

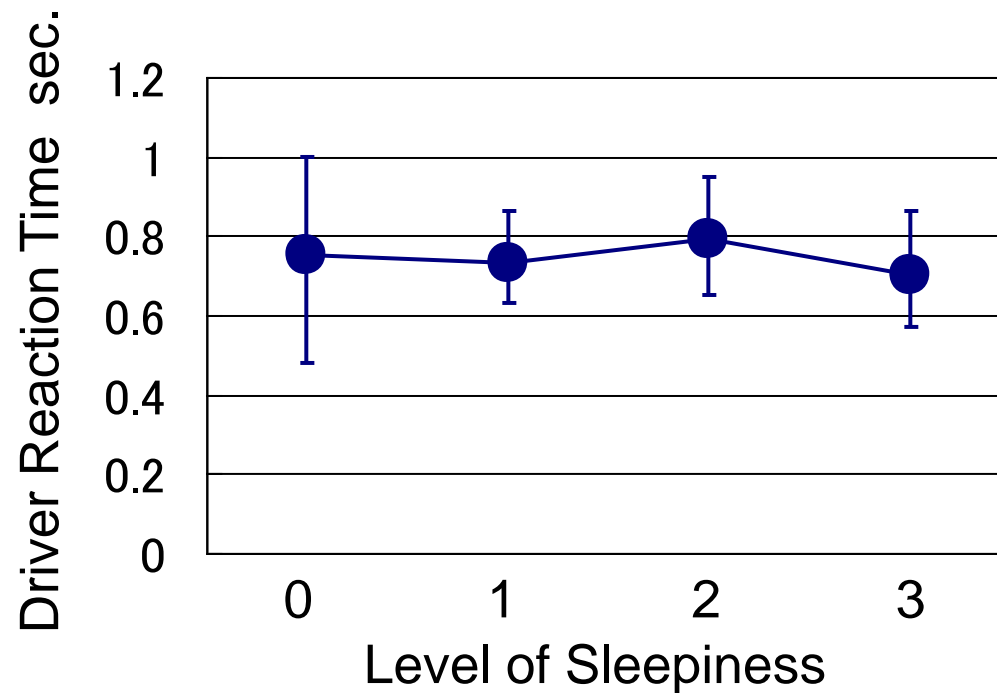
Warning Timing for AEBS

1. Proposal of Warning Timing

- 1) Warning has two functions; to induce the driver to take an avoiding maneuver and to inform an activation of the system brake beforehand.
- 2) The value of “at least” 0.8 second before the activation of emergency brake is appropriate from the regulation point of view.
- 3) Common value will be appropriate under the following condition.
 - a. Vehicles in all categories
 - b. Both moving and stationary target
 - c. Both high speed and low speed range

2. Driver Reaction Time to Warning

Average reaction time is around 0.8 sec., even when drivers are sleepy.



3. False/Nuisance Warnings

Guidelines on establishing requirements for high-priority warning signals

WP.29-150-22, UNECE/WP29/ITS Informal Group, February, 2010

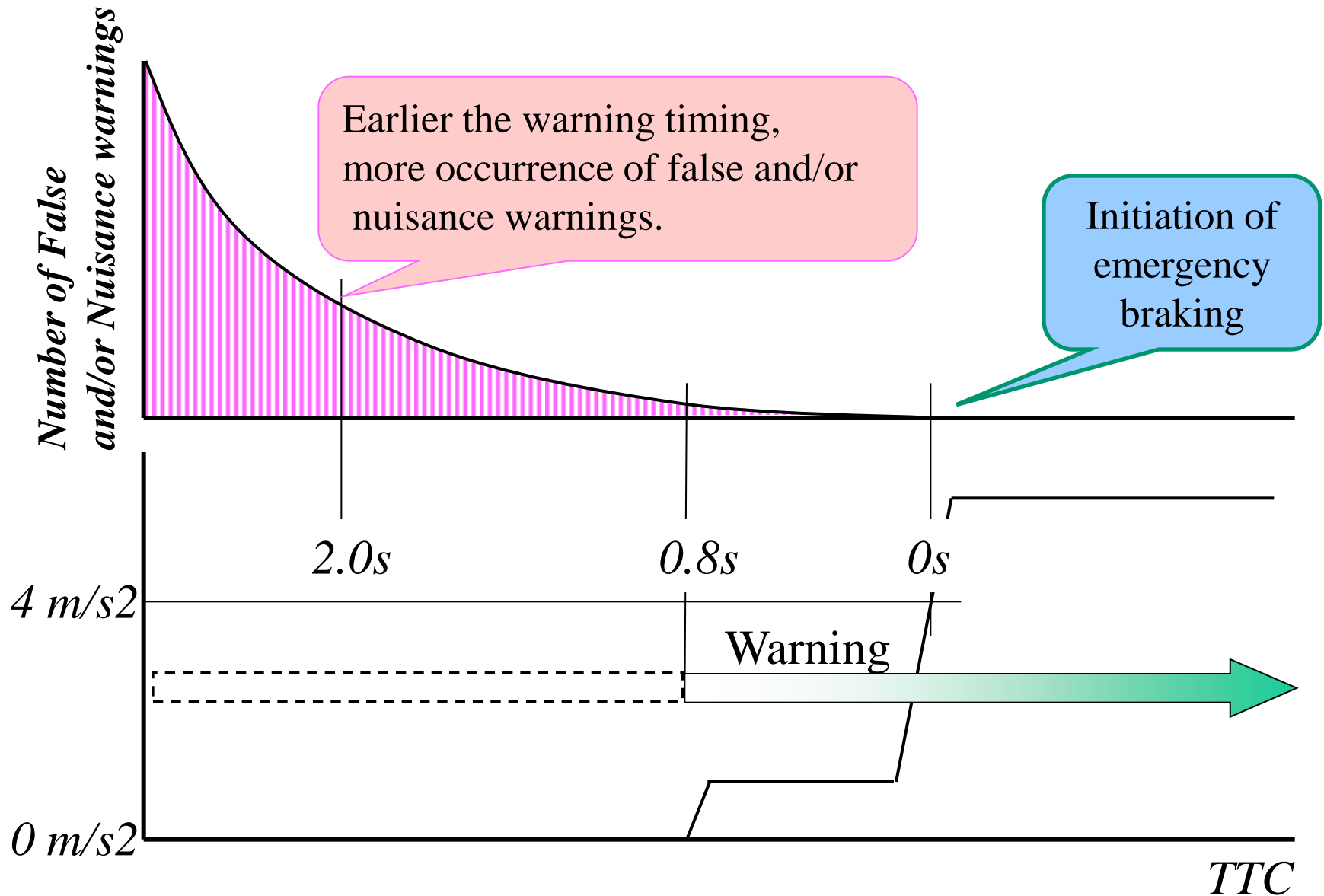
3.7 False / nuisance warnings rate should be low

False warnings and miss rates should be low. False alarms, or false positives, are warnings that are issued when the situation is normal. Misses, or false negatives, occur when no warnings are given although the decision threshold has been attained.

Safety must not be compromised by the introduction of ADAS. Systems should be as reliable as possible because reliability is one of the most crucial determinants of driving response (e.g., Ho, 2006). High false alarm rates reduce driver trust in the system, which in turn can reduce response time, or lead to the driver wanting to turn the system off. Perfect system performance is not a realistic objective for many systems and false alarms can be expected. However, these should be kept at a minimum so as to maintain drivers' trust and confidence in the system.

Nuisance warnings are warnings that occur when the driver is already aware and in control of the situation. Too many nuisance alarms can be irritating and may reduce the utility of the system. Providing some control over sensitivity settings may help to improve acceptance and performance. Adjustable warning thresholds can be possible to help reduce nuisance alarms, as long as the minimum threshold is designed with the intention of providing the driver with sufficient time to respond.

0.8 sec. is appropriate considering the driver reaction time and false/nuisance warnings.



4. Summary

- 1) The minimum driver's response time to the warning even in the sleepy condition can be thought as 0.8 sec. according to Japanese research results.
- 2) Earlier warnings are better because the driver can secure the enough time for the reaction, however, at the same time worse because the driver is forced to receive it even when it is not necessary and only annoying. From the consideration above, the value 0.8 sec. is appropriate. It can also permit the flexibility of warning strategy.
- 3) Warning 2 sec. prior to the initiation of emergency braking may result in frequent false and/or nuisance warnings, and it loses the driver acceptance for the system.