

● Research Trends and Results

Use of ITS technology to implement traffic smoothing measures at expressway sags

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1. Introduction

The National Institute for Land and Infrastructure Management has conducted research to develop a vehicle lane utilization rate optimization service based on the use of ITS SPOT etc. to provide information. Considering linkages between in-car systems such as ACC (Adaptive Cruise Control), which controls distance between vehicles, and services which provide information from roadside systems, the NILIM is performing research to develop a service to mitigate congestion at sags (places where the gradient changes gently from descending to ascending). In FY2010, it built a micro-traffic simulator capable of reproducing the impact on traffic flow of the introduction of these services on a computer, and trial calculated the congestion mitigation effectiveness of including vehicles equipped with the vehicle lane utilization rate optimization service or ACC in the traffic flow.

2. Vehicle lane utilization rate optimization service

The vehicle lane utilization rate optimization service provides information to drivers in three stages in order to correct imbalanced use of passing lanes resulting from heavy traffic approaching the location of congestion. Just in advance of a sag, a “change-lane request message” urges drivers to change from the passing lane to the nearside lane, then near the bottom of the sag, a “keep lane request message” urges drivers to stay in the lane they are using, and finally, a “service end message” informs drivers that they are leaving the service section.

3. Expectations of congestion mitigation at sags by connecting with vehicle control technology

Recent dazzling progress in vehicle control technologies has brought ACC and many other such technologies into practical use. This use of ACC, which has a function which maintains vehicle speed and the distance between vehicles at constant values, is counted on to mitigate congestion by restricting drivers’ unintentional deceleration, which is one cause of congestion at sags.

4. Construction of a micro-traffic simulator to trial calculate congestion mitigation effects

Data (traffic volume, cruising speed by vehicle lane and lane change behavior etc.) obtained from instruments installed in the past at the Yamato Sag on the Tomei Expressway (outbound) was used to construct a micro-traffic simulator capable of reproducing traffic flow before and after the occurrence of congestion at the Yamato Sag (outbound) and before and after the elimination of this congestion. When the system was built, in order to that it could simulate the vehicle lane utilization rate optimization service, parameters at two stages—service awareness rate (percentage of drivers who noticed the information provision) and the acceptability (percentage of the drivers who noticed the information provision who also responded to it)—were considered. The system could also simulate vehicle passing behavior, lane changing behavior, speed reduction characteristic of vehicles in sags, and ACC vehicle behavior.

5. Trial calculation of congestion mitigation effectiveness

The simulator which was built was used to trial calculate the congestion mitigation effects of the following services. As a result of these trial calculations, their usefulness as traffic smoothing measures were summarized during FY2010.

- 1) Congestion mitigation effects of the vehicle lane utilization rate optimization service
- 2) Congestion mitigation effects of mixing in ACC vehicles
- 3) Congestion mitigation effects of considering the vehicle lane utilization rate optimization service and mixing in ACC vehicles

[Sources]

Intelligent Transport System Division web site:
Services to realize AHS/aiming to mitigate congestion at sags and tunnels

http://www.nilim.go.jp/japanese/its/0frame/under/02ahs/index_02_05.htm