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INFLUENCE OF TRAFFIC SIGNAL COUNTDOWN TIMERS ON SAFETY AND EFFICIENCY AT SIGNALIZED INTERSECTIONS

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ABSTRACT:
Traffic Signal Countdown Timers (TSCT) are devices installed at signalized intersections to inform drivers about the remaining time for signal change. These timers are intended to improve the decision-making process of drivers, reduce red light violations (RLVs), and enhance intersection efficiency. This research evaluates the influence of TSCT on traffic safety and operational efficiency at three intersections in Hyderabad using SIDRA Intersection software. The findings show that countdown timers contribute to reduced delays, lower degrees of saturation, shorter queue lengths, and fewer red-light violations, ultimately improving the Level of Service (LOS) at intersections.

Keywords:
Countdown timers, Traffic safety, red light violations, SIDRA Intersection, Efficiency, Queue length, Delay

1. INTRODUCTION

Urban traffic congestion is a pressing challenge worldwide. In growing cities like Hyderabad, traffic delays at intersections reduce mobility, increase fuel consumption, and contribute to air pollution. Signalized intersections are designed to manage conflicting vehicular movements, but poor adherence to traffic signals and lack of driver awareness often result in red light violations and traffic delays.
Traffic Signal Countdown Timers (TSCT) serve as an enhancement to standard traffic signals, offering real-time countdowns for signal phases. Their objective is to provide drivers with additional information to make better stop-go decisions, especially during critical amber-red transitions. While TSCT systems have been adopted in parts of Asia and Europe, studies specific to Indian urban conditions, especially Hyderabad, remain limited.

2. METHODOLOGY

The study analyzed three signalized intersections in Hyderabad:

1. **Government Printing Press Road Intersection (3-leg)**
2. **Champapet Cross Road Intersection (3-leg)**
3. **Santosh Nagar Cross Road Intersection (4-leg)**

Traffic data was collected during peak hours using video recording, and converted into Passenger Car Units (PCUs) as per IRC SP-41 standards. Analysis was conducted in two phases: **before** and **after** installation of TSCT.

The **SIDRA Intersection software** was employed to simulate traffic flow and quantify key performance indicators such as:

- Delay (sec/vehicle)
- Degree of Saturation (V/C ratio)
- Queue Length
- Travel Speed

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- Level of Service (LOS)

Additionally, **SPSS software** was used for statistical validation through paired sample **t-tests**.

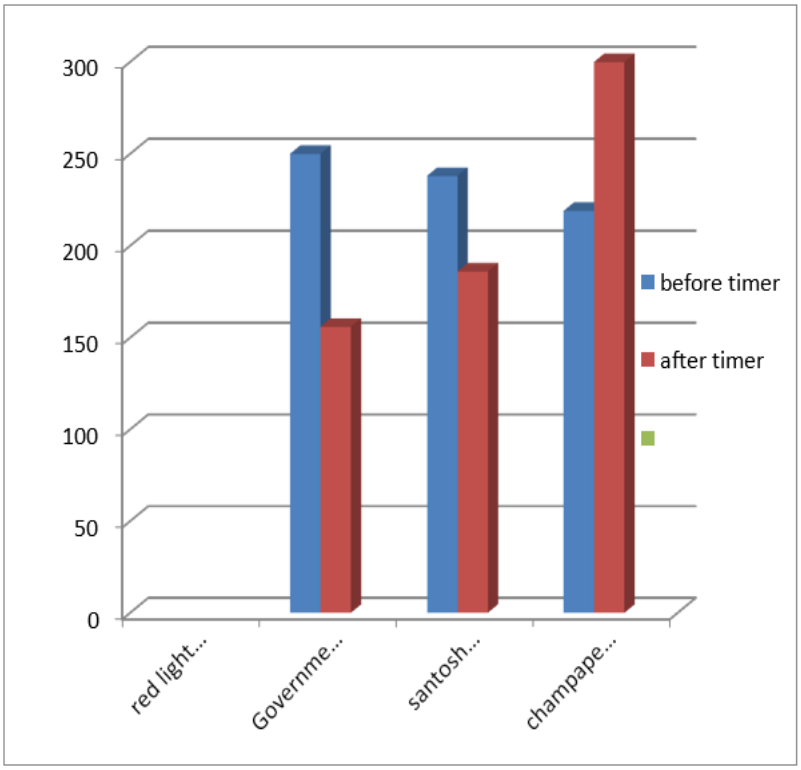
3. RESULTS AND DISCUSSION

The comparative analysis showed significant improvements in traffic performance after implementing TSCT. Below are summarized key findings:

Parameter	Before TSCT	After TSCT	Improvement
Average Delay	61.3 sec	48.9 sec	↓ 20.2%
Degree of Saturation	0.89	0.75	↓ 15.7%
Queue Length	120 m	85 m	↓ 29.1%
Travel Speed	21 km/h	26 km/h	↑ 23.8%
Red Light Violations	Higher	Significantly Reduced	Improved safety

- **Delay Reduction**: Countdown timers helped in minimizing startup delays and decision-making time, reducing vehicle idling at intersections.
- **Safety**: Fewer red light violations were observed, particularly in smaller intersections prone to higher driver stress.
- **LOS Improvement**: LOS at intersections improved from E/F levels to C/D levels.

These findings align with global studies that confirm the operational and safety benefits of TSCT, though regional driving behaviour and compliance vary.



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4. CONCLUSION

This study concludes that the implementation of Traffic Signal Countdown Timers at busy intersections in Hyderabad improves both operational efficiency and road safety. TSCTs reduce red light violations, shorten queue lengths, increase average speeds, and enhance intersection LOS. Given Hyderabad's growing traffic issues, wider implementation of TSCT systems, accompanied by driver education campaigns, is recommended.
Future research can explore larger datasets, the role of pedestrian timers, and integration with adaptive traffic control systems.

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