■ 博士學位論文紹介 ■

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(Analysis of Traffic Actuated Signal Control Strategies at Urban Diamond Interchanges)
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The operational performance of actuated signal control strategies at diamond interchanges is investigated. Four-phase with two-overlap and two single-barrier three-phase phasing strategies are evaluated with a simulation study. The effect of ramp spacing on the performance of each strategy is also identified. A CORSIM simulation combined with Hardware-in-the-Loop is used to implement the actuated signal operations. Four different traffic volume patterns are studied. Performance is evaluated in terms of average cycle length, average control delay, and total number of stops.

For three-phase operations, it is shown that there is a distinct movement preference for each of the two phasing strategies tested. However, no significant performance difference was observed overall between the two three-phase phasing strategies in terms of cycle length and average delay. The total number of stops was the most sensitive test variable.

Three coordination strategies for three-phase operation are also explored, and a method for estimating optimal ramp spacing for each strategy is developed. Optimal ramp spacing is found to depend on the coordination strategy selected. It is also shown that the optimal spacing could vary for the two objective functions: minimum average delay and minimum number of stops.

For four-phase operations, it is shown that cycle length and delay increase as ramp spacing increases. Cycle length is very sensitive to the left-turn volume from arterial approaches. Four-phase operation was less efficient than three-phase operation in terms of cycle length and average delay. However, four-phase operation produces comparable performance to three-phase operation when interchanges have significantly unbalanced demand between the two intersections. Fewer stops are observed in four-phase operation, but the number of stops tends to increase as the ramp spacing becomes longer. Experimental results show that detection design is a critical factor in four-phase operation. A relationship between overlap phase duration and U-turn volume is formulated to characterize the four-phase signal operation.