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# Connectivity and Timing Assessment of Public Transport System in Diverse Scenario in an Urban City Using Geo-Spatial Techniques

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**Abstract:** In modern context the connectivity of transport system is very important and necessary in an urban and smart city. Due to more population and more vehicles in an urban city, it is not very easy to travel from one location to another location in smooth manner. Availability of different kind of transport mediums like metro, buses, auto, ola, uber etc. helps in travelling within the city by covering different locations. Metro is considered as the primarily best and easy medium for travelling with least congestion and stoppage points. After metro, bus and auto are the secondary public transport medium having frequently used by public on daily basis. Other private transit modes are also available like Ola, Uber and Rapido, who charge according to the travel length, journey time and availability of their service in that area. But if we compare all of them in terms of availability, reliability, speed and smoothness, metro is taken as best and safe way to travel without any hesitation. The connectivity of Lucknow city which is the capital of Uttar Pradesh, India, is having good connectivity in terms of metro and bus medium. But beside metro, due to lack of infrastructure and good management it is sometimes difficult to move from one part of the city to another part by other public transport system. This study will assess the different parameters of public transport system and it will provide the correlation between them.

**Keywords:** Connectivity, Reliability, Infrastructure, Smart City, Smoothness, Transport System.

## I. INTRODUCTION

India is the fastest growing and developing country of 21<sup>st</sup> century having 2<sup>nd</sup> biggest country in terms of population after China. Smart city is a major part of the development through which the major infrastructure is required for developing the city. Economy, Investment and development is directly proportional to the availability of the traffic infrastructure in and around the city. Because connectivity reduces the travel time and helps in saving timing during travelling and goods delivery. Saving and utilization of the time during travelling is an asset for every person. Highway and road infrastructure plays a very important role and road infrastructure is very good in Indian Urban context. Government is working very fast on road infrastructure connectivity because movement of goods and people in less time is very helpful in economical and development context. The transport route and road development of an urban city can be easily seen and verify by the satellite data and other online services like Google Maps, Google Earth Pro etc. Through these applications we can easily identify the road route and locate the points or locations by digitizing them with proper color and legends. Lucknow Development Authority and public work department both are working on increasing the connectivity and dilution of traffic in real time at different locations of Lucknow. In this process Lucknow metro is playing an vital role by reaching many parts within the city. Different phases of metro are also undergoing and city buses, electric buses are also playing their role in efficient manner.

## II. OBJECTIVE OF THE STUDY

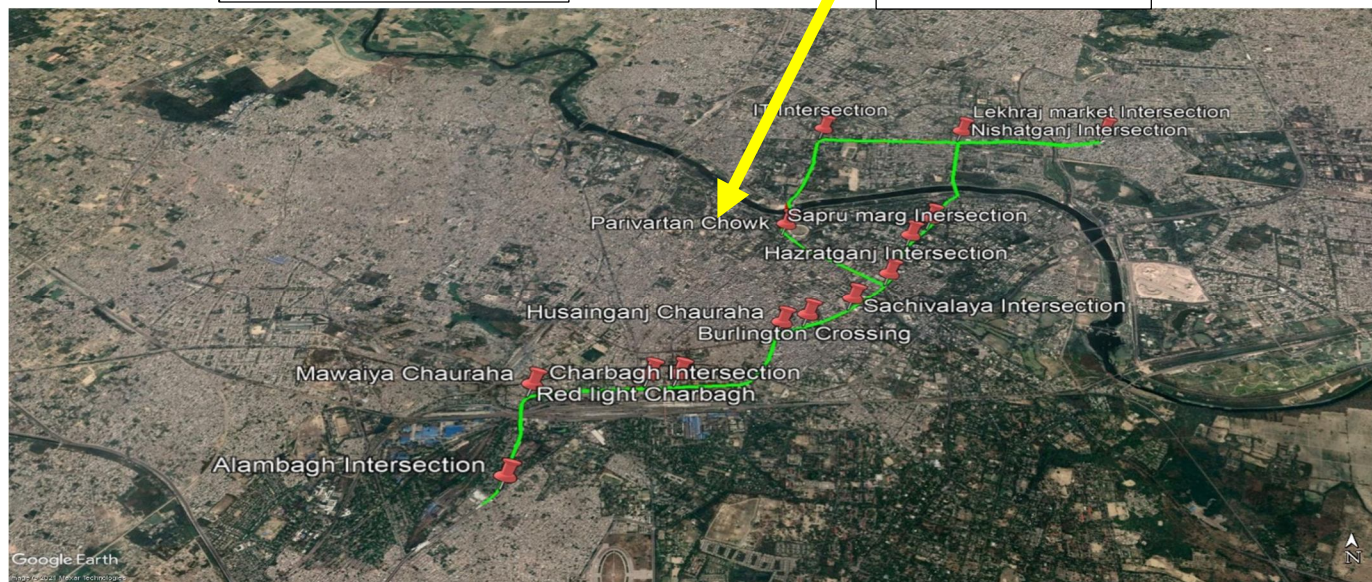
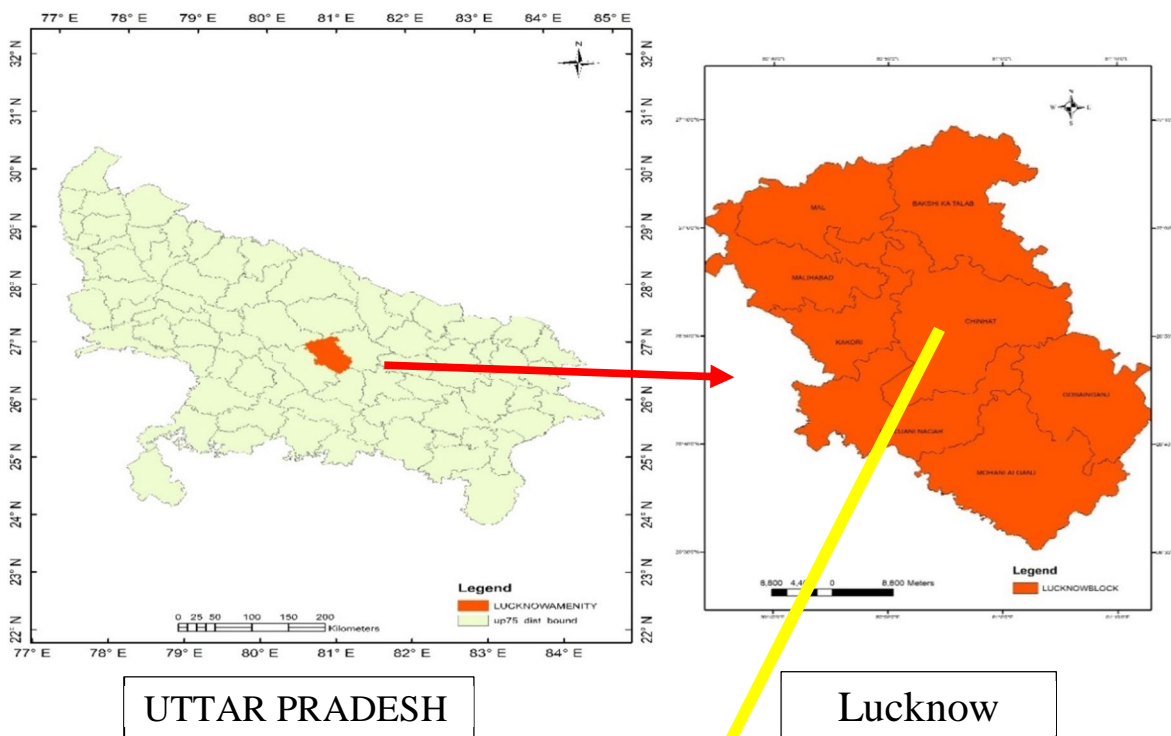
This study is assessing the different aspects of public transport facility and their efficiency in terms of these given parameters-

- A. Travel time calculation of public transport facility.
- B. Smoothness and availability at different points in an urban city.
- C. Connectivity analysis at different locations within city.
- D. Comparison between different available public transport mediums.

### III. STUDY AREA

The study area is Lucknow which is an urban smart city having population more than 35 lakh as census of 2011. But in 2021 it has crossed the population of 40 lakh and the impact of population is directly affects the transit movement and connectivity. The Study route is given below-

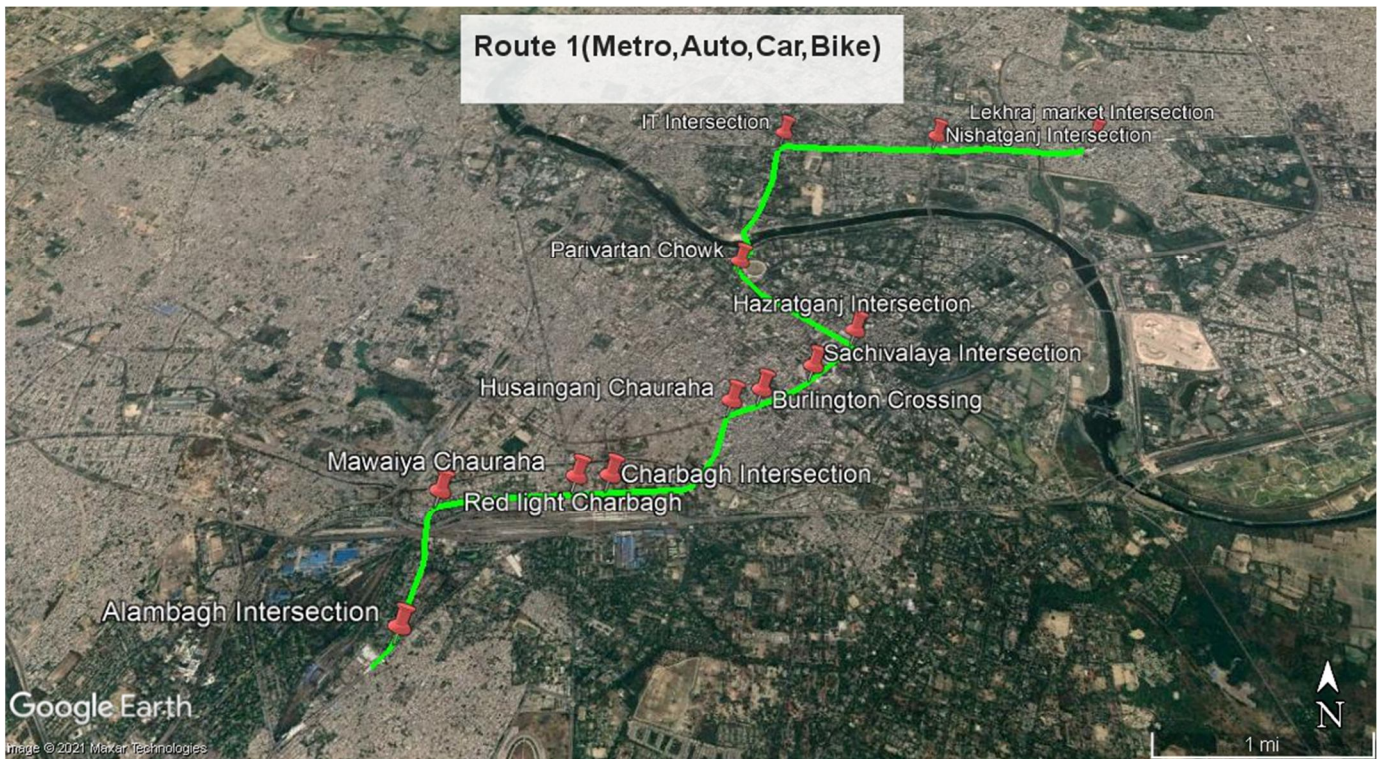
- A. Lekhraj Metro to Alambagh Metro Station. (Metro Route and Road Route)- Route 1
- B. Lekhraj – Nishatganj – Sikandar Bagh – Alambagh (Road Route only)- Route 2



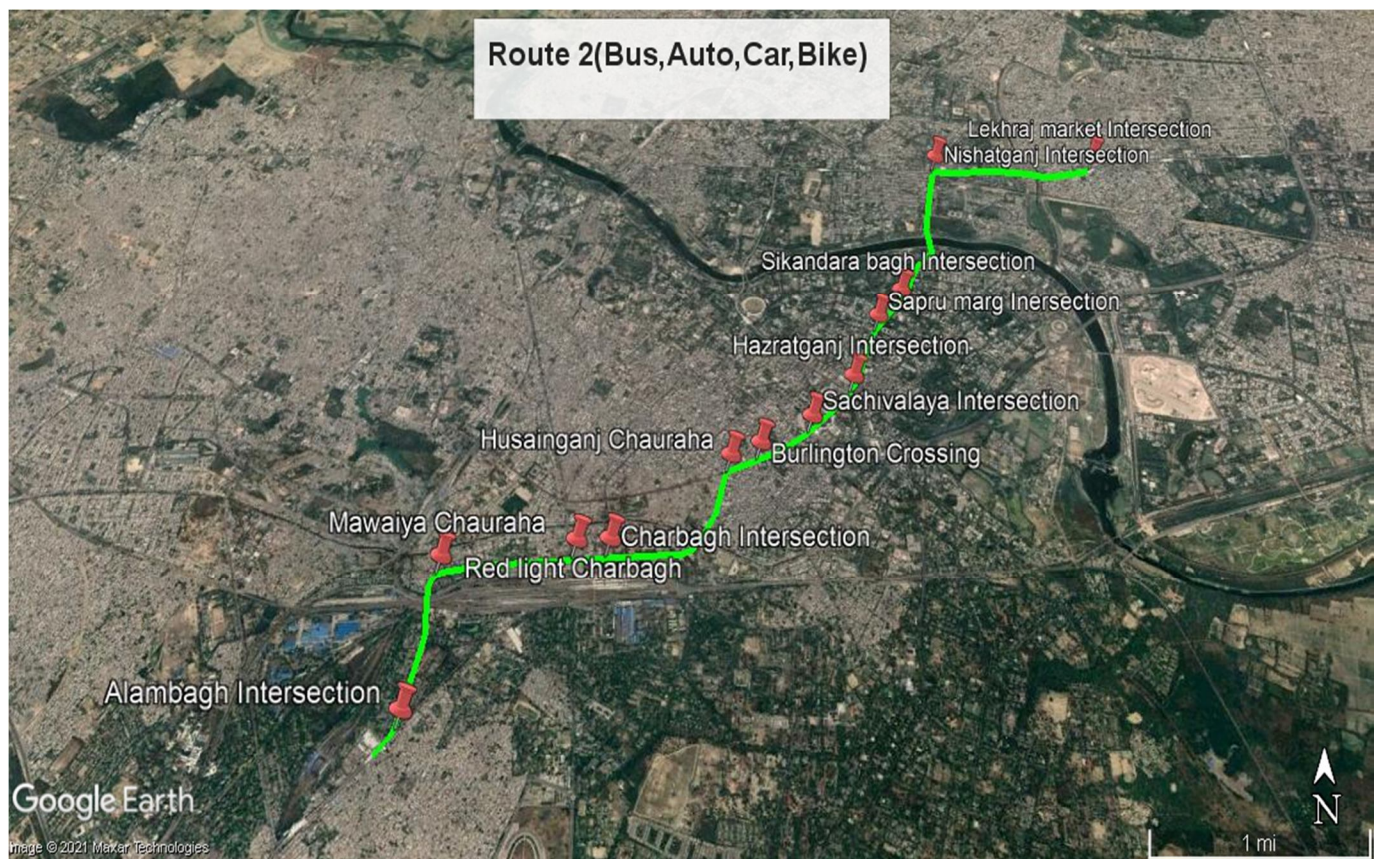
The Study route is taken from Lekhraj metro to Alambagh metro station. But at Nishatganj, route 1 and route 2 are generated because route 1 have metro and route 2 don't have metro.

Lekhraj metro- 26.8708° N, 80.9736° E  
 Alambagh metro- 26.8185° N, 80.9073° E

1) *Route 1*- Length of this route is 12.33 km.



2) *Route 2*- The length of this route is 10.4 km.



#### IV. DATA AND SOFTWARE USED

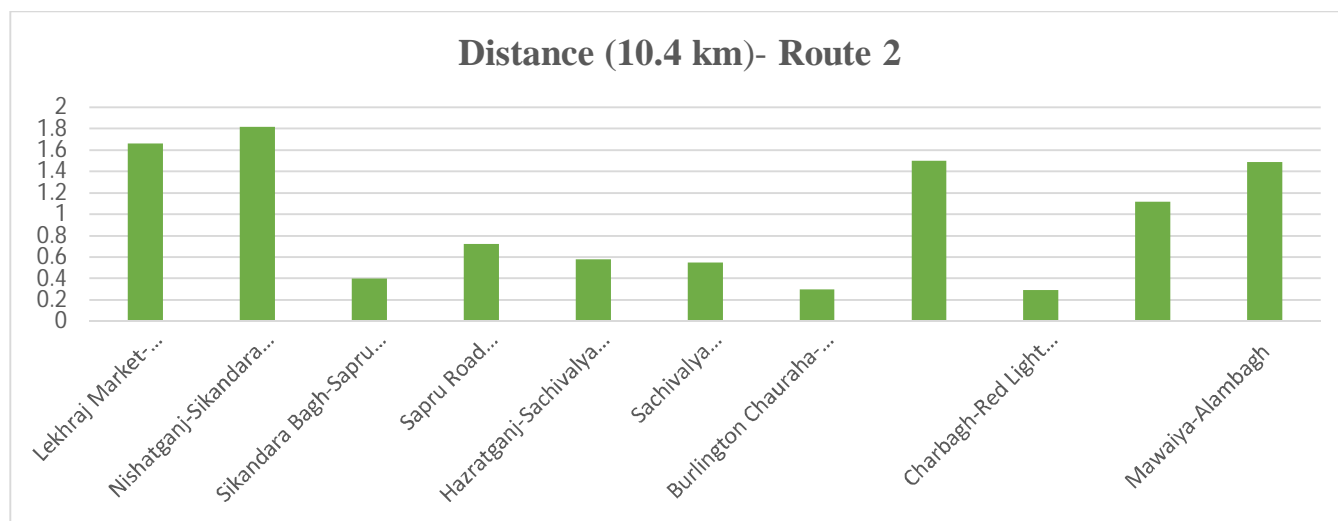
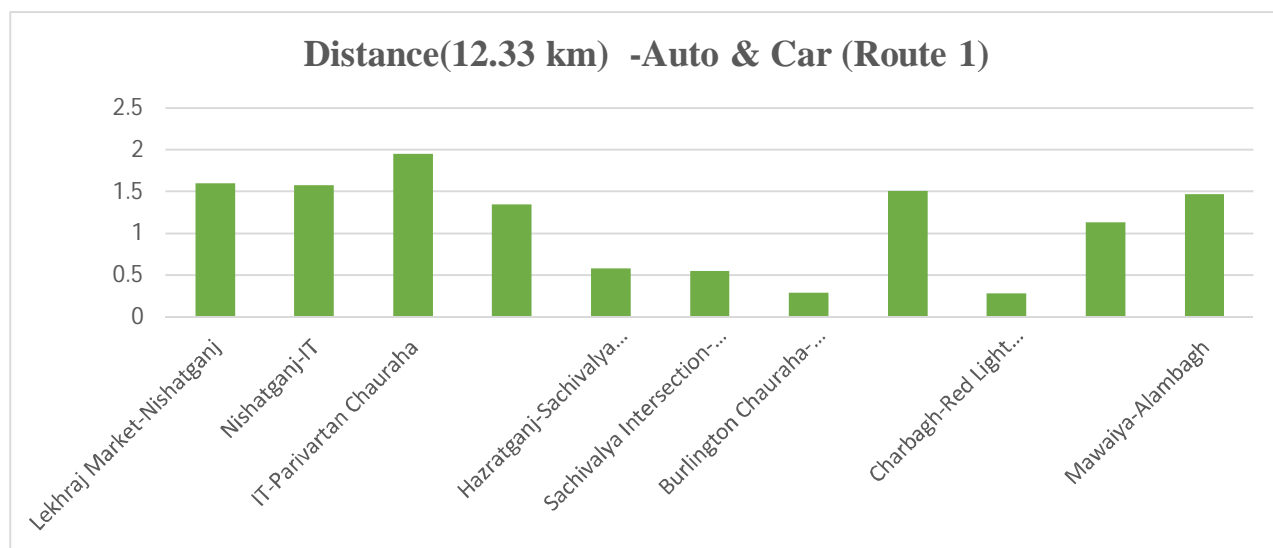
- A. Data used in this study are – Lucknow Metro Data, Shape file of Lucknow, Route Length.
- B. Software used in this study are – ArcGIS, Google Map and Google Earth Pro.

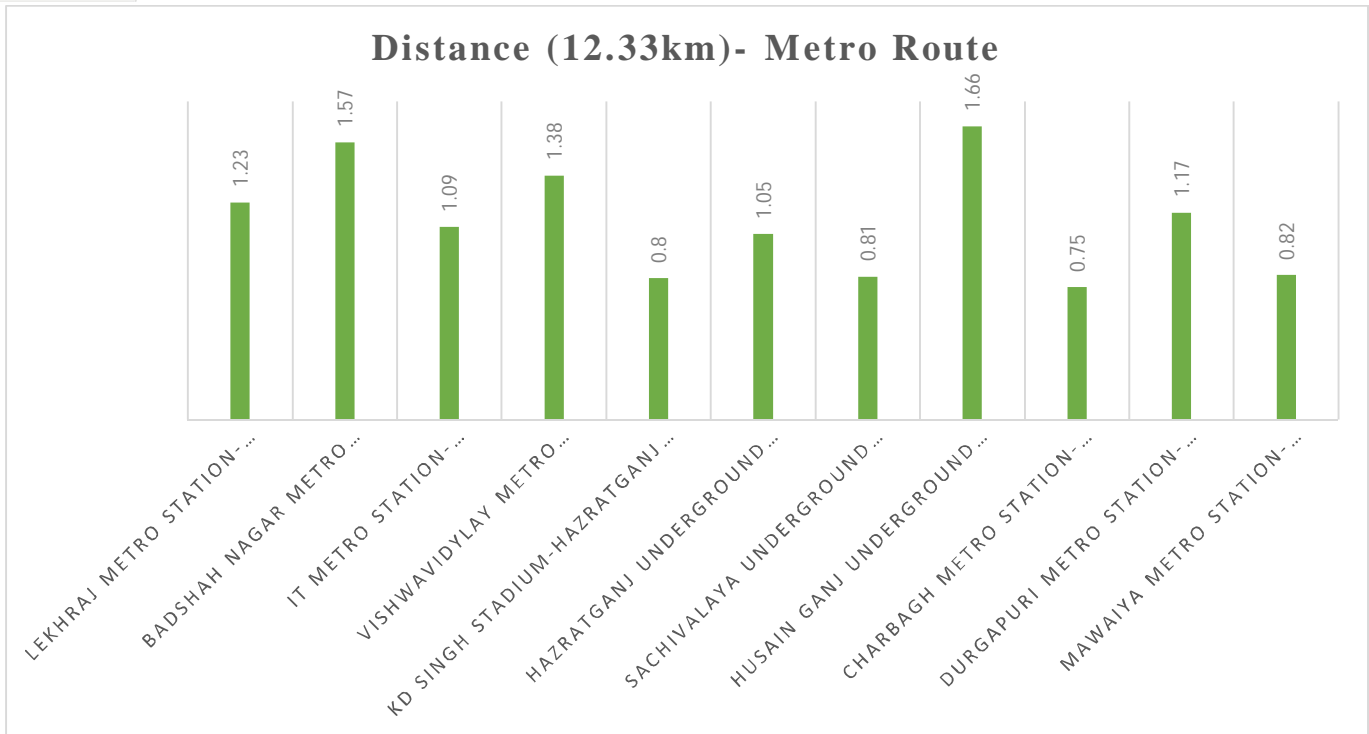
#### V. METHODOLOGY

The methodology is based on the different steps adopted in this study and it is basically the different studies which are related to travel time during journey, route length of study area and the availability of public transport system. At different locations of study area, the availability is according to the time and the connectivity around that point.

##### A. Travel Route Descriptions

Travel Medium	Frequency (in min)	Total Stretch (in km)
Metro	8-10 5:30 (peak hour)	12.33
Bus	15-20	10.4
Auto	5-10	12.33 or 10.4
Bike + Car	-	12.33 or 10.4





**B. Total Stoppage Points During Entire Stretch**

Travel Medium	Total Stoppage Points
Metro	12
Bus	12
Auto	12
Bike + Car	NA

**C. No. Of rotaries on total length**

Travel Medium	Total Intersection/Rotary
Metro	NA
Bus	12
Auto	12
Bike + Car	10-12

**D. Total Travel Time By Different Transit Medium**

Travel Medium	Distance (in km)	Time (min)
Metro	12.33	18-22
Bus	10.43	35-40
Auto (Route 1)	12.29	30-35
Auto (Route 2)	10.43	25-30
Bike + Car (Route 1)	12.29	25-30
Bike + Car (Route 2)	10.43	25-30

## VI. RESULT & CONCLUSION

### A. Result

On the basis of above analysis these findings are obtained-

- 1) Travelling with metro is very fast and reliable on individual basis.
- 2) Metro is available only between 6 AM to 10 PM, that's why it is sometimes not reliable for travelling in late night and early morning.
- 3) The metro route is separated from road network that's why it is fastest medium to travel without congestion.
- 4) Average waiting time is also less in case of metro as compared to other mode of transportation.
- 5) The fare of metro is more for short trip but has less fare for long trip.
- 6) The fare of metro is fixed but in case of car, bus, auto, the fare can be negotiable.
- 7) Speed of bus, car, auto and bike is dependent on the road properties and behavior of driver but metro has their limitations with proper safety guidelines.
- 8) The chances of accident is very least in metro as compared to other public transport facilities.

Name	Metro	Bus	Auto	Connectivity
Lekhraj Market	✓	✓	✓	Best
Badshah Nagar metro station	✓	✓	✓	Best
IT Intersection	✓		✓	Good
Sikandar Bagh		✓	✓	Good
Sapru road Intersection		✓	✓	Good
Parivartan Chauraha	✓		✓	Good
Hazratganj	✓	✓	✓	Best
Sachivalya Intersection	✓	✓	✓	Best
Burlington Chauraha		✓	✓	Good
Husainganj Chauraha	✓	✓	✓	Best
Charbagh	✓	✓	✓	Best
Durgapuri Metro station	✓	✓	✓	Best
Mawaiya	✓	✓	✓	Best
Alambagh Bus stop	✓	✓	✓	Best

### B. Conclusion

This study concludes these parameters

- 1) Bus, auto, car have many other stopping points rather than fixed stops, this creates conflict and congestion on the road frequently.
- 2) During peak time 8-10 am and 5.30-7.30 pm, the random stoppage of public transport system other than metro creates huge problem around the rotary.
- 3) Efficiency of metro with respect to travel time and travel demand delivery is almost similar but other transport systems are heterogenous in nature.
- 4) Every individual requires a fast and smooth travel medium within the city limits without any compromise in safety.
- 5) The travel time between two successive stoppage depends on the medium chosen by the individuals.
- 6) Within a given time period the metro is dependable source of travelling.
- 7) Metro has no flexibility in their route but auto, car, bus etc. have flexibility in their route of travelling.
- 8) The safety and security is very appropriate in metro travelling but by bus, car, auto it is sometimes dangerous due to aggressive driving of driver.
- 9) Rotaries are different in their properties that's why different rotaries have different traffic signal time and it directly affects the speed of vehicle and travel time on entire route.

## VII. ACKNOWLEDGEMENT

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