

Study on the Effects of Four-wheeled Vehicles' Daytime Running Lights on the Improvement of Their Conspicuity and on the Impairment of Conspicuity of Motorcycles

The Japanese Government has carried out experiments at JASIC to get materials for discussion on the introduction of daytime running lights (DRL) for four-wheeled vehicles. The following are the results of the study it has obtained so far.

1. Purpose

The experiments had two purposes. One was to study the effect of the four-wheeled vehicle's lighting of the headlamp or other lamps in the daytime and in the sunset hours on the improvement of their conspicuity. The other was, considering the large fleet of motorcycles in Japan (more than 12 million in circulation), to study the impairing effects of the four-wheeled vehicle's lighting of these lamps on the conspicuity of motorcycles running ahead with the headlamp on.

2. Method

The subjects were each seated on the bench in the intersection area and observed an oncoming passenger car approaching at a speed of 40 km/h and indicated the conspicuity of the car and to what extent the car's lighting impaired the conspicuity of a motorcycle running in front. The subjects were instructed to indicate how the test car looked when the test car arrived at a point 100 meters ahead of their eye point, while a signal tone is given for one second. The subjects were also instructed to indicate the conspicuity of an oncoming motorcycle followed by a passenger car 30 meters behind. The scale of evaluation of conspicuity and that of impairment by lamps were as shown in Figures 1 and 2 (Acceptable if the evaluation point is 3 or more).

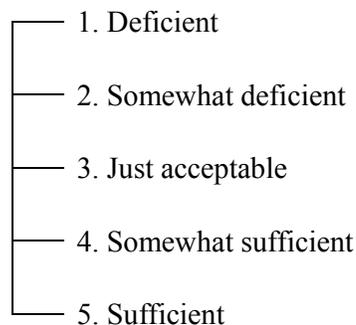


Fig. 1 Scale of conspicuity

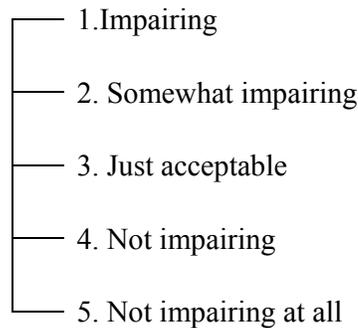


Fig. 2 Scale of impairment by lamps

The tests were conducted in eight lighting conditions of the passenger car: with no lamps on; the headlamp passing beam on; the DRL on (in six conditions: with central luminous intensity of 12.5 cd, 25 cd, 50 cd, 100 cd, 200 cd, and 400 cd respectively, all with a lighting area of 28 cm²).

For the motorcycle, it was tested with the headlamp passing beam on, considering that **DRL AHO** (Automatic Headlamp On) has already been introduced in Japan for motorcycles.

The study was conducted in June 2003 in relatively dim conditions such as cloudy daytime and sunset hours (with the sky illuminance of 20,000 lux or less). Note that the test place (in suburban Tokyo), at lat. 36° N, is located lower than most of the European countries and almost at the same latitude as Athens (which is at lat. 37° N).

3. Results

(1) The evaluation of the passenger car's conspicuity was as follows (Fig. 3):

- In the sky illuminance range of 10,000 to 20,000 lux, the lighting of the headlamps or other lamps had some conspicuity enhancing effect on a four-wheeled vehicle running alone, but the lighting of these lamps hardly seemed necessary, because the body of the four-wheeled vehicle was sufficiently conspicuous.
- In the sky illuminance range of 10,000 lux or less, the lighting of the headlamps or other lamps had a definite conspicuity enhancing effect on a four-wheeled vehicle running alone. The effect was recognized, as barely as it was, even with a lamp of 12.5 cd (with a lighting area of 28 cm²) on.
- In the sky illuminance range of 1,000 lux (equivalent to that observed five minutes before sunset in a fine day) or less, the lighting of the headlamps or other lamps had a strong conspicuity enhancing effect on a four-wheeled vehicle running alone. While the conspicuity of the test car was deficient when it ran with no lamps on, it was not when the headlamps or other lamps were on. Therefore, considering their conspicuity, we think it is desirable for four-wheeled vehicles to run with the headlamps or other lamps on in the sky illuminance range of 1,000 lux or less.

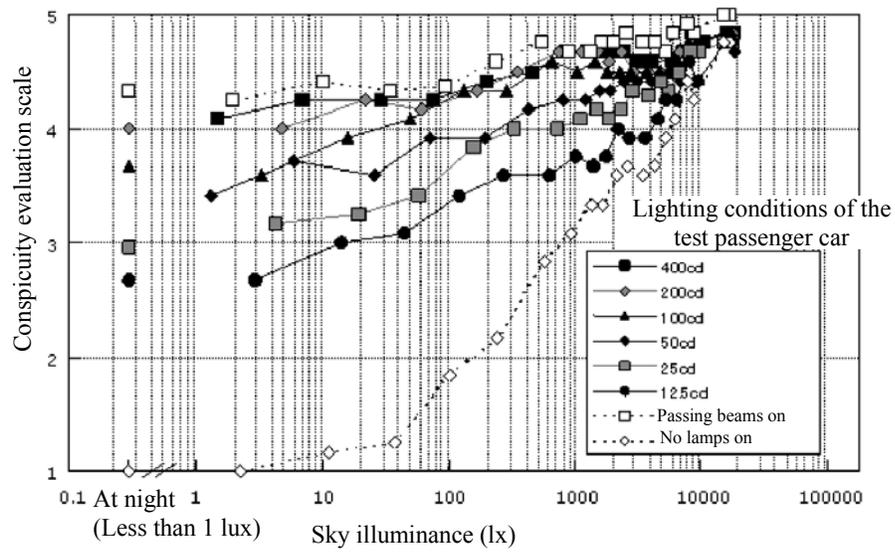


Fig. 3 Conspicuity of passenger car running alone

(2) The evaluation of the impairment by the passenger car's lamps was as follows (Fig. 4):

- In the sky illuminance range of 1,000 lux or less, the impairment of the DRL lamp of 400 cd exceeded the limit of acceptance. Therefore, considering the impairment of their conspicuity, we think that it is desirable for four-wheeled vehicles to use DRL of 200 cd or less in luminous intensity.

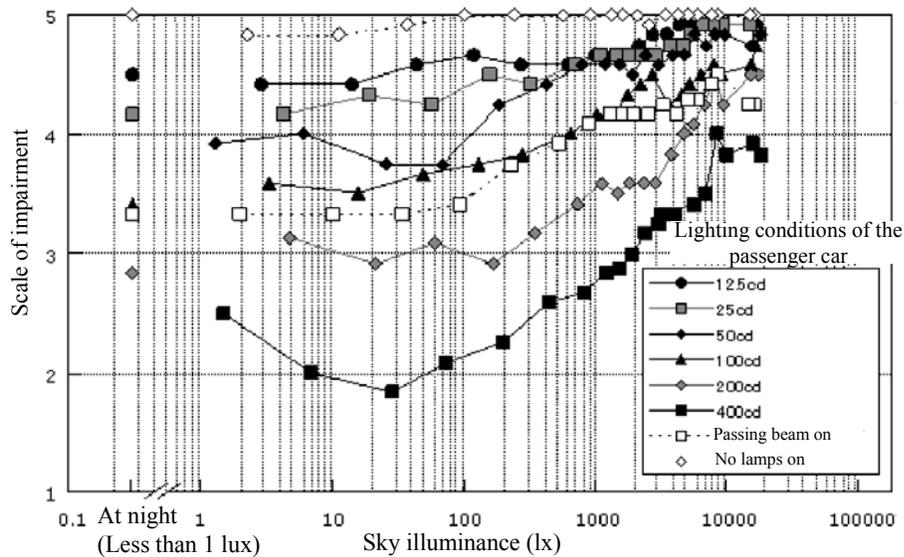


Fig. 4 Scale of impairment of the lamps of a passenger car running alone

(3) The evaluation of the motorcycle's conspicuity was as follows (Fig. 5):

- When the sky illuminance range goes down to around 5,000 lux, the lighting of the headlamps of a passenger car following the motorcycle began to impair the discernibility of the motorcycle and, as the sky illuminance declines further, the impairing effect of the lighting increases (the masking of the motorcycle by the headlamps of the four-wheeled vehicle)(Fig. 6).
- Around the sky illuminance of 1,000 lux, the lighting of the headlamps or DRL lamps of 400 cd by a passenger car running behind the motorcycle makes the conspicuity of the motorcycle deficient even when the motorcycle is running with its headlamps on. Therefore, we think that, considering the impairing effect on the conspicuity of motorcycles running in front, it is desirable for four-wheeled vehicles to use those of 200 cd or less in luminous intensity as DRL lamps.

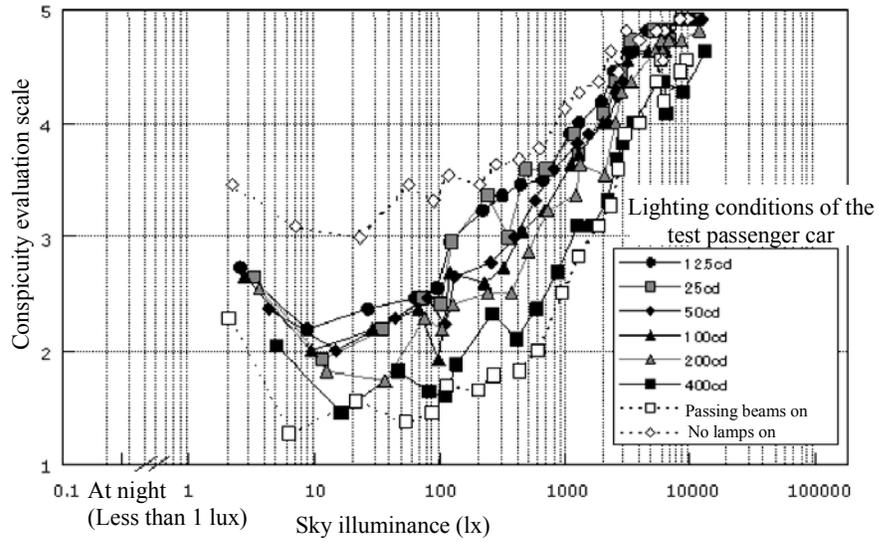


Fig. 5 Conspicuity of a motorcycle followed by a passenger car

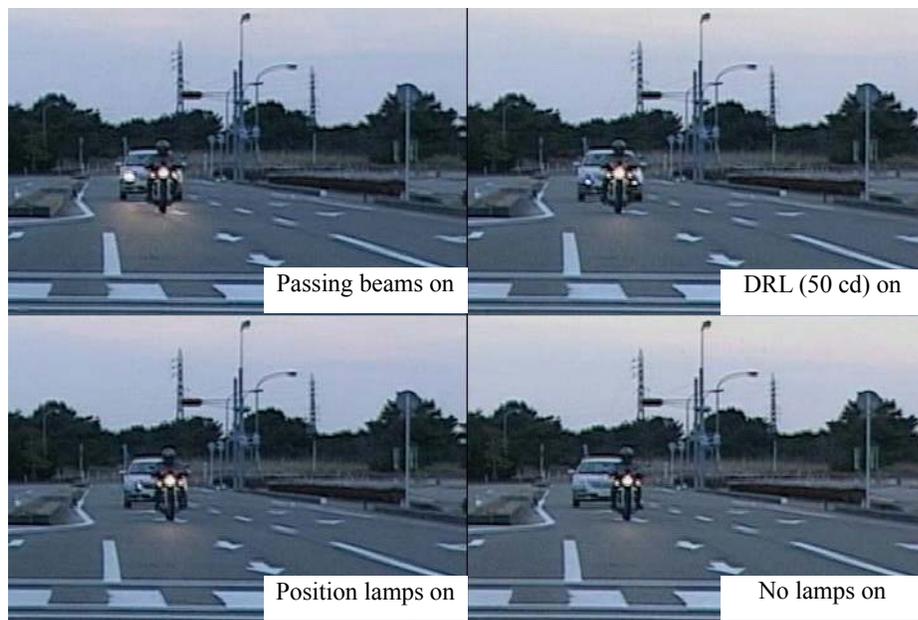


Fig. 6 How a motorcycle looked when followed by a passenger car