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NOTES

THE CASE STUDIES OF THE TRAFFIC ASSESSMENT USING 'AVENUE'

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1. INTRODUCTION OF AVENUE

Recently, traffic congestion has caused serious social problems in urban areas, so that traffic assessment that evaluates the impacts of large events or urban developments on urban traffic is strongly required. AVENUE[1] (an Advanced & Visual Evaluator for road Networks in Urban arEas) was developed to be applied for such assessment, considering the following distinctive features:

1) Hybrid Block Density Method -- is the traffic flow model which reasonably reproduces queue blocking backs and conflicts of vehicles at intersections.
2) Driver's Route Choice Model -- is incorporated into the system in order to dynamically respond to varying traffic condition.
3) Object-Oriented Traffic Flow & Network Model -- affords a high flexibility for modeling various traffic control systems and regulations.
4) Graphical User Interface -- makes easy operation and impressive presentations possible.

Figure 1 displays the image of AVENUE, which contains the road network diagram, the detail of the intersection, the signal phase diagram, etc. The global traffic condition is displayed on the road network diagram with the colored arrows. The detail of the traffic condition around the intersection can be visualized if it is necessary.

Figure 2 illustrates the generic procedure of the traffic assessment using AVENUE. AVENUE requires the input data listed below:

1) road network data including number of lanes, traffic regulations, capacities of links, etc.,
2) signal control parameters and various traffic regulations, and
3) varying traffic demands per each origin-destination pair.

As the result of the simulation, AVENUE simultaneously displays the traffic conditions on CRT and records the following data:

1) count of throughputs at each link end per each turning direction,
2) travel times per each link, each path, each origin-destination pair,
3) queue length of each link, etc.

In this note, two case studies of the traffic assessment using AVENUE are introduced to show its flexible applications.

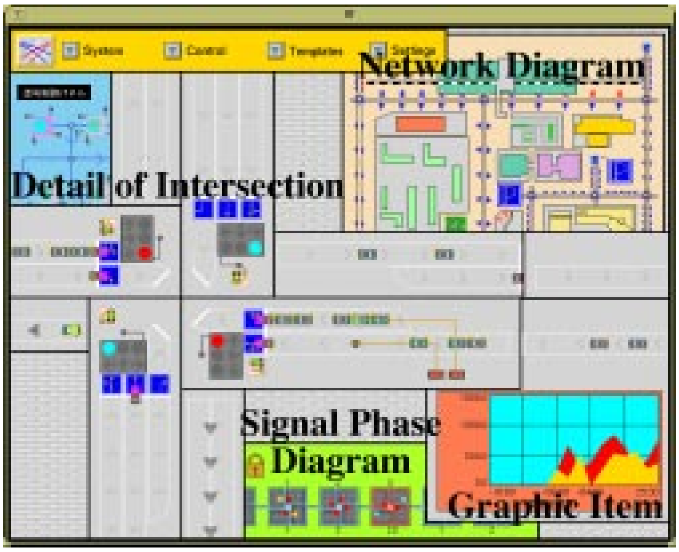


Fig. 1 The displayed image of AVENUE

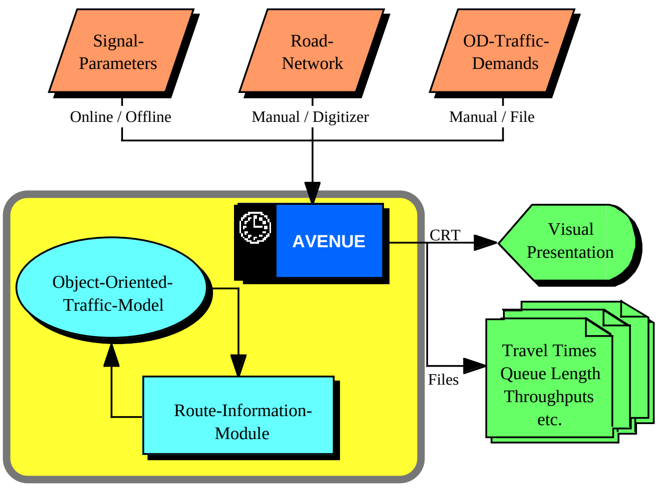


Fig. 2 The flow of the simulation with AVENUE

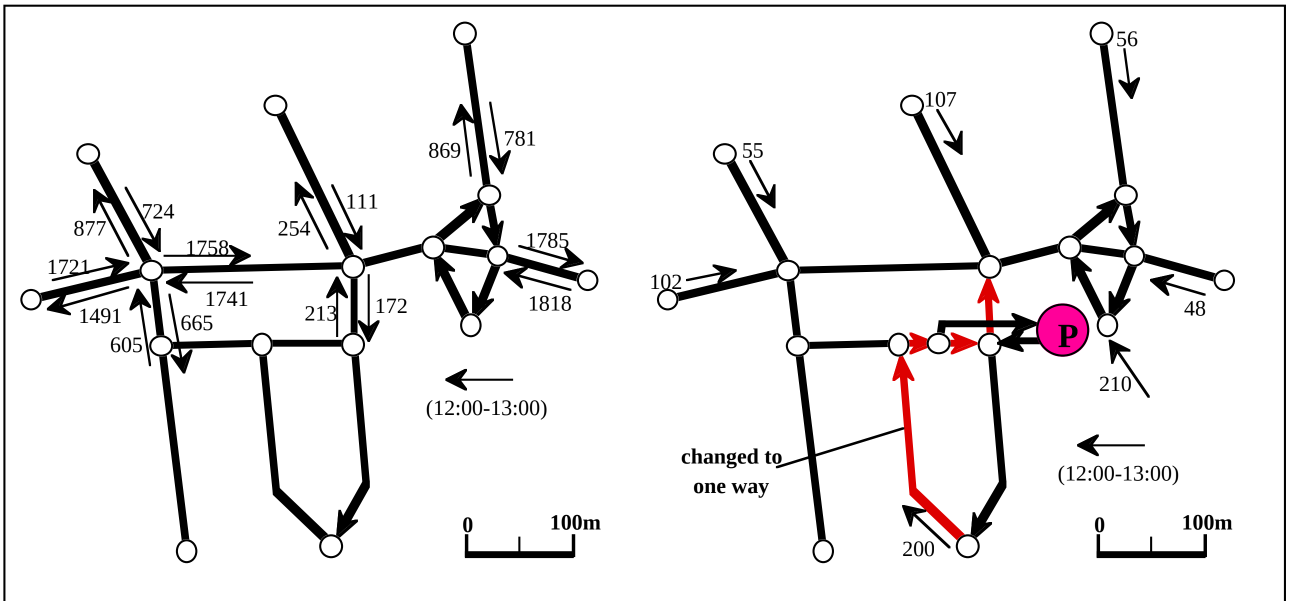
2. CASE 1: PLANNING OF UNDERGROUND PARKING PLACE

The central area of A-City contains several large department stores, so that numbers of cars for shopping concentrate in the daytime of holidays. Figure 3a shows the original road network used in the simulation and the observed traffic volumes at the intersections in a peak period of a holiday. Particularly, the traffic volume on the road crossing from side to side, Route-A, is close to the capacity.

An underground parking place of which capacity is 400 cars is planned in this area. However, this project may generate the additional traffic and consequently it will have some impacts to the traffic condition on Route-A. Figure 3b illustrates the modified network and the generated traffic for the project during the peak period.

Because of the advantages of the Object-Oriented Traffic Model, the function of parking management system can be easily implemented in AVENUE by adding the 'parking object' that has the performance of the gate, the capacity, the distribution of the exit cars, etc. Figure 4a shows the parking object added to the original network and Figure 4b shows the detail around the parking place.

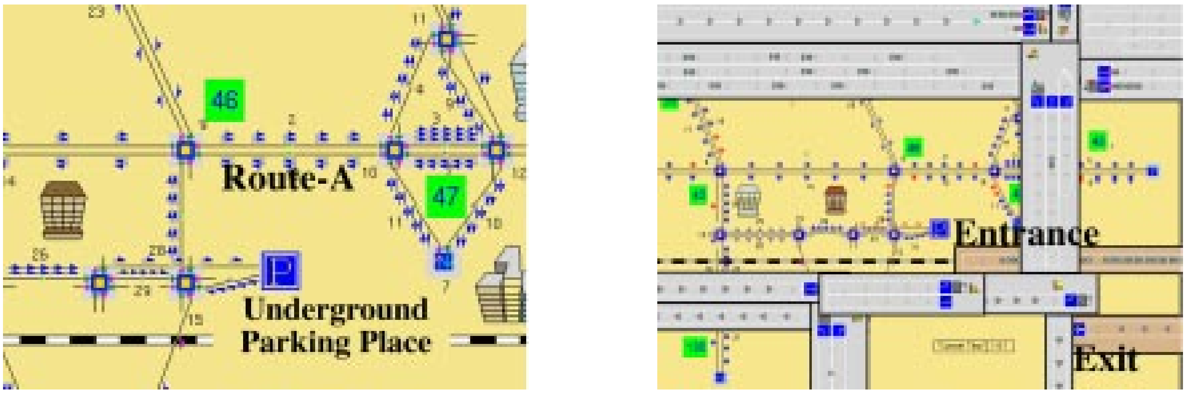
In this case, we applied AVENUE to evaluate the queue length in front of the parking entrance and the travel times along with Route-A. Figure 5 shows the comparisons of both travel times of the original network and the modified network. The results may conclude that there are no obvious differences among these travel times and that they are close to the average travel time of the road traffic census (90.7 seconds).



a) The original network and the observed traffic volumes at the intersections

b) The future network and the generated traffic volumes towards the parking place in a peak period

Fig. 3 The road network used in Case1



a: The parking object added to the network

b: The detail of the traffic around the parking place

Fig. 4 The displayed images of Case1

3. CASE 2: PLANNING OF ROUTE GUIDANCE

Figure 6 illustrates the road network including a shopping center that has the parking place for 1100 cars. Though the parking capacity is enough even during the peak period, traffic jam frequently appears around the marked intersection, A-Cross. This is originated from that the shopper's cars are guided shown in Figure 7a and that these cars consequently concentrate to A-Cross. Figure 7b shows the result of the simulation for the present state of the area.

Figure 8a illustrates the alternation of the guidance to disperse the congestion around A-Cross. In the simulation model, only when the contents of the route guidance objects are modified as shown in Figure 8b, the shopper's cars will follow the direction. As a result of this countermeasure, the queues around A-Cross become shorter than the present state. Figure 8c shows the result of this alternation.

4. CLOSING REMARKS

AVENUE has just been developed as version 1.0 that only has basic functions. For this kind of traffic simulator, there are a lot of demands for the applications such as

- optimization of signal control parameters,
- evaluation of the effects of bus lanes, HOV lanes, reversible lanes, etc.,
- evaluation of the effects of vehicle navigation systems.

Considering these demands, we will develop the next version based on both the microscopic analyses of the driver's behaviors and the macroscopic analyses concerning to the route choice behaviors.

REFERENCE

[1] R. Horiguchi, M. Katakura, H. Akahane and M. Kuwahara: A Development of a Traffic Simulator for Urban Road Networks: AVENUE, VNIS'94 Proceedings , Vehicle Navigation & Information Systems, pp.245-250, Sep. 1994

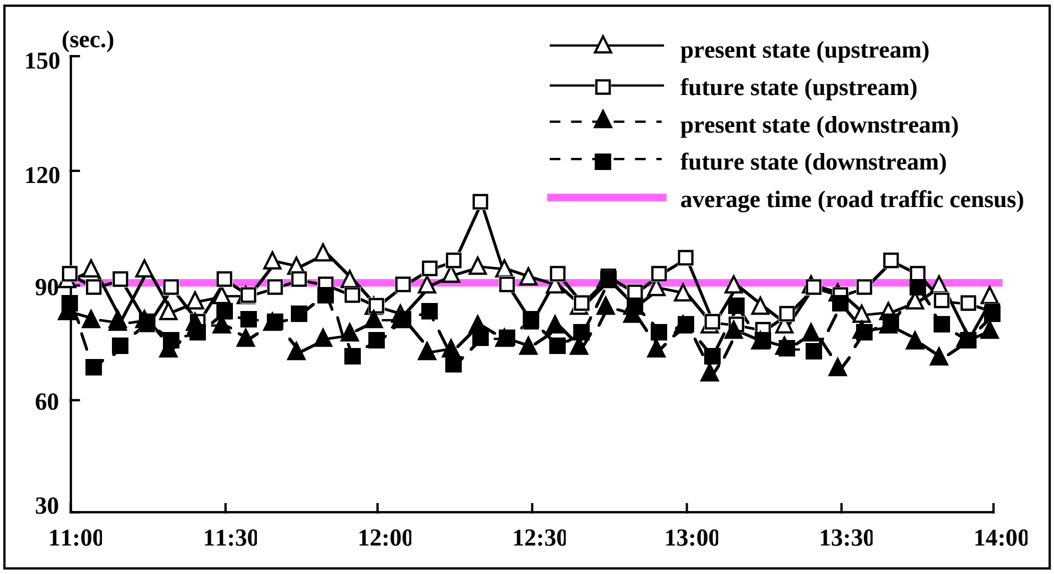
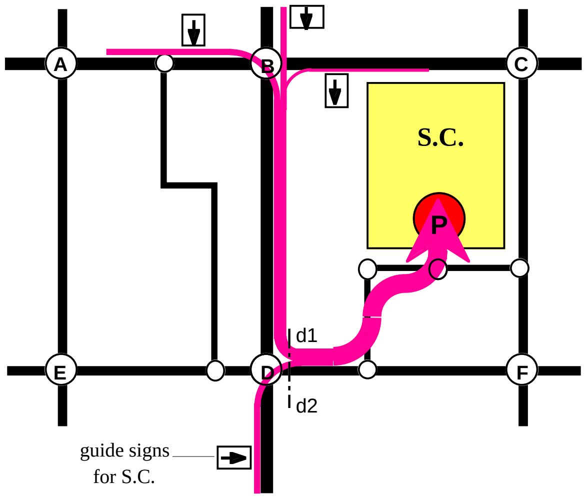


Fig. 5 The comparisons of the travel times on Route-A

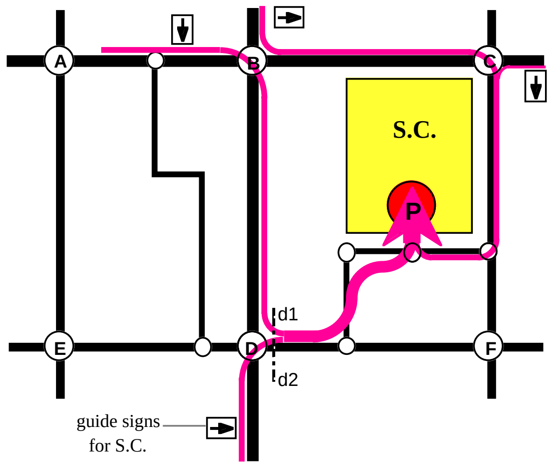
Fig. 6 The displayed image of Case2



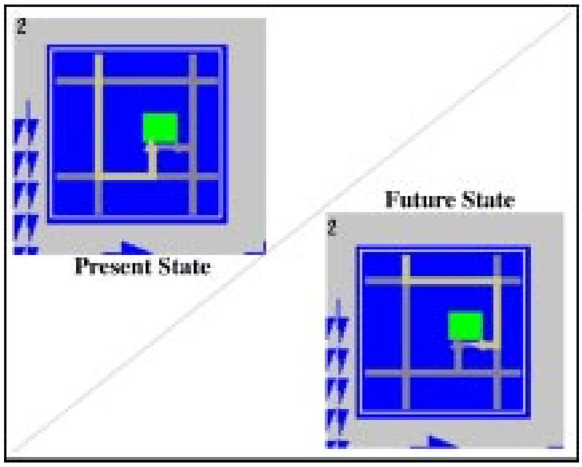
a) The original route guidance for the shopping center

b) The simulation image of the present state

Fig. 7 The original state of Case2



a) The improved route guidance for the shopping center



b) The modification of the route guidance object

c) The simulation image of the future state

Fig. 8 The future state of Case2