PERFORMANCE EVALUATION OF NOISE PREDICTION MODEL

A DISSERTATION

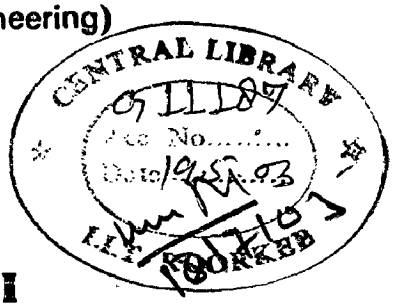
Submitted in partial fulfilment of the requirements for the award of the degree of

MASTER OF TECHNOLOGY

in

CIVIL ENGINEERING

(With Specialization in Transportation Engineering with Diversification to Traffic Engineering)



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CANDIDATE'S DECLARATION

I hereby declare that the work being presented in the dissertation titled **" PERFORMANCE EVALUATION OF NOISE PREDICTION MODEL "** in partial fulfillment of the requirements for the degree of Master of Technology in Civil Engineering, with specialization in Transportation Engineering and diversification into Traffic Engineering, submitted in the Department of Civil Engineering, Indian Institute of Technology, Roorkee, is an authentic record of my own work carried out for a period of six months from September 2002 to February 2003 under the supervision of **Dr. M. Parida**, Assistant Professor, Transportation Engineering Section, Department of Civil Engineering, **Dr.S.S.Jain**, Professor and Co-Ordinator, Centre of Transportation Engineering, Transportation Engineering Section, Department of Civil Engineering, Indian Institute of Technology, Roorkee, Roorkee.

The matter embodied in this dissertation has not been submitted by me for the award of any other degree or diploma.

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CERTIFICATE

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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ABSTRACT

Development of transportation has greatly affected the development of the modern world and development of transport systems has produced both the economic and social benefits to the mankind; however it has polluted the environment too. Studies have shown that motor vehicles operating on highways constitute one of the major sources of noise.

In this dissertation, FHWA TNM Model is used for highway noise prediction and analysis. FHWA TNM calculates noise emission level for five categories of vehicles. For this data has been collected at eight highway locations, in these four locations have data of twenty-four hours and other four locations have night twelve hours' data. And using this, observed data has been compared with predicted data using FHWA TNM.

And it was observed that FHWA TNM Model has been giving good results and it can be applied for Indian environment and the maximum deviation of 5-8 dB(A).

In addition, parametric analysis has been done on the data by banning trucks and banning cars. And it was observed that noise level has been decreasing up to 3-5 dB(A) for trucks and 1-2dB(A) for cars.

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CHAPTER I

INTRODUCTION

1.1 Background

Development of transport systems has produced both the economic and social benefits to the mankind; however it has polluted the environment too. Road transportation is first in causing irreversible damage to the environment. Effects of noise can be cumulative and its influences may cover several aspects of every day life. Road traffic noise has been reported to be a cause of annoyance in many countries of the world [22].

Highway noise is the sum total of the noise produced at the observer point, by all the vehicles moving on the highway. Thus the fundamental component is the noise produced by the individual vehicles, which depend upon on the vehicle type and its mode of operation. The overall noise is also dependent on the characteristics of the vehicle flow and the relative proportions of the vehicle types included in the flow. Knowledge of these factors is thus necessary to define the characteristics of highway noise and to subsequently assess or predict the associated noise level in the surrounding area. [36]

Noise is an important environmental consideration for highway planners and designers. Transportation agencies measure different aspects of highway noise to determine community impacts during urban planning. However, measurement instrumentation and procedures have varied from program to program and agency to agency. Precise, uniform, field measurement practice allows for valid comparison of results from similar studies performed by a variety of transportation practitioners and researchers.

1.2 Traffic Noise Scenario

Noise has always been an important environmental problem for man and community. In the metropolitan cities the traffic noise is a major constituent of the environmental pollution. In some of large metropolitan cities, the noise levels have far exceeded the level of human tolerance.

In 1998 about 60% of the population in Netherlands reported annoyance with road and traffic noise, about 9% of the population has had sleep disturbance due to road traffic. Nearly a quarter of the police force in Bangalore city is suffering from hearing disabilities due to increasing noise pollution levels. Noise levels of 76 dB(A) were measured in residential areas of Bangalore, and levels of 88 dB(A) measured in Calcutta(BBC 1999). Studies conducted by the state pollution control board in the city of Hyderabad have reported high noise levels at all intersections (APPCB 2000). Reports from other countries have established the face that almost all urban areas of the world are affected by the road traffic noise.

1.3 Traffic Noise Levels

Table 1.1 Noise levels at Different Cities

Name of the city	Residential		Commercial		Sensitive		Industrial	
	Day	Night	Day	Night	Day	Night	Day	Night
PrescribedStandards	55	45	65	55	50	40	75	70
Bhopal	60	44	75	57	73	42	68	47
Bangalore	59-79	37-59	68-81	46-64	58-74	-	63-86	42-65
Calcutta	76-86	58-76	70-90	57-78	69-89	65-70	75-82	53-70
Chennai	57-84	45-50	74-80	69-71	46-70	47-50	69-76	63-69
Delhi	53-71	-	63-75	-	62-68	-	65-81	-
Dehradun	50	38	70	50	58	42	50	45
Hyderabad	56-73	40-50	67-84	58-73	62-78	51-67	44-77	42-70
Jaipur	46-82	43-78	64-88	51-80	60-75	55-66	59-81	48-78
Kanpur	49-69	39-59	68-82	57-76	47-61	35-57	63-78	57-63
Kochi	70	51	85	56	72	51	70	61
Lucknow	55	50	70	58	50	40	60	58
Mumbai	45-81	45-68	63-81	60-75	58-77	46-66	73-79	56-72
Varanasi	50	40	70	50	55	40	50	50
Visakhapatnam	74	59	85	70	75	57	75	51

Source: [44]

1.4 Cause of Traffic Noise

In most developing countries, there is little or no enforcement of noise emission limits for road vehicles, even if such regulations exist. Vehicle maintenance is often at a very low level, and vehicles are often overloaded with respect to the vehicles engine power. The result is often very noisy vehicles, with noise emissions far higher than those for similar vehicles in developed countries. Vehicles exist in some developing countries that do not exist in developed countries. Some of these for example, auto rickshaws, can be particularly noisy. Community noise levels in busy urban areas could thus be higher than in similar areas in developed countries [47].

1.5 Traffic Noise control

1.5.1 Special design features

The installation of special design features such as walls or barriers can be effective as a reducer of traffic noises or noises associated with traffic. Such barriers are effective not only in reducing noises adjacent to the street and highway facilities but they can also be effectively utilized as a noise control for off-street parking conditions.Studies have shown that the erection of a five-foot masonry wall can reduce noise level by 5 dB or more. An increase in wall height or thickness will also produce a further decrease in noise levels. Increasing a wall or barrier height by one foot on a six-foot wall has reduced noise levels by 8 dB's and in same instances by as much as 10 dB's.

1.5.2 Land scaping

The buffer planting of right-of-way as a noise control feature without the use of masonry barriers is not entirely dependent upon the width of the buffer. Almost all buffer plantings offer some noise reduction. Buffer plantings ranging from 20 to 50 feet in depth, depending upon the height and density, have produced satisfactory results.Even where the noise reduction may not be considered significant, the effects of the plantings together with their aesthetic value will produce a positive influence.

1.5.3 Elevated or depressed highways

Often a highway in an urban area is built on a grade above or below the elevation of the surrounding property. Such differences in grade provide some shielding of traffic noise, reducing the noise levels at the adjacent property. The difference in dB between the on-grade and other configurations indicates the noise reduction obtained from shielding. For example, at distances of several hundred feet or more from highway, the noise levels from a depressed highway are 7 dB lower than from a highway on-grade. For locations within several hundred feet of an elevated highway the noise levels may be as much as 5 to 10 dB lower than if the highway were on-grade [2].

Unlike other urban highway sections, an elevated highway section is usually provided without noise control features, as the design characteristics preclude positive noise control treatment [1].

1.6 Objective and Scope of Study

The objectives of this dissertation are given below:

1. To collect field data i.e. ambient noise level, classified traffic volume, classified traffic speed and highway geometrics
2. This field data is fitted into Federal Highway Administration Traffic Noise Model (FHWA TNM) to determine the relative prediction efficiency of this model.
3. Development of calibration equations using the FHWA TNM model.
4. Parametric analysis of the field data has been done by banning heavy trucks and cars in some of the locations.

   And for this dissertation, study area is restricted to Delhi only.

1.7 Organization of the Report

First Chapter deals with the introduction to the traffic noise, and it discuss about current traffic noise scenario, and this chapter explains the causes of road traffic noise and traffic noise control also. **Second chapter** deals with the literature review. **Third Chapter** discuss with the parameters affecting traffic noise. These parameters are traffic parameters, roadway characteristics and observer characteristics and it also deals with the FHWA TNM, it discuss about all the adjustments carried out by TNM. And it gives equations for reference energy mean emission level. **Fourth Chapter** discuss about field data study and data collection. And it discuss about various instruments used for field study, physical conditions for measurement and site characteristics. And it is also explains various parameters which are collected in field study. **Fifth Chapter** deals with analysis of field data. **Sixth Chapter** deals with Performance Evaluation of Noise Prediction model. For this, FHWA TNM model has been used for noise prediction and calibration equations are developed using with FHWA TNM model. Parametric analysis has also been done using this data. **Seventh Chapter** deals with the conclusions that have been drawn out of the present study and also suggest some recommendations for further extension.

CHAPTER II

LITERATURE REVIEW

2.1 Noise Studies Conducted around the World

Brach [4] measured and analyzed vehicular road traffic noise near a high-speed highway. Comparison with maximum permissible noise limits has been presented. An extensive study of such noise has shown that level, frequency content and time duration all play an important role in terms of subjective evaluation.

Jacobs et al[16] developed a computer model for predicting traffic noise in built-up situations for free flow traffic conditions and for a flow interrupted by a traffic light. The stream of vehicles is stimulated by a given time headway distribution, and a transfer function obtained from a 1:100 scale model is used to simulate the specific built-up situation.

Johnson and Saunders [17] developed a model based on the assumption that all vehicles are equally spaced and are producing the same maximum noise. They also developed technique for predicting the statistical mean sound level L_{50} due to freely flowing traffic. For higher traffic densities they showed that noise level decreases by 3 dB per doubling of distance.

Thiessen and Olson [39] observed objectionable community noise sources which included automobiles, trucks, buses, motor cycles, trains and power driven equipment

such as lawn mowers and suggested that noise control procedures could be applied to the source, the transmission path, residential zoning or through legislation.

Nelson and Godfrey[24] are studied road traffic noise in rural environment. In this study, traffic noise measurements have been made alongside 26 miles of the A66 within the Lake District National park and in the towns of Keswick and Coker mouth and they constructed a 50dB (A) L_{10} contour for road traffic noise.

Scholes and Vulkan [33] summarized various aspects of noise measuring techniques in order to provide a useful framework to be used for further developments in technique.

Nelson and Piner[25] are classified road vehicles for the prediction of road traffic noise. Measurements of speed, noise level and vehicles had made in road conditions ranging from fairly congested urban situations with speeds around 20 kmph to free flow on motorways with speeds over 100 kmph. The measurements had used to construct approximate vehicle noise levels and speed characteristics over the speed range 20-100 kmph for up to 6 vehicle categories, and used as input in the TRRL computer model of traffic noise.

Langdon and Scholes [21] described a method relating the noise levels produced by traffic to the nuisance caused to people living the neighborhood. They used the traffic noise index, TNI, to forecast the nuisance likely to be produced by a given intensity of traffic and discussed the methods for reducing this nuisance to an acceptably low figure.

Thomas [40] proposed an economic method for reducing traffic noise by using noise-reducing materials.

Samuels and Thomas [31] are studied the measurement and analysis of road noise. In this study, they measured roadside noise levels as a vehicle passes by test track under various conditions of speed, load, and engine operation and so on.

Gordon et al. [12] conducted a study with a view towards formulating those aspects of traffic flow and highway design that influenced traffic noise. They developed a design tool to help highway engineers introduce traffic noise as a parameter in roadway design and route planning.

Scholes et al. [34] proposed design rules for estimating the effects of long noise barriers on the propagation of motorway noise peaks in terms of L_{10}. The rules take into account the effects of wind and ground absorption on barrier performance.

Scholes and Sargent [35] discussed some of the factors to be considered in setting standards for traffic noise and have extended the discussion of possible units for describing traffic noise levels to include the Noise Pollution Level.

Kugler and Piersol [20] evaluated the key procedures in the Design Guide, using field data for selected highway configurations under various normal and environment

conditions. The noise data were reduced statistically in terms of L_{10} and L_{50} noise level descriptors and comparison made between actual field conditions and prediction techniques.

Plotkin [27] developed a model, in two phases, for the assessment of strategies of highway noise control through vehicle noise control. In the first phase a highway noise model was developed with the relationship between individual vehicle noise and overall vehicle highway noise (in terms of L_{EQ} and L_{dn}) clearly defined. Then a computer program was developed and the model successfully employed to predict noise up to 400 feet from a variety of highways.

Roberts and Borthwick [30] responding to increased public response to noise, developed a comprehensive vehicle noise prevention and control program. Data collection, analysis and computer modeling, to evaluate the effectiveness of alternate vehicle noise control strategies, are described.

Delany et al. [8] developed an improved procedure for predicting noise levels L_{10} from road traffic noise. The formulation of the new procedure is discussed and its overall performance assessed with reference to a comprehensive data bank specifically assembled for that purpose.

Kugler et al. [19] in their manual presented an overview of the suggested noise-prediction methodology as a four step process, right from approximating noise impacts, refining the

predictions using computer programs, introducing appropriate noise-control options and lastly evaluating the selected options using the computer program.

Beranek and Newman [2] developed a noise model for free flowing traffic. They showed that propagation loss varies from 3-4.5 dB per doubling of distance depending on the ground cover.

Gilbert [11] proposed a noise model for predicting noise in terms of L_{10} for interrupted flow. This model is suitable for typical urban streets having intersections, traffic signals and other features, which result in interrupted traffic flow characteristics.

Harris et al. [14] have conducted a series of Reference Energy Mean Emission Level (REMEL) measurements of individual vehicle operations in the state of Arizona (USA) to determine the consistency of the data with that contained in FHWA'S Traffic Noise Model (TNM). Comparison has indicated that the two data sets are statistically different at a 95% confidence limit for the three different vehicle categories i.e. Heavy trucks, Medium trucks and Automobiles.

2.2 Traffic Noise Studies in India

Rao and Rao [29] the first comprehensive traffic noise study took place in the city of Visakhapatnam. In this study, noise was measured for different types of land use areas and prediction equations are developed.

Gupta et al [13] studied the road traffic noise for various land uses for mixed traffic flow. For this study, they are selected three sites and one is located in Roorkee town on the

Meerut-Haridwar road. Another area chosen like that to represent to some extent commercial area with the mixed land use. In this study they computed L_{10}, L_{50}, L_{90}, L_{eq} and noise pollution level also evaluated.

Nigam [26] has discussed in detail the methodology for designing an acoustic barrier on a highway with particular reference to situation around the Red Fort, Agra.

Yaganarayana and Ramalingeswara [43] have undertaken a noise monitoring study (at 11 traffic junctions) to measure the overall environmental noise problem in Ramagundam. L_{10}, L_{50}, L_{90} and L_{eq} values have been recorded and on their basis TNI and L_{NP} have been calculated and analyzed.

Srivastava (38) evaluated the environmental noise pollution on SH-45(now NH-58), and models were developed to predict noise levels.

Kumar Vimal (41) carried out a study in Delhi to study the urban noise scenario and has developed equation for equivalent sound level L_{eq}

Siddiramulu [37]developed a software package TNP-MM for traffic noise prediction. This was developed based on the data collected in Delhi and on SH-45(now NH-58).

Pratush Kumar [28] developed model for Indian conditions by calibrating FHWA noise model. The FHWA model calculates noise level through a series of adjustment to a references sound level. These estimated L_{eq} values, which has given R^2 value of 0.793. Thus the equations for estimating the traffic noise levels for Indian conditions need to be calibrated.

Bhattacharya, Jain, Parida et al [3] developed a comprehensive highway noise model for Indian conditions. In this individual vehicle noise level study was carried out at Km 169 on NH-58 and Km. 42 on NH-2. Individual vehicle noise varies with speed. Therefore,

individual vehicle noise levels over a wide range of speeds are taken. And individual noise level equations are developed for bituminous and cement concrete surface.

Neeraj Kumar Gupta [23] developed software NBDP (Noise Barrier Design and Prediction) for design of noise barrier in Visual C++. Visual C++ language is used for developing window-based software. The software can be used to design barrier for two lane and four lane national highways with the both bituminous and cement concrete surfaces.

Sheikh Shahid Salem [36] carried out a study on a national highway-58 and he developed a noise prediction model for Indian traffic conditions. He collected data related to traffic flow rate, traffic speed, gradient, percentage of heavy vehicles and road surface

Devender Singh [9]developed Regression Model for Indian conditions to correlate the traffic parameters and geometric parameters with traffic noise. Statistical analysis of the regression model shows that the model is reliable for prediction of noise in urban areas at 95% confidence level. Using the survey data a new model for Indian condition has been developed using regression analysis.

CHAPTER III

STATE OF ART OF TRAFFIC NOISE PREDICTION

3.1 General

The noise that may result from traffic on a highway is more complicated due to fact that highways are not flat, straight or free from natural terrain variations that affect propagation. The factors like vehicle speed, flow, traffic composition, width of median and number of lanes are not constant. Therefore, for traffic noise, each of these parameters is taken into account.

Traffic parameters, Roadway characteristics and observer characteristics these parameters are effecting traffic noise, and these are listed in Table 3.1

Table 3.1 Parameters affecting Traffic Noise

Traffic Parameters	Roadway Characteristics	Observer Characteristics
Vehicle volume	Flow Characteristics	Observer distance
Vehicle composition	Gradient	Shielding
Average speed	Pavement type	Observer relative height

3.2 Traffic Parameters

3.2.1 Traffic volume

The noise level near the highway depends upon on the number of vehicles. The noise level increases with the increase in traffic volume. Traffic volume is defined as the total number of vehicles flowing per hour. The number of vehicles passing through a fixed point on the road to be counted. The traffic volume is taken as classified traffic volume; it means all individual vehicles are counted separately.

3.2.2 Vehicle composition

Studies have indicated that trucks and buses contribute more noise to the environment as compared to the automobile. Traffic is a composition of different vehicles and the ratio of trucks and buses to total traffic is called truck-traffic mix ratio. This ratio is computed in term of percentage. It has been observed that for very low values of this ratio, traffic noise is controlled by automobile traffic whereas an increase in the ratio will increase the noise level.

3.2.3 Average speed

In a study of urban traffic it was observed that for vehicles traveling within a limited range of road speeds, the noise produced is related to the engine, which in turn varies with each vehicle type. It was further observed that, although the main body of traffic stream was traveling at a particular road speed, many vehicles were either either accelerating or decelerating when passing the measurement position. Thus, it was concluded, that the inclusion of a term for average road speed (which often subject to error in determination). However, some models incorporate the mean traffic speed, v as one of the parameters.

3.3 Roadway Characteristics

3.3.1 Flow characteristics

The fundamental law of traffic flow states that [17]

Flow (vehicles/hour) = concentration (vehicles/km) x speed (kmph)

In practice, when the number of vehicles on a road is not sufficiently large to influence the choice of driving speeds, it is found that, although individual vehicles can cover a wide range of speeds, the majority have a narrow speed distribution, with an effectively constant average value so that flow is directly proportional to concentration. The inverse of concentration is the spacing of successive vehicles, known as headway. At distances greater than about a quarter of the vehicle headway, mean sound level decreases basically at a rate of 3 db per doubling of distance and increases 3db per doubling of flow. Close to the roadway, over the distances that are small compared to vehicle headway, mean sound

level is independent of distance but increases 6 db per doubling of flow, while maximum sound level decreases 6 db per doubling of distance but is independent of flow.

3.3.2 Gradient

The effect of gradient on traffic noise is complex because the multiple sources that constitute motor vehicular noise vary in many and sometimes opposite easy e.g. for an up-grade condition, engine noise of heavy trucks increases significantly [2]. At the same time the speed drops and so does tire noise. Therefore, to determine the effect of gradient, tire noise has to be separated from other noise sources. On the other hand, gradient has little influence on the noise of automobiles.

3.3.3 Pavement type

For vehicles traveling on very rough or very smooth pavement, the basic noise level computations are adjusted upward or downward, as the case may be, for which a 5 db adjustment is recommended by FHWA. For the great majority of new surfaces, no adjustment is needed. Occasionally an old surface, worn badly by studded tires, is encountered for which 5 dB a positive adjustment is justified. Less frequently, a very smooth coated surface warrants a 5 dB negative adjustment. However some models apply a linearly varying correction for different types of roads.

3.4 Observer Characteristics

3.4.1 Observer distance

Most models and prediction equations assume that the traffic is located at a distance d from the observation position [12]. In real life, of course, a highway may have many lanes and the width of the roadway may be such that the observation distance from the near lane is significantly different from the observation distance from the farthest lane. Traffic noise diminishes from the source at the rate of 3 to 4.5 db (A) per doubling of distance on ground cover [4].

3.4.2 Shielding

Three types of shielding namely barriers, structure and plantation are considered [12]. The attenuation effect of a solid, acoustically opaque roadside barrier is quite pronounced, up to 15 dB (A), but if the entire roadway element under consideration is not

shielded, its effectiveness is reduced. The presence of buildings or structures can have an attenuating effect of 3 dB (A) to 5 Db per row of houses and this attenuation should not exceeded a maximum of 10 Db. Plantation, like bushes, trees and similar foliage can attenuate sound only if the growth is dense enough and the depth of the foliage is great. A design value of 5 db for every 100 ft of depth may be used.

3.4.3 Observer relative height

The vertical displacement of an at-grade roadway to a position below or above ground level provides a certain degree of acoustic shielding of the vehicular noise sources from the observation position.[12]

3.5 TNM 1.0

The Federal Highway Administration Traffic Noise Model (FHWA TNM) computes noise level through a series of adjustments to a reference sound level. In theTNM, the reference level is the vehicle noise emission levels, which refers to the maximum sound levels emitted by a vehicle pass by at a reference distance of 15m.Adjustments are then made to the emission level to account for traffic flow, distance, and shielding. These factors are affected by the following equation [7].

$$\mathbf{Leq(1hr)=El_i+A_{traffic\,(i)}+A_D+A_s} \qquad (3.1)$$

where,

EI_i = vehicle noise emission level for the ith vehicle type

$A_{traffic(i)}$ = adjustment for traffic flow, the vehicle volume and speed of the i^{th} vehicle type

A_d = adjustment for distance between the roadway and the receiver

A_s = adjustments for shielding and ground effects between the roadway and receiver

3.6 Traffic Flow Adjustment

The adjustment for traffic flow is simply a function of vehicle volume and vehicle speed.

Of course, the adjustment is computed separately for each vehicle type. The adjustment for traffic flow is given by:

$$A_{traffic} = 10\log_{10} vi/si - 13.2 \qquad (3.2)$$

where,

V_i =vehicle volume in vehicles per hour

S_i =vehicle speed in km per hour

3.7 Distance and Roadway Length Adjustment

The adjustment for distance from the elemental roadway segment to the receiver and for the length of the segment is given by the following:

$$A_d = 10\log_{10}\left[\left(\frac{15}{d}\right)\left(\frac{\alpha}{180}\right)\right] \text{ dB.} \qquad (3.3)$$

where,

d =perpendicular distance to the roadway segment in m

α = angle subtended by the road segment in degrees

This adjustment is number the same for all vehicle types, source heights and frequencies. TNM uses a different equation for cases where the three points of the elemental triangle are collinear (d = 0 and α=0) or nearly collinear. The equation is based on the distances fro, the receiver to the distances from the receiver to the two endpoints of the elemental roadway segment (d1 and d2):

$$A_d = 10\log_{10}\left[\frac{|d2-d1|}{d2d1}\right] + 12 \text{ dB.} \qquad (3.4)$$

3.8 Shielding and Ground Effect

It includes the effects due to the horizontal and vertical geometry. In these adjustment barriers, berms, tree zones, rows, of buildings are considered. Adjustment for ground effects and shielding is:

$$A_S = 10*\mathrm{Log10}(\varphi_s) \qquad (3.5)$$

φ_s =attenuation fraction due to ground and shielding effects

3.9 Vehicle Types

TNM computes highway traffic noise at nearby receivers. In this TNM, vehicles are divided in to 5 categories. [7]

- Automobiles: all vehicles having two axles and four tires – designated primarily for transportation of nine or fewer passengers, i.e., automobiles, or for transportation of cargo, i.e., light trucks. Generally, the gross-vehicle weight is less than 4500 kg (9900lb).
- Medium trucks: all cargo vehicles with two axles and six tires. Generally, the gross vehicle weight is greater than 4,500 kg (9,900 lb), but less than 12,000 kg (26,400 lb).
- Heavy trucks: all cargo vehicles with three or more axle. Generally, the gross vehicle weight is greater than 12,000 kg (26,400 lb).
- Buses: all vehicles having two or three axles and designated for transportation of nine or more passengers.
- Motorcycles: all vehicles with two or three tires with an open-air driver and/or passenger compartment.

3.10 A-weighted Noise-Level Emissions

As a single vehicle passes by a microphone 15 meters to the side, its sound level rises, reaches a maximum, and then falls as the vehicle recedes down the roadway. The maximum A-weighted sound level during the pass by is called that vehicle noise-emission level. These TNM emission-level measurements were confined to relatively flat ground, with the microphone at height 1.5 meters and horizontal distance 15 meters

TNM needs three constants to compute A-weighted noise-level emissions: A, B and C. These three constants depend upon two variables, *i* and *p* (vehicle type and pavement type, respectively), plus whether the vehicle is full throttle or not. Vehicles are full throttle when they accelerate away from traffic-control devices.

For any roadway/traffic situation, the pavement type and throttle condition will be known. The traffic will include several different vehicle types, *i*, each with its own speed, s_i. For these emission calculations, TNM substitutes the relevant constants into the following equation, to determine each vehicle type's total measured noise emissions. The constants for five vehicle types are presented in Table 3.1

$$E_A(s_i) = (0.6214 s_i)^{A/10}\, 10^{B/10} + 10^{c/10} \qquad (3.6)$$

where,

speed, s, is in km/hr and "Log_{10}" denotes the common logarithm (base 10).The above equation yields the energy form, E_A, of the maximum pass by A-weighted sound level for the vehicle type.

Table 3.1 Constants for A-weighted Sound-Level Emissions for Different Vehicles

Vehicle Type	A	B	C
Automobiles	41.740807	0.494698	67.00
LCV	33.918713	19.903775	74.00
Heavy trucks	35.879850	20.358498	80.00
Buses	23.479530	37.318967	74.00
Motorcycles	41.022542	10.013879	67.00

Source: [7]

3.11 Vehicle Noise-Level Emission Equations

In FHWA TNM, vehicles are classified into five categories as Automobiles, Medium Trucks, Heavy Trucks, Buses and Motorcycles. The reference noise emission level equations are presented here in Table 3.2

Table 3.2 Vehicle Noise-Level Emission Equations

Category	Model
Automobile	$10*LOG_{10}(((0.6214s_i)^{4.1740807}10^{0.0494698})+10^{6.7})$
LCV	$10*LOG_{10}(((0.6214s_i)^{3.3918713}10^{1.99.3775})+10^{7.4})$
Heavy Trucks	$10*LOG_{10}(((0.6214s_i)^{3.5879850}10^{2.0358498})+10^{8.0})$
Bus	$10*LOG_{10}(((0.6214s_i)^{2.3479530}10^{3.7318967})+10^{7.4})$
Motorcycles	$10*LOG_{10}(((0.6214s_i)^{4.1022542}10^{1.0013879})+10^{6.7})$

Source: [7]

CHAPTER IV

FIELD STUDIES AND DATA COLLECTION

4.1 The Measurement Method

The method consists of measuring the noise from an actual flow of traffic on a road, which is a flat open surface, free from large reflecting surfaces, such as parked vehicles and signs, within 15m radius of either the vehicle path. The site should also not be influenced by other traffic or extraneous noise.

4.2 Selection of Site

For this study, data was collected from eight locations in Delhi. The sites are chosen like that, they represent current urban and semi-urban conditions. And these locations are divided into different zones like Residential zone, Commercial zone, and Silence zone, Heavy Traffic Zone.

4.3 Physical Conditions for Measurement

4.3.1 Road surface

Measurements were required to be made when the road surface, in the measurement area, was dry.

4.3.2 Measuring equipment

4.3.2.1 Sound level meter

For the purposes of all measurements, sound level meters (SLMs) should perform true numeric integration and averaging. Components of an SLM include: a microphone with preamplifier, an amplifier, frequency weighting, input gain control, time-averaging, and an output indicator or display. Selection of a specific model of sound level meter should be based upon cost and the level of accuracy desired [47].

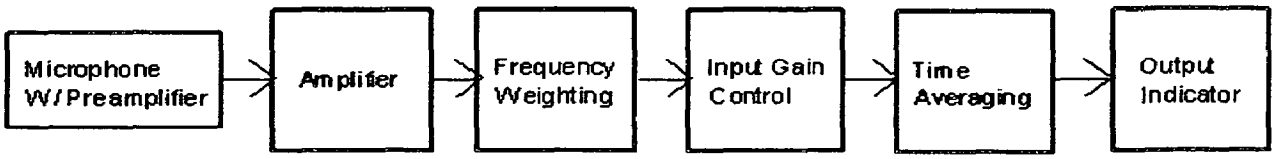


Fig 4.1. Components of a sound level meter

The accuracy of an SLM is characterized by its "type." There are three types of sound level meters available: Types 0, 1, and 2. Type 0 sound level meters are used for laboratory reference purposes, where the highest precision is required. Type 1 sound level meters are designed for precision field measurements and research. Either Type 1 or Type 2 sound level meters are acceptable for use in traffic noise analyses for highway projects.

4.3.2.2 Doppler-radar gun

A Doppler-radar gun may be used to measure vehicle speed. When using a radar gun, it should be placed at least 120 m upstream of traffic flow. This placement has been shown to minimize effects on traffic flow resulting from driver curiosity.

The radar gun should be positioned at a distance of no greater than 10 m (31 ft) from the centerline of the path of the vehicle being measured. This will ensure that the angle subtended by the axis of the radar antenna and the direction of travel of the vehicle will be less than 5 degrees. The resulting uncertainty in vehicle speed readings, due to angular effects on Doppler accuracy, will not exceed 0.5 km/h over a speed range from 15 to 110 km/h [47]

4.4 Site Characteristics

- A flat open space free of large reflecting surfaces, such as parked vehicles, signboards, buildings, or hillsides, located within 30 m (100 ft) of either the vehicle path or the microphone(s) (Fig 4.2) [47].

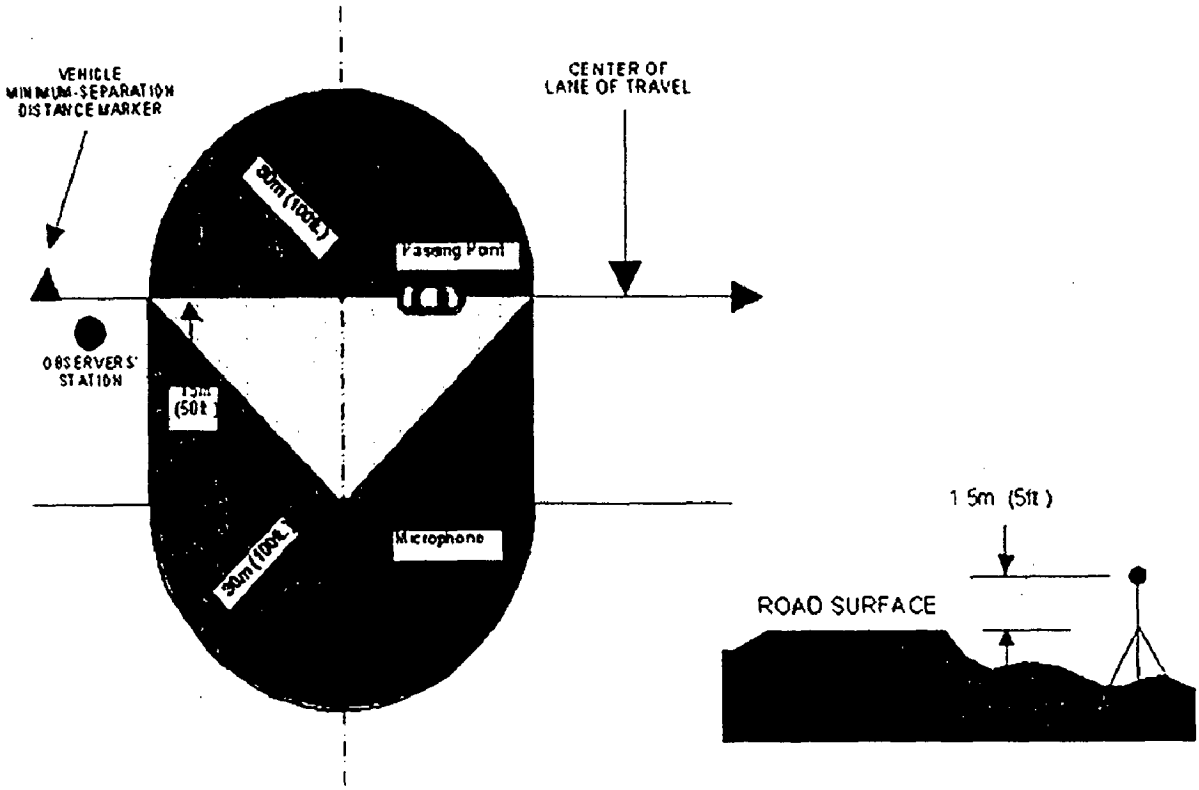


Figure 4.2. Site Geometry.

- Ground surface within the measurement area is free of wet and representative of acoustically hard, e.g., pavement, or acoustically soft, e.g., grass, terrain.
- Line-of-sight from the microphone(s) to the roadway is unobstructed within an arc of 150 degrees.
- Vehicle path, i.e., roadway lane, is smooth, dry concrete, dense-graded asphalt, or open-graded asphalt, and free of extraneous material, such as gravel or road debris.
- Site is to be located away from known noise sources, such as airports, construction sites, rail yards, or other heavily traveled roadways.
- Site is to exhibit constant-speed roadway traffic operating under cruise conditions at speeds between 15 and 110 km/h and located away from intersections, lane merges or any other features that would cause traffic to accelerate or decelerate.
- The above characteristics and parameters are presented for vehicle noise emission level measurements, in the TNM.

4.5 Identification of Study Locations

This field study is mainly intended to measure the noise level in different locations of Delhi and hence locations were chosen as to represent the different zones within a urban area like, Residential Zone, Commercial Zone, Silence Zone and Heavy Traffic zone. The locations chosen for this particular study are shown in Table 4.1. The details of the selected locations are shown in Table 4.2. Photos showing some of the locations are shown from Photo 4.1 to 4.5. The map of Delhi showing all locations for field studies is presented in Photo 4.6. The site diagrams of all locations are shown from Fig 4.3 to 4.10.

Table 4.1 Locations Chosen for Field Studies

Type of Zone	Location
Residential Zone	• New Friends Colony • Laxmi Nagar
Commercial Zone	• Karol Bagh • Red Fort
Silence Zone	• Safdarjung Hospital • AIIMS Hospital
Heavy Traffic Zone	• India Gate • I.T.O

Table 4.2 Details of Locations Chosen for Field Study

Location Code and Number	Name of The Place	No. of Lanes	Details of Median	Type of Land use	Type of Road	Data Duration
L1	Safdarjung Hospital	Six Lanes	Present	Silence	Bituminous	12 hours
L2	Karol Bagh	Six Lanes	Present	Commercial	Bituminous	12 hours
L3	India Gate	Six Lanes	Present	Heavy Traffic	Bituminous	12 hours
L4	New Friends Colony	Four Lanes	Present	Residential	Bituminous	12 hours
L5	I.T.O	Seven Lanes	Present	Heavy Traffic	Bituminous	24 hours
L6	Laxmi Nagar	Seven Lanes	Present	Residential	Bituminous	24 hours
L7	AIIMS Hospital	Six Lanes	Present	Silence	Bituminous	24 hours
L8	Red Fort	Seven Lanes	Present	Commercial	Bituminous	24 hours

Photo 4.1 A View of Location 1(Safdarjung Hospital)

Photo 4.2 A View of Location 4(New Friends Colony)

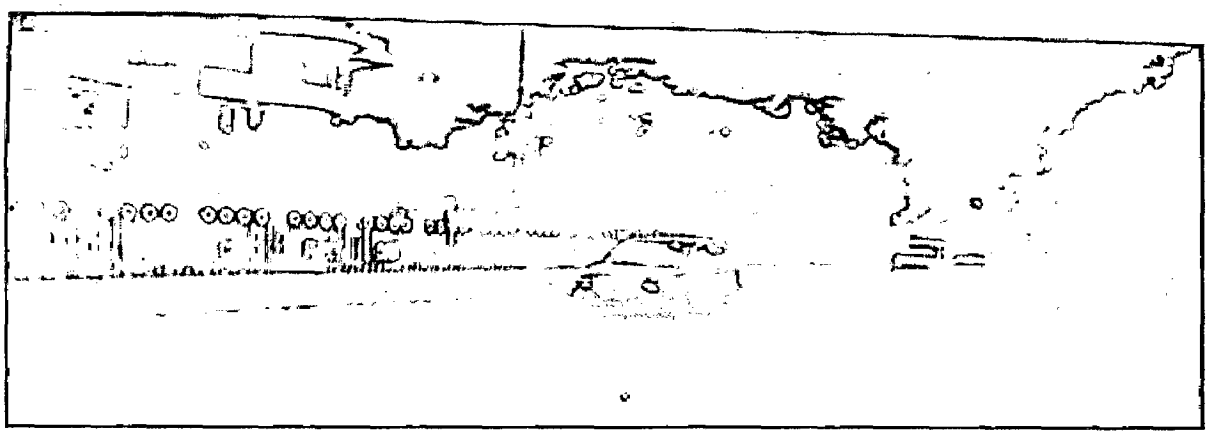


Photo 4.3 A View of Location of Location 6(Laxmi Nagar)

Photo 4.4 A View of Location 5 (I.T.O)

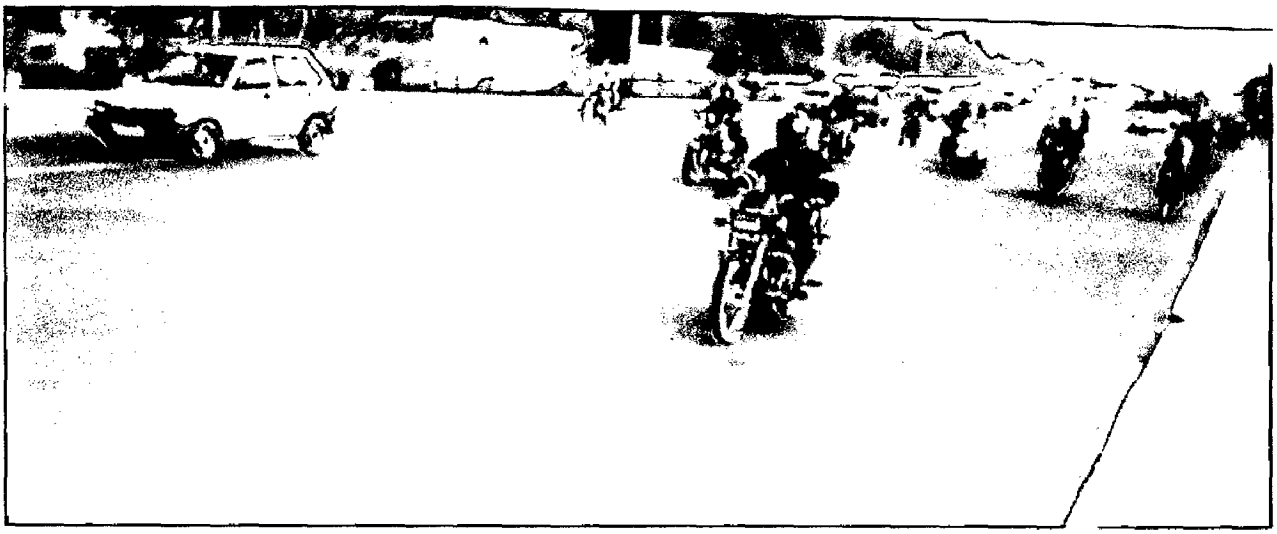


Photo 4.5 A View of Location 7(AIIMS)

Photo 4.6 Map of Delhi with All Locations of Field Study

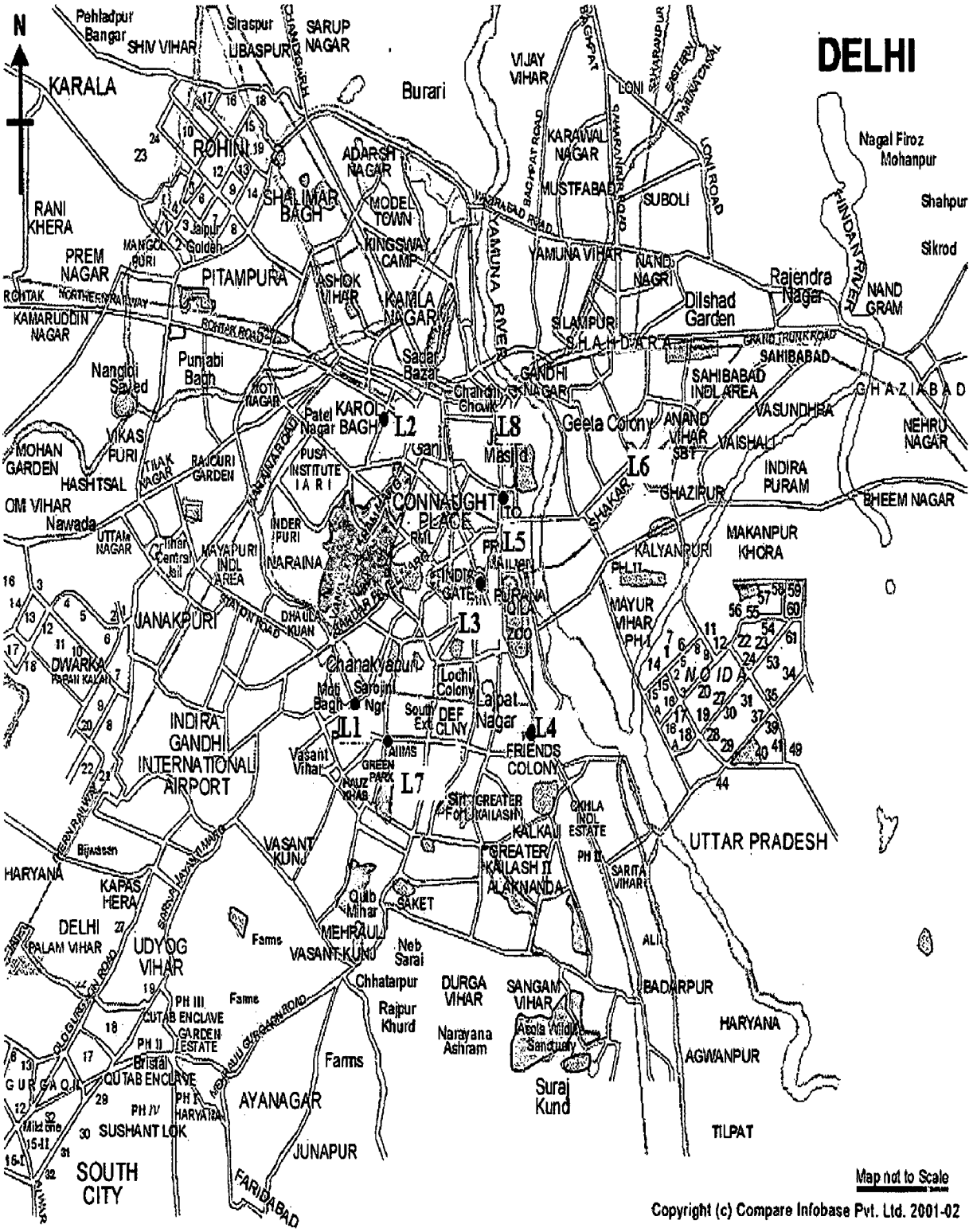
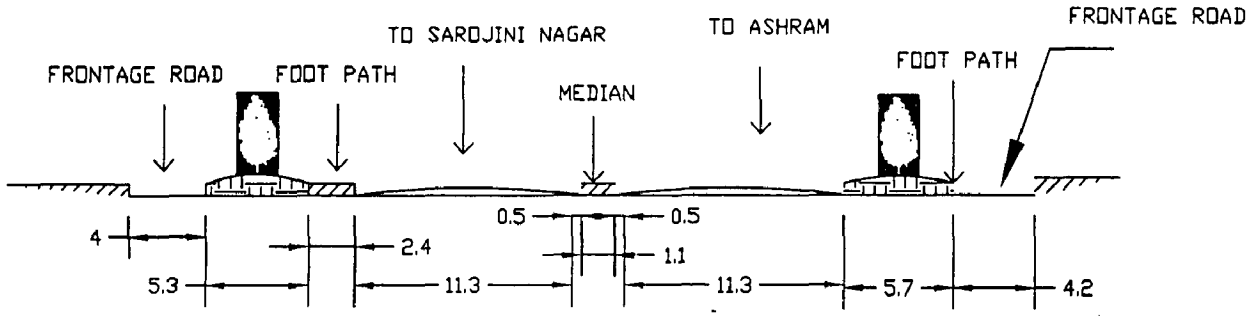
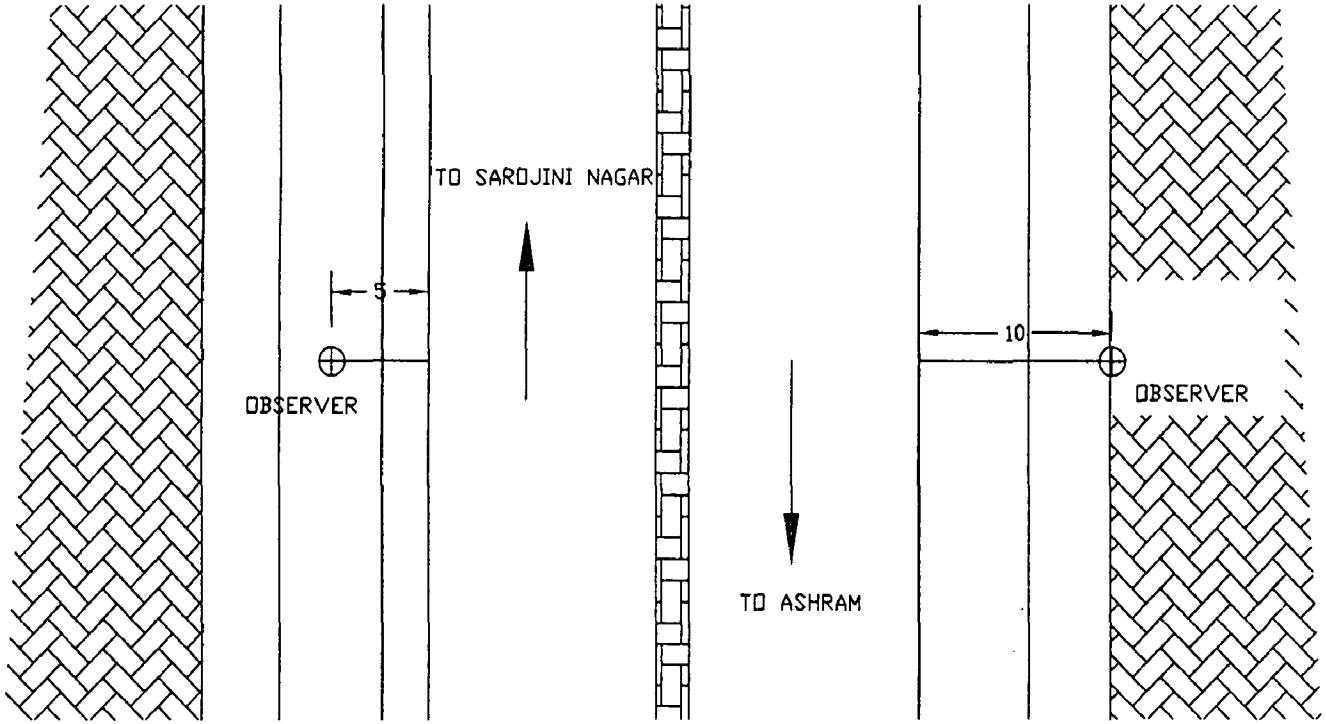


Fig. 4.3 A View of Location 1

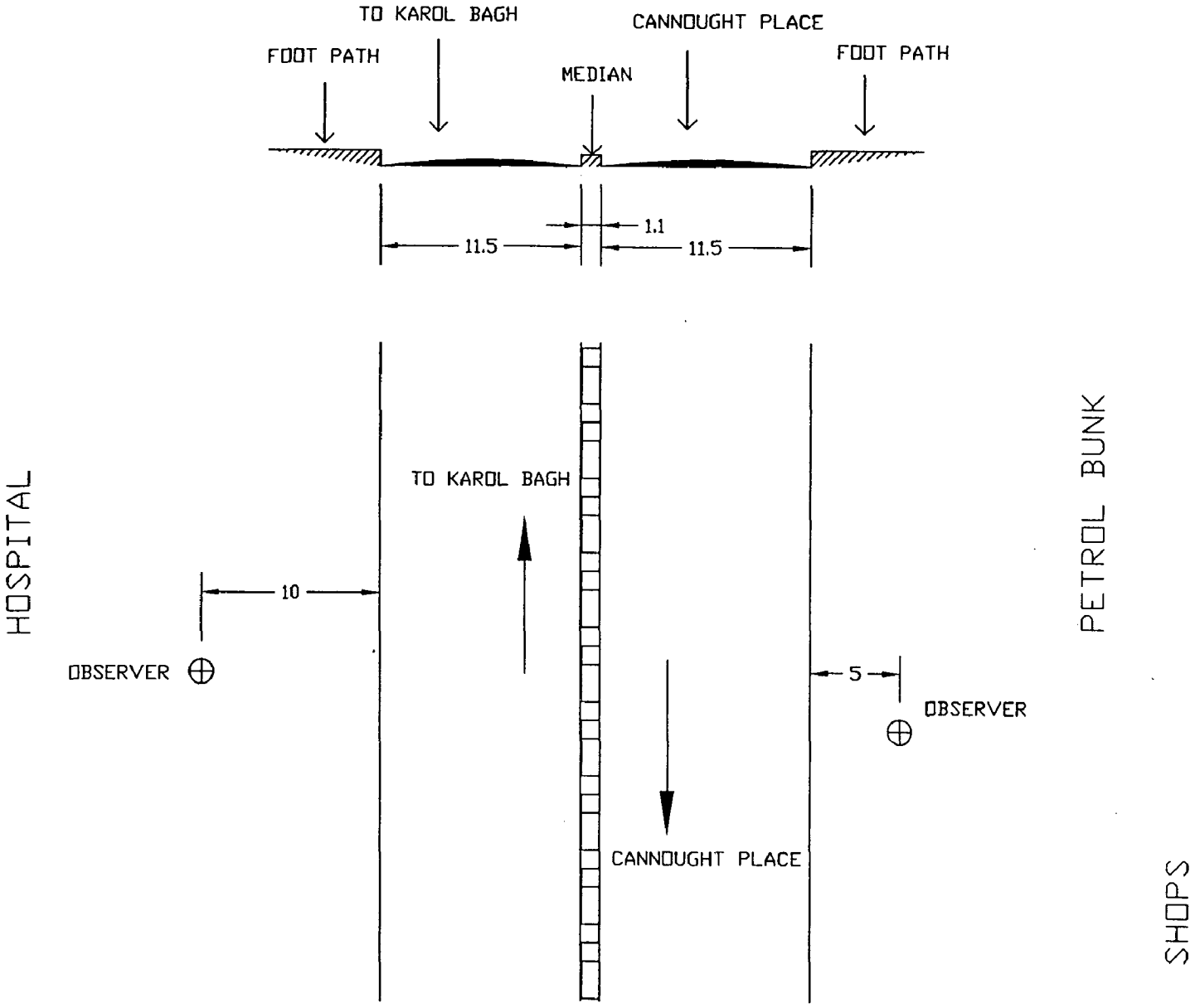




NOTE: ALL DISTANCES ARE IN METRES

C/S AND L/S AT LOCATION 1- SAFDARJUNG HOSPITAL

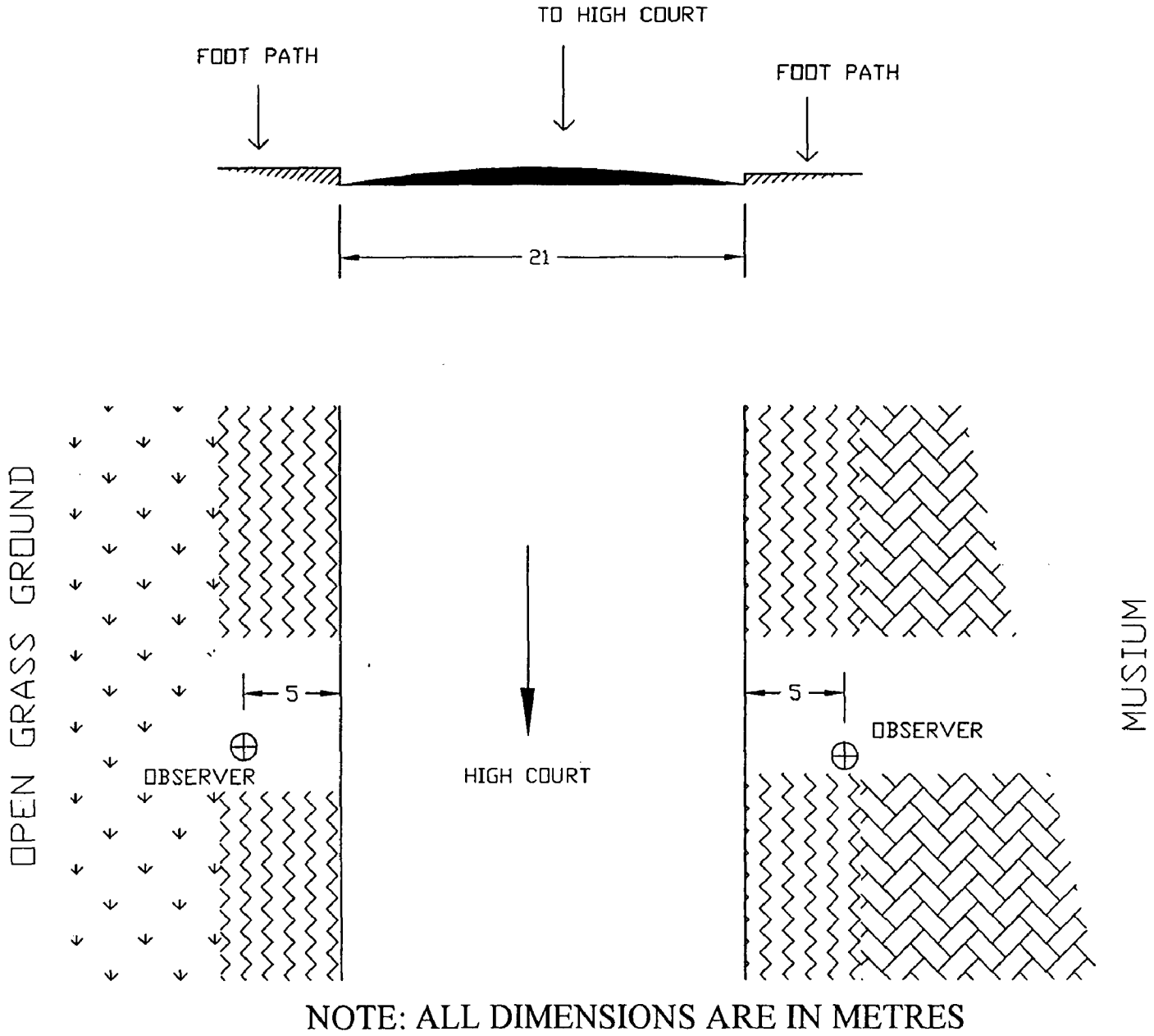
Fig 4.4 A View of Location 2



NOTE:ALL DIMENSIONS ARE IN METRES

C/S AND L/S AT LOCATION 2- CANNOUGHT PLACE

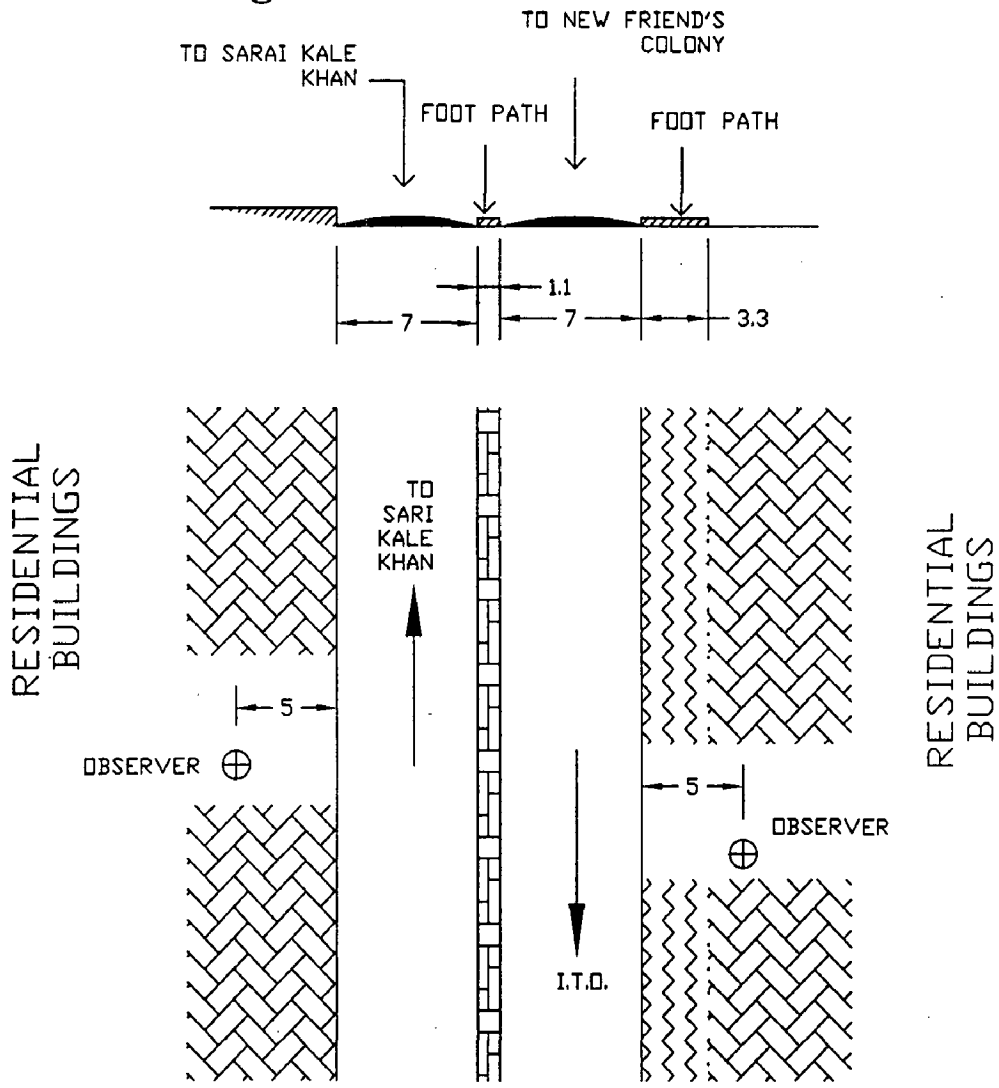
Fig. 4.5 A View of Location 3



NOTE: ALL DIMENSIONS ARE IN METRES

C/S AND L/S AT LOCATION 3-INDIA GATE

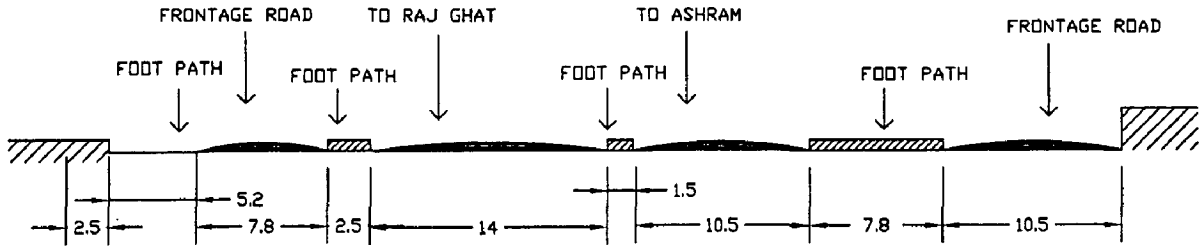
Fig 4.6 A View of Location 4

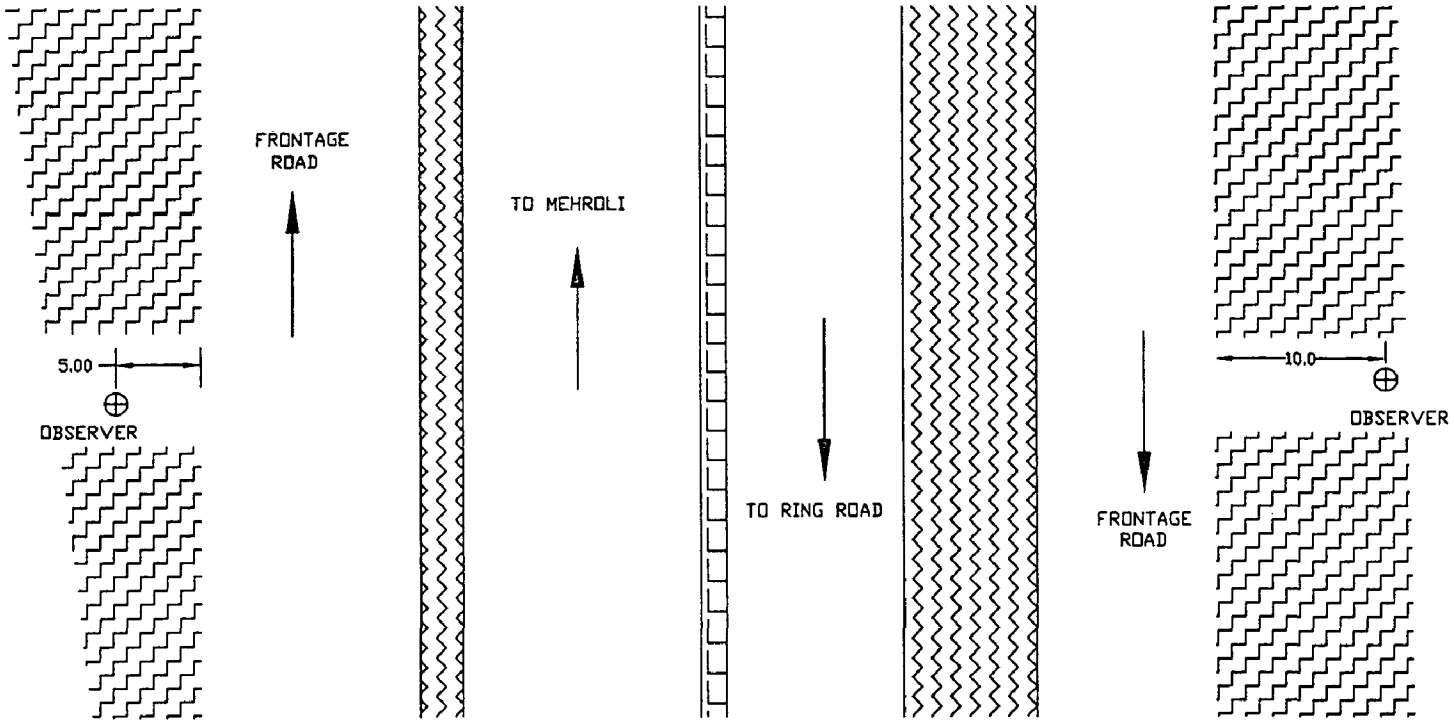


NOTE: ALL DISTANCES ARE IN METRES

C/S AND L/S AT LOCATION 4- NEW FRIEND'S COLONY

Fig 4.7 A View of Location 5

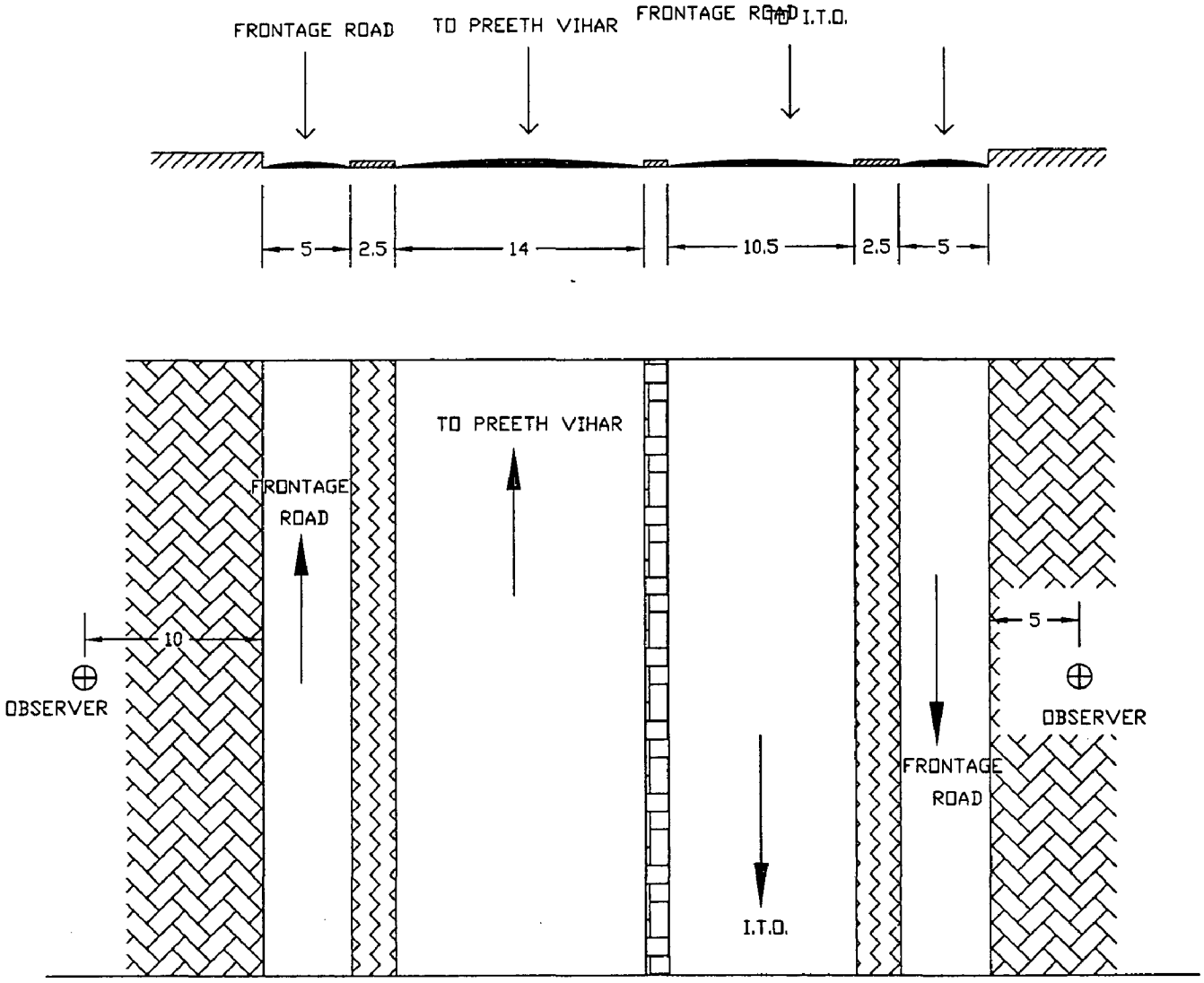




NOTE: ALL DIMENSIONS ARE IN METRES

C/S AND L/S AT LOCATION 5 -I.T.O.

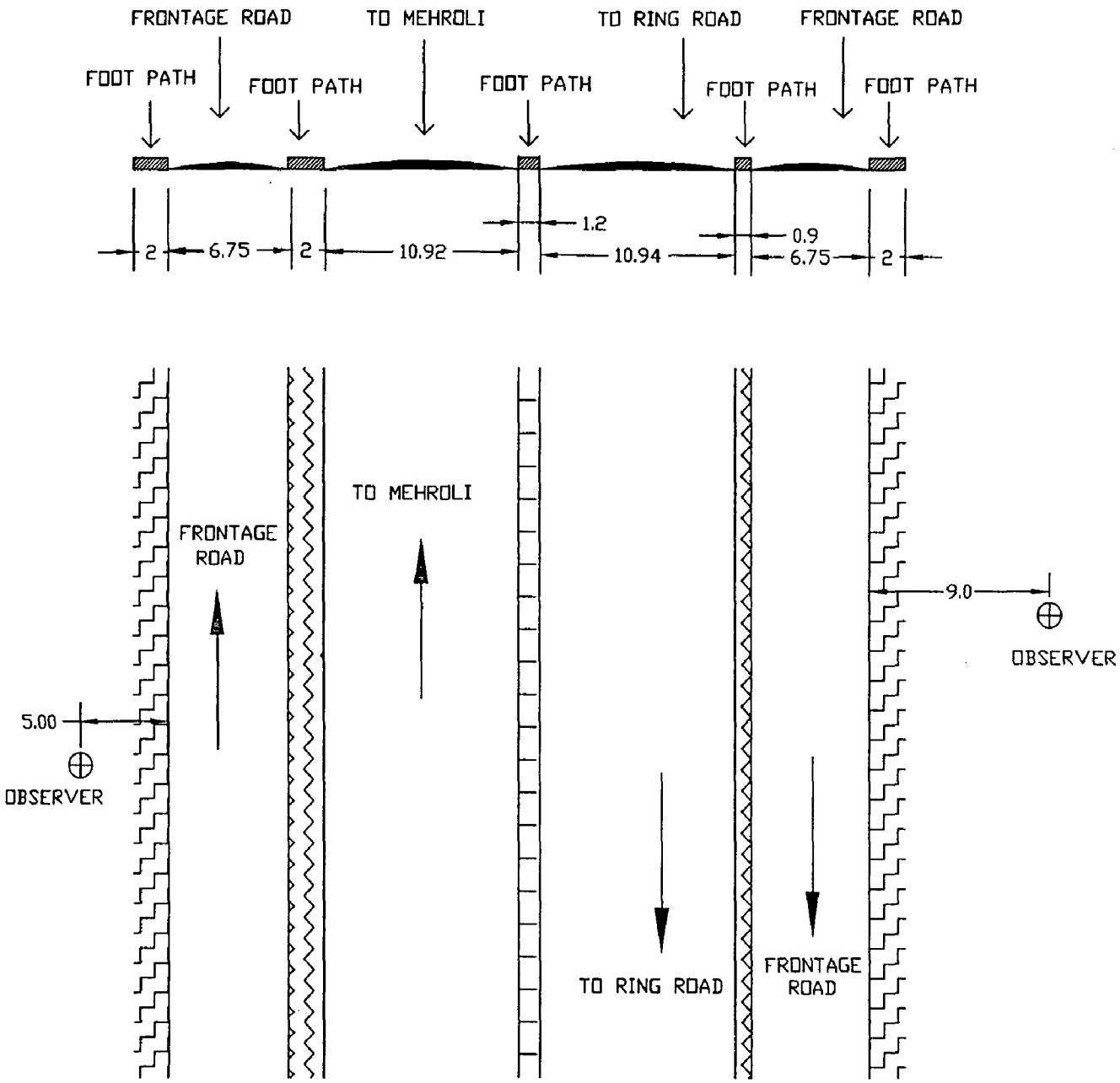
Fig. 4.8 A View of Location 6



NOTE : ALL DIMENSIONS ARE IN METRES

C/S AND L/S AT LOCATION 6 - LAXMI NAGAR

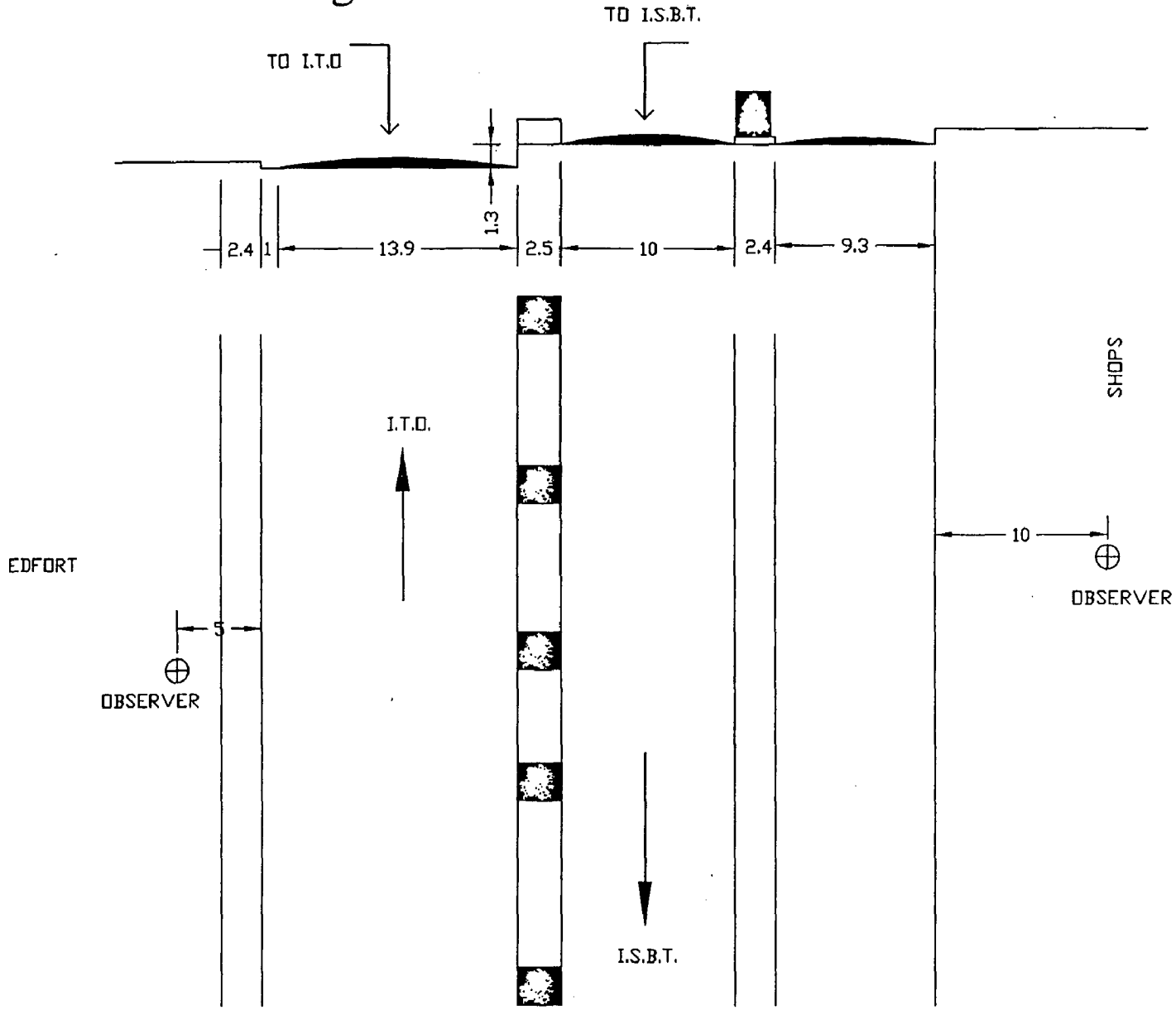
Fig. 4.9 A View of Location 7



NOTE:ALL DIMENSIONS ARE IN METRES

C/S AND L/S AT LOCATION 7 - A.I.I.M.S

Fig . 4.10 A View of Location 8



NOTE: ALL DISTANCES ARE IN METRES

C/S AND L/S AT LOCATION 8 - REDFORT

4.6 Data Collection

4.6.1 Ambient noise level

The ambient noise level data for eight selected locations was collected using the sound level meter (SLM). The ambient noise level data was selected at varying distances from the pavement edge to incorporate effect of distance. And the sound level meter was placed at a height of 1.5 m from the road surface level. In the present study, a noise data was taken for full one hour at varying distances.

4.6.2 Classified traffic volume

This classified traffic volume was conducted for duration of 24/12 hours at each of selected sites. For this classified traffic volume study, manual method was used to count and classify traffic flowing past a fixed point. The data was collected giving the breakdown of traffic in each direction of travel.

4.6.3 Classified traffic speed

Speed is one of the most important characteristics of traffic and its measurement is a frequent necessity in traffic engineering studies. In this study, the classified traffic speed was collected for both directions using the radar gun. For this, sampling period of 20 minutes was selected for one hour. For developing individual noise level equations, classified traffic speed data is very important parameter.

CHAPTER V

DATA ANALYSIS

5.1 Overview

In the present study, eight sites have been selected and data has been collected from all these locations. In this four locations have full 24 hours data and other four locations have 12 hours data.

At each site following data have been collected;

1. Ambient Noise Level
2. Classified Traffic Speed
3. Classified Traffic Volume
4. Geometric Data

5.2 Traffic Noise Level Parameters

Ambient noise data has been collected in different locations for period of 24/12 hours. This data has been taken by varying distances from pavement edge. By analyzing this data, common traffic noise parameters are calculated for every one hour period. This parameters are L_{10},L_{50},L_{90}, and L_{eq}. Computations of noise parameters at different locations are shown in the table 5.1 and observed Leq at various locations are shown per every one hour are shown from the table 5.6 (a-f).

5.3 Traffic Volume

The traffic volume of 24/12 hours has been presented in the table 5.2. And, the traffic volume at all locations has been summarized in the form of total traffic volume for both directions for every hour. This data has been presented from the table 5.4 (a-f)

5.4 Traffic Speed

With the help of radar gun, speeds of various classes are measured for both the directions for every hour. This data has been presented from the table 5.5 (a-f) and average speeds of all locations are presented in the table 5.3.

Table 5.1 Computations of Noise Parameters at Different Locations

Site Code	Distance from edge of pavement	Noise Parameters (in dB(A))					
		L_{10}	L_{50}	L_{90}	L_{eq}	Data Duration	Type of Zone
L1	5	85	80.66	77.01	81.81	12 hours	Silence
	10	85.26	80.12	76.19	81.58		
L2	5	84.98	80.78	76.90	81.94	12 hours	Commercial
	10	86.2	79.1	72.66	82.3		
L3	5	90.91	83.75	78.88	86.33	12 hours	Heavy Traffic
L4	5	87.7	78.71	72.35	82.91	12 hours	Residential
	5	89.1	82.21	74.97	86		
L5	15.5	80.79	74.58	71.0	76.31	24 hours	Heavy Traffic
	5	88.2	79.33	74.45	83.98		
	17.5	83.46	76.84	72.2	79.2		
	10	89.61	82.54	77.90	85.11		
L6	6	85.48	78.76	74	81.13	21 hours	Residential
	10	80.98	74.9	70	77.0		
	10	85.16	73.9	66.56	80.14		
	10	87.88	82.12	77.41	84.0		
L7	5	84.5	76.0	69.58	80.49	24 hours	Silence
	9	83.76	77.89	73	80		
L8	10	81.31	74.82	69.47	77.36	24 hours	Commercial
	6	84.94	78.67	73.63	81.16		

Table 5.3 Summary of Traffic Speed

S.NO	Site Code	Direction	Classified Traffic Speed					
			Car/Jeep	LCV	Bus	Sc/Mc	Truck	A.R
1	L1	S.Nagar to Ashram	48.9	39.5	37.5	44	29.7	34.7
		Ashram to S.N	45.4	38.4	42.0	42.8	36.48	34.4
2	L2	K.B to C.P	38.3	33.3	33.7	35.5	24.8	28.7
		C.P toK.B	40.1	33.8	32.8	33.7	20.2	28.7
3	L3	High Court to UPSC	41.25	40.4	27.2	38.7	35.4	33
4	L4	N.F.C to S.K.K	43.7	28	20.5	35	18.3	30.2
		S.K.K to N.F.C	49.6	26	23.2	41.8	15	32.4
5	L5	I.P Depot. to Raj Ghat	49.5	44	44.6	44.6	36	37.5
		Raj Ghat to I.P.Depot.	51.6	46.7	43.6	47	39.5	38.8
6	L6	Preeth Vihar to I.T.O	37.8	32.3	29.8	36.4	18.7	28.9
		I.T.O to Preeth Vihar	38.8	31.2	31	36.2	24	31.1
7	L7	Ring Road to Mehrauli	46	35.5	34.3	42.3	17.5	31.4
		Mehrauli to Ring Road	46	36.6	31.67	41	23.4	31
8	L8	ISBT to ITO	35	31.7	29	35	18.3	29.6
		ITO to ISBT	36	31.7	30	36	22.6	30.3

Table 5.4 Classified Traffic Volume for all Locations

AIIMS														
RING ROAD TO MEHRAULI							MEHRAULI TO RING ROAD							
TIME(hrs)	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R
7:00-8:00	144	60	88	583	3	0	24	228	77	264	140	2	0	112
8:00-9:00	535	100	191	336	6	0	178	220	45	173	276	3	0	135
9:00-10:00	504	63	262	763	0	3	208	310	43	174	500	3	1	178
10:00-11:00	571	50	204	843	0	0	204	561	40	197	619	4	1	250
11:00-12:00	462	95	242	692	5	2	260	662	44	144	657	6	1	376
12:00-13:00	464	88	177	552	1	0	185	635	36	152	697	5	1	331
13:00-14:00	602	105	192	614	3	0	266	955	65	112	699	5	0	230
14:00-15:00	678	107	199	641	11	5	284	665	50	113	711	12	1	306
15:00-16:00	676	115	198	673	4	0	311	686	39	118	686	10	0	248
16:00-17:00	693	71	170	657	6	0	241	605	27	100	661	8	0	195
17:00-18:00	787	104	194	668	1	1	265	605	30	134	632	8	0	240
18:00-19:00	835	97	203	822	1	0	345	815	32	204	590	3	0	315
19.00-20.00	1276	462	147	53	1	7	136	998	721	51	122	1	0	174
20.00-21.00	1275	334	83	54	3	8	165	817	564	37	83	3	0	221
21.00-22.00	780	309	71	110	2	19	126	553	399	54	65	6	0	217
22.00-23.00	660	224	39	86	11	2	110	524	251	33	23	8	0	165
23.00-24.00	625	169	37	15	18	6	85	233	173	25	7	24	1	141
24.00-1.00	475	99	15	6	13	2	92	183	115	13	5	20	1	98
1.00-2.00	265	34	17	6	13	3	43	106	76	24	1	20	0	61
2.00-3.00	81	32	26	5	14	0	48	67	34	31	4	28	0	37
3.00-4.00	57	28	41	3	29	0	21	26	21	20	1	32	0	13
4.00-5.00	37	23	26	7	15	0	29	33	23	14	3	10	0	27
5.00-6.00	79	30	22	7	9	0	43	148	55	22	11	8	0	72
6.00-7.00	135	76	46	22	9	0	58	318	83	37	45	6	0	104

C/J –Car, Jeep , LCV – Light Commercial Vehicle, Sc/Mc- Scooter, Motor Cycle, T.T – Tractor Trailer, A.R – Auto Rickshaw

ISBT TO ITO						RED FORT			ITO TO ISBT					
TIME(hrs)	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R
7.00-8.00	186	84	76	351	5	4	322	172	118	169	333	8	0	356
8.00- 9.00	201	96	191	203	1	4	332	179	130	147	310	0	0	272
9.00- 10.00	242	117	188	454	1	5	444	208	160	166	304	0	1	303
10.00-11.00	245	136	193	479	0	8	377	292	119	177	485	0	0	225
11.00-12.00	361	157	226	519	0	6	259	337	235	208	467	0	0	226
12.00-13.00	352	114	188	483	0	6	182	324	133	130	474	0	0	252
13.00-14.00	545	116	195	459	0	5	177	292	73	101	573	1	0	309
14.00-15.00	797	123	317	411	0	7	45	321	72	70	490	0	0	371
15.00-16.00	810	104	330	494	0	9	80	378	70	111	448	0	0	292
16.00-17.00	725	142	135	547	0	6	173	425	73	89	486	0	0	266
17.00-18.00	741	143	182	1033	0	6	286	476	79	110	474	0	0	307
18.00-19.00	920	176	215	1064	0	7	339	479	103	125	579	0	0	369
19.00-20.00	1299	1215	75	141	1	1	317	1085	459	128	162	1	0	277
20.00-21.00	262	1099	80	157	1	1	322	1190	388	119	140	1	0	421
21.00-22.00	230	449	94	91	3	0	444	1021	297	100	90	3	0	274
22.00-23.00	169	202	64	55	3	1	287	714	256	88	74	15	0	185
23.00-24.00	131	162	44	39	1	0	259	344	227	50	42	11	0	131
24.00-1.00	119	98	20	21	9	0	182	300	138	40	22	14	0	186
1.00-2.00	46	65	21	12	5	1	177	186	61	27	26	17	0	140
2.00-3.00	60	22	13	1	8	0	35	77	29	18	7	9	0	143
3.00-4.00	71	48	17	8	17	0	80	75	22	17	8	6	1	115
4.00-5.00	61	50	13	15	11	1	173	140	31	39	24	12	0	181
5.00-6.00	110	142	21	56	5	1	236	333	68	42	49	15	0	236
6.00-7.00	165	84	31	60	6	1	339	392	116	58	41	8	0	302

PREETH VIHAR TO ITO							LAXMI NAGAR	ITO TO PREETH VIHAR						
TIME(hrs)	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R	C/J	LCV	Bus	Sc/Mc	Truck	T.T	A.R
6:00-7:00	268	115	126	139	5	0	201	138	34	38	49	14	6	79
7:00-8:00	504	215	284	371	1	3	286	273	83	137	158	1	6	129
8:00-9:00	902	305	382	550	4	0	267	588	164	432	391	0	5	453
9:00-10:00	1403	247	449	1042	2	0	279	981	105	291	889	0	5	336
10:00-11:00	1486	311	461	1555	1	0	251	1030	103	252	1109	0	15	348
11:00-12:00	1426	288	440	1425	5	1	288	921	123	303	909	0	9	494
12:00-13:00	1364	313	377	872	4	1	312	1111	142	328	1070	0	5	500
13:00-14:00	1089	233	319	621	0	1	206	330	96	200	539	0	6	287
14:00-15:00	1035	199	301	373	7	0	197	150	35	195	582	0	7	240
19.00-20.00	1077	703	62	129	0	0	211	965	960	41	129	0	0	284
20.00-21.00	986	709	26	123	6	0	249	1045	775	27	111	0	0	235
21.00-22.00	853	621	118	104	15	0	283	765	705	71	83	0	2	169
22.00-23.00	466	498	111	46	63	0	171	677	920	108	71	7	0	119
23.00-24.00	375	287	76	20	19	0	108	735	683	66	50	11	4	122
24.00-1.00	239	155	50	22	11	1	129	484	279	44	20	18	0	81
1.00-2.00	168	80	34	6	12	0	51	245	46	56	11	11	6	45
2.00-3.00	60	5	20	3	13	0	35	178	25	51	10	29	2	65
3.00-4.00	20	7	44	10	13	0	50	78	37	52	14	33	0	50
4.00-5.00	21	16	28	18	7	0	72	79	26	69	5	41	0	63
5.00-6.00	27	81	50	24	16	4	131	140	32	46	23	30	0	92
6.00-7.00	76	210	75	38	18	0	164	219	77	72	41	34	0	134

I.P DEPO TO RAJ GHAT								ITO	RAJ GHAT TO I.P DEPO						
TIME(hrs)	**C/J**	**LCV**	**Bus**	**Sc/Mc**	**Truck**	**T.T**	**A.R**	**C/J**	**LCV**	**Bus**	**Sc/Mc**	**Truck**	**T.T**	**A.R**
7:00-8:00	261	134	120	120	43	2	140	792	111	78	283	15	0	88
8:00-9:00	1050	140	145	416	10	1	375	845	89	144	616	7	2	198
9:00-10:00	1775	103	170	915	6	0	390	1054	141	207	1127	21	3	360
10:00-11:00	2025	84	175	950	50	0	345	1096	117	191	1498	10	3	293
11:00-12:00	1450	170	135	930	16	0	335	1130	239	158	1194	41	0	236
12:00-13:00	1540	264	168	1085	35	0	360	1148	266	249	1109	36	1	380
13:00-14:00	1045	219	106	925	23	0	325	118	266	138	1095	46	0	361
14:00-15:00	1030	311	95	1127	50	0	305	1170	302	188	1149	42	2	316
15:00-16:00	1020	457	156	1101	89	0	405	1133	343	195	1187	40	2	384
16:00-17:00	1225	315	140	940	41	0	410	1153	380	203	1254	50	0	409
17:00-18:00	1405	312	245	1122	29	0	435	1233	239	208	1322	12	0	424
18:00-19:00	1370	212	196	1234	5	0	360	1242	199	189	1520	25	0	354
19.00-20.00	1103	770	57	100	1	0	211	1471	646	76	81	4	0	342
20.00-21.00	1020	890	26	83	1	0	234	1208	540	37	55	2	3	289
21.00-22.00	995	625	313	58	29	5	199	1048	365	251	45	158	0	227
22.00-23.00	740	406	338	26	324	3	175	572	133	155	33	189	4	137
23.00-24.00	562	211	278	11	314	9	134	432	55	95	20	176	7	92
24.00-1.00	270	64	166	10	292	7	99	290	52	175	14	319	3	85
1.00-2.00	119	42	203	31	352	6	66	135	7	145	6	324	2	65
2.00-3.00	138	57	180	8	366	12	17	39	15	80	6	238	0	26
3.00-4.00	83	33	131	14	390	5	31	14	14	77	1	216	0	17
4.00-5.00	50	17	44	13	209	4	67	25	17	86	5	202	0	23
5.00-6.00	90	37	39	24	108	4	103	21	14	75	29	95	3	123
6.00-7.00	213	57	70	58	61	2	134	75	100	89	25	88	0	116

SAFDARJUNG HOSPITAL

SAROJNI NAGAR TO ASHRAM								ASHRAM TO SAROJNI NAGAR						
TIME(hrs)	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R
19.00-20.00	1295	41	109	668	1	2	497	2366	55	192	625	0	0	411
20.00-21.00	1280	63	165	471	0	1	319	1584	32	0	482	1	0	319
21.00-22.00	920	132	85	479	13	0	368	1658	75	114	325	17	2	252
22.00-23.00	890	56	31	355	49	0	287	803	59	54	205	44	5	274
23.00-24.00	805	118	27	158	140	2	235	379	45	18	203	45	2	259
24.00-1.00	640	42	7	113	95	1	231	311	16	7	184	29	2	242
1.00-2.00	435	14	2	83	77	3	88	182	21	8	95	45	1	99
2.00-3.00	170	13	3	56	75	0	61	133	26	5	50	58	1	45
3.00-4.00	185	12	8	24	20	1	55	86	41	10	18	69	1	46
4.00-5.00	140	29	18	26	29	2	52	150	41	17	29	38	3	63
5.00-6.00	295	17	20	88	21	1	94	310	27	15	35	27	2	75
6.00-7.00	325	18	36	198	2	1	135	296	43	52	71	19	0	124

KAROL BAGH

K.B TO C.P								C.P TO K.B						
TIME(hrs)	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R
19.00-20.00	1175	19	56	730	0	0	326	1156	16	53	738	8	3	639
20.00-21.00	1130	28	88	422	4	0	263	1045	16	45	595	6	3	428
21.00-22.00	920	41	78	286	24	0	261	610	13	21	417	25	0	323
22.00-23.00	675	62	45	296	38	0	179	460	54	23	227	29	1	217
23.00-24.00	735	85	30	216	32	0	110	455	13	13	205	17	2	140
24.00-1.00	515	43	18	147	19	0	86	210	6	7	63	10	21	2
1.00-2.00	305	45	12	43	23	0	32	170	6	6	63	10	0	81
2.00-3.00	203	23	9	26	23	4	35	63	11	2	34	21	1	52
3.00-4.00	37	19	5	28	24	0	41	50	30	5	52	29	1	56
4.00-5.00	48	26	6	26	16	1	82	90	15	12	50	7	4	106
5.00-6.00	59	20	23	52	12	1	181	158	13	23	80	7	2	221
6.00-7.00	119	18	37	62	17	2	212	415	17	60	129	3	4	293

NEW FRIENDS COLONY

	NEW FRIENDS COLONY TO SARIA KALE KHAN							SARIA KALE KHAN TO NEW FRIENDS COLONY						
TIME(hrs)	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R
19.00-20.00	209	6	23	314	0	14	126	450	13	25	315	0	0	214
20.00-21.00	212	8	19	231	0	5	80	390	9	19	215	0	0	164
21.00-22.00	164	10	14	140	1	3	96	325	8	23	154	9	0	147
22.00-23.00	122	5	11	105	0	0	54	210	10	14	63	12	2	131
23.00-24.00	71	0	0	59	0	0	45	125	6	9	55	11	2	60
24.00-1.00	30	0	1	34	1	2	16	52	6	4	18	7	0	21
1.00-2.00	39	4	8	18	1	0	18	25	5	3	13	5	1	15
2.00-3.00	38	1	1	12	0	1	17	34	5	2	6	5	0	4
3.00-4.00	24	0	0	13	0	0	35	17	4	0	1	9	0	9
4.00-5.00	14	10	0	42	16	0	47	14	5	2	10	7	0	10
5.00-6.00	47	2	2	15	2	0	65	33	6	6	30	9	1	14
6.00-7.00	68	5	9	25	1	2	104	90	25	18	78	7	0	73

NEAR INDIA GATE

HIGH COURT TO UPSC

TIME(hrs)	Car/Jeep	LCV	Bus	Sc/Mc	Truck	T.T	A.R
19.00-20.00	7356	24	66	3360	4	0	1001
20.00-21.00	4294	12	87	2355	6	3	895
21.00-22.00	4410	213	71	1903	8	2	747
22.00-23.00	2868	91	18	1057	43	1	488
23.00-24.00	3162	33	21	183	19	0	318
24.00-1.00	539	78	3	48	56	0	164
1.00-2.00	181	59	1	62	27	0	94
2.00-3.00	188	41	13	51	41	0	50
3.00-4.00	74	40	0	48	49	0	34
4.00-5.00	113	13	1	30	38	14	62
5.00-6.00	209	31	10	41	31	0	232
6.00-7.00	369	61	28	109	18	0	401

Table 5.5 Classified Traffic Speed at Various Locations

AIIMS												
RING ROAD TO MEHRAULI							MEHRAULI TO RING ROAD					
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R
7.00-8.00	51.5	52.9	38.2	35.2	0	38.4	51.2	45.2	29	33.6	0	34.1
8.00- 9.00	46.1	46.9	34.7	33.8	0	35.3	49.3	48.7	36.4	32.6	0	32.4
9.00- 10.00	47.9	47	34.2	30.7	0	33	51.25	45.4	36.7	34.3	0	33.5
10.00-11.00	51.75	48.4	36.5	32.7	0	35.85	44.6	40.7	34.4	33.9	0	31
11.00-12.00	50	42.9	28.8	31.2	0	33.1	43.2	39	27.2	32.5	29	30.1
12.00-13.00	50.4	40.3	32.9	32.4	0	32.9	41.4	40.1	31	30.3	0	32.1
13.00-14.00	36.7	36	29.2	30.6	0	32.4	39.7	35.4	35	31	31	30
14.00-15.00	38.8	37.8	25.5	26.9	0	30	40.9	37.7	27	29.7	27.5	34
15.00-16.00	44.5	49.3	34.5	32.9	31	34	40.2	36.4	32.2	30	32	28.2
16.00-17.00	48.3	50.6	38.7	37.7	0	37	38	38.7	35.9	33	0	32.8
17.00-18.00	45.85	41.9	40.5	38.72	39.5	34.2	42.35	38.8	31.6	35.4	29	32.3
18.00-19.00	41.6	42.3	38.5	36.5	0	34.2	40.3	37.8	32.6	35	28	31.3
19.00-20.00	43	37	35	33	29	31	39	39	37	32	0	31
20.00-21.00	40	34	28	26	0	31	37	39	29	34	0	26
21.00-22.00	45	41	27	29	0	34	45	43	35	29	31	31
22.00-23.00	41	45	37	33	39	27	45	39	38	36	28	31
23.00-24.00	45	41	30	38	35	30	45	41	43	31	38	27
24.00-1.00	51	41	44	39	36	26	54	47	45	50	37	31
1.00-2.00	52	35	43	39	39	23	58	47	46	40	45	35
2.00-3.00	48	39	34	35	33	30	52	35	48	0	42	33
3.00-4.00	45	30	42	38	44	21	55	37	40	31	47	24
4.00-5.00	56	50	44	48	23	30	53	41	46	25	40	34
5.00-6.00	42	44	41	29	30	29	51	44	40	21	34	24
6.00-7.00	43	41	34	36	41	30	52	42	43	40	42	32

ITO												
RAJ GHAT TO I.P DEPO						I.P DEPO TO RAJ GHAT						
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R
7.00-8.00	54.6	50.5	45.2	41.4	56	42.8	54.04	43.1	43.5	51.1	46.4	44.9
8.00- 9.00	59.4	40.8	47.4	47.5	54	40.8	58.3	53.9	50.4	49.9	53.7	44.5
9.00- 10.00	50	53.5	44.7	43	47	39.7	57.8	46.5	48.2	38.2	0	42.4
10.00-11.00	46.4	50.3	46	40.2	0	39	52.2	46.6	42.4	47.33	0	36.7
11.00-12.00	47.3	48.8	42.3	40.6	43.6	37.7	36.4	42.4	37.1	39.1	0	32
12.00-13.00	45	47.2	39.7	38	39.8	37.6	44.3	41.8	37	36.8	38	35.4
13.00-14.00	48.8	45.8	42.9	35.8	41.7	35.3	43.8	40.1	39.5	34.8	30	33.9
14.00-15.00	34.7	46.7	41	40.3	35.2	42.7	43.4	45.1	38	39.5	36.3	35.9
15.00-16.00	39.4	44.1	39.4	39	37.6	41.3	43.4	40	35.2	39.7	42.1	38.1
16.00-17.00	41.4	40.4	36.4	34.4	31	34.9	40.7	44	37.9	36.8	39.2	34.7
17.00-18.00	42.6	42.4	41.3	35.66	38.5	38.7	42	47.1	38.4	34.6	36.7	38.3
18.00-19.00	44.3	40.8	39.8	37.4	37.5	37.9	45.4	44.7	33.5	33.56	38.7	37.2
19.00-20.00	50.2	41.28	42.54	41.43	0	40.76	45	39	48	45	0	36
20.00-21.00	52.85	50.96	43	41.29	0	37.9	54	49	45	53	25	36
21.00-22.00	52.8	46.08	44.35	36.67	40.25	39.47	55	48	41	45	43	39
22.00-23.00	54.14	49.22	50.5	40.43	47.82	39	46	38	47	47	47	36
23.00-24.00	59.7	47.85	57	40	50.75	38.87	49	49	45	48	49	39
24.00-1.00	61.49	47.75	52.37	51.25	51.13	40.38	46	45	58	51	48	41
1.00-2.00	60	44.8	47.13	48.67	50.12	44.8	57	54	51	57	49	36
2.00-3.00	53.09	53.5	47.71	60	52.82	35.75	56	39	46		49	38
3.00-4.00	62.15	49.4	61.59	57.67	51.03	39.8	52	46	51	52	53	37
4.00-5.00	58.9	45	59.33	47	45.53	33.75	50	39	45	43	46	33
5.00-6.00	63.33	50.89	57.67	61.67	50.72	35	59	44	48	56	53	37
6.00-7.00	57.3	47.5	52.44	48.17	45.8	37.36	58	45	49	48	42	39

RED FORT												
ISBT TO ITO							ITO TO ISBT					
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R
7.00-8.00	34.2	31.33	28.1	30	0	31.5	34	34.8	30.1	28.9	34	32.9
8.00- 9.00	33.3	36.6	31.5	31.5	0	29.8	36.5	36	33.4	29.6	0	33.3
9.00- 10.00	33.9	38.4	32.2	31.08	0	30.3	34.9	37	29.4	31.5	0	35.1
10.00-11.00	35.9	37.9	36.5	32.1	0	33.8	40.4	41.1	29.6	32.7	0	35
11.00-12.00	41.8	38.55	35.9	35.4	35	32.2	36.1	38.6	29.7	31.4	0	30.2
12.00-13.00	31.1	28.9	29.1	28.6	30	37	39.2	37.5	32.5	33.3	0	34
13.00-14.00	32.4	37.9	30.4	33	0	29.7	28.7	31.8	29.4	30.6	0	29
14.00-15.00	39.3	41.1	35.2	33.6	30	31.8	47.6	40.3	35.5	29.8	32.5	33.2
15.00-16.00	34.7	34.9	27.6	30.9	0	28.4	34.1	34.3	31.6	26.6	28.6	30.6
16.00-17.00	33.1	30.9	32.9	29.2	0	29.6	28.3	30.68	32.1	29.5	27.5	30.2
17.00-18.00	32.1	31.3	27	28.7	0	28.7	33	32.3	27.8	29.7	35	30.1
18.00-19.00	34.3	32.7	30.7	29.2	24	29.4	32.8	33	28.5	32	25	28.9
19.00-20.00	31	31	30	25	25	28	26	27	24	22	39	24
20.00-21.00	31	33	29	29	38	26	35	35	26	30	33	30
21.00-22.00	34	34	32	24	26	27	39	39	33	33	35	30
22.00-23.00	34	33	29	26	32	27	37	39	35	24	28	28
23.00-24.00	35	37	31	32	0	25	37	33	34	29	39	31
24.00-1.00	34	28	32	26	29	26	40	43	35	27	22	25
1.00-2.00	30	29	30	17	25	25	35	33	35	30	32	26
2.00-3.00	42	43	34	40	41	29	34	46	35	31	37	30
3.00-4.00	40	41	38	38	43	30	40	38	32	31	30	30
4.00-5.00	34	38	32	33	39	32	42	35	36	35	35	32
5.00-6.00	42	35	38	33	0	32	37	36	30	27	30	27
6.00-7.00	38	38	29	0	24	33	38	35	36	30	0	32

LAXMI NAGAR

ITO TO PREETH VIHAR							PREETH VIHAR TO ITO						
TIME(hrs)	**CAR**	**Sc/Mc**	**LCV**	**BUS**	**TRUCK**	**A.R**	**TIME(hrs)**	**CAR**	**Sc/Mc**	**LCV**	**BUS**	**TRUCK**	**A.R**
6:00-7:00	41.72	41.5	31.7	33.6	45	36	**6:00-7:00**	35.6	36.2	31	31.4	28	31.2
7.00-8.00	39.8	34.98	34.2	28.3	40	31.1	7.00-8.00	35.5	34	35.8	31.7	0	31.4
8.00- 9.00	37.8	34.9	32.7	30.2	32	39.4	8.00- 9.00	36.9	29.8	26.1	25.2	29	26.3
9.00- 10.00	35.1	36.2	28.8	28.7	34	29.65	9.00- 10.00	28.2	31.6	22.4	22.6	0	27.2
10.00-11.00	33	33	34.44	27.83	32	28.9	10.00-11.00	29.3	30.9	27.7	23.9	0	29
11.00-12.00	33.3	30.5	29	29.63	35	29.17	11.00-12.00	27.8	29.1	27.6	26.8	0	27.3
12.00-13.00	36	37	27.9	27	27.5	31.5	**12.00-13.00**	31.8	28.9	25.8	28.6	0	32
13.00-14.00	36.5	36.3	33	29.2	0	32.85	13.00-14.00	29.5	30.8	24.8	23.75	0	31.2
14.00-15.00	36.5	37	31.6	28.3	0	32.1	14.00-15.00	37.3	33	28.7	28	0	34.9
19.00-20.00	28	24	26	26	0	22	19.00-20.00	33	31	26	28	0	22.3
20.00-21.00	27	26	25	22	0	28	20.00-21.00	33	30	22	24	0	26
21.00-22.00	28	29	26	25	0	27	21.00-22.00	36	35	31	27	22	31.2
22.00-23.00	38	39	31	27	0	28	22.00-23.00	40	42	34	28.5	33	32
23.00-24.00	41	37	31	37	40	31	23.00-24.00	31	29	29	27	37.5	29
24.00-1.00	44	36	33	21	26	27	**24.00-1.00**	40	38	36	31	27	24
1.00-2.00	50	39	31	44	29	31	1.00-2.00	54	53	46	35	40	26
2.00-3.00	52	54	32	41	41	42	2.00-3.00	50	50	45	39	44	28
3.00-4.00	46	35	36	36	39	29	3.00-4.00	49	47	41	36	50	29
4.00-5.00	44	40	32.5	40	35	27	4.00-5.00	43	44	38	35	43	31
5.00-6.00	44	40	33	39	0	37	5.00-6.00	48	41	44	31	39	29
6.00-7.00	42	40	35	30	50	34	6.00-7.00	45	40	36	43	0	29

SAFDARJUNG HOSPITAL

S.NAGAR TO AIIMS							AIIMS TO S.NAGAR						
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R	TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R
19.00-20.00	38.6	40.29	29	29.42	0	32.46	19.00-20.00	30.75	33.16	30.57	27.5	0	28.8
20.00-21.00	38	38.3	27	28.05	31	32.2	20.00-21.00	36.2	36.2		30.47	30	31.4
21.00-22.00	43	40.2	38.9	36.5	37	30	21.00-22.00	43.32	39.3	34	37.6	32	31.1
22.00-23.00	46.5	45.09	31.62	37.87	38.9	32.57	22.00-23.00	42.48	42.76	37.76	39.38	41.12	37.2
23.00-24.00	49	45	44.16	34.66	39.61	36.52	23.00-24.00	47.89	41.72	37.75	44.69	39.39	33.2
24.00-1.00	50.8	45.68	42.66	27.5	40.16	36.28	24.00-1.00	48.02	41.2	38	41.66	42.25	36.3
1.00-2.00	47	46	47		43.85	37.3	1.00-2.00	44.15	40	33	48	42	35.1
2.00-3.00	55.7	47.37	47.75	49	53.75	32.75	2.00-3.00	51.02	50.42	45.5	56	40.85	34.2
3.00-4.00	56.1	47.6	46.8		35.5	37.25	3.00-4.00	52.2	46	46.12	41	40.4	34.5
4.00-5.00	58	47.71	41.75	44.25	36	38.57	4.00-5.00	51.54	52	31.33	50.33	46.25	41
5.00-6.00	51.2	42.16	37.5	56	0	33.85	5.00-6.00	51	45.15	42.5	44.75	42	34.3
6.00-7.00	53.3	43.12	40.5	31.66	0	37.33	6.00-7.00	46.3	45.9	46	42.5	41.5	35.3

KAROL BAGH

KAROL BAGH TO C.P							C.P TO KAROL BAGH						
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R	TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	A.R
19.00-20.00	34.5	32.26	29.66	30.33	0	27.53	19.00-20.00	31.68	37.98	29	26.33	0	25.8
20.00-21.00	35.1	34.63	29.67	31.16	30	30.06	20.00-21.00	34.1	32.46	33.66	31	0	29.8
21.00-22.00	38.1	39.1	30.83	29	35	32.22	21.00-22.00	37.79	35.7	35.66	35.33	38	29.5
22.00-23.00	35.7	31.95	31	31.6	30.6	25.13	22.00-23.00	38.5	33	31.2	35	0	30.5
23.00-24.00	35.8	35.41	28	28	0	29.8	23.00-24.00	38.9	35.41	32.33		33.33	28.4
24.00-1.00	40.6	34.8	35	39.5	40	27.44	24.00-1.00	41.63	33.85	31.71	49.5	42	28.9
1.00-2.00	40.5	38.75	32		31	25.9	1.00-2.00	42.2	38.7	36.5	33	37.33	31.2
2.00-3.00	40.2	30.5	37	30	31.83	23.45	2.00-3.00	45.3	30.1	41	30	37	29.6
3.00-4.00	34.8	37	32.62	40.25	37.25	29.4	3.00-4.00	39.1	33	28.75		0	28
4.00-5.00	41.7	41.66	41.87		30	33.8	4.00-5.00	38.8	38.5	30		27.3	27
5.00-6.00	43.5	32	35.66	39.5	32	31.77	5.00-6.00	47.6	30.2	31.4	32.5	0	27.4
6.00-7.00	39	38.4	36.66	37.75	0	28.47	6.00-7.00	46.4	26.5	32.33	31	28.33	28.4

NEW FRIENDS COLONY

N.F.C TO S.K.K								S.K.K TO N.F.C					
TIME(hrs)	**CAR**	**Sc/Mc**	**LCV**	**BUS**	**TRUCK**	**A.R**	**TIME(hrs)**	**CAR**	**Sc/Mc**	**LCV**	**BUS**	**TRUCK**	**A.R**
19.00-20.00	34.7	36.52	29	22	0	29.5	19.00-20.00	36.71	34.58	35	30.66	0	31
20.00-21.00	39.6	36.68	0	30.75	0	29.85	20.00-21.00	40.48	39.57	30.5	46	0	34.5
21.00-22.00	38.2	39.4	0	37.6	42.5	32.92	21.00-22.00	40.18	39.39	0	19.5	0	33.8
22.00-23.00	41.6	34.68	35	36	0	24.54	22.00-23.00	45.23	43.82	42	33	0	31
23.00-24.00	46.2	40.92	46	0	0	36.25	23.00-24.00	53.8	42.53	0	42	38	36.5
24.00-1.00	49.4	43.77	40	41	0	32.6	24.00-1.00	59.9	45.33	0	0	0	36
1.00-2.00	50.2	46	0	0	42.5	32.5	1.00-2.00	56.33	31	46	0	0	38.3
2.00-3.00	41	0	43	0	52.33		2.00-3.00	60.5	46	40	55	0	28
3.00-4.00	52.3	37.5	35	0	45	33.83	3.00-4.00	50.27	47.8	45.66	0	48.75	26.2
4.00-5.00	51.6	46.66	35	40	0	26	4.00-5.00	50.22	49.5	0	0	45	29.4
5.00-6.00	41.1	28	35	0	37	27	5.00-6.00	51.4	44	38	52	48	33
6.00-7.00	38.4	29.33	39	39	0	28	6.00-7.00	50.3	38.5	36.5	0	0	31.2

INDIA GATE

TIME(hrs)	**CAR**	**Sc/Mc**	**LCV**	**BUS**	**TRUCK**	**A.R**	5.00-6.00	43	44	55	0	43	33
19.00-20.00	32	29		28	29	30	6.00-7.00	41	33	34	39	26	33
20.00-21.00	33	37	32	30	25	26							
21.00-22.00	39	36	32	30	27	28							
22.00-23.00	39	35	37	41	39	29							
23.00-24.00	36	38	40	35	34	35							
24.00-1.00	43	41	40	51	40	33							
1.00-2.00	47	40	39	32	37	33							
2.00-3.00	47	47	46	0	40	35							
3.00-4.00	46	40	46	0	41	46							
4.00-5.00	49	45	43	41	44	36							

Table 5.6 Observed L_{eq} at Various Locations

RING ROAD TO MEHRAULI				AIIMS		MEHRAULI TO RING ROAD			
		{5m}						{9m}	
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
7.00-8.00	85.2	76.9	70.7	**80.65446**	7.00-8.00	82.6	76.4	70.2	**79.14571**
8.00- 9.00	88	78.8	71	**83.96071**	8.00- 9.00	86	79	74	**81.57143**
9.00- 10.00	91.9	81.2	75.5	**86.00286**	9.00- 10.00	83.5	77.6	71.7	**80.08643**
10.00-11.00	88.9	79.1	72	**84.20018**	10.00-11.00	83.8	77.4	71.4	**80.14571**
11.00-12.00	88.6	79	73.1	**83.29018**	11.00-12.00	83.9	78	72.5	**80.32071**
12.00-13.00	86	78.5	72.4	**81.80286**	**12.00-13.00**	82.1	76.7	71.7	**78.63143**
13.00-14.00	84.9	77.1	71.4	**80.35446**	13.00-14.00	82.5	75.4	70.1	**78.14571**
14.00-15.00	82	77.3	73.9	**78.47161**	14.00-15.00	84.6	78.1	73	**80.50286**
15.00-16.00	84.1	78.1	72.88	**80.34801**	15.00-16.00	82.7	75.7	69.8	**78.67161**
16.00-17.00	86	78	72.6	**81.20643**	16.00-17.00	82.2	75.5	69	**78.61143**
17.00-18.00	85.8	78.7	73.5	**81.40161**	17.00-18.00	80.4	75.8	70.4	**77.58571**
18.00-19.00	86.5	78.6	73.4	**81.66446**	18.00-19.00	85.1	77.7	72.7	**80.44571**
19.00-20.00	86.5	78.4	74.2	**81.10161**	19.00-20.00	86.44	81.3	79.06	**82.27258**
20.00-21.00	86	80.54	74.08	**83.07726**	20.00-21.00	89.31	82	78.98	**83.90552**
21.00-22.00	85.5	81.95	76.27	**83.4713**	21.00-22.00	86.5	82.09	80.26	**82.78531**
22.00-23.00	85.64	80.31	75.5	**82.14606**	22.00-23.00	84.58	79.72	76.18	**80.98**
23.00-24.00	86	79.39	72.78	**82.51086**	23.00-24.00	83	77.21	70.1	**80.18161**
24.00-1.00	82.05	71.68	67	**75.72469**	**24.00-1.00**	81.32	76.32	72.12	**77.83143**
1.00-2.00	77.24	57.04	43.39	**77.50112**	1.00-2.00	81.6	76.31	71.99	**77.95914**
2.00-3.00	78.64	69	60	**75.20446**	2.00-3.00	84.65	78.82	73.53	**81.02811**
3.00-4.00	81.61	69.24	58.96	**78.40112**	3.00-4.00	84	77.84	72.8	**80.08**
4.00-5.00	78	73.71	68.27	**75.40059**	4.00-5.00	82.63	78.57	75.3	**79.52944**
5.00-6.00	80.93	71.87	64.87	**76.47578**	5.00-6.00	82	77.67	72.69	**79.21779**
6.00-7.00	82.02	70.62	62.3	**77.56426**	6.00-7.00	85	78.42	73.74	**80.68406**

ITO TO ISBT				RED FORT		ISBT TO ITO			
		{10m}					{6m}		
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
7.00-8.00	84.1	77.52	72.53	**79.91044**	7.00-8.00	86.3	81.7	77	**83.24446**
8.00- 9.00	82.3	76.83	71.86	**78.77631**	8.00- 9.00	87	81	78.1	**82.41446**
9.00- 10.00	83.2	77.3	72.9	**79.19446**	9.00- 10.00	85.8	80.3	78.1	**81.35875**
10.00-11.00	83.5	77.7	72.9	**79.70643**	10.00-11.00	85	78.9	74.6	**80.83143**
11.00-12.00	81.47	75	68.7	**77.91202**	11.00-12.00	80.9	75.2	70.8	**77.02161**
12.00-13.00	79.64	73.6	66	**76.92231**	**12.00-13.00**	80.8	75.5	71.2	**77.14571**
13.00-14.00	80.56	74	67	**77.28346**	13.00-14.00	77.4	70	61.7	**74.40161**
14.00-15.00	72.9	67.7	62.2	**69.74446**	14.00-15.00	80.43	68.7	61.2	**75.30344**
15.00-16.00	78.2	70.3	64.5	**73.65161**	15.00-16.00	80.4	71.2	60.3	**78.41446**
16.00-17.00	82.56	73.2	66.3	**77.92121**	16.00-17.00	81.3	72	65.82	**76.27911**
17.00-18.00	80.3	73.56	67	**76.71875**	17.00-18.00	83.6	75.8	71.2	**78.54571**
18.00-19.00	83.7	74.3	72.6	**76.50018**	18.00-19.00	84.4	77.3	70.6	**80.70071**
19.00-20.00	79.92	73.39	68.5	**75.71886**	19.00-20.00	82.4	76.6	71	**78.92071**
20.00-21.00	80.5	73	67.83	**75.86659**	20.00-21.00	85.6	79.8	73.5	**82.41446**
21.00-22.00	80.1	73.6	68.55	**75.98219**	21.00-22.00	87.2	82.7	78.7	**83.99018**
22.00-23.00	82	76.1	70.3	**78.54446**	22.00-23.00	86.6	82.7	78.7	**83.81446**
23.00-24.00	82.2	75.98	70	**78.63786**	23.00-24.00	87.6	82.8	79.3	**84.03018**
24.00-1.00	81.6	74.9	70.2	**77.22071**	**24.00-1.00**	85.3	80.4	76	**81.94446**
1.00-2.00	82.6	76	70	**78.835**	1.00-2.00	87.4	82.3	77.83	**83.93544**
2.00-3.00	82.1	76.5	71.6	**78.46875**	2.00-3.00	91.7	85	79.2	**87.79018**
3.00-4.00	82	76.7	71.8	**78.55786**	3.00-4.00	92	87	82.63	**88.5678**
4.00-5.00	82	77.3	72.8	**78.81143**	4.00-5.00	91.5	85.7	81.64	**87.43606**
5.00-6.00	81.9	76.2	71.1	**78.28286**	5.00-6.00	84.5	79.2	75.6	**80.61446**
6.00-7.00	82.1	75.1	70.3	**77.58643**	6.00-7.00	83.6	76.5	72.5	**78.70018**

LAXMI NAGAR									
I.T.O TO PREETH VIHAR					PRETH VIHAR TO I.T.O				
		{10,6m}						{10m}	
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
7.00-8.00	81.2	74.5	71.9	**76.0444**	7.00-8.00	76.5	72.6	69.3	**73.5257**
8.00- 9.00	82.1	74.6	72.3	**76.315**	8.00- 9.00	81.3	76	70.1	**78.24**
9.00- 10.00	86.7	79.3	73.8	**82.2716**	9.00- 10.00	81.2	74.6	69.1	**77.2144**
10.00-11.00	86.6	79.5	75	**81.9028**	10.00-11.00	83.4	75.2	69.9	**78.4544**
11.00-12.00	85.9	80	74.7	**82.24**	11.00-12.00	82.4	75.9	71	**78.2207**
12.00-13.00	86.8	80.1	74.5	**82.8016**	**12.00-13.00**	81.6	75.5	70.6	**77.6607**
13.00-14.00	84.9	79.5	74.1	**81.5828**	13.00-14.00	80.4	73.9	70.1	**75.7944**
14.00-15.00	86.4	79.8	73.6	**82.7257**	14.00-15.00	81.8	75.7	70.4	**78.0207**
15.00-16.00	88.8	81.6	76.4	**84.3457**	15.00-16.00	80.3	74.7	70.1	**76.5578**
19.00-20.00	86.66	77.3	70.87	**81.7522**	19.00-20.00	92.2	86.5	82.6	**88.1457**
20.00-21.00	88.7	76.32	70.32	**82.3525**	20.00-21.00	90.6	85.08	80.3	**86.9744**
21.00-22.00	88.86	75.65	68.81	**82.8286**	21.00-22.00	90.2	84.7	80.3	**86.4501**
22.00-23.00	87.7	76.5	67.75	**83.6071**	22.00-23.00	91.7	85	82.56	**86.4917**
23.00-24.00	91.5	76.7	70	**84.9544**	23.00-24.00	90.92	85.5	80.2	**87.5521**
24.00-1.00	87.5	75.4	66.1	**83.5778**	**24.00-1.00**	87.55	81.7	77.22	**83.6055**
1.00-2.00	81	70.34	63.86	**75.5860**	1.00-2.00	85	80.3	74.8	**82.1578**
2.00-3.00	81	72	63.71	**77.3382**	2.00-3.00	84.3	78	72.86	**80.3370**
3.00-4.00	82.4	71.1	65.3	**76.3216**	3.00-4.00	82.8	77.85	72.85	**79.6179**
4.00-5.00	83.3	71.5	65.56	**77.1197**	4.00-5.00	85.3	79.3	74	**81.5801**
5.00-6.00	82	73.1	63	**79.5464**	5.00-6.00	86.2	79.88	75.56	**81.9016**
6.00-7.00	81.4	71	63.5	**76.7216**	6.00-7.00	87.84	81.7	75.7	**84.3317**

INDRA PRASTA TO RAJ GHAT				ITO	RAJ GHAT TO INDRA PRASTA				
		{15.5,5m}					{17.5,10m}		
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
7.00-8.00	79.52	74.05	69.16	**75.9666**	7.00-8.00	88.5	77.5	72	**82.36161**
8.00- 9.00	80.7	74.6	70	**76.64446**	8.00- 9.00	86	77.3	72.4	**80.60286**
9.00- 10.00	80	73.5	72.3	**74.55875**	9.00- 10.00	85.77	77.6	72.3	**80.84002**
10.00-11.00	81	74.5	71	**76.28571**	10.00-11.00	86.1	78	73	**81.06446**
11.00-12.00	80.7	75	70	**77.04446**	11.00-12.00	80.5	74.4	71.5	**75.84643**
12.00-13.00	79.6	74.3	70.3	**75.84446**	**12.00-13.00**	83.4	76.6	72.5	**78.72161**
13.00-14.00	78.5	75	70.9	**76.03143**	13.00-14.00	80.7	77.5	72.89	**78.58922**
14.00-15.00	79.3	73.7	70.32	**75.14001**	14.00-15.00	81.27	75.7	71	**77.58344**
15.00-16.00	82	76	71.5	**77.96875**	15.00-16.00	82.4	76.9	71.65	**78.96362**
16.00-17.00	82.2	74.4	70.6	**76.80286**	16.00-17.00	81.5	76.5	72.8	**77.85161**
17.00-18.00	82.5	74.6	72.8	**76.28018**	17.00-18.00	82.3	77.2	71.2	**79.40018**
18.00-19.00	83.5	75.4	73.3	**77.25786**	18.00-19.00	83.1	76.9	73.2	**78.65018**
19.00-20.00	86.7	79	73.48	**82.12086**	19.00-20.00	91.28	84	80.6	**86.03683**
20.00-21.00	85.56	78.37	73.51	**80.9629**	20.00-21.00	91.06	83.46	78.83	**86.13094**
21.00-22.00	85.87	78.65	74.02	**81.15754**	21.00-22.00	89.93	83.36	79.48	**85.31004**
22.00-23.00	119	84.6	77.5	**115.3545**	22.00-23.00	87.45	83.49	80	**84.48112**
23.00-24.00	86.35	79.71	74.4	**82.26004**	23.00-24.00	90.09	83.88	81.5	**85.19764**
24.00-1.00	83.61	78.67	74.26	**80.23112**	**24.00-1.00**	89.6	84.46	79.97	**86.11602**
1.00-2.00	88.41	79.5	75.29	**82.57383**	1.00-2.00	88.82	83.87	77.18	**86.28946**
2.00-3.00	84	78.52	73.28	**80.57211**	2.00-3.00	87.68	80.87	76.32	**83.17446**
3.00-4.00	83.46	78	73.66	**79.715**	3.00-4.00	92.38	80.86	76.17	**85.55222**
4.00-5.00	83.2	77.96	73.33	**79.69959**	4.00-5.00	88	82.39	75.91	**85.00014**
5.00-6.00	86	78.98	74.61	**81.29664**	5.00-6.00	89.62	80.17	73.9	**84.58283**
6.00-7.00	86.16	80.1	76.1	**81.90721**	6.00-7.00	89.42	79.75	75	**83.46315**

AIIMS TO S.NAGAR(10m)				SAFDARJUNG HOSPITAL			S.NAGAR TO AIIMS(5M)		
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
19.00-20.00	87.8	83.5	79.2	**84.82071**	19.00-20.00	84.3	78.4	72.9	**80.72071**
20.00-21.00	86.37	82.3	78.9	**83.29644**	20.00-21.00	83.3	77.9	71.9	**80.22071**
21.00-22.00	87	81	77	**82.78571**	21.00-22.00	87.4	81.3	78.8	**82.62071**
22.00-23.00	86	81	76	**82.78571**	22.00-23.00	86.6	82.5	80.4	**83.18643**
23.00-24.00	85	81	77	**82.14286**	23.00-24.00	87.3	84.3	82	**84.80161**
24.00-1.00	88	81	78	**82.78571**	24.00-1.00	86.7	83.4	82	**83.79446**
1.00-2.00	87.5	81	77.5	**82.78571**	1.00-2.00	85.5	82.3	78.9	**83.07786**
2.00-3.00	86	80	75.8	**81.85786**	2.00-3.00	86.9	82	78.1	**83.38286**
3.00-4.00	86	79	75	**81.16071**	3.00-4.00	86.3	85.1	81.1	**85.58286**
4.00-5.00	80	75.5	73.5	**76.25446**	4.00-5.00	80.3	76.1	70.7	**77.74571**
5.00-6.00	81	78	71.43	**79.63544**	5.00-6.00	84	79	76.45	**80.0179**
6.00-7.00	82.5	78.2	75	**79.20446**	6.00-7.00	81.78	75.67	70.87	**77.7955**
K.B TO C.P				KAROL BAGH		C.P TO K.B			
	{5m}						{10m}		
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
19.00-20.00	85.8	84	81	**84.41143**	19.00-20.00	85.6	83.3	79.6	**83.94286**
20.00-21.00	89	84.1	81	**85.24286**	20.00-21.00	89	83.6	80.5	**84.89018**
21.00-22.00	88.1	84.4	82	**85.06446**	21.00-22.00	88.2	84	81.5	**84.80161**
22.00-23.00	88	84.2	81.4	**84.97786**	22.00-23.00	88.5	82.4	78.4	**84.22161**
23.00-24.00	86.4	82.7	79.5	**83.55018**	23.00-24.00	89.5	81.5	78.3	**83.74**
24.00-1.00	82.7	78.35	73.898	**79.73349**	24.00-1.00	87.5	80.5	73.5	**84**
1.00-2.00	88.1	85	79	**86.47875**	1.00-2.00	85.4	80.5	68	**85.90643**
2.00-3.00	82.28	76.1	70.6	**78.53611**	2.00-3.00	83.5	77.45	68	**81.74018**
3.00-4.00	81.5	75.4	71.5	**77.18571**	3.00-4.00	86.1	77.7	73	**80.76446**
4.00-5.00	80	76.2	72.67	**77.15944**	4.00-5.00	82.79	72.89	65.39	**78.29643**
5.00-6.00	82.4	77	75	**77.97786**	5.00-6.00	83.28	70.08	58.55	**81.00094**
6.00-7.00	85.5	82	75.3	**83.85786**	6.00-7.00	85.83	75.43	67.19	**81.63446**

NEW FRIENDS COLONY									
		N.F.C TO S.K.K			S.K.K TO N.F.C				
		{5m}					{5m}		
TIME(hrs)	L10	L50	L90	Leq	TIME(hrs)	L10	L50	L90	Leq
19.00-20.00	91.5	84.8	82	**86.41161**	19.00-20.00	88.27	81.88	76.51	**84.3496**
20.00-21.00	88	83.45	78.54	**85.04806**	20.00-21.00	88.53	80.39	74.43	**83.94018**
21.00-22.00	93.5	83.8	79	**87.55446**	21.00-22.00	91.6	85.29	79.04	**88.10703**
22.00-23.00	88	82.2	78	**83.98571**	22.00-23.00	90.32	84.68	78.18	**87.31178**
23.00-24.00	87	79	74.35	**81.85754**	23.00-24.00	89.73	84.53	78.85	**86.64383**
24.00-1.00	84.67	76.21	70.62	**79.73504**	24.00-1.00	90.88	85.47	79.07	**87.96064**
1.00-2.00	88	78.1	69.73	**84.06059**	1.00-2.00	88.64	84.71	79.06	**86.34886**
2.00-3.00	86.63	75.79	68.05	**81.95458**	2.00-3.00	86.87	76.22	66.13	**83.90121**
3.00-4.00	85.64	74.89	66.93	**81.14114**	3.00-4.00	86.67	76.65	66.35	**84.02326**
4.00-5.00	83.49	71.15	66.51	**76.29858**	4.00-5.00	87.44	78.57	68.37	**85.06402**
5.00-6.00	86.58	77.17	67	**84.01601**	5.00-6.00	89.23	82.79	72.91	**87.54611**
6.00-7.00	89.4	78	67.5	**86.56446**	6.00-7.00	91.84	85.43	80.83	**87.59464**
INDIA GATE									
			{5m}						
TIME(hrs)	L10	L50	L90	Leq	6.00-7.00	89	79	75	**82.5**
19.00-20.00	89.93	84.5	79.94	**86.28214**					
20.00-21.00	92.2	84.9	80.6	**87.30286**					
21.00-22.00	94	87	83	**89.16071**					
22.00-23.00	93.4	86.6	81.8	**89.00286**					
23.00-24.00	93	85.3	80	**88.31786**					
24.00-1.00	90.3	84.3	76.8	**87.55446**					
1.00-2.00	88.7	80.7	75	**84.05161**					
2.00-3.00	90.3	84.9	80	**86.79446**					
3.00-4.00	90.5	83.5	79	**85.86161**					
5.00-6.00	89.7	82.8	77						

PERFORMANCE EVALUATION

6.1 Concept of Performance Evaluation

FHWA TNM Model is used to check the performance of noise prediction. Observed data from field study has been compared with predicted noise data using FHWA TNM Model. In this, night and morning data has been included separately.

6.2 Site-wise Performance Evaluation

Performance evaluation has been done for all location. The data, which was collected From field study compared with predicted noise level using TNM model. Those details are given below:

6.2.1 Model performance for L1

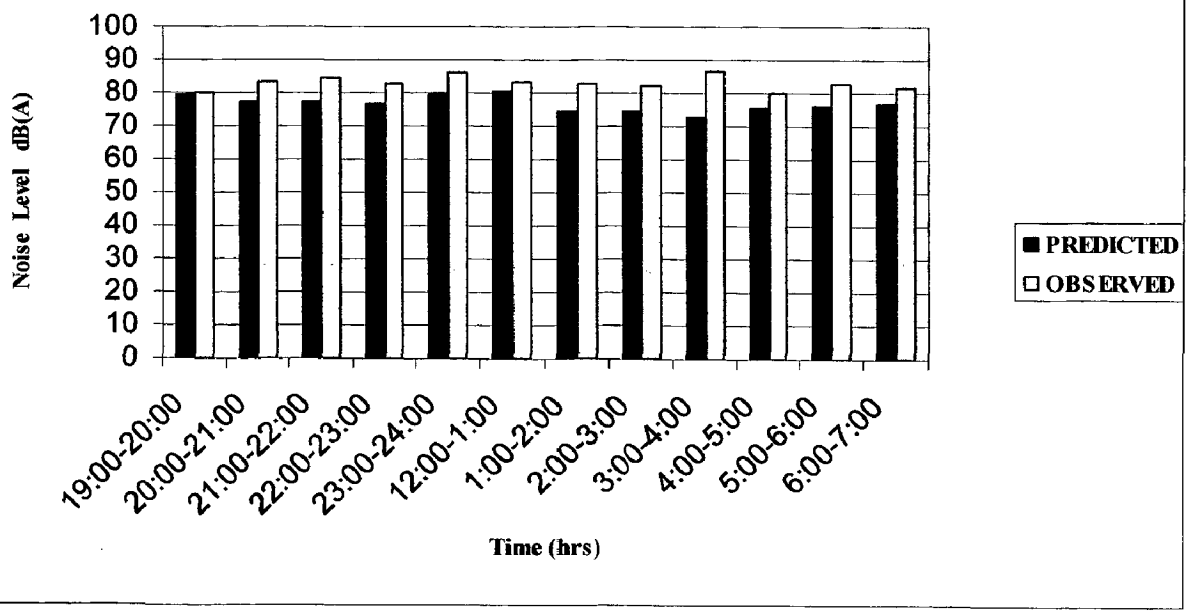
Type of land use is Silence Zone

Observed Noise Level is 83 dB(A)

Predicted Noise Level is 76 dB(A)

Difference in Noise Level is 7 dB(A)

Fig 6.1(a) Graph Between Leq obs Vs Leq predicetd for Location1(Night Time)



6.2.2 Model performance for L2

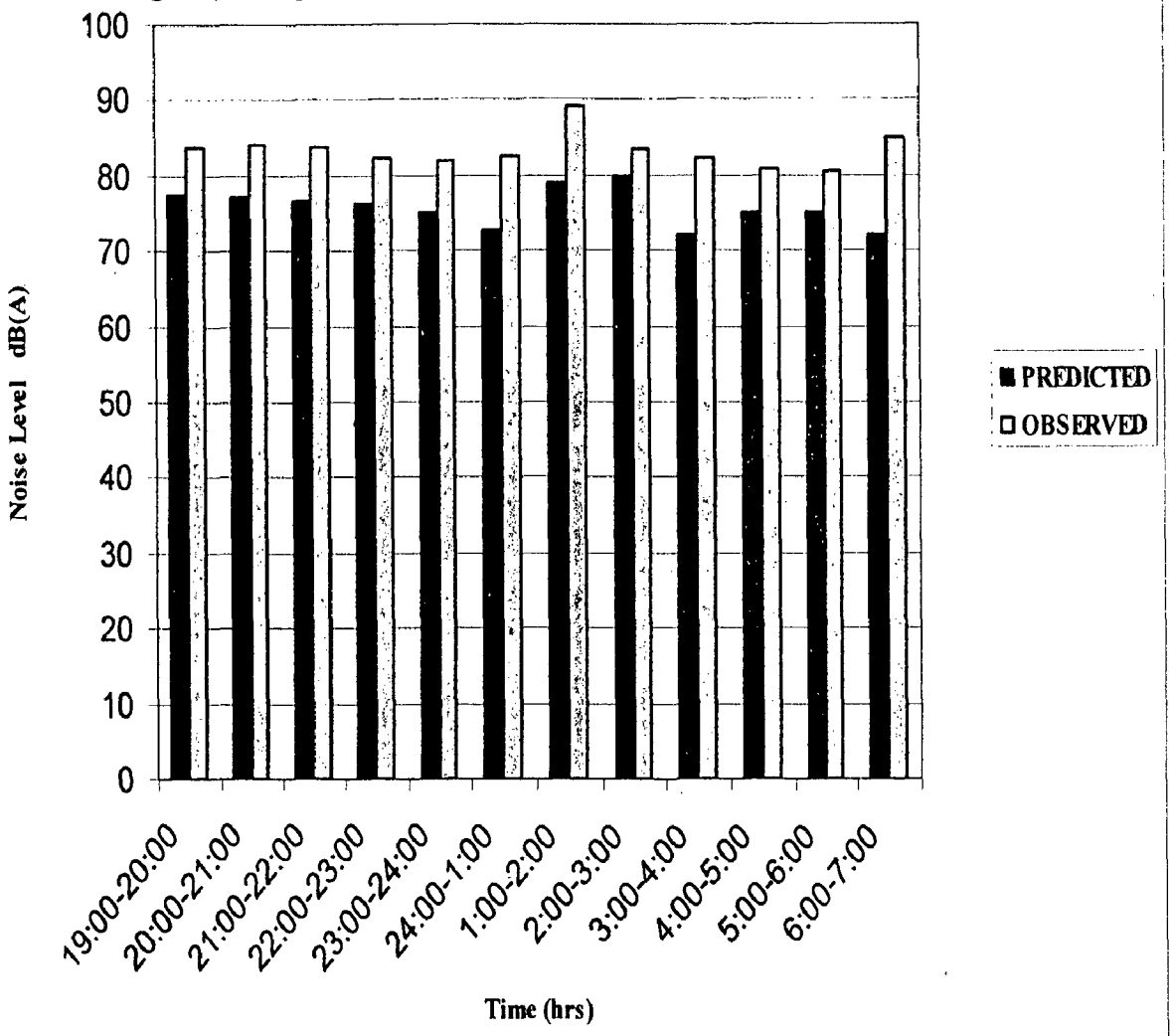
Type of land use is Commercial Zone

Observed Noise Level is 84 dB(A)

Predicted Noise Level is 76 dB(A)

Difference in Noise Level is 8 dB(A)

Fig 6.1(b) Graph Between Leq obs Leq cal for Location 2 (Night Time)



6.2.3 Model performance for L3

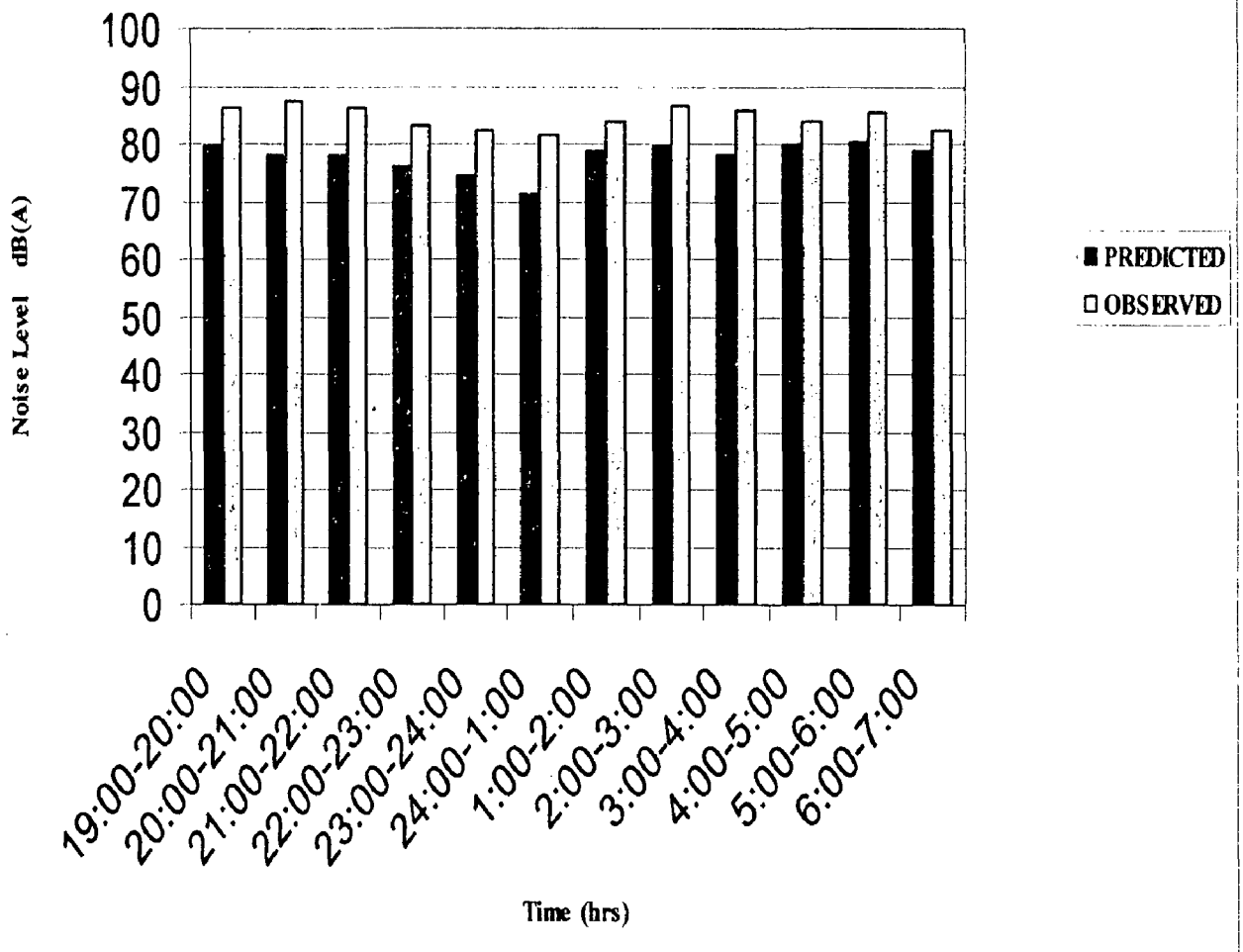
Type of land use is Heavy Traffic Zone

Observed Noise Level is 85 dB(A)

Predicted Noise Level is 79 dB(A)

Difference in Noise Level is 6 dB(A)

Fig 6.1(c)Graph Between Leq obs Vs Leq cal for Location3 (Night Time)



6.2.4 Model performance for L4

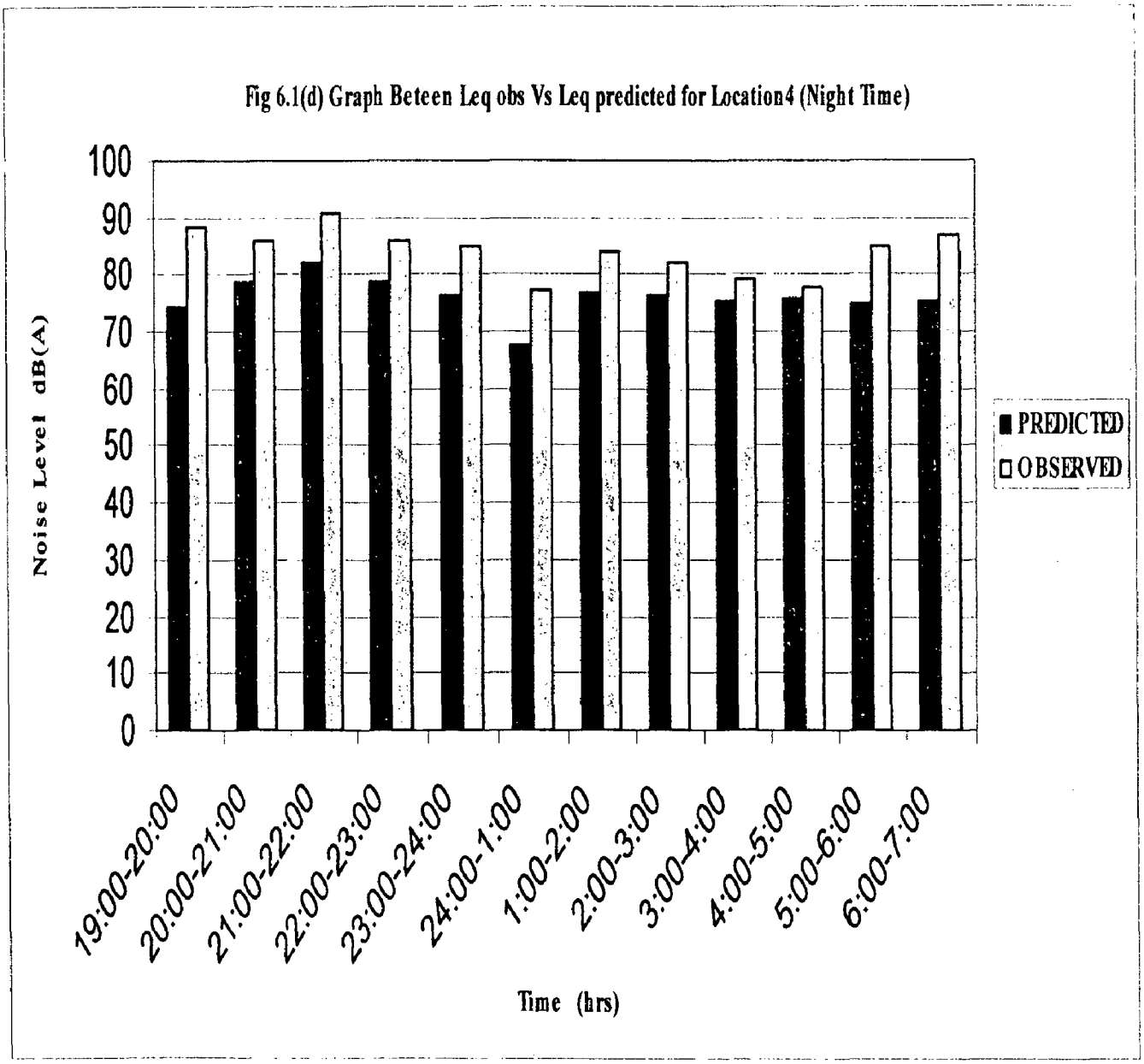
Type of land use is Residential Zone

Observed Noise Level is 84 dB(A)

Predicted Noise Level is 76.5 dB(A)

Difference in Noise Level is 7.5 dB(A)

Fig 6.1(d) Graph Beteen Leq obs Vs Leq predicted for Location4 (Night Time)



6.2.5 Model performance for L5

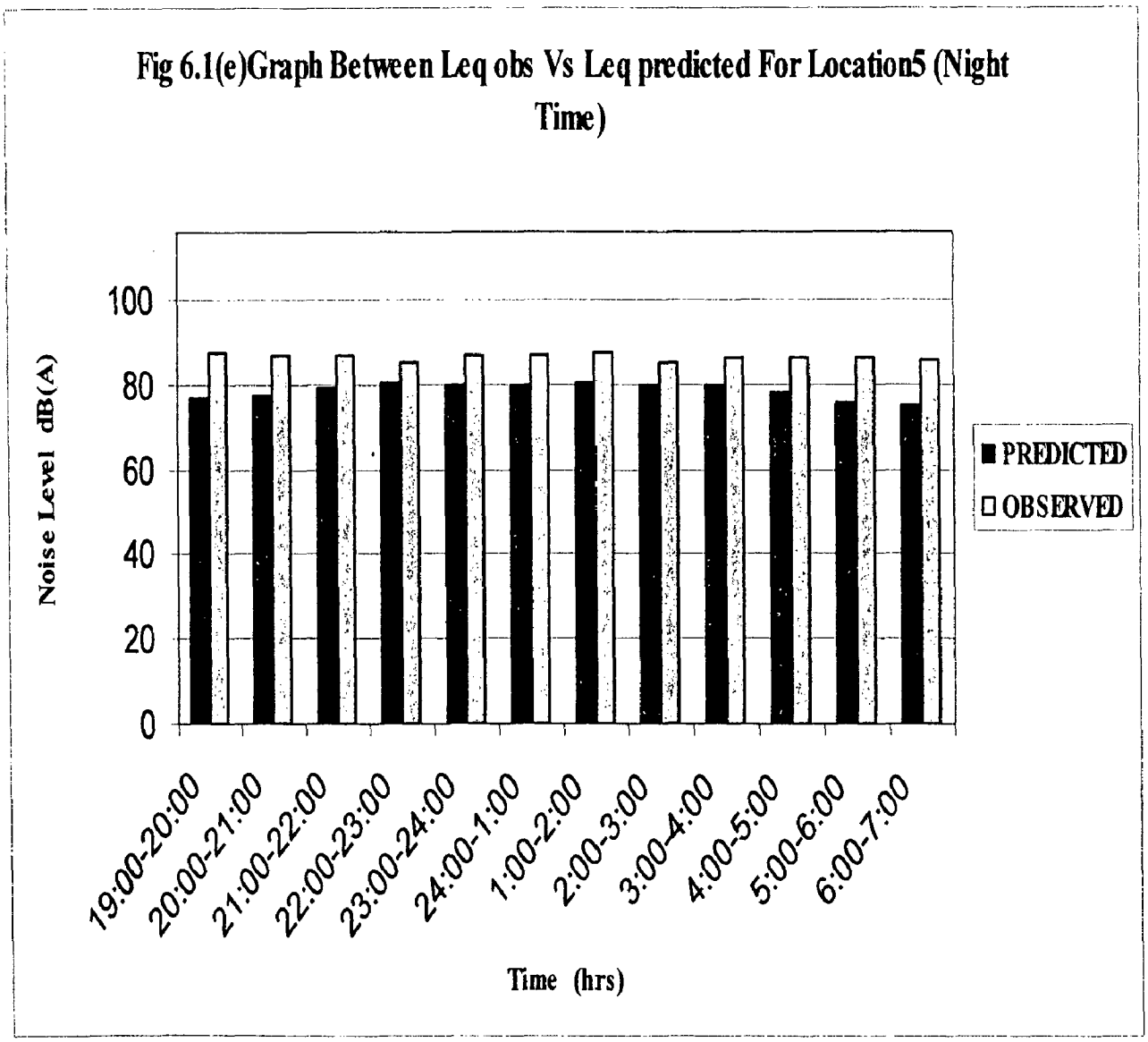
Type of land use is Heavy Traffic Zone

Observed Noise Level is 85 dB(A)

Predicted Noise Level is 79 dB(A)

Difference in Noise Level is 6 dB(A)

Fig 6.1(e)Graph Between Leq obs Vs Leq predicted For Location5 (Night Time)



6.2.6 Model performance for L6

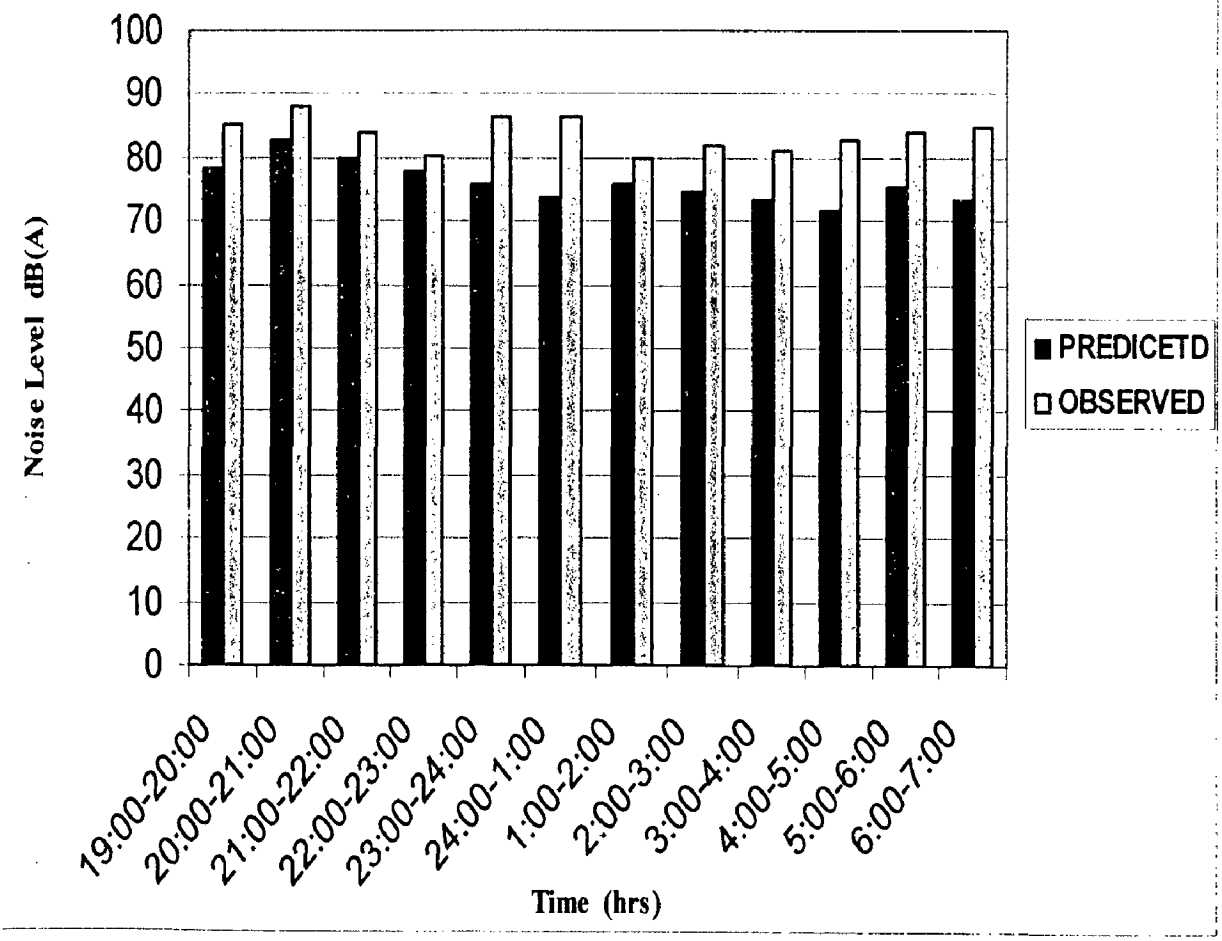
Type of land use is Residential Zone

Observed Noise Level is 84 dB(A)

Predicted Noise Level is 79 dB(A)

Difference in Noise Level is 6 dB(A)

Fig 6.1(f) Graph Between Leq obs Leq predicted for Location6 (Night Time)



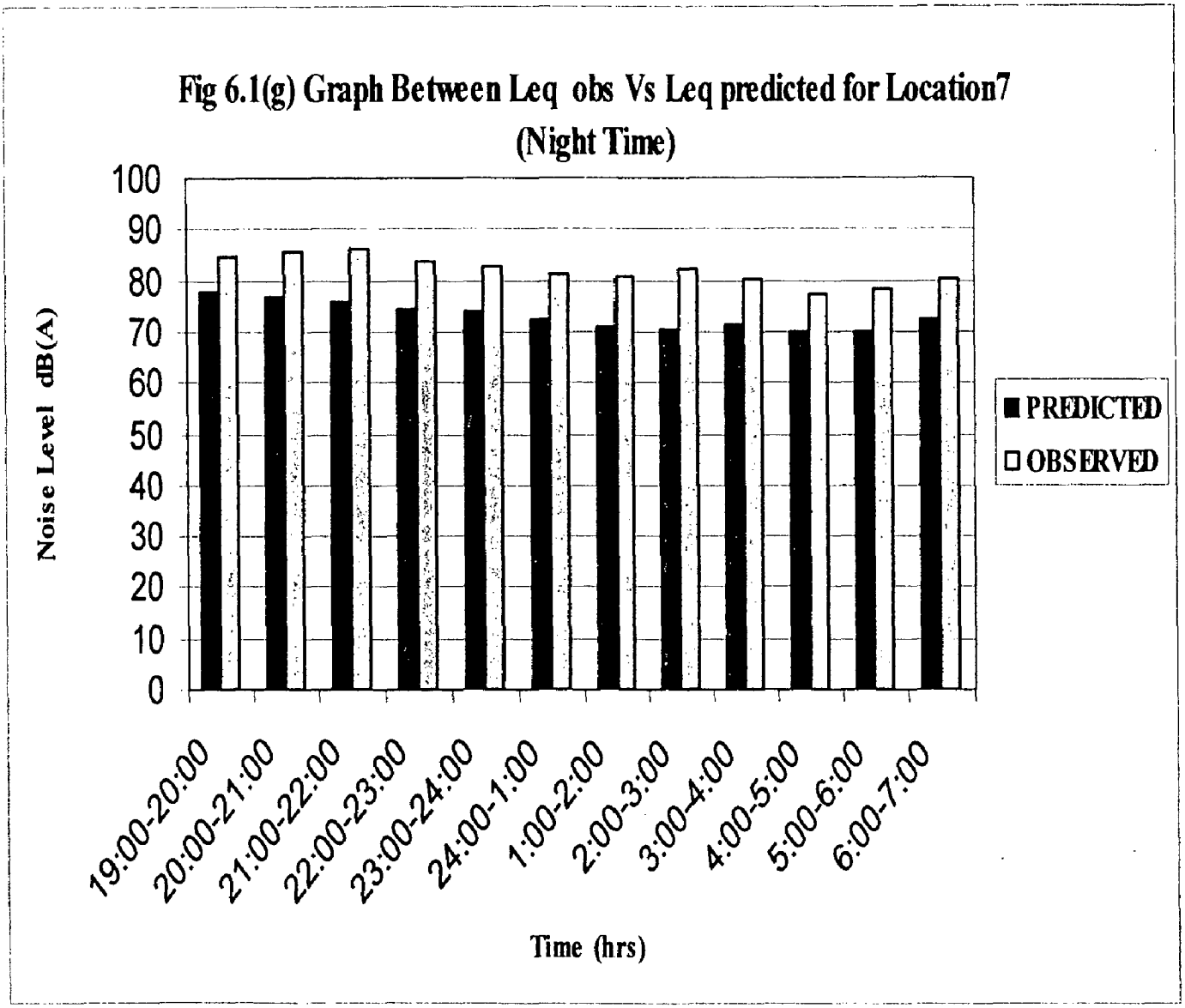
6.2.7 Model performance for L7

Type of land use is Silence Zone

Observed Noise Level is 83dB(A)

Predicted Noise Level is 71 dB(A)

Difference in Noise Level is 8 dB(A)



6.2.8 Model performance for L8

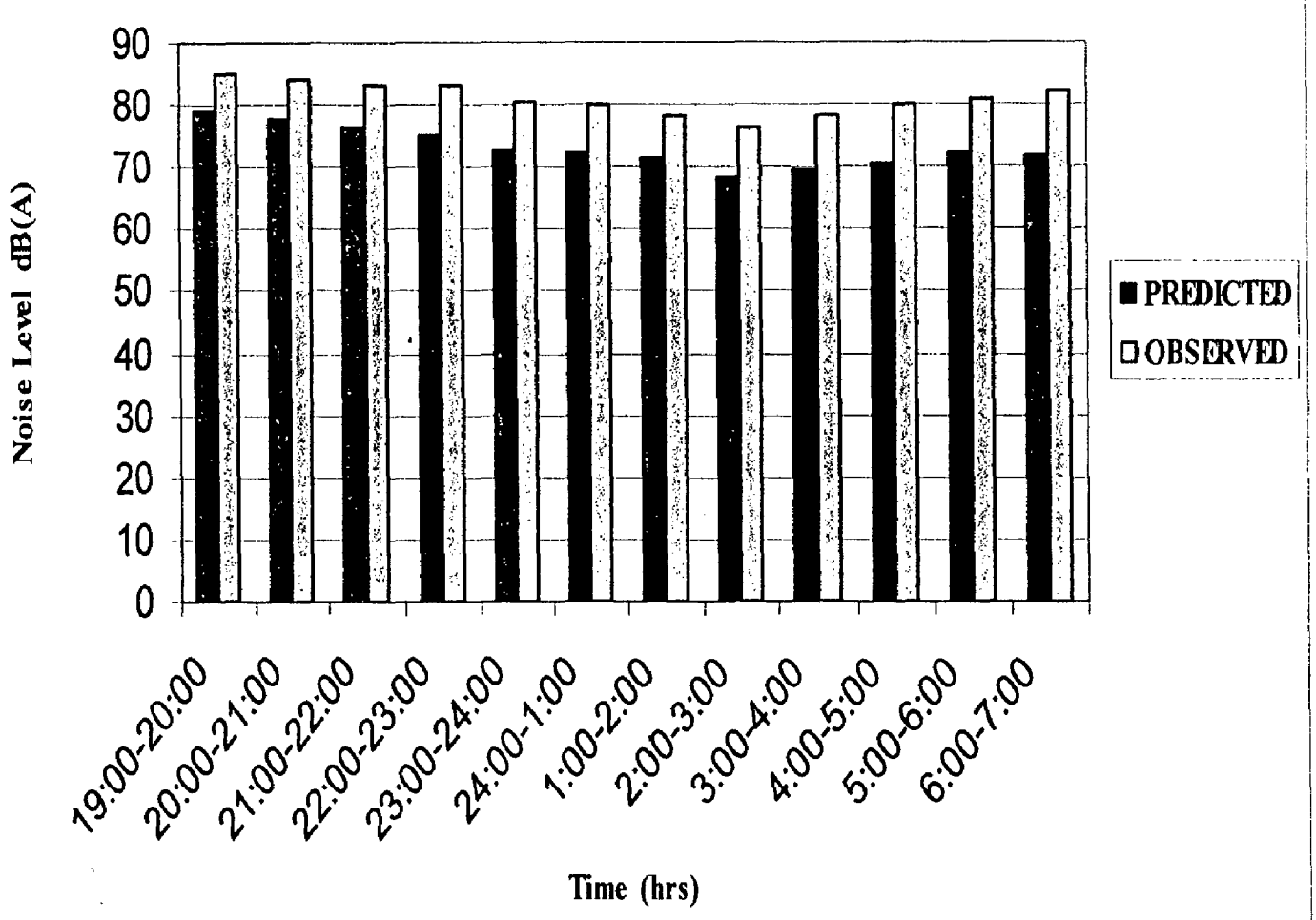
Type of land use is Commercial Zone

Observed Noise Level is 80dB(A)

Predicted Noise Level is 70 dB(A)

Difference in Noise Level is 5 dB(A)

Fig 6.1(h) Graph Between Leq obs Vs Leq predicted for Location8 (Night Time)



6.2.9 Model performance for L5 (Day Time)

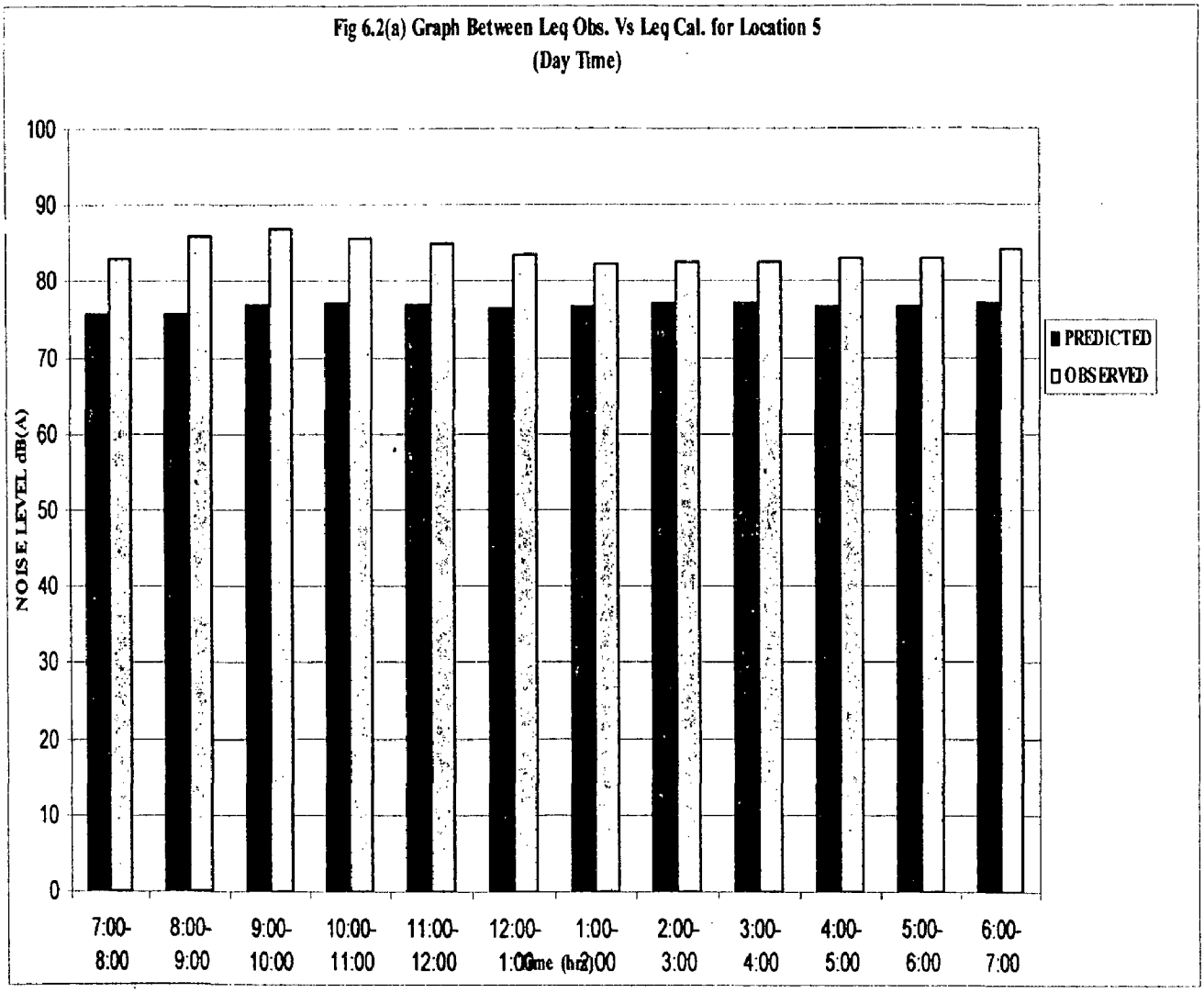
Type of land use is Heavy Traffic Zone

Observed Noise Level is 84 dB(A)

Predicted Noise Level is 77 dB(A)

Difference in Noise Level is 7 dB(A)

Fig 6.2(a) Graph Between Leq Obs. Vs Leq Cal. for Location 5
(Day Time)



6.2.10 Model performance for L6 (Day Time)

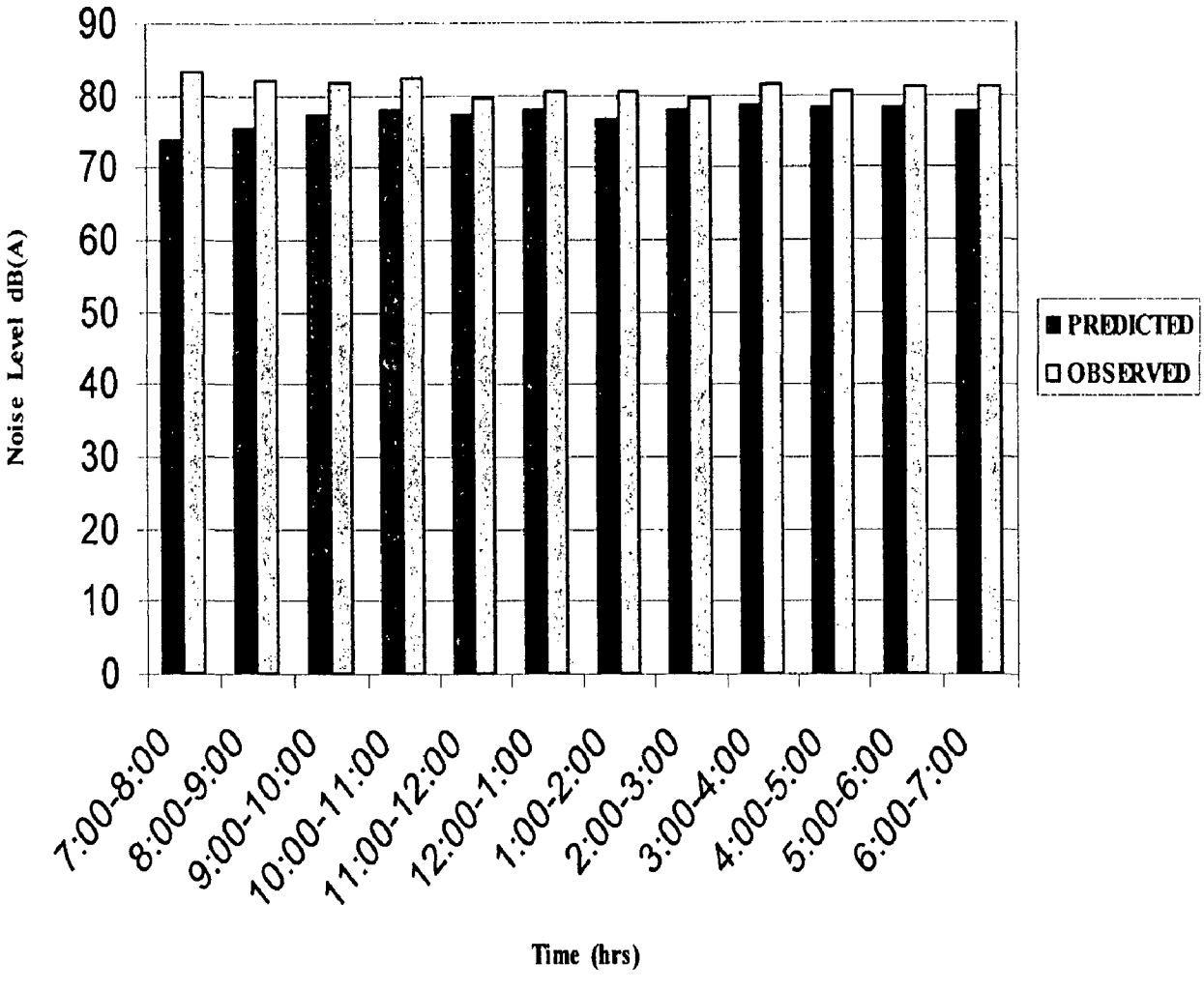
Type of land use is Residential Zone

Observed Noise Level is 81 dB(A)

Predicted Noise Level is 77 dB(A)

Difference in Noise Level is 4 dB(A)

Fig 6.2(b) Graph Between Leq obs. Vs Leq predicted for Location6 (Day Time)



6.2.11 Model performance for L7 (Day Time)

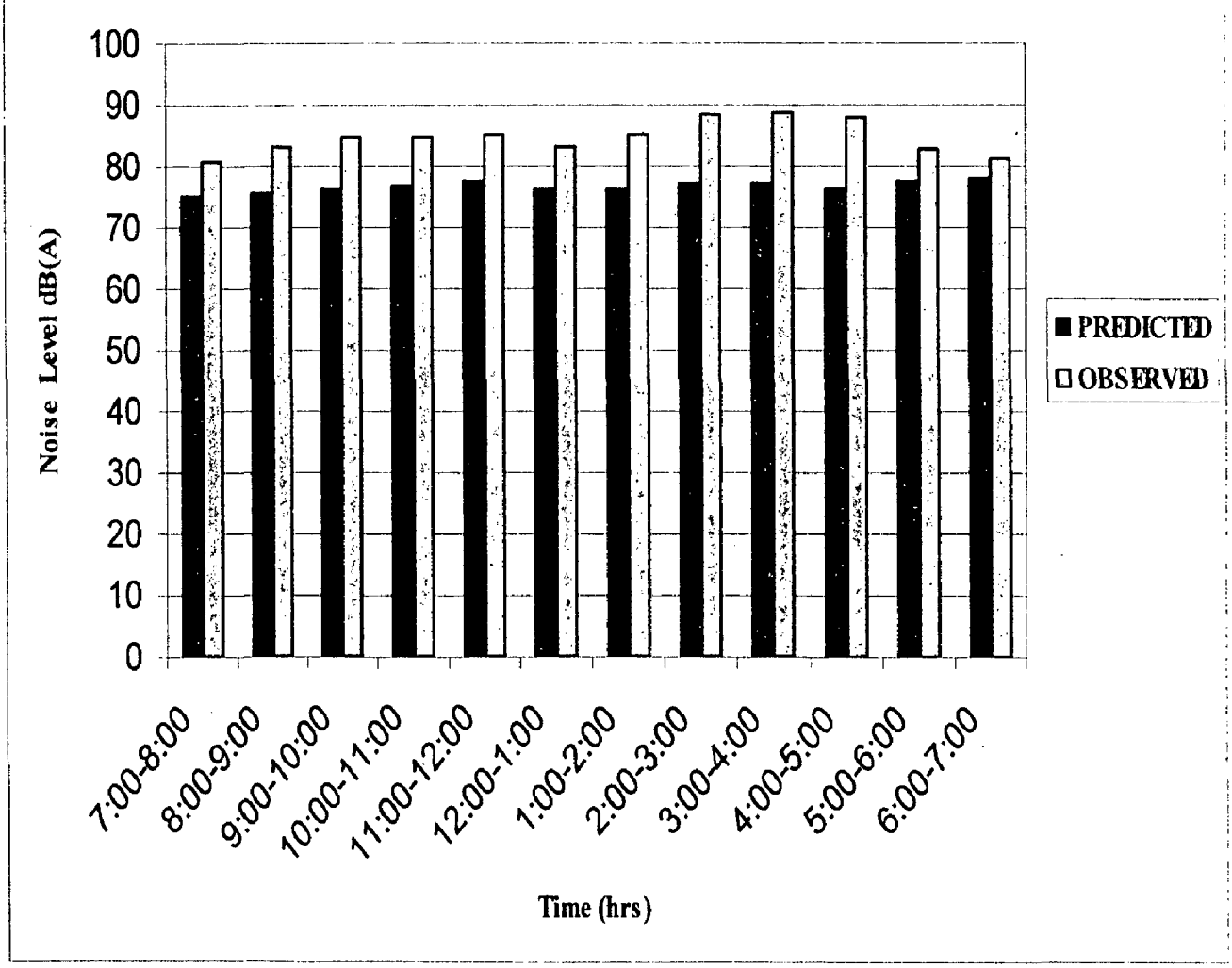
Type of land use is Silence Zone

Observed Noise Level is 84dB(A)

Predicted Noise Level is 77 dB(A)

Difference in Noise Level is 7 dB(A)

Fig 6.2(c) Graph Between Leq Obs. Vs Leq Cal. for Location 7 (Day Time)



6.2.12 Model performance for L8 (Day Time)

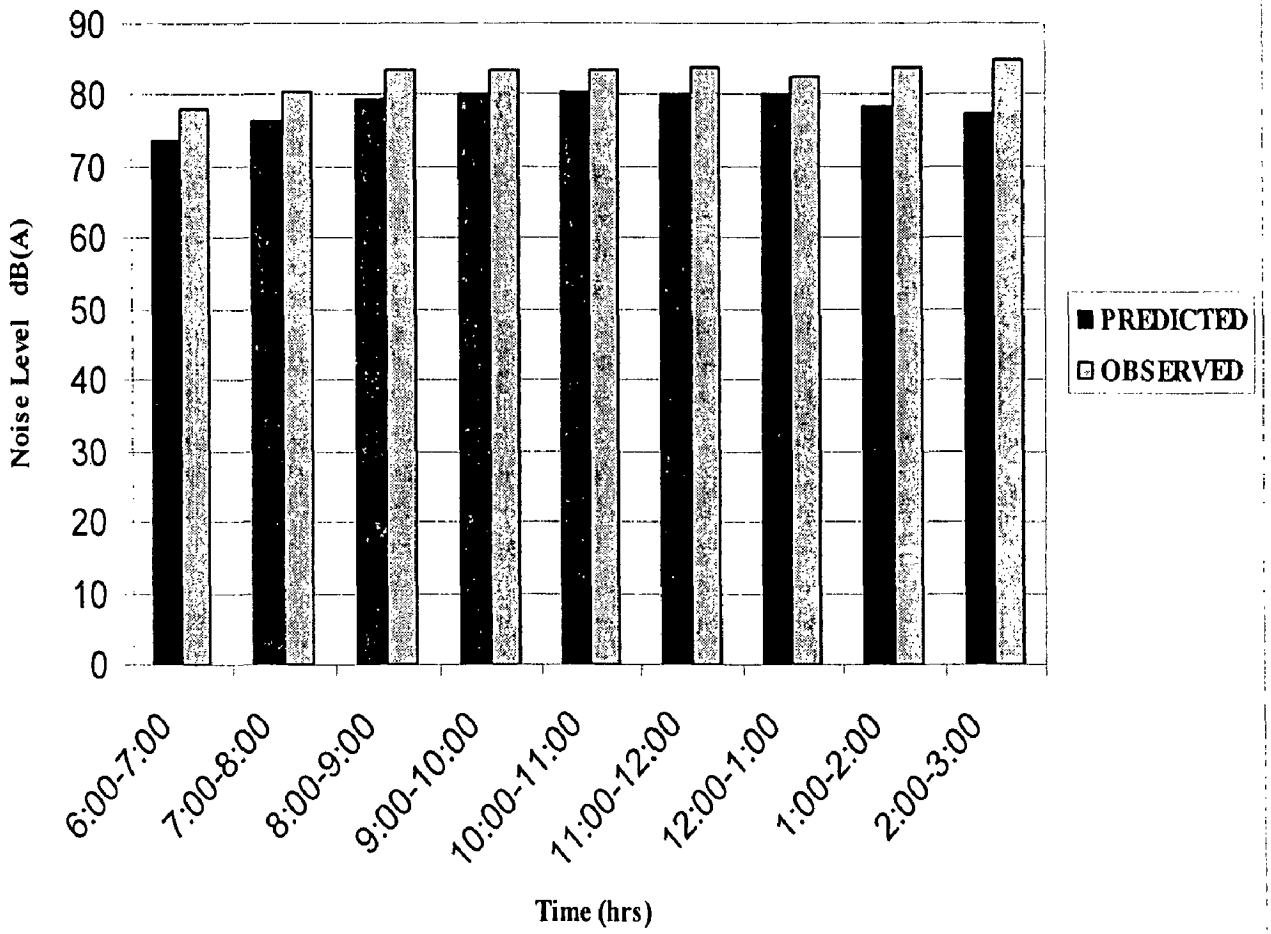
Type of land use is Commercial Zone

Observed Noise Level is 83dB(A)

Predicted Noise Level is 79 dB(A)

Difference in Noise Level is 4 dB(A)

Fig 6.2(d) Graph Between Leq Obs. Vs Leq Cal. for Location 8 (Day Time)



6.3Model Validation

6.3.1 Night time model validation

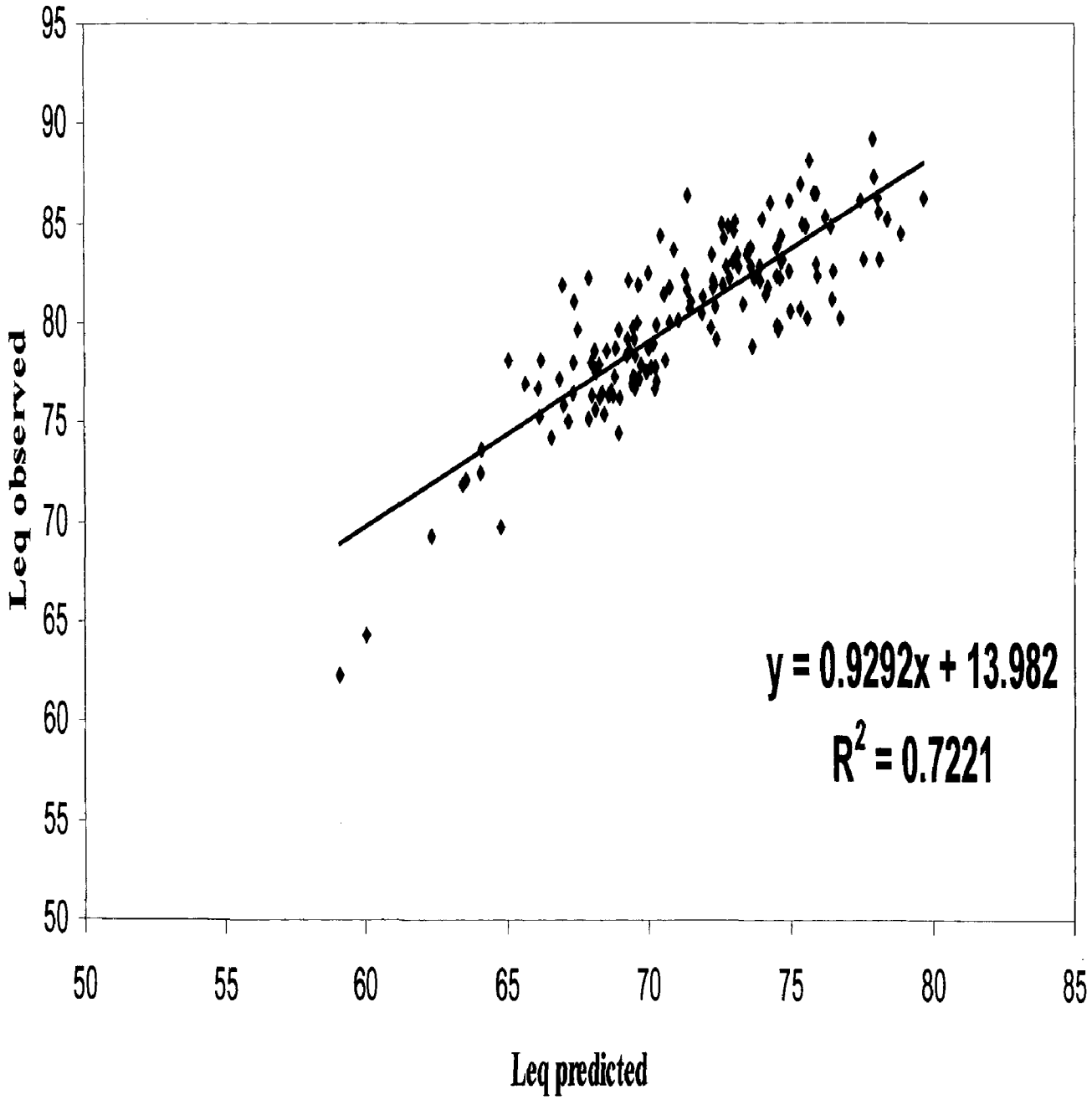
The observed equivalent noise levels and predicted equivalent noise levels for all eight locations is presented in Table 6.1. Predicted equivalent noise levels are calculated using Federal Highway Administration Traffic Noise Model. And graphs for all locations using FHWA TNM model are presented in Fig 6.1(a to h) and Fig 6.3 shows scatter plot data with respect noise level predicted by FHWA TNM. The calibrated equation for FHWA TNM is as follows:

By using FHWA TNM Model, $\mathbf{Y= 0.9292X+ 13.982, R^2 =0.7221}$ (6.1)

where, Y=observed noise level, X= predicted noise level

Table 6.1 Obs. Vs Cal. Leq Values for FHWA TNM Model(Night)							
Leq(CAL)	Leq(OBS)	Leq(CAL)	Leq(OBS)	Leq(CAL)	Leq(OBS)	Leq(CAL)	Leq(OBS)
73.760312	82.27257857	75.3804868	80.720714	68.5074	78.63445714	74.23209	81.75222
72.660046	81.9	75.600122	80.220714	67.368356	81.04456032	73.87982	82.35258
73.96	82.78531429	74.9669982	82.620714	67.879282	82.27851648	73.19915	82.82862
70.15421	78.98	74.7337339	83.186429	62.292156	69.29129901	68.76819	77.33829
69.263951	79.18	76.4448007	84.801607	59.086194	62.34247027	68.74813	76.32161
68.221392	77.83142857	74.5248997	83.794464	60.012468	64.31243479	69.66382	77.11978
67.334615	77.95914464	73.0205213	83.077857	63.520267	72.0504349	72.59206	84.95446
71.49	81.02811429	70.0856785	77.745714	63.420733	71.82481029	73.5668	83.60719
67.145833	75.08	70.7460317	80.017902	65.63364	76.92454789	68.8293	78.7
64.053685	72.5	70.2357836	77.795502	66.160581	78.1646866	70.45383	84.33178
66.555439	74.21	75.5555874	84.820714	71.399212	86.41160714	69.455	77.32
68.65617	76.6	73.6166604	82.785714	70.56	81.37	68.09476	75.58606
74.699905	83.07	72.2762229	81.785714	66.985267	81.85754464	69.63904	81.9016
73.511262	83.47130179	71.0674836	80.142857	66.104227	76.735	70.24549	76.72161
72.275795	82.14606429	70.2990413	79.857857	65.017119	78.1		
71.907431	80.51	70.6008512	78.16	68.567566	76.29857857		
70.021313	78.7246875	68.9604523	76.254464	73.935112	82.12086429		
68.129527	77.50111607	68.9425111	79.635445	73.37556	80.96290179		
67.860174	75.20445714	69.4800743	79.204464	76.468357	81.15754464		
69.205621	78.40111607	79.6812144	86.282145	74.64943	82.26004464		
68.427998	75.4005875	77.9387136	87.302857	76.76732	80.23111607		
67.334996	76.47577857	77.9133639	89.160714	76.531091	82.57382857		
69.917071	77.56425714	75.9263294	83.002857	75.000082	80.57211429		
74.550622	79.91044464	74.5240845	82.345	74.605394	79.715		
73.6644	78.77631429	71.3699605	81.67	74.584355	79.6995875		
72.401869	79.19446429	70.0119521	82.5	71.932646	81.29664464		
72.201645	79.70642857	74.7133834	84.411429	72.335995	81.90720714		
69.73793	77.91201607	74.0351972	85.242857	74.313068	86.03682857		
69.42362	76.92231429	73.094057	85.064464	74.973803	86.13094464		
68.000027	76.28	72.8763086	82.231429	76.240126	85.31004464		
64.749267	69.74446429	71.3138558	82.311607	78.90101	84.48111607		
64.089617	73.65160714	69.4612857	79.733486	78.408266	85.19764464		
67.022617	75.92	68.0909155	78.536114	77.450298	86.11601607		
69.535401	76.71875	69.5417208	77.185714	78.064411	86.28945714		
68.711316	76.50017857	66.8407007	77.159445	78.134099	83.17445714		
77.598862	83.24446429	67.9667982	77.977857	78.091156	85.55221607		
75.976895	82.41446429	74.5717171	83.857857	75.433456	85.00014464		
74.146767	81.35875	73.1733409	83.460714	73.062822	84.58282857		
72.354068	80.83142857	72.762103	82.890179	72.259024	83.46315		
70.296047	77.02160714	72.8513025	84.801607	75.701942	88.14571429		
69.444776	77.14571429	72.6858998	84.221607	75.381662	86.97446429		
68.957458	74.40160714	73.6167307	83.74	75.941563	86.45017857		
66.145743	75.30344464	69.6080289	80	75.835239	86.49177857		
68.336373	76.4	70.7615653	81.740179	70.924042	83.60551607		
68.26542	76.27911429	71.4715127	80.764464	69.290722	82.15785714		
69.344	78.54571429	69.5200141	78.296429	67.473197	79.61790179		

Fig 6.3 Leq obs. Vs Leq predicted.(FHWA TNM)



6.3.2 Day time model validation

The observed equivalent noise levels and predicted equivalent noise levels for four locations are presented in Table 6.2 Predicted equivalent noise levels are calculated using Federal Highway Administration Traffic Noise Model. Graphs for four locations using FHWA TNM model are presented in Fig: 6.2(a to d) and Fig 6.4 shows scatter plot data with respect noise level predicted by FHWA TNM. The calibrated equation for FHWA TNM is as follows:

By using FHWA TNM Model, $\mathbf{Y=0.7875x+20.025, R^2 =0.7176}$ (6.2)

where Y=observed noise level, X= predicted noise level

Table 6.2 Obs Vs Cal. Leq Values for FHWA TNM(Day Time)			
Leq(CAL)	Leq(OBS)	Leq(CAL)	Leq(OBS)
72.88416994	80.65446429	74.76908603	77.25785714
79.54	83.96071429	73.245	76.894
80.87	86.00285714	71.23	74.45
80.69	84.20017857	74.81708074	80.84001607
74.12349686	80.35446429	74.95679017	81.06446429
74.7583295	78.47160714	74.99451256	75.84642857
74.87320211	80.34800714	75.2141765	78.72160714
74.23692026	81.40160714	74.07032797	78.58921607
70.78	73.567	75.31102519	77.58344464
72.63552046	79.14571429	75.27229285	78.96361607
72.243	75.56	75.61375674	77.85160714
73.33452183	80.14571429	74.75892032	79.40017857
73.22142412	80.32071429	74.86625485	78.65017857
73.35082957	78.63142857	80.45	83.256
73.40501063	78.14571429	71.44	74.55
81.24	83.56	69.555	75.666
73.08081704	78.67160714	70.33	76.453
72.60352803	78.61142857	80.9	84.03017857
72.83537375	77.58571429	80.52	81.94446429
73.47412927	80.44571429	80.71	83.93544464
70.85358867	75.9666	85.77896545	87.79017857
72.7026042	76.64446429	85.21	88.56780179
74.06801949	74.55875	83.75	87.4
74.79470712	76.28571429	76.12647782	80.61446429
73.97021987	77.04446429	76.67716289	78.70017857
74.92003867	75.84446429	72.38655511	75.71886429
73.68716987	76.03142857	71.80540912	75.8665875
74.87814666	75.14000714	72.44104029	75.9821875
75.74434751	77.96875	85.83	88.131
74.77047012	76.80285714	73.94045163	78.63785714
75.54741269	76.28017857	72.27680818	77.22071429
72.60445473	77.58642857	71.68253718	78.835
71.60494016	73.52571429	71.09866997	78.46875
74.5499989	78.24	71.67597584	78.55785714
76.70804753	77.21446429	71.66056967	78.81142857
77.90912417	78.45446429	72.02125589	78.28285714
79.567	83.0343	75.51552737	76.55785714
74.3	78.6	69.17962607	76.04446429
69.55	75.777	72.06820196	76.315
76.30113594	82.80160714	78.18	82.27160714
77.04754815	81.58285714	76.24600166	81.90285714
78.43	81.8967	76.27978699	82.24

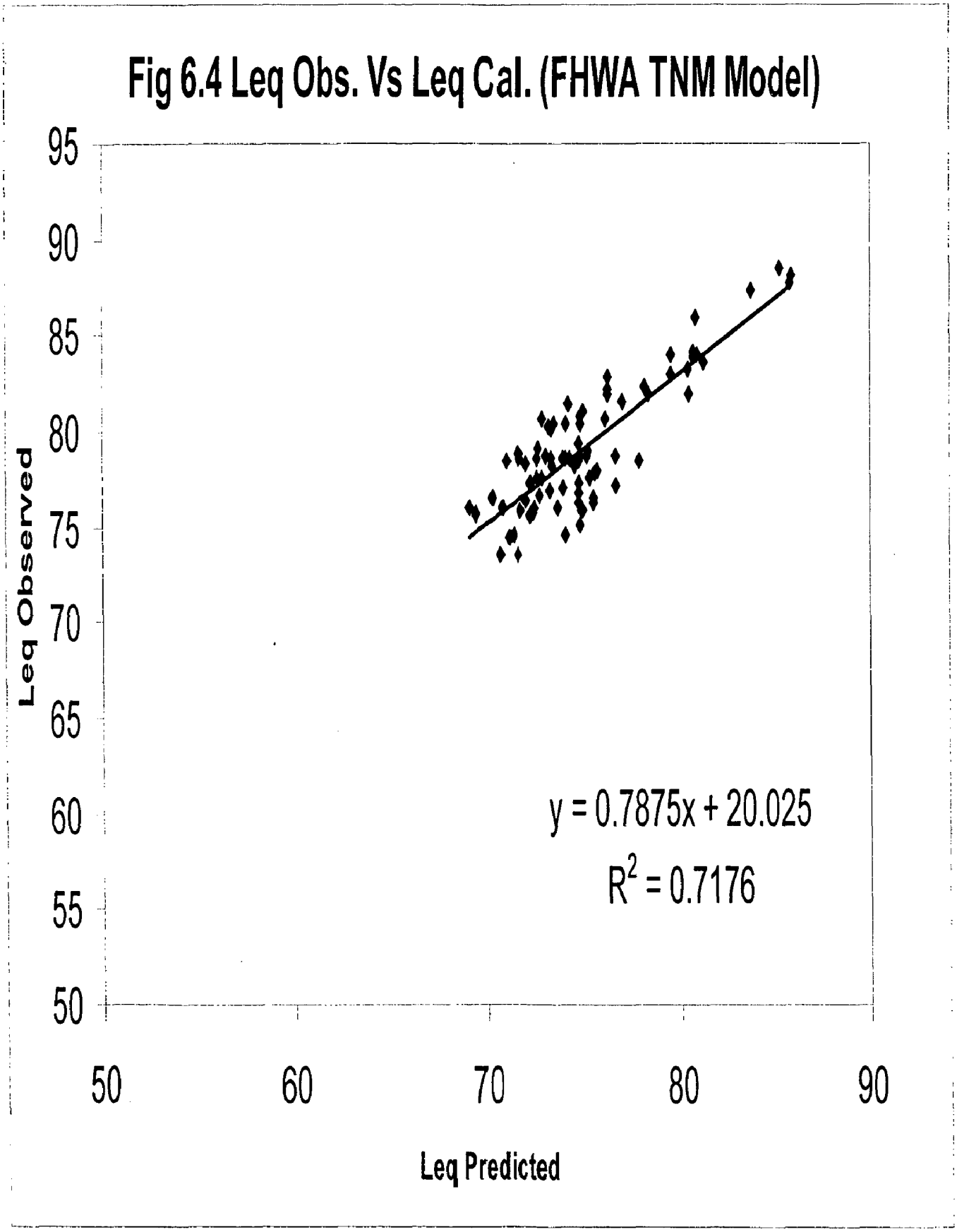


Fig 6.4 Leq Obs. Vs Leq Cal. (FHWA TNM Model)
95
90
85
80
75
70
65
60
55
50
Leq Observed
y = 0.7875x + 20.025
R2 = 0.7176
50
60
70
80
90
Leq Predicted

6.4 Parametric Analysis:

Noise is affected by different parameters. And some of the parameters which affect noise are traffic flow, vehicle composition and vehicle categories. The major vehicle categories which are affecting traffic noise are trucks and passenger cars. and ,in this parametric analysis banning trucks and banning cars in some of the locations are studied.

6.4.1 Banning trucks

Traffic is a composition of different type of vehicles. And we know that, trucks are contributing more noise to the environment as compared with any other vehicle. Their composition is less than other vehicles but their contribution of noise levels higher. The trucks are inherently very noisy even through standard of operation is generally good. And in this, banning of trucks in some of the locations has been shown from Fig.6.5 (a-d) and summary of this data has been shown in Table 6.3

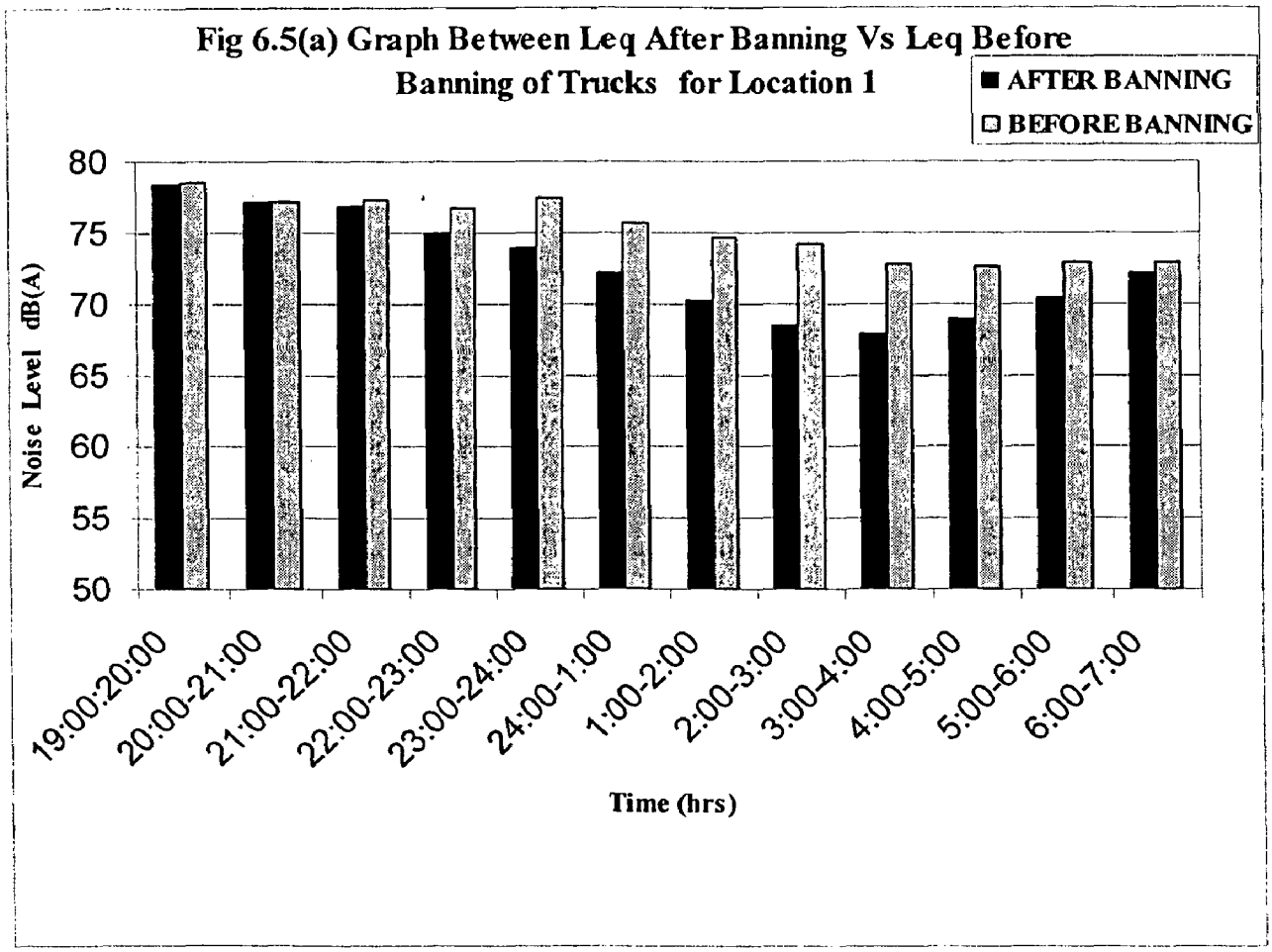


Fig 6.5(b) Graph Between Leq After Banning Vs Leq Before Banning of Trucks for Location 5

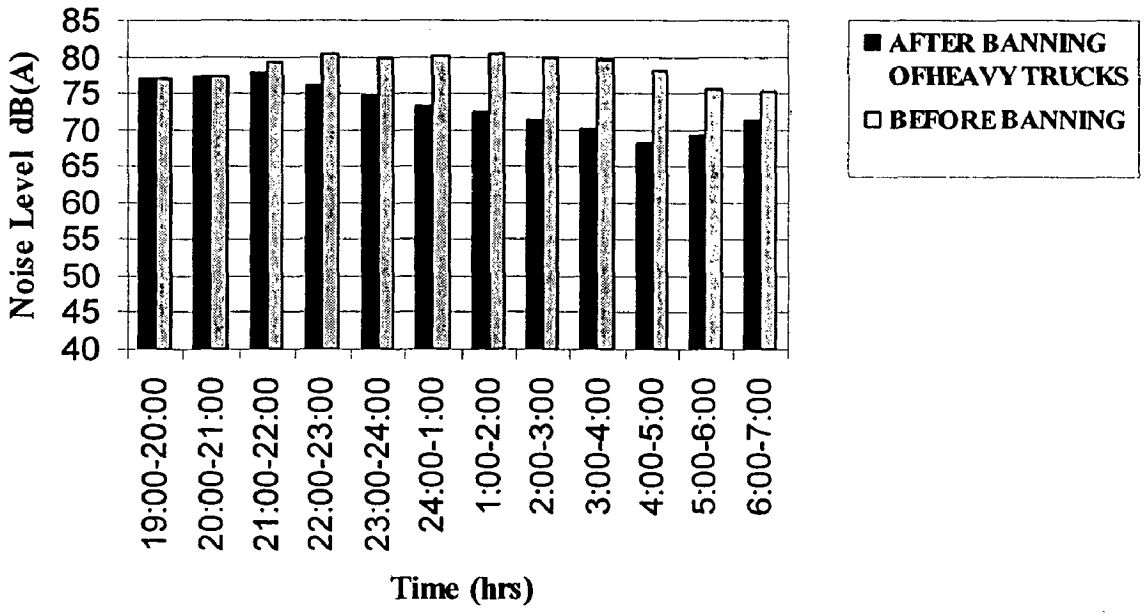


Fig 6.5(c) Graph between Leq After Banning Vs Leq Before Banning of Trucks for Location 5

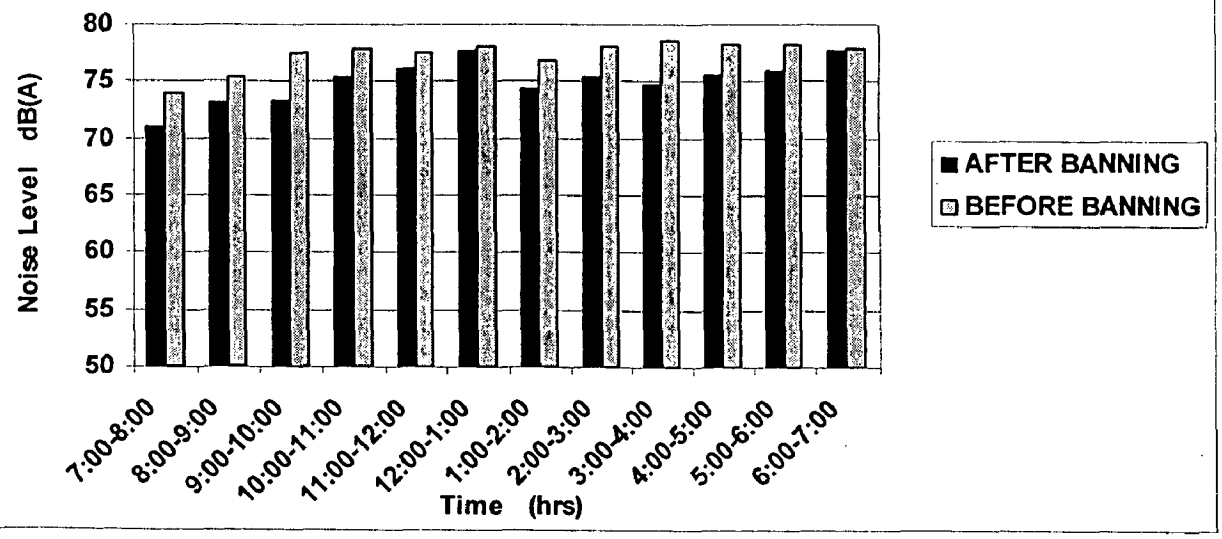


Fig 6.5(d) Graph Between Leq After Banning Vs Leq Before Banning of Trucks for Location 6

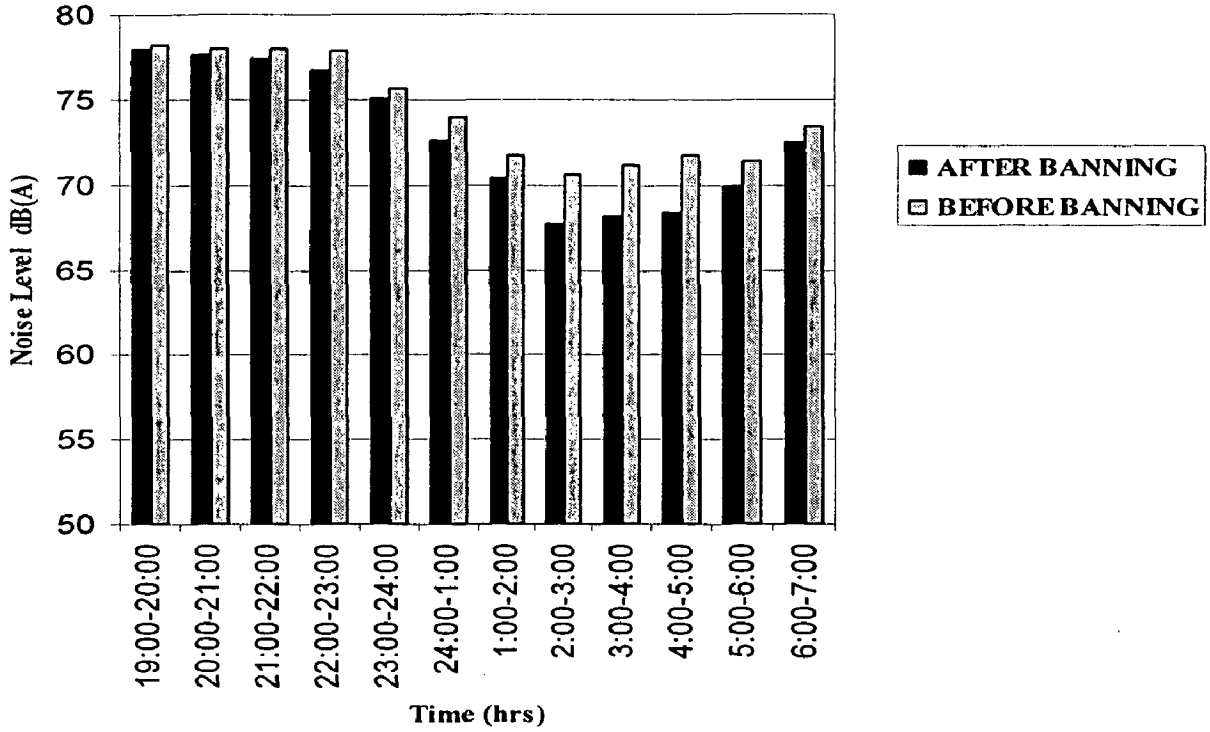


Table 6.3 Noise Levels before and after Banning Heavy Vehicles

S.No	Location	% of heavy vehicles	Noise L_{eq}(h)		Reduction in dB(A)
			Before banning heavy vehicles	After banning heavy vehicles	
1	L1(Night)	3.39	75.26	72.66	2.6
2	L5(Night)	16.28	78.59	73.26	5.3
3	L5(Day)	1.06	77.33	75.0	2.33
4	L6(Night)	1.67	74.3	72.89	1.41

6.4.2 Banning cars

Cars do not differ greatly as noise sources. This might be expected from similarities among different models and the manufactures concern with good muffling practices. Here, before banning and after banning of cars has been studied and by this parametric analysis it is observed that predicted noise level is decreased up to 2 – 3 dB(A). And graphs for some of the locations are shown from Fig 6.5 (e-h)

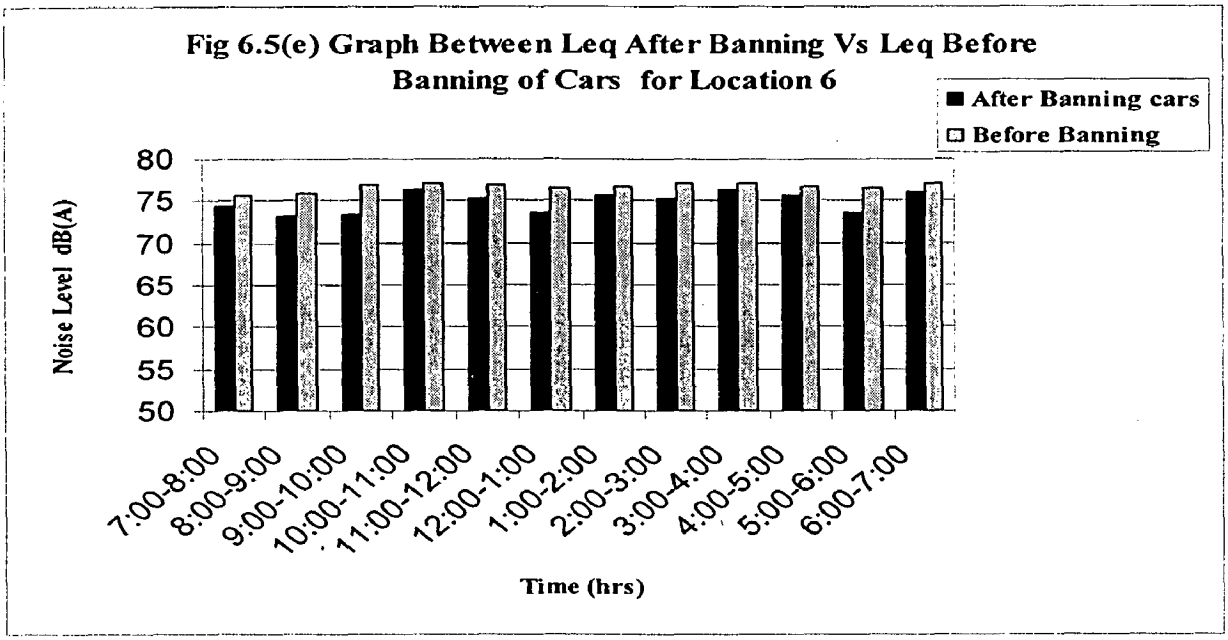


Fig 6.5(e) Graph Between Leq After Banning Vs Leq Before Banning of Cars for Location 6

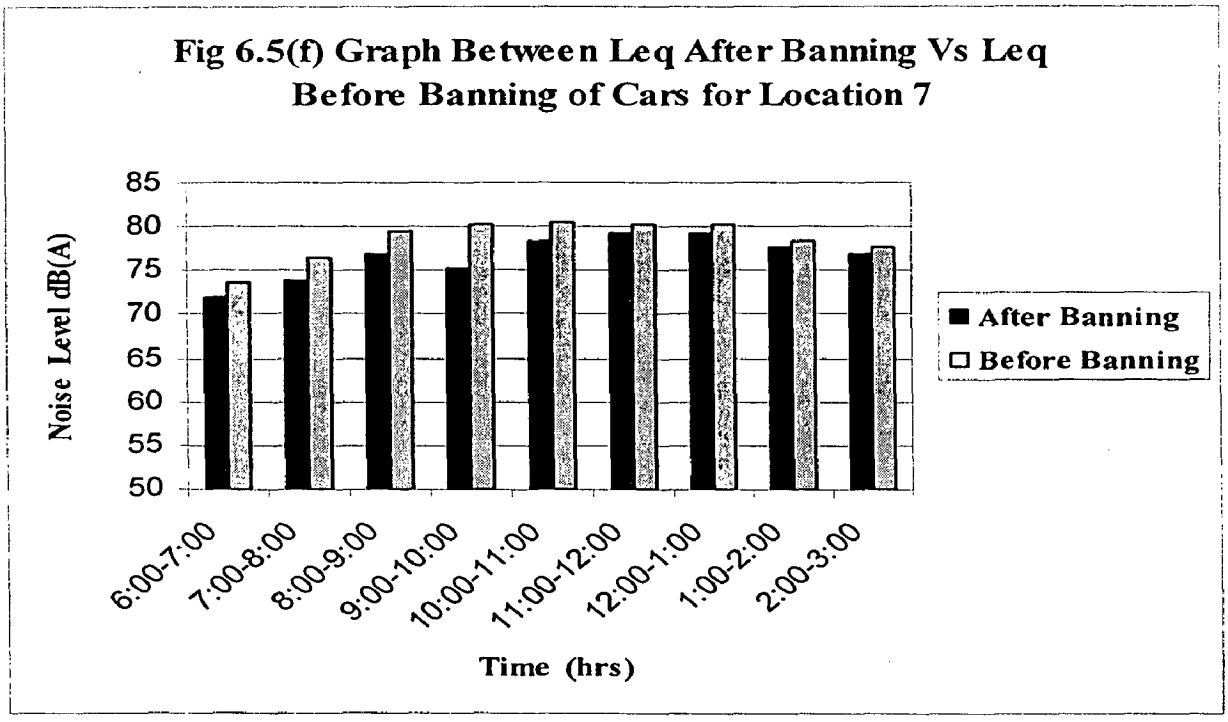


Fig 6.5(f) Graph Between Leq After Banning Vs Leq Before Banning of Cars for Location 7

Fig 6.5(g) Graph Between Leq After Banning Vs Leq Before Banning of Cars for Location 7

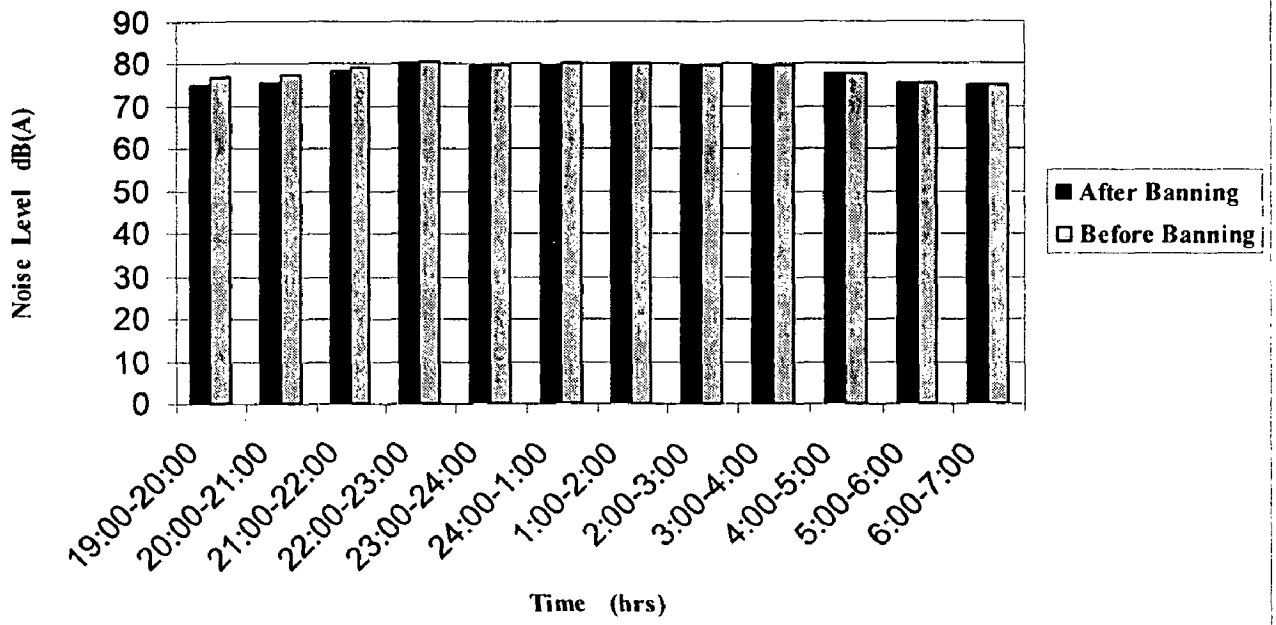
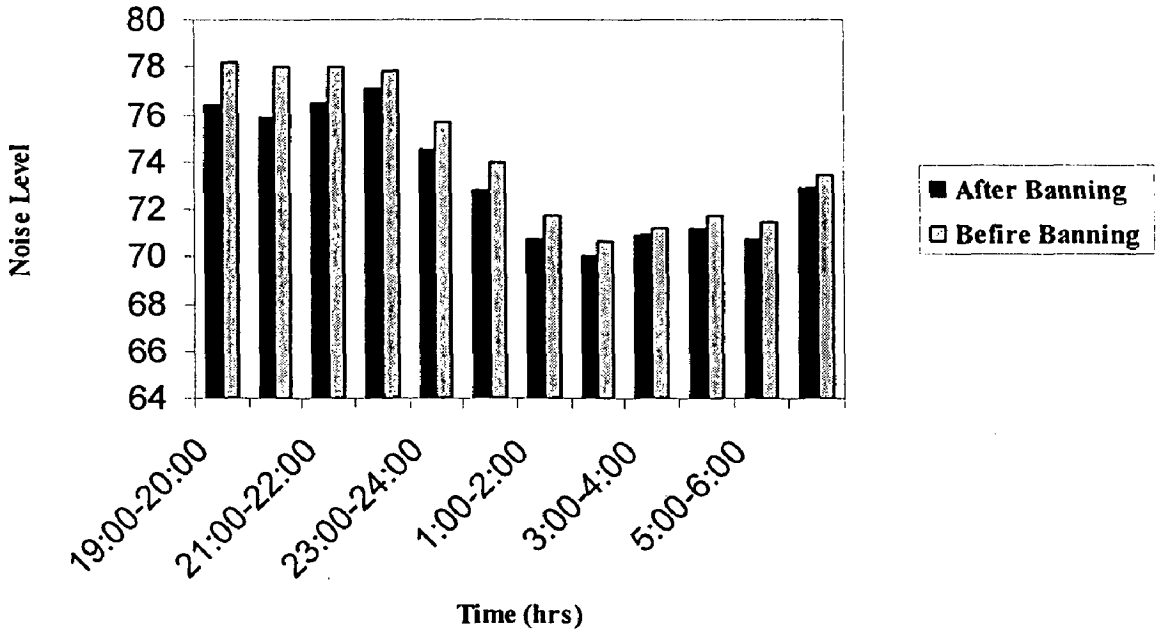


Fig. 6.5 (h) Graph Between Leq Before and After Banning of Cars for Location 6



6.4.3 Reducing cars and increasing buses

By this parametric analysis, noise level is decreased up to 2-3 dB(A). Reducing cars to 50% and increasing buses to 25 % graphs are shown from Fig 6.6 (a –b).

Fig .6.6 (a) Graph Between Leq before and After Reducing Cars to 50 % and increasing buses to 25% for Location 3

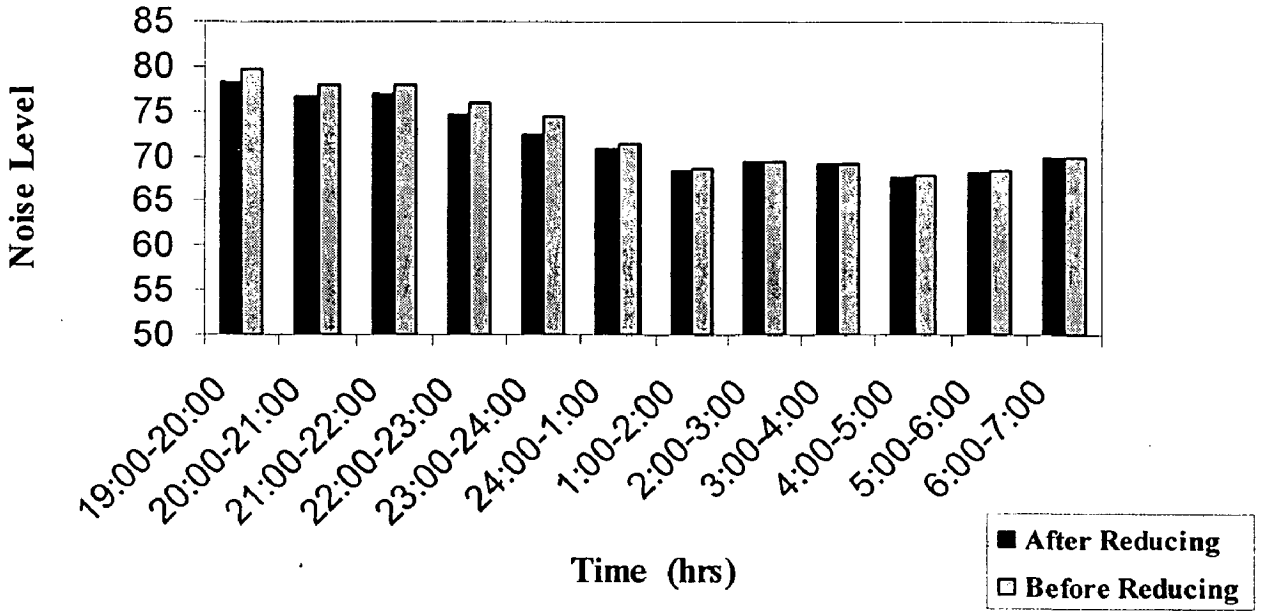
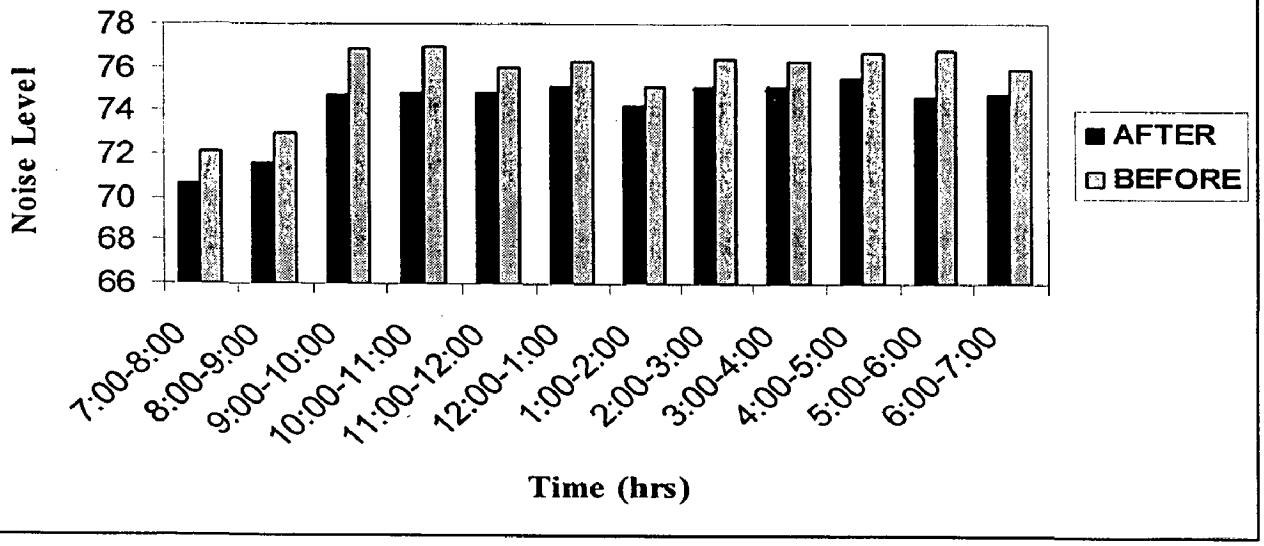


Fig 6.6 (b) Graph Between Leq After and Before Reducing Cars to 50% and increasing Buses to 25% for Location 5



CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions:

From the following dissertation, the following conclusions are drawn:

1. The observed noise levels from sites are very higher than allowable noise levels at different locations.
2. The values of L_{10}, L_{eq} at a varying distances from the highway were observed to be high especially L_{eq}, as per Indian standards.
3. The FHWA TNM (Federal Highway Administration Traffic Noise Model) is used for noise prediction.
4. By using FHWA TNM, it is observed that, it is giving better estimation of measured noise level than FHWA model.
5. The maximum deviation of observed noise level with predicted noise level is 4-8 dB(A) for FHWA TNM model.
6. By using field data of Night, the equation developed for FHWA TNM is $y=0.7875x+20.025$ and $R^2 = 0.7221$
7. By using field data of Morning, the developed for FHWA TNM is $Y=0.9292x+13.982$ and $R^2=0.7176$
8. By Banning Heavy Trucks in some Locations, the predicted noise level is decreased up to 3-5 dB(A)
9. By banning cars in some locations, the predicted noise level is decreased up to 1-2 dB (A)

10. By reducing cars to 50% and increasing buses to 25%, the predicted noise level is decreased up to 2 – 3 dB(A).

7.2 RECOMMENDATIONS:

1. Individual vehicle noise emission equations for full throttle and half throttle conditions need to be developed for Indian conditions to FHWA TNM Model.

2. From the study it is quite obvious that various traffic management measures are not quite effective in reducing traffic noise in a significant manner. There is a need to explore the possibility of adopting other abatement measures i.e. noise wall and planting dense trees.

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APPENDIX A

NOISE TERMINOLOGY

A-WEIGHTING: A frequency weighting network used to account for changes in sensitivity as a function of frequency

AMBIENT NOISE: All-encompassing sound that is associated with a given environment, excluding the analysis system's electrical noise and the sound source of interest.

BACKGROUND NOISE: All-encompassing sounds of a given environment that includes ambient, as well as analysis system noise, excluding the sound source of interest.

COMMUNITY-NOISE EXPOSURE LEVEL (CNEL, denoted by the symbol L_{den}): A 24-hour time-averaged L_{AE} , adjusted for average-day sound source operations. In the case of highway noise, a single operation is equivalent to a single vehicle pass-by. The adjustment includes a 5-dB penalty for vehicle pass-bys occurring between 1900 and 2200 hours, local time, and a 10-dB penalty for those occurring between 2200 and 0700 hours, local time. The L_{den} noise descriptor is used primarily in the state of California. L_{den} is computed as follows:

$$L_{den} = L_{AE} + 10 \times \log_{10}(N_{day} + 3 \times N_{eve} + 10 \times N_{night}) - 49.4 \quad \text{(dB)}$$

where:

L_{AE} = Sound exposure level in dB

N_{day} = Number of vehicle pass-bys between 0700 and 1900 hours, local time;

N_{eve} = Number of vehicle pass-bys between 1900 and 2200 hours, local time;

N_{night} = Number of vehicle pass-bys between 2200 and 0700 hours, local time; and

DAY-NIGHT AVERAGE SOUND LEVEL (DNL, denoted by the symbol L_{dn}): A 24-hour time-averaged L_{AE} adjusted for average-day sound source operations. In the case of highway noise, a single operation is equivalent to a single vehicle pass-by. The adjustment includes a 10-dB penalty for vehicle pass-bys occurring between 2200 and 0700 hours, local time. L_{dn} is computed as follows:

$$\mathbf{L_{dn} = L_{AE} + 10 \times \log_{10}(N_{day} + N_{eve} + 10 \times N_{night}) - 49.4 \quad (dB)}$$

where:

L_{AE} = Sound exposure level in dB

N_{day} = Number of vehicle pass-bys between 0700 and 1900 hours

N_{eve} = Number of vehicle pass-bys between 1900 and 2200 hours

N_{night} = Number of vehicle pass-bys between 2200 and 0700 hours

DECIBEL (dB): A unit of level which denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the base 10 logarithm of this ratio. For the purpose of this document, the reference level is 20 μPa, or the threshold of human hearing.

DOPPLER EFFECT: The change in the observed frequency of a wave in a transmission system caused by a time rate of change in the effective length of the path of travel between the source and the point of observation.

EQUIVALENT CONTINUOUS SOUND LEVEL: L_{eq} is defined as the steady sound level that contains the same amount of acoustic energy as the fluctuating level over the prescribed period of time. Common prescribed periods are one hour, 24 hours, the day time hours -7 am to 10 pm, L_d and the nighttime hours-10 pm to 7 am, L_n.

In mathematical terms, L_{eq} is defined as

$$L_{eq} = 10 \log_{10}\left(\frac{1}{T}\int_0^T \frac{p^2}{p^2_{ref}} dt\right)$$

Where

T= Total measurement time

P= A-weighted instaneous acoustic pressure

P_{ref}= Reference acoustic pressure

GROUND ATTENUATION: The change in sound level, either positive or negative, due to intervening ground between source and receiver. Ground attenuation is a relatively complex acoustic phenomenon, which is a function of ground characteristics, source-to-receiver geometry, and the spectral characteristics of the source. A commonly used rule-of-thumb for propagation over soft ground (i.e., grass, terrain) is that ground effects will account for about 1.5 db per doubling of distance. However, this relationship is quite empirical and tends to break down for distances greater than about 30 to 61 m (100 to 200 ft).

HARD GROUND: Any highly reflective surface in which the phase of the sound energy is essentially preserved upon reflection; examples includes water, asphalt and concrete.

INSERTION LOSS (IL): The difference in levels before and after installation of a barrier, where the source, terrain, ground, and atmospheric conditions have been judged as equivalent.

L_{10}: The sound level that is exceeded 10 percent of the time: that is, the 10^{th} percentage point or the 90^{th} percentile of the sound pressure level probability distribution function.

L_{50}: The sound level that is exceeded 50 percent of the time: that is, the 50^{th} point or percentage of the sound pressure level probability distribution function (also called the median level).

NOISE: Any unwanted sound.

NOISE BARRIER: The structure, or structure together with other material, that potentially alters the noise at a site from a BEFORE condition to an AFTER condition.

NOISE POLLUTION LEVEL, L_{NP}: For many community noise situations of interest, an expression can be used as follows:

$$L_{NP} = L_{eq} + a\,(L_{10} - L_{90}) \text{ where } a = 1.0$$

The noise pollution level is potentially attractive because, in principle, it allows annoyance from aircraft, traffic, and perhaps other sources such as industrial noise to be determined. Since L_{NP} is intended to describe both traffic and aircraft noise successfully and since it describes traffic noise as well as or better than TNI, the Noise Pollution Level has received more interest, attention and use. However, the superiority of L_{NP} over all other forms of noise rating has not been proved in practice.

SOFT GROUND: Any highly absorptive surface in which the phase of the sound energy is changed upon reflection; examples include terrain covered with dense vegetation or freshly fallen snow. (Note: at grazing angles greater than 20 degrees, which can commonly occur at short ranges, or in the case of elevated sources, soft ground becomes a good reflector and can be considered hard ground).

SOUND LEVEL: Weighted sound level measured with a sound level meter having metering characteristics and a frequency weighting of A, B, or C as specified in the sound level meter standard.

SOUND PRESSURE LEVEL (SPL): Ten times the logarithm to the base 10 of the ratio of the time-mean-squared pressure of a sound, in a stated frequency band, to the square of the reference sound pressure of 20 μPa, the threshold of human hearing.

TRAFFIC NOISE INDEX, TNI: The traffic noise index is a weighted combination of L_{10} and L_{90} and takes into account the amount of variability in observed sound levels in

an attempt to improve the correlation between traffic noise measurements and subjective response to noise.

$$\mathbf{TNI = 4(L_{10} - L_{90}) + L_{90} - 30\ dB}$$

Where

L_{10} = 10 percentile exceeded sound level

L_{90}= 90 percentile exceeded sound level

The first term expresses the range of noise climate and describes the variability of the noise, while the second represents the background noise level and the third term is introduced to yield more convenient numbers. Use of TNI, however has not been too widespread.

ROADWAY TERMINOLAGY

AT-GRADE ROADWAY: a roadway element that is level with the immediate surrounding terrain.

AUTOMOBILES: all vehicles having two axles and four tires – designated primarily for transportation of nine or fewer passengers, i.e., automobiles, or for transportation of cargo, i.e., light trucks. Generally, the gross-vehicle weight is less than 4500 kg (9900lb).

Average highway speed (AHS): the weighted average of design speed with in a roadway section.

DEPRESSED ROADWAY: a roadway that is constructed below the immediate surrounding terrain.

ELEVATOR ROADWAY: a roadway that is constructed above the immediate surrounding terrain, either on a landfill or a structure.

HEAVY TRUCKS: all cargo vehicles with three or more axle. Generally, the gross vehicle weight is greater than 12,000 kg (26,400 lb).

MEDIUM TRUCKS: all cargo vehicles with two axles and six tires. Generally, the gross vehicle weight is greater than 4,500 kg (9,900 lb), but less than 12,000 kg (26,400 lb).

OBSERVER: the location at which noise levels are computed and analyzed: also called the "receiver".

PAVEMENT: the part of the roadway having a constructed surface for the facilitation of vehicular movement.

ROADWAY: used here to designate any arterial highway, expressway, freeway, or parkway.

ROADWAY WIDTH: the distance between the outside edges of the nearest and farthest traffic lanes including median.

SHIELDING: any construction or natural barrier which, when interposed between the roadway and observer, will provide an excess reduction in roadway noise.

SHOULDER: that portion of the roadway between the outer edge of the nearer traffic pavement and the farthest point from the roadway which has been graded or paved for emergency vehicular use.

	SPEED DATA		26/11/2003		PRETHI VI	VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	33	31	26	28	0	1077	703	62	129	0	10.25	
8:00-9:00	33	30	22	24		986	709	26	123	6	10.25	
9:00-10:00	36	35	31	27	22	853	621	118	104	15	10.25	
10:00-11:0	40	42	34	28.5	33	466	498	111	46	63	10.25	
11:00-12:0	31	29	29	27	37.5	375	287	76	20	19	10.25	
12:00-1:00	40	38	36	31	27	239	155	50	22	11	10.25	
1:00-2:00	54	53	46	35	40	168	80	34	6	12	10.25	
2:00-3:00	50	50	45	39	44	60	5	20	3	13	10.25	
3:00-4:00	49	47	41	36	50	20	7	44	10	13	10.25	
4:00-5:00	43	44	38	35	43	21	16	28	18	7	10.25	
5:00-6:00	48	41	44	31	39	27	81	50	24	16	10.25	
6:00-7:00	45	40	36	43		76	210	75	38	18	10.25	

DIRECTION: PRETHI VIHAR TO ITO

HOURLY LEQ CALCULATION USING FHWA EQUATION FOR DIRECTION 1

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
7:00-8:00	70.8719	70.42055	66.43502	69.7907	0	12223350	11016793	4400500	9529500	1	37170143	75.70194
8:00-9:00	70.48851	70.44554	63.29794	70.05169	0	11190551	11080358	2136949	10119727	1	34527585	75.38166
9:00-10:00	69.59899	70.06986	68.62804	68.95965	0	9117980	10162168	7291289	7869825	1	34441263	75.37079
10:00-11:0	66.72134	69.87483	68.08959	65.26296	0	4700386	9715899	6441085	3359664	1	24217035	73.84121
11:00-12:0	66.49858	66.52109	66.93475	61.79962	0	4465376	4488585	4937134	1513428	1	15404525	71.87648
12:00-1:00	63.82146	64.31211	64.47724	61.8387	0	2410713	2699050	2803651	1527110	1	9440525	69.74996
1:00-2:00	62.20857	63.73964	62.40662	55.9225	0	1662866	2365725	1740450	391065.8	1	6160108	67.89588
2:00-3:00	57.64108	51.16842	60.11798	52.72049	0	580909.3	130870.5	1027538	187089.4	1	1926408	62.84748
3:00-4:00	52.86	52.12026	63.65595	58.08604	0	193196.7	162939.4	2320574	643582.8	1	3320294	65.21177
4:00-5:00	53.14	55.23459	61.83514	60.69371	0	206062.8	333779.1	1525856	1173197	1	3238896	65.10397
5:00-6:00	54.15936	61.85187	64.11812	62.21659	0	260576.8	1531746	2581145	1665938	1	6039407	67.80994
6:00-7:00	58.67835	65.86125	66.23815	63.62206	0	737624.6	3855893	4205477	2302536	1	11101531	70.45383

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	28	24	26	26		965	950	41	129	0	16	
8:00-9:00	27	26	25	22		1045	775	27	111	0	16	
9:00-10:00	28	29	26	25		765	705	71	83	0	16	
10:00-11:0	38	39	31	27		677	920	108	71	7	16	
11:00-12:0	41	37	31	37	40	735	683	66	50	11	16	
12:00-1:00	44	36	33	21	26	484	279	44	20	18	16	
1:00-2:00	50	39	31	44	29	245	46	56	11	11	16	
2:00-3:00	52	54	32	41	41	178	25	51	10	29	16	
3:00-4:00	46	35	36	36	39	78	37	52	14	33	16	
4:00-5:00	44	40	32.5	40	35	79	26	69	5	41	16	
5:00-6:00	44	40	33	39		140	32	46	23	30	16	
6:00-7:00	42	40	35	30	50	219	77	72	41	34	16	

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
7:00-8:00	69.03732	70.08775	62.70498	68.07371	0	8011837	10204116	1864224	6417580	1	26497757	**74.23209**
8:00-9:00	69.52117	69.00589	61.03584	67.96145	0	8956061	7954060	1269358	6253816	1	24433296	**73.87982**
9:00-10:00	68.02866	68.49021	65.08973	66.27951	0	6351353	7063510	3228290	4245721	1	20888874	**73.19915**
10:00-11:0	66.52203	70.22331	66.3095	65.36794	0	4489557	10527646	4275136	3441866	1	22734204	**73.5668**
11:00-12:0	66.71998	68.71826	64.1707	63.09168	0	4698919	7444328	2612583	2037829	1	16793660	**72.25145**
12:00-1:00	64.80533	64.73989	62.22107	60.67962	0	3023657	2978442	1667659	1169398	1	8839157	**69.46411**
1:00-2:00	61.81727	57.21301	63.45714	56.28187	0	1519592	526382.3	2216737	424802.8	1	4687515	**66.70943**
2:00-3:00	60.46675	56.93362	62.95313	55.94528	0	1113462	493584.6	1973847	393122.4	1	3974017	**65.9923**
3:00-4:00	56.84287	55.887	62.71361	57.61336	0	483378	387882.7	1867933	577213.4	1	3316408	**65.20668**
4:00-5:00	56.93314	54.85483	64.21963	52.96802	0	493530.8	305832	2642181	198062.6	1	3639608	**65.61055**
5:00-6:00	59.41815	55.75659	62.41413	59.6326	0	874611.6	376408.6	1743462	918881.9	1	3913364	**65.9255**
6:00-7:00	61.42167	59.57	64.19813	62.69167	0	1387291	905733.1	2629134	1858519	1	6780677	**68.31273**
63667900	78.03921	81.75222	88.14571	1.5E+08		6.52E+08	6.52E+08	88.14571	78.03921	78.24645		
58960880	77.70564	82.35258	86.97446	1.72E+08		4.98E+08	4.98E+08	86.97446	77.70564	77.98145		
55330138	77.42962	82.82862	86.45018	1.92E+08		4.42E+08	4.42E+08	86.45018	77.42962	78.04764		
46951240	76.71647	83.60719	86.49178	2.29E+08		4.46E+08	4.46E+08	86.49178	76.71647	77.85192		
32198185	75.07831	84.95446	87.55211	3.13E+08		5.69E+08	5.69E+08	87.55211	75.07831	75.67065		
18279682	72.61969	83.57786	83.60552	2.28E+08		2.29E+08	2.29E+08	83.60552	72.61969	73.9353		
10847623	70.35335	75.58606	82.15786	36191487		1.64E+08	1.64E+08	82.15786	70.35335	71.73426		
5900425	67.70883	77.33829	80.33703	54178721		1.08E+08	1.08E+08	80.33703	67.70883	70.66014		
6636702	68.21952	76.32161	79.6179	42870714		91577794	91577794	79.6179	68.21952	71.18955		
6878504	68.37494	77.11978	81.58018	51520238		1.44E+08	1.44E+08	81.58018	68.37494	71.69452		
9952771	69.97944	79.54643	81.9016	90083003		1.55E+08	1.55E+08	81.9016	69.97944	71.41853		
17882208	72.52421	76.72161	84.33178	47006803		2.71E+08	2.71E+08	84.33178	72.52421	73.44924		

	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	50.2	41.28	42.54	41.43	45	1471	646	76	81	4	15	
20:00-21:0	52.85	50.96	43	41.29		1208	540	37	55	2	15	
21:00-22:0	52.8	46.08	44.35	36.67	40.25	1048	365	251	45	158	15	
22:00-23:0	54.14	49.22	50.5	40.43	47.82	572	133	155	33	189	15	
23:00-24:0	59.7	47.85	57	40	50.75	432	55	95	20	176	15	
24:00-1:00	61.49	47.75	52.375	51.25	51.13	290	52	175	14	319	15	
1:00-2:00	60	44.8	47.13	48.67	50.12	135	7	145	6	324	15	
2:00-3:00	53.09	53.5	47.71	60	52.82	39	15	80	6	238	15	
3:00-4:00	62.15	49.4	61.59	57.67	51.03	14	14	77	1	216	15	
4:00-5:00	58.9	45	59.33	47	45.53	25	17	86	5	202	15	
5:00-6:00	63.33	50.89	57.67	61.67	50.72	21	14	75	29	95	15	
6:00-7:00	57.3	47.5	52.44	48.17	45.8	75	100	89	25	88	15	
				HOURLY Leq CALCULATIONS								
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
19:00-20:0	69.8847	69.25288	64.32225	65.29737	56.96414	9737995	8419540	2705361.42	3386390.7	497066.3	24746354	**73.93511**
20:00-21:0	69.08555	70.01689	61.18255	63.62032	#DIV/0!	8101309	10038956	1312969.55	2301610.9	#DIV/0!	21754845	**73.37556**
21:00-22:0	68.46707	67.48835	69.46366	62.93041	73.20312	7025979	5608348	8838246.18	1963543.5	20907974	44344090	**76.46836**
22:00-23:0	65.88026	63.62866	67.32691	61.42907	73.59406	3872810	2306033	5403700.32	1389654.5	22877363	35849561	**75.54484**
23:00-24:0	64.93375	59.56079	65.32348	59.26891	73.20153	3114405	903813.5	3406812.75	845066.97	20900343	29170441	**74.64943**
24:00-1:00	63.31982	59.30041	67.87324	57.53511	75.7761	2147741	851219.1	6128076.83	566906.29	37810257	47504201	**76.76732**
1:00-2:00	59.90094	50.11347	67.03963	53.86583	75.86675	977448.2	102647.2	5057820.26	243547.03	38607824	44989286	**76.53109**
2:00-3:00	54.18257	54.90557	64.45288	53.92045	74.47427	261973.1	309426.5	2787971.1	246629.53	28017375	31623375	**75.00008**
3:00-4:00	50.20342	53.88242	64.58141	46.10865	74.08483	104795.3	244479.1	2871711.28	40819.234	25614354	28876159	**74.60539**
4:00-5:00	52.51035	53.99818	64.97007	53.08974	73.97297	178252.2	251083.7	3140560	203692.13	24963018	28736606	**74.58435**
5:00-6:00	52.05113	54.14192	64.31783	60.78942	70.52432	160366.4	259532.8	2702607.5	1199338.8	11283184	15605029	**71.93265**
6:00-7:00	57.19408	62.09857	64.93768	60.06765	70.35249	524092.7	1621277	3117222.07	1015698.7	10845484	17123775	**72.336**
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	45	39	48	45	26	1103	770	57	100	1	12	
20:00-21:0	54	49	45	53	25	1020	890	26	83	1	12	
21:00-22:0	55	48	41	45	43	995	625	313	58	29	12	
22:00-23:0	46	38	47	47	47	740	406	338	26	324	12	
23:00-24:0	49	49	45	48	49	562	211	278	11	314	12	
24:00-1:00	46	45	58	51	48	270	64	166	10	292	12	
1:00-2:00	57	54	51	57	49	119	42	203	31	352	12	
2:00-3:00	56	39	46	56	49	138	57	180	8	366	12	
3:00-4:00	52	46	51	52	53	83	33	131	14	390	12	
4:00-5:00	50	39	45	43	46	50	17	44	13	209	12	
5:00-6:00	59	44	48	56	53	90	37	39	24	108	12	
6:00-7:00	58	45	49	48	42	213	57	70	58	61	12	

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
19:00-20:0	69.6114	70.69973	63.94842	65.29737	53.72031	9144079	11748242	2482228.02	3386390.7	235522	26996462	**74.31307**
20:00-21:0	69.35691	72.81537	60.57284	63.62032	53.87753	8623644	19122146	1140995.28	2301610.9	244204.1	31432600	**74.9738**
21:00-22:0	69.2865	71.11029	71.4923	62.93041	66.63885	8484972	12913070	14100342.9	1963543.5	4611954	42073882	**76.24013**
22:00-23:0	67.86363	67.80948	71.68532	61.42907	76.93363	6114525	6038761	14741178.7	1389654.5	49358650	77642769	**78.90101**
23:00-24:0	66.66249	66.56429	70.86355	59.26891	76.73015	4637124	4533453	12199872.6	845066.97	47099380	69314896	**78.40827**
24:00-1:00	63.48495	60.7246	68.74824	57.53511	76.44624	2230975	1181570	7495906.1	566906.29	44118881	55594239	**77.4503**
1:00-2:00	60.15343	60.4361	69.47142	53.86583	77.22628	1035961	1105630	8854047.23	243547.03	52799305	64038490	**78.06441**
2:00-3:00	60.74947	59.39357	68.95998	53.92045	77.39567	1188358	869675.1	7870419.25	246629.53	54899278	65074359	**78.1341**
3:00-4:00	58.40272	58.00676	67.56917	46.10865	77.58574	692264.8	631940.6	5713695.5	40819.234	57355352	64434072	**78.09116**
4:00-5:00	56.1647	54.13931	62.85763	53.08974	75.0697	413494.5	259376.8	1930915.09	203692.13	32134349	34941827	**75.43346**
5:00-6:00	59.04886	58.19083	62.30031	60.78942	72.00933	803315.6	659300.6	1698366.54	1199338.8	15883021	20243342	**73.06282**
6:00-7:00	62.73374	60.22154	64.83863	60.06765	69.92615	1876609	1052336	3046934.78	1015698.7	9831382	16822960	**72.25902**
								PREDICTED	OBSERVED			
51742815	77.1385	82.12086	86.03683	1.63E+08	4.01E+08	5.64E+08	87.51633	**77.1385006**	**87.516328**			
53187445	77.25809	80.9629	86.13094	1.25E+08	4.1E+08	5.35E+08	87.28447	**77.2580913**	**87.284472**			
86417972	79.36604	81.15754	85.31004	1.31E+08	3.4E+08	4.7E+08	86.72257	**79.3660407**	**86.722568**			
1.13E+08	80.54967	115.3545	84.48112	3.43E+11	2.81E+08	3.43E+11	115.358	**80.5496651**	**85.358015**			
98485337	79.93372	82.26004	85.19764	1.68E+08	3.31E+08	4.99E+08	86.98293	**79.9337158**	**86.982926**			
1.03E+08	80.13252	80.23112	86.11602	1.05E+08	4.09E+08	5.14E+08	87.1126	**80.1325209**	**87.112598**			
1.09E+08	80.37537	82.57383	86.28946	1.81E+08	4.26E+08	6.06E+08	87.82775	**80.3753715**	**87.82775**			
96697734	79.85416	80.57211	83.17446	1.14E+08	2.08E+08	3.22E+08	85.07566	**79.854163**	**85.075657**			
93310231	79.69929	79.715	85.55222	93648322	3.59E+08	4.53E+08	86.55862	**79.6992926**	**86.558618**			
63678433	78.03992	79.69959	85.00014	93316566	3.16E+08	4.1E+08	86.12312	**78.0399237**	**86.123121**			
35848372	75.54469	81.29664	84.58283	1.35E+08	2.87E+08	4.22E+08	86.25371	**75.5446943**	**86.253713**			
33946735	75.30798	81.90721	83.46315	1.55E+08	2.22E+08	3.77E+08	85.76479	**75.3079801**	**85.76479**			

			PARAMETRIC ANALYSIS			FOR CAR						
	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	33	31	26	28	0	1077	703	62	129	0	10.25	
20:00-21:0	33	30	22	24	0	986	709	26	123	6	10.25	
21:00-22:0	36	35	31	27	22	853	621	118	104	15	10.25	
22:00-23:0	40	42	34	28.5	33	466	498	111	46	63	10.25	
23:00-24:0	31	29	29	27	37.5	375	287	76	20	19	10.25	
24:00-1:00	40	38	36	31	27	239	155	50	22	11	10.25	
1:00-2:00	54	53	46	35	40	168	80	34	6	12	10.25	
2:00-3:00	50	50	45	39	44	60	5	20	3	13	10.25	
3:00-4:00	49	47	41	36	50	20	7	44	10	13	10.25	
4:00-5:00	43	44	38	35	43	21	16	28	18	7	10.25	
5:00-6:00	48	41	44	31	39	27	81	50	24	16	10.25	
6:00-7:00	45	40	36	43		76	210	75	38	18	10.25	
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
19:00-20:0	0	70.42055	66.43502	69.7907	0	1	11016793	4400500	9529500	1	24946794	73.97015
20:00-21:0	0	70.44554	63.29794	70.05169	0	1	11080358	2136949	10119727	1	23337035	73.68046
21:00-22:0	0	70.06986	68.62804	68.95965	66.84609	1	10162168	7291289	7869825	4837362	30160645	74.79441
22:00-23:0	0	69.87483	68.08959	65.26296	71.49578	1	9715899	6441085	3359664	14111649	33628298	75.26705
23:00-24:0	0	66.52109	66.93475	61.79962	65.86524	1	4488585	4937134	1513428	3859437	14798585	71.7022
24:00-1:00	0	64.31211	64.47724	61.8387	64.66936	1	2699050	2803651	1527110	2930459	9960271	69.98271
1:00-2:00	0	63.73964	62.40662	55.9225	63.67935	1	2365725	1740450	391065.8	2333109	6830351	68.34443
2:00-3:00	0	51.16842	60.11798	52.72049	63.7855	1	130870.5	1027538	187089.4	2390839	3736338	65.72446
3:00-4:00	0	52.12026	63.65595	58.08604	63.55743	1	162939.4	2320574	643582.8	2268522	5395619	67.32041
4:00-5:00	0	55.23459	61.83514	60.69371	61.15042	1	333779.1	1525856	1173197	1303294	4336127	66.37102
5:00-6:00	0	61.85187	64.11812	62.21659	65.00106	1	1531746	2581145	1665938	3163049	8941879	69.51429
6:00-7:00	0	65.86125	66.23815	63.62206	#DIV/0!	1	3855893	4205477	2302536	#DIV/0!	10363907	70.15524
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	28	24	26	26	0	965	960	41	129	0	16	
20:00-21:0	27	26	25	22	0	1045	775	27	111	0	16	
21:00-22:0	28	29	26	25	0	765	705	71	83	0	16	
22:00-23:0	38	39	31	27	0	677	920	108	71	7	16	
23:00-24:0	41	37	31	37	40	735	683	66	50	11	16	
24:00-1:00	44	36	33	21	26	484	279	44	20	18	16	
1:00-2:00	50	39	31	44	29	245	46	56	11	11	16	
2:00-3:00	52	54	32	41	41	178	25	51	10	29	16	
3:00-4:00	46	35	36	36	39	78	37	52	14	33	16	
4:00-5:00	44	40	32.5	40	35	79	26	69	5	41	16	
5:00-6:00	44	40	33	39		140	32	46	23	30	16	
6:00-7:00	42	40	35	30	50	219	77	72	41	34	16	

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
19:00-20:0	0	70.08775	62.70498	68.07371	0	1	10204116	1864224	641 7580	1	18485921	72.66841
20:00-21:0	0	69.00589	61.03584	67.96145	0	1	7954060	1269358	625 3816	1	15477235	71.89693
21:00-22:0	0	68.49021	65.08973	66.27951	0	1	7063510	3228290	424 5721	1	14537523	71.6249
22:00-23:0	0	70.22331	66.3095	65.36794	0	1	10527646	4275136	344 1866	1	18244649	72.61136
23:00-24:0	0	68.71826	64.1707	63.09168	61.3675	1	7444328	2612583	203 7829	1370094	13464835	71.29201
24:00-1:00	0	64.73989	62.22107	60.67962	65.02365	1	2978442	1667659	116 9398	3179547	8995047	69.54003
1:00-2:00	0	57.21301	63.45714	56.28187	62.45821	1	526382.3	2216737	424802.8	1761249	4929172	66.92774
2:00-3:00	0	56.93362	62.95313	55.94528	65.51011	1	493584.6	1973847	393122.4	3556402	6416957	68.07329
3:00-4:00	0	55.887	62.71361	57.61336	66.21104	1	387882.7	1867933	577213.4	4179302	7012332	68.45862
4:00-5:00	0	54.85483	64.21963	52.96802	67.49389	1	305832	2642181	198062.6	5615512	8761589	69.42583
5:00-6:00	0	55.75659	62.41413	59.6326	#DIV/0!	1	376408.6	1743462	918881.9	#DIV/0!	3038754	64.82695
6:00-7:00	0	59.57	64.19813	62.69167	65.79882	1	905733.1	2629134	1858519	3800864	9194251	69.63516
								AFTER	BEFORE			
43432715	76.37817	81.75222	88.14571	1.5E+08	6.52E+08	8.02E+08	89.04275	76.37817	78.24645			
38814270	75.88991	82.35258	86.97446	1.72E+08	4.98E+08	6.7E+08	88.26167	75.88991	77.98145			
44698168	76.5029	82.82862	86.45018	1.92E+08	4.42E+08	6.33E+08	88.01674	76.5029	78.04764			
51872946	77.14941	83.60719	86.49178	2.29E+08	4.46E+08	6.75E+08	88.295	77.14941	77.85192			
28263420	74.51225	84.95446	87.55211	3.13E+08	5.69E+08	8.82E+08	89.45498	74.51225	75.67065			
18955318	72.77731	83.57786	83.60552	2.28E+08	2.29E+08	4.57E+08	86.60201	72.77731	73.9353			
11759523	70.7039	75.58606	82.15786	36191487	1.64E+08	2.01E+08	83.02217	70.7039	71.73426			
10153295	70.06607	77.33829	80.33703	54178721	1.08E+08	1.62E+08	82.1018	70.06607	70.66014			
12407951	70.937	76.32161	79.6179	42870714	91577794	1.34E+08	81.28556	70.937	71.18955			
13097716	71.17196	77.11978	81.58018	51520238	1.44E+08	1.95E+08	82.90938	71.17196	71.69452			
11980633	70.7848	79.54643	81.9016	90083003	1.55E+08	2.45E+08	83.89205	70.7848	71.41853			
19558158	72.91328	76.72161	84.33178	47006803	2.71E+08	3.18E+08	85.02614	72.91328	73.44924			

		SPEED DATA					VOLUME DATA					
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	39	39	37	32	0	998	721	51	122	1	14.75	
20:00-21:0	37	39	29	34	0	817	564	37	83	3	14.75	
21:00-22:0	45	43	35	29	31	553	399	54	65	6	14.75	
22:00-23:0	45	39	38	36	28	524	251	33	23	8	14.75	
23:00-24:0	45	41	43	31	38	233	173	25	7	24	14.75	
24:00-1:00	54	47	45	50	37	183	115	13	5	20	14.75	
1:00-2:00	58	47	46	40	45	106	76	24	1	20	14.75	
2:00-3:00	52	35	48		42	67	34	31	4	28	14.75	
3:00-4:00	55	37	40	31	47	26	21	20	1	32	14.75	
4:00-5:00	53	41	46	25	40	33	23	14	3	10	14.75	
5:00-6:00	51	44	40	21	34	148	55	22	11	8	14.75	
6:00-7:00	52	42	43	40	42	318	83	37	45	6	14.75	
	HOURLY Leq CALCULATIONS FOR DIRECTION 1						LOGARTHEM CALCUALATIONS AND SUMMATION					
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
19:00-20:0	68.5010977	69.51807	62.91754	67.62038	0	7081248	8949662	1957737.28	5781462.618	1	23770110	73.76031
20:00-21:0	67.7579714	68.4515	62.22795	65.81112	0	5967565	7000846	1670301.72	3811637.786	1	18450350	72.66005
21:00-22:0	65.716788	67.47394	63.30202	65.13622	59.92874	3729742	5589771	2138956.43	3263039.003	983725.1	15705234	71.96044
22:00-23:0	65.4828495	64.93545	60.96801	60.12264	61.56355	3534150	3115625	1249687.27	1028641.72	1433359	10361462	70.15421
23:00-24:0	61.9630959	63.5668	59.55292	55.28477	65.25859	1571483	2273420	902177.887	337658.3029	3356284	8441023	69.26395
24:00-1:00	60.9993095	62.69558	56.66643	53.13961	64.54915	1258725	1860192	464133.675	206044.7017	2850463	6639559	68.22139
1:00-2:00	58.8068918	60.89674	59.31326	46.3316	64.02684	759782.3	1229345	853740.394	42969.50677	2527456	5413293	67.33461
2:00-3:00	56.5765818	55.87306	60.40718	#DIV/0!	65.64832	454630.1	386638.9	1098291.79	#DIV/0!	3671403	5610963	67.49037
3:00-4:00	52.561899	53.94952	58.69277	46.83379	65.98357	180380.6	248285.9	740077.623	48236.90041	3966043	5183024	67.14583
4:00-5:00	53.5277756	54.80361	56.97243	52.21323	61.30686	225308.5	302246.6	498015.23	166464.8751	1351094	2543129	64.05368
5:00-6:00	59.9971557	59.01634	59.1067	58.43653	60.8486	999345.3	797321.9	814085.385	697674.5638	1215795	4524222	66.55544
6:00-7:00	63.3401049	60.51264	61.25554	62.86373	58.95825	2157797	1125288	1335223.27	1933627.805	786729.1	7338665	68.65617
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
19:00-20:0	43	37	35	33	29	1276	462	147	53	1	10.5	
20:00-21:0	40	34	28	26	0	1275	334	83	54	3	10.5	
21:00-22:0	45	41	27	29	0	780	309	71	110	2	10.5	
22:00-23:0	41	45	37	33	39	660	224	39	86	11	10.5	
23:00-24:0	45	41	30	38	35	625	169	37	15	18	10.5	
24:00-1:00	51	41	44	39	36	475	99	15	6	13	10.5	
1:00-2:00	52	35	43	39	39	265	34	17	6	13	10.5	
2:00-3:00	48	39	34	35	33	81	32	26	5	14	10.5	
3:00-4:00	45	30	42	38	44	57	28	41	3	29	10.5	
4:00-5:00	56	50	44	48	23	37	23	26	7	15	10.5	
5:00-6:00	42	44	41	29	30	79	30	22	7	9	10.5	

6:00-7:00	43	41	34	36	41	135	76	46	22	9	10.5	
	HOURLY Leq CALCULATIONS FOR DIRECTION 2											
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARTHEM CALCUALATIONS AND SUMMATION					
19:00-20:0	70.8716554	68.84977	69.12728	69.02536	53.87359	12222655	7673217	8179527.84	7989793.394	243982.5	36309175	75.60016
20:00-21:0	70.9879239	67.20496	67.33281	67.9879	0	12554297	5254076	5411048.88	6292024.202	1	29511446	74.6999
21:00-22:0	68.6865099	67.56195	66.78267	66.61225	0	7390112	5704201	4767237.37	4583792.885	1	22445342	73.51126
22:00-23:0	68.0818521	66.7452	63.22852	61.77904	63.26913	6429619	4726281	2103059.51	1506272.525	2122820	16888052	72.2758
23:00-24:0	67.7243641	64.94123	63.59158	56.33675	65.74809	5921564	3119773	2286429.35	430204.7384	3756719	15514690	71.90743
24:00-1:00	66.5375018	62.61872	58.78468	54.83433	64.24189	4505575	1827559	755906.736	304391.5173	2655762	10049195	70.02131
1:00-2:00	64.0243197	57.34908	59.35404	47.84463	63.99464	2525992	543135.6	861794.686	60878.30346	2508788	6500588	68.12953
2:00-3:00	58.8259157	57.46624	61.68144	54.05693	64.859	763117.8	557987	1472800.63	254503.112	3061257	6109666	67.86017
3:00-4:00	57.3243124	56.306	63.20834	47.88577	67.1654	540046.6	427169.4	2093312.95	61457.81977	5206424	8328410	69.20562
4:00-5:00	55.6126184	57.69134	61.1735	52.40997	66.55794	364134.5	587670.8	1310238.34	174179.3518	4526832	6963055	68.428
5:00-6:00	58.8228108	57.85995	60.541	58.89704	63.28763	762572.4	610934.9	1132661.05	775718.7959	2131880	5413768	67.335
6:00-7:00	61.1164864	61.4705	64.15928	64.51352	62.25786	1293149	1402975	2605724.19	2827167.461	1681845	9810861	69.91707
								PREDICTED OBSERVED				
60079285	77.7872476	82.27258	81.10161	1.69E+08	1.29E+08	2.98E+08	84.73674	77.7872476	84.73673941			
47961796	76.8089543	81.9	83.07726	1.55E+08	2.03E+08	3.58E+08	85.5387	76.8089543	85.53869739			
38150576	75.815011	82.78531	83.4713	1.9E+08	2.22E+08	4.12E+08	86.15214	75.815011	86.15213828			
27249514	74.3535875	78.98	82.14606	79067863	1.64E+08	2.43E+08	83.85567	74.3535875	83.85567368			
23955713	73.794091	79.1816	80.51086	82824725	1.12E+08	1.95E+08	82.90719	73.794091	82.90719154			
16688753	72.2242389	77.83143	78.72469	60693594	74553622	1.35E+08	81.31128	72.2242389	81.31128336			
11913881	70.7605325	77.95914	77.50112	62504958	56248586	1.19E+08	80.74647	70.7605325	80.74646576			
11720629	70.6895092	81.02811	75.20446	1.27E+08	33147113	1.6E+08	82.03732	70.6895092	82.03732393			
13511435	71.3070147	75.08	78.40112	32210688	69200878	1.01E+08	80.06087	71.3070147	80.0608749			
9506184	69.7800621	72.52944	75.40059	17903769	34678376	52582145	77.20838	69.7800621	77.20838297			
9937989	69.9729853	74.21779	76.47578	26410629	44419929	70830558	78.50221	69.9729853	78.50220663			
17149526	72.3425211	76.68406	77.56426	46602201	57072345	1.04E+08	80.15672	72.3425211	80.15672141			

6:00-7:00	38	38	29		24	165	84	31	60	6	9.35	
	HOURLY Leq CALCULATIONS FOR DIRECTION 2						LOGARTHEMETIC CALCULATIONS AND SUMMATION					
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
7:00-8:00	72.29348	73.19588	67.16395	71.51697	54.96123	16956969	20873170	5204691.756	14180671	313417.1	57528918	77.59886
8:00-9:00	65.3404	72.82723	67.55664	70.44817	53.43628	3420112	19174445	5697228.009	11087084	220611.4	39599481	75.97689
9:00-10:00	64.47248	68.99374	67.9418	69.09418	59.57522	2800582	7931839	6225576.021	8117427.9	906822.7	25982248	74.14677
10:00-11:0	63.13407	65.47076	66.58754	67.99322	58.78248	2057819	3524329	4557782.408	6299726.6	755524.3	17195181	72.35407
11:00-12:0	61.94119	64.80228	64.74287	64.96908	0	1563577	3021539	2980486.919	3139840.5	0	10705443	70.29605
12:00-1:00	61.61067	62.27243	61.22082	62.72513	63.91979	1448997	1687498	1324590.643	1872891.7	2465920	8799897	69.44478
1:00-2:00	57.90007	60.47053	61.63553	64.92819	61.95093	616604.2	1114431	1457313.692	3110417.8	1567085	7865852	68.95746
2:00-3:00	58.13183	56.86824	59.17492	56.76239	62.25011	650403.6	486210.4	826973.6148	474502.84	1678847	4116938	66.14574
3:00-4:00	58.94918	59.97855	60.06717	57.42045	65.40305	785087.8	995073.7	1015586.071	552134.42	3469808	6817690	68.33637
4:00-5:00	58.7085	59.79761	59.34995	62.46765	63.77291	742763	954468.1	860983.9178	1765081	2383916	6707212	68.26542
5:00-6:00	60.76424	64.06095	60.98487	65.56749	0	1192407	2547390	1254547.499	3603707.1	0	8598051	69.344
6:00-7:00	62.72407	62.05071	63.43935	0	62.90816	1872437	1603506	2207675.854	0	1953513	7637132	68.8293
								PREDICTED	OBSERVED			
86043185	79.34716	79.91044	83.24446	97959027	2.11E+08	3.09E+08	84.90013	79.34716479	84.900129			
62850396	77.98308	78.77631	82.41446	75445168	1.74E+08	2.5E+08	83.97601	77.98308015	83.976011			
43367737	76.37167	79.19446	81.35875	83070424	1.37E+08	2.2E+08	83.42035	76.37166765	83.420355			
33797337	75.28882	79.70643	80.83143	93463676	1.21E+08	2.15E+08	83.31555	75.28882486	83.315555			
20119851	73.03625	77.91202	77.02161	61830336	50368697	1.12E+08	80.49989	73.03624752	80.499891			
17557031	72.44451	76.92231	77.14571	49230181	51828833	1.01E+08	80.04575	72.44451076	80.045751			
14175465	71.51537	76.28345	74.40161	42495701	27552481	70048182	78.45397	71.51537319	78.453969			
7101816	68.51369	69.74446	75.30344	9428583	33911302	43339885	76.36888	68.51369439	76.368878			
9381948	69.72293	73.65161	76.41446	23182524	43797208	66979732	78.25943	69.72293038	78.259434			
11745253	70.69862	77.92121	76.27911	61961328	42453297	1.04E+08	80.18761	70.69862369	80.187613			
17583506	72.45105	76.71875	78.54571	46975888	71543705	1.19E+08	80.7379	72.45105462	80.737902			
15069576	71.78101	76.50018	80.70071	44670196	1.18E+08	1.62E+08	82.09995	71.78101023	82.099954			

								PREDCTED	OBSERVED			
22749557.93	73.56973	73.52571	76.04446	22520158	40220404	62740562	77.97548	73.5697296	77.975484			
44609964.9	76.49432	78.24	76.315	66680677	42805542	1.09E+08	80.39359	76.4943188	80.3935946			
88360135.19	79.46256	77.21446	82.27161	52655826	1.69E+08	2.21E+08	83.45126	79.4625637	83.4512573			
103920022.5	80.16699	78.45446	81.90286	70056176	1.55E+08	2.25E+08	83.52259	80.1669923	83.5225927			
109902769.9	80.41009	78.22071	82.24	66385225	1.67E+08	2.34E+08	83.68992	80.4100864	83.6899218			
105334960.3	80.22573	77.66071	82.80161	58354107	1.91E+08	2.49E+08	83.96148	80.2257254	83.9614825			
103820521.7	80.16283	75.79446	81.58286	37970510	1.44E+08	1.82E+08	82.5994	80.1628321	82.5994026			
69844768.25	78.44134	78.02071	82.72571	63397397	1.87E+08	2.51E+08	83.99175	78.4413388	83.9917497			
57567521.27	77.60178	76.55786	84.34571	45267417	2.72E+08	3.17E+08	85.01428	77.6017753	85.0142764			

LOCATION 6	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
6:00-7:00	35.6	36.2	31	31.4	45	268	139	115	126	5	15.5	
7:00-8:00	35.5	34	35.8	31.7	40	504	371	215	284	1	15.5	
8:00-9:00	36.9	29.8	26.1	25.2	32	902	550	305	382	4	15.5	
9:00-10:00	28.2	31.6	22.4	22.6	34	1403	1042	247	449	2	15.5	
10:00-11:00	29.3	30.9	27.7	23.9	32	1486	1555	311	461	1	15.5	
11:00-12:00	27.8	29.1	27.6	26.8	35	1426	1425	288	440	5	15.5	
12:00-1:00	31.8	28.9	25.8	28.6	27.5	1364	872	313	377	4	15.5	
1:00-2:00	29.5	30.8	24.8	23.75	0	1089	621	233	319	0	15.5	
2:00-3:00	37.3	33	28.7	28	27	1035	373	199	301	7	15.5	
	HOURLY Leq CALCULATIONS											
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARITHMIC CALCULATION AND SUMMATION					
6:00-7:00	62.8058	61.84005	66.71891	67.58659	57.78757	1908007.	1527585	4697756.55	5736663.21	600837.3	14470849	71.60494
7:00-8:00	65.55671	65.94527	69.02763	71.09298	51.08925	3594769	3931219	7993983.94	12861696.6	128506.6	28510175	74.55
8:00-9:00	67.97932	67.52956	71.54333	73.01991	57.83567	6279594	5661814	14267004.7	20044324.8	607528.8	46860266	76.70805
9:00-10:00	70.77383	70.32798	71.20783	74.0754	54.61136	11950414	10784444	13206359.4	25558802	289158.5	61789178	77.90912
10:00-11:00	70.88241	72.05187	71.41495	74.00491	51.81507	12252951	16039342	13851434.3	25147286.7	151882.2	67442896	78.28936
11:00-12:00	70.89805	71.66809	71.09396	73.44679	58.49226	12297170	14682788	12864593.7	22114612.4	706684.4	62665849	77.97031
12:00-1:00	70.22344	69.53763	71.69812	72.5898	58.40743	10527950	8990070	14784696.9	18154332.6	693015.5	53150065	77.25504
1:00-2:00	69.50784	68.06395	70.56317	72.42629	0	8928621	6403173	11384592.1	17483539.5	1	44199927	76.45422
2:00-3:00	68.54904	65.91659	69.35333	71.67129	60.90979	7159859	3905340	8616546.59	14693630.2	1233046	35608423	75.51553
	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
6:00-7:00	41.72	41.5	31.7	33.6	28	138	49	34	38	14	13	
7:00-8:00	39.8	34.98	34.2	28.3	29	273	158	83	137	1	13	
8:00-9:00	37.8	34.9	32.7	30.2	0	588	391	164	432	0	13	
9:00-10:00	35.1	36.2	28.8	28.7	0	981	889	105	291	0	13	
10:00-11:00	33	33	34.44	27.83	0	1030	1109	103	252	0	13	
11:00-12:00	33.3	30.5	29	29.63	0	921	909	123	303	0	13	
12:00-1:00	36	37	27.9	27	0	1111	1070	142	328	0	13	
1:00-2:00	36.5	36.3	33	29.2	0	330	539	96	200	0	13	
2:00-3:00	36.5	37	31.6	28.3	0	150	582	35	195	0	13	
	HOURLY Leq CALCULATIONS											
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARITHMIC CALCULATION AND SUMMATION					
6:00-7:00	60.32813	58.66428	62.12129	62.98759	64.5418	1078481	735238.1	1629778.5	1989569.96	2845641	8278709	69.17963
7:00-8:00	63.37684	63.06535	65.77722	68.98677	52.94535	2176124	2025514	3782005.46	7919115.26	197031.1	16099789	72.0682
8:00-9:00	66.8243	66.99493	68.86185	73.7996	0	4813155	5006029	7694572.8	23986111	1	41499869	76.18047
9:00-10:00	69.24547	70.66281	67.32876	72.21958	0	8405185	11648787	5405993.49	16670878.2	1	42130845	76.246
10:00-11:00	69.64586	71.4127	66.69587	71.68078	0	9216917	13844267	4672908.22	14725781.4	1	42459874	76.27979
11:00-12:00	69.13125	70.47886	67.9925	72.30901	0	8186995	11165712	6298684.94	17017718.1	1	42669111	76.30114
12:00-1:00	69.71435	71.53905	68.74897	72.913	0	9363422	14252970	7497159.27	19556903.5	1	50670456	77.04755
1:00-2:00	64.40496	68.49822	66.50952	70.54393	0	2757377	7076559	4476643.29	11334261	1	25644842	74.09
2:00-3:00	60.98073	68.89445	62.25687	70.51991	0	1253353	7752550	1681460.77	11271733.4	1	21959099	73.41615

LOCATION 8(NIGHT)			SPEED DATA			VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	26	27	24	22	39	1085	459	128	162	1	16.7	
8:00-9:00	35	35	26	30	33	1190	388	119	140	1	16.7	
9:00-10:00	39	39	33	33	35	1021	297	100	90	3	16.7	
10:00-11:0	37	39	35	24	28	714	256	88	74	15	16.7	
11:00-12:0	37	33	34	29	39	344	227	50	42	11	16.7	
12:00-1:00	40	43	35	27	22	300	138	40	22	14	16.7	
1:00-2:00	35	33	35	30	32	186	61	27	26	17	16.7	
2:00-3:00	34	46	35	31	37	77	29	18	7	9	16.7	
3:00-4:00	40	38	32	31	30	75	22	17	8	6	16.7	
4:00-5:00	42	35	36	35	35	140	31	39	24	12	16.7	
5:00-6:00	37	36	30	27	30	333	68	42	49	15	16.7	
6:00-7:00	38	35	36	30		392	116	58	41	8	16.7	
		HOURLY Leq CALCULATIONS FOR DIRECTION 1										
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARTHEMETIC CALCULATIONS AND SUMMATION					
7:00-8:00	69.6444	66.49399	67.76253	69.41741	50.83993	9213826	4460657	5973833.046	8744614.1	121337	28514267	74.55062
8:00-9:00	69.0049	65.90734	67.14665	67.83915	51.38245	7952251	3897031	5183996.328	6080154.3	137481.6	23250915	73.6644
9:00-10:00	68.06081	65.12703	65.60058	65.68891	55.9513	6398535	3256142	3631267.056	3705877.5	393668.1	17385490	72.40187
10:00-11:0	66.63349	64.48187	64.88366	65.72503	63.75432	4606264	2806641	3078693.113	3736825.2	2373732	16602156	72.20164
11:00-12:0	63.46209	63.45846	62.50613	62.70034	61.25386	2219265	2217411	1780793.021	1862231.8	1334707	9414407	69.73793
12:00-1:00	62.68876	62.32376	61.45944	60.09362	64.42653	1857275	1707559	1399405.961	1021790.4	2771103	8757134	69.42362
1:00-2:00	60.94456	57.7515	59.75247	60.5276	63.79671	1242957	595868	944599.0234	1129171.5	2397018	6309613	68.00003
2:00-3:00	57.20106	56.01025	57.99156	54.74553	60.54203	524935.9	399048	629732.6823	298231.14	1132931	2984879	64.74927
3:00-4:00	56.66816	53.71309	57.99596	55.32545	59.51144	464318.8	235130.7	630370.3074	340835.58	893602.5	2564258	64.08962
4:00-5:00	59.29255	54.93264	61.27826	59.82317	61.9719	849678.9	311360.8	1342227.121	960101.56	1574673	5038041	67.02262
5:00-6:00	63.32095	58.42297	62.12678	63.57135	63.49084	2148300	695500.4	1631842.277	2275805.9	2234006	8985455	69.5354
6:00-7:00	63.96304	60.6636	63.00189	62.5057	0	2490602	1165092	1996132.642	1780616.6	1	7432443	68.71132
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	31	31	30	25	25	1299	1215	75	141	1	9.35	
8:00-9:00	31	33	29	29	38	262	1099	80	157	1	9.35	
9:00-10:00	34	34	32	24	26	230	449	94	91	3	9.35	
10:00-11:0	34	33	29	26	32	169	202	64	55	3	9.35	
11:00-12:0	35	37	31	32		131	162	44	39	1	9.35	
12:00-1:00	34	28	32	26	29	119	98	20	21	9	9.35	
1:00-2:00	30	29	30	17	25	46	65	21	12	5	9.35	
2:00-3:00	42	43	34	40	41	60	22	13	1	8	9.35	
3:00-4:00	40	41	38	38	43	71	48	17	8	17	9.35	
4:00-5:00	34	38	32	33	39	61	50	13	15	11	9.35	
5:00-6:00	42	35	38	33		110	142	21	56	5	9.35	

LOCATION 8		SPEED DATA				VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	34.2	31.33	28.1	30	30	186	351	84	76	5	11.95	
8:00-9:00	33.3	36.6	31.5	31.5	35	201	203	96	191	1	11.95	
9:00-10:00	33.9	38.4	32.2	31.08	35	242	454	117	188	1	11.95	
10:00-11:0	35.9	37.9	36.47	32.1	0	245	479	136	193	0	11.95	
11:00-12:0	41.77	38.55	35.9	35.4	35	361	519	157	226	1	11.95	
12:00-1:00	31.1	28.9	29.1	28.6	30	352	483	114	188	1	11.95	
1:00-2:00	32.4	37.9	30.4	33	0	545	459	116	195	0	11.95	
2:00-3:00	39.3	41.1	35.2	33.6	30	797	411	123	317	1	11.95	
3:00-4:00	34.7	34.9	27.6	30.9	0	810	494	104	330	0	11.95	
4:00-5:00	33.1	30.9	32.9	29.2	0	725	547	142	135	0	11.95	
5:00-6:00	32.1	31.3	27	28.7	0	741	1033	143	182	0	11.95	
6:00-7:00	34.3	32.7	30.7	29.2	24	920	1064	176	215	3	11.95	
		HOURLY Leq CALCUALATIONS										
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	LOGARITHMIC CALCULATION AND SUMMATION						
7:00-8:00	62.4668	66.72549	66.80980803	66.63588716	60.17232	1764736	4704883	4797122	4608809	1040477	16916027	72.28298
8:00-9:00	62.88636	64.64935	67.01441421	70.51510227	52.63219	1943732	2916988	5028534	11259270	183324	21331848	73.29028
9:00-10:00	63.63677	68.32262	67.80670349	70.4793436	52.63219	2310348	6796130	6034904	11166945	183324	26491650	74.23109
10:00-11:0	63.5223	68.50277	68.12309202	70.51507141	0	2250247	7083974	6490964	11259190	1	27084375	74.32719
11:00-12:0	64.86825	68.91999	68.78496245	70.9879861	52.63219	3067784	7798291	7559555	12554477	183324	31163430	74.93645
12:00-1:00	65.5461	68.10158	68.01665861	70.6976058	53.18262	3585994	6458884	6333822	11742500	208095.4	28329296	74.52236
1:00-2:00	67.30677	68.31754	67.94834288	70.4959186	0	5378702	6788192	6234969	11209645	1	29611509	74.71461
2:00-3:00	68.42189	68.2136	67.77477204	72.56610329	53.18262	6953263	6627658	5990695	18055534	208095.4	37835244	75.77897
3:00-4:00	68.81298	68.37619	67.80000719	72.93738272	0	7608479	6880484	6025606	19667007	1	40181577	76.04027
4:00-5:00	68.47694	68.64407	68.58424763	69.20272431	0	7041962	7318250	7218131	8322857	1	29901202	74.75689
5:00-6:00	68.67173	71.41276	69.26089981	70.54712325	0	7365009	13844459	8435095	11342592	1	40987156	76.12648
6:00-7:00	69.4007	71.58553	69.72746542	71.22377122	58.83195	8711039	14406315	9391750	13254920	764179.5	46528204	76.67716
		SPEED DATA				VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	34	34.8	30.1	28.9	34	172	333	118	169	8	17	
8:00-9:00	36.5	36	33.4	29.6	0	179	310	130	147	0	17	
9:00-10:00	34.9	37	29.4	31.5	0	208	304	160	166	0	17	
10:00-11:0	40.4	41.1	29.6	32.7	0	292	485	119	177	0	17	
11:00-12:0	36.1	38.6	29.7	31.4	0	337	467	235	208	0	17	
12:00-1:00	39.2	37.5	32.5	33.3	0	324	474	133	130	0	17	
1:00-2:00	28.7	31.8	29.4	30.6	0	292	573	73	101	0	17	
2:00-3:00	47.6	40.3	35.5	29.8	32.5	321	490	72	70	1	17	
3:00-4:00	34.1	34.3	31.6	26.6	28.6	378	448	70	111	1	17	
4:00-5:00	28.3	30.68	32.13	29.5	27.5	425	486	73	89	2	17	
5:00-6:00	33	32.3	27.8	29.7	35	476	474	79	110	2	17	

6:00-7:00	32.8	33	28.5	32	25	479	579	103	125	1	17	
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARITHMIC CALCULATION AND SUMMATION					
7:00-8:00	60.61404	65.12564	66.52385376	68.675445	60.23079	1151872	3255098	4491438	7371307	1054578	17324293	72.38656
8:00-9:00	60.5833	64.9056	66.62667275	68.00538759	0	1143746	3094282	4599041	6317406	1	15154476	71.80541
9:00-10:00	61.36102	64.9089	67.92368048	68.37503932	0	1368050	3096632	6199663	6878661	1	17543007	72.44104
10:00-11:0	62.47455	67.40179	66.61544889	68.56528433	0	1767889	5497674	4587171	7186682	1	19039417	72.79654
11:00-12:0	63.36084	66.93615	69.55951983	69.3623492	0	2168122	4938724	9035496	8634455	1	24776797	73.94045
12:00-1:00	62.98741	66.88605	66.80493582	67.18391481	0	1989486	4882086	4791744	5228673	1	16891990	72.27681
1:00-2:00	63.49065	67.33517	64.51570926	66.28923388	0	2233908	5413990	2828596	4255233	1	14731729	71.68254
2:00-3:00	62.71332	67.34421	63.89653569	64.76542347	51.35821	1867809	5425270	2452752	2996004	136716.7	12878551	71.09867
3:00-4:00	64.02469	66.38127	64.10211167	67.08653295	51.83354	2526207	4346371	2571646	5112735	152529.6	14709489	71.67598
4:00-5:00	65.17276	66.59659	64.2337959	65.83510179	54.99596	3290610	4567294	2650816	3832747	315933.5	14657401	71.66057
5:00-6:00	65.1285	66.52762	65.04983055	66.73722167	54.11168	3257240	4495338	3198770	4717611	257732	15926692	72.02126
6:00-7:00	65.17536	67.42511	66.1158803	67.10518329	52.36445	3292576	5527279	4088726	5134738	172363.3	18215684	72.60445
		PREDICTE	OBSERVED									
34240319	75.34538	75.34538	80.61871093									
36486323	75.6213	75.6213	83.28310635									
44034656	76.43795	76.43795	84.62800655									
46123792	76.63925	76.63925	84.94442187									
55940227	77.47724	77.47724	85.13241634									
45221286	76.55343	76.55343	83.20576601									
44343238	76.46827	76.46827	85.10483416									
50713795	77.05126	77.05126	88.2703661									
54891066	77.39502	77.39502	88.98082552									
44558603	76.48932	76.48932	87.9946528									
56913848	77.55218	77.55218	82.61358877									
64743888	78.11199	78.11199	81.18920883									

		Leq	CALCULATIONS USING FHWA TNM									
LOCATION 5		SPEED						VOLUME				
TIME(hrs)	CAR	Sc/Mc	LCV	BUS	TRUCK	C/J/V	SC/MC	LCV	Bus	Truck	distance	
7:00-8:00	54.6	50.5	45.2	41.4	56	792	283	111	78	15	22.75	
8:00-9:00	59.4	40.8	47.4	47.5	54	845	616	89	144	7	22.75	
9:00-10:00	50	53.5	44.7	43	47	1054	1127	141	207	21	22.75	
10:00-11:00	46.4	50.3	46	40.2	40	1096	1498	117	191	10	22.75	
11:00-12:00	47.3	48.8	42.3	40.6	43.6	1130	1194	239	158	41	22.75	
12:00-1:00	45	47.2	39.7	38	39.8	1148	1109	266	249	36	22.75	
1:00-2:00	48.8	45.8	42.9	35.8	41.7	118	1095	266	138	46	22.75	
2:00-3:00	34.7	46.7	41	40.3	35.2	1170	1149	302	188	42	22.75	
3:00-4:00	39.4	44.1	39.4	39	37.6	1133	1187	343	195	40	22.75	
4:00-5:00	41.4	40.4	36.4	34.4	31	1153	1254	380	203	50	22.75	
5:00-6:00	42.6	42.4	41.3	35.66	38.5	1233	1322	239	208	12	22.75	
6:00-7:00	44.3	40.8	39.8	37.4	37.5	1242	1520	199	189	25	22.75	
		HOURLY Leq CALCUALATIONS					LOGARTHMETHIC CALCULATION AND SUMMATION					
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
7:00-8:00	65.50153	65.26769	64.09082	63.31862	60.62757	3549381	3363324.68	2564967.149	2147147.661	1155465	12780285	**71.06541**
8:00-9:00	66.02027	67.13597	63.1044	65.8606	57.33061	3999698	5171273.2	2043808.822	3855319.877	540830.3	15610930	**71.93429**
9:00-10:00	66.62507	71.7979	65.13916	67.51404	62.26861	4597345	15128293.2	3265248.213	5641625.123	1686014	30318525	**74.81708**
10:00-11:00	66.78717	72.47025	64.30695	67.24665	59.42276	4772177	17661392.6	2695848.387	5304750.678	875539.5	31309708	**74.95679**
11:00-12:00	66.91444	71.22802	67.49345	66.4094	65.32919	4914098	13267902.1	5614940.497	4374613.973	3411291	31582846	**74.99451**
12:00-1:00	67.00683	70.64015	68.06029	68.48402	64.99989	5019764	11588178.1	6397781.313	7053456.985	3162199	33221379	**75.21418**
1:00-2:00	57.10437	70.35885	67.9399	66.02767	65.93819	513377.3	10861383.1	6222852.977	4006515.578	3924812	25528941	**74.07033**
2:00-3:00	67.61385	70.71238	68.55594	67.17446	66.04951	5772783	11782505.6	7171234.472	5217307.186	4026715	33970545	**75.31103**
3:00-4:00	67.14807	70.4465	69.17859	67.38093	65.62574	5185692	11082803.2	8276738.608	5471333.697	3652360	33668928	**75.27229**
4:00-5:00	67.12989	70.17239	69.794	67.78397	67.25414	5164029	10404930.4	9536730.652	6003401.298	5313905	36422997	**75.61376**
5:00-6:00	67.37725	70.66743	67.52834	67.81708	60.32518	5466702	11661188.5	5660223.235	6049343.483	1077751	29915208	**74.75892**
6:00-7:00	67.36241	71.0586	66.7954	67.31359	63.59276	5448048	12760284.5	4781230.339	5387148.772	2287054	30663766	**74.86625**
		SPEED							VOLUME			
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	distance	
7:00-8:00	54.04	43.1	43.5	51.1	46.4	261	120	134	120	43	22.5	
8:00-9:00	58.3	53.9	50.4	49.9	53.7	1050	416	140	145	10	22.5	
9:00-10:00	57.8	46.5	48.2	38.2	40	1775	915	103	170	6	22.5	
10:00-11:00	52.2	46.6	42.4	47.33	37.8	2025	950	84	175	50	22.5	
11:00-12:00	36.4	42.4	37.1	39.1	35.4	1450	930	170	135	16	22.5	
12:00-1:00	44.3	41.8	37	36.8	38	1540	1085	264	168	35	22.5	
1:00-2:00	43.8	40.1	39.5	34.8	30	1045	925	219	106	23	22.5	
2:00-3:00	43.4	45.1	38	39.5	36.3	1030	1127	311	95	50	22.5	
3:00-4:00	43.4	40	35.2	39.7	42.1	1020	1101	457	156	89	22.5	
4:00-5:00	40.7	44	37.9	36.8	39.2	1225	940	315	140	41	22.5	
5:00-6:00	42	47.1	38.4	34.6	36.7	1405	1122	312	245	29	22.5	
6:00-7:00	45.4	44.7	33.5	33.56	38.7	1370	1234	212	196	5	22.5	

		HOURLY Leq CALCUALATIONS					LOGARTHMETHIC CALCULATION AND SUMMATION					
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck							
7:00-8:00	60.70827	60.39445	64.99359	65.09517	65.45275	1177137	1095076.87	3157612.187	3232343.363	3509744	12171914	70.85359
8:00-9:00	66.94778	67.589	65.11804	65.92071	58.93083	4951967	5739844.99	3249402.572	3909048.394	781777.4	18632041	72.7026
9:00-10:00	69.20063	69.73898	63.78255	66.86587	57.25226	8318853	9416691.05	2389215.848	4859453.777	531160.6	25515375	74.06802
10:00-11:00	69.55072	69.91818	62.99706	66.75719	66.62652	9017213	9813376.97	1993911.065	4739352.604	4598881	30162735	74.79471
11:00-12:00	68.45845	69.18793	66.30407	65.828	61.88738	7012052	8294556.96	4269793.186	3826484.868	1544323	24947210	73.97022
12:00-1:00	68.34439	69.77466	68.2218	66.87862	65.0614	6830286	9494359.88	6640187.585	4873733.014	3207305	31045872	74.92004
1:00-2:00	66.67209	68.8616	67.2733	64.98615	64.05176	4647384	7694140.88	5337403.087	3152207.301	2542001	23373136	73.68717
2:00-3:00	66.61983	70.42204	68.87421	64.28666	66.75383	4591804	11020565.8	7716511.067	2683279.643	4735683	30747844	74.87815
3:00-4:00	66.57746	69.60581	70.72674	66.43329	68.8281	4547223	9132326.89	11821529.76	4398750.548	7635025	37534856	75.74435
4:00-5:00	67.47092	69.46626	68.93536	66.0868	65.6562	5585884	8843546.99	7825930.63	4061444.179	3678066	29994872	74.77047
5:00-6:00	68.01319	70.72235	68.86615	68.6366	64.35302	6328771	11809584.7	7702195.095	7305673.566	2724592	35870817	75.54741
6:00-7:00	67.81612	70.75421	67.5248	67.73253	56.55567	6048000	11896538	5655616.113	5932713.918	452446	29985314	74.76909
								PREDICTED	OBSERVED			
24952198.45	73.97109	75.9666	82.36161	39505722	1.72E+08	2.12E+08	83.2583636	73.97108816	83.25836361			
34242970.51	75.34571	76.64446	80.60286	46179203	1.15E+08	1.61E+08	82.0701499	75.34571432	82.07014994			
55833899.98	77.46898	74.55875	80.84002	28567682	1.21E+08	1.5E+08	81.7582196	77.46897964	81.75821959			
61472442.53	77.8868	76.28571	81.06446	42517863	1.28E+08	1.7E+08	82.3119685	77.8868047	82.31196851			
56530055.77	77.52279	77.04446	75.84643	50634489	38427564	89062053	79.496927	77.52279414	79.49692701			
64267250.89	78.0799	75.84446	78.72161	38410188	74500762	1.13E+08	80.5273606	78.07989723	80.5273606			
48902076.86	76.89327	76.03143	78.58922	40099860	72263935	1.12E+08	80.506264	76.89327304	80.50626399			
64718389.14	78.11028	75.14001	77.58344	32658837	57325053	89983890	79.5416476	78.11027699	79.54164763			
71203783.42	78.52503	77.96875	78.96362	62643354	78770138	1.41E+08	81.5049085	78.52503071	81.50490846			
66417868.63	78.22285	76.80286	77.85161	47894508	60976250	1.09E+08	80.3691125	78.22284935	80.36911247			
65786025.44	78.18134	76.28018	79.40018	42463702	87099940	1.3E+08	81.1248315	78.18133649	81.1248315			
60649079.63	77.82824	77.25786	78.65018	53184578	73285467	1.26E+08	81.0198767	77.82824215	81.0198767			

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck			C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	34.54	32.26	29.66	30.33	29			1156	738	16	53	8	10.75	
8:00-9:00	35.13	34.63	29.67	31.16	30			1045	595	16	45	6	10.75	
9:00-10:00	38.05	39.1	30.83	29	35			610	417	13	21	25	10.75	
10:00-11:00	35.66	31.95	31	31.6	30.6			460	227	54	23	29	10.75	
11:00-12:00	35.77	35.41	28	28	30			455	205	13	13	17	10.75	
12:00-1:00	40.57	34.8	35	39.5	40			210	63	6	7	10	10.75	
1:00-2:00	40.5	38.75	32	35	31			170	63	6	6	10	10.75	
2:00-3:00	40.16	30.5	37	30	31.83			63	34	11	2	21	10.75	
3:00-4:00	34.83	37	32.62	40.25	37.25			50	52	30	5	29	10.75	
4:00-5:00	41.66	41.66	41.87	41	30			90	50	15	12	7	10.75	
5:00-6:00	43.5	32	35.66	39.5	32			158	80	13	23	7	10.75	
6:00-7:00	39	38.4	36.66	37.75	29			415	129	17	60	3	10.75	
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck				LOGARITHMIC CALCULATION AND SUMMATION					
7:00-8:00	70.83105	70.43938329	59.884892	65.50180651	62.80159576			12108896.93	11064666.51	973843.5339	3549610.098	1906160.985	29603178.1	74.7134
8:00-9:00	70.34282	69.62530478	59.883779	64.72311518	61.4237314			10821362.1	9173403.102	973594.0627	2966958.815	1387947.824	25323265.9	74.0352
9:00-10:00	67.7933	68.49070144	58.857952	61.59977133	67.07118744			6016309.294	7064316.431	768767.7862	1445363.667	5094701.499	20389458.7	73.0941
10:00-11:00	66.73652	65.30878765	65.025097	61.77394519	68.19221287			4716853.013	3395304.783	3180604.434	1504508.06	6595098.517	19392368.8	72.8763
11:00-12:00	66.68043	65.05317151	59.178415	59.61429196	65.94670811			4656327.054	3201232.009	827640.0327	915017.0693	3932518.835	13532735	71.3139
12:00-1:00	63.02541	59.88500899	55.131611	56.16814424	62.67848682			2006971.136	973869.8008	325957.5734	413822.809	1852885.924	5573507.24	67.4613
2:00-3:00	57.81602	57.03336338	57.627432	51.2976456	66.64576419			604786.4347	505052.282	579086.1266	134823.1781	4619302.665	6443050.69	68.0909
3:00-4:00	57.16639	59.23059833	62.317163	54.68002538	67.51386894			520761.0716	837644.6769	1704968.181	293766.6821	5641399.997	8998540.61	69.5417
4:00-5:00	59.29943	59.59885203	58.740461	58.45749136	62.0931993			851026.0657	911769.8004	748248.9298	701050.2291	1619272.461	4831367.49	66.8407
5:00-6:00	61.68304	60.78099795	58.441707	61.3344422	61.8552812			1473344.23	1197015.557	698506.8761	1359703.515	1532950.461	6261520.64	67.9668
6:00-7:00	66.06398	63.3175495	59.539476	65.57030203	58.54190844			4040151.55	2146618.908	899388.9988	3606037.207	714810.3695	11407007	70.5717
	SPEED DATA		17/11/2002	C.P TO KAROL BAGH				VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck			C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	31.68	37.98	29	26.33	35	25.76		1175	730	19	56	1	15.75	
8:00-9:00	34.1	32.46	33.66	31	28	29.75		1130	422	28	88	4	15.75	
9:00-10:00	37.79	35.7	35.66	35.33	38	29.54		920	286	41	78	24	15.75	
10:00-11:00	38.5	33	31.2	35	31	30.5		675	296	62	45	38	15.75	
11:00-12:00	38.9	35.41	32.33		33.33	28.41		735	216	85	30	32	15.75	
12:00-1:00	41.63	33.85	31.71	49.5	42	28.85		515	147	43	18	19	15.75	
1:00-2:00	42.2	38.7	36.5	33	37.33	31.2		305	43	45	12	23	15.75	
2:00-3:00	45.3	30.1	41	30	37	29.6		203	26	23	9	23	15.75	
3:00-4:00	39.1	33	28.75	29	32	28		37	28	19	5	24	15.75	
4:00-5:00	38.8	38.5	30	30	27.3	27		48	26	26	6	16	15.75	
5:00-6:00	47.6	30.2	31.4	32.5		27.35		59	52	20	23	12	15.75	
6:00-7:00	46.4	26.5	32.33	31	28.33	28.37		119	62	18	37	17	15.75	

TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck				LOGARITHMIC CALCULATION AND SUMMATION					
7:00-8:00	69.51892	69.14177525	59.047612	64.47736578	51.43306641			8951416.52	8206869.454	803084.3621	2803732.517	139093.4378	20765102.9	73.1733
8:00-9:00	69.11224	66.36056998	60.268638	65.98987488	61.38774962			8151245.623	4325705.994	1063809.39	3971801.07	1376496.026	18889058.1	72.7621
9:00-10:00	67.93568	64.86305006	61.771391	65.1726333	67.16501897			6216809.212	3064114.616	1503623.471	3290510.872	5205972.831	19281031	72.8513
10:00-11:00	66.5468	64.84292915	63.946197	62.80258659	68.20054993			4515235.303	3049951.369	2480959.581	1906595.917	6607771.143	18560513.3	72.6859
11:00-12:00	66.89331	63.62144947	65.207865	#DIV/0!	66.02104766			4890253.143	2302210.058	3317313.501	#DIV/0!	4000412.415	14510189.1	71.6167
12:00-1:00	65.21752	61.84658444	62.306844	58.41075659	62.75986645			3324698.877	1529883.794	1700922.007	693546.6184	1887933.294	9136984.59	69.608
1:00-2:00	62.92125	56.92035353	62.118743	57.18825842	63.69016249			1959408.868	492079.5904	1628824.547	523390.5078	2338924.745	6942628.26	68.4152
2:00-3:00	61.07442	54.20673714	58.970157	56.1710498	66.78685031			1280684.304	263435.145	788888.5604	414099.7612	4771830.744	7518938.51	68.7616
3:00-4:00	53.90119	54.60159235	59.076928	53.70855749	67.36851779			245538.3259	288508.9132	808523.7703	234885.2519	5455716.309	7033172.57	68.4715
4:00-5:00	55.04858	54.71348301	60.297291	54.41013721	62.04603225			319785.2419	296038.572	1070851.252	276066.5075	1601781.322	3564522.9	65.52
5:00-6:00	55.68848	57.21752559	59.012706	60.04865964	61.64630856			370550.8333	526929.5556	796655.6055	1011267.298	1460934.875	4166338.17	66.1975
6:00-7:00	58.74154	58.06655806	58.466401	62.2270654	58.53020203			748434.4662	640701.5969	702489.9178	1669961.814	712886.1928	4474473.99	66.5074
50368280.9	77.02157	84.41142857	83.460714	276148607.2				221856127.7	498004734.9	86.97233472				
44212324	76.45543	85.24285714	82.890179	334414973.1				194544007.2	528958980.3	87.23421995				
39670489.7	75.98468	85.06446429	84.801607	320956687.1				302106948.5	623063635.6	87.94532405				
37952882.1	75.79245	82.32071429	84.221607	170636301.2				264338678.4	434974979.6	86.38464276				
28042924.1	74.47823	82.31160714	83.74	170278852.3				236591969.7	406870822	86.09456546				
14710491.8	71.67627	79.33	80	85703784.52				100000000	185703784.5	82.68820754				
#REF!	#REF!	86.47875	85.906429	444503310.7				389621449	834124759.7	89.21231013				
13961989.2	71.44947	78.53	81.740179	71285303.01				149285579.1	220570882.1	83.4354818				
16031713.2	72.0498	77.18571429	80.764464	52308399.09				119246716.3	171555115.4	82.34403672				
8395890.38	69.24067	77.15	78.296429	51880003.89				67552722.59	119432726.5	80.77123347				
10427858.8	70.18195	77.97785714	77.320945	62774854.43				53962798.53	116737653	80.67210957				
15881481	72.00891	83.85785714	78.634	243100422.9				73012967.49	316113390.4	84.99842893				
				TIME(hrs)	PREDICTED	OBSERVED								
				19:00-20:00	77.4328314	83.97233472								
				20:00-21:00	77.1155138	84.23421995								
				21:00-22:00	76.67106944	83.94532405								
				22:00-23:00	76.21779058	82.38464276								
				23:00-24:00	75.26011148	82.09456546								
				24:00-1:00	72.68119217	82.68820754								
				1:00-2:00	78.92888489	89.21231013								
				2:00-3:00	79.97428734	83.4354818								
				3:00-4:00	72.01111951	82.34403672								
				4:00-5:00	75.2274196	80.77123347								
				5:00-6:00	75.21139316	80.67210957								
				6:00-7:00	72.1670713	84.99842893								

	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	51.5	52.9	38.2	35.2	30	144	583	60	88	3	14.8	
8:00-9:00	46.1	46.9	34.7	33.8	31.5	535	336	100	191	6	14.8	
9:00-10:00	47.9	47	34.2	30.7	0	504	763	63	262	0	14.8	
10:00-11:0	51.75	48.4	36.5	32.7	0	571	843	50	204	0	14.8	
11:00-12:0	50	42.9	28.8	31.2	33.5	462	692	95	242	5	14.8	
12:00-1:00	50.4	40.3	32.9	32.4	34.1	464	552	88	177	1	14.8	
1:00-2:00	36.7	36	29.2	30.6	39	602	614	105	192	3	14.8	
2:00-3:00	38.8	37.8	25.5	26.9	33.8	678	641	107	199	11	14.8	
3:00-4:00	44.5	49.3	34.5	32.9	31	676	673	115	198	4	14.8	
4:00-5:00	48.3	50.6	38.7	37.7	30	693	657	71	170	6	14.8	
5:00-6:00	45.85	41.9	40.5	38.72	39.5	787	668	104	194	1	14.8	
6:00-7:00	41.6	42.3	38.5	36.5	31.2	835	822	97	203	1	14.8	
		HOURLY Leq CALCUALTIONS										
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARITHMIC CALCULATION AND SUMMATION					
7:00-8:00	59.87305233	70.69573393	63.53621	65.97403	57.0249	971192.3063	11737440	2257463	3957339	504068.9	19427503	**72.88417**
8:00-9:00	65.54270239	67.2723158	65.98422	69.42399	59.85445	3583193.317	5336194	3966631	8757886	967042.3	22610947	**73.54319**
9:00-10:00	65.27429145	70.85050092	64.01666	71.02265	0	3368442.554	12163263	2521542	12655070	1	30708319	**74.87256**
10:00-11:0	65.86128201	71.515902	62.84651	69.78373	0	3855921.654	14177191	1925975	9514206	1	29473295	**74.69429**
11:00-12:0	64.91028128	69.79414832	66.33091	70.63744	58.8428	3097619.913	9537067	4296269	11580949	766091.2	29277996	**74.66541**
12:00-1:00	64.93460611	68.46351553	65.57725	69.18846	51.79166	3115018.363	7020233	3611813	8295570	151065.7	22193700	**73.4623**
1:00-2:00	66.43812416	68.47553753	66.71905	69.6809	56.13367	4403646.162	7039694	4697912	9291599	410551.2	25843402	**74.1235**
2:00-3:00	66.81865716	68.82882259	67.28036	70.19051	62.23605	4806906.962	7636287	5346085	10448437	1673422	29911139	**74.75833**
3:00-4:00	66.5836044	70.69040455	66.60662	69.64016	58.15223	4553658.312	11723046	4577853	9204833	653466.7	30712857	**74.8732**
4:00-5:00	66.65794674	70.81005223	64.2405	68.70699	60.0352	4632278.632	12050504	2654910	7425037	1008138	27770867	**74.43589**
5:00-6:00	67.22176065	69.50095098	65.81368	69.23698	51.32559	5274436.458	8914461	3813889	8388757	135693.6	26527238	**74.23692**
6:00-7:00	67.5876782	70.45706883	65.60617	69.5346	52.10797	5738096.135	11109816	3635942	8983794	162479.1	29630127	**74.71734**
	SPEED DATA					VOLUME DATA						
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance	
7:00-8:00	51.2	45.2	29	33.6	28	228	140	77	264	2	15.8	
8:00-9:00	49.3	48.7	36.4	32.6	32.3	220	276	45	173	3	15.8	
9:00-10:00	51.25	45.4	36.7	34.3	29	310	500	43	174	3	15.8	
10:00-11:0	44.6	40.7	34.4	33.9	31.2	561	619	40	197	4	15.8	
11:00-12:0	43.2	39	27.2	32.5	29	662	657	44	144	6	15.8	
12:00-1:00	41.4	40.1	31	30.3	25.6	635	697	36	152	5	15.8	
1:00-2:00	39.7	35.4	35	31	31	955	699	65	112	5	15.8	
2:00-3:00	40.9	37.7	27	29.7	27.5	665	711	50	113	12	15.8	
3:00-4:00	40.2	36.4	32.2	30	32	686	686	39	118	10	15.8	
4:00-5:00	38	38.7	35.9	33	29.5	605	661	27	100	8	15.8	
5:00-6:00	42.35	38.8	31.6	35.4	29	605	632	30	134	8	15.8	
6:00-7:00	40.3	37.8	32.6	35	28	815	590	32	204	3	15.8	

		HOURLY Leq CALCUALATIONS										
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck			LOGARITHMIC CALCULATION AND SUMMATION				
7:00-8:00	61.57869033	62.91489358	65.11122	70.55866	55.24368	1438364.754	1956543	3244306	11372758	334478.6	18346450	**72.63552**
8:00-9:00	61.39662466	66.43338171	62.11153	68.79098	56.46944	1379311.845	4398840	1626121	7570029	443551.5	15417853	**71.88024**
9:00-10:00	62.91394575	68.47457469	61.89462	68.70386	56.86942	1956115.861	7038133	1546900	7419690	486342.5	18447181	**72.6593**
10:00-11:0	65.48778091	68.7275114	61.74409	69.26799	57.84462	3538165.071	7460211	1494202	8448883	608782.3	21550244	**73.33452**
11:00-12:0	66.2409482	68.78113349	62.90289	68.00124	59.87972	4208184.96	7552893	1951143	6311377	972685	20996283	**73.22142**
12:00-1:00	66.12257425	69.1677661	61.5917	68.40754	59.57675	4095033.176	8256132	1442679	6930332	907140.7	21631317	**73.35083**
1:00-2:00	67.97324113	68.70716088	63.80675	67.02346	58.83738	6270816.802	7425336	2402562	5039023	765135.1	21902872	**73.40501**
2:00-3:00	66.34413759	68.98485051	63.48435	67.172	63.09539	4309369.755	7915622	2230667	5214345	2039571	21709575	**73.36651**
3:00-4:00	66.51142887	68.70709309	61.8226	67.33368	61.73181	4478606.301	7425220	1521458	5412127	1489983	20327394	**73.08082**
4:00-5:00	66.08821153	68.77391828	59.92671	66.38268	61.06405	4062759.863	7540356	983266.3	4347785	1277630	18211797	**72.60353**
5:00-6:00	65.87681198	68.59017433	60.74026	67.50506	61.12911	3869734.752	7227988	1185840	5629966	1296913	19210443	**72.83537**
6:00-7:00	67.25495738	68.1848087	60.92677	69.353	57.0046	5314907.832	6583864	1237875	8615883	501717.9	22254248	**73.47413**
TIME(hrs)	PREDICTED	OBSERVED										
7:00-8:00	75.77192442	82.97558034										
8:00-9:00	75.80112611	85.93864932										
9:00-10:00	76.91572118	86.9929924										
10:00-11:0	77.07770572	85.64014408										
11:00-12:0	77.01345847	85.06474576										
12:00-1:00	76.41722095	83.51072166										
1:00-2:00	76.78939486	82.39931823										
2:00-3:00	77.12824004	82.61522035										
3:00-4:00	77.07912797	82.60049728										
4:00-5:00	76.62594131	83.11023283										
5:00-6:00	76.60274134	82.91023536										
6:00-7:00	77.1503659	84.10800155										

LOCATION 7			SPEED DATA			VOLUME DATA								
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance			
7:00-8:00	51.5	52.9	38.2	35.2	30	144	583	60	88	3	14.8			
8:00-9:00	46.1	46.9	34.7	33.8	31.5	535	336	100	191	6	14.8			
9:00-10:00	47.9	47	34.2	30.7	0	504	763	63	262	0	14.8			
10:00-11:00	51.75	48.4	36.5	32.7	0	571	843	50	204	0	14.8			
11:00-12:00	50	42.9	28.8	31.2	33.5	462	692	95	242	5	14.8			
12:00-1:00	50.4	40.3	32.9	32.4	34.1	464	552	88	177	1	14.8			
1:00-2:00	36.7	36	29.2	30.6	39	602	614	105	192	3	14.8			
2:00-3:00	38.8	37.8	25.5	26.9	33.8	678	641	107	199	11	14.8			
3:00-4:00	44.5	49.3	34.5	32.9	31	676	673	115	198	4	14.8			
4:00-5:00	48.3	50.6	38.7	37.7	30	693	657	71	170	6	14.8			
5:00-6:00	45.85	41.9	40.5	38.72	39.5	787	668	104	194	1	14.8			
6:00-7:00	41.6	42.3	38.5	36.5	31.2	835	822	97	203	1	14.8			
			HOURLY Leq CALCUALTIONS FOR DIRECTION 1											
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck		LOGARITHMIC CALCULATION AND SUMMATION							
7:00-8:00	59.873052	70.6957339	63.536206	65.9740328	57.024899	971192.3063	11737440	2257463	3957339	504068.9	19427503	**72.88417**		
8:00-9:00	65.542702	67.2723158	65.984218	69.4239931	59.854455	3583193.317	5336193.6	3966631	8757886	967042.3	22610947	**73.54319**		
9:00-10:00	65.274291	70.8505009	64.016662	71.0226456	0	3368442.554	12163263	2521542	12655070	1	30708319	**74.87256**		
10:00-11:00	65.861282	71.515902	62.846506	69.7837254	0	3855921.654	14177191	1925975	9514206	1	29473295	**74.69429**		
11:00-12:00	64.910281	69.7941483	66.330915	70.6374414	58.842805	3097619.913	9537067	4296269	11580949	766091.2	29277996	**74.66541**		
12:00-1:00	64.934606	68.4635155	65.577253	69.1884622	51.791659	3115018.363	7020233.4	3611813	8295570	151065.7	22193700	**73.4623**		
1:00-2:00	66.438124	68.4755375	66.719049	69.6809045	56.133673	4403646.162	7039693.5	4697912	9291599	410551.2	25843402	**74.1235**		
2:00-3:00	66.818657	68.8288226	67.280359	70.1905135	62.236055	4806906.962	7636287.3	5346085	10448437	1673422	29911139	**74.75833**		
3:00-4:00	66.583604	70.6904046	66.606618	69.6401592	58.152235	4553658.312	11723046	4577853	9204833	653466.7	30712857	**74.8732**		
4:00-5:00	66.657947	70.8100522	64.240498	68.7069859	60.035199	4632278.632	12050504	2654910	7425037	1008138	27770867	**74.43589**		
5:00-6:00	67.221761	69.500951	65.813681	69.2369762	51.325593	5274436.458	8914461.2	3813889	8388757	135693.6	26527238	**74.23692**		
6:00-7:00	67.587678	70.4570688	65.606169	69.5345977	52.107974	5738096.135	11109816	3635942	8983794	162479.1	29630127	**74.71734**		
	SPEED DATA					VOLUME DATA								
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck	C/J/V	SC/MC	LCV	Bus	Truck	Distance			
7:00-8:00	51.2	45.2	29	33.6	28	228	140	77	264	2	15.8			
8:00-9:00	49.3	48.7	36.4	32.6	32.3	220	276	45	173	3	15.8			
9:00-10:00	51.25	45.4	36.7	34.3	29	310	500	43	174	3	15.8			
10:00-11:00	44.6	40.7	34.4	33.9	31.2	561	619	40	197	4	15.8			
11:00-12:00	43.2	39	27.2	32.5	29	662	657	44	144	6	15.8			
12:00-1:00	41.4	40.1	31	30.3	25.6	635	697	36	152	5	15.8			
1:00-2:00	39.7	35.4	35	31	31	955	699	65	112	5	15.8			
2:00-3:00	40.9	37.7	27	29.7	27.5	665	711	50	113	12	15.8			
3:00-4:00	40.2	36.4	32.2	30	32	686	686	39	118	10	15.8			
4:00-5:00	38	38.7	35.9	33	29.5	605	661	27	100	8	15.8			
5:00-6:00	42.35	38.8	31.6	35.4	29	605	632	30	134	8	15.8			
6:00-7:00	40.3	37.8	32.6	35	28	815	590	32	204	3	15.8			

			HOURLY Leq CALCUALATIONS FOR DIRECTION 2											
TIME(hrs)	C/J/V	SC/MC	LCV	Bus	Truck			LOGARITHMIC CALCULATION AND SUMMATION						
7:00-8:00	61.57869	62.9148936	65.111218	70.5586581	55.243683	1438364.754	1956542.8	3244306	11372758	334478.6	18346450	72.63552		
8:00-9:00	61.396625	66.4333817	62.111527	68.7909752	56.469441	1379311.845	4398840.1	1626121	7570029	443551.5	15417853	71.88024		
9:00-10:00	62.913946	68.4745747	61.894621	68.7038578	56.869422	1956115.861	7038133	1546900	7419690	486342.5	18447181	72.6593		
10:00-11:00	65.487781	68.7275114	61.744094	69.2679927	57.84462	3538165.071	7460211.5	1494202	8448883	608782.3	21550244	73.33452		
11:00-12:00	66.240948	68.7811335	62.902891	68.0012409	59.879722	4208184.96	7552893.3	1951143	6311377	972685	20996283	73.22142		
12:00-1:00	66.122574	69.1677661	61.591698	68.4075404	59.576746	4095033.176	8256131.7	1442679	6930332	907140.7	21631317	73.35083		
1:00-2:00	67.973241	68.7071609	63.806746	67.0234631	58.837381	6270816.802	7425335.6	2402562	5039023	765135.1	21902872	73.40501		
2:00-3:00	66.344138	68.9848505	63.484348	67.1719976	63.095388	4309369.755	7915622.1	2230667	5214345	2039571	21709575	73.36651		
3:00-4:00	66.511429	68.7070931	61.822599	67.3336795	61.731815	4478606.301	7425219.7	1521458	5412127	1489983	20327394	73.08082		
4:00-5:00	66.088212	68.7739183	59.926712	66.3826807	61.064052	4062759.863	7540355.6	983266.3	4347785	1277630	18211797	72.60353		
5:00-6:00	65.876812	68.5901743	60.740262	67.5050579	61.12911	3869734.752	7227988.2	1185840	5629966	1296913	19210443	72.83537		
6:00-7:00	67.254957	68.1848087	60.926769	69.3529978	57.004596	5314907.832	6583864.3	1237875	8615883	501717.9	22254248	73.47413		
TIME(hrs)	PREDICTE	OBSERVED												
7:00-8:00	75.771924	82.9755803												
8:00-9:00	75.801126	85.9386493												
9:00-10:00	76.915721	86.9929924												
10:00-11:00	77.077706	85.6401441												
11:00-12:00	77.013458	85.0647458												
12:00-1:00	76.417221	83.5107217												
1:00-2:00	76.789395	82.3993182												
2:00-3:00	77.12824	82.6152204												
3:00-4:00	77.079128	82.6004973												
4:00-5:00	76.625941	83.1102328												
5:00-6:00	76.602741	82.9102354												
6:00-7:00	77.150366	84.1080015