Research on Daytime Running Lamps of 4-wheeled Vehicles

Expert from JAPAN
Background of DRLs in Japan

Permanent lighting of motorcycle headlamps mandatory since 1996

Effective in reducing motorcycle accidents

* Concern for DRL glare to drivers

* Concern for reduced conspicuity of motorcycles in front of 4-wheeled vehicles

Currently, Japan does not allow DRLs for 4-wheeled vehicles.
To verify the effects of DRLs on road traffic in Japan

The effects of a 4-wheeled vehicle with the DRL on were studied from the following perspectives:

1. Right-turn behavior of the oncoming vehicle’s driver
2. DRL glare given to the oncoming vehicle’s driver
3. Conspicuity of a motorcycle in front of the 4-wheeled vehicle with the DRL on
4. Pedestrians’ road-crossing behavior
## Test Conditions

<table>
<thead>
<tr>
<th>Items</th>
<th>Conditions</th>
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<tbody>
<tr>
<td><strong>Sky illuminance</strong></td>
<td>Day (10,000 lx or above)</td>
</tr>
<tr>
<td></td>
<td>Dusk (2,000 lx, 1,000 lx)</td>
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<tr>
<td></td>
<td>Night (0 lx)</td>
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<tr>
<td>Lamp type (mounting height)</td>
<td>Test vehicle</td>
</tr>
<tr>
<td></td>
<td>Passing beam: HID, originally installed (775 mm)</td>
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<td></td>
<td><strong>Daytime Running Lamp</strong> (DRL): LED (620 mm)</td>
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<tr>
<td>Motorcycle</td>
<td>Passing beam: HID, originally installed (895 mm)</td>
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<tr>
<td>Vehicle speed</td>
<td>60 km/h</td>
</tr>
<tr>
<td>Test subjects</td>
<td>20 persons (8 males, 12 females, aged 22 - 48, ordinary driver license holders)</td>
</tr>
<tr>
<td>Eye-point height of test subjects</td>
<td>1,200 mm</td>
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</tbody>
</table>
Test Parameter: Sky illuminance

Sky illuminance: Day (10,000 lx)
DRL: 1,200 cd

Sky illuminance: Dusk (2,000 lx)
DRL: 1,200 cd

Sky illuminance: Dusk (1,000 lx)
DRL: 1,200 cd

Sky illuminance: Night (0 lx)
DRL: 1,200 cd
**Test Parameter:** DRL intensity

Tests conducted at dusk (1,000 lx)

- **w/o lighting**
- **Passing beam**

<table>
<thead>
<tr>
<th>DRL Intensity</th>
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<tbody>
<tr>
<td>300 cd</td>
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<tr>
<td>1,200 cd</td>
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<tr>
<td>2,000 cd</td>
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</tbody>
</table>
At 6 simulated intersections, measurements were taken simultaneously from 5 test subjects and 5 pedestrians.
* The situation where the driver turns right was reproduced at a simulated intersection.
* The timing where each driver decides not to turn right if the motorcycle approaches any closer (1. right-turn limit timing) was measured.
* In addition, 2. DRL glare and 3. motorcycle conspicuity were also measured and evaluated.
The situation where pedestrians are about to cross the road was reproduced in front of the crosswalk at a simulated intersection. The timing where each pedestrian decides not to cross the road if the motorcycle approaches any closer (4. road-crossing limit timing) was measured.
(1) **Results: Time gap toward two-wheeled vehicle**

The difference from the "OFF" condition is significant according to the t-test result.

* Except for the "Day, 5,000 cd" condition, no particular effect of the DRL on the test subject's right-turn behavior was observed.
Under the "Day (10,000 lx or above)" condition, the evaluation rating 4 or below was rarely given even for the DRL intensity of 5,000 cd.
(2) Results: Evaluation of glare from DRL

Under the "Dusk (1,000 lx)" condition, the evaluation rating 4 or below was given by 25% or more of the test subjects for the DRL intensity of 2,000 cd.

Under the “Night” condition, the DRL caused more glare than the headlamp.
(2) Results: Evaluation of glare from DRL

* The evaluation rating tended to decline as the DRL intensity increased.
* Under the "Dusk (1,000 lx)" condition, the evaluation rating for the DRL intensity of 2,000 cd was around "5: Tolerable (limit)".
(3) Results: Conspicuity of two wheeled vehicle

Under the "Day (10,000 lx)" condition, the DRL, regardless of its intensity, had almost no effect on the motorcycle conspicuity.
(3) Results: Conspicuity of two wheeled vehicle

Under the "Dusk (1,000 lx)" condition, the evaluation "Somewhat difficult to see", "Difficult to see" or "Very difficult to see" was given by about 30% of the test subjects for the DRL intensity of 1,200 cd.

Under the "Night (0 lx)" condition, the motorcycle conspicuity decreased with or without the DRL.
(3) Results: Conspicuity of two wheeled vehicle

Weighted means for all test subjects

* Under the "Day" condition, the evaluation rating tends to remain almost unchanged regardless of the DRL intensity.
* Under the "Dusk" and "Night" conditions, the evaluation rating tended to decline as the DRL intensity increased; under the "Dusk (1,000 lx)" condition, the mean rating from all test subjects for the DRL intensity of 2,000 cd was around "Normal".
(4) Results: Time gap between pedestrian and two-wheeled vehicle

- Overall, the time gap tended to decrease as the DRL intensity increased.
- On the other hand, the t-test result indicates that, under the "Day" and "Dusk" conditions, the trailing vehicle's DRL did not affect the road-crossing judgment involving the motorcycle.

No significant difference between "Day" and "Dusk" according to the t-test result.
(1) Time gap in the driver’s right-turn behavior

* Under the “Day (10,000 lx)” condition, there was a significant difference from the “headlamp OFF” condition when the DRL intensity was 5,000 cd.

* Under the other conditions, no effect of the DRL was found.

(2) Evaluation of DRL glare

* The evaluation rating tended to decline, i.e., more glare was generated, as the DRL intensity increased.

* Under the "Dusk (1,000 lx)" condition, the mean rating from all test subjects for the DRL intensity of 2,000 cd was around "5: Tolerable (limit)".

(3) Effect of the DRL on motorcycle conspicuity

* Under the "Day (10,000 lx)" condition, the DRL had almost no effect on the motorcycle conspicuity regardless of its intensity.

* Under the "Dusk" and "Night" conditions, the evaluation rating tended to decline as the DRL intensity increased; under the "Dusk (1,000 lx)" condition, the mean rating from all test subjects for the DRL intensity of 2,000 cd was around "Normal".

(4) Time gap in pedestrians' road-crossing behavior

* Although, overall, the time gap tended to decrease as the DRL intensity increased, the t-test result indicates no effect of the DRL's lighting under the "Day" and "Dusk" conditions.
Thank you for your attention!