Application of Inter-vehicle Traffic Signals at Non-signalized Intersection

Fund: Next-generation Energies for Tohoku Recovery Project

Introduction

In-vehicle traffic lights were proposed to assist drivers at non-signalized intersections. Traffic information, including the speeds and the positions of vehicles, were transferred among the vehicles. The updated information were used by the in-vehicle traffic lights to analyze the traffic conditions at intersections and determine the appropriate color of light presented to drivers.

Gap < 6.5 s

Green

Range of lights: 80 m

Red

Inter-vehicle traffic signal for non-signalized intersection

80 m

None

Priority-controlled intersections:

(1) Major-road vehicles will confront a

green signal after entering the range of in-vehicle traffic lights; For minor-Range of lights: road vehicles within the range that 80 m arrived at the not yet have intersection, a red light is presented.



Range of lights:

80 m

None

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None

(2) If the major-road gap is less than – 6.5 seconds, a green light is displayed to major-road vehicles, and a red light is offered to the minor-road vehicle. (3) If a gap greater or equal to 6.5 seconds appears, the red light Range of lights: displayed to the minor-road vehicle will turn green, and the green light presented to major-road vehicles will turn to a blinking yellow light.

Non-priority-controlled intersections: (1)All the vehicles approaching to an intersection will confront a red signal first.

②Signal will turn green if a vehicle arrives at the intersection first.

(3) If two vehicles arrive at the simultaneously, intersection the vehicle on the left side can go first.

DS experiments

23 subjects participated in the experiments. The experiment was performed under four conditions, as presented in the Table.

No.	Inter-vehicle traffic signal	Auditory warning
1	Off	Off
2	Off	On
3	On	Off
4	On	On

Red

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 $Gap \ge 6.5 s$

Green

Range of lights: 80 m

None

Results







Inter-vehicle traffic signal displayed by HUD

Driving route of the experiment, highlighted in red

The results demonstrated that the in-vehicle traffic light significantly improved post-encroachment time and decreased maximum brake stroke, which implies that driving safety was enhanced. In terms of eye-gaze behaviors, the percent road centre and mean glance duration values indicated that the system did not present an increase in visual distraction.

Publications

Yang B., Zheng R., Shimono K., Kaizuka T., Nakano K., 2017, Evaluation of the effects of in-vehicle traffic lights on driving performances for unsignalised intersections, IET Intelligent Transport Systems, vol.11, no.2,







