On-street parking affects intersection service rate

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Problem Statement

An on-street parking maneuver can often start a temporary bottleneck, leading to additional delay endured by the following vehicles. When the maneuver occurs at a close distance upstream a signalized intersection, the scope of the impact can be magnified.


Steps

1. Define the parking maneuver (duration, location in reference to the intersection).
2. Define the saturation conditions.
3. Find the service rate reduction of the intersection due to the parking maneuver based on the hydrodynamic theory of traffic flow.


Results

The accuracy refers to the service rate (instead of the reduction). The survey was conducted on a section of Dreikonigstrasse in the city of Zurich, Switzerland. During the survey, more than 90 maneuvers were recorded, but only 32 were used.


Validation

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Solutions/ Conclusions

1. According to our analysis, the amount of the service rate reduction depends very much on the saturation conditions (i.e., volume-to-capacity ratio) and the virtual arrival time of the parking vehicle to the intersection (i.e., $\beta$).
2. Based on the comparison between upstream and downstream parking maneuvers and their influence on the intersection, we do not suggest to provide downstream parking spaces close to the intersection unless the intersection is often very undersaturated, as parking at those locations always cause a relatively high service rate reduction.
3. If the intersection is often oversaturated, the best choice is to place the parking area far downstream (areas 2 and 3), the second is to place the parking area far upstream (area B), the third is to place the parking area upstream and close to the intersection (area A), and the last one is to place the parking area downstream and close to the intersection (area 1).