Informal Document - ACSF-19-06

Ministry of Land, Infrastructure and Transport

Korea Automobile Testing & Research Institute

Safety Distance to the front

ACSF IWG 19th meeting
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Korea **A**utomobile **T**esting & **R**esearch **I**nstitute

Safety Distance to the front

5.6.3.2.x Safety distance to the front

The distance to a vehicle in front is deemed to be critical when the distance the ACSF vehicle travels in [x.x] seconds is greater than the distance to the vehicle in front.

The critical distance shall be calculated using the following formula:

$$S_{Critical-Front} = v_{ACSF} \times t_{front}$$

Where: v_{ACSF} : the actual speed of the ACSF vehicle [m/s]

t_{front} : time gap of [x.x] seconds between the ACSF vehicle and the lead vehicle

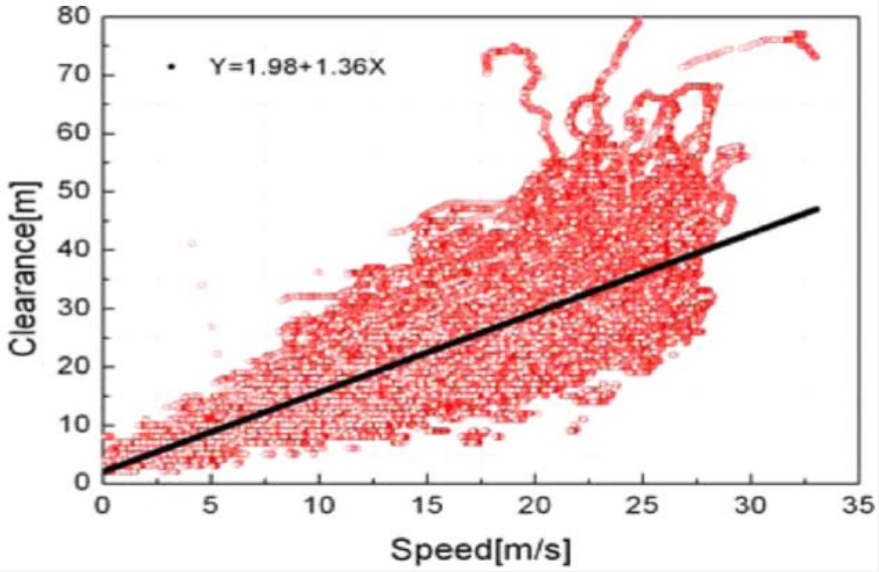
- **Road traffic Act, paragraph 1 of Article 19, of Republic of Korea**

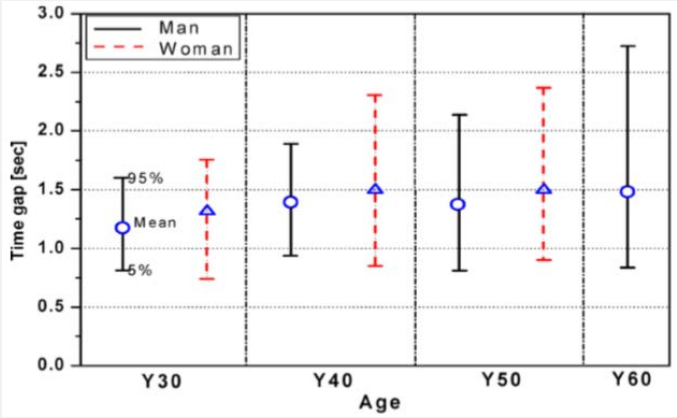
  "Driver shall control vehicle speed to prevent collision with other road user in front when another road user suddenly stopped"

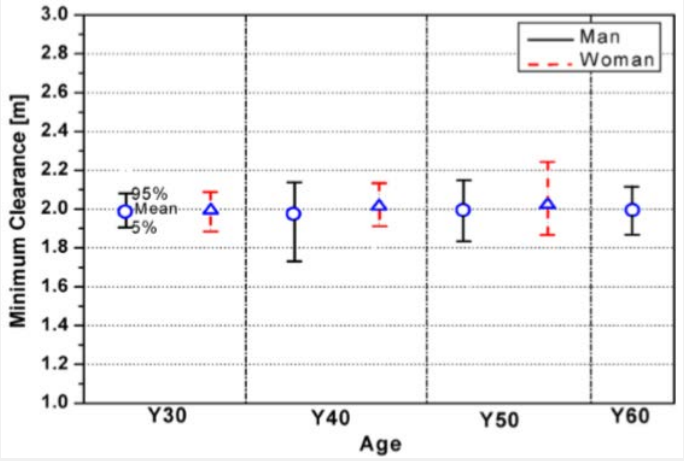
- **Considerations to determine Safety distance**
  - Human driving data in following situation for acceptance of driver to clearance
  - Braking distance to avoid collision in view of physics

Human Driving Data (125 drivers) - Motorway

- **Steady-state following data collected from 125 driver test data and the linear regression**
  - Age : 25 ~ 69 years old / Male : Female = 70 : 55(persons)







- Human driver's steady following clearance could be well represented by a first-order regression as follows :

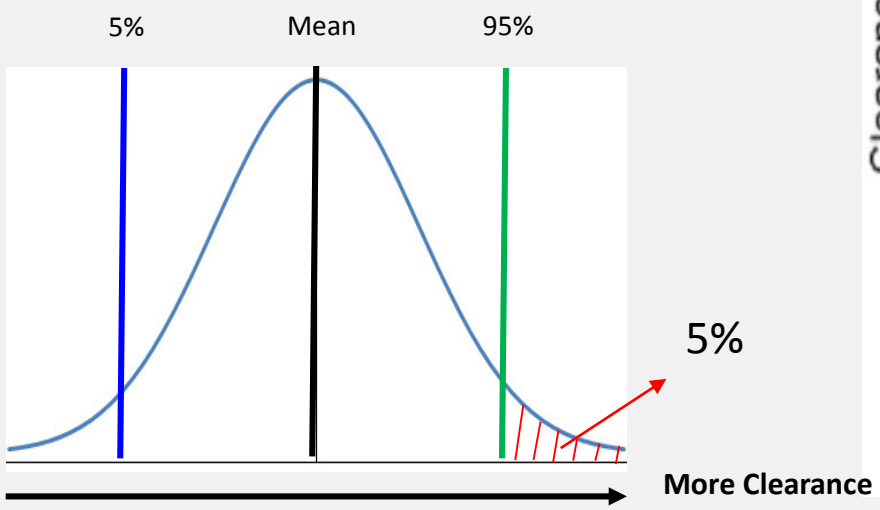
$$C_{following} = v_x \times \tau + c_0$$

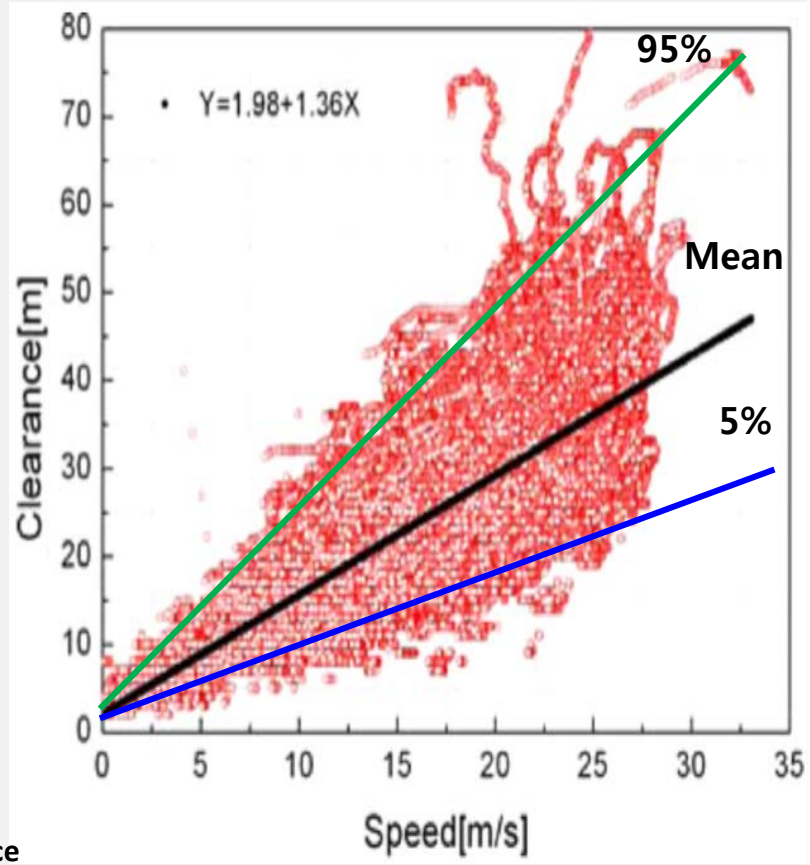
Time Gap Minimum Clearance

Human Driving Data (125 drivers) - Motorway

➢ **Linear coefficient of the Time Gap**

Index-Percentile	5%	Mean	95%
Linear coefficient [s]	0.7	1.4	2.3



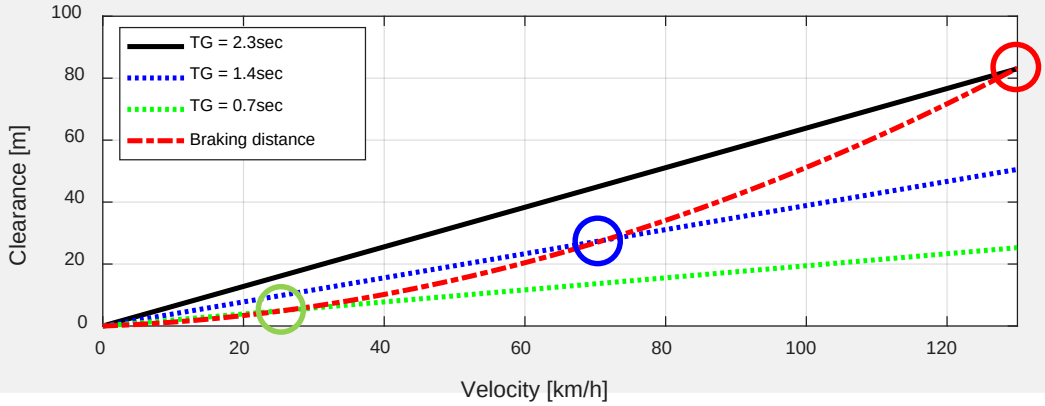


Braking Distance

- **Analysis of physical behavior for collision avoidance**
  - The way for collision avoidance : Braking
- **Braking distance (d_{brake})**
  - A situation where velocity of front vehicle suddenly reaches zero, that is, successive collision, is considered
  - System delay (t_{sys}) = 0.3sec
  - Maximum deceleration ($a_{x,max}$) = $-9m/s^2$

$$d_{brake} = (t_{sys} - {}^{v_x}/_{2a_{x,max}}) \times v_x$$

- **Clearance by TG 2.3 sec is higher than braking distance in operating velocity (0~130km/h)**



Conclusion

- Safety distance in front

$$S_{Critical-Front} = v_{ACSF} \times t_{front}$$

Where: v_{ACSF} : the actual speed of the ACSF vehicle [m/s]

t_{front} : time gap of [x.x] seconds between the ACSF vehicle and the lead vehicle

- Time gap of [x.x] seconds between the ACSF vehicle and the lead vehicle
  - Human driving data in following situation for acceptance of driver to clearance
  - Braking distance to avoid collision in view of physics

➡ $t_{front} = 2.3$ sec (proposed time gap)