**Title: Can Chaos Theory Revolutionise Traffic Management In Urban Signalised Networks?**

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Current signal control systems for managing traffic in urban areas lack a coordinated approach to detecting the spatial and temporal evolution of congestion across network regions within cities. This inhibits these systems’ ability to reliably detect the onset of congestion and implement effective preventative action through strategic adjustment of traffic signal settings. As traffic is a time-dependent and non-linear system, Chaos Theory is a prime candidate for application to urban traffic control to improve congestion and pollution management. Previous studies have identified that traffic, and in particular the nebulous region between free-flow and congested traffic, may exhibit deterministic and nonlinear characteristics, which could be analysed to help address this shortcoming. However, this has not been investigated in detail across wide spatial areas to allow its application within traffic control strategies. Chaos Theory can be used to analyse a condition that is highly sensitive to initial conditions and leads to aperiodic behaviour in deterministic nonlinear systems, thereby rendering long-term prediction impossible; consequently, making it appropriate to the study of congestion – a chaotic situation. This paper reviews previous attempts to use Chaos Theory in this challenging environment and how new emerging data sources may become beneficial for traffic management. Results will be presented from an application of an algorithm based on the principles of Chaos Theory to a SCOOT region in the city of Leicester's traffic network. It will describe how the application of Chaos Theory can be used to indicate the network’s cyclical dynamical states (i.e. stable and asymptotic and steady states could be used to identify the dynamical states of a road network of interconnected signalled junctions). Furthermore, it develops the Lyapunov exponent as a predictive tool, and demonstrates how this is useful for understanding the spatial interactions in the network and consequently for predicting temporal network traffic conditions. This research suggests that incorporating chaos-based algorithms in existing UTC systems to trigger optimum control strategies that are one-step ahead of real-time traffic congestion, rather than being one-step behind, could radically improve strategic management of traffic playing an important role in improving air quality.