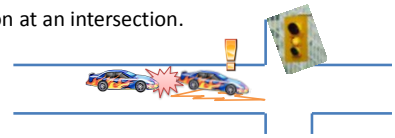
A Study of the Effects of Introducing Advanced Driver Alert System

Major in Transportation Engineering and Socio Technology
Graduate School of Science and Technology,
Nihon University
Masatoshi NAKAZAWA
Atsushi FUKUDA

ALMEC Corporation
Makoto OKAMURA

Introduction

- A traffic signal helps to control the traffic smoothly and safely at an intersection in a city.
- However, it is rather difficult for a driver to determine change of signal phase when a driver faced yellow signal.
- A driver used to confuse whether he/she should stop or go under a dilemma zone and this becomes cause of collision at an intersection.



Objective

- Recently, Advanced Driver Alert System (ADAS) which will provide information of phases traffic signal states information to a driver and help to avoid hard braking at intersection has been put in to a market and is expected to reduce collision at an intersection.

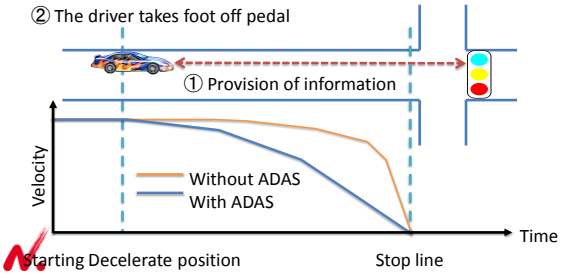
- We estimate an impact of ADAS on collision at an isolated signalized intersection.

Methodology

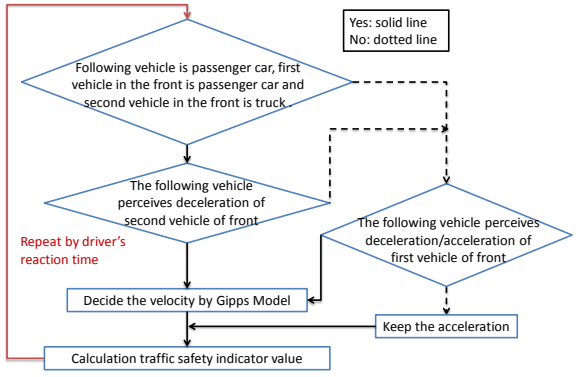
- **Advance Driving Alert System (ADAS)**
  - This system provides vehicle traffic signal status information from the traffic intersection when the vehicle approached the signalized intersection.
- **Micro traffic simulation model**
  - Modified the model which was developed evaluate the impact of ACC installation on traffic safety (Okamura, et al., 2011).
- **Time Integral of Difference of Space distance and Stopping distance (TIDSS)**
  - This is the indicator represents the amount of deviation from Difference of Space distance and Stopping distance (Okamura, et al., 2011).

ADAS

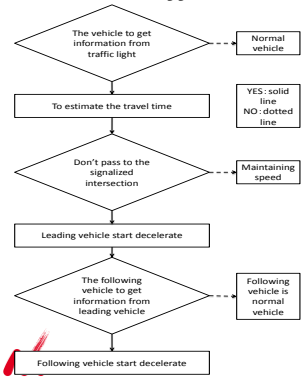
1. If a driver doesn't get signal information （Without ADAS）
   - A driver hit the brakes hard
2. If a driver gets signal information（With ADAS）
   - A driver should judge whether he/she should stop or go. When a driver stop to intersection, he/she has to decelerate properly.



Micro traffic simulation model (1)



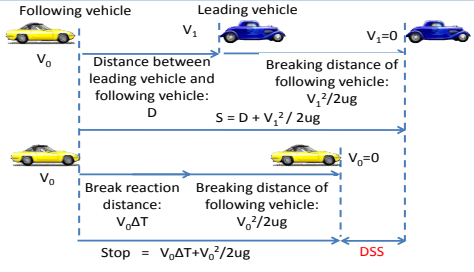
Micro traffic simulation model (2)



1. The vehicle can make a decision whether to retrieve information from traffic light.
2. If the vehicle can get information from intersection, it estimated travel time to intersection.
3. If the vehicle cannot pass through to the intersection, a driver started decelerate.
4. It is to make a decision whether the deceleration of the leading vehicle provide in the following vehicle.

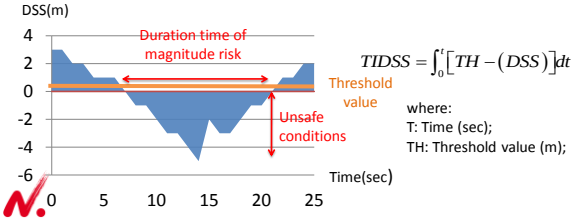
Traffic safety indicator DSS

• DSS shows the freeze position of the following and leading vehicle when the leading vehicle brakes suddenly, and then the following vehicle also brakes to avoid collision.



Traffic safety indicator TIDSS

Traffic safety indicator（TIDSS） (Okamura, et al. , 2011)
・This method can consider both the degree and duration of danger.
・The existing and the new method are observed depending on the driving support system installation rate in the traffic flow.
⇒This indicator is that includes the evaluation of the duration time of magnitude of risk and unsafe conditions.



$$TIDSS = \int_0^t [TH - (DSS)]dt$$

where:
T: Time (sec);
TH: Threshold value (m);

Setting Cases

・We were set up 3cases to estimate the effect of the introduction of ADAS

Case 1: *Without ADAS*

Case 2: *With ADAS (Only leading vehicle)*

Case 3: *With ADAS (Provision of information leading vehicle and following vehicle）*

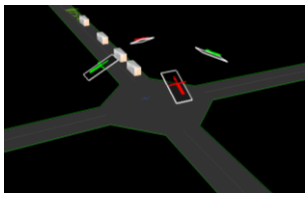
Micro traffic simulation model

Situation
・One lane urban major road
・A four legs isolated intersection

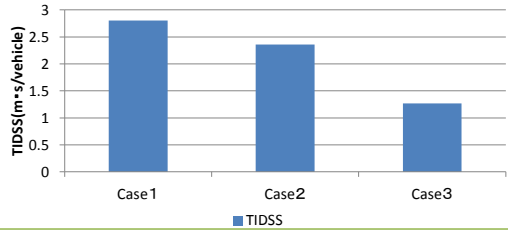
The evaluation period
・50m in front of intersection

Vehicle type
・Only a passenger car

Number of simulation time
・Total of 30 times
・Simulation time is 30 minutes



Simulation evaluation



TIDSS per Vehicle
⇒**Case3** is the lowest value of TIDSS.
⇒It was found that more increasing safety which it will introduce the ADAS to the all vehicles than it will only introduce an ADAS the leading vehicle.

Conclusions and Future research

Conclusions

・Receiving information from the signalized intersection
⇒It was found that an ADAS might help to reduce collision.
⇒In addition, it was confirmed that increasing safety by the leading vehicle provides more information to the following vehicle.

Future research

・Emission redaction by introducing ADAS will be estimated as well as impact safety .
・Different of vehicle type will be regarded on estimation. Especially, Impact of the light duty vehicle will be estimated.
⇒ This approach will be applied for network including multiple intersection.

THANK YOU FOR YOUR ATTENTION!