

# Characteristics of red light running violations in urban areas in Tabuk, Kingdom of Saudi Arabia



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## ABSTRACT

This paper aims to assess the characteristics of red light violations in Tabuk city of the Kingdom of Saudi Arabia. The paper also analyzes the effect of intersection characteristics, such as geometric design, control system and location, on number of violations. Data on traffic characteristics and violations, intersection geometric design (road width, number of lanes, speed) were collected at 38 intersections in Tabuk using video cameras. Statistical analysis reveals that number of approaches, speed, road width, speed on cross road, and width of cross road significantly affects red light violation. Regression analysis implies that road width, red time and speed are the most important factors affecting red light violation.

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## 1. Introduction

Traffic violations, particularly red light violation, are one of the major causes for traffic accidents. Al-Ghamdi [1] indicated that red light running at intersections is the major cause for accidents in Saudi Arabia. It is a big challenge to the transport professionals in the Kingdom of Saudi Arabia (KSA) because of the rise of human fatalities and associated financial losses which result from red light violations. The number of deaths resulting from accidents on national level was 6124 in 2010. Arriyadh Development Authority (ADA) [2] estimated the financial losses to exceed 13 billion Saudi Riyals in the year 2005.

The main goal of installing a traffic signal is to increase the level of traffic safety at intersections by giving priority to each direction and eliminating conflicts. Al-Ghamdi [3] indicated that the main cause for accidents at intersections is running the red lights. The study shows the danger of running a red light and its impact on the level of safety at traffic intersections.

Despite the continuous efforts from local authorities and awareness campaigns in different media means, traffic violations and accidents continue to increase and claim the lives of hundreds of people in the KSA every year. Despite the challenges represented by the traffic violations, there exists dearth of literature and studies that investigate those accidents and their causes through comprehensive data collection and

analysis. This lack of literature signifies the importance of this study which aims at studying the characteristics of red light running in Tabuk and identifying the factors that affect them.

The subsequent sections of the paper present the aim of the study, the relevant literature review, research methodology and data analysis. Finally discussions of the results and the conclusions are also included.

## 2. Research aim

This paper addresses the problem of red light running in Tabuk city of the KSA. The paper aims to analyze the extent of the problem in the city and examine the effects of geometric properties and spatial characteristics of the intersection in Red Light Running (RLR).

## 3. Literature review

Bonneson and Zimmerman [4] identify the vehicle that runs the red light as: “a vehicle that enters the intersection or passes the stop line after the red light turns on”. This means that it is legal for a motorist to pass the stop line when the light is yellow.

Federal Highway Administration has estimated that the cost of red light running crashes amounted to more than 7 billion dollars in the year 1998 [5]. Table 1 shows the red light running rates from previous studies. From the table, it can be seen that the rates vary widely. Most of the previous studies of red light violation focused on analyzing the extent of traffic violations. Retting et al. [6] observed red light running violation rate of 1.3 for every 1000 vehicles in the United States, and that the rate is 3 violations an hour. Another study reported rates ranging from 0.45–38.5 violations for every 1000 vehicle [7,8].

Studies have shown that the frequency red light running violations increase with the volume of traffic and with the increase of the time

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**Table 1**  
Red light running rates in different countries.  
Source: [9].

Location	Number of intersections	Average violations per 1000 vehs	Max reported rate of red light violations	Min reported rate of red light violations
Oxnard, CA	14	1.32	NA	NA
Fairfax, VA	9	3.68	NA	NA
Arlington	2	3	NA	NA
Iowa	13	NA	38.5	0.45
Texas	5	4.1	10.8	NA
Australia	15	3.9	NA	NA
Tuscaloosa, AL	3	5.3	29	0.47

of the signal cycle [7,10]. Baguley [11] noted the negative correlation between the volume of traffic and the number of red light running violations (i.e. red light running violations increase with volume of traffic). He also found that there is a negative relationship between the number of violations and volume of traffic in the minor street of the intersection. Bonneson and Zimmerman [12] investigated the effect of changing the yellow light interval on red light running violations. The study showed that increasing the yellow light interval results in lowering the number of red light violations. Datta et al. [13] claimed that the design of the signal cycle is an effective factor on increasing or decreasing red light running violations.

Local studies such as Al-Ghamdi [3] showed that most types of accidents that take place at intersections in Riyadh are usually the right-angle collisions which explain the fact that the red light is not very efficient in preventing side-crashes between vehicles at intersections. The study of Koushki and Al-Ghadeer [14] indicated that Saudi drivers are non-compliant of traffic rules as compared to drivers of other countries. The study revealed that red-light running, moving during red-light phase, and speeding up to pass through during yellow phase are highly prevalent at intersections in Riyadh. Al-Ghamdi [3] emphasized on the scarcity of research in KSA on the characterization of traffic violations at intersections and devising solution techniques.

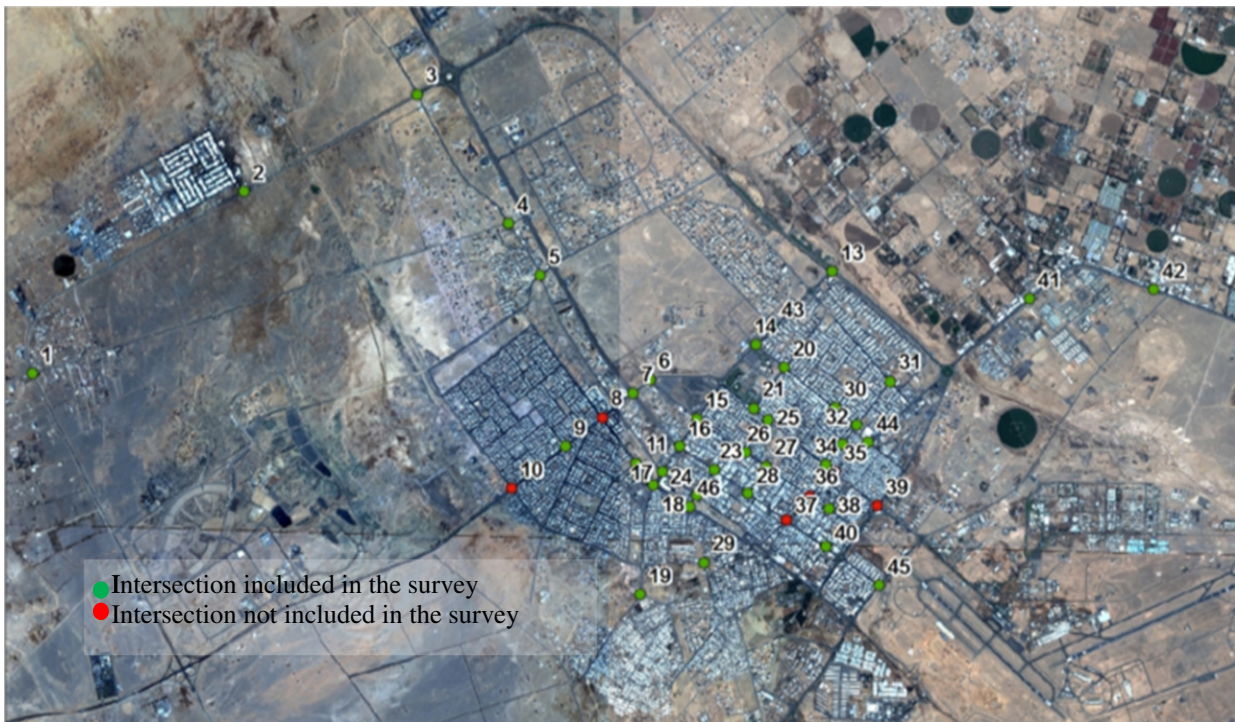
Review of the literature of local studies reveals the scarcity of research that analyzes the characteristics of red light running violations. In this study, the volume of traffic at the intersection, the width of the street, the speed limit and the number of lanes will all be studied as variables that determine the engineering attributes of the intersections affecting red light violation. The study will also focus on the effect of intersections location on red light violation through distance from the nearest signalized intersection and distance from the central business district (CBD).

#### 4. Data collection

This research deals with the problem of red light running traffic violation in Tabuk city. Tabuk is one of the largest and rapidly growing cities in the Kingdom of Saudi Arabia. It is situated in the north of the country and is strategically important for its role as the gateway to the Mediterranean countries. Its population is about 0.5 million with a rate annual growth of 2.5%. Tabuk is an example of a typical Saudi city that is mainly car dependent. Car ownership rate is about 1.8 cars/household. Urban density of Tabuk is very low (100 person/hac).

Data collection has been carried out during the period between 17th September to 24th October, 2011. All traffic surveys were carried out during working days of the week (Saturday to Wednesday), during morning period (6.00 am to 9.00 am) and evening period (6.00 pm to 9.00 pm). The study focused on collecting the following data which are relevant to the nature of the research:

- Intersection engineering characteristics. These include the type of the intersection (number of legs in each intersection), number of lanes in each leg, width of the road, speed limit in each intersection leg and the signal cycle.
- Intersection location characteristics. These include the distance of the nearest signalized intersection and the distance to the CBD.
- Traffic characteristics of the intersection. These include volume of traffic in each leg and the total volume of traffic of the intersection.
- Red light running violation. This includes the number of vehicles that runs the red light as compared to the number of cars allowed to pass the intersection.



**Fig. 1.** The locations of controlled intersections in Tabuk.

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