# TRAFFIC ANALYSIS AND CONGESTION MITIGATION OF G 11 INTERSECTION, ISLAMABAD

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This is to certify that the

Final Year Project, titled

# TRAFFIC ANALYSIS AND CONGESTION MITIGATION OF G 11 INTERSECTION

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"In the name of Almighty Allah, the Most Beneficent, the Most Merciful"

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# Abstract

Aging transportation infrastructure of Rawalpindi is unable to meet the enhanced traffic demand due to increased motorization. A well-planned, efficient and sensible transportation system is necessary to ensure better traffic movement. This project analyzes the Current Traffic Condition of DefenceG 11 intersection, Rawalpindi by performing microscopic multi-modal traffic flow simulation, and offers Congestion Mitigation Measures, including infrastructure development.

# Chapter 1

## Introduction

For any present day society, a well-established Transportation framework is vital for its development and advancement. The arrangement of urban social orders is generally affected by the sort of the transportation framework accessible. Each day, a enormous number of individuals commute from one put to another to perform their day to day errands such as reaching to school, work, shopping, and recreational purposes etc. Among all shapes of transportation, street transportation holds the most noteworthy significance in terms of its utilization and affect. Individuals in both the created as well as creating nations travel day by day for work, instruction, diversion, shopping and other conveniences utilizing street transportation implies. A parcel of assets, counting fuel and time, are expended amid transportation operations and any obstacle to these operations gives a part of strain on these assets. This renders it crucial that the traffic runs easily without any intrusions and delays.

Traffic has expanded in later a long time in twin cities due to expanded commercial and improvement exercises. G 11 intersection found on the intersection of NUST and G 11 sector has been influenced due this traffic increment. Traffic volumes are more than the capacity of G 11 intersection. In our extend, we have
analyzed distinctive alternatives for blockage relief of the G 11 intersection. We have analyzed the G 11 intersection for anticipated volumes after ten a long time for
proposed arrangement and famous LOS in Vissim computer program. We recommended a

few transitory and lasting arrangements for the issue. We have moreover made models for the arrangements considered and the arrangement given.

## G 11 intersection

So G 11 intersection require entering traffic to deliver way to traffic as of now within the circle and ideally observe various plan rules to extend security. Compared to halt signs, traffic signals, and prior shapes of G 11 intersections, present day G 11 intersections diminish the probability and seriousness of collisions by lessening traffic speeds and minimizing T-bone and head-on collisions. Varieties on the fundamental concept incorporate integration with cable car and/or prepare lines, two-way stream, higher speeds and numerous others.

Traffic moves gradually sufficient to permit visual engagement with people on foot, empowering yielding towards them. Other benefits incorporate decreased driver perplexity related with opposite intersections and decrease d lining related with traffic lights. They permit U-turns inside the ordinary stream of traffic, which regularly are not conceivable at other shapes of intersection. In addition, since vehicles on normal spend less time lingering at G 11 intersections than at signaled intersections, employing a G 11 intersection possibly leads to less contamination.

## Site Description

The G 11 intersection, found close NUST Islamabad has been a portion of the modern advancement and extension inside the city limits of Islamabad. With more attractions, shopping centers, and commercial improvement, there has been an increment of traffic to the range. The G 11 intersection serves as an intersection between the G 11 and Nust . In any case, the venture has fizzled to meet the current traffic requests of the range. The range has been subjected to visit traffic congestions particularly amid the top hours. The issue is as it were anticipated to decline with the developing advancement within the twin cities.

This intersection carry traffic from

- Islamabad.
- Rawalpindi
- From Nust towards G 11.

- From G 11 towards Rawalpindi .

# Research Objectives

- Data collection at G-11 intersection
- Congestion mitigation at G-11 intersection
- Reduction of travel time at said location by proposing different alternatives

## Purpose of the Project

With the developing economy, there has been a surge of individuals from all over the nation to discover work openings within the twin cities, Rawalpindi and Islamabad. Both the cities are quickly getting to be a goal for firms and companies to move their workplaces and personnel. In arrange to supply space to oblige this growth, there's a got to give the foremost efficient transportation arrangement for the cities. With the current rate of deluge toward the twin cities, the circumstance of traffic is reaching to decline within the expected future. As of now, Islamabad and Rawalpindi have been once in a while seeing colossal traffic jams.

## Current Design

The current plan for the proposed G 11 intersection could be a non-traditional G 11 intersection. As as of now examined, the extend has fizzled to meet the current traffic requests of the zone. The zone has been subjected to visit traffic congestions particularly amid the crest hours. The issue is as it were expected to compound with the developing improvement within the twin cities.

We are planning to design the G 11 intersection to achieve the following objectives:

- Offering less collisionpoints;
- Minimize theweaving;
- Encouraging fewer cars to wait on G 11 intersection, making the G 11 intersection moreefficient.

# Chapter 2

## Literature Review

| Authors | Year Published | Year Published |
|---|---|---|
| RAGAB M. MOUSA. MINISTRY OF TRANSPORT – OMAN | 1993 | Four Leg Signalized Intersection Versus U-Turns Control in Greater Cairo: A Pilot Study |
| GANDHI SOFIA ABDULHAQ AL-HADDAD ISRAA SAEED AL-HAYDARI | 2018 | Improvement of traffic performance at intersections in Karbala city |
| MOHAMMAD ABOJARADEH MAJED MSALLAM BASIM JREW | 2014 | Evaluation and Improvement of Signalized Intersections in Amman City in Jordan |

### Engineering terms definition:

#### Traffic Engineering

Traffic engineering is of one of civil engineering's branch that deals with the roads and streets design and construction and uses engineering practices to assure the safe and efficient movement of people and goods on roadways.

### Traffic Congestion

Traffic congestion could be a circumstance on transport systems that happens as its utilization increments, and is characterized by slower speeds, longer trip times, and expanded vehicular lining. The foremost common illustration is the physical utilize of streets by vehicles. When traffic request approaches the capacity of a street or of intersection at that point due to the interaction between vehicles, speed of moving vehicles moderate down and clog sets in. When the speed of vehicles is nearly zero, a circumstance alluded to as “traffic jam” happens

**Average Daily Traffic**

Average daily traffic or ADT, and sometimes also known as mean daily traffic, is the total volume of vehicles during a given time period (in whole days), more than one day and less than one year, divided by the number of days in that time period.

**Annual Average Daily Traffic (AADT)**

Annual Average Daily Traffic (AADT) is the total volume of vehicles (EPCUs) of a highway for one complete year divided by 365 days (number of days in the year). It gives us some idea about the demand of the particular road.

**Traffic Count**

A traffic count is counting of vehicles along a particular road, it can either done electronically (JAMAR counter etc.) or manually using Traffic Count Sheets.

**Passenger Car Unit (PCU)**

Passenger Car Unit (PCU) is a metric used in Transportation Engineering, used for expressing highway capacity. A Passenger Car Equivalent is basically the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car. For example, typical values of PCU (or PCE) are:

**Table: Equivalent Passenger Car Units for each class as defined by AASHTO, Green Book.**

| **VEHICLES** | **PCU/PCE** |
|---|---|
| Car (including taxis, jeeps, land Cruisers, Hiace, Wagons, Minibus, Mazda ) | 1.0 |
| Motorcycles, Rickshaw, Qingqi, Bicycle | 0.5 |
| Large Bus (>3o seats) | 3.0 |
| All Trucks including construction vehicles | 4.0 |
| Tractors with or without trolley | 5.0 |

**Peak Hour Factor**

One hour period is the accepted unit of time for expressing flow rate. The total hourly volume that can be served without exceeding a specified degree of congestion is equal to or less than four times the maximum 15- minutes count. The factor used to convert the rate of flow during the highest 15-minute period to the total hourly volume is the peak hour factor (PHF).

## Capacity Modeling

Major research on G 11 intersection capacity has been carried out in numerous countries. Software can offer assistance calculate capacity, delay and lines. Bundles incorporate ARCADY, Rodel, Thruway Capacity Computer program and Sidra Intersection, PTV Vissim. PTV-VISSIM could be a effective examination device being utilized broadly in transportation arranging. It was created by PTV Arranging transport Varchar A.G, A German based company. It is utilized to assess the adequacy of different proposed options. VISSIM employments micro-simulation procedures for mimicking the substances of genuine world in simulation. The notable include of the computer program is its multi-modality, which implies more than one kind of traffic can be simulated

## Objective

To redesign G 11 intersection to eliminate traffic congestion and delays

- Acquire/ estimate present and future capacity of our concernedarea.
- Conduct traffic count and other surveys with a view to assess existing traffic onthe section.
- Assess future traffic based upon pace of construction and vehicle growthrate

- Analyze present and increased capacity demand of the section in future usingHCM and computer software, VISSIM andHCS.
- Conclusion and recommendations for congestion mitigation, including traffic management measures and infrastructure development, ifnecessitated.

# JUSTIFICATION FOR SELECTION OF TOPIC

## Inadequate Capacity

Insufficient Capacity due to high traffic volumes capture attempt the G 11 intersection from G11 to Pindi with the consolidating traffic at
a high weaving. Additionally, path capacity shifts broadly due abutting paths, path width, number of overwhelming vehicles, and lacking path arrangement amid blockage. The commonsense capacity falls broadly underneath the perfect capacity and the Level of Service (LOS)
drops underneath the least suggested by HCM.

## Noise Pollution

In fast creating built – up cities, traffic clamor has gotten to be a extreme issue these days since of wasteful town and urban arranging. The issue has been compounded by rise in traffic volumes more than the desires. Traffic blockage leads to an increment within the foundation Commotion of an region past the suggested levels

## Air Pollution

Developing traffic and industrial exercises lead to discuss contamination by transmitting gasses which contains arsenic, cadmium, nickel and other hydrocarbons. Discuss contamination is terrible for wellbeing and for the environment. The foremost tricky toxins nowadays are fine particles, nitrogen dioxide and ground level ozone transmitted by engine vehicles.

## Time Delays

The preeminent thing that comes in intellect when considering blockage is the delay. Delay is straightforwardly related to the push caused to the drivers. Morning traffic blockage leads to arriving late at work put and evening surge includes to dissatisfaction of drivers since they need to reach domestic and unwind. This disappointment can moreover lead to street mishaps.

### Fuel Consumption

The utilization of fuel is more as halting and beginning in traffic jams devours the fuel at a quicker rate as compared to continuous traffic stream conditions. Higher the rate of fuel, higher will be the fetched and it'll be exceptionally uneconomical and it also adds to the whole of emanations discharged by the vehicles which in return comes about in more contamination. It has unfavorable impacts on environment as well.

# Chapter 3

# Methodology

This section will cover up the methodology which we had carried out for completion of this study. The step carried out in executing this project would be mentioned.

The following methodology is carried out:

- Literaturereview
- Fieldsurveys
- DataCollection
- Capacity Modeling andAnalysis
- ProblemsIdentification
- Evaluating possiblesolutions
- Compilation of Results

## Surveys

Survey is a very crucial for carrying out any type of analysis. Therefore, following survey was carried out for the study:

- Volume/Traffic countsurvey

## Capacity Analysis

The procedure adapted for capacity analysis included the collection of traffic counts for the turning movements and through movements at the G 11 intersection. The traffic counts enabled us to get the peak hour volume of the traffic which in turn is used to find the peak hour factors. This peak hour volume and peak hour factor is further used to determine the existing overall delay, capacity of G 11 intersection, whether is suffice or not with the help of simulation on VISSIM.

## Traffic Count Survey

The G 11 intersection is a busy intersection. It comprises of three legs. Traffic counts for turning moment and through movement have been done. These traffic counts are required for further analysis process. Volume count is carried out to find the peak hour volume and peak hour factor. Counting is carried out using manual method. The survey has been conducted for following timings:

- 8 am to 10am
- 4 pm to 8 pm

These timings have been selected after observance of traffic flow. 8 am to 10 am is selected because during this duration people travel for reaching to their work places, offices, colleges, schools etc. 4 pm to 8 pm time for evening count is selected because during this span of time people travel back towards their homes and large amount oftraffic transverse through the G 11 intersection.

Traffic counts were done for:

- Traffic coming from Rawalpindi and going towards Islamabad.
- Traffic entering G 11 intersection from NUST.
- Traffic coming from G 11 and going towards Rawalpindi.

## Methods for traffic count

Two methods are accessible for conducting traffic volume counts namely Manual counts and Jamar Counter. We used the manual method for conducting the traffic volume counts.

## Manual Count

Tally sheets are utilized for the traffic number physically. Count marks are the essential units of unary numeral framework utilized for checking reason. They are gathered in five so that calculation may ended up simpler and neat

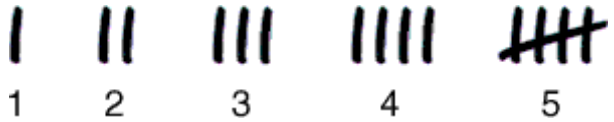



**Figure 4.2: Manual Count (Tally Bar)**

### Manual Count Method

First of all traffic was segregated into following classes.

- **Bikes**

    - Bicycles
    - MotorBikes

- **Cars**
    - PassengerCars
    - Hiace
    - LandCruisers
    - Suzuki
    - Coasters ( less than 16seats)
- **Buses**
    - Coasters (up to 24seats)
    - Public TransportBuses
- **Trucks**
    - ConstructionVehicles
    - 2-AxleTrucks
    - 3-Axle orabove
    - Tractors (with or withouttrolley)

**Selection of representative day:** Traffic tallies conducted amid Monday morning and Friday evening rush/peak hour may appear extraordinary behavior of tall traffic volumes and are not by and large utilized in examination hence, checks are as a rule taken on Tuesday, Wednesday, or Thursday.

**Selected time slot:** Initial visits to the location were made to select timings for survey to determine peak hour. Timings selected were

Table 4.2: Time Slots

| | |
|---|---|
| • Morning | • 8:00 - 10:00AM |
| • Evening | • 4:00 - 8:00PM |

**Manual Count, Recording Method and Timings.**

Noticing down information onto manual count sheet is the foremost basic and simple strategy of taking checks. A halt observe is needed to note the specified check interim. The complete points of interest of the traffic counts are given within the conclusion . Refer to Attach A for manual traffic number sheet and working of crest hour volumes by changing over each course to its EPCU utilizing Exceed expectations Sheets**.**

**Personnel Involved in a Manual Count Study:**

The information collection group measure depends on the tallying period span, the sort of check being executed and the volume level of traffic. The number of staff alluring too depends on the ponder information required. For case, two spectator can record certain sorts of vehicles in one heading whereas rest can check in other direction.

**Determining Peak Hour Volume:**

Peak hour volume is the traffic volume that occurs during the peak/ rush hour. It is expressed in EPCUs per hour and it represents the highest traffic volume. For calculating peak hour first of all different types of vehicles were converted into EPCU (Equivalent Passenger Car Units).

Traffic counts for each 10 minutes time period were converted to EPCU of different vehicles, added and total EPCU was determined. Peak hour volume was taken which yielded the max EPCUs for 60 consecutive minutes. EPCUs for the peak hour are shown in the diagram below:

# Chapter 4

# Results and Discussion

## Data Simulation - PTV VISSIM

PTV-VISSIM may well be a viable examination gadget being utilized broadly in transportation organizing. It was made by PTV Orchestrating transport Varchar A.G, A German based company. It is utilized to evaluate the ampleness of diverse proposed alternatives. VISSIM livelihoods micro-simulation strategies for imitating the substances of veritable world in reenactment. The striking incorporate of the computer program is its multi-modality, which suggests more than one kind of movement can be recreated.

These entities include:

- Vehicles (Cars, Buses, Trucks, OilTankers)
- Public Transports (Trams,Buses)
- Cycles (Bicycles,Motorcycles)
- Pedestrians

It appears each character at infinitesimal level in this way giving the precise picture of a real-world situation. It can analyze the different public and private transport operations beneath distinctive restrictions including

- Lane configurations
- different compositions of vehicle mix
- stopssigns

- trafficsignals
- barriers

Hence viability of different options can be analyzed beneath distinctive conditions of assessed and anticipated volumes. VISSIM too models the operations of people on foot either exclusively or combined with the traffic operations.

**Benefits of VISSIM**

Other than multi modeling, there are some other features that make this software more effective.

**Scenario Management:**

Different scenario results can be matches conveniently, giving the user a clear idea of which scenario is the best. Using this information an effective solution to traffic congestion or low LOS can be proposed.

**Maximum Accuracy:**

With the assistance of this computer program most extreme precision can be accomplished. Client can outline organize and any wanted geometry can be accomplished, i.e. from a standard hub to a complex intersection. Reasonable behavior of all street clients inside the existing and arranged framework is conceivable in this computer program.

**Ease of Use and Productivity:**

It is exceptionally user friendly program permitting us to construct our possess interfacing (Driver Model, Driver Simulator etc.). The interfacing with dock able windows permits for effectively making and altering organize objects.

**Flexibility and Integration Capacity:**

The Generic COM interface permits connection with outside applications. It empowers you to have manual settings for drivers and vehicle properties at diverse levels. For current studies it makes a difference you to test the environment. Other than this, you'll be able interface your work to any other PTV software.

**Visualization in 2D and 3D:**

Switch point of view makes a difference you to show your investigation comes about in both 2D and 3D. This helps in open decision-making forms with the assistance of nitty gritty reports. This striking highlight makes
the traffic recreations more engaging and reasonable to all.

## Simulation of present scenario

G 11 intersection was analyzed in show conditions without

any alter for noticing line lengths and delays which were at that

point utilized to decide LOS. Diverse need rules were moreover attempted at each hub.

The needs were so balanced to allow the least delays.

**Problems with Existing Intersection**

- Failure of Signalized Intersection
- Traffic Accidents that even lead to fatalities
- Congestion on G-11 Intersection

## COMPILATION & ANALYSIS OF DATA

Here we show the traffic counts which we collected on field .

# FRIDAY 5-6

| FHWA VEHICEL CLASSIFICATION | Motorcycles | Passenger Vehicles | Pickups+ Panels+Vans | Buses | Single Unit 2-Axle truck | Single unit 3 axle trucks | Single Unit 4 or more Axle Trucks | Single.Trailer 3 or 4 Axle Trucks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **From Srinigar Highway to G-11** | 157 | 59 | 14 | 0 | 0 | 0 | 0 | 0 |
| **From G-11 to Srinigar Highway** | 604 | 805 | 95 | 5 | 5 | 2 | 1 | 0 |
| **From G-11 to NUST** | 53 | 74 | 9 | 2 | 2 | 0 | 0 | 0 |
| **From NUST to G-11** | 103 | 84 | 18 | 2 | 0 | 0 | 0 | 0 |
| **Srinigar Highway to Srinigar Highway (ISL to RWP)** | 489 | 2235 | 440 | 50 | 24 | 24 | 2 | 3 |
| **Srinigar Highway to Srinigar Highway (RWP to ISL)** | 616 | 2522 | 593 | 111 | 33 | 6 | 2 | 0 |
| **From Srinigar Highway to NUST** | 44 | 120 | 13 | 1 | 2 | 0 | 0 | 0 |
| **From NUST to Srinigar Highway** | 67 | 210 | 35 | 3 | 4 | 0 | 0 | 0 |

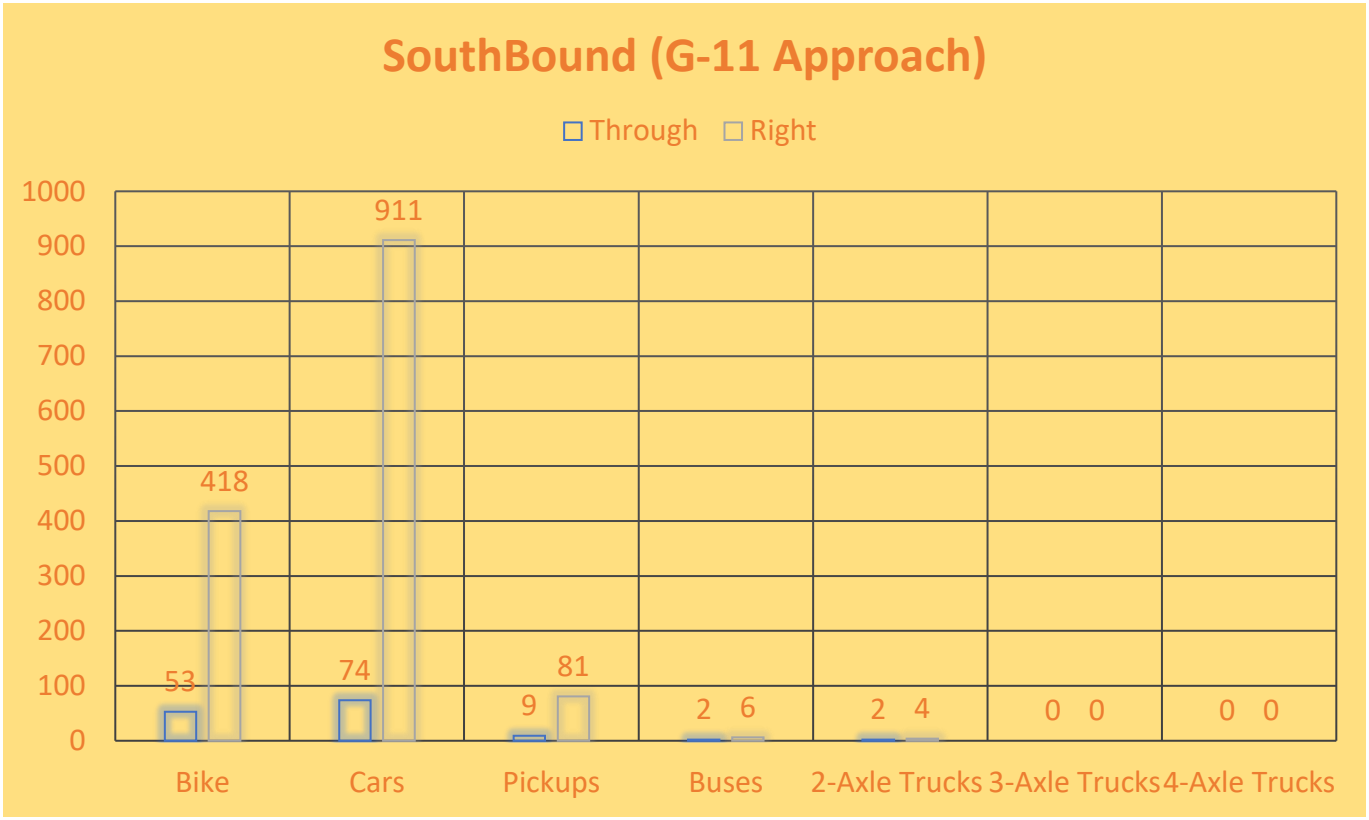
## FRIDAY 4-5

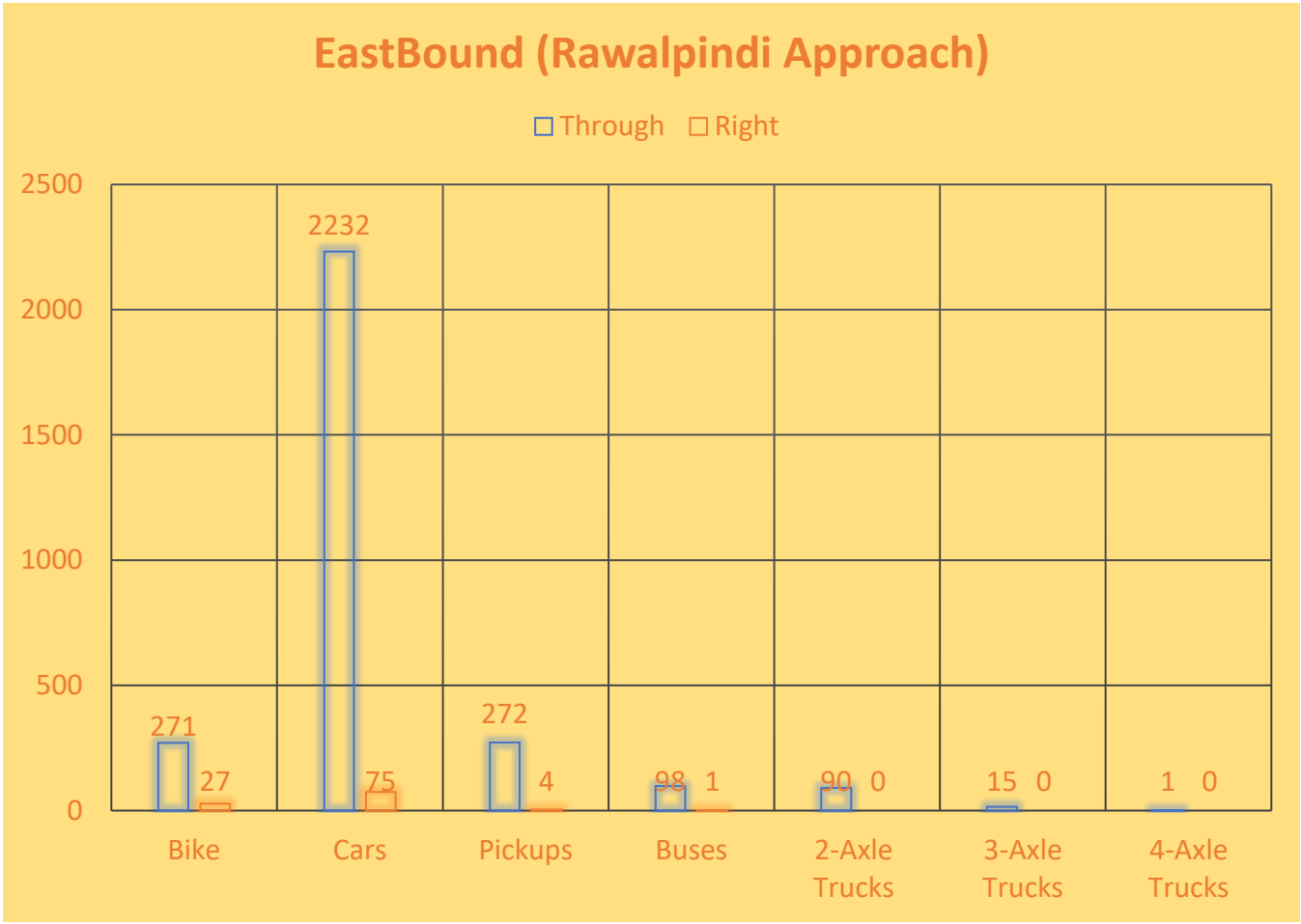
| FHWA VEHICEL CLASSIFICATION | Motorcycles | Passenger Vehicles | Pickups+ Panels+Vans | Buses | Single Unit 2-Axle truck | Single unit 3 axle trucks | Single Unit 4 or more Axle Trucks | Single.Trailer 3 or 4 Axle Trucks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **From Srinigar Highway to G-11** | 142 | 55 | 11 | 0 | 0 | 0 | 0 | 0 |
| **From G-11 to Srinigar Highway** | 543 | 723 | 87 | 4 | 4 | 3 | 1 | 0 |
| **From G-11 to NUST** | 45 | 65 | 6 | 1 | 1 | 0 | 0 | 0 |
| **From NUST to G-11** | 99 | 78 | 15 | 1 | 0 | 0 | 0 | 0 |
| **Srinigar Highway to Srinigar Highway (ISL to RWP)** | 387 | 2167 | 413 | 43 | 23 | 21 | 3 | 2 |
| **Srinigar Highway to Srinigar Highway (RWP to ISL)** | 576 | 2300 | 525 | 105 | 34 | 5 | 1 | 0 |
| **From Srinigar Highway to NUST** | 38 | 101 | 10 | 1 | 1 | 0 | 0 | 0 |
| **From NUST to Srinigar Highway** | 54 | 190 | 31 | 2 | 3 | 0 | 0 | 0 |

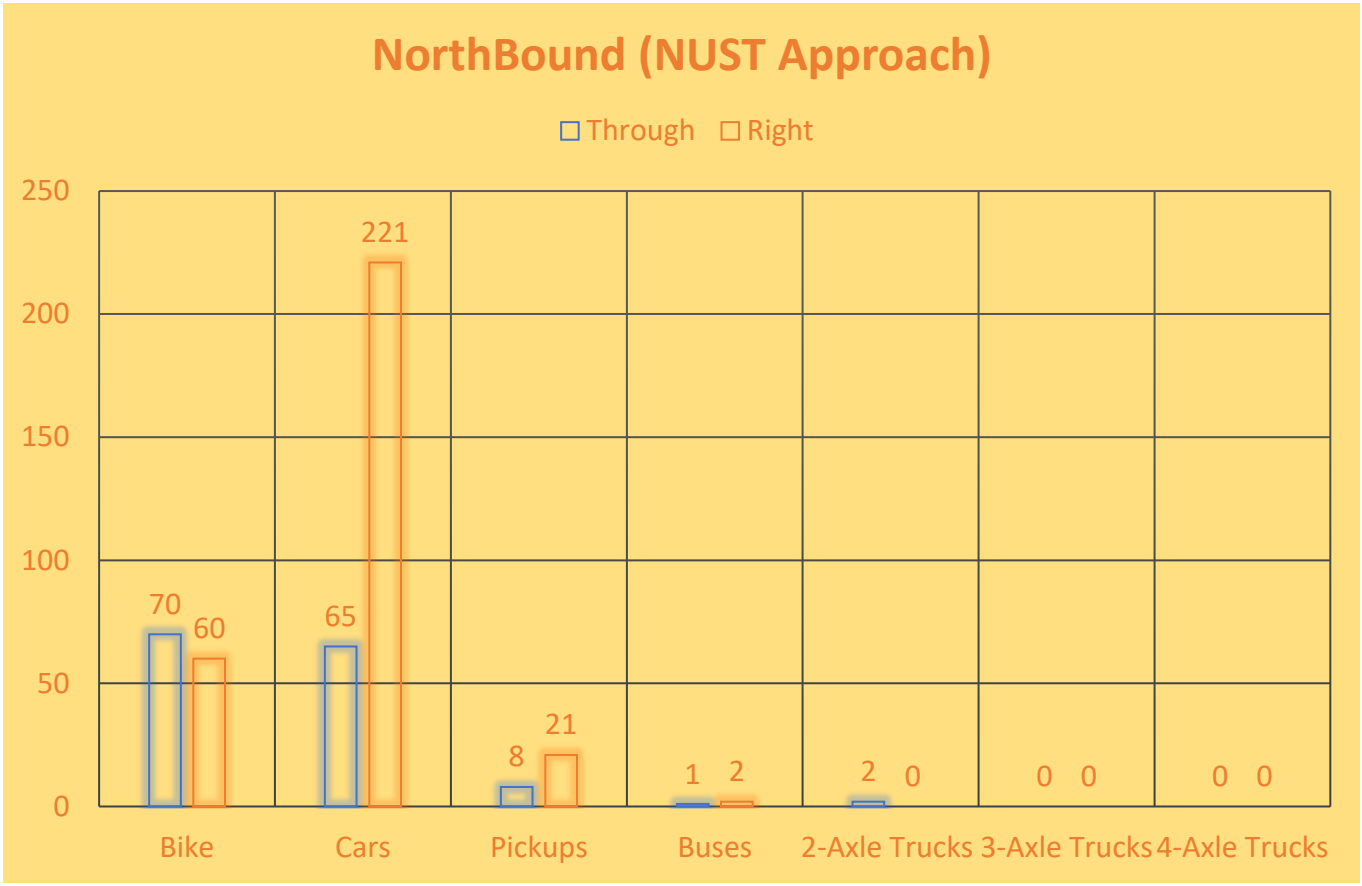
## FRIDAY 6-7

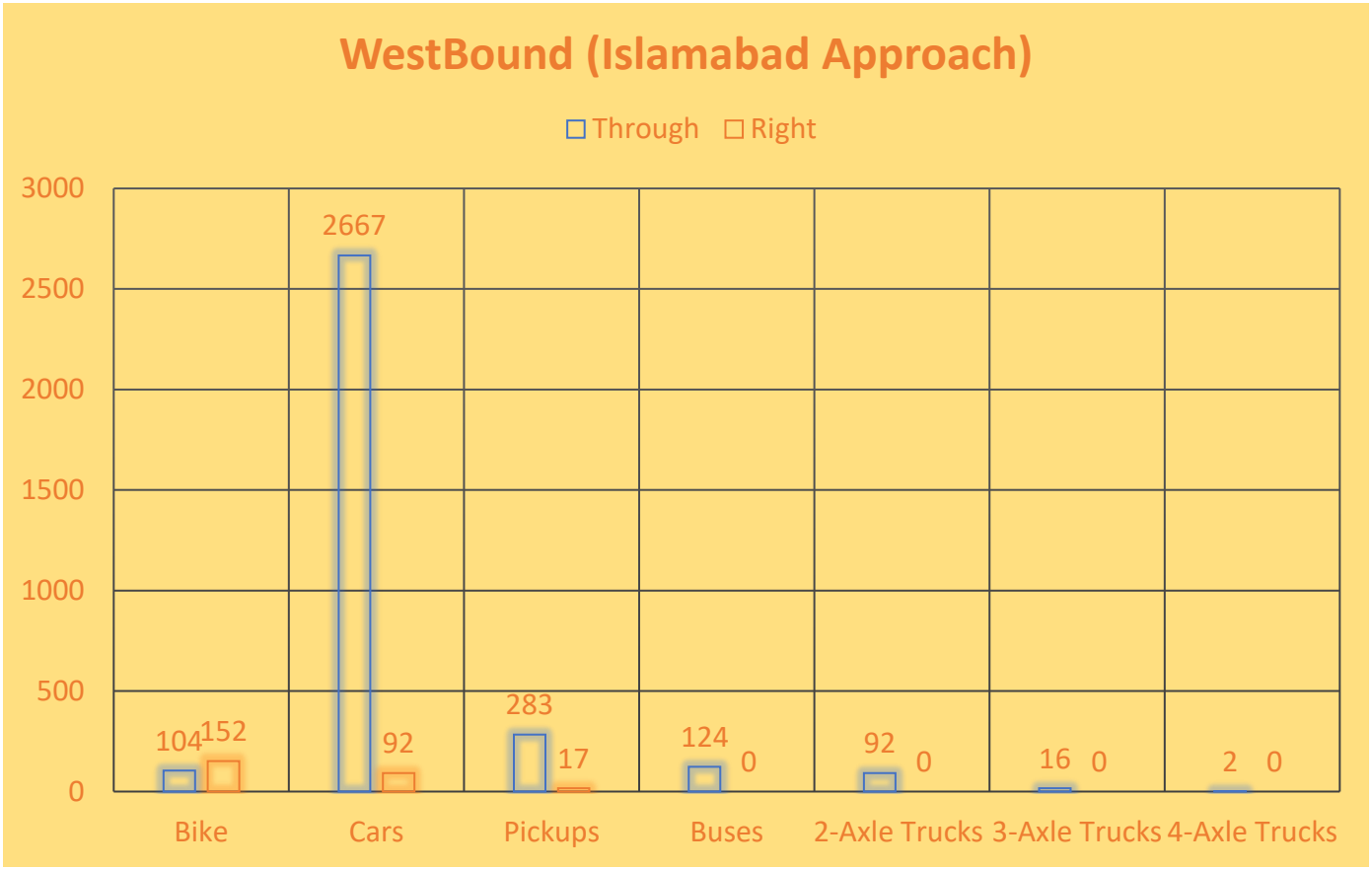
| FHWA VEHICEL CLASSIFICATION | Motorcycles | Passenger Vehicles | Pickups+ Panels+Vans | Buses | Single Unit 2-Axle truck | Single unit 3 axle trucks | Single Unit 4 or more Axle Trucks | Single.Trailer 3 or 4 Axle Trucks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **From Srinigar Highway to G-11** | 132 | 45 | 9 | 0 | 0 | 0 | 0 | 0 |
| **From G-11 to Srinigar Highway** | 512 | 543 | 67 | 3 | 6 | 1 | 1 | 0 |
| **From G-11 to NUST** | 40 | 56 | 5 | 0 | 1 | 0 | 0 | 0 |
| **From NUST to G-11** | 87 | 57 | 13 | 2 | 0 | 0 | 0 | 0 |
| **Srinigar Highway to Srinigar Highway (ISL to RWP)** | 342 | 2176 | 412 | 43 | 14 | 17 | 1 | 3 |
| **Srinigar Highway to Srinigar Highway (RWP to ISL)** | 550 | 2287 | 435 | 105 | 29 | 3 | 1 | 0 |
| **From Srinigar Highway to NUST** | 32 | 122 | 9 | 1 | 1 | 0 | 0 | 0 |
| **From NUST to Srinigar Highway** | 51 | 165 | 24 | 2 | 3 | 0 | 0 | 0 |

# Volume Data


SouthBound (G-11 Approach)
Through
Right
1000
900
800
700
600
500
400
300
200
100
0
53
418
74
911
9
81
2
6
2
4
0
0
0
0
Bike
Cars
Pickups
Buses
2-Axle Trucks
3-Axle Trucks
4-Axle Trucks


EastBound (Rawalpindi Approach)
Through
Right
2500
2000
1500
1000
500
0
271
27
2232
75
272
4
98
1
90
0
15
0
1
0
Bike
Cars
Pickups
Buses
2-Axle Trucks
3-Axle Trucks
4-Axle Trucks


NorthBound (NUST Approach)
Through
Right
250
200
150
100
50
0
70
60
65
221
8
21
1
2
2
0
0
0
0
0
Bike
Cars
Pickups
Buses
2-Axle Trucks
3-Axle Trucks
4-Axle Trucks




**Proposed Solutions to the Problem**

- U Turn
- Flyover

## Solution 1

- Closing off  G-11 Intersection and providing protected U-Turns at 800m each side from the site of intersection
- We made protected u turns on each side so that traffic safely goes from it without intersection with other vehicles .
- Although this solution plays with safety of drivers as high speed lanes merge and Bus coming in high speed lane will have to change its lane to cross u turn . But this is most economical solution to our existing problem
- The delay time comes out to be 30 sec.

We designed this u turn on vissim software which is shown below .


*PTV VISSIM generated model of G 11 intersection*

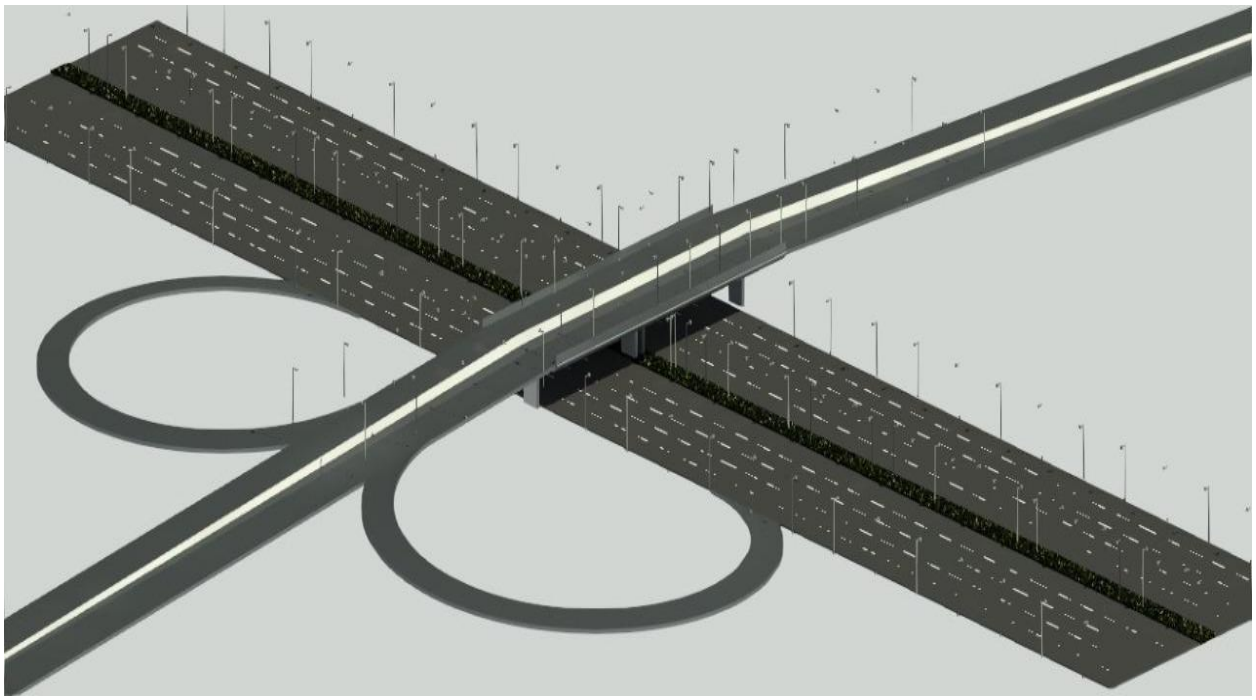

*Figure 1: VIssim Model of the current G 11 intersection Design*

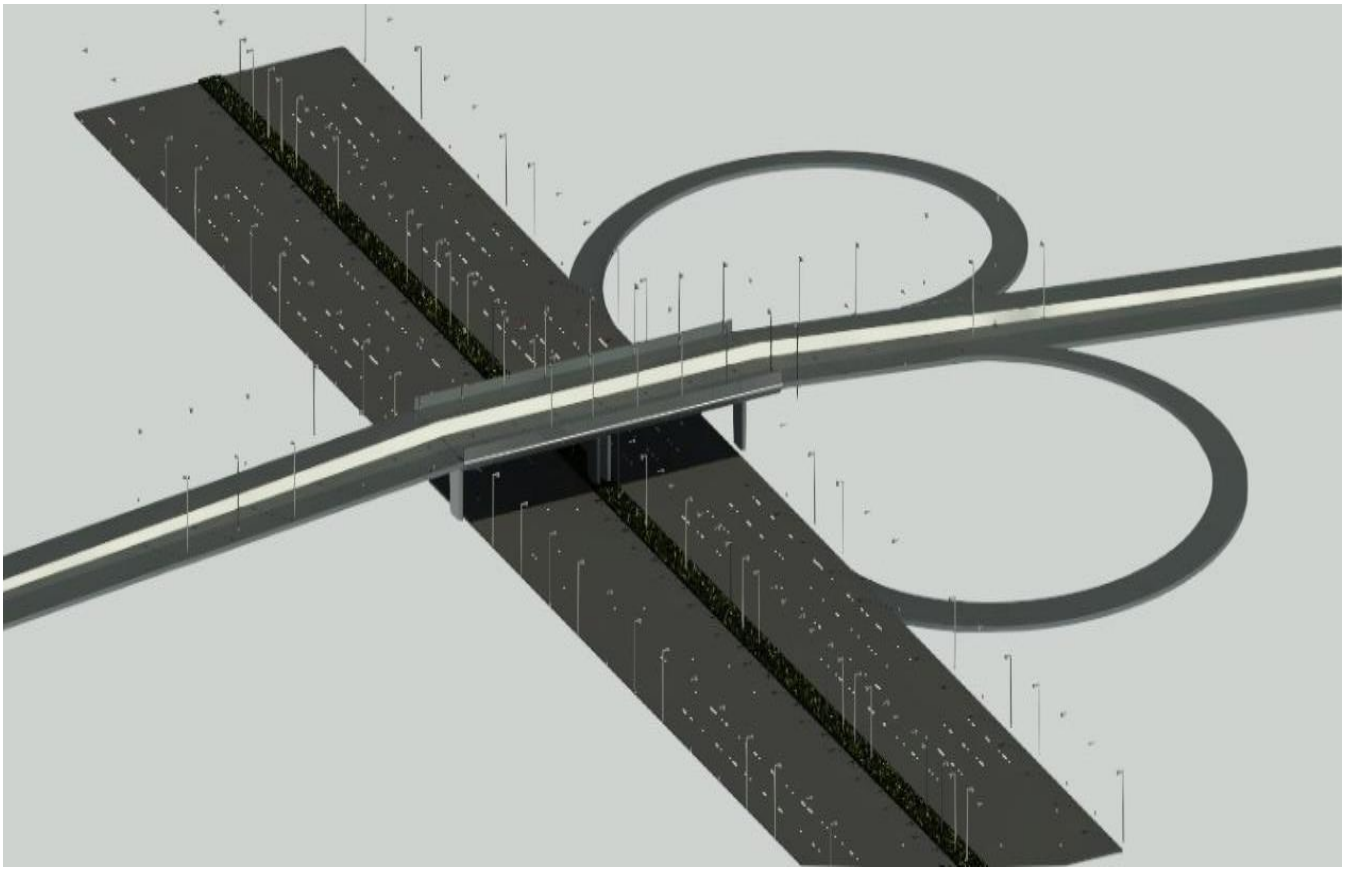
## Solution 2

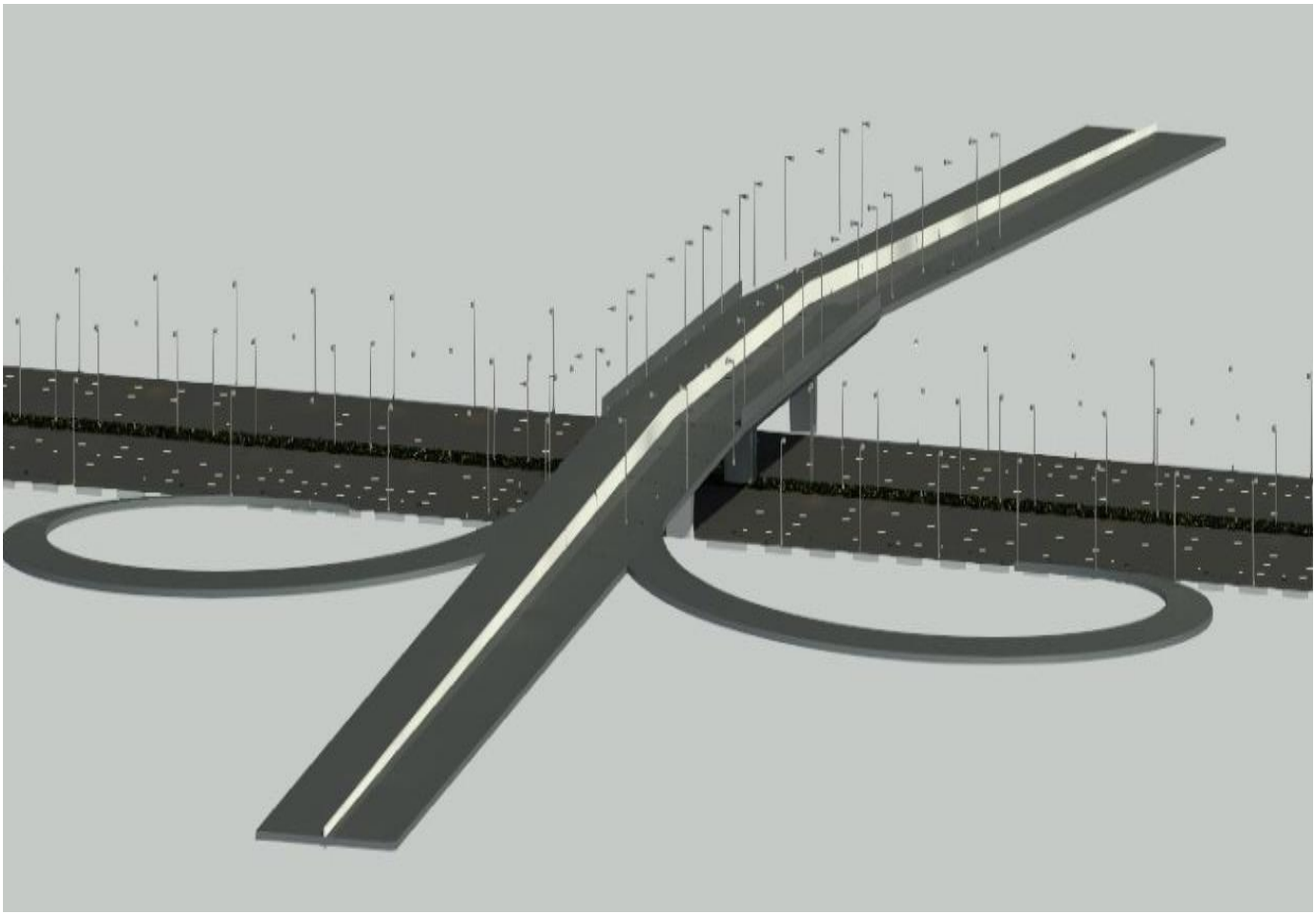
### Partial Clover Flyover

- A 3-D Model of proposed Partial Clover Flyover is designed and rendered using AutoDesk Revit 2022
- We have made best possible outcome from existing site .
- This partial lover flyover will fix all the problems that occur on G 11 intersection
- But this solution is very costly

The 3 D model which we designed is shown below







## Traffic  flow on Our Flyover

- The huge traffic which is coming from G 11 will use flyover to go Rawalpindi.
- Persons from Kashmir Highway who wants to go G 11 will use flyover to go in G-11 sector.
- The traffic from nust will uses u turn at the end of flyover and then go to Kashmir Highway.

# Advantages & Disadvantages of Flyover

## ADVANTAGES

- Uninterrupted flow of traffic
- Delay Time decreased
- Safe solution

## DISADVANTAGES

- Very expensive and uneconomical
- G-11 Approach cannot join intersection as it is
- Demolition of some structures would be required

## Conclusion

- Flyover is without doubt a better and safer solution but it is very cost unfriendly.

- Hence, we conclude that protected U-Turns are the more feasible option and the requirement of the time.

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