

# Criteria for deeming Driver availability

**ACSF IWG 23<sup>rd</sup> meeting**

**July 2019, Brussel**

**Korea Automobile Testing & Research Institute**



# Driver availability

## 2.6.2.1 Criteria for deeming Driver availability

- The driver shall be considered available by the system when:
    - The driver is present in the driving seat with safety belt fastened, and at least one of the following conditions are met:
      1. Input to any driver-exclusive vehicle controls during the last [180]s
      2. [Driver has blinked at least [3] times during the last [60]s
      3. Driver shows conscious head or body movements during the last [30]s
      4. Driver has been talking during the last [30]s
      5. The driver did not have his eyes continuously closed for the last [30]s
- Exp.1
- Exp.2

# Experiment 1 Outline

## ● Experiment 1

– blinking/head movement detection while driving

	Younger generation(20~39)		Late middle age(LMA)(over 60s)	
	Male	Female	Male	Female
#Subject	13	13	13	13

### ➤ Driving section: Total 40km (Approx. 65min)

- ✓ Participants spent about 20 min. for adapting on the instrumented vehicle by driving on a rural road and an urban road
- ✓ To help participants keep their own driving style, the experiments were conducted at off-peak time

No	Driving section		Duration (time)
	Road type	distance	
1	Rural	5.5km	10min
2	Urban	7.9km	25min
3	Highway	10.4km	10min
4	Rural	5.5km	10min
5	Highway	10.4km	10min
<b>Total</b>		<b>39.7km</b>	<b>65min</b>



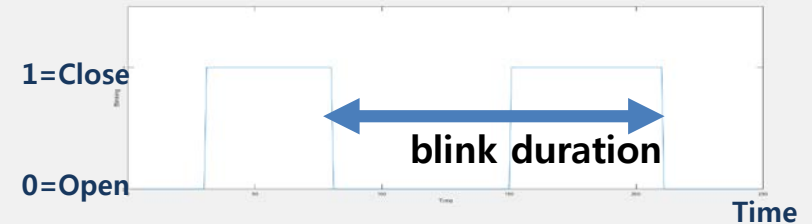
Figure 1. Typical traffic scenes

# Experiment 1 Results

## ✓ Condition 2: [Driver has blinked at least [3] times during the last [60]s]

➤ Blinking data(0:open/1:close) used

➤ Considered left/right eye close confidence data



➤ Eye blinking[times/60sec]

Group	Avg.(times)	Min(times)
Younger female	19	4
Younger male	22	6
LMA female	18	5
LMA male	20	5
Avg.(S.D.)	20	5

# Experiment 1 Results-2

✓ **Condition 3 : Driver shows conscious head or body movements during the last [30]s**

- Z-axis rotation data used to detect driver's head movements

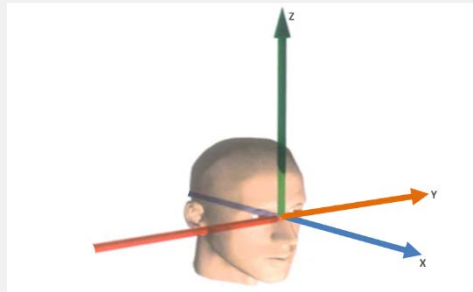


Figure 2. Head coordinate system

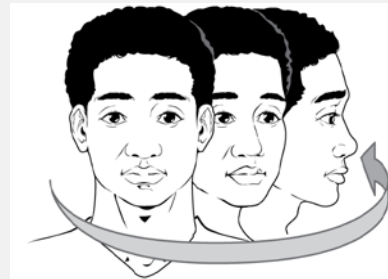


Figure 3. Head rotation

- **Head rotation duration: The time it takes from one rotation to the next rotation**

- **Head rotation duration result data**

1 <sup>st</sup> highway(sec)			2 <sup>nd</sup> highway(sec)		
Avg.	MIN.	MAX.	Avg.	MIN.	MAX.
12	2	35	12	2	40

\*Note: The above data shows the average of each experimenter's (total: 52) avg, min and max period

# Experiment 2 Outline

✓ **Condition 5: The driver did not have his eyes continuously closed for the last [30]s**

## ● Experiment 2

- Drowsiness driving pattern data

- Based Simulator Experiment
- Number of participants: 10 people(Age : 20 to 40s)

- Experiment Conditions

- More than two years of driving experience
- Driving more than twice a week
- Sleep deprivation: less than 4 hours
- No Caffeine ingestion  
(coffee, carbonated drink, cigarette, alcoholic drink etc.)

- Driving scenario

- Highway mode: two lanes(width: 3.6m), 37km (average speed : 100km/h, Approx. 22min)
- All lanes empty for stable driving environment
- Roadside trees around the highway are max. 45 to be as simple as possible to make sleeping easier and to give a sense of reality



Figure 4. Driving Simulator Exp.

# Experiment 2 Results

## ✓ Condition 5 : The driver did not have his eyes continuously closed for the last [30]s

### ● Definition of drowsiness

#### ➤ Alert : stable blinking period and stable driving performance

\*SOURCE : Alert [Brodbeck, V.; Kuhn, A.; von Wegner, F.; Morzelewski, A.; Tagliazucchi, E.; Borisov, S.; Michel, C.M.; Laufs, H. EEG microstates of wakefulness and NREM sleep. NeuroImage 2012, 62, 2129–2139]

#### ➤ Drowsiness : accident occurred / eyes continuously closed over 3 seconds / unstable head position during driving

### ● Result

#### ➤ Six drivers had drowsiness period (from 10 experimenters)

#### ➤ Total 30 times in drowsiness were detected from 6 drivers

#### ✓ Below results are average, minimum and maximum of total drowsiness periods

Avg.(sec)	4
Min.(sec)	1
Max.(sec)	11

# Conclusion

Condition 2 : [Driver has blinked **at least [3 4] times** during the last [60]s]

Group	Younger female	Younger male	LMA female	LMA male	Avg.
Min(times)	4	6	5	5	5

Condition 3 : Driver shows conscious head or body movements **during the last [30 35]s**

Group	1 <sup>st</sup> highway	2 <sup>nd</sup> highway
Max.(sec)	35	40

Condition 5 : The driver did not have his eyes continuously closed for **the last [30 4]s**

AVG.(sec)	4
MIN.(sec)	1
MAX.(sec)	11