

Unit 2

Compliance with Traffic Control Device Studies

2.1 Introduction

These studies are useful tools for evaluating the level of effectiveness of traffic control devices and other traffic regulations by statistically comparing the proportion of people (drivers or pedestrians) who are obeying a specific traffic regulation or device with those who choose to ignore it. Such comparison enables the traffic engineer to evaluate the effectiveness of these regulations and detect problematic areas in the transportation system.

2.2 Objective

The objective of this unit is to demonstrate the use of statistical concept in a basic traffic engineering study.

2.3 Theory and Concept

These studies are applicable to any traffic investigation in which the observations are only of two types: Yes or No. Such as obeying the stop sign or fastening seat belt.

2.3.1 Applications

Compliance studies can be done in any situation where non-compliance problem is suspected. In particular, the following situations are common in compliance studies:

- Violating the red signal (crossing on red)

- Not stopping at stop signs
- Exceeding posted speed limit
- Overtaking in zones where overtaking is prohibited by lane marking or traffic signs
- Not fastening seat belts
- Driving without a valid driving license.

2.3.2 Sample-Size Requirements

These studies estimate proportions and consequently Equation (1.12) can be re-arranged and used as follows:

$$N = \frac{pqK^2}{E^2} \quad (1.12)$$

where

N = minimum sample size

p = proportion of drivers obeying the traffic control device or regulation.
If an estimate of P is not available, P may be taken to be 0.5.

q = proportion of drivers not obeying the traffic control device or regulation ($q = 1 - p$)

E = permitted error in the proportion estimate of compliance

K = constant corresponding to desired confidence level assuming normal distribution of the observations (Table 2.1).

Table 2.1: Constant corresponding to level of confidence

Constant, K^*	Confidence Level (%)
1.64	90.0
1.96	95.0
2.00	95.5
2.50	98.8
2.58	99.0

*These values can be obtained from Table 1.1 with confidence level = $1-\alpha$.

2.3.3 Data Collection

The traffic data should be collected in 5 to 15 minutes intervals sampled over all applicable period of the day. The collected observations should always be equal or greater than the required minimum sample size. It is also important to understand that “applicable period of the day” mentioned above, should take into consideration the conditions in which the problem is most likely to exist. For example, speeding and violating the red signal are usually more predominate during off-peak period when traffic volume is light.

The data is collected manually by observers who evaluate each incident and record it by a tick mark in a simple form such as the forms shown in Figures 2.1 and 2.2 for driver compliance with traffic signal and stop sign, respectively.

DRIVER OBSERVANCE OF TRAFFIC SIGNALS FIELD SHEET

Location _____

Time _____ to _____ Weather _____

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Date _____ Recorder _____

Figure 2.1: Field sheet for the study of driver compliance with traffic signals. Source: Box and Oppenlander, 1976.

DRIVER OBSERVANCE OF STOP SIGNS FIELD SHEET

Location _____

Time _____ to _____ Weather _____

N.S.E.W. on		NON-STOPPING	
		PRACTICALLY STOPPED - 0 to 3 mph	
		STOPPED BY TRAFFIC	
		VOLUNTARY FULL STOP	
	Right	Straight	Left



N.S.E.W. on		Straight VOLUNTARY FULL STOP	Right
		STOPPED BY TRAFFIC	
		PRACTICALLY STOPPED - 0 to 3 mph	
		NON-STOPPING	

Date _____ Recorder _____

Figure 2.2: Field sheet for the stop sign compliance study.
Source: Box and Oppenlander, 1976.

2.4 Example Problems

2.4.1

What is the minimum sample size required to estimate the proportion of drivers who are not stopping at a given intersection, such that the error in this estimate will not exceed 5% at 90% confidence level?

Solution:

$$N = \frac{pqk^2}{E^2} \quad (1.12)$$

$$p = q = 0.5 \text{ (no prior estimate is available)}$$

$$k = 1.64 \text{ (Table 2.1)}$$

$$E = 0.05$$

$$N = \frac{0.5(0.5)(1.64)^2}{(.05)^2} = 269$$

2.4.2

In a particular stop sign compliance study, the following data was collected:

Number of driver not stopping	= 178
Number of driver practically stopped	= 54
Number of driver stopped by traffic	= 14
Number of driver voluntarily stopped	= 23
Sample size	= 269

Find the proportion of each category of drivers and construct 90% confidence bound for the proportion of drivers who voluntarily stopped.

Solution:

$$\text{Number of driver not stopping} = \frac{178}{269} * 100 = 66\%$$

$$\text{Number of driver practically stopped} = \frac{54}{269} * 100 = 20\%$$

$$\text{Number of driver stopped by traffic} = \frac{14}{269} * 100 = 5\%$$

$$\text{Number of driver voluntarily stopped} = \frac{23}{269} * 100 = 9\%$$

Confidence bound for the proportion of drivers voluntarily stopping:

$$P = p \pm E_p (t_{\alpha/2}) \quad (1.6)$$

$$P = 0.09 \pm 1.645 \sqrt{\frac{(0.09)(0.91)}{296}}$$

$$P = 0.09 \pm 0.03 \quad \text{or} \quad P = 0.06 - 0.12$$

2.5 Lab Exercise

The students will be divided into groups of two members and each group will be assigned an intersection controlled by either a stop sign or traffic signal. Use the appropriate form (Figure 2.1 or 2.2) to conduct the study after determining the minimum sample size needed. Take the permitted error in the proportion estimate (E) to be 10% and use 95% confidence level in your calculations.