Nowcast Simulation Predicting Network Traffic Conditions by Assimilating Floating Car Data

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1 Introduction

In recent years, real time traffic data collected by floating car data (FCD) can be used for many traffic information services. There are many advantages of real time traffic data. For example, the accuracy of the travel time information for car navigation systems is improved by using FCD. However, it must be noted that FCD is observed temporally and spatially as only a part of the traffic situation. In this case, one of the solutions is to estimate the traffic conditions between FCDs using some traffic models or algorithms. An online traffic simulation system should be provided as an example of a framework to estimate all traffic conditions in an area. 'Online traffic simulation systems' is one of the important research topics in the traffic engineering field. Some systems are developed and applied to real road networks for new traffic information services. It is said that the reproducibility and the accuracy of the estimated traffic situation are one of the challenges for practical use. However, online traffic simulation can be a breakthrough for the upgrading of traffic information services and road administration. In past studies, Ishibashi et al. [Ish09] described the method of an online traffic simulation system and the validation results, such as travel times on the Hanshin Expressway in Japan. Munakata et al. [Mun09] described validation results on the Metropolitan Expressway using the online traffic simulation system developed by Shiraishi et al [Shi05]. DYNASMART-X[Dsx04], DynaMIT [Dym98] and Aimsun Online [Aim08] were also developed and applied as online traffic simulation systems to predict traffic situations using real time traffic data. These studies and examples are developed for application to road networks in which traffic volumes and speeds are obtained by traffic sensors. However, it is possible that there may be few sensors, or even no sensors, in regular road networks compared to arterial roads and highways. In addition, the locations of origin and destination of vehicles are difficult to determine. We can be fairly certain that the solution in the case of insufficient sensors has not been studied enough. Although applications of FCD, such as travel time prediction, have been the object of study in recent years, no studies have ever tried application according to the characteristics of

FCD (e.g. traffic volume cannot be estimated from FCD). Therefore, we developed a framework of an online traffic simulation system which can estimate the traffic conditions of an entire road network using FCD in the case of insufficient traffic volume data.

2 Concept

The purpose of this study is to develop the Nowcast Traffic Simulation System (simply noted as 'Nowcast') to estimate the road traffic conditions in urban areas in real time. **Figure 1** shows the image of the Nowcast.

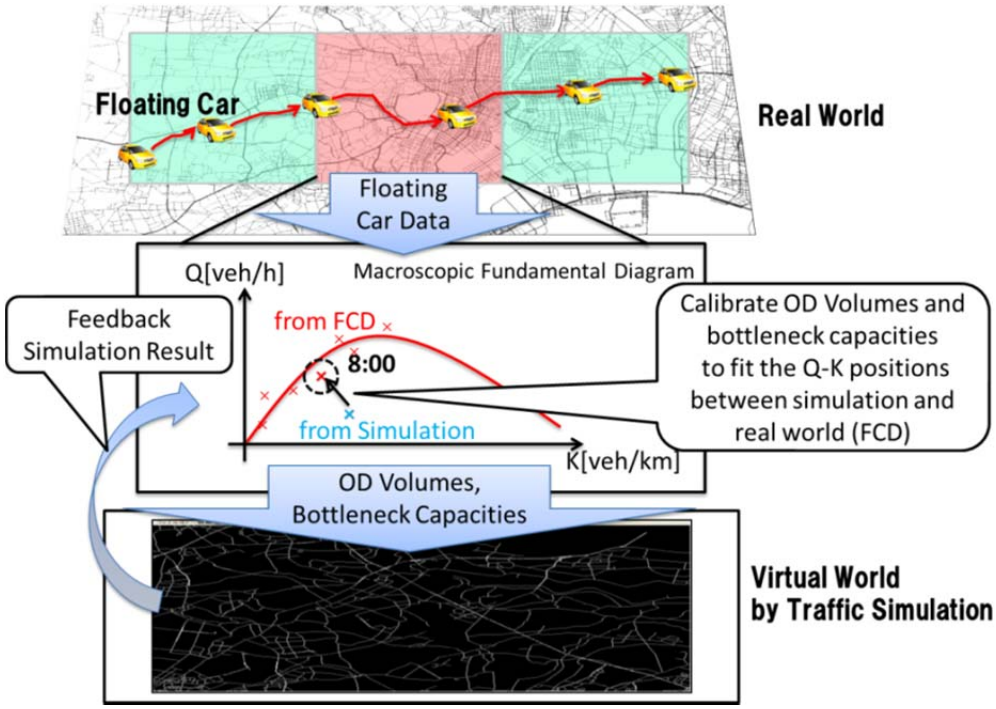

Figure 1: Concept of the Nowcast.

"Nowcasting" is the meaning to predict some sort of present situation such as weather. Thus the Nowcast forecasts the present traffic situation using real time traffic data. The Nowcast can be applied to several kinds of traffic monitoring systems for city-wide road networks. The purpose of the monitoring is to measure not only traffic flow and travel time but also environmental impacts such as CO_2 emission and traffic noise. The Nowcast complements the entire present traffic situation by a traffic simulation model using FCD. In this case, the Nowcast calibrates the parameters of traffic simulation to fit the traffic situation given by the traffic simulation model to the traffic situation from the observed data in real time. In this study, the traffic simulation model SOUND is used and the parameters for the calibration are below.

- OD traffic volume
- Bottleneck capacity (saturation flow rate)

Figure 2 shows the image of the parameter calibration of the Nowcast. The Nowcast calibrates these two types of parameters estimating the variation in the average traffic situation (the base case).

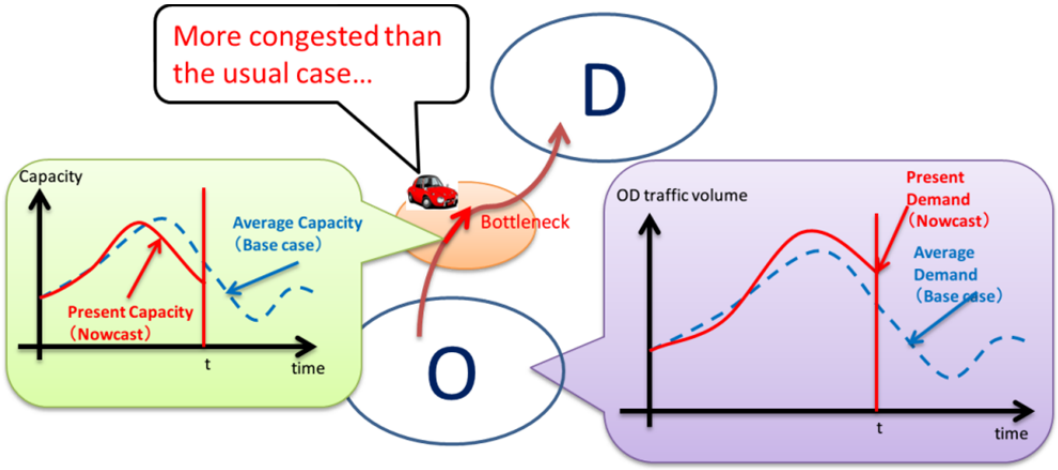

Figure 2: Image of Parameter calibration of NTSS.

In the full paper, the methodology of floating car data assimilation in the Nowcast will be detailed followed by the validation study using field operation test data.

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