

(Abstract)

Objective: To investigate the available evidence referring to the effectiveness of digital countdown timers (DCTs) in improving the safety and operational efficiency of signalized intersection.

Methods: A systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement guidelines. Relevant literature was searched from electronic databases using key terms. Based on study selection and methodological quality assessment, 14 studies were included in the review. Findings of the studies were synthesized in a narrative analysis.

Results: Three types of DCT had different effects on intersection safety and operational efficiency. Green signal countdown timers (GSCTs) reduced red light violations, type I dilemma zone distributions, and rear-end collision likelihood but increased crossing after yellow onset and had mixed impacts on type II dilemma zone distributions and intersection capacity. In contrast, red signal countdown timers (RSCTs) increased intersection capacity, although their effectiveness in reducing red light violations dissipated over time. Likewise, continuous countdown timers (CCTs) significantly enhanced intersection capacity but had mixed influences on red light violations and crossing after yellow onset.

Conclusions: Due to the limited and inconsistent evidence regarding DCTs' effects on intersection safety and efficiency, it is not sufficient to recommend any type of DCT to be installed at signalized intersections to improve safety and operational efficiency. Nevertheless, it is apparent that both RSCTs and CCTs enhance intersection capacity, though their impacts on intersection safety are unclear. Future studies need to further verify those anticipated safe and operational benefits of DCTs with enriched field observation data.