

Science of Transportation

Transportation systems are complex systems consisting of interactions among humans' decision makings, vehicles' physical behaviors, and infrastructures. We are conducting theoretical and empirical studies for *a better understanding of transportation systems' behaviors* and are aiming to develop management and control strategies for *maximizing a potential of transportation systems and leading to a better society*.

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Traffic Flow Theory

How does traffic congestion occurs and evolve spatially and temporally? We are developing hydrodynamic theories of describing some interesting congestion phenomena at freeway sag sections (Wada et al., 2020) and signalized intersections (Wada et al., 2018).

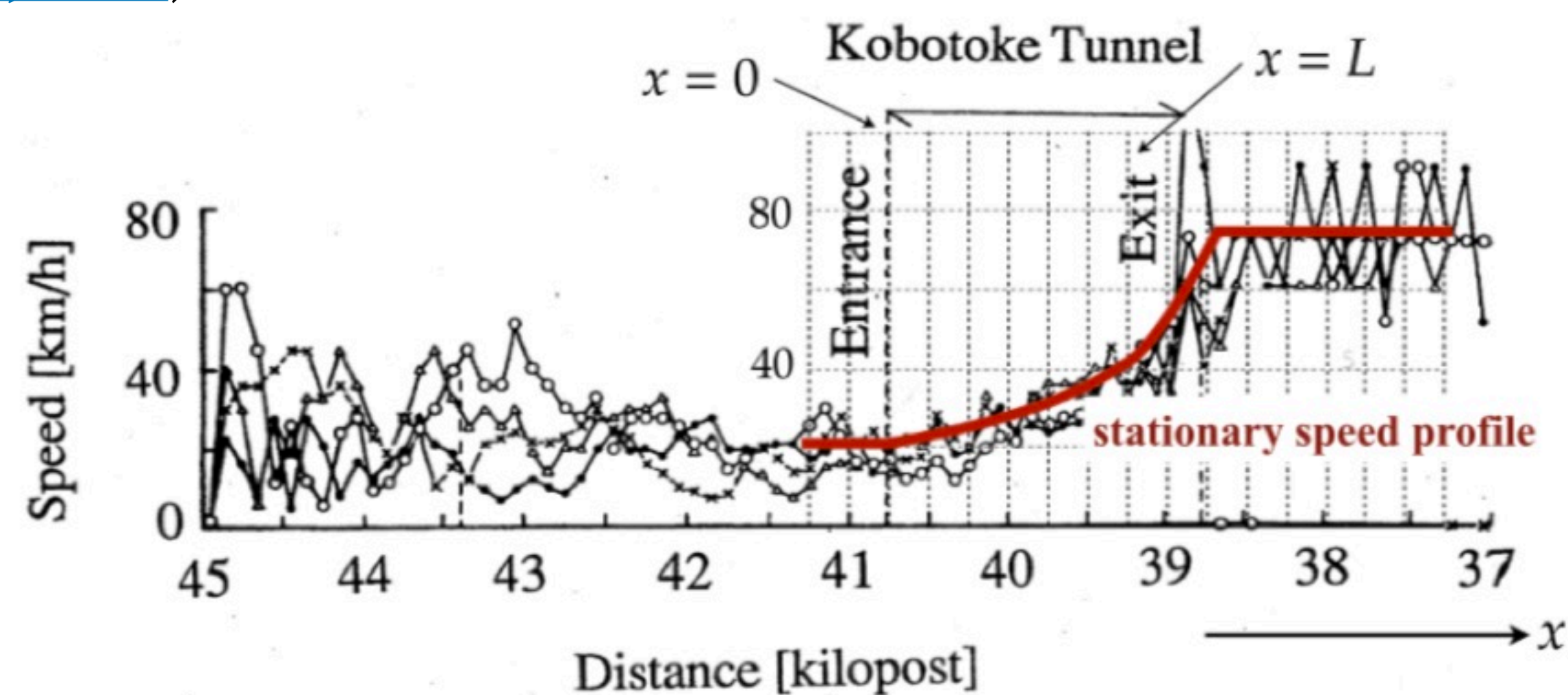


Fig. Observation & prediction of vehicles' speed at sag

Equilibrium Theory of Dynamic Transportation Networks

What traffic flow patterns emerge at an equilibrium between congestion spread and users' choice behaviors on networks? We are analyzing the equilibrium patterns by exploiting a game theoretic approach. So far, we have successfully obtained the results on the existence, stability, and some regularities of the patterns and have developed a robust computational method for them (Akamatsu et al., 2015, Akamatsu et al., 2018; Wada et al., 2019; Satsukawa et al., 2019).



Modeling & Analysis

Supply side (short term)

Demand side (long term)

Traffic Control

How to improve a global traffic performance or efficiency on networks by controlling local arterials and streets? We are developing centralized and decentralized traffic signal control methods for improving the global network performance (Wada et al., 2018; Wada et al., 2019).

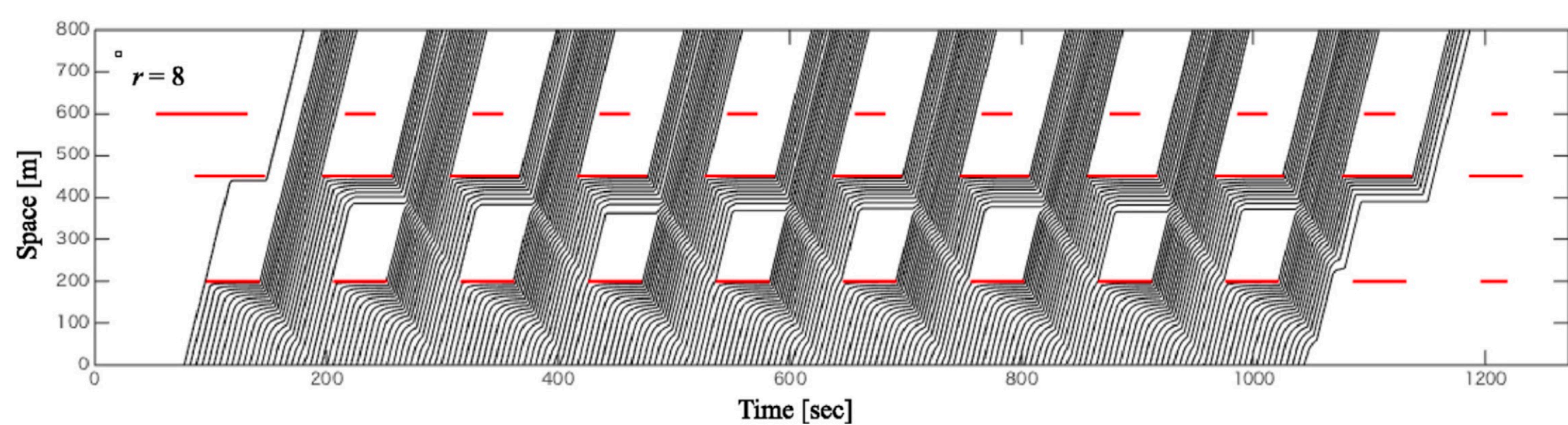
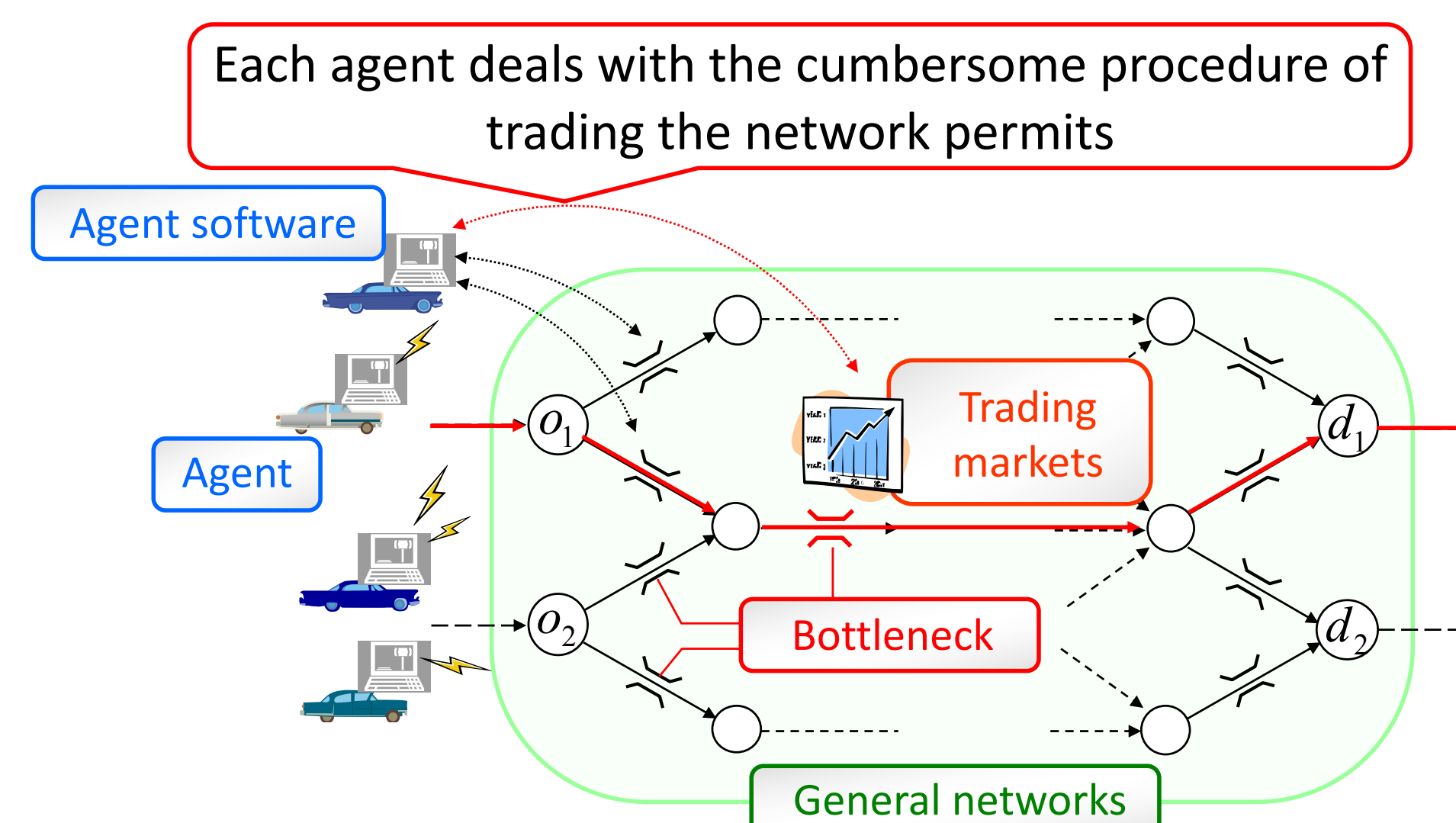


Fig. Time-space diagram describing vehicles' movements under an optimal signal timing

Futuristic Traffic Congestion Management based on Market Mechanism

Is it possible to achieve a world with no traffic congestion? We have proposed a novel congestion mitigation scheme called "tradable bottleneck permits (TBP)," which combines reservation-based road usage with market-based pricing. We are analyzing its properties and designing an intelligent implementation system for it (Wada & Akamatsu, 2013; Akamatsu & Wada, 2017).



Management & Control