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Simulation Model for Vehicular Traffic Flow at Intersection of Road to Reduce Traffic Congestion

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ABSTRACT

This study used PTV VISSIM to analyse traffic flow congestion. For the purpose of modelling, traffic volume data was initially collected through a visual survey. A traffic simulator is used to study vehicle traffic at road intersections in order to study traffic management at a city junction. For every traffic parameter at the suggested intersection, the simulator offers visual and graphical explanations. It functions as the basic model for simulating traffic at city crossroads intersections. The recommended PTV simulator is used to simulate different traffic situations. There are various simulation objects created by this mathematical model. The conclusion reached is that adding improved systems to the intersection such as distinct underpasses and signals reduces traffic volume. This paper provides an overview of the methodology utilized in the process and applies modern developments on intersection.

KEYWORDS: PTV VISSIM, AADT

1 INTRODUCTION

In order examine their effects on vehicle delays and traffic congestion, this study compares a traditional design with a shared-space design option. The research develops a microsimulation traffic modelling method with currently accessible tools that produces enough data for decision-making processes. According to parameters like delay and travel time. To obtain a conservative estimate of the shared space's influence on congestion levels, we present an innovative way of adjusting PTV Vissim's built-in features. The case study location, Dera Ismail Khan Bannu Adda, was selected because of its well-known delays and traffic congestion.

The PTV Vissim model uses the gathered data as well as a conceptual design drawing, satellite photos, and a visual survey of the existing road layout as a baseline. The impact of a shared space design is then evaluated by calculating travel time and delay using this model. In PTV Vissim, turning movement percentages and vehicle traffic volume were gathered to produce a realistic model. [1]

Reducing traffic congestion in the modern era demands the application of modern technology and innovative thinking. Artificial intelligence, sensors, and real-time data are used by smart traffic management systems to enhance flow and reduce problems. With the help of comprehensive mobile applications that offer up-to-date information on public transportation, traffic, and

alternative routes, travellers can make well-informed decisions. Examining the use of self-driving or self-driving cars can reduce accidents and improve traffic flow. [2,3]
By promoting electric cars and other environmentally friendly modes of transportation, the negative effects of conventional vehicles on the environment and traffic congestion can be reduced. Urban air mobility is one emerging technology that can be used to reduce ground-level congestion in densely populated areas. Encouraging telecommuting and flexible work arrangements reduces the need for transport overall and helps to disperse rush hour traffic. [4]
Many factors contribute to traffic congestion in Dera Ismail Khan City, including a large population, inadequate infrastructure, an excessive reliance on private vehicles, and inadequate traffic management. PTV Vissim is a traffic simulation tool that simulates dynamic interactions between cars, pedestrians, and other traffic factors in order to model and analyse transportation networks. It consists of network modelling, public transportation modelling, realistic vehicle dynamics, and traffic control simulation. The application offers a visual representation of simulation results for traffic pattern and congestion analysis. Users are able to examine potential outcomes and assess how changes might impact traffic flow. PTV Vissim operates at a microscopic level and considers individual vehicle behaviour, simplifying data analysis for performance evaluation and decision-making in transportation planning. [5]

1.1 Problem Statement

Every day, a large number of vehicles travel through dera ismail khan bannu road in order to get to their destinations. The problem lies in the fact that although this is a crucial road, there are no underpasses, traffic signals, or special measures in place to control traffic flow. As a result, there are regularly traffic jams that make driving challenging.

2 LITERATURE REVIEW

Engineering and research studies are currently coming out rather often as a result of the numerous shared space project types that have been appearing in several countries. Provides an overview of the benefits observed at shared space execution in Pakistan.
Furthermore, cities like Dera Ismail Khan, share space-type zones. To increase vehicular traffic, Jordan is aiming to introduce shared space on routes like Amman's Al Medina Street, which historically had a strong pedestrian-automobile mix but has lost its character. [6, 7]
It should be noted that shared space has increased pedestrian safety in practically all of the mentioned installations, which may be related to slower traffic. Moderman’s hypothesis that at slower speeds, motorists and pedestrians would be able to make eye contact and engage in "social interaction" with others Recognize each other's actions, and decide on their own, Accidents have been successfully decreased by effective response and harm Previous attempts also demonstrate that Both crowded ways have had success with shared space both in rural and urban locations. Additionally, shared space is linked to a decrease in the majority of traffic conflict types. In other circumstances, like Poynton, shared spaces have resulted in enhanced movement of traffic. Yet no published research has been done up until this point to quantify the congestion benefit or lack of shared space, which is the primary subject of this essay. [8]

3 STUDY METHODOLOGY

3.1 Data Collection of Traffic Volume

The team visited the research site in Dera Ismail Khan, Bannu-Adda, and manually recorded the traffic volume for one hour at three different times: morning, afternoon, and night using a visual survey and video recording. Further more using the recorded video to categorize each vehicle into types such as motorbike, rickshaw, car, and busses. Afterward each vehicle category is calculated separately.

Figure 01: Intersection on PTV Vissim

3.2 Analysis of Collected Data

Annual Average Daily Traffic (AADT)

The term AADT, or Annual Average Daily Traffic (AADT), is specifically used to represent the average number of vehicles passing a particular point on a road or highway over the course of a year, multiply the hourly volume with no of hours in a day. This metric is calculated to provide an average daily traffic volume, and it includes data from all hours of the day. In other words, AADT takes into account the 24-hour volume of traffic, providing an overall average for each day of the year. This comprehensive measure is valuable for transportation planning, design, and management as it helps in understanding the typical traffic patterns and informing decisions related to road infrastructure.

Weekly Average Traffic

The phrase "Weekly Average Traffic of 7 Days" usually describes the average amount of traffic for seven days in a row. This measure gives information about the typical traffic volume on a road or highway over the course of a week. To find the daily average, it is commonly calculated by multiplying the total number of cars in 24 hours that pass a particular site during the course of seven days by seven. it's the mean quantity of cars every day for a whole week. In transportation engineering, this kind of data is important for comprehending weekly traffic trends, which can help with maintaining and building road infrastructure.

Annual Traffic

"Annual traffic" typically refers to the total volume of vehicles that travel on a road or highway over the course of a year. This metric is important in transportation engineering for planning,

designing, and managing infrastructure. It is often quantified through measures like Annual Average Daily Traffic (AADT), which calculates the average number of vehicles passing a specific point each day throughout the year.

4 TRAFFIC ANALYSIS

Hence, we have a "Four-way junction" on which we collected our traffic volume data in three phases in a day on an hourly basis for each junction, as shown below.

Table 01: Data for Traffic Analysis

Sr.	Location	ADT	AADT	AAWT
01	Bannu Road Toward D.I.Khan	58413	79848	112094
02	Bannu Road Toward Bannu	42820	68880	96696
03	Saddar Bazar in	5780	9696	13611
04	Saddar Bazar out	10702	25824	36252
05	River Indus in	6630	11072	15543
06	River Indus out	8630	13584	19069

4.1 Intersection on Site Location

In this research work, the team initially visited the site, conducted actual measurements, including determining the width of the carriage way, shoulder width, and measuring the side drain. The team also established the number of lanes Subsequently, the team manually sketched the road based on these measurements and proceeded to refine the design using AutoCAD.

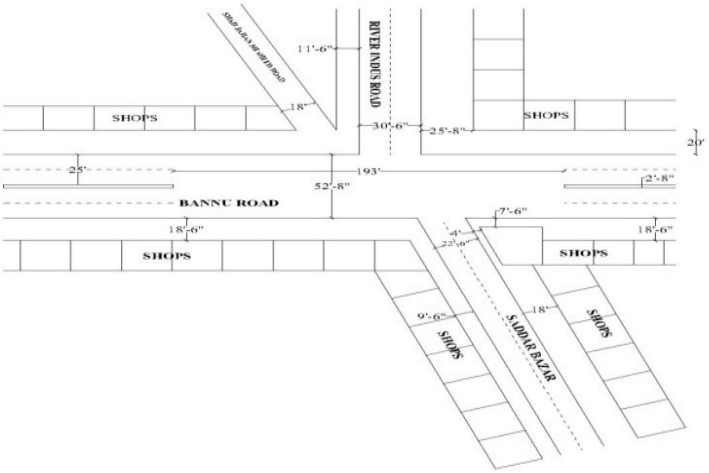


Figure 02: Intersection Measurements (Auto Cad)

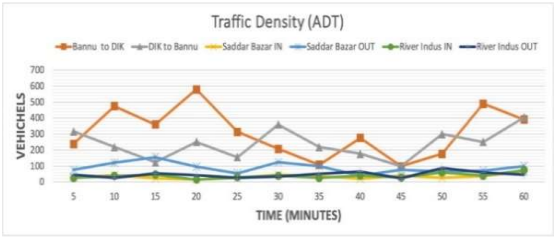
4.2 Simulation Design:

The PTV VISSIM software was opened, the site was located on the map, and a 3D model was added, including vehicles like rickshaws, motorbikes, cars, and buses. Vehicle types were adjusted by placing rickshaws under cars and motorbikes under bikes. Next, a vehicle composition was created, the tram was deleted, the speed for each vehicle was adjusted, links were drawn and joined based on traffic flow, reduced-speed areas were designated for each lane, and desired speeds were set for each vehicle class. Additionally, traffic signals with red, green, and amber colours were added, cycle times were set, and the simulation was finally run in the software.

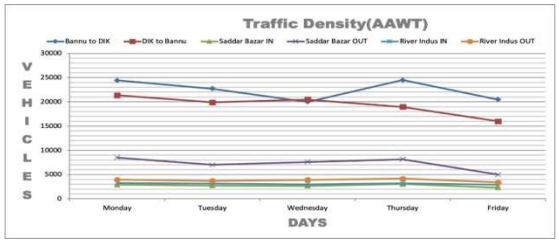
Figure 03: Simulation Design (Modeling)

4.3 Results

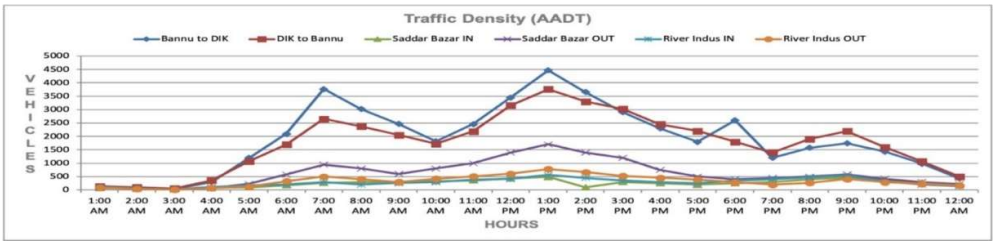
These are the simulation results which show the traffic density in different time and show the peak hour volume in which the selected intersection is full of traffic congestion. These congestion being reduce by the modification of modern traffic system in the modelling of intersection on the PTV Vissim.



Graph 01: Traffic Density (ADT)



Graph 02: Traffic Density (AAWT)



Graph 03: Traffic Density (AADT)

5 CONCLUSION:

In this research simple approach to the traffic analysis and reduce the traffic congestion with reducing traffic density by using simulation modeling on PTV vissim software through the use of PTV VISSIM software, we controlled traffic flow by employing traffic signals. Vissim software analysis the collected data and conclude that if improvements are make like signalized intersection, markings and under pass on actual intersection according to modern design then the traffic density will be decrease. By decreasing traffic density traffic congestion will also decrease on the intersection. This is the best method to analyze the traffic volume or improvements make in this design by modelling the actual intersection on PTV Vissim.

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