1 Introduction

2 Assumptions

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3.1 Simulation and discussion

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We simulate a toll plaze with 8 tollbooths and 3 lanes of travel.

Common vehicles are usually $4-4.5m$ long and $1.65-1.85m$ wide, so a vehicle will take up 2 cells. According to the *Green Book, 1994*, an appropriate design of a toll plaze would be a trapezoid with a 168-meter-long recovery zone and a 612-meter-long departure zone. The width of a tollbooth along with a toll island is usually $5.5m$, while that of each lane is $3.5-4m$. We set the length of each cell equal to $2m$: $l_{car} = 4m$. So the parameters are as follows:

$$l_{veh} = 2w_{veh} = 1WB = W_bB = 3 \times 8 = 24WL = W_lL = 2 \times 3 = 6L_r = 84L_d = 306$$

Figure 1 shows the relationship between current throughput and traffic flow density with different p_v.

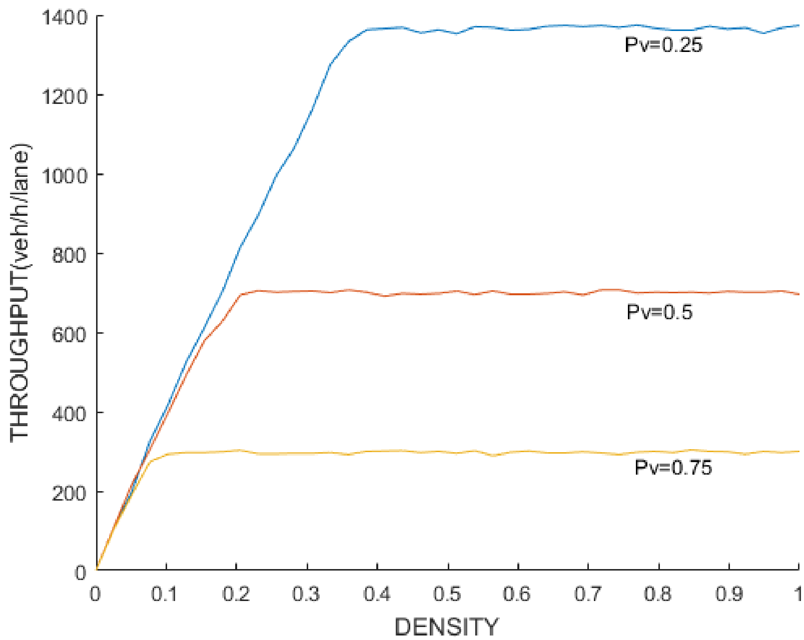

Figure 1: The relationship between throughput and density with different p_v

The density in the correspondence with the maximal throughput q_{max} is defined as critical density d_c. We can distinguish that the curves in Figure 1 are divided into two sections by that critical density. If the flow density is lower than d_c, it will be a free flow; otherwise, a crowded flow.

As mentioned above, p_v is the probability of random deceleration. It varies among different drivers. It is not difficult to conclude that the smaller the value is, the larger q_{max} is accessible. At the same time, d_c will increase correspondingly. In the following chapters, we adopt $p_v = 0.5$ as our basis, because the q_{max} at this time is consistent with the actual value, approximately $700veh/h/lane$.