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Urban Traffic: Understanding the Traffic Flow Factor Through Fluid Dynamics

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Abstract : The study of urban traffic dynamics, underpinned by the principles of fluid dynamics, offers a distinct perspective to comprehend and enhance the efficiency of traffic flow within bustling cityscapes. Leveraging the concept of the Traffic Flow Factor (TFF) as an analog to the Reynolds number, this research delves into the intricate interplay between traffic density, velocity, and road category, drawing compelling parallels to fluid dynamics phenomena. By introducing the notion of Vehicle Shearing Resistance (VSR) as an analogy to dynamic viscosity, the study sheds light on the multifaceted influence of traffic regulations, lane management, and road infrastructure on the smoothness and resilience of traffic flow. The TFF equation serves as a comprehensive metric for quantifying traffic dynamics, enabling the identification of congestion hotspots, the optimization of traffic signal timings, and the formulation of data-driven traffic management strategies. The study underscores the critical significance of integrating fluid dynamics principles into the domain of urban traffic management, fostering sustainable transportation practices, and paving the way for a more seamless and resilient urban mobility ecosystem.

Keywords : traffic flow factor (TFF), urban traffic dynamics, fluid dynamics principles, vehicle shearing resistance (VSR), traffic congestion management, sustainable urban mobility
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