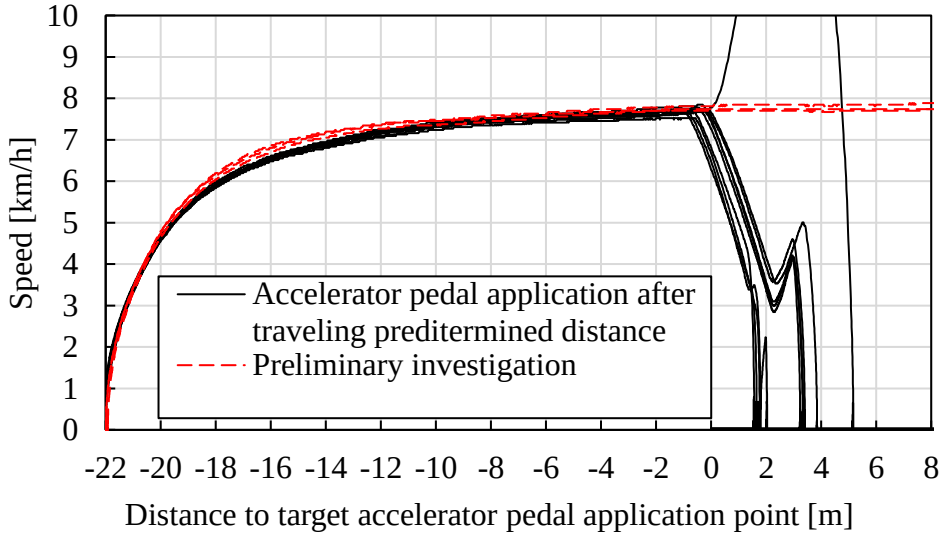


Experimental result

Vehicle C

- In the method of accelerator pedal application after creep traveling for a predetermined time, **time deviation by driver was generally within 0 to 0.3 seconds** (0.3 seconds is equivalent to 0.67 m when the creep speed at the time of stepping on the accelerator pedal is 8 km/h).
- The variation in creeping speed between trials was smaller than in Vehicle A, around 0.3 km/h
- Creep speeds of from around 6 m/h to 7 km/h were slightly lower than in the preliminary investigation.





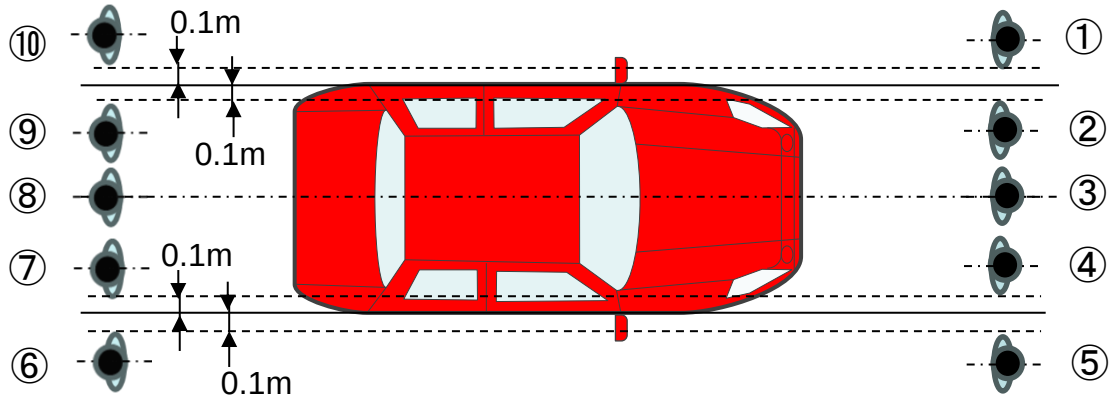
Summary of ACPE performance evaluation by the method of accelerator pedal application after traveling for a predetermined time and after traveling for a predetermined distance

- ACPE performance was evaluated on a steady creeping speed by the method of accelerator pedal application after a traveling predetermined time and after traveling a predetermined distance
- The error of the actual accelerator pedal application point relative to the target accelerator pedal application point was confirmed to be smaller with the method of accelerator pedal application after traveling a predetermined distance.
- One of the vehicles, AEBS was activated before accelerator pedal application, and causing the vehicle to come to a stop.

From the above results, it is confirmed that the method of accelerator pedal application after traveling a predetermined distance is more accurate than the method of accelerator pedal application after traveling a predetermined time.

3. ACPE performance evaluation with offset placement of the child pedestrian target

- Accelerator pedal is applied after traveling L_1 m (distance until steady creeping speed + 2 m) determined from the results of the preliminary investigation
- Place the target 1.25 m from the target accelerator pedal application point.
- Child pedestrian target (ISO 19206-2) was used as the target.
- Direction of the vehicles,
  - Forward direction
  - Backward direction
- Offset placement was 5 levels forward and 5 levels backward (see figure)
- The number of trials is 3 times
- Carried out Vehicle A, Vehicle B, and Vehicle C



Experimental result

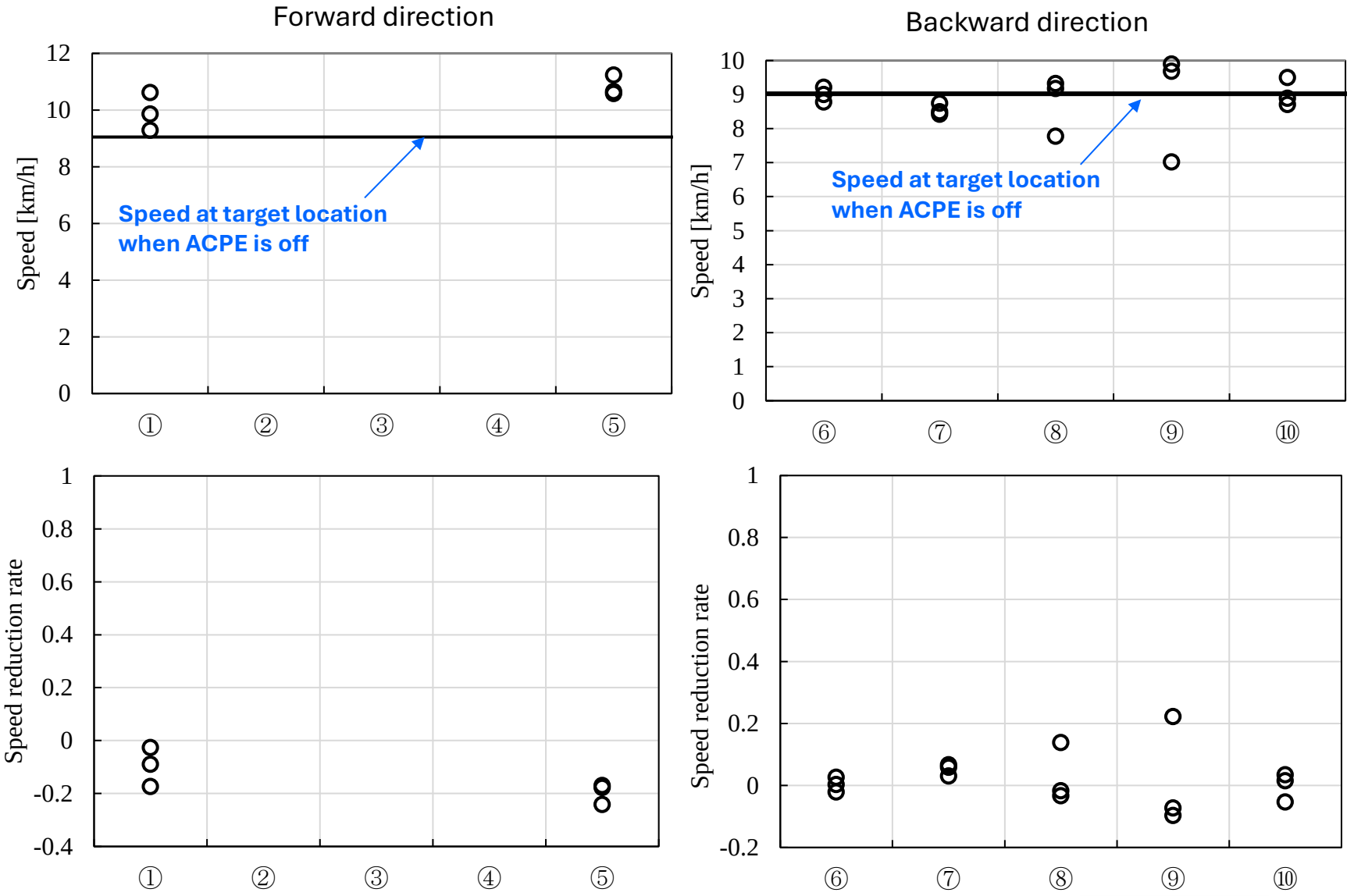
Vehicle A

Forward direction

- ACPE was not activated in case the target was placed outside the sides of the vehicle body.
- In case the target was placed inside the side of the vehicle, AEBS was activated to stop before the accelerator pedal application (ACPE performance could not be evaluated).

Backward direction

- ACPE was not activated nearly, regardless of target placement position.



Experimental result

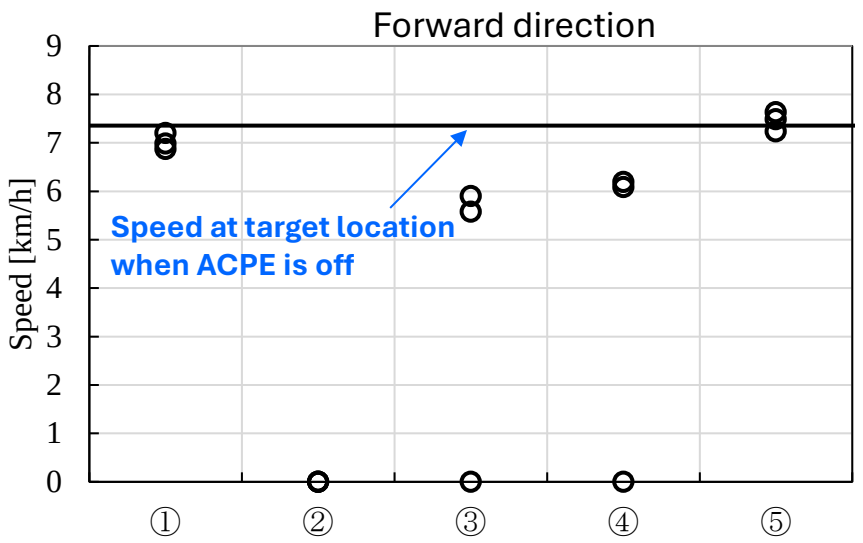
Vehicle B

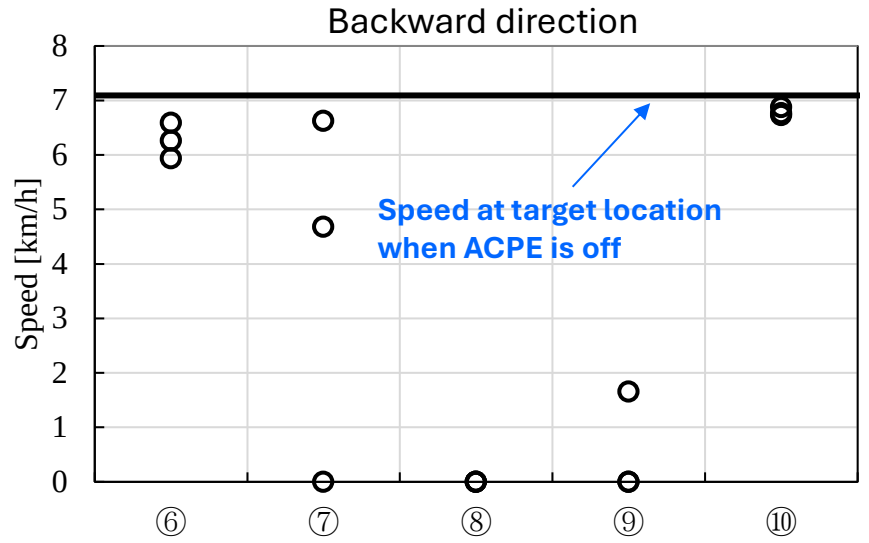
Forward direction

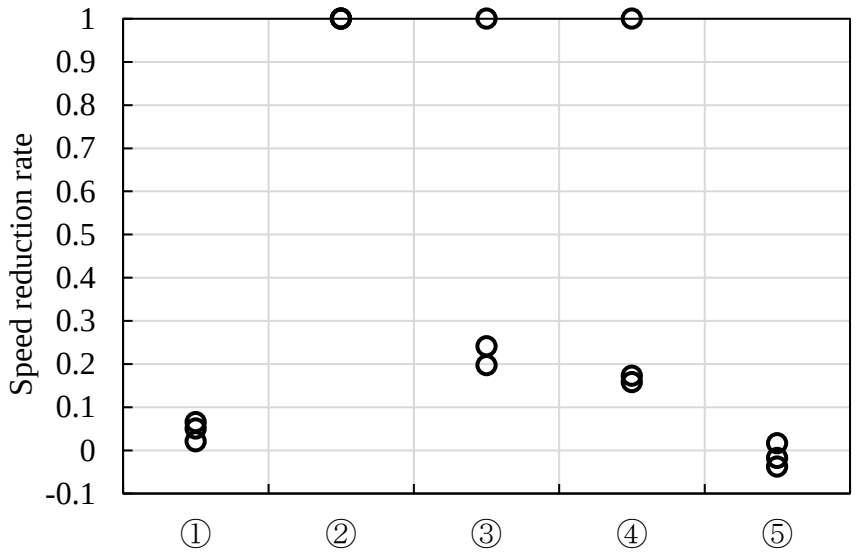
- ACPE was not activated in case the target was placed outside the sides of the vehicle body.
- In case the target was placed inside the side of the vehicle, variation was observed, with some cases where ACPE was activated and stopped and others where it was almost not activated.

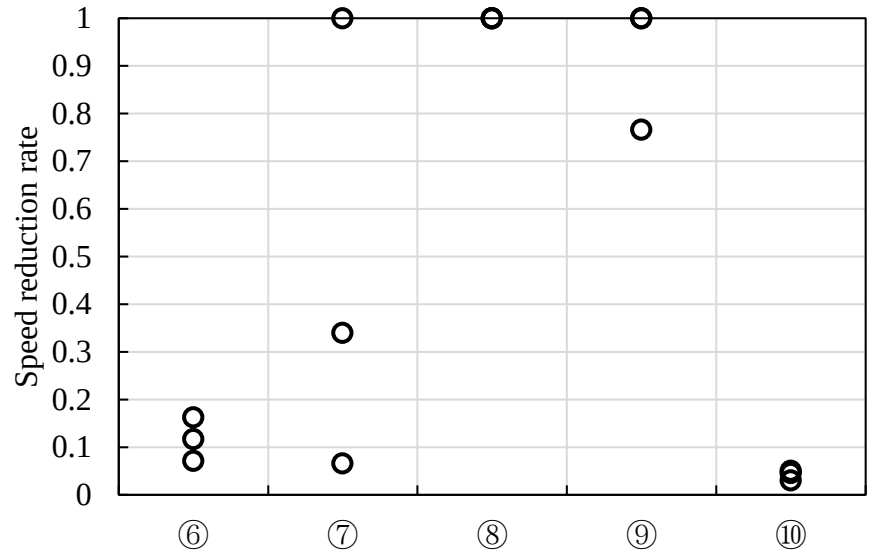
Backward direction

- ACPE was not activated in case the target was placed outside the sides of the vehicle body.
- In case the target was placed inside the side of the vehicle, variation was observed among the number of trials at the position of ⑦, but otherwise ACPE was activated and stopped or acceleration was controlled.









Experimental result

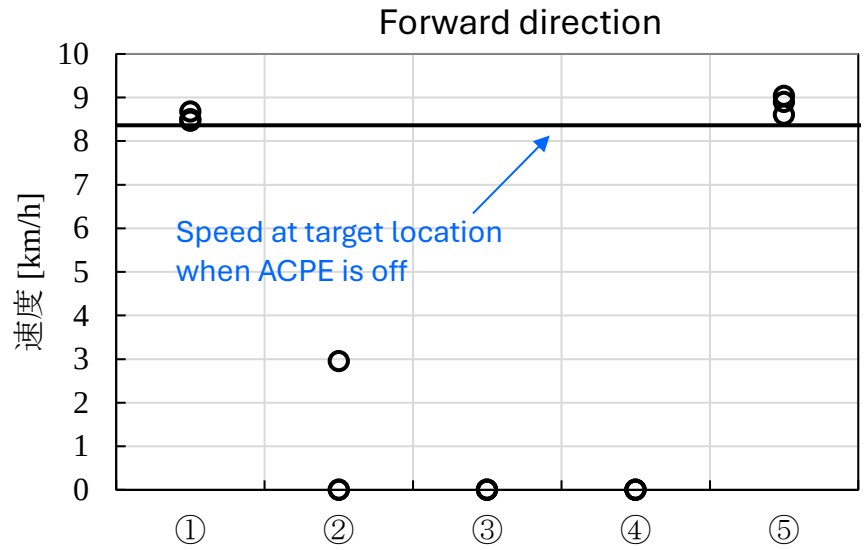
Vehicle C

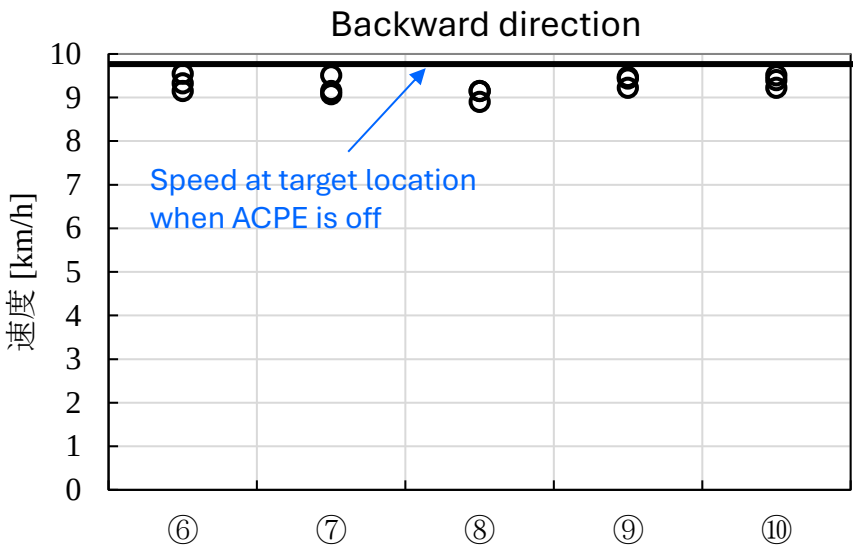
Forward direction

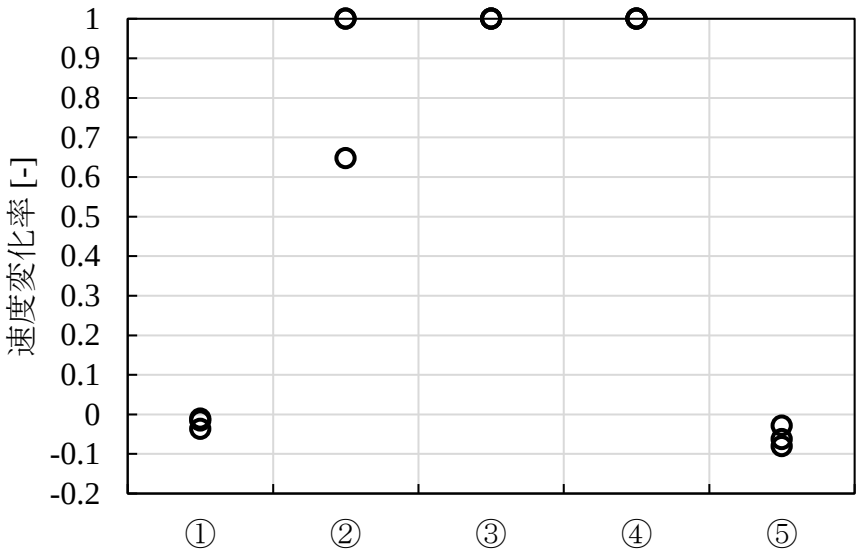
- ACPE was not activated in case the target was placed outside the sides of the vehicle body.
- In case the target was placed inside the side of the vehicle, ACPE was activated and stopped or acceleration was controlled.

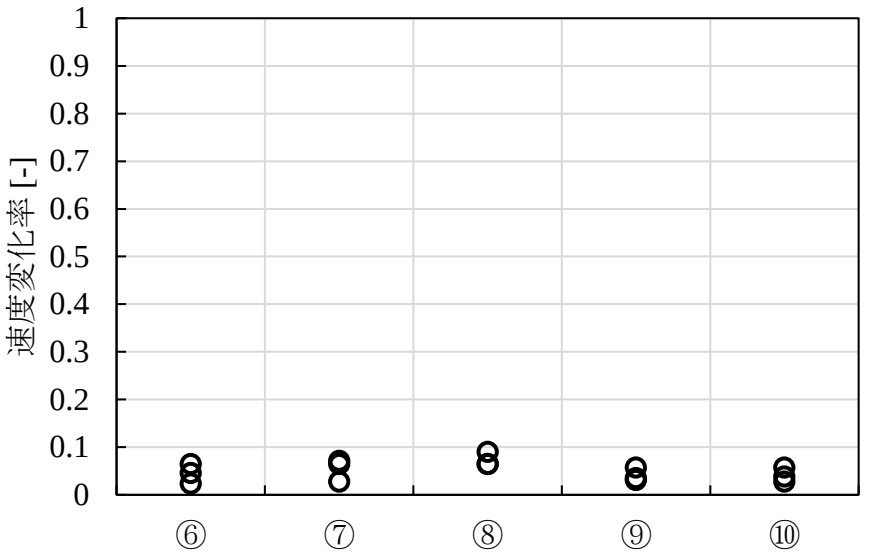
Backward direction

- ACPE was not activated nearly, regardless of target placement position.









Summary of ACPE performance evaluation with offset placement of the child pedestrian target

- ACPE was not activated in case the target was placed 0.1 m outside the sides of the vehicle body in both forward and backward directions
- For the forward direction in case the target was placed inside the sides of the vehicle, Vehicle A stopped with AEBS activated (ACPE could not be evaluated), Vehicle B had ACPE was activated but also showed variability, Vehicle C either stopped with ACPE was activated or had acceleration was controlled.
- For the backward direction in case the target was placed inside the side of the vehicle, Vehicle A and Vehicle C had ACPE was not activated nearly regardless of the target location, Vehicle B showed some variation depending on the target location, but ACPE was most reliably activated among the three vehicles

The above results confirm that the child pedestrian targets, especially in the backward direction, are not adequately addressed at this stage.