Urban gridlock: Macroscopic modeling and mitigation approaches

Transportation Research Part B: Methodological, Vol. 41, No. 1, pp. 49-62, 2007

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Abstract

This paper describes an adaptive control approach to improve urban mobility and relieve congestion. The basic idea consists in monitoring and controlling aggregate vehicular accumulations at the neighborhood level. To do this, physical models of the gridlock phenomenon are presented both for single neighborhoods and for systems of inter-connected neighborhoods. The models are dynamic, aggregate and only require observable inputs. The latter can be obtained in real-time if the neighborhoods are properly instrumented. Therefore, the models can be used for adaptive control. Experiments should determine accuracy. Pareto-efficient strategies are shown to exist for the single-neighborhood case, and optimality principles are introduced for multi-neighborhood systems. The principles can be used without knowing the origin–destination table or the precise system dynamics.

Keywords: Urban mobility; Traffic congestion; Gridlock; Adaptive control