

**TRAFFIC FLOW ANALYSIS AND HIGHWAY CAPACITY OF
NH44 (PHAGWARA TO LUDHIANA)**

A RESEARCH REPORT

Submitted by

IRFAN YOUSUF

11604560

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In partial fulfillment for the award of the degree of

MASTERS OF TECHNOLOGY

IN

TRANSPORTATION ENGINEERING



L LOVELY
P ROFESSIONAL
U NIVERSITY

Transforming Education Transforming India

Under the guidance of

Mr. Waseem Bhat

Assistant Professor

School of Civil Engineering

LOVELY PROFESSIONAL UNIVERSITY

Phagwara-144411, Punjab (India)

CERTIFICATE

It is certified that this project report entitled “TRAFFIC FLOW ANALYSIS AND HIGHWAY CAPACITY OF NH44 (PHAGWARA TO LUDHIANA)” submitted by “IRFAN YOUSUF”, bearing Registration no.11604560 in partial fulfilment of the requirement for the award of degree M.Tech. in Transportation Engineering to Lovely Professional University, Phagwara, Punjab is a record of the candidates own work carried out by him under my supervision. The matter embodied in this thesis is original and has not been submitted for the award of any other degree.

Approved as to style and content by:

Mr. Waseem Akram

Assistant Professor

Transportation Engineering

Ms. Mandeep Kaur

Department Head

Transportation Engineering

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IRFAN YOUSUF

**11604560
RC1612A12**

ABSTRACT

The overlong main north– south National Freeway in India is National Highway 44 (NH 44). It originates at Srinagar and finishes in Kanyakumari. This freeway covers the regions of Jammu and Kashmir, Punjab, Haryana, Delhi, Uttar Pradesh, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.[1]. However, we learned around 45 km of street length from Phagwara to Ludhiana. In which we discover different issues related with that road like blockage, speed constrain, mishaps, dark spot, crest hour movement stream, the normal speed of the vehicle. Transport division assumes an imperative part in enhancing and upgrading the financial state of any nation or states. Since real measures of merchandise have been provided through highways ways if the activity condition like movement stream smoothness and steady, issues looked by street clients amid driving time, security insurance and planning of the street ought to be considered. India is having one of the biggest coordination on the earth covering around 64285009 km at display time. As figured in percent, street arrange conveys around 65% as goods and 90% of traveller movement. The investigation has demonstrated that movement is grown 7% to 10% every year while vehicle populace development is around 12% every year. Among them the national road is the blood vessel streets which joins the various neighbouring nations, states capitals, business and vacationer focuses. This demonstrates the blockage in activity stream and drops in the level of service (LOS) on our street grid. The different approach has been performed to comprehend the activity stream and reduces the movement congestion.

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INTRODUCTION

1.1 GENERAL

The stream of movement is analysis about person on foot, drivers, vehicles, cyclists, others explorers and foundation (roadway, sign and gadget of activity control and so on.) with the primary marvel of understanding and creating of the street coordinate with the smooth development of movement and which causes least movement congestion. Transportation is the fundamental wellspring of economy to the nation or world so we need to keep up the activity stream smooth and mischance free region with the goal that it doesn't influence the economy of the world or independently, different examination has been performed in transportation field to influence the movement to stream smooth and consistent.

The scope of transportation agenda has grown to a boundless level. This urged the expansion in vehicular movement mostly in remote transport form. The number of citizens in Punjab is increasing day by day. The power of the activity and people on foot crossing has extended altogether and there remains no degree for expanding the street length and broadening because of land procurement issue principally at intersections in different customs. For an group of reasons, intended for, populace, monetary and auto tenure development, growing movement request can surpass the transmission limit of the path amid crest phases. As a result, activity situation decays and danger make worse. The bound of a road is signified by the greatest amount at which traffic can go via a given fact in a hour beneath peak dominant situations.

This investigation depends on Traffic Flow Study and Highway Volume of NH-44 in this we endeavor to make sense of it different parts of issues identified with that street which impact the activity stream to run smooth and steady and attempt to discover the dark spot of that street. With the goal that this investigation ought to be useful to all that street clients to keep away from any sort of mishap and issues amid voyaging and understudy in future for their examination.

In India by and by 4.2 million km length of the aggregate road arrangement is accessible yet India is confronting gigantic challenges in giving better vehicular activity stream and operations. The primary wellspring of transportation in India is by street. Fast and persistent increment populace is real issue for Highway engineers. Because of increment in populace the diverse methods of transportation are Increases in urban areas which are brought about stuck activity condition out

and about. Streets assume the important part in the transportation of products and travelers for short to medium separations and street transport is more adaptable than different methods of transport. Street transport assumes critical part in percent share in India's GDP. Be that as it may, now daily's the activity conditions on Indian streets are very heterogomous in nature because of an assortment of vehicles with various static and dynamic qualities. The vehicle extent is significantly more various with many ineffectively performing vehicles, moderate moving vehicles and non-mechanized vehicles. From a productive and expanded vehicular movement it requires better roadway framework with higher limit. Along these lines for powerful arranging examination and operation there is a need to discover the movement volume and gauge roadway limit. The limit of a street I significantly impacted by roadway, movement condition and driver condition. Roadway condition comprises of geometric parameters, for example, path width, bear width, Horizontal geometry and vertical geometry. Out of which path width and shoulder width significantly affect the movement stream. The limit estimation of streets is finished by utilizing different conventional models and in addition by utilizing Microscopic reproduction show. This paper fundamentally concentrates on the survey on a near investigation of techniques utilized for limit estimation [1].

1.2 Objectives of the Study

- 1) Activity stream is managed to just a single course of development, hence wiping out extreme clashes between intersection developments.
- 2) Every one of the vehicles entering the turning are tenderly compelled to lessen the speed and keep on moving at slower speed. Accordingly, none of the vehicles should be halted, dissimilar to in a signalized crossing point.
- 3) As a result of lower speed of transaction and end of serious clashes, mishaps and their seriousness are substantially less in rotaries.

- 4) Rotaries are self-administering and don't require basically any control by police or movement signals
- 5) They are in a perfect world suited for direct movement, particularly with unpredictable geometry, crossing points with more than three or four methodologies s.
- 6) To revision the current traffic condition for the particular road expanse of Phagwara to Ludhiana City.
- 7) To assess the movement execution operation and transport situation of blended activity in a urban extend of Ludhiana.

1.3 Need of Investigation

a. Traffic flow

It can be well-defined as a mathematical study of the movement of means of transportation over road network. The subject is a mathematical approach to define, characterise and describe different aspects of vehicular traffic. The subject has virtually grown from the measurement in the field of various characteristics of the traffic and the urge to describe these observed characteristics in precise mathematical language, with a view to understand traffic behaviour better. The study is of great importance to a traffic engineer as it provides him with a comprehensive knowledge of vehicular traffic, leading to improved techniques for the control, regulation and management of traffic. Road traffic inevitably causes congestion, queuing and delay occur in all congested situations. Delay causes economic loss since time mean money in the modern age. A study of queuing and delay is, therefore of great relevance to a traffic engineer.

b. Highway capacity

Capacity of a facility is the maximum hourly frequency at which individuals or vehicles can be practically be likely to cross a point or uniform segment of a street or highway during a given time period under dominant roadway, traffic and fixed conditions. The interval period normally used for expressing volume is hour, and capacity is, therefore, expressed in so many vehicles or persons per hour. Sometimes it is considered more expedient to bring all the vehicles to a common type,

usually the passenger car. The capacity is then specified in passenger car units (PCU) for every hour. These conditions affect the ability of the roadways to accommodate traffic and hence it is essential to state these conditions whenever capacity is being expressed

c. Performance measures

Each facility type that has defined method for accessing capacity and level of service also perform some measures which are useful for calculations. These measures shows the operating situation of facility, given set of roadway traffic and control conditions. Performance measures that characterize flow conditions of traffic examples speed of travels and density on freeways, signalised intersection, delay and pedestrian walking speed

1.4 Importance of study

The importance of this study is to provide safety for the road user, as we know that in the present era vehicles are growing in a very fast manner so there will more chances of accidents in the highways. Due to the more number of vehicles on the highway it will also cause congestion, so after studying this we will get know how to overcome the congestion on the highways. By this study it will be economical for the road user.

LITERATURE REVIEW

2.1 General

- Pratik U. Mankar, Dr. B.V Khode, March 2016, Comparative Study of Methods used for a Capacity estimation of Road[1]

These days the movement is growing quickly and activity volume on streets surpasses as far as possible. The movement conditions on Indian streets are exceptionally heterogeneous in nature because of an assortment of vehicles with various static and dynamic qualities. Investigation of different qualities of street activity is essentially required for the arranging, outline and operation of roadway services. For an extended vehicular it requires better roadway framework with higher limit. For the limit examination of street it is very hard to evaluate the movement volume and limit of roadway offices under heterogeneous activity condition. This paper examines and survey the Capacity estimation of streets under heterogeneous movement condition by different creators and the elements impacting the limit of streets and parameters to influence the limit of streets is assessed and considered. This Paper is able to utilize for investigating distinctive strategies utilized for Capacity examination of streets to enhance the roadway and movement condition.

- Adam John Leslie, Mitsuru Saito, Chair Grant, G. Schultz, W. Spencer Guthrie 2012, Analysis of Traffic Flow and Capacity at the Beck Street Work Zone[2]

Work area limit has been a remarkable issue, yet limit information at work areas have been gathered just periodically. The Highway Capacity Manual 2000 gives just a constrained exchange of this issue. As more restoration or modernisation of existing public road occur, it ends up plainly basic that Utah Sector of Transportation activity engineers take legitimate limit gauges for various work areas activities. These setups incorporate incomplete path terminations, bear terminations, limited paths and path intersections. Appropriate limit gauges are basic keeping in mind the end goal to effectively assess capacities with respect to these work zone control measures, appraise conceivable lines that would be shaped, and assess the impacts of various work zone activity

control measures on line relief. The Beck Road work area was chosen for this investigation since it gives data about Interstate 15, which is the most utilized hall in the Salt Lake City territory. When models for stream rate, thickness, and speed were finished, the general limit of the Beck Street work zone subsequent to encountering a path lessening from 3 to 2 paths was resolved to be roughly 1,350 vehicles for every hour per path (veh/h/ln), much lower than a commonplace one turnpike path limit of around 2,000 veh/h/ln, however just marginally lower than anticipated for a work zone in light of a normal of 1512 veh/h/ln from comparable investigations.

- Breeten Singh Konthoujam, Dr. M. R. Rajashekara 2015 A Study on Urban Road Widening Project based on Prediction of Level of Service (LOS) – A Case Study in Banerghatta Road Banagalore[3]

The street system of any city is its life saver and the assessment of their execution is exceptionally important for future movement arranging, plan, operation and support, and so on. Movement stream in many urban areas of India is a blended activity trademark and furthermore the movement clog is the regular issue in most real urban communities in India. In Bengaluru city, the greater part of the streets are congested and work in Level of Service E or F. The goal of the present examination is to enhance the execution operation of the urban street arrange by proposing the best possible other options to improve the road traffic capacity. To accomplish this goal, a total system for examining the combined activity stream in 2 km long extend from Koli Farm Gate to Jalli Machine Bus-stop in Bangalore city, along the Bannerghatta street, is chosen and studied. Traffic flow readings were done before augmenting of the street as volume and speed and speed stream relationship was built up to comprehend LOS and movement volume for future years anticipated to know the drop in LOS. In perspective of fast urbanization, the city is encountering a change in natural conditions and broke down physical improvements. In this manner, there is a need to approach the whole cosmic system of urban issues in a more complete way and plan for its precise advancement. The examination goes for accomplishing reasonable transport, expanded open transport ridership, sheltered and agreeable walkways, and so on by limiting the activity affect on the investigation territory. To enhance the activity execution, it is essential to receive a few contrasting options to evoke the ceased postpone time and enhance the level of service.

- Rahim F. Benekohal, Kivanc Avrenli, Hani Ramezani 2009 Traffic Movement Characteristic and Volume in Intelligent Work Regions[4]

This examination explored the impacts of executing ITS in work regions as a rapidity regulator quantity. While the kind of ITS sent in the work region can change examination, investigated the impacts of SPE off working velocity and working limit in keen work sectors. The working pace in a savvy work region is essentially affected by the path width, sidelong leeway, work force and the kind of ITS used in the work region. As specified by the products in regards to the speed-lessening impacts of SPE, it prompted huge diminishments in unkind vehicle speeds through the degree of the mean speed decrease contingent upon the free stream rapidity of vehicles. The outcomes demonstrate that the magnitude of mean rapidity diminishment actuated by SPE is directly identified with the free stream speed of vehicles earlier the SPE head winds up plainly unmistakable to them. When the working rate in the savvy work region is assessed by considering completely the speed-lessening factors, the working limit of the keen work region can be resolved from the connection amongst space mean speed also movement stream rate. As indicated by the outcomes, the operation of ITS in the work sector changed the connection among space mean speed and action stream rate by bringing down the velocities in the upper (uncongested) some portion of the speed-stream bend. By the speed-stream bend for the astute work region built up, single can apply the working rate as a contribution to precisely evaluate the limit of the smart work region under the overarching situations. Precise assessment of working limit of wise work regions offers ascend to more compelling process consistently, more exact redirection and explorer data for exchange steering and improved framework unwavering quality. In addition, it realizes enhanced learning on the qualities of movement stream in wise work zones. Meanwhile, the impacts of different sorts of ITS on work region, working pace and working limit have not however stayed explored. Accordingly, it has prescribed as upcoming exploration that the results of actualizing different sorts of ITS, for example, alterable memorandum signs, adjustable speed points of confinement and lively dawn converge in interstate work regions be examined keeping in mind the end goal to pick up a more extensive comprehension of the movement stream qualities in clever work regions.

- S.velmurugan, Errampalli Madhu, k. Ravinder, k. Sitaramanjaneyulu & s. Gangopadhyay 2010 critical estimation of roadway capacity of multi-lane high speed corridors under heterogeneous traffic conditions through traditional and microscopic simulation models [5]

The central point influencing the Road User Costs (RUC) remain the speed combined with activity stream qualities at which automobiles work on streets, which thus decides energy utilization and added charge segments each unit remove voyaged. Since, the Government of India has been involved with roadway limit increase by construction multi-path partitioned carriageways to interface real urban areas through the usage of different activities, as, Golden Quadrilateral, North-South, East-West and Expressway Passageways amid the furthest current years. These fundamental changes in street organize combined with fundamental headways in vehicle innovation have brought about colossal varieties in speed - stream qualities, which required the advancement of selective speed-stream conditions and roadway limit with respect to multi-path parkways. Appropriately, an endeavor has been made in this Paper to expressly think about the speed - stream qualities on shifting sorts of multilane parkways enveloping four-path, six-path and eight-path separated roadways in plain terrain. From the gathered information, permitted speed shapes and speed – stream conditions for various automobile sorts for changing widths of multi-path parkways in the nation has been produced in view of customary and minute recreation models and thusly roadway limit has been assessed. Further, the path change conduct of various vehicle sorts has been widely examined and its effect on roadway limit has been assessed on multi-path parkways. At long last, the Policy Facility Capacity for fluctuating sorts of separated carriageways counting four-path, six-path and eight-path consumes the developed with a sensible level of validness underneath predominant mixed activity circumstances on different-path thruways in India. In this examination, allowed rapidity profiles and speed – stream conditions for various vehicle sorts for shifting sorts of multi-path interstates has been built up without precedent for the nation in view of conventional and tiny re-enactment simulations and consequently street limit has been assessed. Further, the path change conduct of various vehicle sorts has been broadly examined and its effect on street limit has been basically assessed on different path parkways.

- Nipjyoti Bharadwaja, Shriniwas Arkatkarb, Ashish Bhaskarc, Gaurang Joshid Expressing Traffic movement on Intercity Expressways in India: lane vs. manoeuvring traffic flow behaviour.[6]

Interstates are the most noteworthy class of roadway services. They are intended for a speed in the scope of 100 to 120 km/h and are worked as completely get to controlled streets with exchanges at all areas, where other minor streets cross. Furthermore, in intercity freeways moderate moving vehicle classes like bikes, three-wheelers are not permitted. Due to such particular highlights, movement stream practices of Expressways are fundamentally not quite the same as rest of the multilane streets under blended activity conditions winning in India. In spite of the fact that the level of heterogeneity is less for interstates contrasted with other multilane streets in India, still activity stream conduct on Indian turnpike is not the same as expressways in created nations like the USA. The nearness and execution of multiclass overwhelming vehicles (e.g. Trucks of various axles and weight-to-control proportion, Busses, Light Commercial Vehicles), path teach, path evolving and so forth are the components making the distinction in execution of freeways in India to that of created nations. In India parallel appropriation of vehicles may differ in light of the vehicle speed, as well as in view of the kind of vehicle. For instance, the majority of the autos might dependably want to be as close as conceivable to middle side path (MSL) contrasted with other contiguous paths. Likewise, moderate moving substantial vehicles, for example, trucks might want to be more on bear side path (SSL), especially on turnpikes. In light of such attribution, however vehicular movement is principally included autos activity with a sensible extent of substantial vehicles on freeways, the dissemination of these vehicles isn't uniform for every one of the paths. Subsequently, the connections among essential parameters of continuous office, i.e., speed; stream and thickness are altogether unique for various paths and also for provided guidance of movement stream. Among the three essential parameters of activity, speed has been most ordinarily featured in different examinations since it is specifically identified with movement security and nature of-benefit. Evaluation of progress in vehicular collaborations, over an widespread variability of roadway and activity stream circumstances, should be possible better by taking velocity as the measure of execution, since it mirrors the blend of the components adding to the general impact of Paper Number: 221 the kind of vehicle on the execution of the movement

stream. The speed-stream relationship in such manner, has additionally been an imperative issue for movement operations and nature of administration. Extent of substantial vehicles is another factor that profoundly affect movement stream parameters. Substantial vehicles may influence activity stream in light of their inhabitations on streets and furthermore their execution. Thusly, more is the extent of overwhelming vehicles in a movement stream; the lower is the normal mean speed of the stream. It additionally relies upon the method for its demeanor that is bearing astute (considering whole roadway width) or path insightful. The learning on impact of substantial vehicles dispersion and extent on the speed-stream relationship is once in a while contemplated. This sort of concentrate under movement conditions winning in creating nations especially in Asia can be truly a fascinating contextual analysis. Tending to the previously mentioned explore issues, the present investigation is led with a rationale to comprehend variety in speed-stream connections for various paths of Indian turnpikes. These connections are then contrasted and rules and benchmarks gave by the HCM (2010) and HBS (2001). Such sort of similar investigation can positively enhance the understandings of how expressway frameworks work in various nations with various control systems and driver conduct designs. The paper additionally means to research the impacts of extent and dispersion of substantial vehicles, for example, trucks on speed-stream relationship. What's more, this paper additionally endeavor to interest the operational freedom of one path to neighboring path. Whatever remains of the paper is organized as takes after: the following area gives a writing survey took after by the points of interest of the investigation site and field information accumulation. From there on the points of interest of the embraced strategy and investigation with respect to impact of the substantial vehicle proportion on free stream speeds, dispersion of overwhelming vehicles over the carriageway width among various paths, operational autonomy of paths are given.

- Stephen Agyeman, Herbert Abeka, Samuel Boamah Asiedu 2015, Capacity and Performance Analysis of 3 Roundabouts in Sunyani[7]

These days activity blockage at convergences is one of the fundamental societal, monetary and ecological issues in urban regions which especially wind up plainly extreme amid top hours. Roundabouts are being weighed up as a substitute for movement control gadget equipped for enhancing wellbeing and compelling working at hubs. This investigation broke down limit and

execution of 3 noteworthy roundabouts (Jubilee Park, Cocoa House and Post Office) in Sunyani, Ghana. Activity information were gathered physically at the roundabouts amid top hours in the interim of 15 minutes. Additionally, as-manufactured geometric information of the roundabouts were measured in the field. Synchro in addition to SimTraffic 7 programming's were utilized to run PC reenactments to appraise the limits and exhibitions of the roundabouts. Results demonstrated that the Jubilee Park and Post Office roundabouts were performing above limits in view of the general volume to limit proportions of 0.78 and 1.13 separately, with convergence limit usage (ICU) level of administration H. The roundabouts were no less than 9% above limit and were being subjected to clog periods in overabundance of 120 minutes for every day. Correspondingly, the Cocoa House indirect with volume to limit proportion of 0.51 and ICU level of administration G was 9% over the movement conveying capacity and experiencing progressive blockage times of 60 to 120 minutes. The 3 roundabouts ought to be signalized to enhance vehicular development.

□ James b. Michael, datta n. Godbole, john lygeros and raja sengupta,1997,capacity analysis of traffic flow over a single-lane automated highway system [8]

We ascertain limits on per-path Automatic Freeway System limit by way of a component of vehicle capacities in addition regulator framework data assembly. We accept that the AHS path is devoted for use by completely robotized vehicles. Limit is obliged by the minimum intervehicle partition vital for safe operation. A system for inferring the protected least between vehicle detachment for a specific security rule is exhibited. The between vehicle division, which relies upon the vehicle braking ability, control circle delays and working velocity, is then used to process site-free upper limits on AHS limit with regards to a given blend of vehicle classes. The affectability of the limit as for the level of between vehicle collaboration, registration approaches (administering least satisfactory vehicle-braking ability), parkway speed breaking points, and path utilize arrangements (overseeing the sharing of a path by numerous vehicle classes) is additionally examined.

➤ Pothula sanyasi Naidu, Gundu Navya, Chukka Deepika, Mahesh Yamala 2015 Capacity Road with vehicle Characteristics and Road Geometrics Interface Modelling [9]

The limit of streets assumes an essential part in expecting better system attributes and in giving great execution of streets. Limit esteems assume a critical part for promote changes of streets. Different geometric measures like carriage way width, walkways, benefit streets, skirt, medians, and street hold and movement designs identified with various streets. Traveler auto proportionate (PCE) and Passenger auto Unit (PCU) are commonly utilized for street limit investigation with heterogeneous movement conditions. This paper presents imperative parts of limit assessment for street planning utilizing PCE as opposed to utilizing PCU. A numerical model is created which utilizes IRC particulars on which relapse examination is performed for limit esteems accommodated urban streets, which are utilized for creating standard limit capacities. Relations amongst limit and cross area components are recognized, which infers the limit affecting zones. This connection helps in considering variety in limit as for different widths of street components. Movement components are additionally considered on par of examining this measure with PCE property. Effect of geometrics and street components on limit is considered and limit is inferred on the premise of PCE and street geometric elements, which brings about reasonable winning street limits in Indian streets.

- Jain K, Jain S S and Sing M 2014 Traffic movement characteristics for Multilane Roads in India 2014 [10]

The activity creation on multilane parkways in India contains an extensive variety of vehicles as far as their sort, estimate, motor control, moving capacity, and so forth. This blend of vehicles with various working capacities brings about an expansive scope of speed. Moderate touching or non-mechanized automobiles possess the minor scopes of rapidity range while the fresh innovation autos overwhelm the advanced extents. To comprehend the genuine movement conduct, it involves evaluation of a portion of a essential activity stream attributes for example, Speed, Density and Possession. The fundamental variations in street arrange also, automobile innovation have brought about varieties in speed-stream qualities. The issues emerge out of three noteworthy angles related with a few vehicles in the movement blend i.e. rapidity and quickening abilities of automobiles, moves and sidelong leeway prerequisites inside the privilege of street. The fundamental target of

the current investigation can evaluate essential movement stream constraints aimed at six path partitioned activity stream below examination and advance speed-stream connections for six path separated roadways for various vehicle sorts.

RESEARCH METHODOLOGY**3.1 General**

Depiction of the Area of Reading Phagwara district is the territorial Center of the Jalandhar Region of Punjab and is among the quickest developing urban areas in Punjab. The area imparts fringes to Pathankot city toward the north, Dharmshala East locale of the Himachal, The Ludhiana region toward the south. As indicated by the 2012 lodging and populace evaluation, Sunyani municipally has of around 248, 496. The roundabouts utilized for this investigation were the primary roadway from Jalandhar to Delhi The elevated perspectives of the last two are appeared in Figures 1(a) and 1(b) The multilane roundabouts with comparative attributes have 2 passage paths from each approach and 2 circling paths with a non-safe middle. The inward circles which enable course to different paths every which way have track cook's garments on top with grasses planted in them. The roundabouts have person on foot crosswalks on each approach for safe people on foot crossing. The 4-legged roundabouts have movement lights at their focuses. The Post Office indirect permits movement spill out of G.T Road Township street, Municipal Hospital street and Chandigarh street. The Leg 1 of the interstate indirect is a blood vessel street from the Local towns of Jalandhar, leg 2 is a street from the focal business region (CBD), leg 3 is the blood vessel street from Gurdaspur and leg 4 is the street from the close-by ranges. The aeronautical perspectives of the parkway under examination

The further methodology used in this study is as follows.

- A. A point by point examination which incorporates surveillance and geographical investigations observation study was done to recognize the issues relating to the convergences, stopping, dark spots, and so on and additionally distinguish the activity dissemination design in and around the investigation zone. This was trailed by the information accumulation exertion as essential and optional studies where essential

studies like activity volume tally, transport boarding and landing. Transport traveler assessment, stopping studies, and so forth were done to acquire a thought of the movement situation of the Study regions.

- B. Traffic survey and investigation: The gathered information was studied to recognize the Roadway Sections limit and Level of Facility, in view of the Indian Highways models obtained from Procedures for Bulk of Urban Streets in Plain Areas IRC 106-1990.



Figure 3-1: rotatory system



Figure 3-2: other side of rotary

3.2 Methodology for Assessing the Effective Capacity in Intellectual Work Regions

The methodology is to be enhanced for assessing the working rate in quick regions meanwhile the execution of ITS in work regions may prompt an alternate connection between work force and the ensuing pace diminishment. In this way, the speed-stream bends for effort regions created by Benekohal (2004) need advance adjustment to mirror the activity stream attributes in smart work area. In like manner, Kwonet (2007) discovered that the utilization of variable speed constrains in work regions can expand work region amount as high as 20 percent. In this way, consumption of ITS in a work region is relied upon to prompt an alternate speed-stream bend contrasted with that of a work region which could not convey ITS. Consequently, ground information is gathered in keen work regions with a specific end goal to set the proper connection between working pace and stream rate so as to set up the connection between the working rate and limit of work regions wherever SPE is utilized then information was gathered in a work region on I-55. As far as possible

in the work region was 55 mph. Additional informational collected on August 7, from 2 pm to 3 pm when SPE was executed in the work region. Since the various variables that impact the limit in the work zone, for example, climate situations, effort force, path thickness, and so forth remained the similar in the two cases.

DATA COLLECTION

4.1 Introduction to concerned Region

In this specified area from Phagwara to Ludhiana which covers around 40km of the road stretch and the time taken to cover this distance is 72 minutes. In this specified area we find out the high traffic volume in the peak hours and the dark spots of this stretch. Peak hour traffic can be counted in Passenger Car Unit (PCU) which tells us about the traffic volume of the given stretch. The impact on mode of transportation depends on different parameters like movement, swiftness, concreteness.

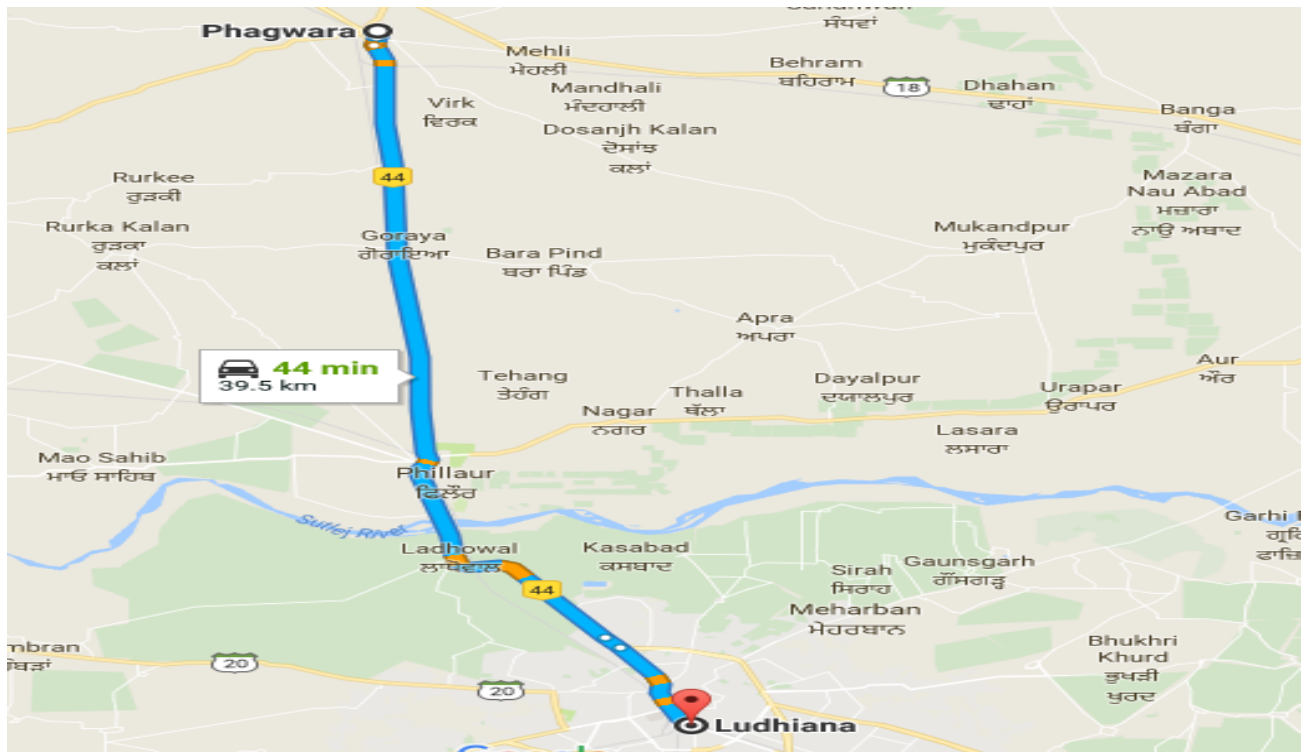


Figure 4-1: Phagwara to Ludhiana map

4.2 Data collected

Passenger Car Unit (PCU)

Activity in India is exceptionally heterogeneous, including diverse sorts of automobiles through generally changing stationary furthermore, dynamic attributes. One type of vehicle in the activity level can't viewed as proportional to some extra vehicle type, as already there is extensive contrast in their stationary and active attributes. The individual approach to measure the impact of various classifications of vehicles on limit is to change over all vehicles in identical number of a typical vehicle and thus all vehicles in the movement stream are changed over into equal amount of vehicles allocating equivalency elements to every other vehicle. This feature is recognised as Passenger Car Unit (PCU) and limit is communicated regarding PCU every hour. PCU esteems for different classes of vehicles are embraced as given in table 1.

Table 4-1 PCU as per IRC

Vehicle class	PCU
Car, private Taxi including pickup	1
Motorcycle	0.5
Bicycle	0.2
Bus, Tractor, Truck	3.5
Truck trailer	4.5

4.3 DATA COLLECTION ON DIFFERENT DAYS

MORNING SHIFT

Table 4-2: TRAFFIC FLOW ON 27-9-2017

Time	Trucks	Buses	Cars	Two wheelers
07:30 to 08:30	235	72	312	55
08:30 to 09:30	242	132	460	168
09:30 to 10:30	278	222	486	213

EVENING SHIFT

Table 4-3: TRAFFIC FLOW ON 27-9-2017

Time	Trucks	Buses	Cars	Two wheelers
04:00 to 05:00	310	230	861	180
05:00 to 06:00	355	245	873	186
06:00 to 07:00	368	177	960	113

MORNING

Table 4-4: TRAFFIC FLOW ON 28-9-2017

Time	Trucks	Buses	Cars	Two wheelers
07:30 to 08:30	238	77	308	43
08:30 to 09:30	235	145	477	54
09:30 to 10:30	313	225	470	66

EVENING

Table 4-5: TRAFFIC FLOW ON 28-9-2017

Time	Trucks	Buses	Cars	Two wheelers
04:00 to 05:00	318	192	855	167
05:00 to 06:00	345	233	832	187
06:00 to 07:00	360	207	810	110

4.3 PCU Calculations

MORNING

Table 4-6: TRAFFIC FLOW ON 27-9-2017

Time	Volume	PCU
07:30 to 08:30	674	1414
08:30 to 09:30	1002	1848
09:30 to 10:30	1199	2342

EVENING

Table 4-7: TRAFFIC FLOW ON 27-9-2017

Time	Volume	PCU
04:00 to 05:00	1581	2841
05:00 to 06:00	1659	3065
06:00 to 07:00	1618	2923

PCU CALCULATIONS

MORNING

Table 4-8: TRAFFIC FLOW ON 28-9-2017

Time	Volume	PCU
07:30 to 08:30	666	1431
08:30 to 09:30	911	1833
09:30 to 10:30	1074	2385

EVENING

Table 4-9: TRAFFIC FLOW ON 28-9-2017

Time	Volume	PCU
04:00 to 05:00	1532	2723
05:00 to 06:00	1597	2947
06:00 to 07:00	1487	2849

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