

Analysis of Driver Behavior and Psychological Research During Yellow Light

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ABSTRACT

At intersections, the traffic environment is often more complex compared to regular road segments. At intersections, motor vehicles, non-motorized vehicles, and pedestrians are concentrated, coupled with the mandatory nature of traffic channeling, which may lead to drivers feeling tense and impatient. During the process of entering and exiting intersections, drivers often exhibit behaviors such as running red lights, speeding, illegal lane changes, and cutting in line, which not only reduce road efficiency but also create numerous safety hazards. The sudden transition from green light to yellow light at intersections can have a significant impact on drivers' psychology, leading to certain safety risks. Research has shown that countdown timers at signalized intersections can have a certain impact on driver behavior, but these studies have their limitations to varying degrees. This article will further analyze driver behavior and psychology during yellow lights through survey questionnaire results and empirical data.

Keywords: intersection driving behavior; yellow light; driver psychology; decision-making; risk perception.

INTRODUCTION

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Domestically, some scholars have also conducted corresponding research. Zhao Jing, Ma Wanling, and others concluded through analysis of the speed, space, and size distribution of vehicles passing through the stop line at signalized intersections during phase transition periods, as well as the length of the dilemma zone, that countdown timers for green lights can increase the speed of vehicles passing through the intersection during the yellow light period by about thirty percent. Deng Rongfeng found that countdown timer signals for green lights have a certain impact on the optimal duration of the yellow light, with the optimal duration of the yellow light decreasing by about 0.7 seconds when not considering the countdown timer for green lights. Zhang Jie and others, through a comparative analysis before and after the installation of countdown display devices at a certain intersection in Beijing, found that countdown signals have a

significant impact on drivers, especially in reducing the acceleration through the yellow light period and the number of red-light violations.

RESEARCH METHODOLOGY

This study focused on the signalized intersection located at the east gate of the Western Campus of Shandong University of Technology in Zhangdian District, Zibo City, Shandong Province. The driving behavior data of straight-ahead vehicle drivers were collected through video recording, while the psychological data of drivers were gathered through the design and distribution of questionnaires. The study investigated the impact of countdown timers on drivers by establishing the interrelationship between driver behavior and psychology. According to the survey conditions, the main content of driver behavior collected was focused on studying the misconduct of straight-ahead vehicles passing through the intersection, including running yellow lights and illegal lane changes.

Due to the large size of the intersection and limited filming conditions, the filming location for the north-south direction of straight-ahead vehicle information was chosen on the safety island in the north-south direction. This enabled the capture of information on vehicles approaching the intersection while also

recording relevant information about the traffic signals. The initiation time of the countdown timer for green lights could be determined by the total

duration of green lights within one cycle. The camera position is shown in Figure 1.

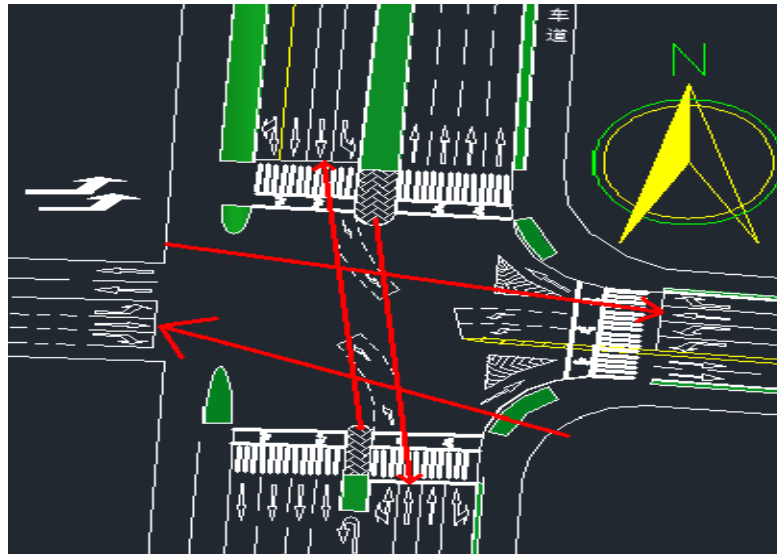


FIGURE 1: Schematic diagram of the position and direction of the video camera at the signalized intersection.

As shown in the above figure, the tail of the arrow indicates the placement position of the camera, and the direction pointed by the arrow is the view of the entrance direction captured by the camera.

TABLE 1: Frequency Statistics Table for Vehicles Running Yellow Lights.

Behaviour	South entrance		North entrance	
	Peak hours	Off-peak hours	Peak hours	Off-peak hours
running a yellow light	45%	13.33%	65.85%	9.76%
not running a yellow light	55%	86.67%	34.15%	90.24%

The table above indicates that during off-peak hours, the frequency of vehicles running yellow lights while proceeding straight is quite low. Although occasional instances occur, they are infrequent. Conversely, during peak hours, there are more instances of vehicles running yellow lights, with a higher frequency.

This suggests that running yellow lights at signalized intersections with high traffic volume is more common. In such situations, many drivers lack the patience to wait for the next green light. However, during periods of lower traffic volume, more drivers tend to be patient and lean towards cautious driving.

TABLE 2: Driver Behaviour in the Final Countdown of the Green Light (Within 3 Seconds).

Options	Accelerate through	Decelerate driving	Uniform speed driving
Percentage (%)	9.3%	51.16%	39.54%
Driver Psychology and Emotions	Have urgent matters, accelerate through when ensuring safety, feeling slightly tense; must pass, will complain if the preceding car is slow, feeling impatient, tense, with more focused attention.	Want to accelerate but won't put it into practice; not in a hurry, worried about accidents; worried about being fined; have had accidents before, safety first.	Assess, accelerate if clear, decelerate if obstructed, be ready for accidents; feel nervous at yellow light; prioritize safety, stay calm; accelerate if can pass in two seconds, otherwise stop.

Table 2 presents the survey results on driver behaviour during the final countdown of the green light (within 3 seconds). Among them, 9.3% of drivers chose option A (accelerate through, exit the intersection before the red light comes on). The psychology of these drivers is mostly characterized by "having urgent matters, will accelerate through

the intersection while ensuring safety, feeling slightly tense," and "must pass this time, will complain if the preceding car is slow, feeling somewhat impatient and tense, with relatively focused attention." 51.16% of drivers chose option B (decelerate driving, stop just before the stop line when the green light ends).

The psychology of these drivers is often described as "wanting to accelerate but not putting it into practice," "not in a hurry, not assured about rushing through the last few seconds, worried about accidents," "no need to rush through, afraid of getting fined again if running the red light," and "having learned from past accidents, safety comes first, must stop and wait near the red light." 39.54% of drivers chose option C (uniform speed driving, observing surrounding conditions to determine whether to accelerate through or decelerate to stop). Their psychology includes statements such as "when driving at a uniform speed, observe the surrounding conditions, decelerate and stop if there are pedestrians or other obstructions, accelerate

through if there are no obstructions, to deal with vehicles violating traffic rules from other directions," "will judge whether it's possible to pass through the intersection based on the current road conditions, accelerate through if the situation is good without pedestrian and vehicle interference, decelerate to stop if there is interference," "aware that there is still a yellow light, confident in their driving skills to safely pass through, prepared to stop at any time in case of emergencies, feeling slightly anxious and tense, silently urging the preceding car to speed up," "for safety, if unable to pass through, won't rush through, maintain a calm mindset," and "accelerate through if can pass within 2 seconds, otherwise stop and wait."

TABLE 3: Driver Behaviour at Yellow Light.

Option	Accelerate through	Decelerate driving
Percentage (%)	6.98%	93.02%
Driver Psychology and Emotions	Trust in oneself, nothing will happen; in a hurry, if there's an urgent matter, will attempt to rush through the yellow light when it's relatively safe.	Fear of being caught by cameras; treat yellow lights as red lights, won't run them; safety comes first, prevention is key, maintaining a calm mindset; unwilling to take risks; lack of experience for beginners, might feel a bit nervous; had accidents before, won't dare to run them again.

Table 3 presents the survey results regarding drivers' behaviors during yellow lights. Among them, only 6.98% of drivers chose Option A (accelerate through, exiting the intersection even if it might occupy red light time). Their mentality at the time included "believing they can safely leave the intersection before the red light comes on, relying on their years of driving experience that nothing will happen" and "feeling anxious when there's an urgent matter, and in relatively safe conditions, they will attempt to rush through the yellow light to pass the intersection." On the other hand, 93.02% of drivers chose Option B (decelerate driving (emergency braking), coming to a stop just before the stop line when the yellow light ends). Their mentality mainly comprised thoughts such as "traffic regulations are strictly enforced now, with many cameras, so they dare not run yellow lights," "treating yellow lights as red lights, won't run them," "safety comes first, prevention is key, practicing defensive driving, maintaining a relatively calm mindset," "preferring to stop three minutes rather than rush one second, safety first, no risk-taking," "being inexperienced, might feel a bit nervous," and "having experienced several accidents, they dare not run them again, intending to adhere to traffic rules and be responsible for their own and others' lives."

RESEARCH CONCLUSION

Based on the investigation of drivers' choices to pass through intersections during yellow lights and statistical analysis of video data, this study draws the following conclusions:

- **Inconsistency between drivers' subjective awareness and objective behavior:** Despite most drivers having long driving experience and confidence, believing they can safely leave the intersection before the red light comes on, video data statistics show a high frequency of drivers running yellow lights, especially during peak traffic periods. This indicates a significant disparity between drivers' subjective awareness and actual behavior.
- **Psychological factors behind drivers' behavior:** Drivers' behavior choices are influenced by various psychological factors. On one hand, they may rely on years of driving experience and confidence, thinking they can safely pass through intersections. On the other hand, some drivers may choose to run yellow lights through emotions such as urgency or impatience.
- **Impact of drivers' behavior on traffic safety:** Although some drivers may consider running yellow lights acceptable in relatively safe conditions, frequent running of yellow lights not only increases the risk of traffic accidents but also brings unnecessary inconvenience and danger to other road users.

This study reveals the complex relationship between drivers' behavior and psychological states during yellow lights, reminding traffic management departments and individual drivers to pay attention to driving safety, strengthen the publicity and education of traffic regulations, and reduce the occurrence of traffic accidents to ensure road safety.

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