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Latent heat of vehicular motion FARZAD AHMADI, AUSTIN BERRIER, MOHAMMAD HABIBI, JONATHAN BOREYKO, Virginia Tech — We have used the thermodynamic concept of latent heat, where a system loses energy due to a solid-to-liquid phase transition, to study the flow of a group of vehicles moving from rest. During traffic flow, drivers keep a large distance from the car in front of them to ensure safe driving. When a group of cars comes to a stop, for example at a red light, drivers voluntarily induce a "phase transition" from this "liquid phase" to a close-packed "solid phase." This phase transition is motivated by the intuition that maximizing displacement before stopping will minimize the overall travel time. To test the effects of latent heat on flow efficiency, a drone captured the dynamics of cars flowing through an intersection on a Smart Road where the initial spacing between cars at the red light was systematically varied. By correlating the experimental results with the Optimal Velocity Model (OVM), we find that the convention of inducing phase transitions at intersections offers no benefit, as the lag time (latent heat) of resumed flow offsets the initial increase in displacement. These findings suggest that in situations where gridlock is not an issue, drivers should not decrease their spacing during stoppages in order to maximize safety with no loss in flow efficiency.

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