Optimizing Traffic Systems Through Queueing Theory and Simulation

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Automotive traffic in its current form serves as a major problem for the United States' car driven society. Looking for ways to increase efficiency could lead one to the evaluate the efficacy of the current stop light infrastructure, leading to the question, "To what extent does varying the length of traffic signals affect the accumulation of automotive traffic?" Using a Monte Carlo simulation built upon queuing theory principles it was found that during high flow situations (1400 cars per hour per lane) higher signal lengths, 104 seconds of green, are necessary to move traffic at peak efficiency, whereas in lower traffic situations (500 cars per hour per lane) shorter signal lengths, 54 seconds of green, are necessary for peak efficiency. By analyzing current signal lengths and data regarding lost productivity due to traffic, it can be determined that implementing smart control structures, those which modulate signal length depending on flow rate, could result in up to billions of dollars of financial gain.