Optimization of Public Transport Demand: A case study of Ludhiana (Jalandhar Bypass - Railway station)

A PROJECT REPORT

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Submitted by

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CERTIFICATE

This is to certify that **Akshat Gupta** under Reg. no. 11301748 has prepared the Pre-Dissertation Report Titled "**Optimization of Public Transport Demand – A Case Study of Ludhiana (Jalandhar Bypass- Railway station)**" under any direction. This is a bonafide work of the above competitor and has been submitted to me in fractional satisfaction of the prerequisite for the honour of MASTER OF TECHONOLOGY in CIVIL ENGINEERING.

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ABSTRACT

There has been a rapid increment in the number of vehicles in all million plus cities in India due to improper transportation system and high vehicle ownership .The main reasons for not using public transport is because of unoptimized public transport ,poor service, less travel speed and more travel time. This problem can be solved by properly analysing the problem and then by proposing a suitable solution for that. This research is concerned of evaluation of public transport demand for Ludhiana and identifies the main factors for poor ridership with finding out the factors and promote the private car owners to use public transport. This can be done by taking various type of methods and plans. Here in my research I have decided to provide a separate lane for auto rickshaws on clock tower road till railway station as this road stretch is very important and the busiest one in Ludhiana. By doing so , the traffic on this road stretch will move in more systematic way which will ultimately make more room for other types of vehicles like two wheelers ,private cars, buses etc to move smoothly on the same road. This will reduce the travel time and congestion which will ultimately help in increasing the public transport demand by encouraging people to use public transport rather than the private mode of transportation. This study will also help in finding various solution to current problems in the Ludhiana city such as energy consumption, imbalance in model split nad poor traffic management.

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DECLERATION

I **AKSHAT GUPTA** (11301748), hereby declare that this submission is my own work and that to the best of my insight and conviction, its content no material beforehand distributed or composed by other individual or office. No material which has been acknowledged for reward of some other degree or certificate of the college or other organisation of higher learning with the exception of where due affinitions have been made in the content. It was arranged and displayed under the direction and supervision of **Mr. Akash verma** (Assistant Professor)

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INTRODUCTION

1.1   GENERAL

All cities in India which are having population more than million going through a critical transportation problems, due to the increase in population as people from smaller cities are migrating to urban cities .This growth in the number of vehicle population in the cities has brought a major transport demand in all million plus cities in India as shown in from Figure .In many cases, this call for has outstripped the existing street capability. Because of the reason it led to more congestion and delays which a matter of concern for us regarding transportation system and problems evolving from them. Pollution is one of the major issue which is very much undesirable but it is occurring due to overloaded roads. Another matter 0of concern is increasing number of accidents.
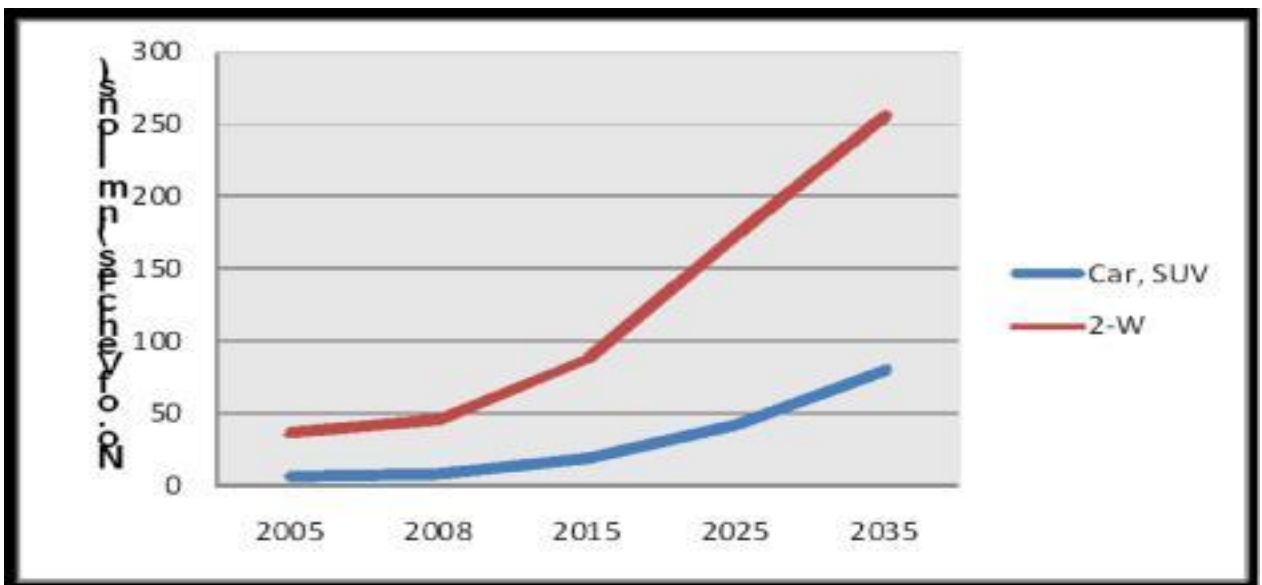
Fig. 1.1: Vehicle Populations Forecast of India
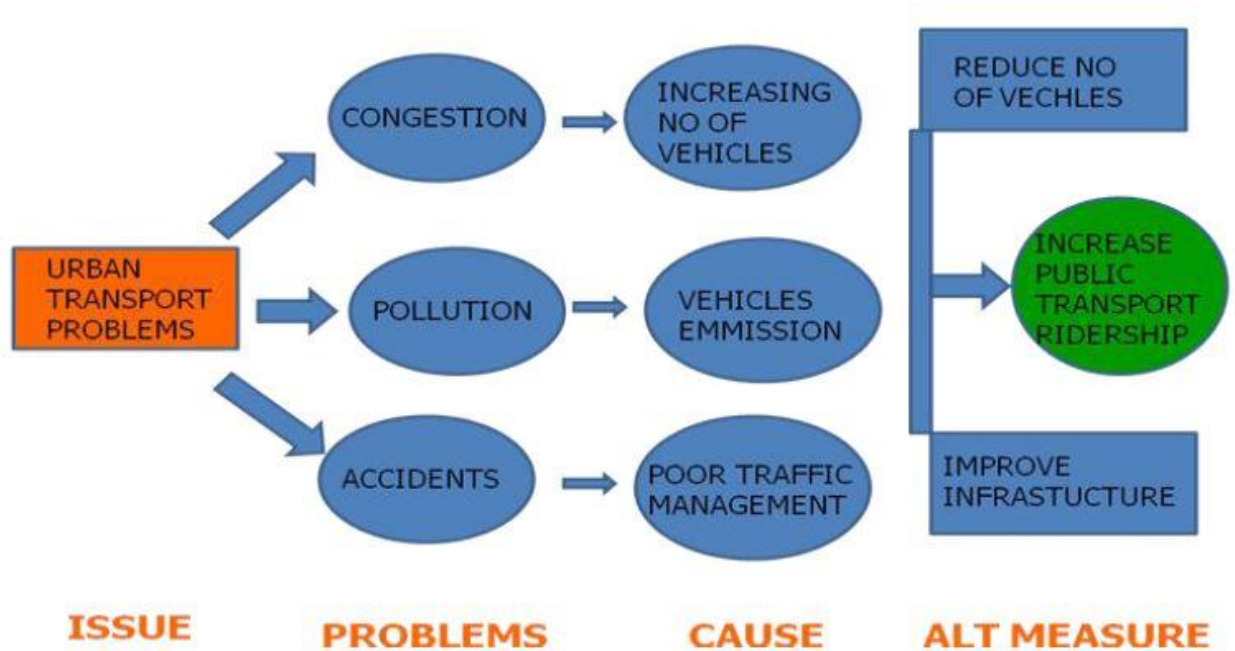
Fig 1.2: General way to improve Public Transport

Public transport is affect by mainly two factors which are internal and external factors. External factors cannot be controlled like household characteristics, population, employment, car ownership and income. Whereas internal factors can be controlled and policy decisions can be made .It includes service levels, travel time, trip length, fares etc. This figure shows the major issue, problems, cause and their alternative measures related to city transport and indicates that how public transport can lessen city's problem of congestion. These cities cannot cater only private vehicles and two wheelers. There should be a encouragement for people to use public transport rather than private vehicles.

	Cities with population between 1 million-2 million	Cities with population between 2 million-5 million	Cities with population more then 5 million
■ Private Transport	70	58	37
■ Public Transport	30	42	63

Source: Census 2011

Fig 1.3: Details of Urban trips in Indian

	< 5 Lakhs	5-10 Lakhs	10-20 Lakhs	20-40 Lakhs	40-80 Lakhs	>80 Lakhs
■ IPT	5	3	8	6	7	7
■ Public Transport	5	9	13	10	21	44
■ Car	27	12	12	12	10	10
■ Two Wheelers	26	24	24	29	26	9
■ Cycle	3	20	19	18	11	8
■ Walk	34	32	24	25	25	22
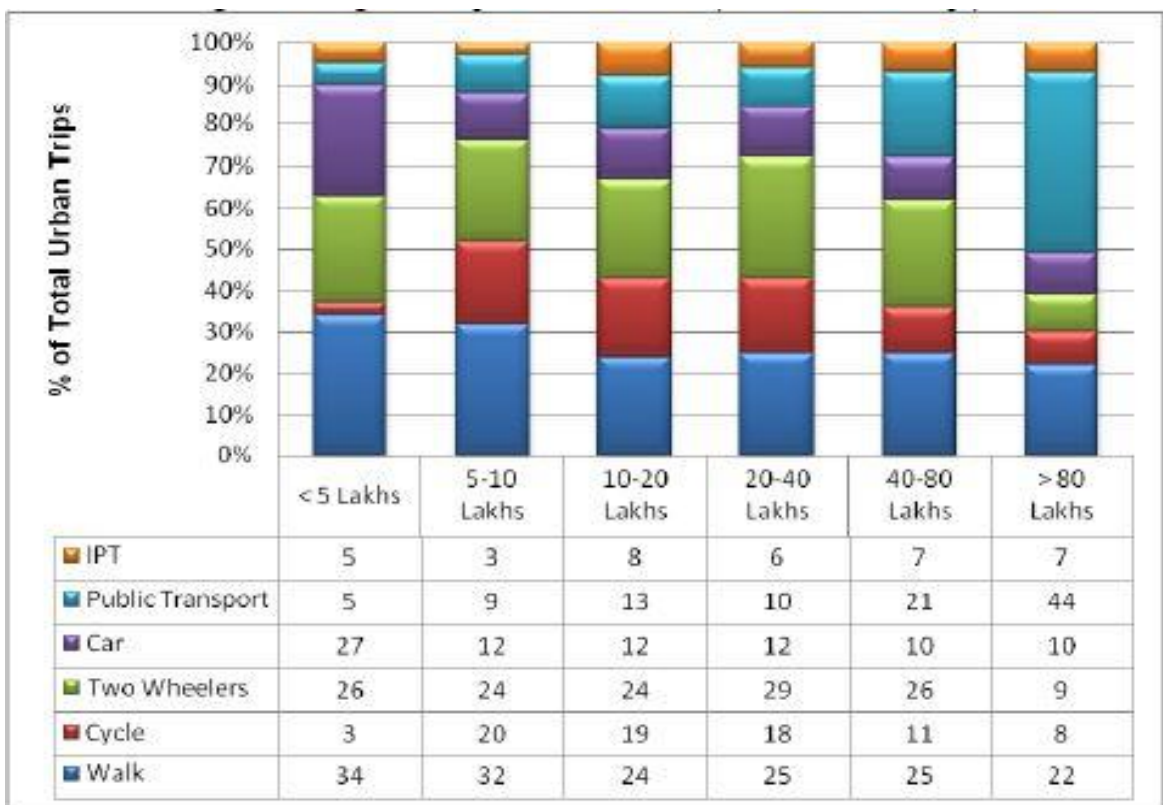
Fig 1.4 Existing Model split in Indians cities

Table 1.1: Category wise daily trips of cities

City Category	Population	Passenger trips/day (in lakhs)			
		2007	2011	2021	2031
Category 1	< 5 lakhs	8.5	10	13.4	17.2
Category 2	5-10 lakhs	263.1	308.3	423	558.3
Category 3	10-20 lakhs	427.7	498.2	675.6	871.9
Category 4	20-40 lakhs	183.6	210.4	309.6	433.5
Category 5	40-80 lakhs	403.6	469.8	675.2	868
Category 6	>80 lakhs	992.1	1124.9	1552.4	2054.7
Total		2286	2630.4	3661.2	4819.2

1.2 ABOUT LUDHIANA CITY

1.2.1 Bus Terminal:

In Ludhiana the important bus terminal is positioned within the centre of the town, which has vicinity of 14.66 acres. Buses move in all the directions on inter city and intra city roads. The Local Bus stands is also at some distance from central bus terminal.: -

Table 1.2: Yearly bus traffic route-wise

Name of Route	1999	2001	2003	2005	2007
Malerkotla Road	190	189	220	227	250
Ambala G.T. Road	480	484	494	490	506
Jalandhar G.T. Road	830	966	930	985	1035
Ferozepur Road	431	476	530	563	563
Pakhowal Road	31	136	136	141	141
Humbhran Road	32	76	76	76	76
Chandigarh Road	342	376	401	441	459
Mini Buses					
Ambala Road	-	-	11	13	13
Malerkotla Road	-	-	11	11	13

 Table shows that there has been a increase in number of buses with time .. Effective transport is the want of every metropolitan town and for towns which are developing at speedy tempo. The idea of public delivery is quite antique inside the city however trendy couldn't met with any affordable fulfilment thus far. If we talk about Ludhiana the services of public initially had 30 buses which was initiated by Punjab roadways which was further transferred we Municipal Corporation which is controlled by Private operators. But organised now this system has been transferred to state government then also it is not utilized properly as it is not properly. As bus stand is in the central part of the city therefore all routes terminate and originate from this place therefore it is very much congested all the time. Due to this problem people prefer travelling by cycle rickshaws , auto rickshaws and personal vehicles which ultimately leads to congestion ,parking problems, accidents, pollution etc in the city. Therefore it is urgent need of proper planning and implementation of rules.

1.2.2 Pattern of Vehicular Population

Registered car population in Ludhiana has reached over million mark as per given by the District Transport Officer, Ludhiana. The wide variety of registered automobiles has recorded greater than three fold increase for the duration of the 1995-2007 period when it rose from 2,ninety one,384 (1995) to 9,sixty one,988 (2007) to 12,00,000 (2017). 8-13% is the increase in annual growth rate. Highest boom in quantity was recorded in 2006 when almost 63,725 vehicles have been registered in a 12 months Of 2005-06. Approximately automobiles in keeping with month handed 5 hundreds.Among all of the vehicles twowheeler vehicles had most number of registration which is around 70% of total registration.. After 2 wheelers , 4 wheelers had 25% of the entire registrations. Therefore we can see that there both two wheeler and 4 wheeler makes 95% of total registration. The vehicles ownership has additionally been observed to be very excessive in comparison variably with Delhi metro.

TABLE1.3: pattern of growth of Registered Vehicles and category wise addition to the city on annual basis

Year	No. of vehicles
1992	2,19,628
1993	2,38,412
1994	2,58,056
1995	2,91,384
2001	6,80,494
2006	9,41,694
2007 (Till April)	9,61,988

1.2.3 Travel Characteristics:

RITES has conducted the survey in which he found that 13.92 lakh trips are done for various purposes in a working day.In home based trips were 92% which is 12.8 lakh and remaining 8% were non home based which is 1.15 lakh.

TABLE 1.4: Purpose wise distribution of passenger trips in Ludhiana is defined below

Purpose	Vehicular trips		Walk trips		Total		Grand total
	Intra	Inter	Intra	Inter	Intra	Inter	
Work	72851	447387	75403	34702	148254	482089	630343
	38%	58%	34%	36%	36%	56%	49%
Education	64066	154180	80915	323616	144981	186496	331477
	34%	20%	37%	33%	35%	22%	26%
Others	52651	168292	63773	29961	116424	198253	314676
	28%	22%	29%	31%	28%	23%	25%
Total	189569	769858	220091	96979	409660	866837	1276497
	100%	100%	100%	100%	100%	100%	100%
Total	189569	769858	220091	96979	409660	866837	1276497
Home based	68%	98%	98%	96%	82%	97%	92%
Non Home based	87633	18970	4702	4234	92335	23204	115539
	32%	2%	2%	4%	18%	3%	10%
Total	277202	788828	224793	101213	501995	890041	1392036
	100%	100%	100%	100%	100%	100%	100%

2 CHAPTER

LITERATURE REVIEW

Optimization of Public Transport Demand: A Case Study of Bhopal [1]. This observe deals with locating out the different troubles in optimization of public delivery call for and it also provide us with extraordinary answers to the problems. So the major reasons for now not the use of public delivery came out to be low accessibility, less comfort & greater journey and ready time in comparison to the private delivery modes. The evaluation of opinion survey additionally showed that almost 50% of folks that had been not the use of public transport have been doing so due to less handy journey, more incurred tour time, much less frequency among the successive trips and absence of accessibility within the modes of public transport. Some techniques for accomplishing favored public transport are Improving consumer facts, customer support, and advertising applications. Parking pricing, parking coins-out, travel trip reduction packages, and comparable applications that promote use of alternative modes. Modal integration, with transit carrier coordinated with strolling and cycling facilities, taxi offerings, intercity bus, and transport offerings (to facilitate purchasing by transit).Improving lodging of human beings with unique desires, which include humans with physical disabilities, negative imaginative and prescient and trouble studying symptoms. Improving security for transit customers and pedestrians

A case study on options to improve public transport in Hyderabad [2]. In this study they searched for the viable ways to improve public transport in Hyderabad metropolis. First of all they decided on the planning place with the help of Andra Pradesh State Road Corporation(APSRTC). They created unique bus network model and Development of different network options to optimise the network. Then they searched optimization of transportation improvement of value-performance. So with the assist of this take a look at they located out that extra bus stops are wished for higher accessibility. Also rerouting and creation of recent line course are required for excellent public transport network.

Best practices for Transportation demand management [3]. This study said that use of improves Transportation options like biking and walking, transit and ridesharing ,universal transit passes, road and parking prices, number of lanes , parking cash-out programs, commute Trip reduction Act and like these various method can reduce the load on roads and helps in implementing transport demand management.

Optimization of local public transport system [4]. This take a look at become performed in Perm Krai,Russia to discover the trouble of optimization of public transport device. They located out the issues which might be, presence of areas which are not served with the aid of public transport, presence of opposition between transportation modes, usage of small motors and small variety of hubs which permits the use of larger vehicles on the most popular segments and shortage of explicit routes. For these issues they indexed a few solutions like coordination of the timetables on distinctive routes will make using public transport simpler for those passengers who need to make a switch, The included price ticket implementation will enhance the excellent of intermodal trips due to the fact there might be no need to pay for the switch and the transfer becomes quicker, modifications of the settlement patterns, journey instructions, which include the modifications occurring because of the realization of the brand new infrastructural initiatives, and so forth.

Review of Capacity Improvement Strategies for Bus transit service [5]. By their take a look at we concluded that Bus structures have developed from unmarried path operations in small to medium length towns to excessive ability structures in big city agglomerations. Improvement in ability usage and working costs have come from incremental modifications in bus forestall places, scheduling, direction operations, course making plans, fleet management, unique infrastructure designs, and institutional systems. This indicates viable potential improvement because of incremental modifications in numerous aspects. GIS based selection support structures were located to be very effective in designing top-quality bus offerings. Bus transport carrier should provide at ease touring, affordable fare and minimal time for travelling. Providing green street network, superior routing and minimum postpone can make sure those attributes. The system efficiency can be assured by overall synchronization with all different associated factorsi.E. Route optimization, switch optimization, and feeder bus provider co-ordination.

Multi-goal Optimization Method of Public Transit Networks Based on Travel Behavior [6]. This observe stated that A mathematical expression of a public transit community is constructed in keeping with its description. On the basis of the analysis of the travel characteristics of bus passengers, the 4-stage optimization approach of public transit community is proposed. It also tells us that The shortest journey time model should beconstructed, with the aid of which the bus traces among one pair of OD may be optimized. The method indicates excessive efficiency for smallscale public transit networks; however, the technique can nonetheless be advanced and optimized to solve complex public transit networks.

Optimal design of public bus service with demand equilibrium [7]. This paper has examined the superior design of a bus transit machine analytically. The key layout variables taken into consideration are the gap between parallel bus routes, the frequency of provider on a route, and the fare. Optimal spacing among parallel bus routes and headway are observed to be proportional to every other for the identical objective feature without or with vehicle capacity constraints tested in this paper. The most reliable values with and with out capacity are based strongly on the demand mode desire coefficients of walk and wait time, over which substantial confrontation exists between making plans fashions and operators. Onthe other hand, fare degree without automobile ability constraint are extremely touchy to the mode desire coefficient of the wait and walk time.

Optimization of a Transit Services Model with a Feeder Bus and Rail System Using Metaheuristic Algorithms [8]. In this paper, an progressed version is usually recommended for the TNDP. The most important cause of this paper turned into to broaden a actual-life model (actualizing the cost function and adding extra constraints) for handling the TNDPs. The case look at used in this paper changed into extracted from the literature. Finding the superior feasible routes to lessen the price function is a vital and difficult undertaking for solving the TNDP categorised as NP-difficult hassle.

3   CHAPTER

OBJECTIVES OF STUDY

3.1 OBJECTIVES

The main motive of this study is to contribute to the know how public transport demand is affected from various factors. It may also perceive the impact of parameters like land use, travel-time, travel-value, accessibility, comfortability, population of place, in line with per capita income, affordability and flexibility onto the general public transport call for.

Identification of factors influencing public transport demand is the one of the issues of this research. Then effect of those factors on trip generation and modal split is also evaluated. Also, the role of those factors, i.e., how they could grow and influence the public transport demand as may also be regarded upon a good way to provide you with revolutionary solutions for growing the efficiencies in addition to aid for opportunity modes of public transport.

Extra emphasis is given in optimizing the volume and movement of auto rickshaws as their volume is very high on the selected stretch . so if we optimize the auto rickshaws movement then we will also led to some proper flow of traffic on this road. For this we are providing a extra lane for auto which will be a single lane without the overtaking space just like BRTS.

4   CHAPTER

METHODOLOGY

4.1 Overview of Tasks

The general approach to implement the study comprised the following tasks, which are
also described in detail in the following sections:

Data collection:

First we will do map study then next we will collect traffic data and accident data. Then in my
research it includes some miscellaneous data like Average speed, Average time, Distance, Total
,registered vehicles in Ludhiana, Population of Ludhiana, No. of stops while travelling on bus
,Number of registered two-wheelers & Four wheelers ,Waiting time for Bus, Carriage way, Number
of registered buses.

Data analysis

Within the planning area the bus network and the transfer points between bus routes

Development of different network options to optimise the network:

Iterative process based on basic model-information or output. For example socioeconomic
data (number of inhabitants, employees or the density per zone) can be helpful
to identify new customer potentials.

Analysis and assessment of the different options .

Selecting the best location From map study and analysis of all collected data.
After all this a formulation of plan is made and afterwards results and discussion is done on whole
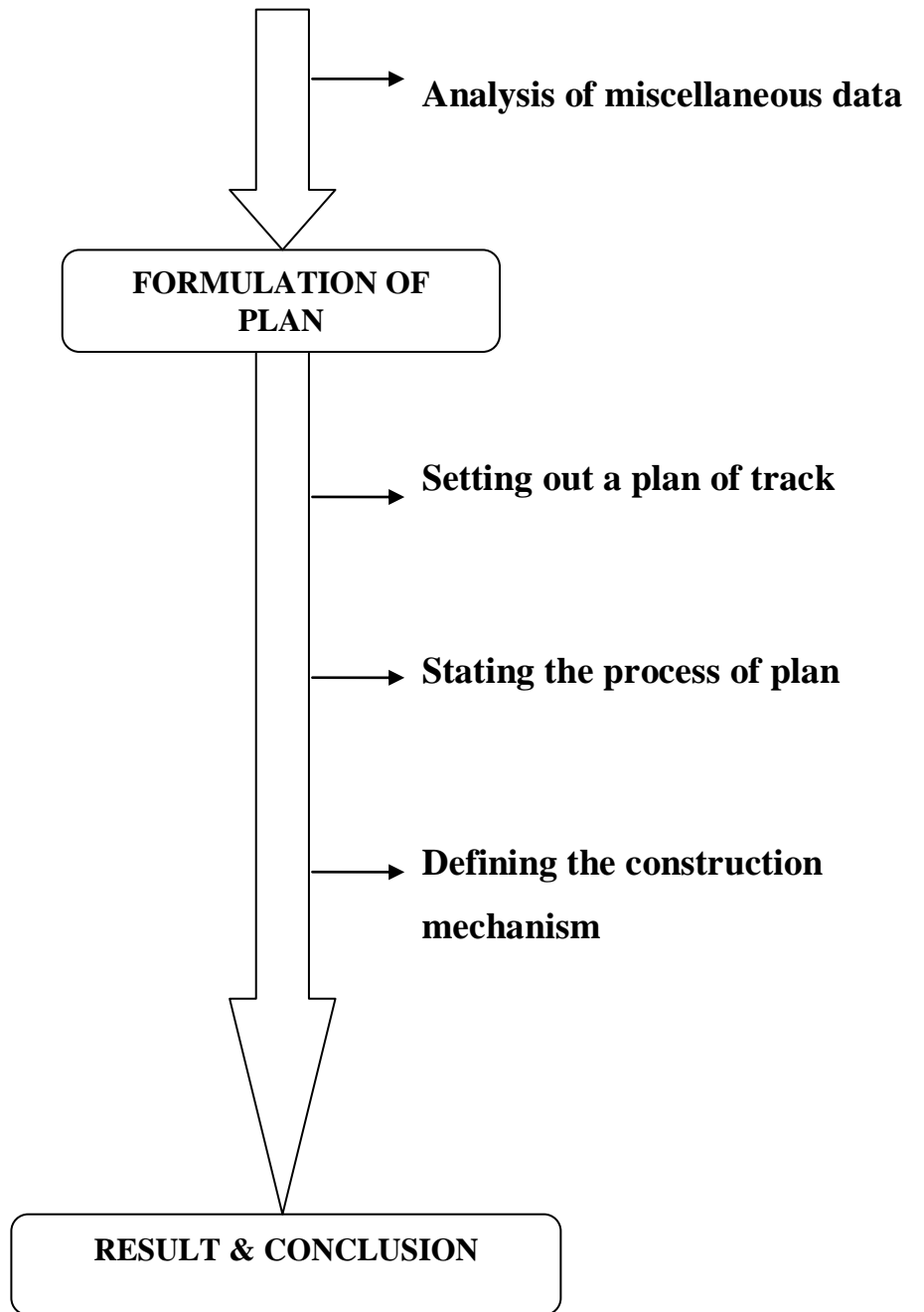study.

4.2 Flowchart representing the methodology

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        ┌─────────────────────────────────────────┐
        │   DEFINING THE PROBLEM AND GOALS         │
        └─────────────────────────────────────────┘
                          │
                          ▼
        ┌─────────────────────────────────────────┐
        │   DATA COLLECTION                        │
        └─────────────────────────────────────────┘
                          │ ──────────►  Map study
                          │
                          │ ──────────►  Traffic & accident data
                          │
                          │ ──────────►  Miscellaneous data
                          │
                          │ ──────────►  Road measurements
                          ▼
        ┌─────────────────────────────────────────┐
        │   DATA ANALYSIS                          │
        └─────────────────────────────────────────┘
                          │ ──────────►  Selecting the best location
                          │              From map study
                          │
                          │ ──────────►  Analysis of all collected data
                          ▼
```

Analysis of miscellaneous data

FORMULATION OF PLAN

Setting out a plan of track

Stating the process of plan

Defining the construction mechanism

RESULT & CONCLUSION

Figure 4.1: Flowchart representing methodology

5   CHAPTER

DATA COLLECTION AND ANALYSIS
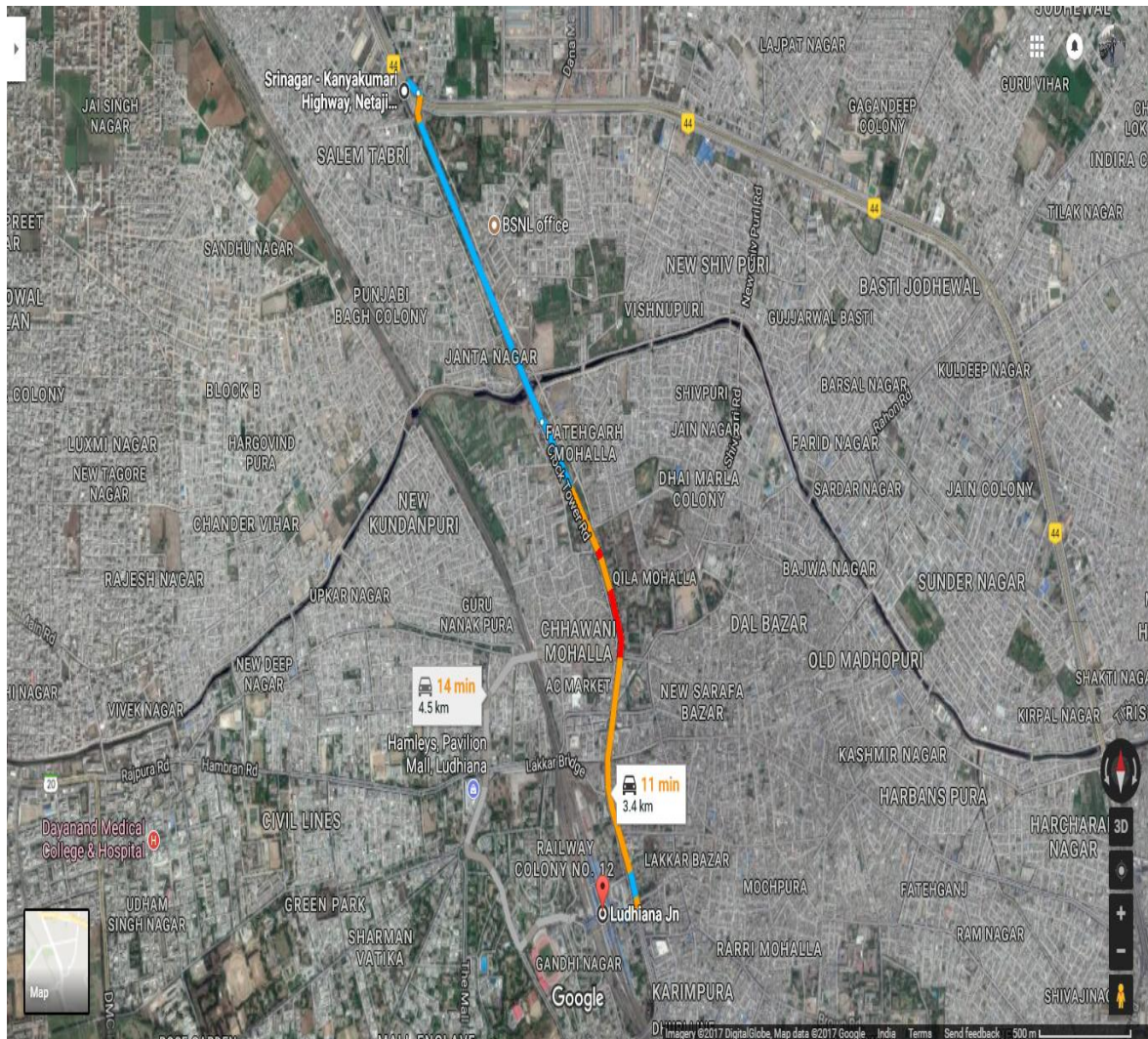
5.1 MAP STUDY & SITE SELECTION

Figure 5.1 : Map of Clock tower road

The study area has been selected in Ludhiana city which is from Jalandhar bypass chowk to Ludhiana railway station is shown in Fig.5.1. The traffic in this is very much high due to several reasons therefore there is need for optimizing transport in this area.

The solution which I am going to propose is provision of separate lane for the auto rickshaws. A detailed information and data is given in later part of this study.
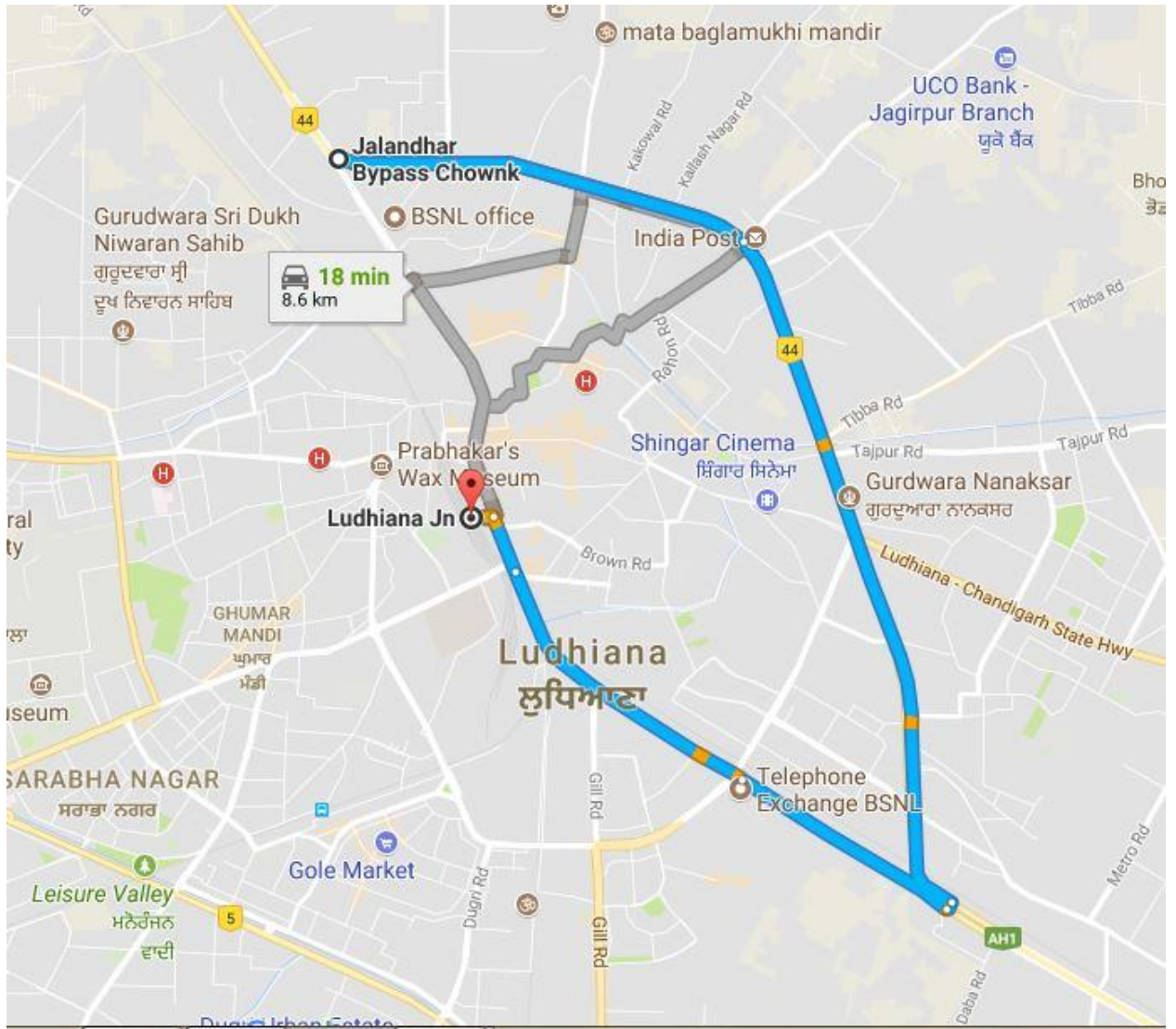
Fig 5.2: All possible routes to reach Ludhiana railway station from Jalandhar bypass

5.2 Traffic volume data

A traffic volume survey has been done on clock tower road which connects jalandhar bypass chowk to Ludhiana railway station and ADT (Average Daily Traffic) has been calculated and is listed below in the tables below .The primary step is counting the number of vehicles flowing on the road and secondary step is to arrange the count of vehicles and the route of vehicles. Vehicle classification has also been done as we used manual count method for getting traffic volume in that area.

Table 5.1: ADT (Average Daily Traffic) on Clock tower road

Time	Two Wheelers	Three Wheelers	Cars	Vans	Buses	L.C.V.	Bicycles	Rickshaws	Trucks
8:15-9:00	37	60	15	1	2	3	21	5	0
10:00-10:15	30	57	9	0	1	2	15	9	1
12:00-11:15	24	39	7	0	3	2	25	11	0
13:00-13:15	29	54	11	0	3	5	19	7	0
18:00-18:15	35	45	5	0	2	1	14	5	0
19:00-19:15	41	35	8	1	3	2	13	4	0
20:00-20:15	39	57	13	1	1	1	25	13	0

The above traffic volume data is collected for some particular time slot. These data has been collected for three days mainly Monday Wednesday and Saturday. There average traffic is given in table 5.1. From the above data it is clear that number of Auto rickshaws which are running on this road is not proper. There should be some rules or provisions should be made for running autos optimally. There are huge number of autos in running from jalandhar bypass chowk to railway station which are not really needed as buses are also running on this area which can be properly utilized for transportation purpose after some modification in bus timing and removing congestion from road. This can be done by providing separate lane for auto rickshaws and also taking actions on the autos which unauthorized to run on that area.

Fig 5.3: Traffic congestion in Clock tower road

5.3 Miscellaneous data

Various data has been collected regarding the traffic congestion problem in Ludhiana city and mainly on clock tower road. The data regarding average speed, average time of vehicles to reach railway station from Jalandhar bypass , length of road section , width of road section, causes for delays and congestions has been found and are tabulated here.

Table 5.2: Miscellaneous data

Average speed	9 Kmph
Average time	20 min
Distance	3.2 Km
Total registered vehicles in Ludhiana	24,08,107
Population of Ludhiana	20 lakh (as per census 2011)
Number of registered buses	6291
Number of registered two-wheelers	18,25,699
Four wheelers	31,694
Waiting time for Bus	10-15 min
Carriage way	10 + 10 m
No. of while travelling on bus	6 stops

5.4 Main reasons for poor Public Transport demand on selected stretch (Jalandhar chowk to railway station)

1. Market coming on the road:

Whole market along this road comes on the way of traffic movement which cause obstruction in movement of traffic because of which traffic congestion occurs. Due to more traffic, delays are caused which increases the travel time and ultimately people use two wheelers rather than buses and autos.

Fig 5.4: Market on road

2. Uncomfortable ride on buses:

People don't prefer the journey which is not comfortable. But this has been the case on this road stretch . Many people don't find comfortability by travelling by public transport so they use their private vehicles which increases congestion on road.

Fig 5.5: overcrowded Public Transport (Buses)

3. Excessive number of Auto Rickshaws:

Excessive number of autos runs on this stretch which are really not required. Therefore of occupancy of the autos are less and sometimes auto runs with one or two passenger which actually can carry 6 persons in one go.

Fig 5.6: Excessive autos running at same time

Fig 5.7 Autos running with low occupancy

Because of this reason we have decided to provide a separate lane for the auto rickshaws as they are in large numbers so they promote traffic congestion because of which people don't prefer public transportation. Optimization of movement of auto rickshaw will ultimately help in reducing traffic congestion which will further help in promoting the use of public transport. For this we are providing a extra lane for auto which will be a single lane without the overtaking space just like BRTS.

Width of one way lane of carriageway = 10m

Width of a three wheeler auto rickshaw = 1.3m

Proposed width of separate lane for Autos = 2.3m (0.5m spacing from side edge of Auto)

So this idea is feasible from possible space can be given or not point of view.

In Ludhiana almost 11000 registered auto rickshaws are running and also same number of unregistered numbers is also there which have support of the unions. Although autos are not the part of public transport and should be used by only private transport but they get permits from Transport Department and cause problems in traffic movement.

Previously many steps has been taken regarding autos rickshaws to reduce congestion on clock tower road but all have been ineffective. Like once it is suggested To reduce traffic congestion at Clock Tower Chowk and nearby areas, the traffic police have decided not to allow autorickshaw drivers to ply beyond Rekhi Cinema point. Assistant commissioner of police (traffic) Swapan Sharma said all autorickshaws which earlier plied from the bus stand to Clock Tower now had to take a U-turn from Rekhi Cinema point to travel back to the bus stand.

Fig 5.8 : Actual site condition

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