Analysis and Improvement on the Morning Traffic Control of Kyushu University Ito Campus

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1. Introduction

Nowadays there is only one entrance to West Zone and Center Zone of Kyushu University Ito Campus. People who want to go to work and classes by driving the car have to drive on only one lane of the road in order to turn left for entering the campus. Therefore the waiting line of vehicles heading to campus is very long and causes traffic jam which influencing a certain amount of people in the morning on weekdays. The analyzing objectives are the car and the weekday peak period in the morning which is around the first period and second period of classes. This study emphasizes on analyzing the current morning traffic condition of Kyushu University Ito Campus and obtaining the methods which would contribute to the improvement for convenience of people.

2. Method

(1) Collect data by survey

The survey was proceeded at 7:30-10:30 on 19th May (Monday). The two main determinants includes: traffic volume and length of traffic jam by cars. The method to collect data of traffic volume is by taking video then count number of cars later. In this step, three video cameras were used at three different positions: one is in the bridge between Center2 building and new East Zone building and facing to north, one is in same bridge and facing to south, one is in Center2 Building and facing to southeast. About the data for length of traffic jam, the time was written down on the tape and stick on the ground at the last car's tail end which stopped due to the traffic jam. In the end measure the length by measuring tape. In addition the videos were taken to obtain the time period of traffic signals and barrier gate.

Figure 1. Map of main research area

(2) Simulate by program

To simulate the current condition, a Spain software named Aimsun was used. It is an integrated transportation modelling software which is used for traffic simulation, transportation planning, traffic engineering, etc. Set the network, traffic signal and barrier gate then input the traffic volume and turning information into every ten minutes in every vehicle type which includes bus, car and trucks.

(3) Verify the simulation with the current condition

Run the simulation amount of times to ensure weather the simulation conditions were stable with accuracy. After that measure the longest length of traffic jam in every five minutes and comparing with the data of current condition. Make x-y scatter graph by two groups of the data and calculate the correlation (***r***) to verify by equation:

$$\boldsymbol{r} = \frac{1}{n-1}\sum\left(\frac{x_i-\overline{x}}{S_x}\right)\left(\frac{y_i-\overline{y}}{S_y}\right) \qquad S_x = \sqrt{\frac{1}{n-1}\sum(x_i-\overline{x})^2} \qquad S_y = \sqrt{\frac{1}{n-1}\sum(y_i-\overline{y})^2}$$

Where, ***r***: correlation n: 36 (data number for the length of traffic jam) *S*: standard deviation
x: length of traffic jam from simulation y: length of traffic jam from current condition

(4) Methods for improving

A) Keep the signal time period same and decrease the time of green signal in WestZone-EastZone direction (WED) then increase the time of green signal in Taromaru-Sakurai direction (TSD). At least twenty seconds considered indispensable for pedestrian to cross the road in WED therefore the changes of signal time for four conditions are -7s(WED) +7s(TSD), -6s(WED) +6s(TSD), -5s(WED) +5s(TSD) and -4s(WED) +4s(TSD). Where, s: second.

B) Decrease the signal time period by reducing the time of green signal in WED. The changes of signal time for four conditions are -7s(WED) , -6s(WED), -5s(WED) and -4s(WED).

C) Increase the signal time period by increasing the time of green signal in TSD. The changes of signal time for four conditions are +7s(TSD), +6s(TSD), +5s(TSD) and +4s(TSD).

Measure the length of traffic jam by the same method in Method (3) then contrast all methods above. Obtain the average vehicle delay time in TSD by Aimsun.

3. Results and Discussion

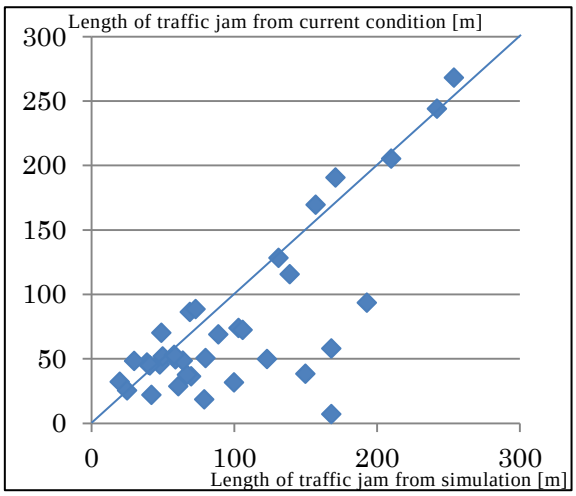

Figure 2. Traffic lengths from observation and simulation

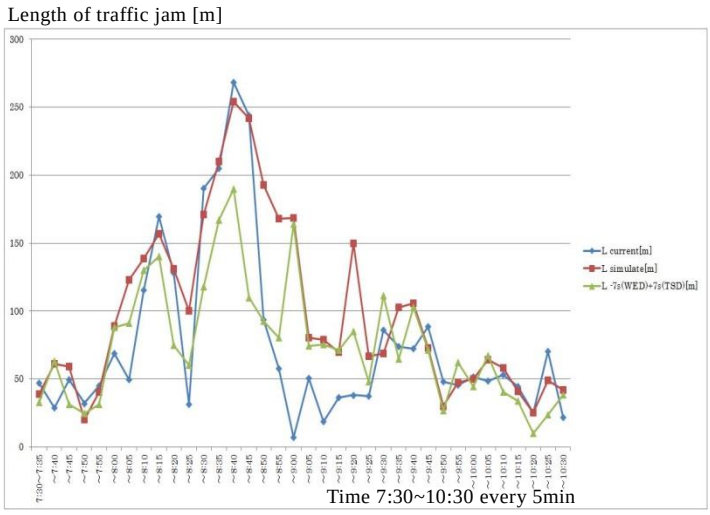

Figure 3. Comparison between current condition, simulation and method A)

Figure 2. shows each traffic length from observation and simulation. The correlation 0.8 obtained shows the result of simulation is good. Therefore we could continue next step to search the method for improving the traffic condition. The average vehicle delay time 12.86s in TSD is lower than others meanwhile by contrasting the data for length of traffic jam of all presupposed methods, as fig 3. shows, better traffic condition during two peak periods occurred in method A) -7s(WED)+7s(TSD) . The decrease of the time for red signal and increase of the time for green signal in TSD should be the important determinants. Higher efficiency conduces the improvement for the traffic control in the simulation by increasing the traffic volume at the point of the intersection. For the reason that it is for improve the traffic control in the morning, the signal setting should be changed after the peak periods in the morning.

4. Conclusions

After analysis, the method to improve the current condition of morning traffic jam in Kyushu University Ito Campus is by changing the signal control at the WE-TS intersection. It is to keep the signal time period same and decrease the time of green signal in WED by 7s then increase the time of green signal in TSD by 7s. The future research is to get data of faculty members and students in order to optimize analysis and simulate the traffic control and traffic condition of East Zone.