Statement of Contribution/Potential Impact

Most theoretical analyses of rush-hour traffic dynamics employ Vickrey's bottleneck model (1969). The bottleneck model has the virtue of simplicity but the congestion technology it assumes, queuing behind a bottleneck of fixed flow capacity, is unrealistically simple. One wonders which properties of the bottleneck model are robust and which derive from the assumed form of congestion. This paper replaces the bottleneck of fixed flow capacity with a single-entry traffic corridor with LWR flow congestion. Newell (1988) analyzed the general problem with no late arrivals, obtaining qualitative results. This paper treats a special case of Newell's model in which commuters have a common desired arrival time and velocity is a negative linear function of density (Greenshields' Relation). Building on a detailed analysis of traffic flow along a single-entry corridor when there is a constant inflow rate for a fixed period of time, it obtains a complete, closed-form solutions for the social optimum and an analytical solution for the user optimum departure rate, and investigates their economic properties. In the social optimum the inflow rate waxes and then wanes, with both the first and last commuter traveling at free-flow velocity, whereas in the user optimum the inflow rate steadily increases, with a queue developing for sufficiently large populations. Since the inflow rate to the road cannot exceed capacity, traffic is uncongested in both régimes.