

Empirical study of traffic smoothing service at sag sections on expressways by means of vehicle to infrastructure communication

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(Key Words) Sag or ascending slope, road-vehicle links, adaptive cruise control, traffic smoothing, traffic simulation

1. Introduction

Approximately 60% of congestion on inter-city expressways in Japan occurs at sags or ascending slopes. The Intelligent Transport System (ITS) Division is conducting a series of research projects intended to develop a new service for mitigating traffic congestions by means of vehicle to infrastructure (V to I) communication at sags or ascending slopes¹⁾. Congestion at sags or ascending slopes occurs as a result of drivers unconsciously slowing down at the points where gradient changes and driving aimlessly after encountering congestion. It is possible to restrict or prevent these negative human factors by taking advantage of ACC vehicles' (Adaptive Cruise Control equipped vehicles) characteristics, which can control their speed and headway, so this service would contribute to mitigate congestion at those points.

A microscopic traffic simulator was built to clarify the congestion mitigation effects of the inclusion of ACC vehicles. This paper will report the results of a series of trial calculations of congestion mitigation by using the microscopic simulator.

2. Congestion mitigation measures by means of ACC vehicles to Infrastructure communication

Figure 1 shows an image of the service which uses V to I communication, and which was the object of the estimation of congestion mitigation effects based on inclusion of ACC vehicles. In response to information (for instance: appropriate traveling speed, headway, etc.) provided from ITS Spots (road side units), ACC vehicles activate their ACC function to maintain a preset speed or headway.

3. Trial calculation of congestion relief effects of ACC vehicles

To clarify the congestion mitigation effects of including ACC vehicles, the microscopic traffic simulator capable of reproducing the unique vehicle behavior on sag sections and ascending slopes already clarified by past research²⁾ was built to trial calculate congestion mitigation effects. Figure 2 presents the congestion loss hours according to ACC vehicles inclusion rate and the rate of reduction from the present situation (ACC vehicles inclusion is 0%). The results of the trial calculation have clarified that the more ACC vehicles are included in traffic flow, the

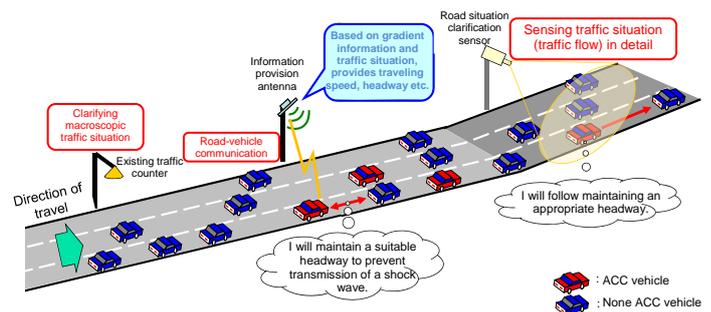


Figure 1. Image of the Service Linked to ACC Vehicles

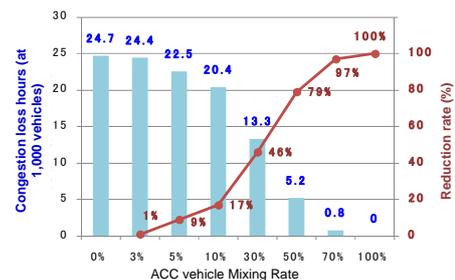


Figure 2. Results of Trial Calculation of Congestion Loss Hours by ACC Vehicle Mixing Rate

more congestion mitigation rate is improved.

4. Summing up

In this report, the results of a trial calculation of the microscopic traffic simulation show that congestion mitigation effects increase according to the ACC vehicles inclusion rate. In the future, more detailed estimations will be made by performing simulations under different conditions at the same time as the research will be conducted to realize the services by conducting feasibility studies.

[References]

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