BE CIVIL ENGINEERING

PROJECT REPORT

ANALYSIS OF TRAFFIC CONGESTION MITIGATING MEASURES ON MALL ROAD RAWALPINDI (GPO TO EME MESS INTERSECTION) BY USING PTV VISSIM

Project submitted in partial fulfillment of the requirements for the degree of

BE Civil Engineering

SUBMITTED BY

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MILITARY COLLEGE OF ENGINEERING

NATIONAL UNIVERSITY OF SCIENCES & TECHNOLOGY

RISALPUR CAMPUS, PAKISTAN

(2019)

This to certify that the

BE Civil Engineering Project entitled

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Has been accepted towards the partial fulfilment of the requirements for

BE Civil Engineering Degree

Col Dr. Muhammad Bilal Khurshid, PhD

Syndicate Advisor

Dedication

Special dedication to our parents, teachers and well wishers

For all the support, encouragement and belief in us.

ACKNOWLEDGEMENT

First of all, thanks to Allah Almighty for his blessings, which has enabled us to complete our part related to 8th semester. There are number of people without whom this might not have been written, and to whom we are greatly obliged.

Last but not the least, our deepest gratitude goes to our beloved parents and project advisor who have always been a symbol of encouragement and inspiration to us. To those, who in some way contributed in this research, your kindness means a lot to us. Thank you very much.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Due to ever expanding population and urbanization, there exists an extreme issue of traffic congestion on major city roads. Similar situation is currently being faced on Mall Road Rawalpindi especially starting from GPO Intersection to EME Mess Intersection due to existence of commercial hub, expansive number of intersections within few kilometers, nonexistence of city bypass and presence of key installations on its outskirts i.e. GHQ, Military Hospital, PC Hotel and various schools and colleges. Despite of various short-term congestion mitigation measures taken by city authorities in the past few years, problem of traffic congestion on this road is still on the rise. With this perspective, this project was undertaken to carry out a detail analysis of selected road section and intersections to propose a permanent viable solution. Necessary traffic data was obtained with the help of traffic police and on-site video recording. PTV VISSIM Software was used to simulate the existing level of service which ultimately helped in identification of key issues as well as finding viable solutions to make the selected road section a signal fee signal free passage, which included flyover, underpass, signal optimization and provision of additional and exclusive lanes. Implementation of this project will not only help in minimizing congestion and improving travel time but will also create an overall positive environmental impact on surrounding.

INTRODUCTION

CHAPTER - 1

INTRODUCTION

1.1 General:

Transportation and communication administrations are prerequisite in supporting financial development and making strides nations beneficial capacity. An effective transport and communication organize upgrades efficiency, progresses productivity and minimizes the fetched of doing commerce. It has been broadly recognized that economies with superior street and communication organize are more competitive compared to those having lacking organize. Activity joins and systems are an appearance of the human crave to live in a community and to associated with other individuals. Traffic courses serve to transport people and products.

Traffic congestion may be a condition of street systems that's characterized by slower speeds, longer trip times, and expanded queuing. When traffic demand is incredible sufficient that the interaction between vehicles hampers the speed of the traffic stream, blockage is caused. As request approaches the capacity of a road (or of the convergences along the road), extraordinary traffic blockage sets in. When vehicles are completely halted for periods of time, this can be known as a traffic jam. Blockage in any transport framework anticipates vehicles from travelling unreservedly on the transportation arrange. In this way in a congested framework vehicle may travel at diminished speeds or may be ceased. Blockage for the most part emerges when either transportation request approaches capacity or a fabric taking care of framework component breaks down and blocks traffic on a section of the network. Crossing points are getting to be progressively congested all through the urban regions in Pakistan and other nations. The financial and social issues to cities with customary traffic jams has been assessed by financial analysts around the world and is amazingly tall. A study conducted by the World Assets Organized assessed that the financial penalty of activity clog in huge cities can surpass hundreds of millions of dollars each year. A lot of study and inquire about is being carried out within the space of traffic designing for finding reasonable arrangements to the issue of traffic clog. Rawalpindi is the fourth biggest city in

Pakistan. In Rawalpindi, the road arrange speaks to a spider-net structure. Around 3500 new vehicles are enlisted within the city of Rawalpindi each month. Both the road standard and the common activity environment are not of the desired standard and blockage is common and increasing.

The GT Road where its skims pass the central region of Rawalpindi is called as Mall Road. It carries a major parcel of the city's traffic.

1.2 Problem Statement:

Blockage could be a recognized Problem at crossing points in urban setups, and is compounding since of development of personal/private vehicle proprietorship with each passing day. A handful amount of research has been carried out in this space. Traffic blockage happens on Mall Road amid crest hours.

The fundamental causes of blockage on this avenue are:

1) Presence of an expansive number of intersections inside a radius of few kilometers.
2) The most trade center of Rawalpindi i.e. Saddar Bazar and GHQ lie fair adjoining to the Mall Road. Since of this prime area it carries a major extent of the city traffic. (Clements, 2008)
3) No reasonable interchange route is accessible for the traffic going out of the city and it needs to commute on the Mall Road i.e. nonappearance of Rawalpindi Bypass.
4) Nonappearance of synchronized signaling framework which comes about in blockage during crest hours and to manage with this the signals are turned off and the traffic is controlled physically by the traffic constables.

In view of above, study is required to be performed to analyze the traffic blockage issue on the Mall Road which has come about in following as well as to recommend the measures to make it signal free passage.

1) Increased travelling time.
2) Increase in fuel wastage, hence, causes financial loss.
3) Increase in weakness for the drivers.

4) Increase in contamination and natural degradation.

1.3 Research Objectives:

Our investigate is centered to attain following objectives:

1) To carryout traffic analysis in order to find congestion problems and to ascertain the existing operational conditions by using software.

2) To propose viable solutions (primarily signal free through passage) based on ground substances keeping in view present day strategies using simulations through PTV VISSIM

1.4 Scope of Thesis:

Scope of the proposal inside which we are going be accomplishing our research objectives is as followed:

1) A review of the literature with respect to studies held on comparative ventures inside Pakistan or in other countries.

2) Total no of intersections, inside our Area of study, will be recognized. These intersections will be then distributed in stages for collection of data.

   a. Traffic counts.
   b. Vehicle delays.
   c. Signal timings.
   d. Geometric data.

3) Vehicle number at intersections will be counted during peak hours.

4) Space accessible at those intersections will be measured.

5) Collected Information will be utilized for simulating different traffic facilities through PTV VISSIM Software.

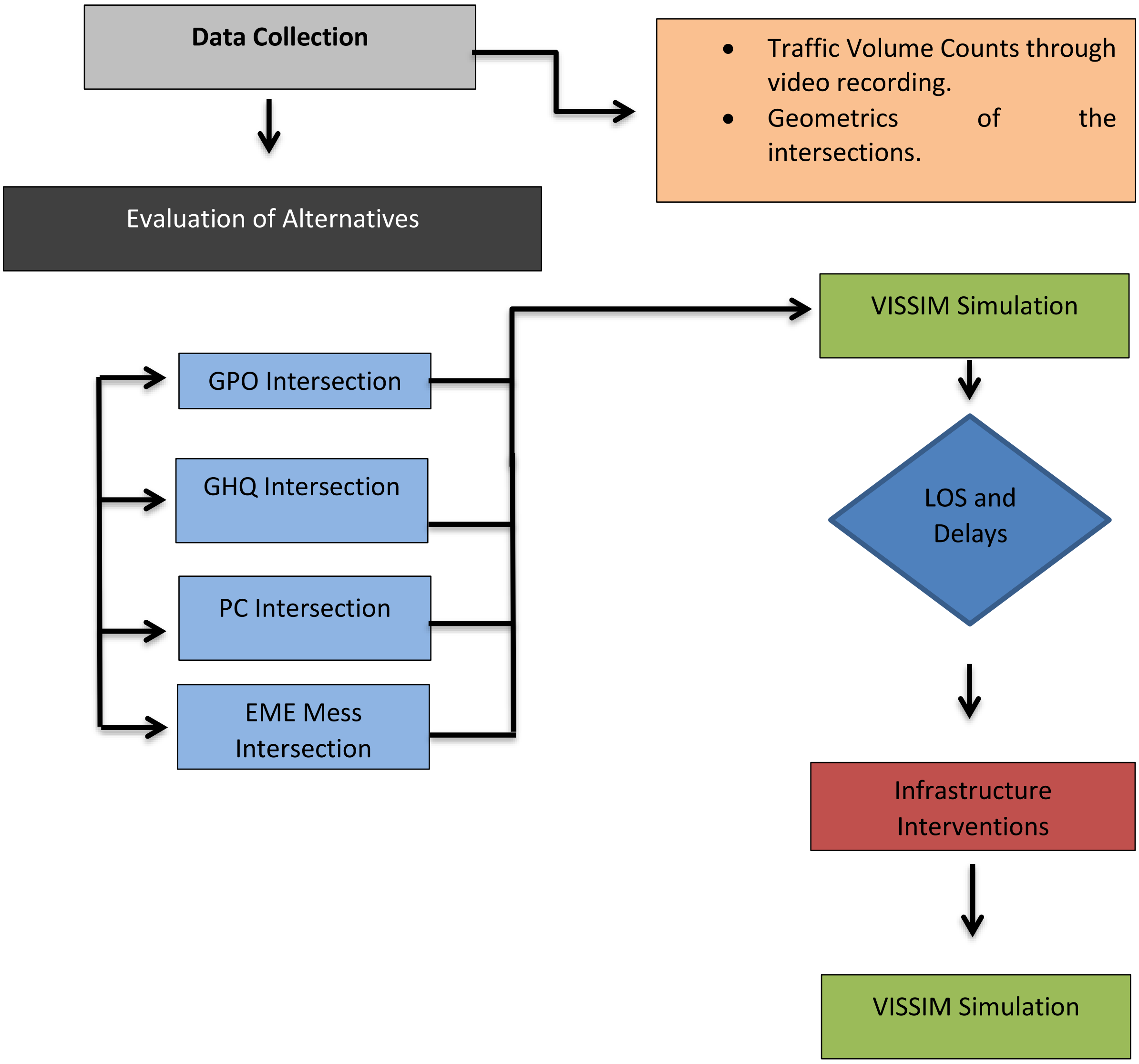
1.5 Limitations:

The limitations of our project are:

1) Due to the security situation we were not able to take physical counts of vehicles therefore resorted to recording of videos and thereafter calculation.
2) Recording of video at GHQ intersection could not be done due to area sensitivity, hence the vehicle counts from a private firm (Zeeruk International) were obtained on the advice of Advisor.
3) The Software VISSIM used by us is student version which has limitations like limited area, water mark on result etc.
4) The cost analysis of the various solutions proposed by us will not be covered in our project.

1.6 Research Methodology:

The research strategy adopted during the study to attain the required objectives is as followed:



1.7 Expected Benefits:

To suit the mass development of free flow of traffic, Signal Free Passages are prepared with number of architectural facilities, which incorporate Underpasses, U turns, pedestrian bridges and flyovers. Hence, conceivable benefits of the execution of this extend are as followed:

1) Reduction in travelling time.
2) Conservation of fuel, in this way, leads to financial gains.
3) Reduction in driver's fatigue.
4) Reduction in contamination and moves forward environmental indicators.
5) Decrease in mishaps due to elimination of signalized intersections.

LITERATURE REVIEW

CHAPTER - 2

LITERATURE REVIEW

2.1 Introduction:

This chapter entails the studies and researches carried out in the field of traffic congestion, traffic conditions, its effects on intersections and calculation of level of service of an intersection. This chapter discuss how to reduce delays on intersections. The design and alignment of a new freeway has been emphasized in the last chapter.

2.2 Concept of Freeways:

A long stretch of road connecting various large and small streets intersecting it at various spots. They provide a nonstop, comfortable and an easy access to the road users without delays and with less vehicular fuel costs with the presence of grade separated junctions including flyovers and underpasses.

Freeways and corridors are free of regulatory signals or stop signs hereby allowing the vehicles to adopt higher traveling speeds. That is why the corridors are also most commonly known as Signal Free Corridors. Corridors aim at managing traffic, minimizing disruptions and reducing inconveniences experienced by motorists and other road users while traveling.

The interconnection of freeways or corridors by other roads is typically achieved with grade separated facilities in the form of either underpasses or overpasses. Freeways / Signal Free Corridors usually have footpaths attached with it to provide a safe place to walk for the pedestrians. Other than that, specialized pedestrian footbridges or tunnels are also provided at various spots along the corridors after careful and detailed study of the pedestrian movement involved at the spots.

2.3 Urban Signalized Intersection and Traffic Flow:

Mainly there are two types of traffic flows on urban signalized intersections –Heterogeneous and Homogeneous traffic flow.

2.3.1 Heterogeneous Traffic Flow

This is composed of a variety of vehicles these include cars (including jeeps and vans), buses, motorized two wheelers (MTW), light commercial vehicles, auto-rickshaws (three wheeled motorized vehicles) (LCV), bicycles and trucks which although share a common space but do not follow the road regimen and queue order since there is no physical segregation.

Normally the smaller vehicles tend to accommodate into the spaces between the larger vehicles. Thus, there is diversity in the performance and operations of the vehicles in this traffic flow which makes it hard to study its characteristics using analytical models therefore, 'Simulation tools' are used for studying these varying Heterogeneous traffic flows. For example:

a. A simulation study determining the delays and queue lengths of uncontrolled T-intersections was done by Popat et al. (1989).
b. Simulation of an uncontrolled urban intersection with pedestrian crossings was conducted by Raghavachari et al. (1993).
c. Simulation of intersection flows to analyze the mixed traffic performed by Agarwal et al. (1994).
d. The influence of vehicular heterogeneity on urban signalized intersections was conducted by Arasan and Jagadeesh (1995). They proposed a probabilistic approach to estimate saturation flow and delay.
e. Various simulation models for uncontrolled signalized intersection including modeling conflicts of heterogeneous traffic at urban uncontrolled intersection were designed by Rao and Rengaraju (1998).
f. The discharge characteristics of vehicles and vehicle characteristics at urban signalized intersections were analyzed by Maini and Khan (2000).
g. Hossain (2001) estimated saturation flow at urban signalized intersections based on turning proportion, road width and percentage of heavy and non-motorized vehicles using a micro-simulation modeling approach.

h. The platoon dispersal pattern for heterogeneous traffic at an urban signalized intersection using a simulation model was done by Arasan and Kashani (2003).

i. A simulation model was created by Marwah et al. (2006) for signalized intersection to estimate queue length and delay.

j. Akgüngör, A. P. (2008a and 2008b) analyzed the delay parameter, which dependents on variable analysis period at urban signalized intersections

Yet, there still remains a necessity to further improve the traffic flow at urban signalized intersections, for effective traffic regulation and control, que formation, density, accumulation, and dissipation, strategies to effectively use the transport infrastructure etc.

2.3.2 Homogeneous Traffic Flow:

On the contrary, this is a hypothetical simulation of traffic flow in which all vehicles move with the same speed independent of time and have the same space gaps. Thus, it can be studied via analytical models. Many studies have been already been conducted on Homogeneous traffic flow for example:

a. Modeling of queue dissipation to control signal timing was studied by Lin and Cooke (1986).

b. Lin (1992) provided left-turn adjustment factors for shared permissive, left turn lane and also estimated the capacities.

c. Left turn adjustment factors for double left turn lanes in medium size cities was developed by Spring and Thomas (1999).

d. Dynamic and stochastic aspects of queue including queue length and queue delays at signalized intersections were studied by Zuylen and Taale (2001).

e. The study on platoon dispersion, and factors affecting it was carried by Cleftent et al. (2004)

f. The order and chaos in the dynamics of vehicle platoons were studied by Addison and Low (1996)

g. Laoufi et al. (2004) predicted the intersection queues with a dynamic balance model along with queue length, and queue dissipation.

2.4 Traffic Congestion:

Traffic congestion is a major concern of metropolitan areas resulting in various trials undertaken to reduce congestion. The first step in the process is its identification and comprehending counter measures. It retards movement.

1) Effects:

a. Traffic circulation.
b. Time wastage.
c. Stress elevation.
d. Cost of travel is increased.
e. Economic losses.
f. Commodity wastage.
g. Pollution increase.

2) Causes

a. Number of vehicles exceeding the design capacity.
b. Blockade on the roadway.
c. Inadequate intersection cycle length.
d. Traffic signal malfunction.
e. Excessive pedestrian crossing.
f. Increase in vehicle ownership causing limited use of Mass transit system.

Optimization of intersections especially during peak hour traffic can help in reduction of congestion. Another measure for reducing congestion is demand management such as high occupancy vehicle lanes and mass transit system. It is therefore essential to distinguish both types of measures. Primary elements influencing the supply side of transportation are:

1) Capacity i.e. total roads and the number of lanes.
2) Optimizing the road network such as optimizing signals.
3) Number of accidents or road works. Due to difficulties in increasing the capacity of road network; the traffic management is being influenced by the last two factors.

2.5 Delays at Intersections:

Intersections in the urbanized road network are significant in the traffic system. There are two types of intersections i.e. at grade and grade separated. An intersection can either be completely controlled (automated), semi controlled or uncontrolled. In case of controlled intersection, the roadway width for all the traffic flows remains the same and the factor which controls the various streams is the signal time. The factors which are used for the assessment of signalized intersection

1) Capacity,
2) Volume-to-capacity ratio,
3) Delay
4) Length of queue

2.5.1 Capacity:

The maximum hourly rate at which vehicles can be expected to traverse a point or a uniform segment of a length/roadway during a given time period is called the capacity.

It is analyzed by saturation stream values. Capacity elucidates various roadway conditions such as, grades, and lane use allocations, the number and width of lanes as well as signalization conditions.

It is calculated for critical lane groups (lanes requiring maximum green time).

2.5.2 Volume/Capacity Ratio:

It is the ratio between the vehicular demand and the roadway capacity. For intersections v/c ratios for all the lanes is calculated and the lane having the maximum v/c ratio (critical lane) is considered. It is also regarded as degree of saturation. V/C ratio less than 1 specifies that the traffic on the road is less than the capacity and the vehicles will not experience any queues or delays. V/C ratio equal to 1 may cause unstable traffic conditions i.e. delays and queuing. Whenever the vehicular demand is greater than the capacity i.e. v/c ratio is greater than 1, extreme delays and long queues are generated and is generally referred as cycle failure. In design, a volume/capacity ratio between 0.85 and 0.95 is usually measured for peak hour flow.

2.5.3 Delay

Delay is the extra time that a driver or a passenger experience. Delay includes start up lost time, queue time as well as the clearance lost time.

Factors affecting controlled delay are

a. Volume of the lane group.
b. Capacity of the lane group.
c. Cycle length.
d. Effective green time.
e. Delays ultimately affect the level of service of the roads.

2.5.4 LOS:

Level of service (LOS) is qualitative which is used to relate the quality of traffic service by transportation planners on transportation devices, or infrastructure. LOS is referred as a measure of traffic density and is used to examine highways by classifying the flow of traffic and maintaining quality levels of traffic based on the performance measures like density, speed etc. It is also linked to transportation time, with lesser the time, the better LOS.

LOS is a measure categorized from A to F, A being the top grade where other vehicles do not influence the driver, whereas F grade points out the 'jammed' or forced flow.

The mathematical formula to calculate LOS depends of three factors i.e.

a. Speed
b. Service flow rate
c. Volume to capacity ratio (v/c).

The least acceptable grade between A to F is D.

The speed of the vehicle accounts for approximately 80 to 90% of the total capacity. When measuring the LOS for intersection over a 15-minute analysis period, it is termed as the average stopped delay per vehicle.

2.5.5 Vehicle Queuing:

A study of traffic behavior and a significant measure of effectiveness to be calculated while analyzing the signalized intersection usually where the demand exceeds available capacity.

It helps in determining if the spillover will occur at upstream facilities (signalized intersections, un-signalized intersections and driveways etc.) or the storage amount required for the turn lanes. These are typically estimated based on the 95th percentile queue.

The role of traffic engineer is to solve traffic problems on intersections by optimization of the operation of the traffic system. The process starts with problems which obstructs the traffic flow along the traffic facility; and it is essential to increase the effectiveness of the traffic control factors so to minimize the traffic congestion.

Traffic efficiency and performance are the key factors which should be increased while improving the different traffic elements. These traffic elements consist of

a. TDM actions
b. Parking control
c. Geometric design elements
d. Phase sequences.

2.6 Classification of Intersections:

Intersections are classified depending upon the number of crossing conflicts i.e.

1) At Grade Intersection.
2) Grade Separated Intersection.

2.6.1 Grade Separated Intersections:

Grade separated interchanges ensure the elimination of crossing conflicts that might occur at intersections by vertical separations of roadways in space.

The patterns of various turning ramps and roadways are interchanges. The basic design of interchange configuration is made to ensure economical traffic necessities of flow, right-of-way and direction of movements, type of controls, adjoining land use, physical requirements of topography and operation on the crossing facilities.

Elimination of all grade crossing conflicts and incorporating other intersecting maneuvers by weaving, diverging and merging at low speed is the main objective of grade separated intersections. Some of the grade separated intersections are as follows:

2.6.1.1 Underpass:

An underpass also known as tunnel is completely enclosed underground passageway except for the basic entry exit openings.

Tunnels are used for foot or rail or vehicular traffic. Subway on the other hand is constructed beneath a road or railway for cyclists/pedestrians. Underpass and subways are built to assist the movement of pedestrians to cross railroad.

Figure 1 Image showing an underpass

2.6.1.2 Overpass:

An overpass or flyover is a structure similar to bridge which usually crosses over the railway or road line. Overpasses ensure that the traffic flow is unobstructed. If there are busy roads, pedestrian overpass allows the safe crossing for pedestrians.

Figure 2 Image showing an Overpass

SITE DESCRIPTION

CHAPTER - 3

SITE DESCRIPTION

3.1 Site Description:

The project location exists within the middle of Rawalpindi and handles high activity volumes every day. From the South traffic is coming from G.T. Road, Islamabad Airplane terminal, Chaklala Garrison, Chaklala Scheme III, Jhanda Chichi, Murree Road and District Courts. From the North traffic flow is basically contributed by Peshawar Road, Westridge, Islamabad, FAST, Islamic University, NUST and numerous other commercial and trade ranges. On the east of the Mall Road lie the most commercial center of Rawalpindi i.e. Saddar and a few educational institutions like Fatima Jinnah College and F.G. Sir Syed College. To the west is found the GHQ, Headquarter FWO, E-in-C Branch, MH and CMH. In brief the location handles traffic coming from all over Rawalpindi and congestion is regularly watched during the morning surge hour and the office break off timing.

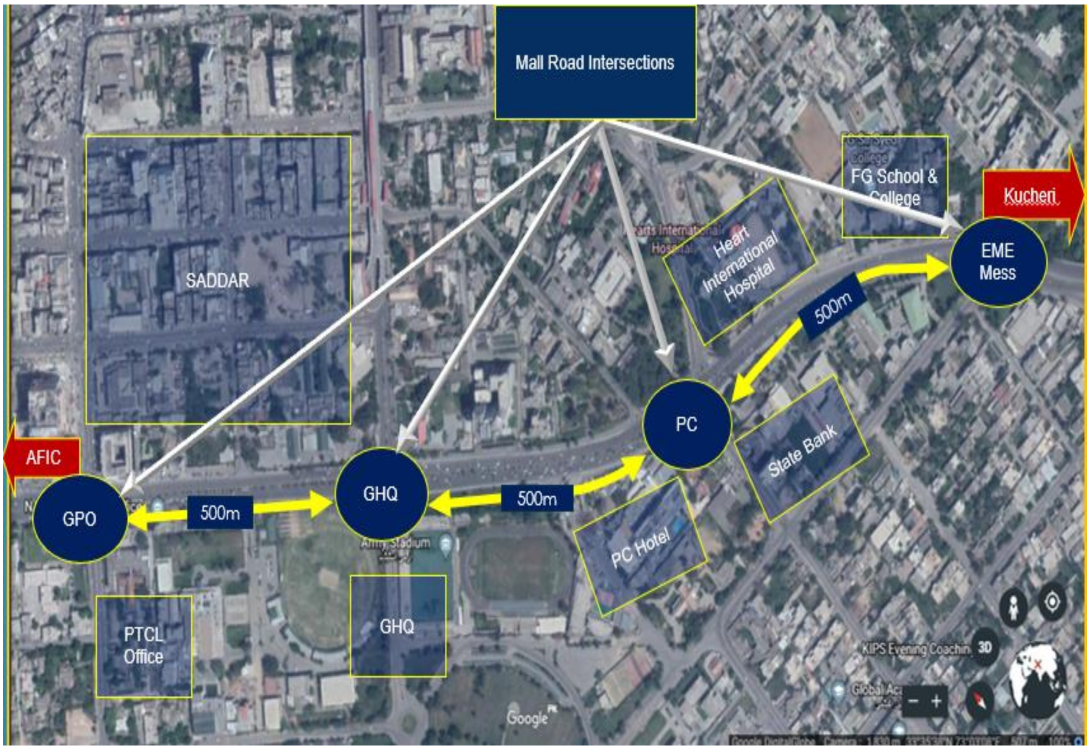


Figure 3 - Overall area showing four intersections

3.2 Geometric Properties of Existing Intersections

3.2.1 GPO Intersection

It is a four-legged intersection with four approaches generally known as GPO Intersection. It is a signalized intersection with a total of four phases, one for each approach. All the approaches have median separated lanes for outgoing and incoming vehicles. The North & South bound approach has got a total of four lanes, three lanes for through traffic and one lane for left turning vehicles. The East & west bound approach has got two lanes which are shared by through, right turning and the left turning vehicles. North bound traffic is coming from GT Road, GHQ, Lalkurti, CMH, MCS, Murree Road and adjoining commercial zone. The south bound traffic is coming primarily from Saddar, Westridge and Rawalpindi Railway Station. The west bound traffic comes from GHQ, FWO HQ, E-in-C's Branch and CMH. The east bound traffic is coming mainly from Saddar and Murree Road. Major traffic flows on the Mall Road which joins North and South bound traffic but traffic from other two bearings is also significant. The traffic volumes from each bound are appeared as below.

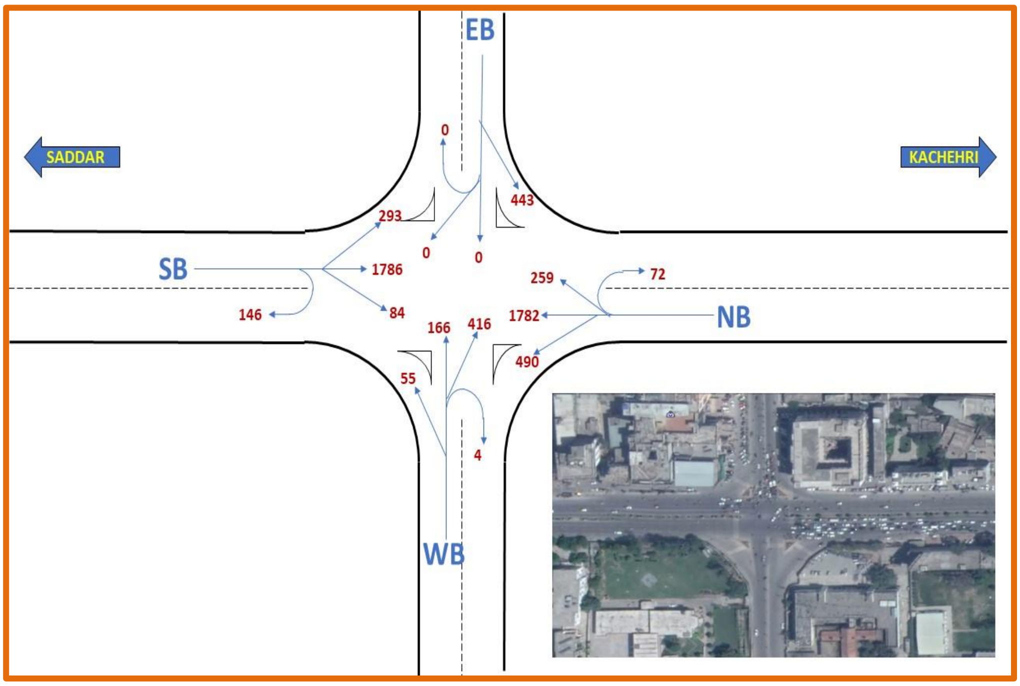


Figure 4 GPO Intersection

3.2.2 GHQ Intersection

It is a four-legged intersection and consists of four approaches. It is a signalized intersection with a total of four phases, one for each approach. All the approaches have median separated lanes for outgoing and incoming traffic. The North bound approach has got three lanes for through traffic and one lane for left turning vehicles. Essentially the south bound approach contains a total of four lanes of which three lanes are utilized for the through traffic and one lane is for left turning vehicles. The west bound approach has got two paths which are shared by through, right turning and the left turning traffic. the left turning traffic is channelized by an island and does not halt at the crossing point. The east bound approach has got three lanes. Two lanes are utilized by through traffic and one path by left turning vehicles. The left turning traffic is channelized by an island and does not halt at the crossing point. North bound traffic is coming from GT Road, GHQ, Lalkurti, CMH, MCS and adjoining commercial region. The south bound traffic is coming primarily from Saddar. The west bound traffic comes from GHQ. The east bound traffic is coming from Murree Road, Jhanda Chichi. Major traffic flows on the Mall Road which joins North and South bound traffic. The traffic volumes from each bound are appeared below.

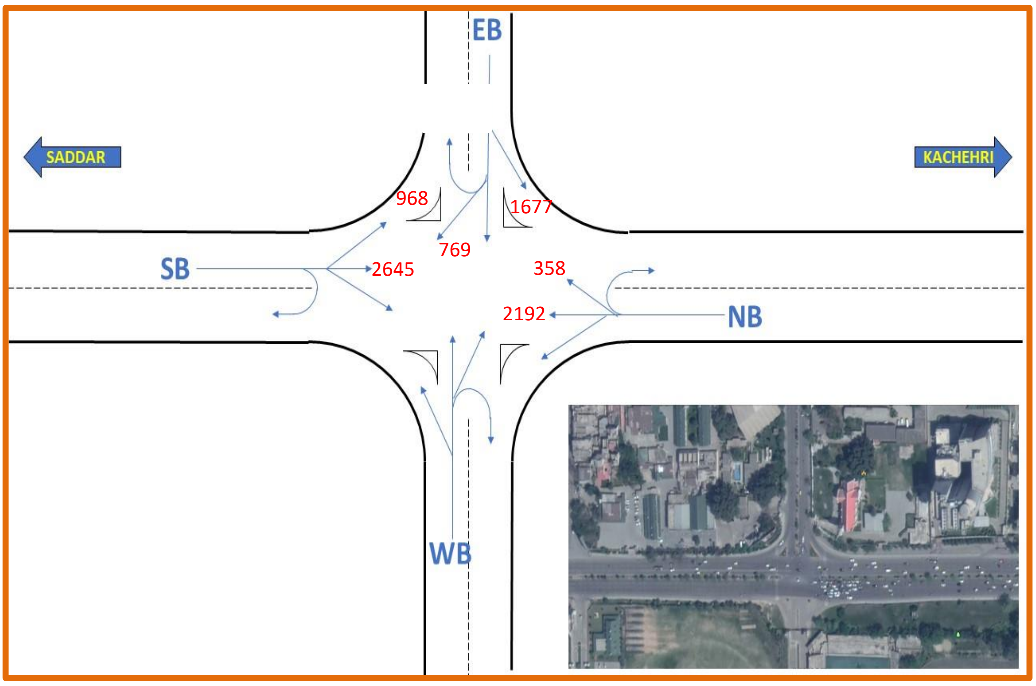


Figure 5 GHQ Intersection

3.2.3 PC Intersection

It is a four legged intersection and consists of four approaches. It could be a signalized crossing point with a total of four stages, one for each approach. All the approaches have median separated paths for outgoing and approaching traffic. The North bound approach has got three lanes for through traffic and one lane for left turning vehicles. So also the south bound approach includes a total of four lanes of which three paths are utilized for the through traffic and one lane is for left turning traffic. The west bound approach has got two lanes which are shared by through, right turning and the left turning traffic. the left turning traffic is channelized by an island and does not halt at the intersection. The east bound approach has too got two lanes and all through, right and left turning traffic utilize these paths. The left turning traffic is channelized by an island and does not halt at the intersection. North bound traffic is coming from Islamabad old Air terminal, Chaklala Garrison, District Courts, GT Road, GHQ and Lalkurti. The south bound traffic is coming primarily from Saddar. The west bound traffic comes from GHQ, Lalkurti, CMH and MCS. The east bound traffic is coming from Muree Road, Jhanda Chichi. Major traffic flows on the Mall Road which joins North and South bound traffic. The traffic volumes from each direction are appeared underneath.

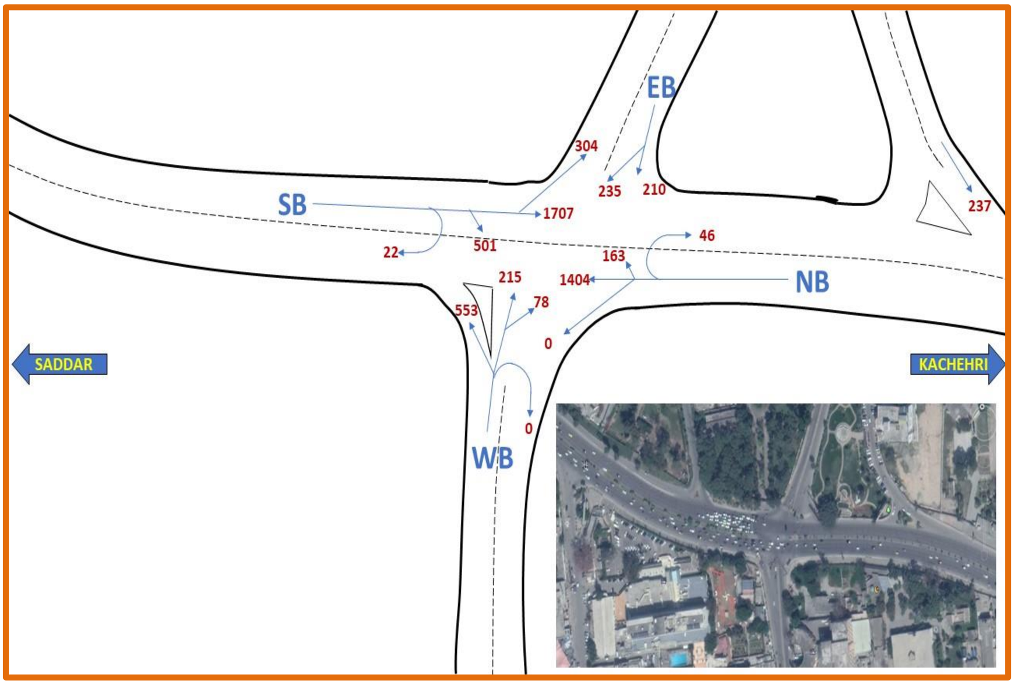


Figure 6 PC Intersection

3.2.4 EME Mess Intersection

It is a T or three legged intersection and consists of three approaches. It is a signalized intersection with a total of three stages, one for each approach. All the approaches have median separated lanes for outgoing and approaching traffic and the south bound approach has median separated exclusive lanes for through traffic as well which does not halt at the intersection. The North bound approach has got four lanes for through traffic and one path for left turning vehicles. The south bound approach contains a total of four lanes of which two lanes are utilized solely for the through traffic which does not halt at the intersection and the other two lanes are shared by through and right turning traffic. The west bound approach has got two lanes which are shared by both left turning and right turning Vehicles. The left turning traffic is channelized by an island and does not halt at the intersection. North bound traffic is coming from Islamabad Airport, Chaklala Garrison, Chaklala Scheme III, Jhanda Chichi, District Courts, GT Road and Murree Road. The south bound traffic is coming primarily from Saddar. The west bound traffic comes from GHQ and Lalkurti. Major traffic flows on the Mall Road which joins North and South bound traffic. The traffic volumes from each direction are appeared below.

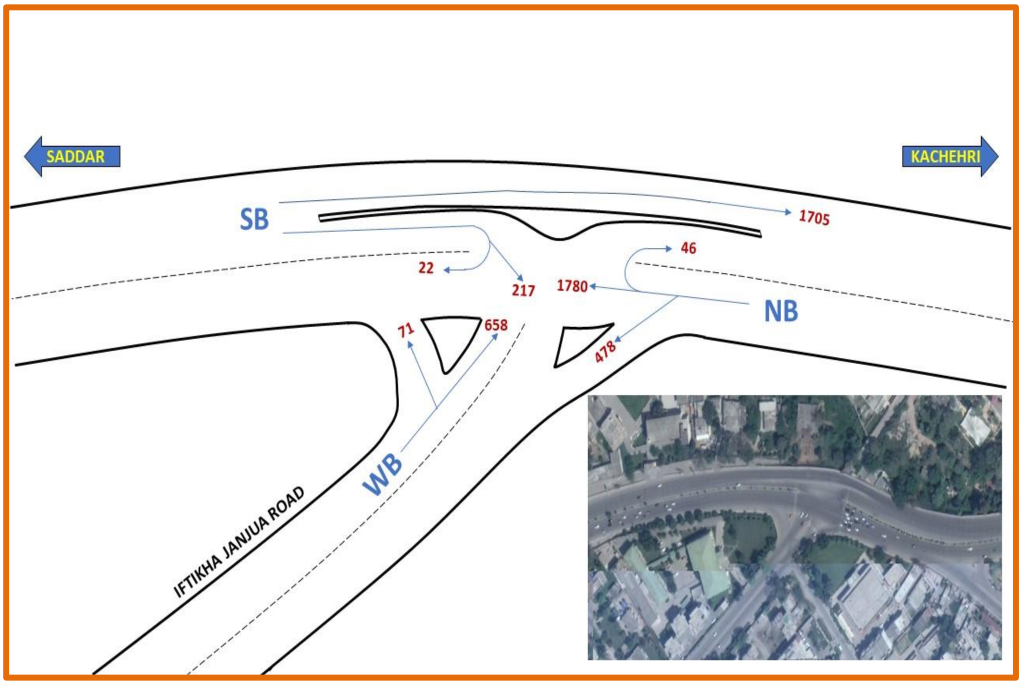


Figure 7 EME Mess Intersection

ABOUT THE SOFTWARE

CHAPTER - 4

INTRODUCTION TO VISSIM

4.1 General:

VISSIM is a microscopic, time step, and behavior-based traffic simulation computer program. It can analyze traffic (cars, trucks, pedestrians) and transit (buses, trains, trams) operations under constraints such as lane configuration, traffic composition, traffic signals, transit stops, etc.

VISSIM consists internally of three different parts:

1) The traffic flow model generates an online visualization of traffic operations
2) The traffic control model generates the indications (i.e. green, red, amber) which is “exported” to the traffic flow model
3) The data analysis package creates offline output files containing statistical data such as travel times and queue lengths

VISSIM simulate complex vehicle interactions realistically on a microscopic level, model demand, supply, and behavior in detail, simulate new forms of mobility such as CAV and MaaS, Seamless integration with PTV Vissim and it is by and large the world's leading traffic planning tool.

4.2 Getting Started VISSIM:

4.2.1 General Settings:

a. Go to base data then Network settings.

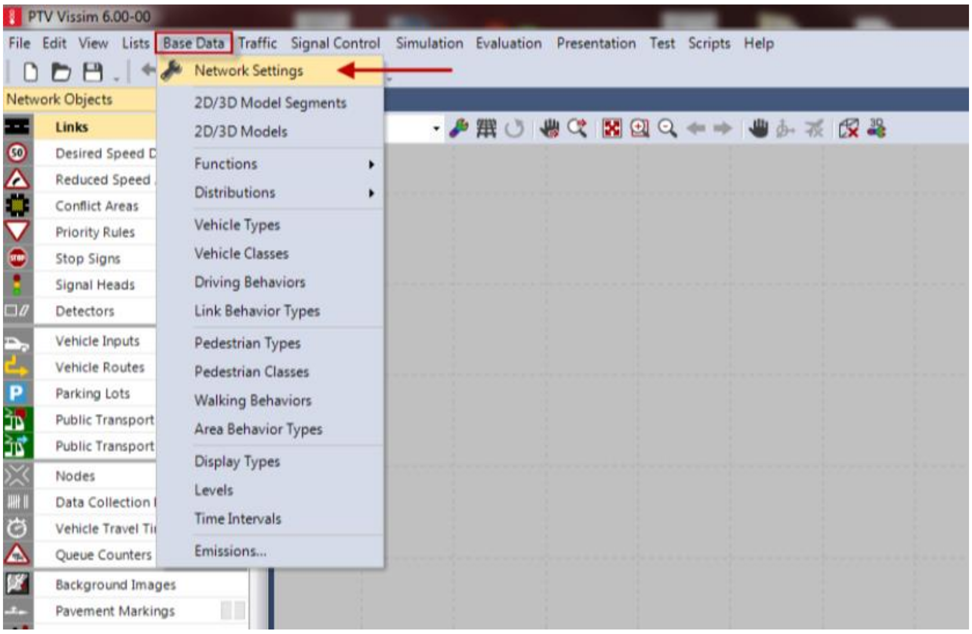


Figure 8 General Settings

b. Select the Units tab. Click **All Imperial** to change to English units.

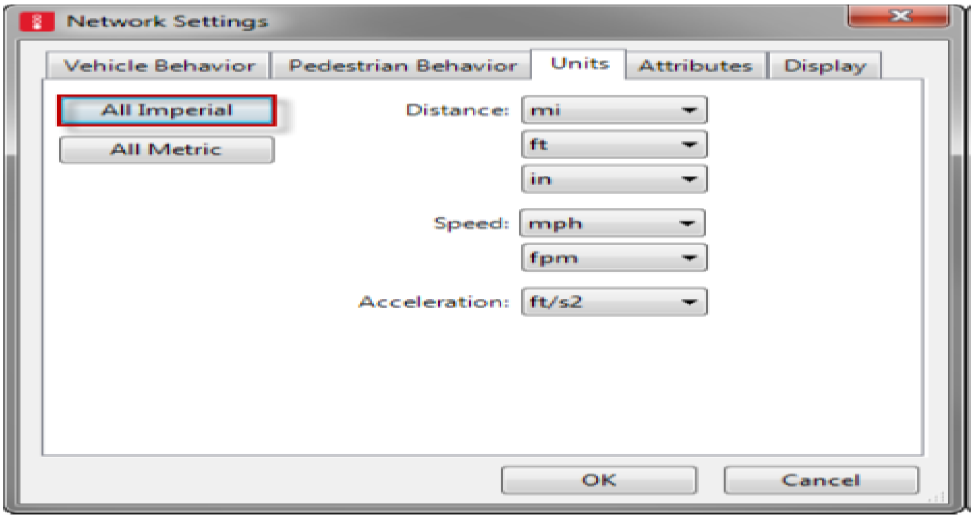


Figure 9 Change units

4.2.2 Build a Network:

a. Select **Background images** from the **Network Objects** side menu.

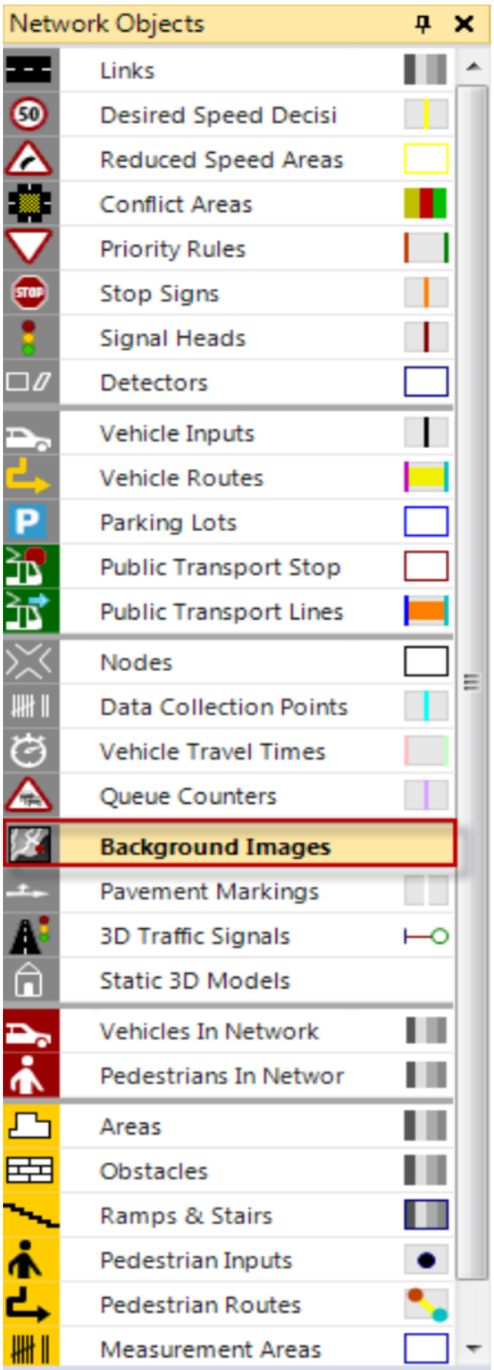


Figure 10 Build Network

b. Right click in the network editor window and select **Add New Background image**.

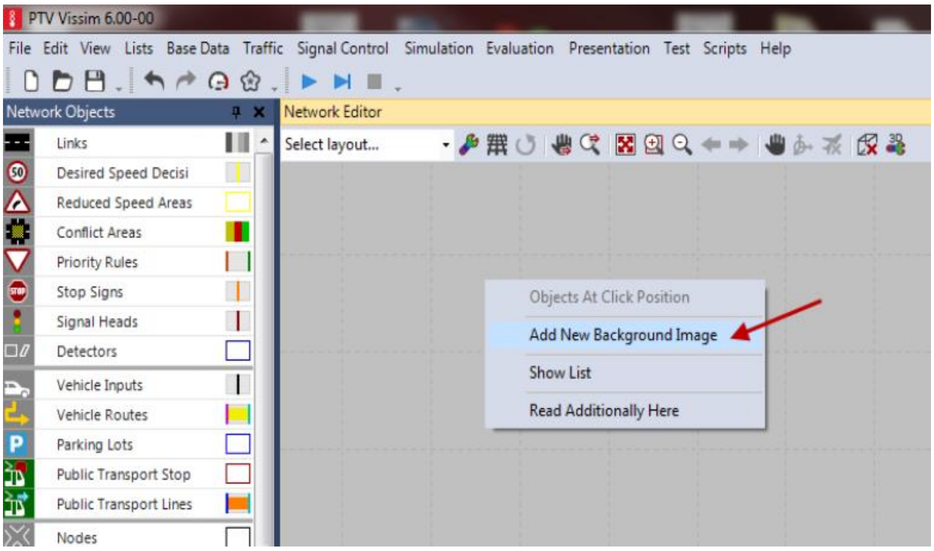


Figure 11 Adding Background Image

c. Enter the data in the following window.

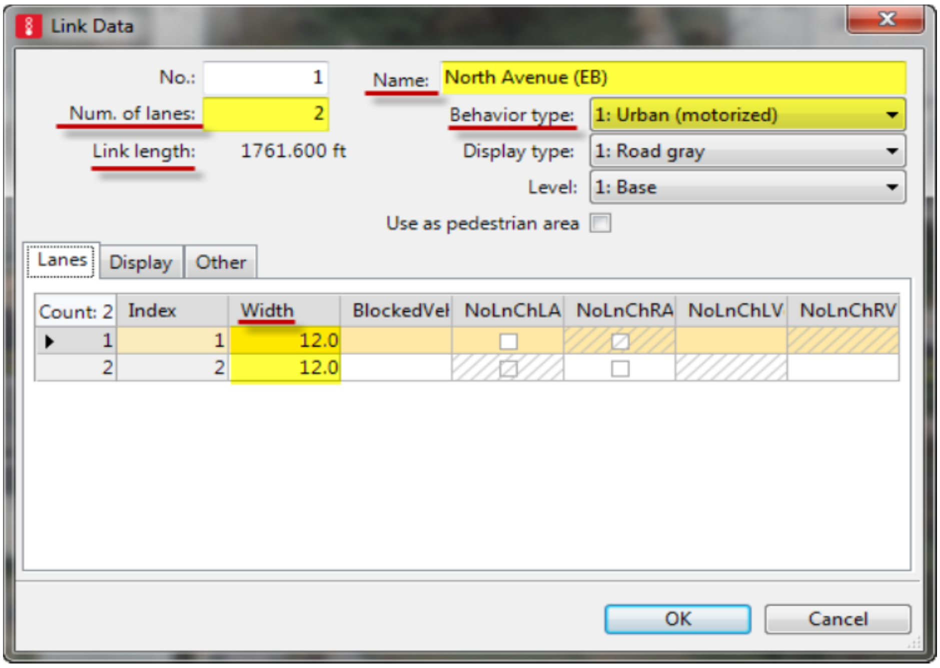


Figure 12 Addition of data for lane

d. Complete connector window.

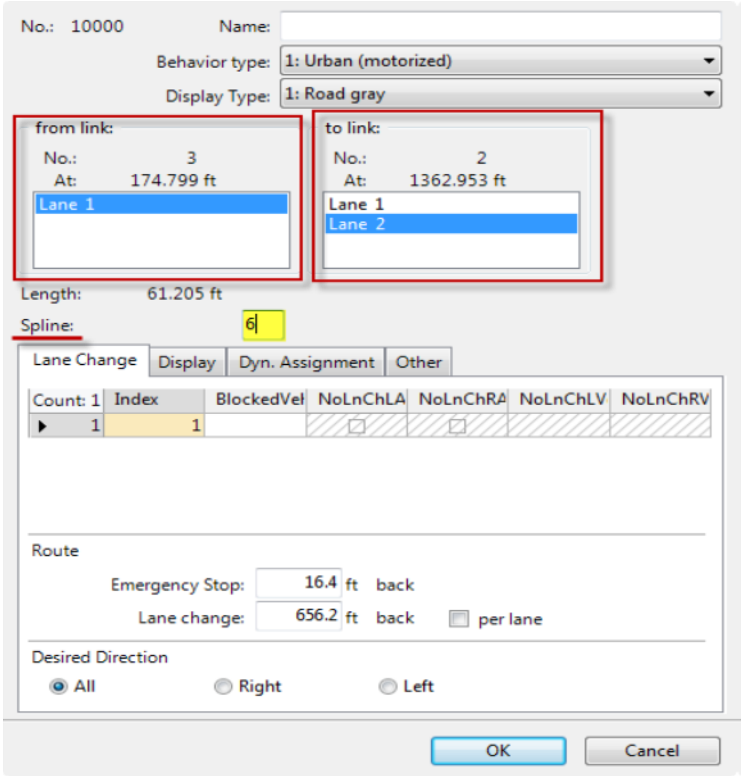


Figure 13 Making Connectors

4.2.3 Add Vehicles:

a. Go to traffic > vehicle composition.

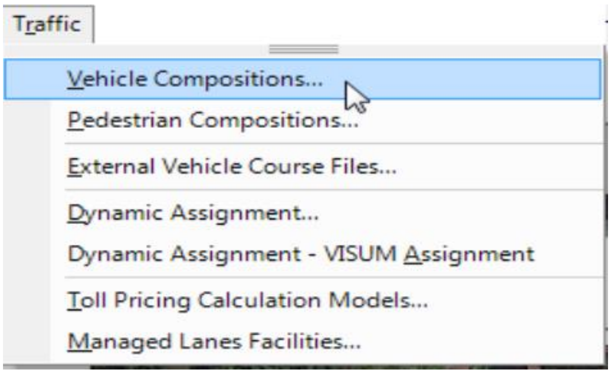
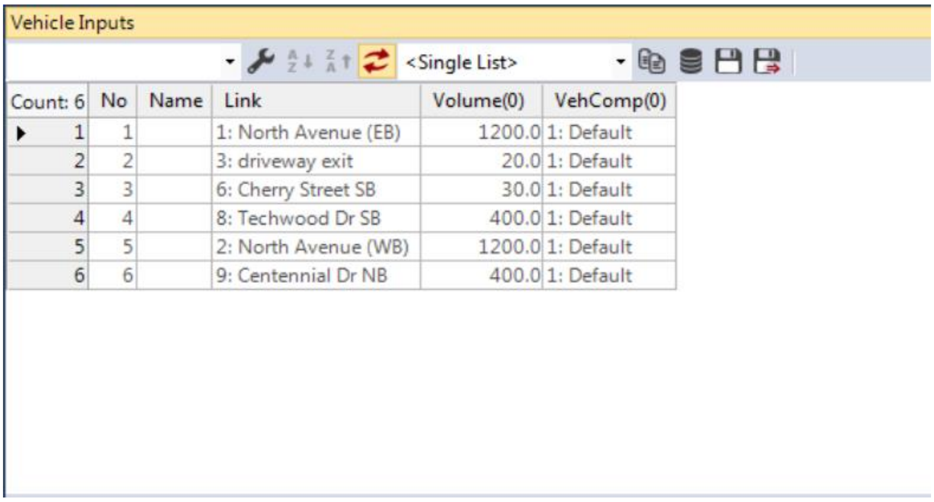


Figure 14 Vehicle composition

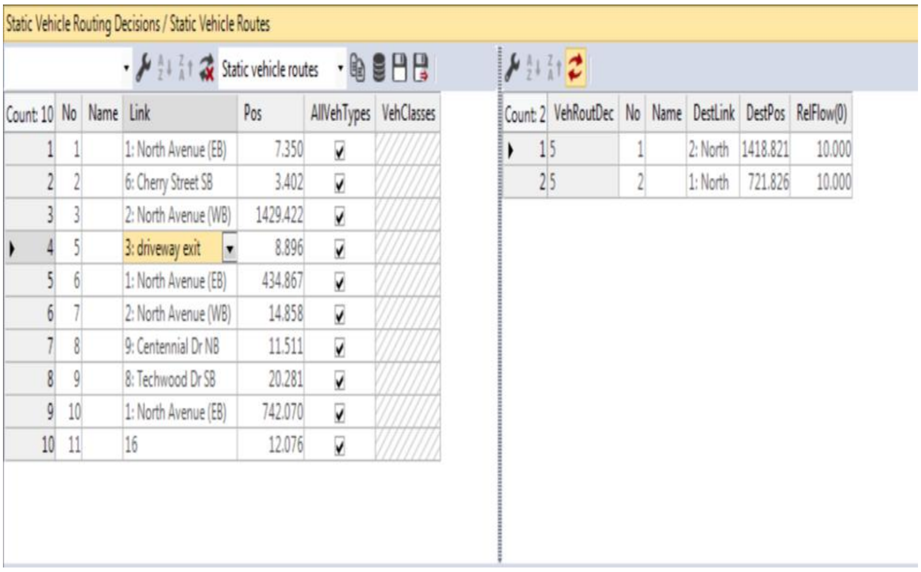
b. Enter the volumes in the vehicle inputs.


Vehicle Inputs

Count: 6	No	Name	Link	Volume(0)	VehComp(0)
1	1		1: North Avenue (EB)	1200.0	1: Default
2	2		3: driveway exit	20.0	1: Default
3	3		6: Cherry Street SB	30.0	1: Default
4	4		8: Techwood Dr SB	400.0	1: Default
5	5		2: North Avenue (WB)	1200.0	1: Default
6	6		9: Centennial Dr NB	400.0	1: Default

Figure 15 Vehicle composition

c. Enter route decisions.


Static Vehicle Routing Decisions / Static Vehicle Routes

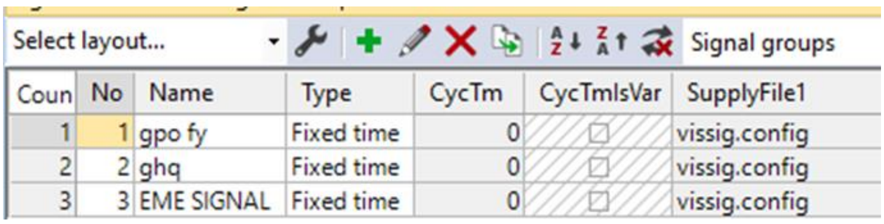
Count: 10	No	Name	Link	Pos	AllVehTypes	VehClasses
1	1		1: North Avenue (EB)	7.350	☑	
2	2		6: Cherry Street SB	3.402	☑	
3	3		2: North Avenue (WB)	1429.422	☑	
4	5		3: driveway exit	8.896	☑	
5	6		1: North Avenue (EB)	434.867	☑	
6	7		2: North Avenue (WB)	14.858	☑	
7	8		9: Centennial Dr NB	11.511	☑	
8	9		8: Techwood Dr SB	20.281	☑	
9	10		1: North Avenue (EB)	742.070	☑	
10	11		16	12.076	☑	

Count: 2	VehRoutDec	No	Name	DestLink	DestPos	RelFlow(0)
1	5	1		2: North	1418.821	10.000
2	5	2		1: North	721.826	10.000

Figure 16 Route Decisions

4.2.4 Add Signal Controls:

a. Go to Signal controllers.



Coun	No	Name	Type	CycTm	CycTmIsVar	SupplyFile1
1	1	gpo fy	Fixed time	0	☐	vissig.config
2	2	ghq	Fixed time	0	☐	vissig.config
3	3	EME SIGNAL	Fixed time	0	☐	vissig.config

Figure 17 - Add Signal Controllers

b. Go to Edit Signal Groups.

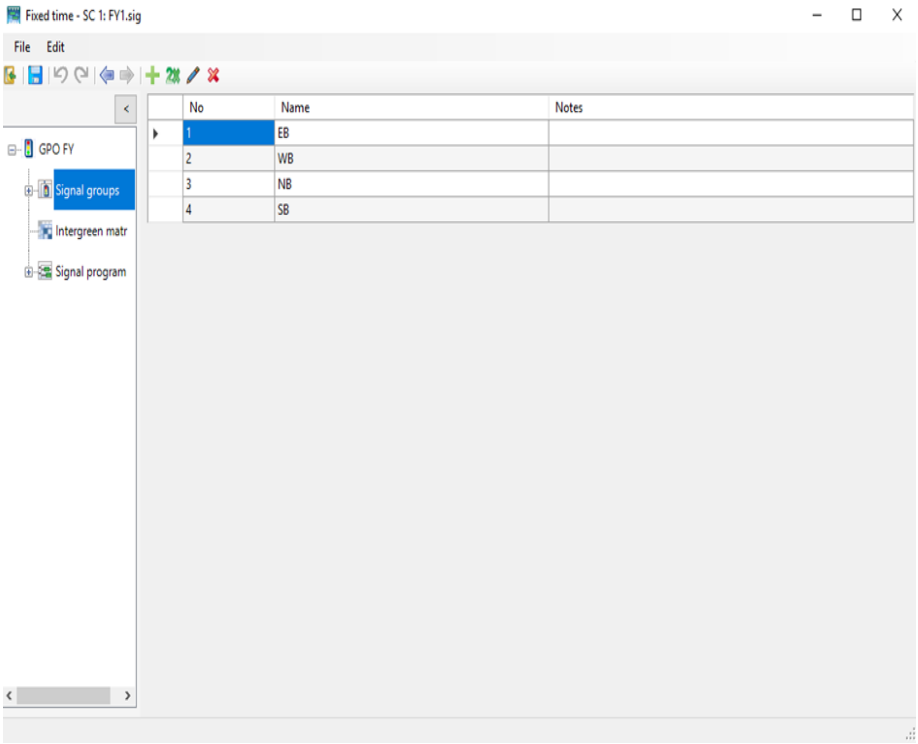


Figure 18 - Add signal control

c. Complete the Editing in Signal Control window.

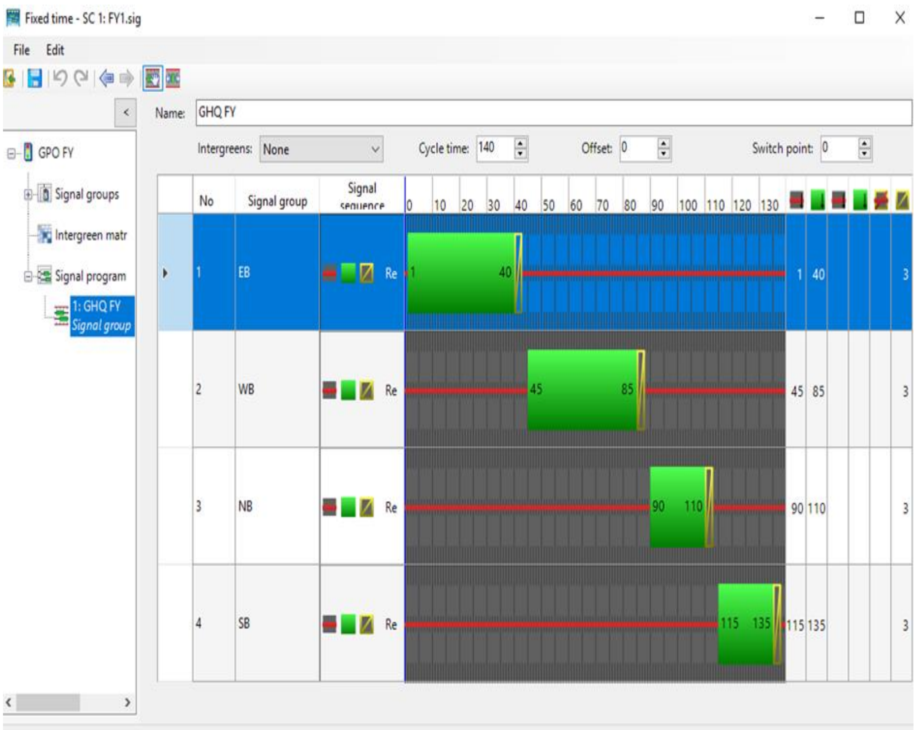


Figure 19 Add timing for signal control

4.2.5 Run Simulation:

a. Select **simulation** from menu bar and go to **parameters**.

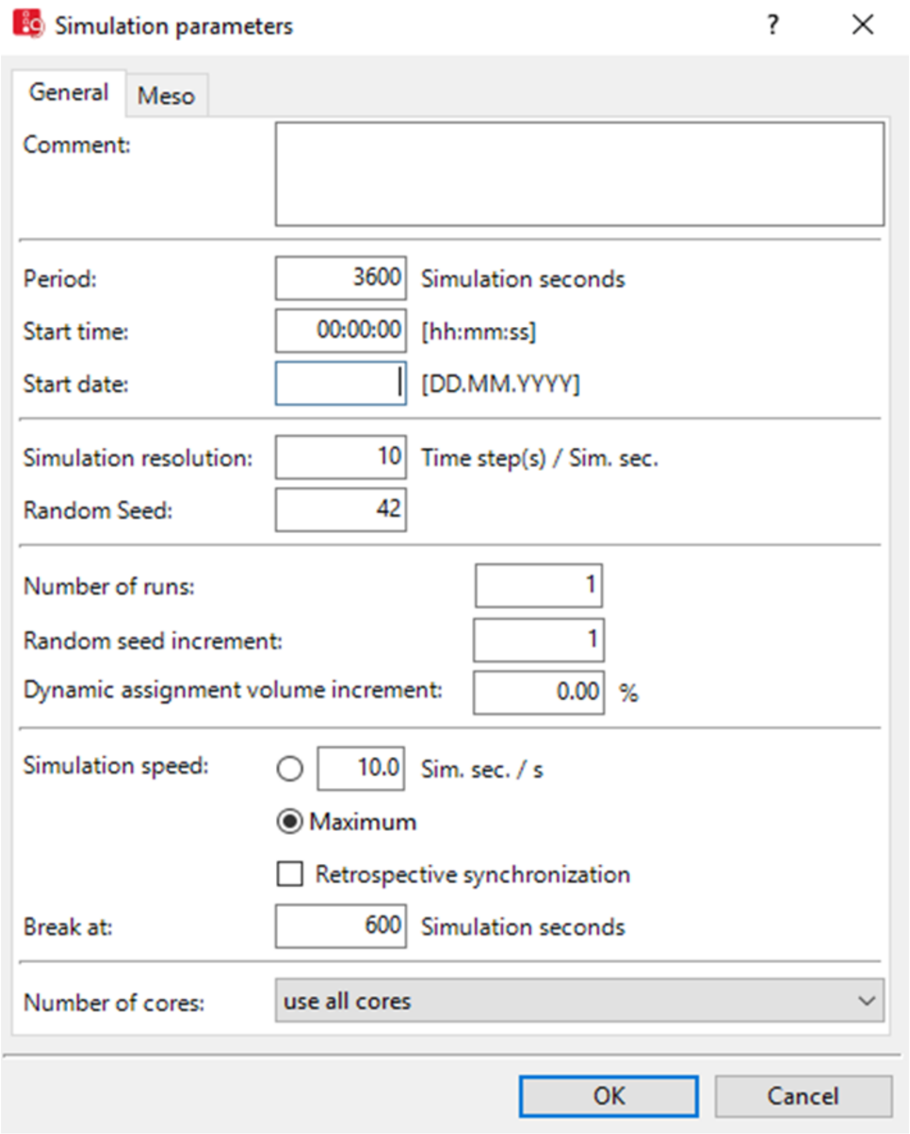


Figure 20 - Add Simulations parameters

b. Run the simulation.

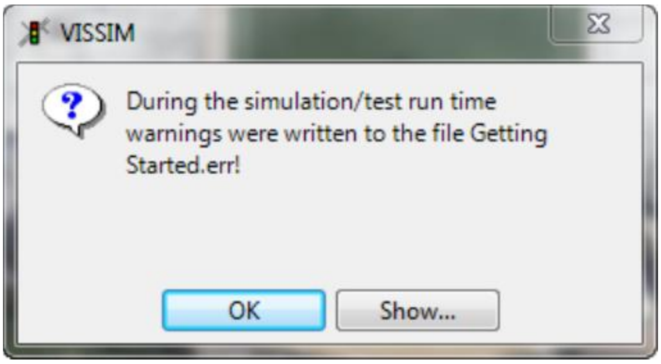


Figure 21 - Run Simulations

4.2.6 Output Data:

a. Use of Node to collect output data.

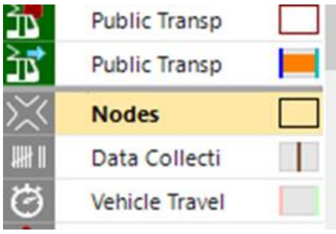


Figure 22 - Node

b. Configure Evaluation.

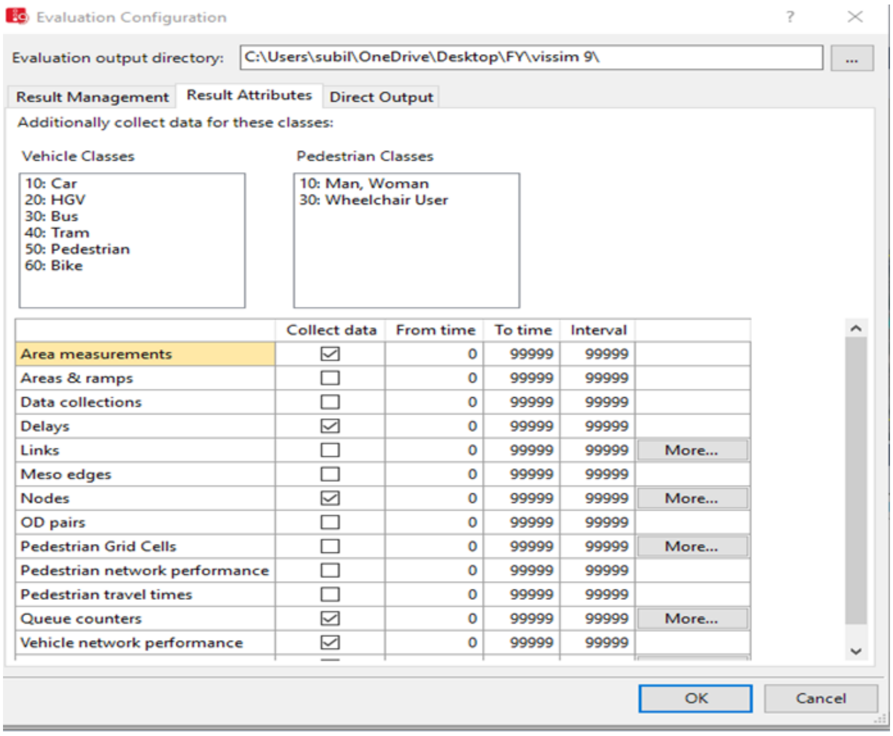


Figure 23- Output data parameters

c. Configure Node Results.

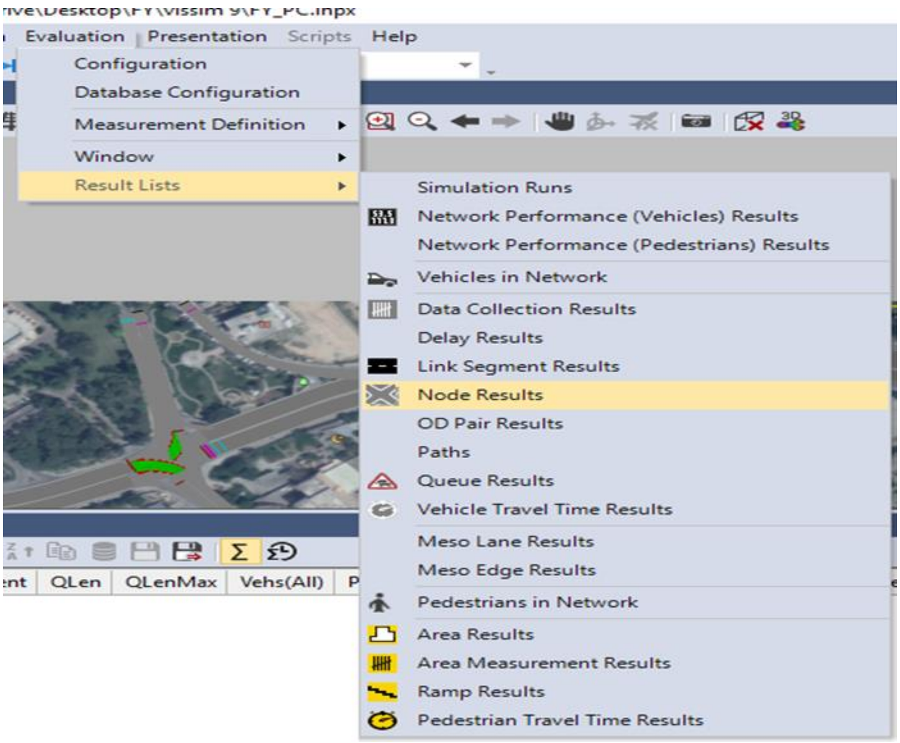


Figure 24 - Output data interval setting

d. View LOS, Que Length, Veh Delay on output Data Table.

Node Results (2)

Coun	SimRun	TimeInt	Movement	QLen	QLenMax	Vehs(All)	Pers(All)	LOS(All)	LOSVal(All)	VehDelay(All)	PersDelay(All)	StopDelay(All)
1	9	0-3600	1: PC - 18: EB IN@48.5 - 19: WB OUT@157.	151.60	211.55	3	3	LOS_F	6	138.28	138.28	110.27
2	9	0-3600	1: PC - 18: EB IN@48.5 - 25: SB In@105.1	151.60	211.55	26	26	LOS_E	5	57.41	57.41	38.93
3	9	0-3600	1: PC - 18: EB IN@48.5 - 27: SB OUT@129.5	151.60	211.55	37	37	LOS_F	6	151.17	151.17	123.37
4	9	0-3600	1: PC - 18: EB IN@48.5 - 31: EB OUT@212.2	151.60	211.55	151	151	LOS_F	6	128.92	128.92	106.65
5	9	0-3600	1: PC - 22: WB IN@229.7 - 19: WB OUT@15	24.88	100.65	26	26	LOS_B	2	17.03	17.03	11.35
6	9	0-3600	1: PC - 22: WB IN@229.7 - 25: SB In@105.1	24.88	100.65	97	97	LOS_D	4	37.33	37.33	30.56
7	9	0-3600	1: PC - 22: WB IN@229.7 - 27: SB OUT@12	24.88	100.65	118	118	LOS_B	2	12.95	12.95	6.59
8	9	0-3600	1: PC - 22: WB IN@229.7 - 31: EB OUT@21	24.88	100.65	0	0	LOS_F	6			
9	9	0-3600	1: PC - 26: NB IN@41.5 - 19: WB OUT@157.	0.00	0.00	92	92	LOS_A	1	0.72	0.72	0.01
10	9	0-3600	1: PC - 26: NB IN@41.5 - 25: SB In@105.1	9.86	28.51	29	29	LOS_D	4	54.22	54.22	48.75
11	9	0-3600	1: PC - 26: NB IN@41.5 - 31: EB OUT@212.	9.86	28.51	10	10	LOS_C	3	32.99	32.99	29.11
12	9	0-3600	1: PC - 28: NB In@32.8 - 19: WB OUT@157.	15.40	45.36	30	30	LOS_D	4	51.29	51.29	45.03
13	9	0-3600	1: PC - 28: NB In@32.8 - 27: SB OUT@129.5	15.40	45.36	35	35	LOS_E	5	58.28	58.28	52.04
14	9	0-3600	1: PC - 36: SB In@40.2 - 31: EB OUT@212.2	0.57	5.59	34	34	LOS_A	1	3.31	3.31	2.63
15	9	0-3600	1: PC	33.72	211.55	688	688	LOS_F	6	55.55	55.55	45.08

Figure 25 - Output Data table

RESULT AND ANALYSIS

CHAPTER - 5

RESULT AND ANALYSIS

5.1 Introduction:

This portion of the study highlights the estimation and evaluation of the current LOS of four intersections (GPO, GHQ, PC and EME Mess Intersections) of Rawalpindi city. In order to ensure comprehensive analysis MS Excel and PTV VISSIM were used. This research topic needed first-hand information therefore field observations were made including vehicle counts, turning volumes and geometric conditions.

5.2 Traffic Volumes Counts:

Traffic volume counts of all four intersections was collected between 1300 to 1500hrs with the consent of CTO Rawalpindi. The truck traffic and passenger cars traffic were recorded and included in VISSIM. The traffic volume data collected is attached as Appendices “A to C”.

5.3 Data Analysis:

Traffic counts were analyzed by using an MS Excel program in order to ascertain following results: -

5.3.1 GPO Intersection

a. Bound wise and overall traffic volume and peak hour are illustrated in following table and graph: -

GPO CHOWK															
Time (Hrs)	North Bound			South Bound			East Bound			West Bound			Intersection		
	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol
1300-1400	2377	2473	(1345-1445) 2687	2340	2424	(1315-1415) 2425	473	487	(1330-1430) 497	743	**781**	(1300-1400) 781	5933	6164	(1345-1445) 6191
1315-1415	2440	2522		2348	**2425**		479	493		684	719		5951	6157	
1330-1430	2384	2470		2318	2387		483	**497**		684	722		5869	6075	
1345-1445	2603	**2687**		2309	2371		443	454		641	680		5996	**6191**	
1400-1500	2484	2576		1998	2047		438	449		554	584		5474	5655	

Table 1 - Traffic volume and peak hour

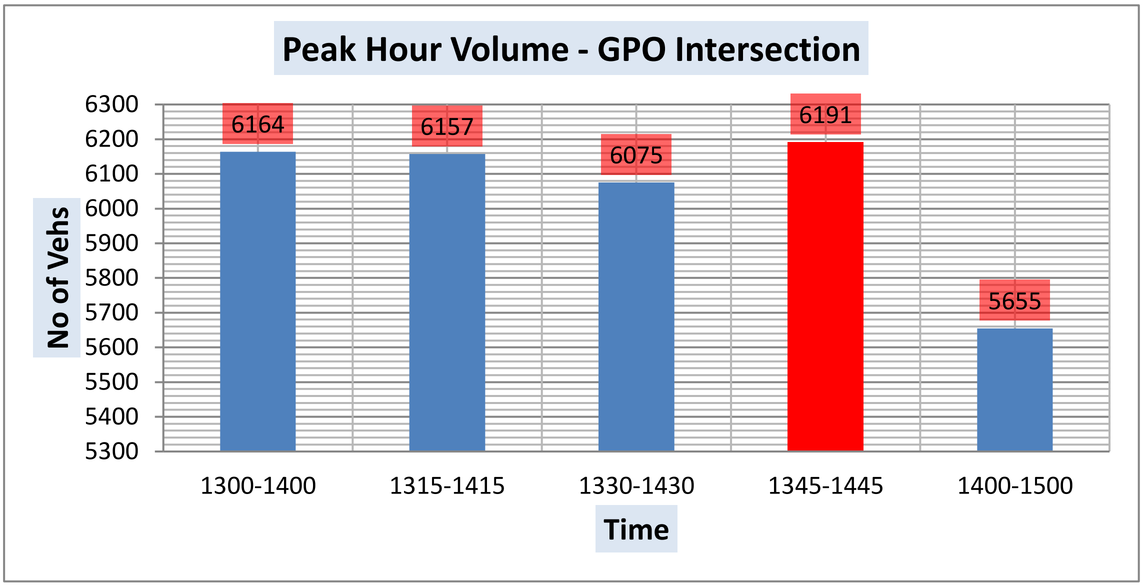


Figure 26 - Traffic Volume and Peak Hour

b. Comparison of peak hour volume of each bound with overall intersection peak hour volume is as following: -

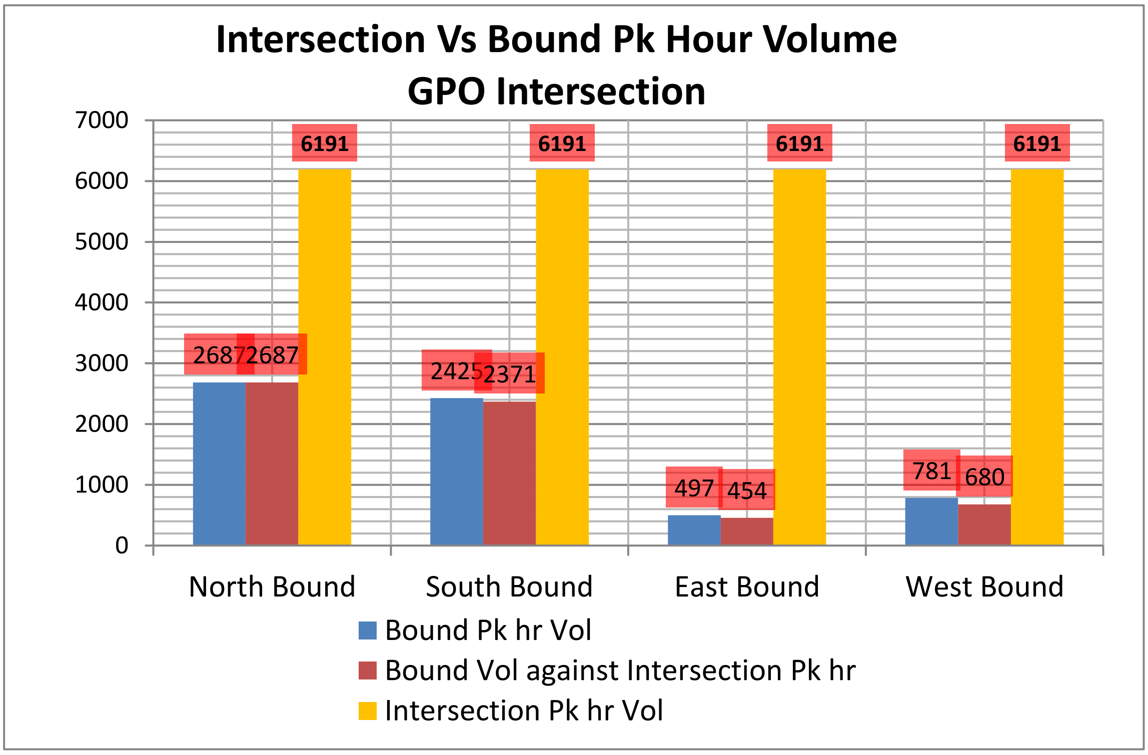


Figure 27 - Each bound with overall intersection

c. The PHF is the ratio of total volume to the maximum 15-minute rate of flow within the hour. PHF was evaluated using an excel program. Table below illustrates the PHF for each turning movement: -

GPO INTERSECTION												
Bound	Peak Hour	Volume										
		Straight		Left		Right		U Turn		Total		
		No	PHF	No	PHF	No	PHF	No	PHF	No	PHF
North	1345-1445	1833	0.90	512	0.85	270	0.95	72	0.69	2687	0.85
South		1836	0.93	299	0.90	86	0.74	151	0.90	2372	0.96
East		0	0.00	454	0.83	0	0.00	0	0.00	454	0.83
West		174	0.74	63	0.72	440	0.93	4	0.33	681	0.94

Table 2 PHF Values

d. PTV VISSIM software was used to identify the current operating parameters of the intersection i.e. vehicle delays, Queue length and LOS as exhibited in table: -

GPO Intersection			
Approach	Vehicle Delay (seconds)	Existing LOS	Queue Length (m)
Towards Peshawar	37	F	168
Towards Kachehri Intersection	65	E	95
Towards Saddar	43	D	12
Towards HQ FWO	90	F	43
Overall	50	F	79

Table 3 – Existing operational parameters

5.3.2 GHQ Intersection:

a. PTV VISSIM software was used to identify the current operating parameters of the intersection i.e. vehicle delays, Queue length and LOS as exhibited in table: -

GHQ Intersection			
Approach	**Vehicle Delay (seconds)**	**Existing LOS**	**Queue Length (m)**
Towards Peshawar	84	F	132
Towards Kachehri Intersection	45	E	95
Towards Murree Road	77	E	209
Overall Intersection	72	F	58

Table 4 – Exiting operational parameters

5.3.3 PC Intersection

a. Bound wise and overall traffic volume and peak hour are illustrated in following table and graph: -

PC/SHALIMAR CHOWK															
Time (Hrs)	North Bound			South Bound			East Bound			West Bound			Intersection		
	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol
1300-1400	1613	1667	(1345-1445) 1728	2534	2639	(1300-1400) 2639	660	725	(1315-1415) 779	846	915	(1315-1415) 957	5653	5946	(1300-1400) 5946
1315-1415	1555	1617		2394	2499		699	779		867	957		5515	5851	
1330-1430	1612	1687		2419	2517		674	748		857	943		5562	5894	
1345-1445	1644	1728		2492	2602		621	696		815	901		5572	5926	
1400-1500	1645	1722		2482	2580		628	700		820	900		5575	5901	

Table 5 Traffic volume and peak hour

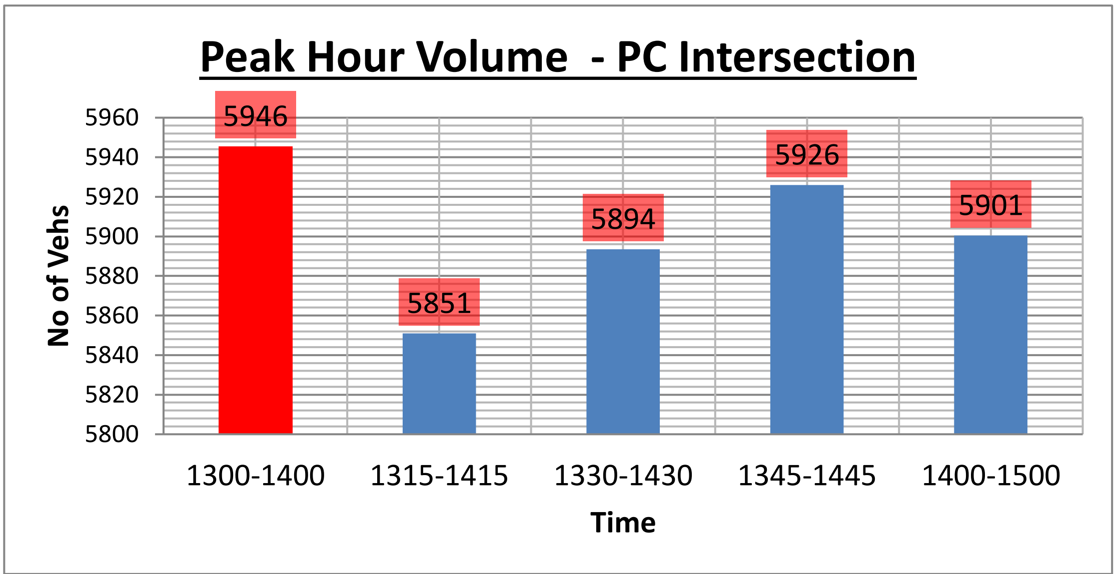


Figure 28 - Traffic volume and peak hour

b. Comparison of peak hour volume of each bound with overall intersection peak hour volume is as following: -

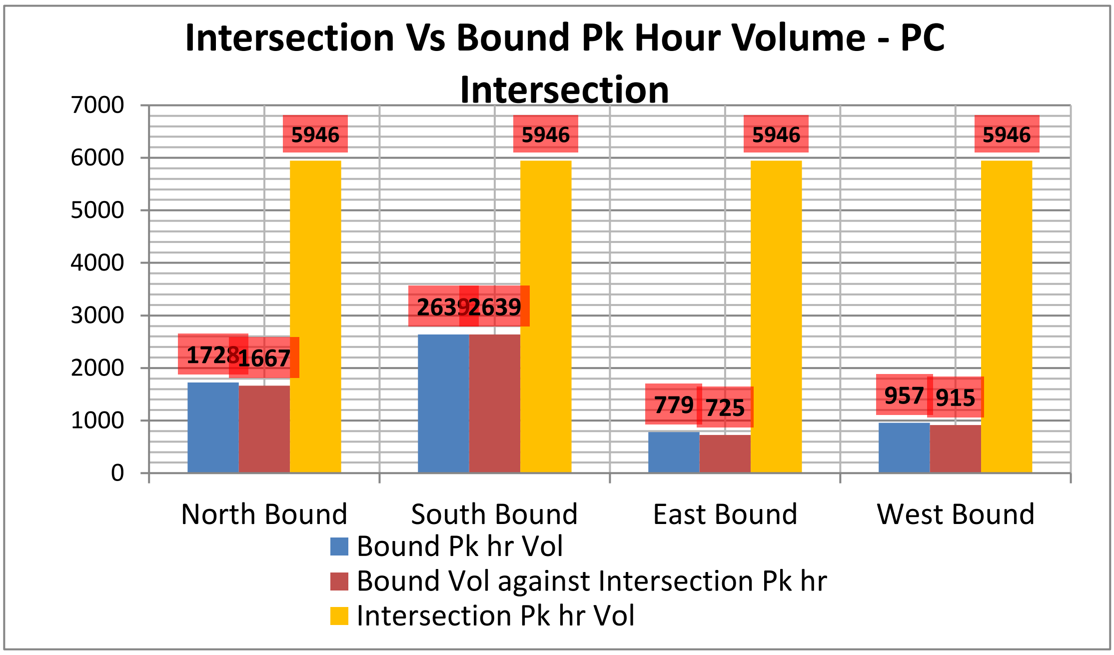


Figure 29 - Each bound with overall intersection

c. The PHF is the ratio of total volume to the maximum 15-minute rate of flow within the hour. PHF was evaluated using an excel program. Table below illustrates the PHF for each turning movement: -

PC Intersection												
Bound	**Peak Hour**	**Volume**										
		Straight		**Left**		**Right**		**U Turn**		**Total**		
		No	**PHF**	**No**	**PHF**	**No**	**PHF**	**No**	**PHF**	**No**	**PHF**
North	1300-1400	1452	0.93	0	0.00	163	0.91	52	0.68	1667	0.93
South		1778	0.87	325	0.89	515	0.95	22	0.55	2640	0.89
East		228	0.92	267	0.80	230	0.82	0	0.00	725	0.85
West		238	0.86	589	0.85	89	0.77	0	0.00	916	0.92

Table 6 – PHF Values

d. PTV VISSIM software was used to identify the current operating parameters of the intersection i.e. LOS, queue length and vehicle delays as exhibited in table: -

PC Intersection			
Approach	**Vehicle Delay (seconds)**	**Existing LOS**	**Queue Length (m)**
Towards Peshawar	14	B	16
Towards Kachehri Intersection	120	F	161
Towards Shalimar	58	E	15
Towards Shell Fueling Station	51	D	21
Overall Intersection	50	F	25

Table 7 - Existing operational parameter

5.3.4 EME Mess Intersection

a. Bound wise and overall traffic volume and peak hour are illustrated in following table and graph: -

EME MESS INTERSECTION												
Time (Hrs)	North Bound			South Bound			West Bound			Intersection		
	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol	Vehs	PCUs	Peak Hour and Vol
1300-1400	2196	2260	(1400-1500) 2480	265	**2249**	(1300-1400) 2249	479	508	(1400-1500) 779	2940	5016	(1400-1500) 5339
1315-1415	2180	2253		306	2210		529	559		3015	5022	
1330-1430	2124	2206		294	2226		627	663		3045	5094	
1345-1445	2240	2365		236	2216		690	740		3166	5320	
1400-1500	2337	**2480**		239	2081		729	**779**		3305	**5339**	

Table 8 Traffic volume and peak hour

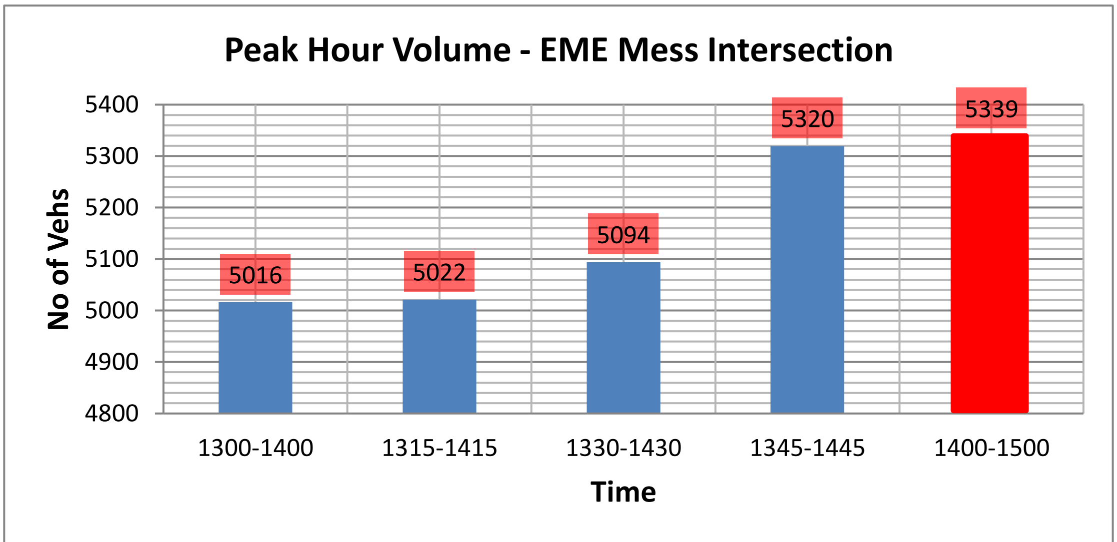


Figure 30 - Traffic volume and peak hour

b. Comparison of peak hour volume of each bound with overall intersection peak hour volume is as following: -

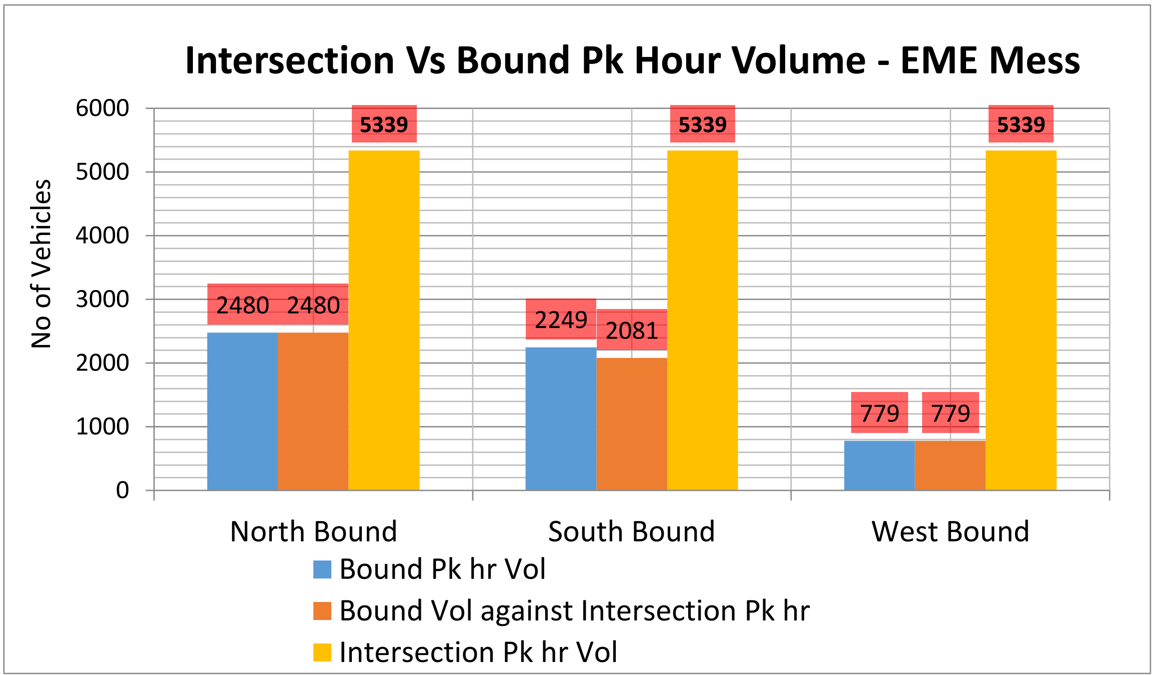


Figure 31 - Each bound with overall intersection

c. The PHF is the ratio of total volume to the maximum 15-minute rate of flow within the hour. PHF was evaluated using an excel program. Table below illustrates the PHF for each turning movement: -

EME Mess Intersection											
Bound	**Peak Hour**	**Volume**									
		Straight		**Left**		**Right**		**U Turn**		**Total**	
		No	**PHF**	**No**	**PHF**	**No**	**PHF**	**No**	**PHF**	**No**	**PHF**
North	1400-1500	1873	0.89	561	0.83	0	0.00	46	0.82	2480	0.92
South		1818	0.86	0	0.00	241	0.80	22	0.61	2081	0.91
West		0	0.00	77	0.80	702	0.85	0	0.00	779	0.87

Table 9 PHF Values

d. PTV VISSIM software was used to identify the current operating parameters of the intersection. The data collected was entered into the software and analysis was done to find out the existing Queue length, LOS and Vehicle delay as exhibited in table: -

EME MESS INTERSECTION			
Approach	**Vehicle Delay (seconds)**	**Existing LOS**	**Queue Length (m)**
Towards Peshawar	21	C	19
Towards Kachehri Intersection	10	A	4
Towards EME Mess	35	D	4
Overall Intersection	12	B	5

Table 10 – Existing operational parameter

5.4 Discussion on Results:

After analyzing the results generated by PTV VISSIM Software, it is assessed that the intersections are currently being operated below acceptable LOS i.e. LOS F (except EME Mess Intersection). Therefore, to propose an intervention in the infrastructure to improve the overall efficiency, necessary measures have been discussed in preceding chapter.

PROPOSED DESIGN ALTERNATIVES

CHAPTER - 6

PROPOSED DESIGN ALTERNATIVES

6.1 Introduction:

This chapter includes the proposed design alternatives to overcome the traffic congestion problems of Mall Road Rawalpindi. The issue of heavy traffic congestion at the city may be addressed by the provision of following facilities either by constructing individually or simultaneously:

1) Flyover and Underpass
2) Signal Optimization
3) Provision of exclusive and additional lanes

Proposed solutions have been analysed after altering the existing vehicle counts with 3.5% annual growth rate for next 10 years.

6.2 Design Parameters:

Following design parameters were set for the proposed options.

1) There should be 2 lanes each for flyover and underpass for both bounds (South and North) except EME Mess Intersection.
2) EME Mess Intersection will have two lanes of underpass only at North Bound.
3) Width of lane should be 12 m wide.
4) Speed is to be designed for 50 kmph, as it is the permissible speed on highways passing through urban area.
5) The maximum grade proposed is 3.5%.
6) The remaining traffic should use exclusive lanes and signal arrangements.

6.3 Proposed New Flyover at GPO Intersection:

To ensure signal free through traffic on GPO Intersection a flyover on North and South Bound are proposed. However, for turning movements, signal optimization is resorted as illustrated below: -

Figure 32 - Proposed flyover at GPO Intersection

6.3.1 Results through Simulations:

The proposed traffic data with 3.5% annual growth for next 10 years was entered in PTV VISSIM 9 software. The analysis and results were generated which are as described: -

Description	Existing	Proposed
Vehicle Delay (sec)	50	13.18
LOS	F	B
Queue Length (m)	79	10.87
Signal Length (sec)	130	86
Signal Phases	4	4

Table 11 Comparison of Operational Parameters GPO Intersection

6.4 Proposed Underpass at GHQ Intersection:

To ensure signal free through traffic on GHQ Intersection an underpass on North and South Bound are proposed. However, for turning movements, signal optimization is resorted as illustrated below: -

Figure 33 - Proposed underpass at GHQ Intersection

6.4.1 Results Through Simulations:

The proposed traffic data with 3.5% annual growth for next 10 years was entered in PTV VISSIM software. The analysis and results were generated which are as described.

Description	Existing	Proposed
Vehicle Delay (sec)	72	7.69
LOS	F	A
Queue Length (m)	58	11.86
Signal Length (sec)	140	86
Signal Phases	4	2

Table 12 Comparison of Operational Parameters GHQ Intersection

6.5 Proposed Flyover at PC Intersection:

To ensure signal free through traffic on PC Intersection a flyover on North and South Bound are proposed. However, for turning movements, signal optimization is resorted as illustrated below: -

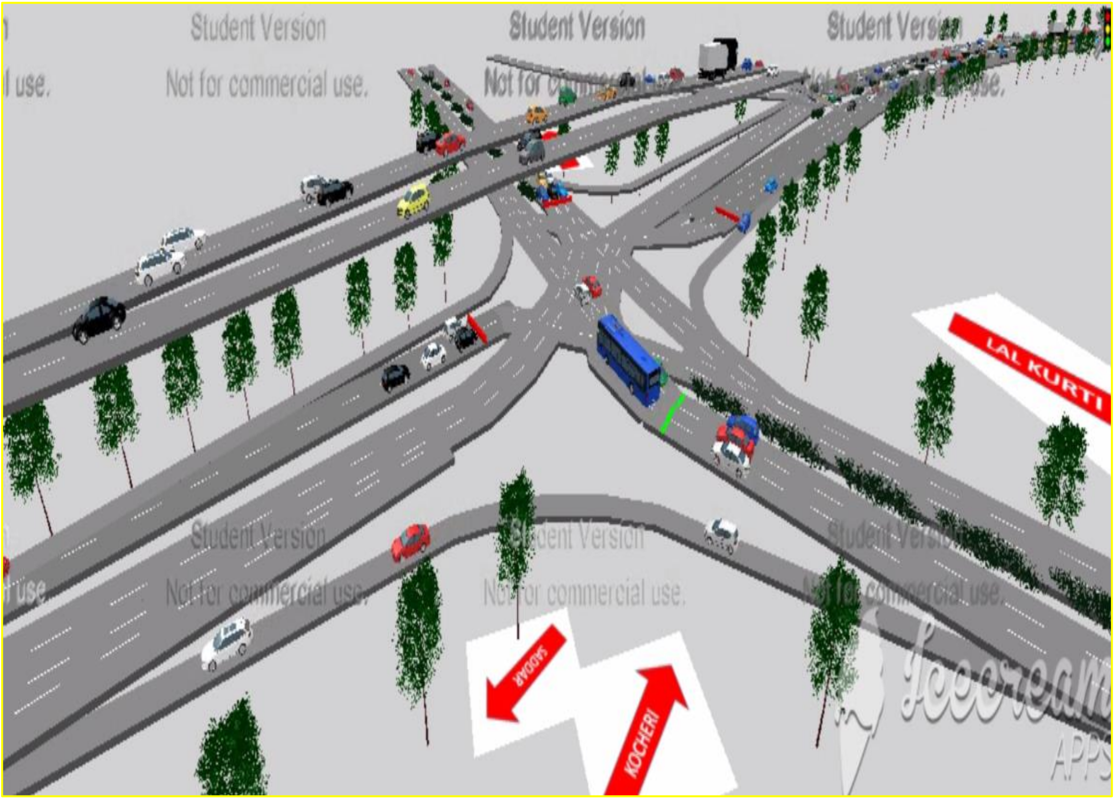


Figure 34 - Proposed flyover at PC Intersection

6.5.1 Results through Simulations:

The proposed traffic data with 3.5% annual growth for next 10 years was entered in PTV VISSIM software. The analysis and results were generated which are as described: -

Description	Existing	Proposed
Vehicle Delay (sec)	50	5
LOS	F	A
Queue Length (m)	25	3.29
Signal Length (sec)	170	63
Signal Phases	4	4

Table 13 Comparison of Operational Parameters PC Intersection

6.6 Proposed Underpass at EME Mess Intersection:

To ensure signal free through traffic on GHQ intersection an underpass on north and south bound are proposed. however, for turning movements, signal optimization is resorted as illustrated below: -

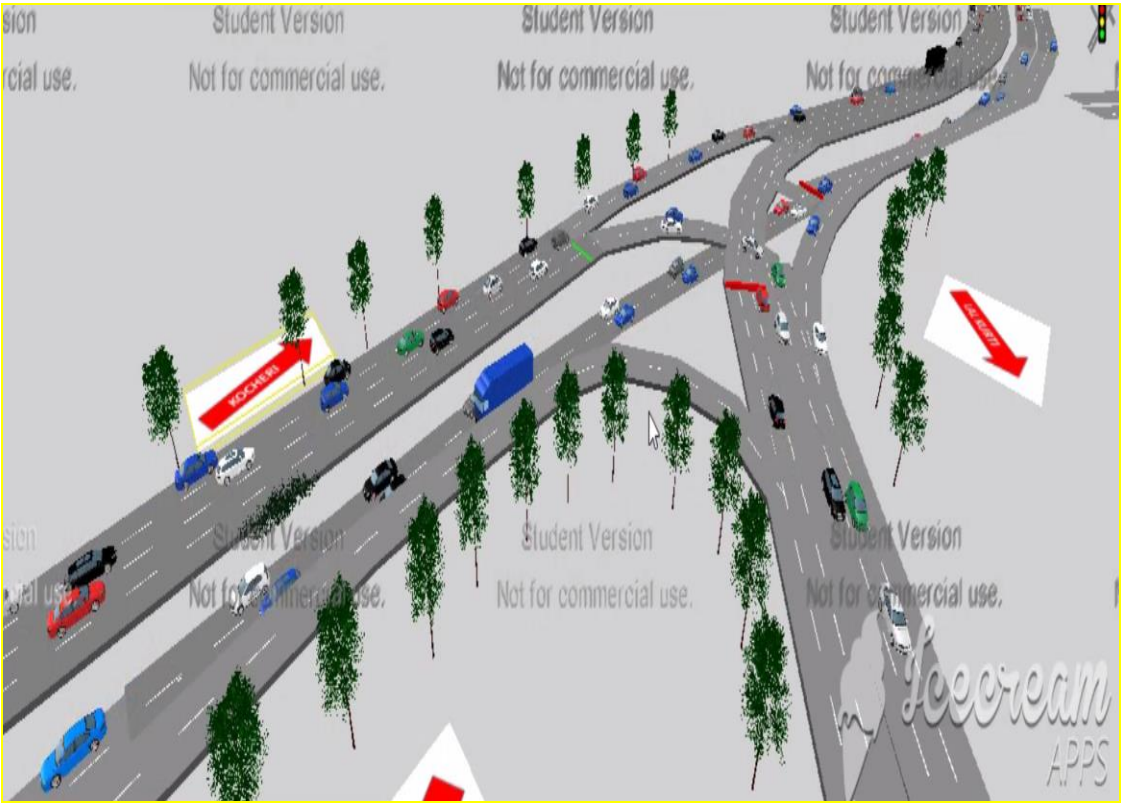


Figure 35 - Proposed underpass at EME Mess Intersection

6.6.1 Results through Simulations:

The proposed traffic data with 3.5% annual growth for next 10 years was entered in PTV VISSIM Software. The analysis and results were generated which are as described: -

Description	Existing	Proposed
Vehicle Delay (sec)	12	7.30
LOS	B	A
Queue Length (m)	5	5.07
Signal Length (sec)	60	57
Signal Phases	3	2

Table 14 Comparison of Operational Parameters EME Mess Intersection

6.7 Discussion on Proposed Solutions

After intervening in the existing infrastructure as discussed above, various effects encountered will be as under: -

6.7.1 Advantages:

a. All operating parameters (LOS, Vehicle delay and Queue lengths) have been improved on all intersections.

b. Signal phases are reduced at GHQ and EME Mess Intersection.

c. Signal Cycle length are reduced on all intersections.

d. Improve the availability, connectivity and ease of access to all road users.

e. Reduction in Travelling Time and fuel consumption.

f. By passing Commuters will not face any conflicts on intersections, thus reducing the time.

g. Minimizing disturbances, lessening burdens experienced by drivers as well as an overall positive environmental impact on surrounding.

h. Lesser possibilities of delays, congestions, bottlenecks and road jams.

i. Reduction in vehicle crashes due to low conflicts.

6.7.2 Disadvantages:

a. Higher construction cost

b. More economic burden due to no of intersection within 1.5 km

c. Not a permanent solution keeping in view the city's ever-growing traffic, related problems and requirements.

CONCLUSION & RECOMMENDATIONS

CHAPTER - 7

CONCLUSION & RECOMMENDATIONS

7.1 Conclusions

After conducting the traffic analysis and simulating the field conditions on the computer program utilizing the collected information it leads towards the following conclusions:

1) Traffic overview is generally conducted in urban zones, which demands incredible prudence and concern. A good endeavour should be made to gather precise information, because when the geometric data, traffic volumes and signal timings are utilized as an input to the software, results may change remarkably.
2) Long lines were watched at the intersections during the crest period, which made problems for the effective working of the traffic framework. This eventually comes about in misfortune of fuel and time.
3) Traffic simulation was carried out utilizing VISSIM. This Software gauges the delays experienced by the vehicles and LOS of the intersection which is utilized to progress the above said parameters. Analysis utilizing this Software communicated:
   a. The intersections were outstandingly congested.
   b. Vehicles at these intersections experience impressive sum of delay.
   c. LOS was exceptionally destitute and could be moved forward utilizing present day strategies.
   d. Signal optimization could be supportive in diminishing the delays which could save time and fuel.
4) VISSIM gives remarkable results about LOS, vehicle delay and queue length with accurate feeding of data.

7.2 Recommendations:

Following are the recommendations:

1) A computerized signal control framework is already in practice on various other roads in Pakistan which automatically adjust signal timings and their offsets depending on the traffic volumes. Similar sort of control framework ought to be introduced on Mall Road to better managing of traffic at these fundamental arterials of Rawalpindi.

2) Rawalpindi Bypass should be built so that the traffic which is predetermined for cities other than Rawalpindi can proceed their travel without entering the city.

3) The traffic superintendents in Rawalpindi are doing a very great work of managing traffic but the require is to begin an awareness drive through them to teach the general public about traffic rules and regulations with a focus on Lane Discipline. This awareness drive ought to not be restricted to on location counselling by the superintendents but should also be done through mass media i.e. television, daily papers etc.

4) Flexitime implies that workers are permitted some flexibility in there every day work plans. For example, instead of all workers working 8:00 to 4:30, a few might work 7:30 to 4:00, and others 9:00 to 5:30. This shims travel from top to off-peak periods, which can decrease traffic congestion straightforwardly.

5) Parking Pricing are successful ways to decrease car travel, and tend to be especially effective in urban zones where congestion issues are most prominent. Efficient pricing of on-street parking would make urban driving more costly but more proficient, due to lower levels of traffic blockage.

6) Commute trip reduction programs encourage commuters to utilize elective modes for trips to work and school. Such programs tend to be especially effective if they join appropriate financial Motivating forces, such as Travel benefits or Parking pricing. In most regions, commute traffic represents the larger part of traffic on congested roads so commute trip reduction programs can be especially effective at reducing traffic blockage.

7) It is emphatically suggested that as traffic designing issues are expanding in urban regions of Pakistan. MCE graduates should be made familiar with traffic engineering and management applications by making it a portion of the educational modules.

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