

**PROJECT REPORT
ON
LUCKNOW METRO**



CE541 INFRASTRUCTURE PLANNING

SUBMITTED BY

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INTRODUCTION

Lucknow is the capital of Uttar Pradesh, the most populous state of India. The population of Lucknow is about 3 million (As per Census of India 2011). Being an important cultural and trading centre Lucknow continues to grow and attract large number of people to the city. The rapid growth of the city and urban sprawl has widened the gap between demand and supply of urban infrastructure.

Transportation infrastructure which is essential component of urban infrastructure is constrained due to inadequate public transportation system and growth of private vehicles.

Inadequate transport facilities cause congestion, delays and hazards result in significant socio – economic costs to the society.

Economic growth and spatial development are quite often governed by the quality and quantity of infrastructure provided. Supplying and maintaining optimum of infrastructure is the key to planned development. India is currently growing rapidly and in phase where urbanisation is taking place at increasing rate.

CASE OVERVIEW

Lucknow, being the important city in terms of trading and administrative services it attracts large number of people every year. Density of Lucknow is very high. As population is increasing the no of vehicle are also increasing at rapid rate which possess a problem to city existing transport infrastructure.

The major traffic generating areas in Lucknow are Railway Station, Charbagh Bus Stand, Vidhan Sabha, Secretariat and the commercial areas in the central part of the city.

Due to the lack of proper public transportation, many personalized modes of transportation have emerged in the city. The Rites and UP State Transport Dept. report suggests that there is nearly 16% growth rate in the number of vehicles in Lucknow every year, which clearly suggests that there is a strong need for a new transportation system.

The data from the UP State Transport Dept. shows an annual growth of vehicles by nearly 16% to 19%. On close observation one finds that the traffic of Lucknow comprises of 82% of two wheelers, 14% of four wheelers and rest only 4% for public transport and other modes of transport. Thus it is very clear that the city lacks any form of Mass Transit Rapid System.

Table 1: Annual Growth rate of vehicles in Lucknow

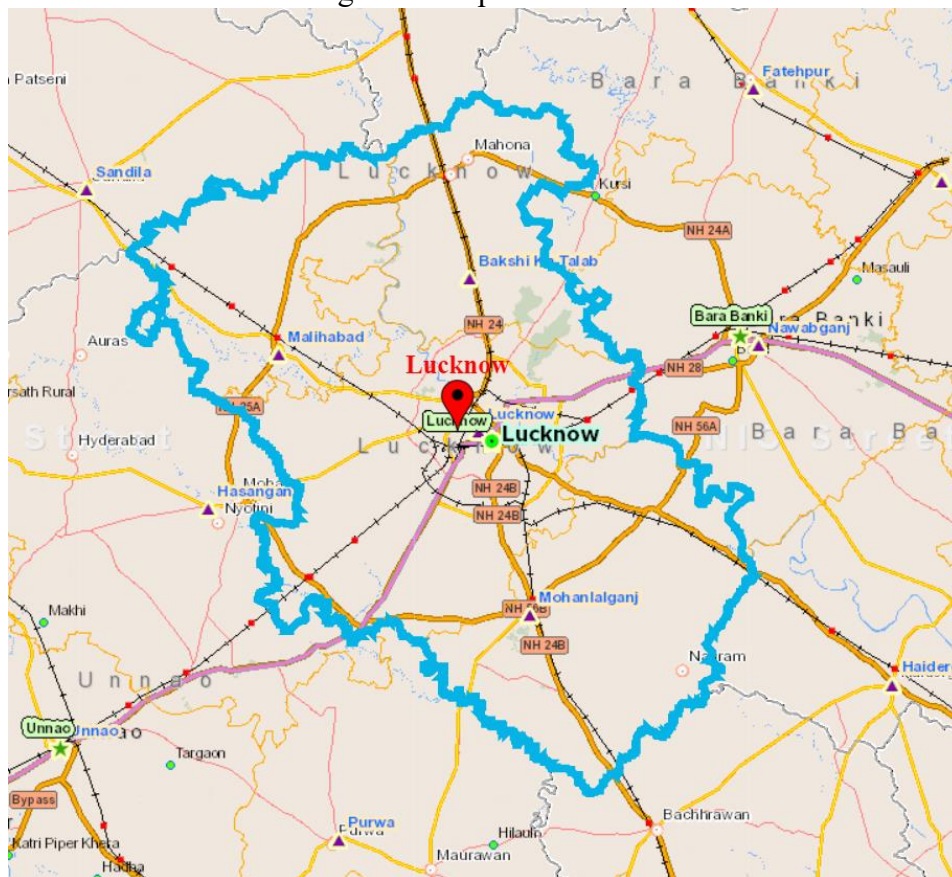
Registration of Vehicles in Lucknow					
S.No	Types of Vehicles	1994	1998	2005	Annual Growth Rate%
					(1994-2005)
1	Two Wheelers	212774	285511	601745	16.62
2	Car/Jeep/vans	27608	42855	97878	23.14
3	Bus	1126	1349	3583	19.59
4	Truck/HCV	4219	5264	7742	7.59
5	Tractor and LCVs	10077	11017	19985	8.94
6	Three Wheelers, taxis and others	6487	8579	9567	4.32
	Total	262291	354579	749395	16.88
Source: Rites Report and UP State transport department					

Therefore, the implementation of robust mass transit systems has become essential to meet the increasing demand. The metro transport system is considered suitable being a fast and clean transport system, however it also displaces people and businesses in a place like Lucknow where

land is already scarce. The adverse impacts of metro rail project are minimal in comparison to the other surface transport systems.

Area of Study

Figure 1: Map of Lucknow



Source: lucknow.nic.in

PROBLEM IDENTIFICATION

- Heavily choked narrow roads with varied traffic conditions and regular traffic jams at major intersections have been found in Mobility study 2012.
- Parking demand is high due to numerous vehicles moving on roads.
- The condition & width of roads requires attention in terms of widening, remove the encroachments and construct subways, flyovers and parking places.
- Rapid expansion of the exterior areas has increased demand for new connections to central part of the city.
- Public transport system of the city is not that efficient and cannot cater to the increasing demand. It is very much confined to small area with less frequency due to limited availability of public transports.

BASE LINE DATA

Base year 2011.

1. Demographic Details of City

As per Census of India, 2001, Lucknow urban agglomeration has population of 22.46 lakh. Population of Lucknow grew due to extension of LMC (Lucknow Municipal Corporation) from 14,594 hectares in 1981 to 33,750 hectares in 1991. The Master Plan 2021, of Lucknow shows projected population of **32.26 lakhs** for year 2011 and **45 lakhs** for year 2021.

Table 2: Population Details

Year	Population LMC	Decadal Change	Decadal Growth Rate	Population LMA	Decadal Change	Decadal Growth Rate
1981	947990	173346	22.38%	1007604	193622	23.79%
1991	1619116	671126	70.79%	1669204	661600	65.66%
2001	2185927	566811	35.01%	2245509	576305	34.53%
2011	2903000	717073	32.80%	3226000	980491	43.66%

Source: Master Plan of Lucknow, 2021

Table 2 shows more than 70% growth between 1981-1991, this rapid growth due to increase municipal boundary area of a city which has expanded from 118 sq.km to 350 sq.km because of this nearby villages merged into the municipality that caused increase in population. There is decline in population growth rate since last decade this can be happened due to low child birth rate or migration from Lucknow city to other metropolitan city of India.

In total population of Lucknow city male constitute 51.86% while female constitute 48.14%. The literacy rate is 82.50%. The population density is 8049 persons per sq.km.

2. Migration Pattern in Lucknow

- Main reasons for migration are employment, business, higher education and social factors likes movement of family members after marriage.
- As per the data available from “Study on Counter Magnet Areas to Delhi & NCR by National Capital Region Planning Board”, total in-migrants in Lucknow city for the decade 1991-2001 have been 2,36,788 in numbers and out migration was 75,486.

Table 3 Data showing In and Out migration of Lucknow City.

City	In Migration	Out Migration
Lucknow	236788	75486

Source: Study on Counter Magnet Areas to Delhi & NCR by National Capital Region Planning Board.

3. Economy Survey

The major industries in Lucknow city are aeronautics, machine tools, distillery chemicals, furniture and Chikan embroidery. The workers population in city is 27.51% in 2001. The tertiary sector accounts for 80% of the workforce in 2001 as compared to 1981. The Master Plan, 2021 shows there is no significant change in proportion of tertiary workforce in 2011 and 2021. There will be decrease in proportion of primary workers and a relative rise in secondary workers.

Table 4: Percentage of Workers to Population in 2001 and 2011

S.No	Type	2001		2011*	
		Population	Percent (%)	Population	Percent (%)
1	Workers	617664	27.51	970644	33.70
2	Non-Workers	1627845	72.49	1909464	66.30
	Total Population	2245509	100	2880108	100

Source: Master plan of Lucknow, 2021

Table 5: Workforce distribution in year 2001 and 2011

S.No	Type	2001		2011*	
		Population	Percent (%)	Population	Percent (%)
1	Primary Workers	12783	2.07%	16016	1.65%
2	Secondary Workers	111180	18.00%	178113	18.35%
3	Tertiary Workers	493701	79.93%	776515	80.00%
	Total Population	617664	100.00%	970644	100.00%

Source: Master plan of Lucknow, 2021

4. Traffic and Transportation system

The major traffic attracting zones: - offices and commercial complexes which are located in the central part of the city.

The major traffic generating areas:- Railway Station, Charbagh, Bus Stand, Vidhan Sabha, Secretariat and the commercial areas in the central part of the city.

Currently 104 public bus operates in the city. Other public transports are taxis, auto rickshaws, city buses etc.

As per Master Plan, 2021 around 13.5 lakh people are estimated who will require public transport services.

Table 6: Vehicle Registration Data (2004-08)

year	Goods Vehicle			Passenger Vehicle						Total	Growth
	Heavy Goods Vehicle	Lights Goods Vehicle	Wheeler Goods Vehicle	Buses	Taxi	Tempo Taxi	Auto Rickshaw	Two Wheelers	Four Wheelers		
2004-05	5303	4780	2392	3553	4602	7381	1544	601745	97317	728617	-
2005-06	5541	5018	2782	3831	5080	7475	2228	660332	106874	799161	10%
2006-07	5893	5783	3197	3914	6283	8233	4762	720158	105447	863670	8%
2007-08	6066	6738	3576	3842	7083	8216	5008	771846	129316	941691	9%
2008-09	6242	7657	3776	3741	7399	8447	5015	825088	142861	1010226	7%

Table shows minimum 7% annually growth of vehicles in Lucknow City from 2004-08.

5. Trip Information

Entire study area has been divided into 127 zone among which 119 zones are internal zones and remaining zones (8 zones) are external zones.

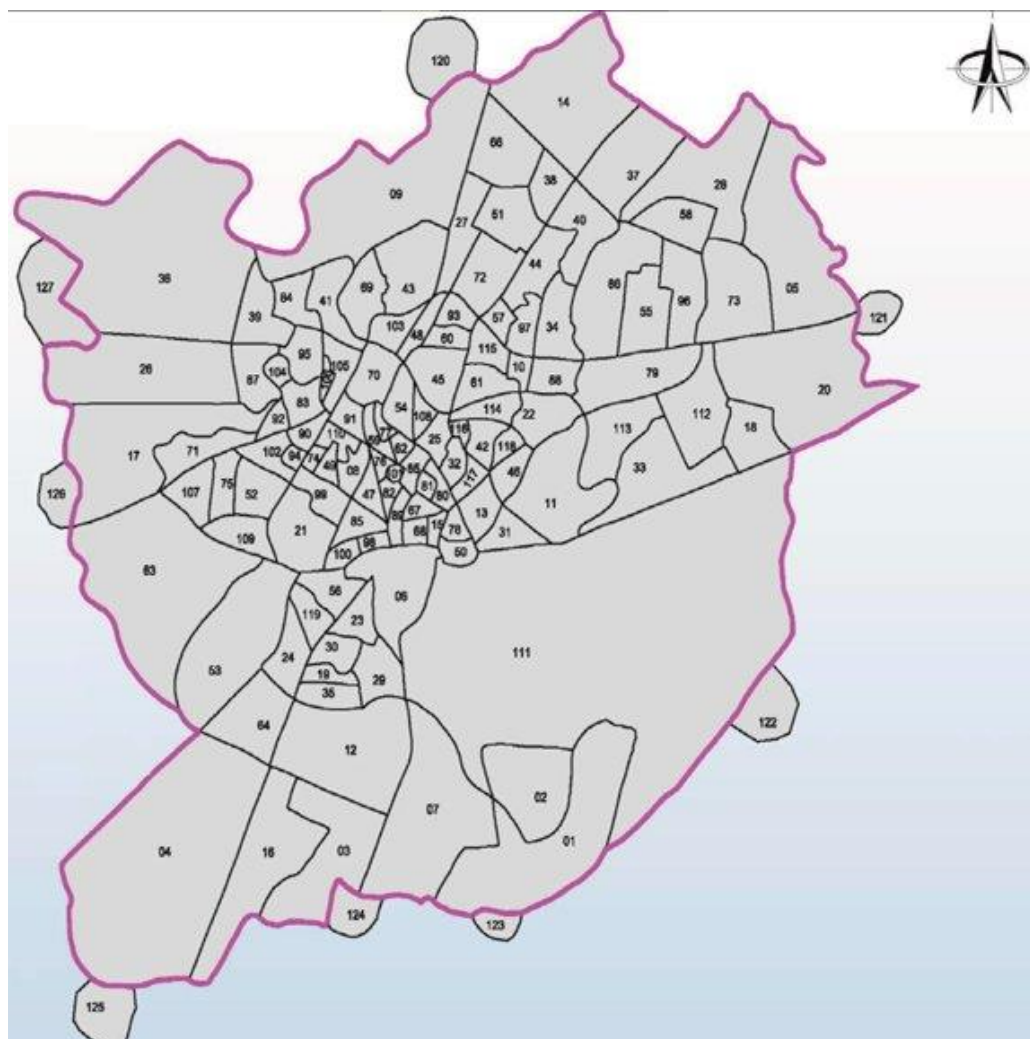
Passenger use many transportation modes to travel between Origin and Destination zones which are defined as trips in zones.

Below table shows the proportion of mode of transport and trips between internal and external trips.

Table 7: Distribution of motorised trips

S.No.	Mode	Internal Trips	External Trips	Total Trips	Modal Split
1	Two-Wheelers	1342500	43913	1386413	71%
2	Car	156225	60200	21643	8%
3	Auto Rickshaw	71525	15938	87463	4%
4	Public Transit	316850	157000	473850	17%
	Total	1887100	221640	2164151	100%

Source: Lucknow Metro DPR, 2013



Map showing internal and external zones in Lucknow City.

6. Traffic Congestion

Hazratganj, the main CBD of Lucknow, Parivartan Chauraha and Polytechnic Chauraha are the main traffic concentration zones in Lucknow city. Average peak hour volume of traffic at most of the junctions is more than 6,000 however the volume of traffic at Polytechnic Chauraha and Hazratganj Chauraha is about 15,000 and 14,000 respectively. The areas like Hazratganj, Charbagh, Polytechnic, Gol Market, Kapoorthala, IT Chauraha and old city area of Lucknow remain congested throughout the day which is evident from the table showing the volume by capacity (v/c) ratio of the highly congested roads of Lucknow. Most of the roads have v/c ratio of more than desired standard of 1 which indicates the need to take measurements for improvement. Highest volume

capacity ratio is found in Kanpur Road (1.7) and Ashok Road (1.41). The average speed of vehicles in Lucknow city varies between 15 kilometres per hour and 9 kilometres per hours in peak hours.

Table 8: Volume by Capacity (v/c) ratio of the highly congested roads of Lucknow.

S. No.	Name of the road	V/C ratio
1	Nadan Mahal Road	1.1
2	Tulsidas Marg	0.86
3	Talkatora Road	1.18
4	Gangaprasad Road	0.85
5	M.G.Road	1.13
6	Motilal Nehru Road	0.87
7	Ashok Marg	1.41
8	Faizabad Road	1
9	Kanpur Road	1.7
10	Gautam Budh Road	1.12

Source: City Mobility Plan for Lucknow 2012

7. Land Use Distribution Data

Lucknow has grown into a metropolis of 28,000 inhabitants in an area of 350 km². In 1951, the total area under the LMC was only 48 km², but in 40 years it increased ninefold. The LMC's perimeter was last extended in 1987, after the surrounding villages were incorporated. Expansion of the LMC area over the years is shown in the below table;

Table 9: Population of Lucknow Municipal Corporation from 1951 to 2011

Year	Population Total - LMC	Area in sq. km
1951	4,59,484	48
1961	6,15,523	107
1971	7,74,644	101
1981	9,47,990	118
1991	16,19,116	350
2001	21,85,927	350
2011	28,17,105	350

The driving forces for the growth of the city were capital city, administration hub, educational hub and trade and commerce activities which have been continuous attraction for the people of rural and nearby urban areas. The CBD of Lucknow is the high-density zone with major land use under residential and commercial activities. The old city is congested with its narrow roads and lack of open spaces.

According to master plan, 2031 the urban area increased from 9,170 hectares in 1987 to 16,270 hectares in 2005 to 24481.57 Ha in 2011. The land use distribution pattern for year 1984, 2004-05 and 2011 has been shown in below table;

Table 10: land use distribution of Lucknow city through year 1987,2004-05 to 2011

N o.	Land Use	Lucknow Development Area (Urban Area)
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		1987		2004-05		2011	
		Area in Hectare	%	Area in Hectare	%	Area in Area	%
1	Residential	4486	48.92	8945	54.98	10278.68	41.99
2	Commercial	224	2.44	360	2.21	623.14	2.55
3	Industrial	596	6.50	990	6.08	940.57	3.84
4	Institutional	475	5.18	560	3.44	888.76	3.63
5	Public Services	902	9.84	1410	8.67	2137.26	8.72
6	Recreational	346	3.77	435	2.67	14672.75	4.08
7	Transport	952	10.38	1240	7.62	7842.74	32.04
8	Water Bodies	194	2.11	310	1.91	2255.32	2.36
9	Other areas	996	10.86	2020	12.42	194.07	0.79
		9171	100	16270	100	24481.57	100

Source: Lucknow Master Plan, 2031

8. Road Accidents data

Numbers of accidents are increasing every year with average annual growth rate of 14%. The continuous increase in accidents in Lucknow city can be attributed to the growing vehicular traffic, faulty public transportation and lack of pedestrian facilities.

Table 11: Total No Fatalities in Lucknow

Year	Total Accidents	Injured in Nos.	Fatalities in Nos.
2006	962	602	468
2007	1150	755	507
2008	1321	878	531
2009	1421	854	528
2010 till October	1043	620	348

Source: Traffic Police Department, Lucknow

GOAL ARTICULATION

1. Goal and Objectives

- To support and amplify the transport infrastructure of the city with a holistic multi modal transport system by increasing share of public transport in existing transportation network.
 - Connect all the existing and future transportation hubs (mentioned in Master plan 2031) like truck stops, Bus stations, Railway station and airport)
 - To minimize travel time between major attractions of cities.
 - Aligning the routes to cater the public needs.
 - Requirement of proper fare regulation and management system.
 - Feeder service regulation and management.
- Making metro as major urban public transport by 2031.
 - Providing last mile connectivity in the city.
 - Connecting major markets, hospitals, heritage sites etc which will make metro as an attractive choice.

- Connect all the existing and future transportation hubs (mentioned in Master plan 2031) like truck stops, Bus stations, Railway station and airport)
- Develop a feeder system in nearby residential areas which increase the ridership in metro.
- c. A safe and secure mode of transport
 - A well-established safety system with use of ICT which make people safe and secure.
 - Reduction in accidents as a smaller number of vehicles are present at road.
- d. Making metro Self-sustaining economic model
 - Monitoring of environmental parameter through a regular monitoring program
 - Develop strategies to use solar energy to reduce operation cost.
 - Use of clean and green technologies.

2. Constraint

- Constructions of 80m span bridge above existing Broad-Gauge railway track near Mawaiya junction on (Route-1 and Route-3) possess technicality and implementation problem as Charbagh railway station is one of the busiest stations of central railways.
- Issue in positioning of ramp.
- Presence of Indira flyover before Mahanagar junction or at ring road near polytechnic Chauraha.
- Non-Availability of ROW on some routes.
- Hindrance inside Botanical Garden as ramp is proposed inside it.
- Require more Private land acquisition (Route-2, Route-4, Route-3) .
- Existing flyover on the route.
- Positioning of elevated bridge to cross Gomti River (route-2).
- Presence of suburban railway station near Mohibullapur, Rajajipuram and Gomtinagar.
- Land acquisition problem in Gomti Nagar, Patkarpuram and at Khursi Road.
- Awadh rotary on Kanpur road.

LEGISLATION, POLICIES AND LEGAL FRAME WORK

The Government of India has enacted nearly 30 'Environment Conservation Laws and Acts'. Some of these are: Wildlife (Protection) Act 1972; Forest (Conservation) Act 1980; Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981; 1988 Amendment of Motor Vehicle Act (M.V.) Act, 1939 and Environment (Protection) Act (EPA) 1986. Environment (Protection) Act, 1986 is widely regarded as a comprehensive / umbrella legislation for environment in its entity and it provides measures for protection of environment and aims at loopholes in the other related Acts. The other Acts and Rules related to environment in India, such as Air and Water Acts were brought under this umbrella legislation.

FORECASTing

1. Transport Demand Projection

They used scenario generation method (Exploratory Descriptive Trend analysis) for transport demand projection, in this model we required lots of past traffic data for project traffic demand. Here we used data traffic of 2010, 2012 and census-2011 data.

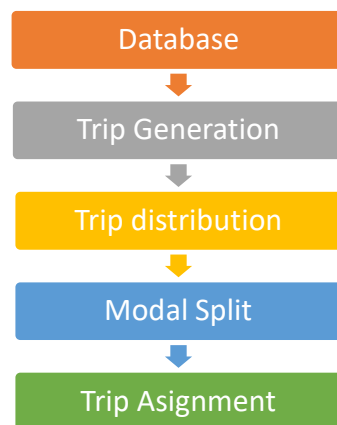
Database:

- Zoning of city – we divided in 134 zones in city.
- House-hold and various traffic surveys.
- Vehicle growth rate average is 8.5 from 2004-2009 and 7% upto 2041.
- Trip information- Analyses with respect to motorized mode of trip. (i.e NMT id excluded)
- Projected population and employment.

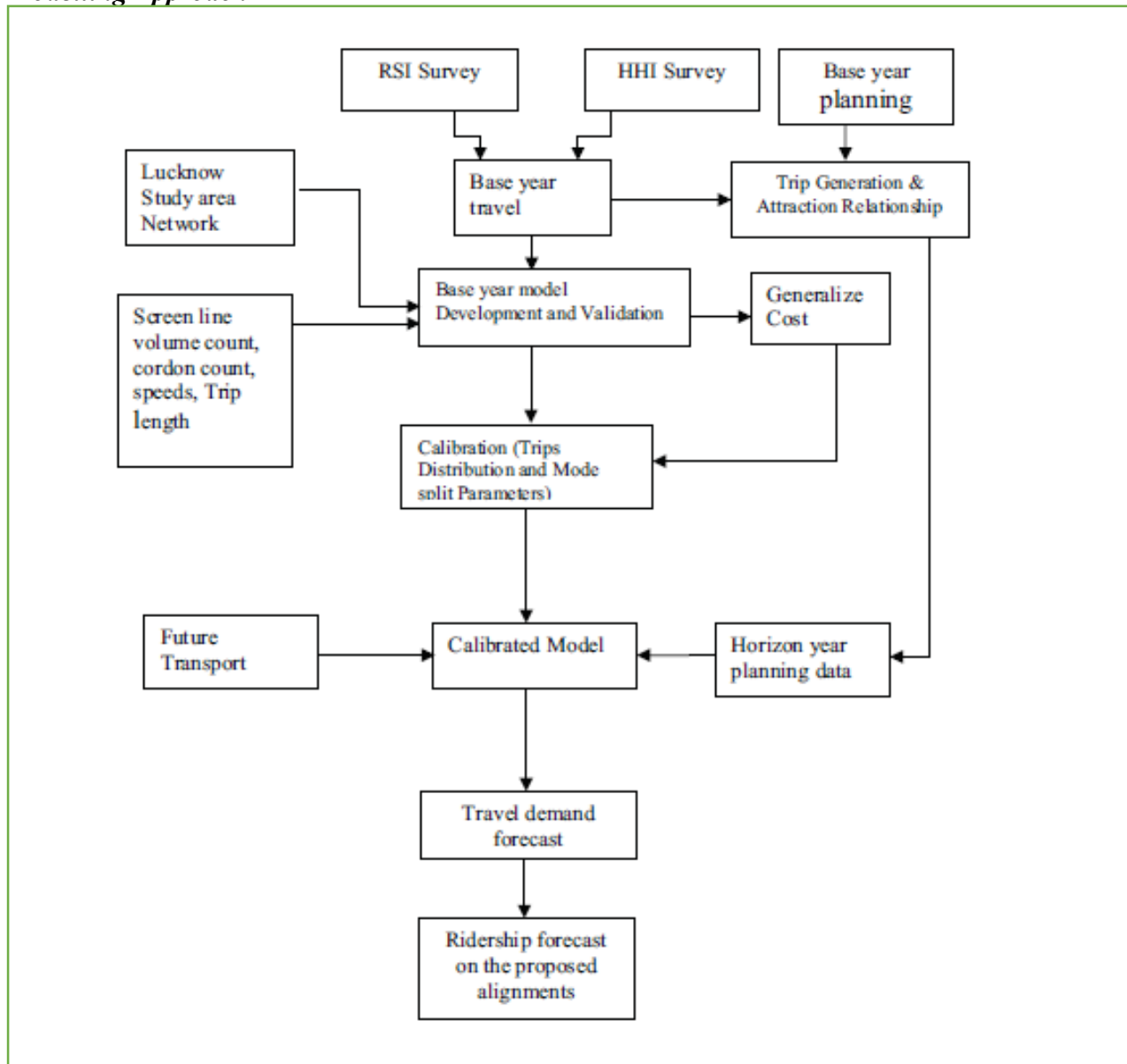
Description	2001	2011	2021	2031
Population	22.45	29.08	44.41	54.61
Employment	6.17	9.19	13.50	17.47

2. Transport Demand Model

On the basis of database, we develop a 4-stage model that is



Modelling Approach



1. Trip Generation:

On the basis of survey in zones or previous data we get the information of Origin – Destination of zone. Then we also the no of trips are generation or ends at particular zone.

Predicts no of trips starting and ending of each zone.

It is a function of three factors:

1. Land use pattern and development in the study area.
2. Socio-economic characteristics of the trip-making population of the study area.
3. Nature, extent and capabilities of the transportation system in the study area.

Mathematical Expression for Trip Generation:

Trips Generated = Function (socio-economic, locational etc. variables)

Various techniques for developing the trip generation sub-models are available and notable among them are:

Regression Analysis

Category Analysis or Cross Classification Analysis

$$G = A_0 + \sum k a_{ij} X_i$$

where

G- No. of trips(produced/attraction) in a particular zone for a specific purpose

A₀- Constant term calibrated

K- constant factor

a₀ , a₁..... a_k=Coefficients to be determined by the regression analysis

X₁, X₂.....= Zoning factor

Influence factor:

- 1. Population**
- 2. Employment**
- 3. Vehicle owner**
- 4. House hold income**
- 5. Residential density**

Equation of trip generation in generalized form is:

$$Y=A+BX$$

Where

Y=No. of trips produced or attracted

A=Constant term

B=Trip rate to be determined from least square Analysis

X=Independent variable e.g., population, employment, Vehicle ownership

The results of calibration of different models are given in:

Table 14: Generation for Total Trips

Description	Co-off.
Intercept	0.0343
X Variable	311.65

By using the above table, the value of R^2 was found to be 0.55, T-value – 10.7, F-value-114.2
(Assuming Population in zones as the variable).

Table 15: Trip attraction for total trips

Description	Co-off.
Intercept	0.0343
X Variable	311.65

By using above expression, the value of R^2 was found to be 0.66, T-value-12.7,
F Value-160.8 (Assuming Employment in zone as variable)

Per Capita Trip Rate (PCTR): Per capita trip rate (PCTR) for base and horizon years 2009, 2015,2020,2025and 2030 are given in table:

Table 16: Adopted PCTR (Motorized) Value

YEAR	PCTR VALUE
2009	0.63
2015	0.77
2020	0.91
2025	0.96
2030	1.01

2 & 3. Trip Distribution and Mode Of choice:

Trip distribution: Attaching the origins and destinations for complete trips.

Mode of choice: Determining the mode for each trip (Two-wheeler, Car, Auto, Public Transport).

- Trip distribution is carried on the basis of gravity distribution method.
- Mode of choice is selected based on diversion curve, utility-based logic model.

The present study combines the trip distribution and mode choice to form a combined Trip Distribution and Modal Split phase using a conventional doubly constrained gravity model of the form

$$T_{ijm} = r_i G_i s_j A_j F_{ijm}$$

Where

T= number of inter zonal trips between zone i & j and by mode m

G= Total generation trip ends by zone

A= Total attraction trip ends by zone

i=Generation Zone

j= Attraction Zone

r, s=Balancing factors (constants)

F_{ijm}= Deterrence function for mode m

Deterrence function-it assumes that the interaction between two sites declines with increasing distances, cost and time of travel

$$F_{ijm} = K_m e^{-\beta_{cijm} C_{ijm}^\alpha} \dots\dots\dots(1)$$

Where

K= Constant Factor

C=Generalized Cost

β= Calibration Constant –Exponential function

α=Calibration Constant- Power function

Double Constraints are imposed by ensuring that

$$\sum T_{ij} = G_i \quad \text{and} \quad \sum T_{ij} = A_j$$

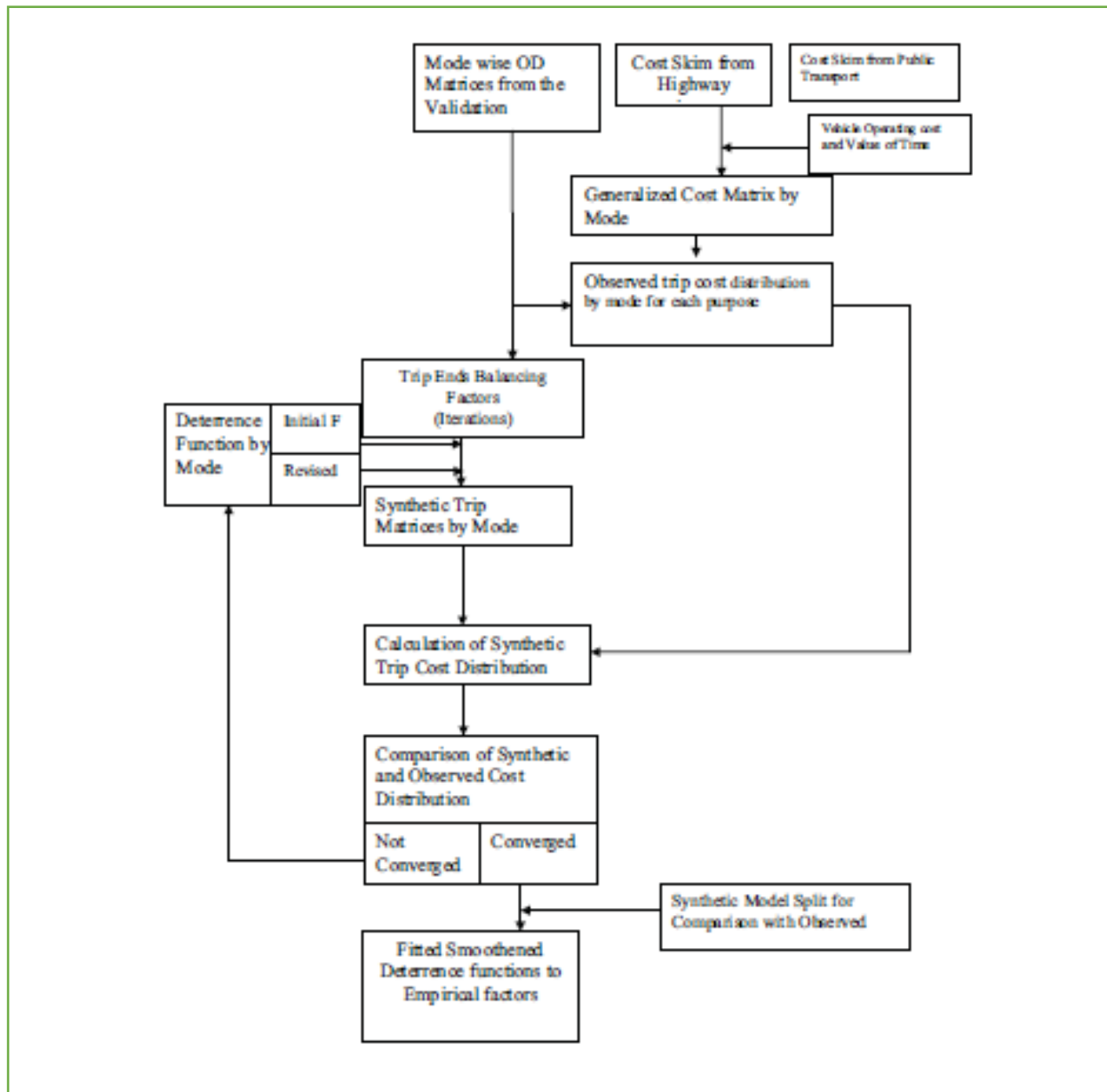
The cost of travel (C- generalized cost) between the zones has been estimated based on skims matrix from the Highway and Public Transport assignment.

(Skim matrix provides travel time, distance, costs, or a combination thereof (called Generalized Costs) for each origin-destination).

Table 17 : Calibrated Deterrence Functions for Morning peak hour

MODE	Morning Peak		
	K	ALPHA	BETA
TWO-WHEELER	3.4	-0.2	52.9
CAR	4.2	0.8	12
AUTO RICKSHAW	9.1	1.0	26.8
PUBLIC TRANSPORT	1.0	0.2	59.4

Calibration Process

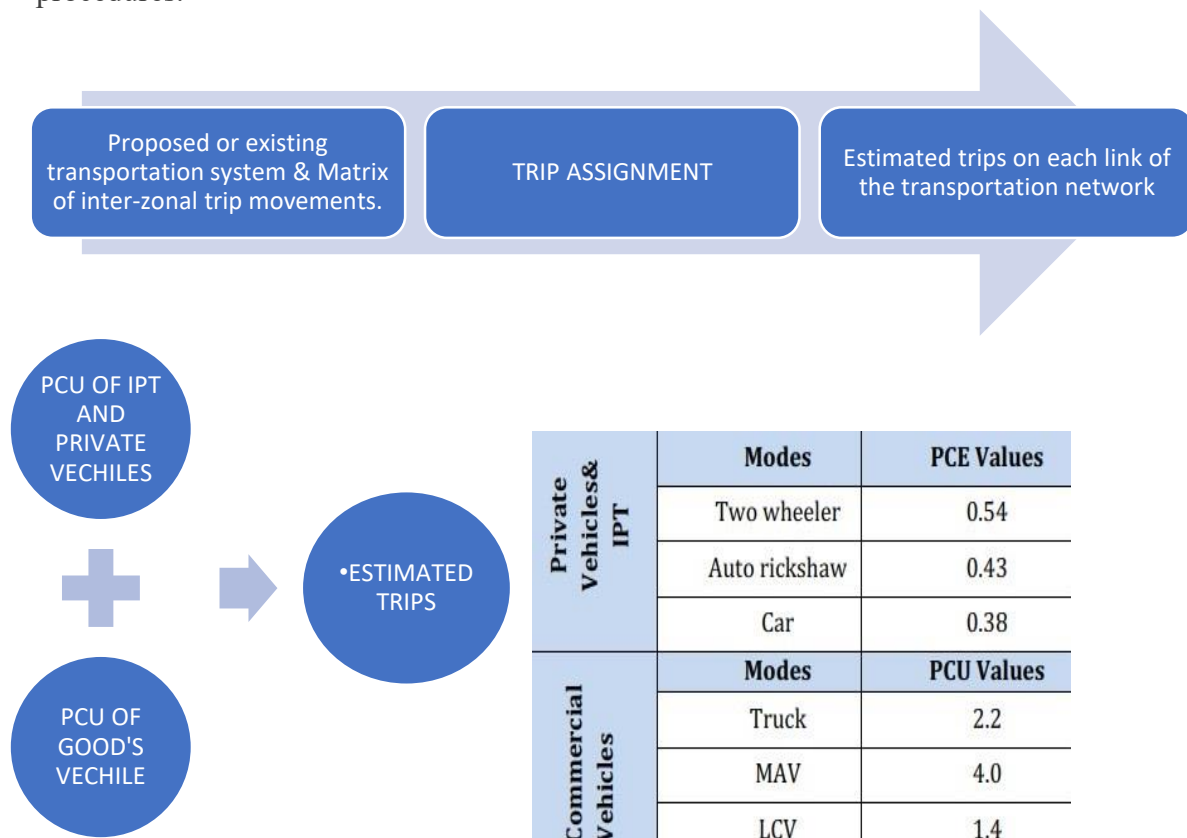


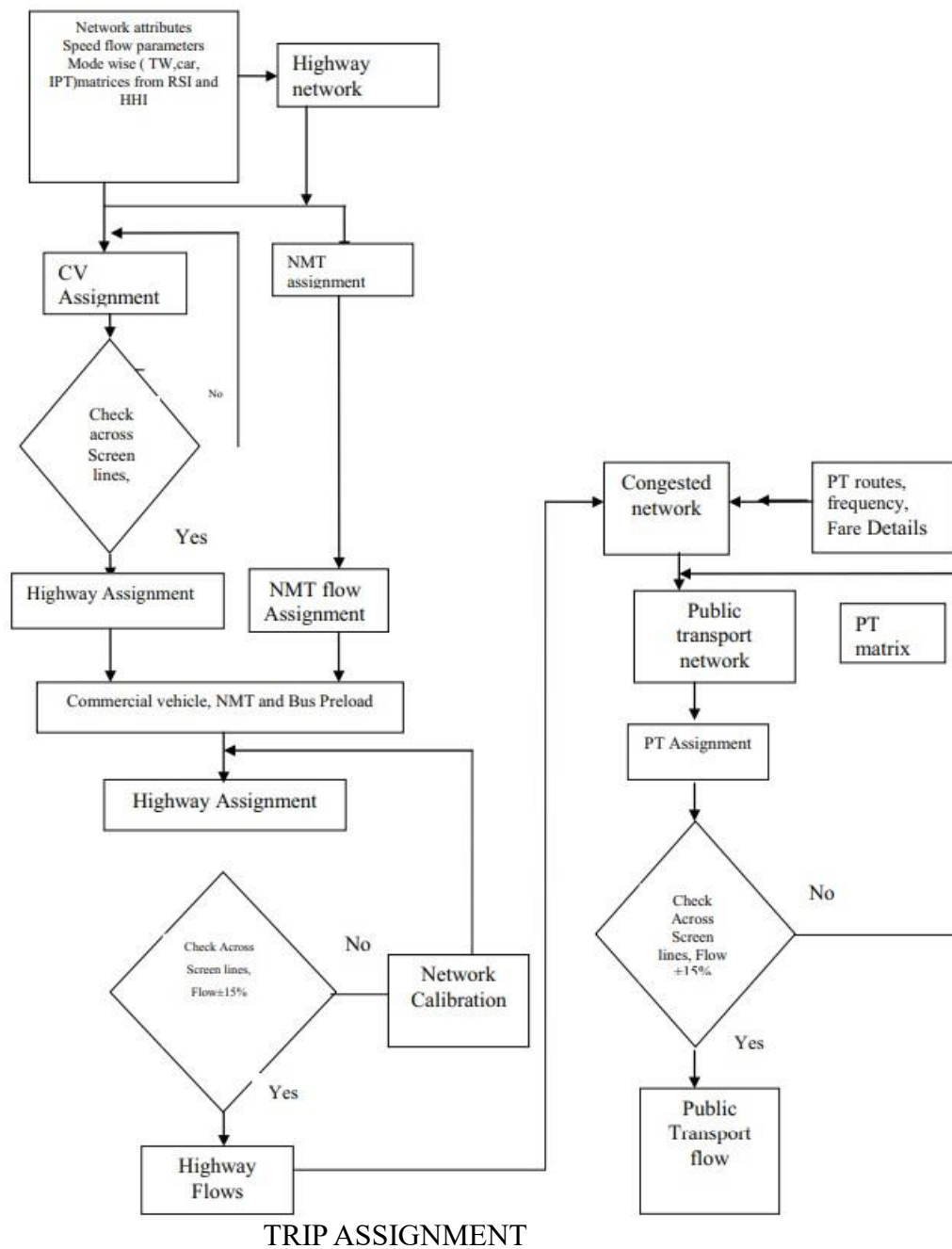
3. TRIP ASSIGNMENT

- The allocation of trips between a pair of zones to the most likely route(s) on the network.
- The process requires as input, a complete description of either the proposed or existing transportation system, and a matrix of inter-zonal trip movements.

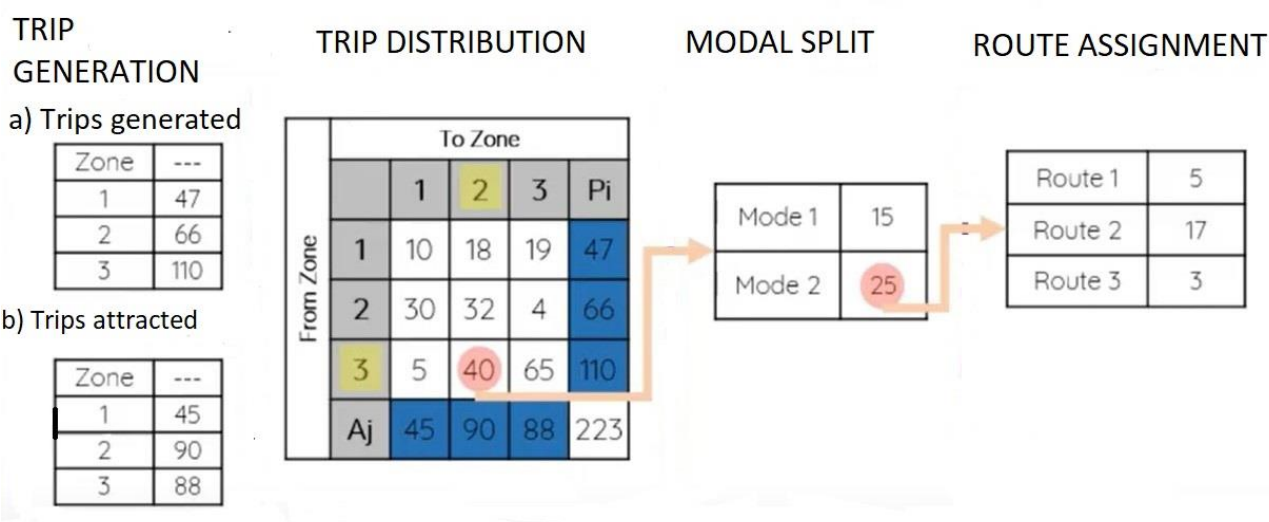
Purposes of trip assignment are:

- 1. To assess the deficiencies of the existing transportation system by assigning estimated future trips to the existing system – **Do Nothing Scenario**
- 2. To evaluate the effects of limited improvements and extensions to the existing transportation system by assigning estimated trips to the network which included these improvements.
- 3. To develop system development priorities by assigning estimated future trips for intermediate years to the transportation system proposed for these years.
- 4. To test alternative transportation system proposals by systematic and readily acceptable procedures.





TRIP ASSIGNMENT



SAMPLE REPRESENTATION OF DATA.

4. Transport Demand Projections.

Based on traffic projection DMRC preferred 2 routes from 5 routes named as:

1. North-South (CCS Amausi Airport to Munshipulia)
2. East-West (Lucknow Railway station to Vasantkunj)

a. Population Projection

Population growth of a city not only depends on natural increase but also in-migration. Future expansion will be greatly influenced by the development pattern, in addition to Lucknow's socioeconomic development, which had a big impact on urbanization in the city.

The population of Lucknow city is projected upto the horizon year 2041 taking consideration of decadal trend of past previous census data from 1951-2011. The population is projected using the extrapolative statistical methods viz. Arithmetic progression method, incremental increase method and Geometric progression method.

Table 12: Population Projection

Year	Census Population	Arithmetic Population	Incremental Increase	Geometric Progression	Average	%Population Growth Rate
1951	4,59,484					
1961	6,15,323					33.96
1971	7,74,644					25.85
1981	9,47,990					22.38
1991	16,19,116					70.79
2001	21,85,987					35.01
2011	28,17,105					28.87
2021		34,40,143	34,81,375	39,86,682	36,36,066	29.07
2031		40,63,182	40,64,465	56,41,831	45,89,826	26.23
2041		46,86,220	46,27,581	79,84,148	57,65,983	25.63

Source: sense consultant projection analysis

The projected population for the year 2021, 2031, and 2041 are (36, 36,066) (45, 89, 826) and (57, 65, 983) respectively for Lucknow.

b. Mode Shift

Given below the table shows shifts of trips from various mode to metro in various years. Projected as per DMRC.

YEAR	MODE	TRIP	PERCENTAGE
2015	Two-Wheeler	12850	20%
	Car	4497.5	7%
	Auto	1285	2%
	Shared Auto	16062.5	25%
	Public transport	29555	46%
	TOTAL	64250	100%
2020	Two-Wheeler	28415	32%
	Car	7104	8%
	Shared Auto	4440	5%
	Auto	17759	20%
	Public transport	31079	35%
	TOTAL	88796	100%
2025	Two-Wheeler	34196	32%
	Car	22404	8%
	Shared Auto	5896	5%
	Auto	18867	16%
	Public transport	36554	31%
	TOTAL	117917	100%
2030	Two-Wheeler	63631.68	42%
	Car	22725.6	15%
	Shared Auto	4545.12	3%
	Auto	22725.6	15%
	Public transport	37876	25%
	TOTAL	151504	100%

Table 18 : Mode of shift

c. PHPDT and Average trip length projections for 2 routes

Year	Corridor Length (km)	PHPDT	Daily Passenger (Km)	Daily Ridership	Average Trip Length (km)
North-South Corridor : CCS Airport to Munshipulia					
2015	22.878	13190	3227960	429250	7.52
2020		20976	4886515	644659	7.58
2025		25890	6132646	833240	7.36
2030		34955	7664688	1054290	7.27
2041		44408	9501868	1343970	7.07
North-South Corridor : CCS Airport to Munshipulia					
2015	11.098	7639	619487	155650	3.98
2020		14157	1007262	243300	4.14
2025		21434	1477121	345930	4.27

2030		29171	1982341	459940	4.31
2041		36196	2496832	600200	4.16

Table 20 PHPDT And Average Trip Length

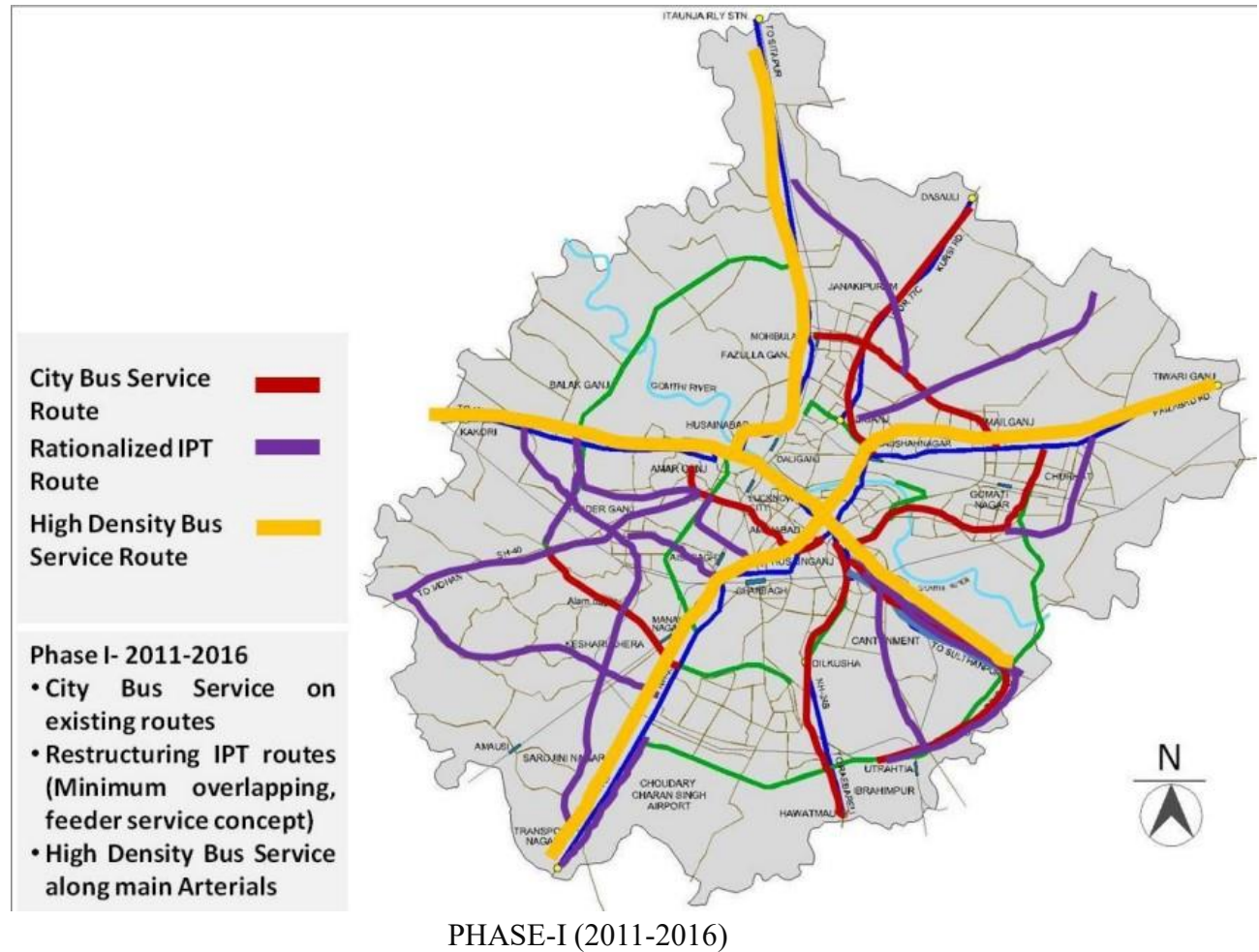
d. Fare Projections

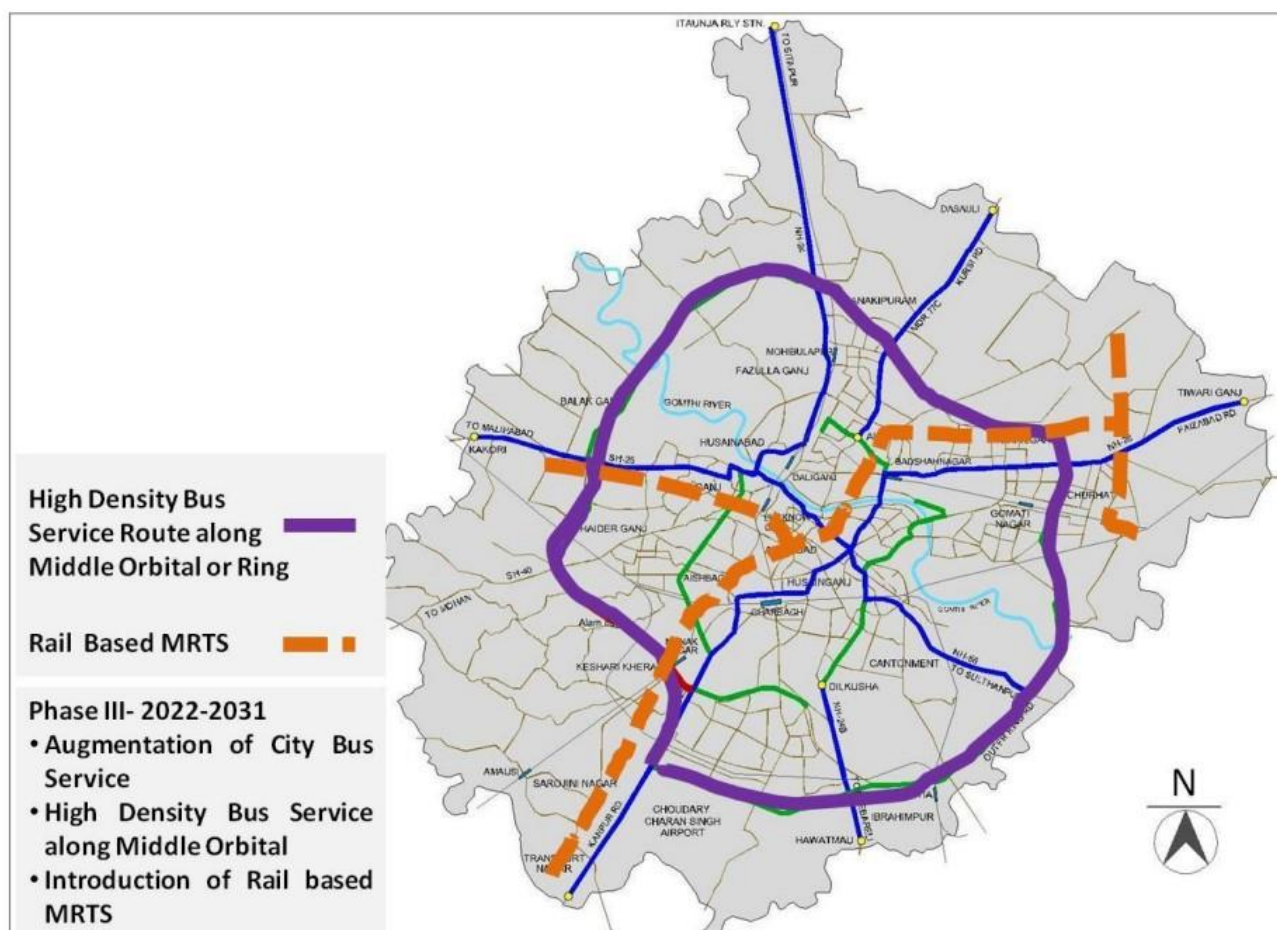
Fare has been compared with AC buses operating on existing bus routes.

DISTANCE	FARE	SMART CARD FARE	AC BUS FARE
0-2	12	11	15
2-4	15	13.5	15
4-6	18	16	20
6-9	23	21	25
9-12	25	22.5	30
12-15	28	25	35
15-18	29	26	35
18-21	32	29	40

5. SCENARIO GENERATED

The following scenario has been generated by Urban development Ministry of government of Uttarpradesh for the development Urban transport system of lucknow in 3 phases out of which in our case phase 1 and phase 3 has relevance.





PHASE -III (2022-2031) i.e after Rail based metro

6. DO NOTHING SCENARIO

Table 19: V/C ratio of some of the congested roads of Lucknow City

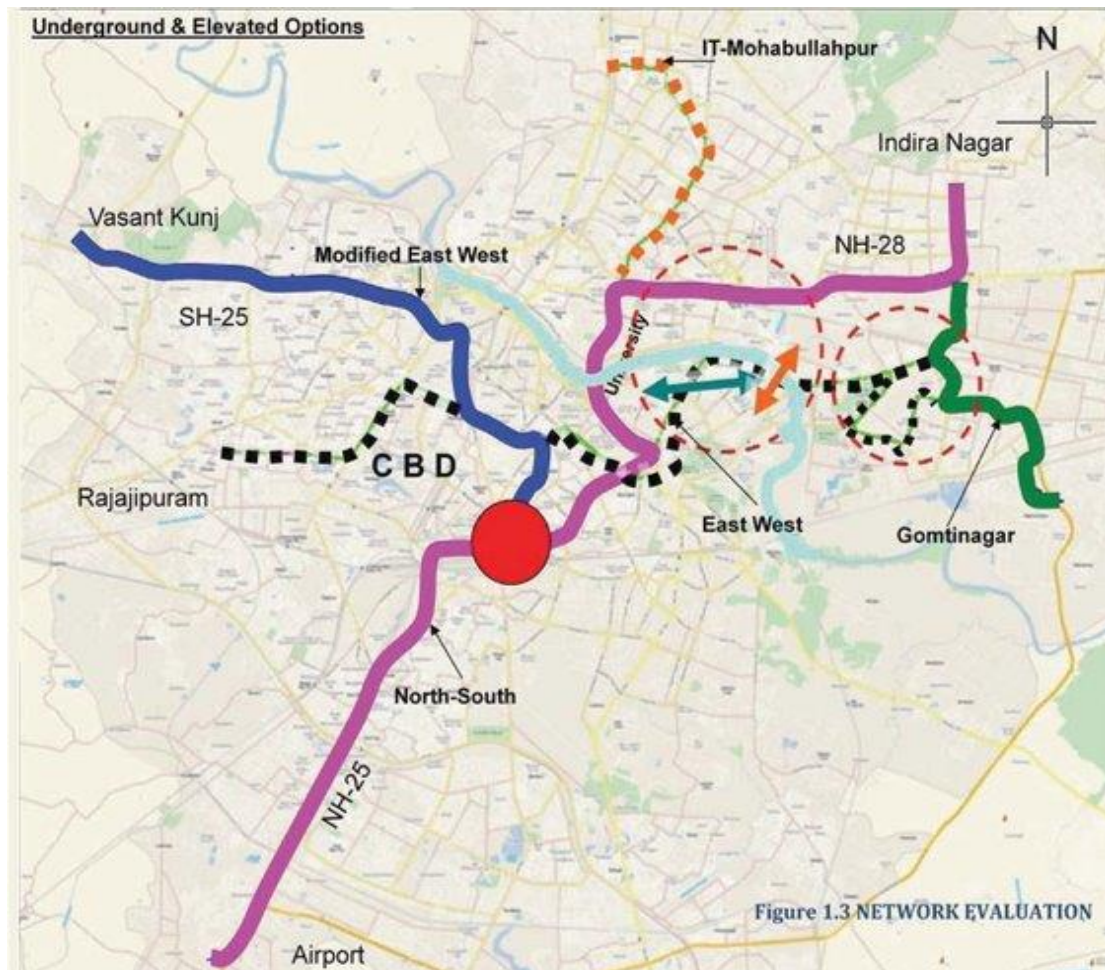
S. No	Name of the Road	V/C Ratio (base year)	V/C Ratio 2031 (Do Nothing)
1	Nandan Mahal Road	1.1	2.97
2	Tulsidas Marg	0.86	1.53
3	Talkatora Road	1.18	3.04
4	Gangaprasad Road	0.85	1.69
5	M.G.Road	1.13	1.97
6	Motilal Nehru Road	0.87	1.22
7	Ashok Marg	1.41	1.97
8	Faziabad Road	0.98	1.45
9	Kanpur Road	1.7	3.53
10	Gautam Buddha Road	1.12	1.67

DESIGN OF ALTERNATIVES

Five alternative routes are selected considering social and economic problems, traffic conditions, integration with existing systems and economic policy.

1. Identified Alignments

- *Route 1:- CCS (Chaudhary Charan Singh) Airport – Munshipulia via Kanpur Road(22.878km) extension to Gomti Nagar. (—)*
- *Route 2:- Rajajipuram – Gomtinagar (East- West corridor 27.3km) (.....)*
- *Route 3:- Modified route from Krishan Nagar to Mohabullapur(17km) (.....)*
- *Route 4:- Modified route from Rajajipuram to Munshipullia (17km)*
- *Route 5:- Lucknow Railway Station to Vasantkunj(11km) (—)*



Route 1:- CCS (Chaudhary Charan Singh) Airport – Munshipulia via Kanpur road(22.878km)

- Due to less ROW and very high hourly traffic available between charbagh to hazrat ganj has made it difficult to built elevated metro at this route(3.05km), so we have to opt for underground alignment and for rest of route an elevated option for 19.051km was preferred.
- It will increase accessibility of major important areas of city i.e Charbagh and lucknow NE railway station, alambagh station, IT chahuraha, gomti nagar, and polytechnic chauraha . All roads leading to these locations are congested and have vehicle/capacity ratio greater than 1.

- For crossing Gomti river an elevated option was preferred owing to cost issues and complexity of construction of metro underground.
- The major challenge by going with elevated option was presence of existing BG Railway line near Mawaiya. In this case alignment has to cross railway line in elevated way, minimum metro level should be 12m above the existing railway line, for this purpose a bridge of span of minimum 80m required.
- Other constraints were passing of metro line over existing flyover on Faizabad road between lekhraj and mahanagar metro. Similar issue was encountered at turning point near IT chauraha. For this a Double elevated section has been planned to maintain safe distance from existing flyover.
- This following corridor requires area traffic control system as per mobility study of lucknow.
- Construction of bridge over awadh rotary was a challenge as the rotary is one of the busiest in lucknow.



MAWAIYA BRIDGE



POLYTECHNIC CHAURAHA



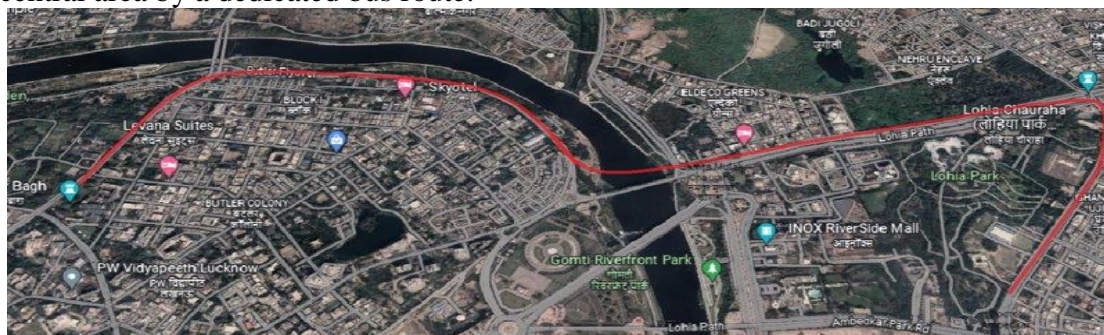
MAHANAGAR MARKET



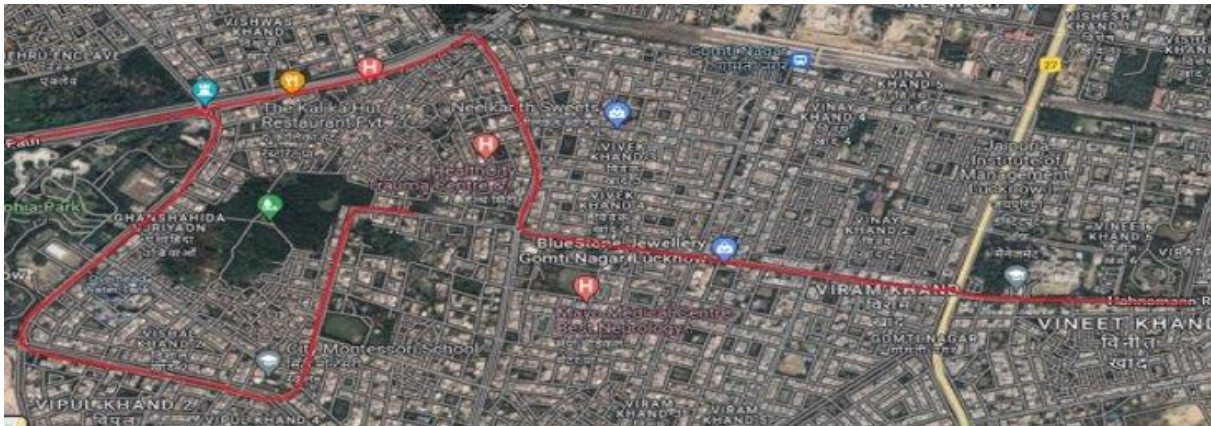
AWADH ROTARY

Route 2:- Rajajipuram – Gomtinagar (East- West corridor 18.8km)

- The route passes through central area, old lucknow, Aminabad, Subash marg, Kaiserbagh, Ashoka Marg and Sarojini nagar road.
- The route is planned to have underground alignment between section Rajajipuram west to botanical garden.
- The alignment was supposed to cross Gomti River elevated but the switch over ramp had been proposed in the campus of the Botanical garden along the boundary wall. The alignment was planned to cross the Gomti River before the Cremation area, Baikunth Dham. Thereafter, alignment followed the road towards Fun Mall to reach Ram Manohar Lohiya Park towards Gomti Nagar, But positioning of elevated bridge was a difficult issue since 3 existing bridge is present at that location. So only upstream location was available but land acquisition was still a problem.
- The total length of the corridor was proposed to be 18.8 km and the underground section shall be about 8.5 km long. A total of 11 metro stations were planned on this corridor of which 6 stations were underground.
- Two terminal location was decided initially planned. First alignment was planned along Lohia road turning at CMS school to reach patrakar puram chauraha. But problem was large scale private land acquisition and disturbance to heritage location Mutiny ground. In Second alignment, alignment was proposed to cross the flyover at double height and terminating at Haneyhmaan chowk station
- The major issue with this route was a 4km corridor along Butler road, from botanical garden to sangeet academy no major station were planned. No ridership has been found in preliminary survey along this route
- Less ridership and less trip length was found during people's survey in this route due to presence of existing bus route and intermediate public transport (8 seater tempo) connection.
- The connectivity to Rajajipuram can be enhanced by integrating City railway Station in the central area by a dedicated bus route.



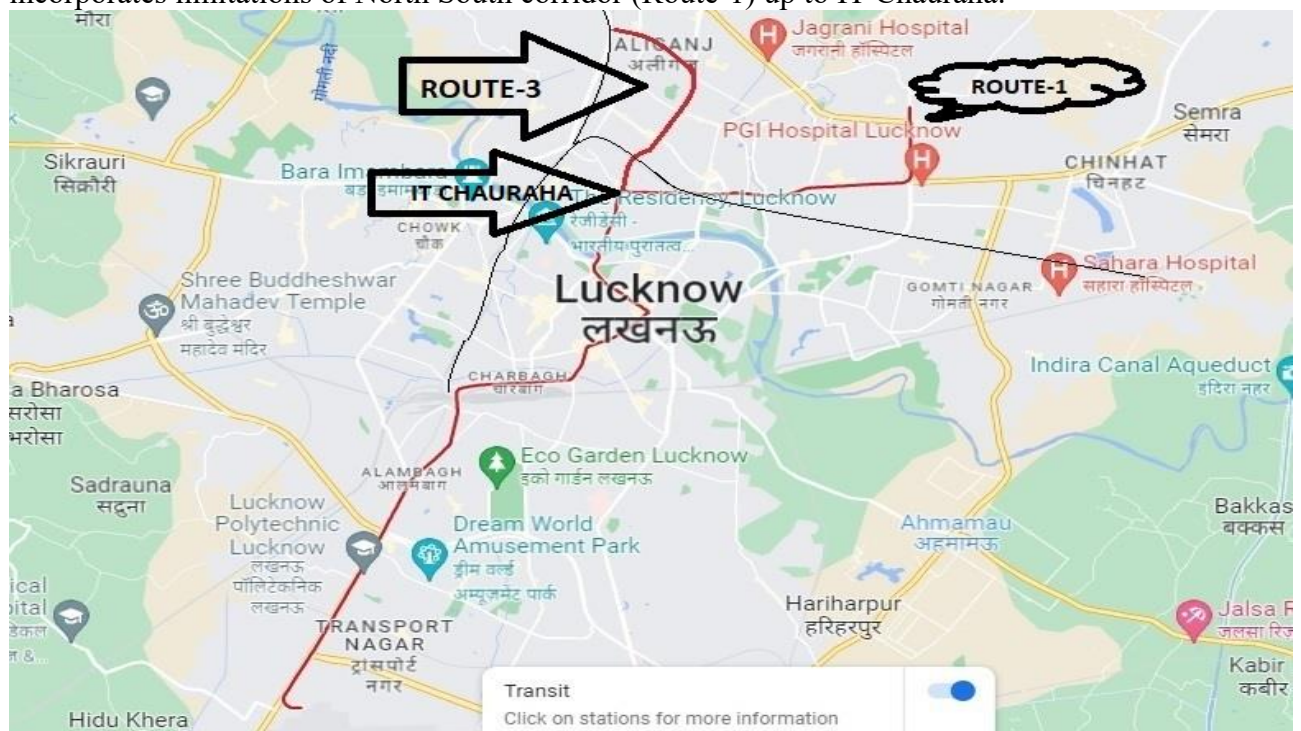
4km corridor along Butler road Along with bridge alignment



Two terminal location one near CMS school and other at haneyman chowk near Vineet khand.

Route 3:- Modified route from Krishan nagar to Mohabullahpur(17km)

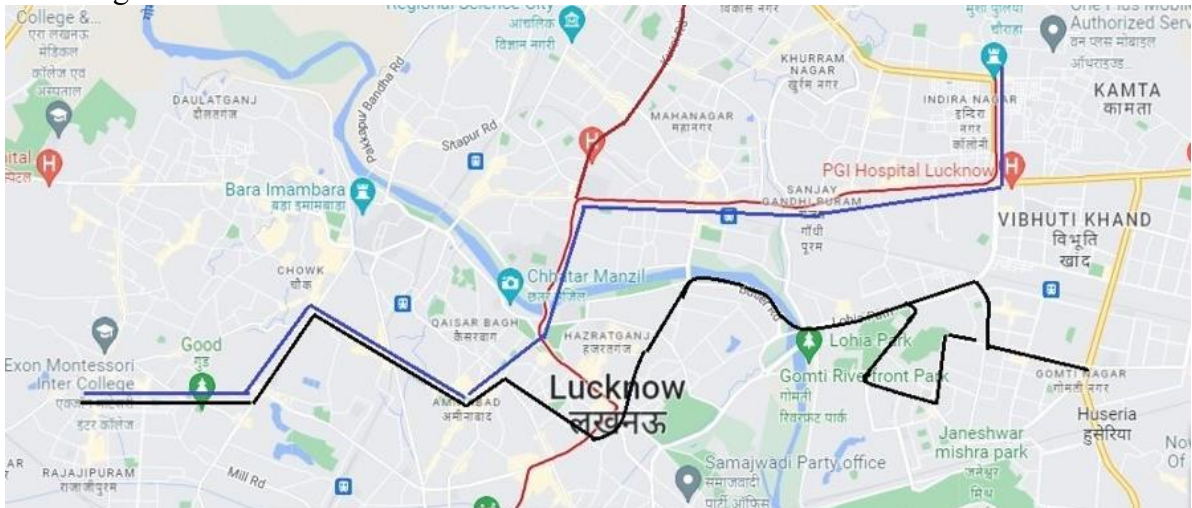
- This route is modified North south corridor except the route changes from IT Chauraha and terminates at Mohabullahpur.
- This route has BG line from Charbagh to Mohabullahpur (a sub-urban railway station) which caters current public transportation of the area and is comparable cheaper than metro and people are less likely to use metro for daily commutation. This route also incorporates limitations of North South corridor (Route-1) up to IT Chauraha.



Route 4:- Modified route from Rajajipuram to Munshipullia (17km)

- The corridor has mixed routes of Route 2 and Route 1, rajajipuram to hazratganj(route 2) and KD stadium to munshipullia (route 1).

- This route incorporates limitations of both routes so route was not considered feasible enough.



blue color route-4 and black color- route 2)

Route 5- Lucknow Railway Station to Vasantkunj(11km)

- This route has potential public mass transport demand as it has much public demand for other ridership.
- This route passes through Gautam budha marg, Subash marg, hardoi road via chowk chauraha , they all have vehicle/capacity greater than 1.
- Due more ridership, residential complex and commercial establishment in future, this route has future demand for a public transport system.
- The route has 6 lane roads after chowk chauraha so elevated option can be preferred. So, the proposed alignment between Lucknow RS and Chowk Chauraha is planned underground in view dense mix of commercial cum residential landuse and thereafter, the alignment is proposed elevated along Hardoi Road till Vasant Kunj.
- A major bus terminal is also under construction near the Fish Mandi adjacent to proposed O&M Metro Depot location near Vasant Kunj
- The major problem is placement of station at chota and bara Imambara(heritage sites) , medical college, pandeyganj and Aminabad(local cloth market).

PLAN TESTING

The analytic hierarchy method (AHP), is a powerful multi-criteria decision-making tool/technique that has been used in numerous applications in various fields of economics, construction and

engineering. It is a technique by which we can rationally structure a complex problem in a real-life scenario.

- Goal on top (Fundamental Objective)
- Decompose into sub-goals.
- Further decomposition as necessary.
- Identify criteria (attributes) to measure achievement of goals (attributes and objectives)
- Alternatives added to bottom

A scenario was generated with and without Lucknow metro and it was found that this project offers more benefit to society rather than cost to society

IDENTIFIED CORRIDORS

With the help of traffic study and engineering alignment conducted by DMRC in discussion with LDA and 5 corridors were found to possess potential for the alignment of route. The following criteria taken into account for route selection are-

- Ridership,
- Land Acquisitions,
- Right of way (ROW),
- Cost and
- Accessibility.

Ridership- The weight of ridership has been calculated by keeping the importance of following the factors- PHPDT(Peak hour per direction traffic), passenger per km, Daily Ridership, and average trip length and major roads in the zone of influence of the route. (V/C ratio).

Land Acquisition- The weight of land Acquisition has been depend upon the two factors i.e. government land required and private land required.

Right of way- The width of roads available on major routes. The route with more ROW has been given priority.

Cost: - Cost includes total cost of project from planning, implementation, miscellaneous (like extra flyover and bridges) and operational cost. The route with low cost has been a priority.

Accessibility- It refers to the “ability to access the metro”. It is one of the major concerns while route selection. It depends various factors such as Inter public transport system, tourist places nearby, market zones, public utilities like bus station, railway station etc. The less distance of metro station will result in more accessibility of the project by public.

AHP Hierarchy Network

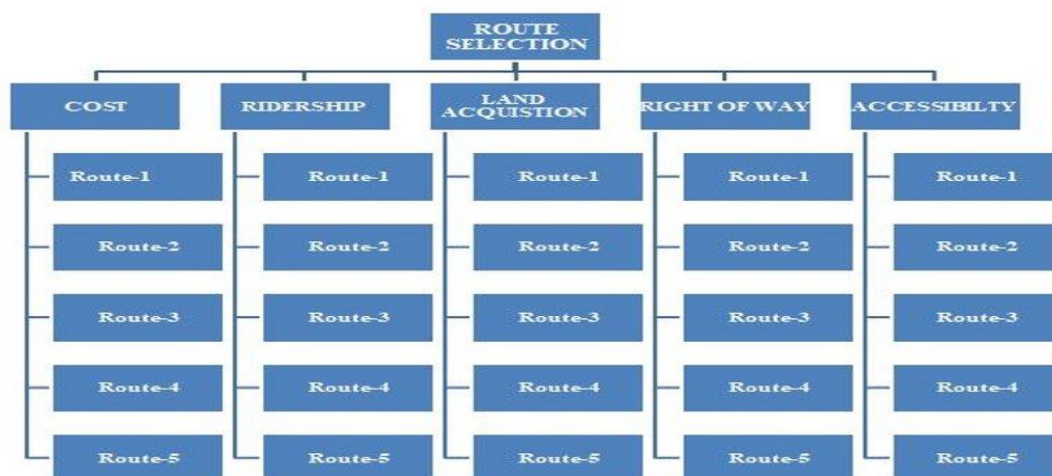


Table 21 : Weights Given for Criteria

CRITERIA	SUB-CRITERIA	WEIGHTS
Ridership	<ul style="list-style-type: none"> • Volume/Capacity ratio of roads • PHPDT • Population 	1
Land acquisition	<ul style="list-style-type: none"> • Private • Government * both temporary and permanent 	3
Cost	<ul style="list-style-type: none"> • Underground • Elevated • Operational • Maintenance • Extra flyover and bridges cost 	5
Right of way	<ul style="list-style-type: none"> • Width of road available for commuter during and after construction 	7
Accessibility	<ul style="list-style-type: none"> • Safety • Major public utilities in the route (ISBT, railway stations, markets, parks) • Presence of intra transport facilities to reach metro. 	9

Table 22 :

CRITERIA	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
COST	9	5	7	3	1
RIDERSHIP	1	9	3	7	5
ROW	1	7	5	9	3
ACCESSIBILITY	1	5	7	9	3
LAND ACQUISTION	1	9	5	7	3

*The weights are assigned by the help of sub-criteria.

Criteria Matrix for Cost

Cost						
	Route 1	Route 2	Route 3	Route 4	Route 5	Weight
Route 1	1.0000	0.5556	0.7778	0.3333	0.1111	0.0622
Route 2	1.8000	1.0000	1.4000	0.5999	0.2000	0.1119
Route 3	1.2857	0.7143	1.0000	0.4286	0.1429	0.0799
Route 4	3.0000	1.6667	2.3333	1.0000	0.3333	0.1865
Route 5	9.0000	5.0000	7.0000	3.0000	1.0000	0.5595

	Route 1	Route 2	Route 3	Route 4	Route 5	Sum	Weights
Route 1	5.0000	2.7778	3.8889	1.6666	0.5556	13.8889	0.0622
Route 2	8.9996	4.9998	6.9997	2.9998	1.0000	24.9988	0.1119
Route 3	6.4286	3.5714	5.0000	2.1428	0.7143	17.8571	0.0799
Route 4	15.0000	8.3333	11.6666	4.9998	1.6667	41.6665	0.1865
Route 5	45.0000	25.0000	34.9999	14.9994	5.0000	124.9994	0.5595
						223.4106	1.0000

	Route 1	Route 2	Route 3	Route 4	Route 5	Sum	Weights
Route 1	124.9983	69.4435	97.2208	41.6646	13.8887	347.2159	0.0622
Route 2	224.9866	124.9926	174.9893	74.9927	24.9985	624.9597	0.1119
Route 3	160.7122	89.2846	124.9982	53.5688	17.8569	446.4207	0.0799
Route 4	374.9942	208.3301	291.6616	124.9934	41.6660	1041.6453	0.1865
Route 5	1124.9825	624.9903	874.9848	374.9802	124.9981	3124.9359	0.5595
						5585.1774	1.0000

Criteria Matrix for Ridership

Ridership						
	Route 1	Route 2	Route 3	Route 4	Route 5	Weight
Route 1	1.0000	9.0000	3.0000	7.0000	5.0000	0.5595
Route 2	0.1111	1.0000	0.3333	0.7778	0.5556	0.0622
Route 3	0.3333	3.0000	1.0000	2.3333	1.6667	0.1865
Route 4	0.1429	1.2857	0.4286	1.0000	0.7143	0.0799
Route 5	0.2000	1.8000	0.6000	1.4000	1.0000	0.1119

Criteria Matrix for Right of Way

Right of way						
	Route 1	Route 2	Route 3	Route 4	Route 5	Weight
Route 1	1.0000	7.0000	5.0000	9.0000	3.0000	0.5595
Route 2	0.1429	1.0000	0.7143	1.2857	0.4286	0.0799
Route 3	0.2000	1.4000	1.0000	1.8000	0.6000	0.1119
Route 4	0.1111	0.7778	0.5556	1.0000	0.3333	0.0622
Route 5	0.3333	2.3333	1.6667	3.0000	1.0000	0.1865

Criteria Matrix for Accessibility

Accessibility						
	Route 1	Route 2	Route 3	Route 4	Route 5	Weight
Route 1	1.0000	5.0000	7.0000	9.0000	3.0000	0.5595
Route 2	0.2000	1.0000	1.4000	1.8000	0.6000	0.1119
Route 3	0.1429	0.7143	1.0000	1.2857	0.4286	0.0799
Route 4	0.1111	0.5556	0.7778	1.0000	0.3333	0.0622
Route 5	0.3333	1.6667	2.3333	3.0000	1.0000	0.1865

Criteria Matrix for Land Acquisition

Land Aquisition						
	Route 1	Route 2	Route 3	Route 4	Route 5	Weight
Route 1	1.0000	9.0000	5.0000	7.0000	3.0000	0.5595
Route 2	0.1111	1.0000	0.5556	0.7778	0.3333	0.0622
Route 3	0.2000	1.8000	1.0000	1.4000	0.6000	0.1119
Route 4	0.1429	1.2857	0.7143	1.0000	0.4286	0.0799
Route 5	0.3333	3.0000	1.6667	2.3333	1.0000	0.1865

Criteria Matrix for Comparison

Criteria Matrix						
	Cost	Ridership	Land Aquisition	Right of way	Accessibility	Weight
Cost	1.0000	0.2000	0.6000	1.4000	1.8000	0.1119
Ridership	5.0000	1.0000	3.0000	7.0000	9.0000	0.5595
Land Aquisition	1.6667	0.3333	1.0000	2.3333	3.0000	0.1865
Right of way	0.7143	0.1429	0.4286	1.0000	1.2857	0.0799
Accessibility	0.5556	0.1111	0.3333	0.7778	1.0000	0.0622

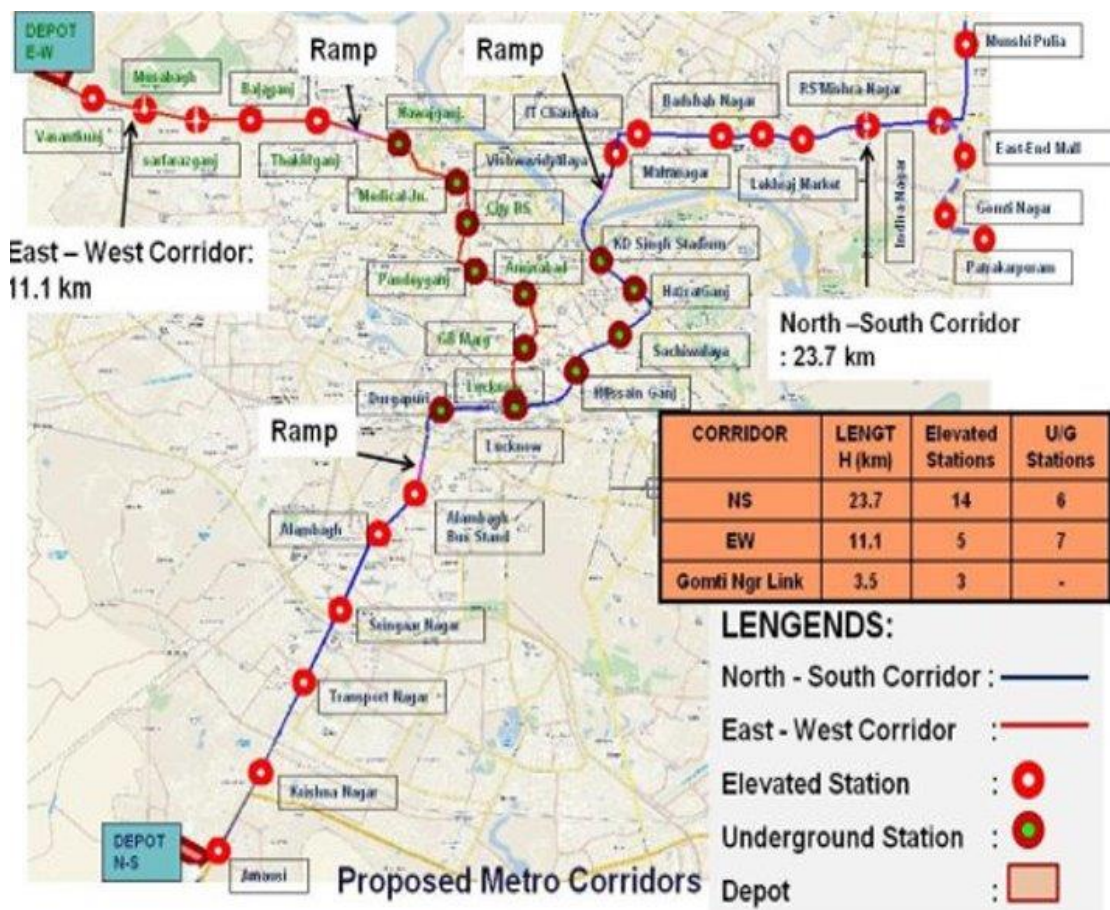
Result Matrix

	Cost	Ridership	Land Aquisition	Right of way	Accessibility	Ranking Criteria	
Route 1	0.0622	0.5595	0.5595	0.5595	0.5595	0.1119	0.5038
Route 2	0.1119	0.0622	0.0622	0.0799	0.1119	0.5595	0.0722
Route 3	0.0799	0.1865	0.1119	0.1119	0.0799	0.1865	0.1481
Route 4	0.1865	0.0799	0.0799	0.0622	0.0622	0.0799	0.0893
Route 5	0.5595	0.1119	0.1865	0.1865	0.1865	0.0622	0.1865

RESULTS

We get the final result from AHP technique, higher the value give highest priority. On the basis of that we choose 2 routes for construction during phase 1

- Route-1 (CCS- Munshipulia) has been selected for phase-1a construction.
- Route 5 (Lucknow station to Vasantkunj) as Phase-1b for the project.



ANNEXURE

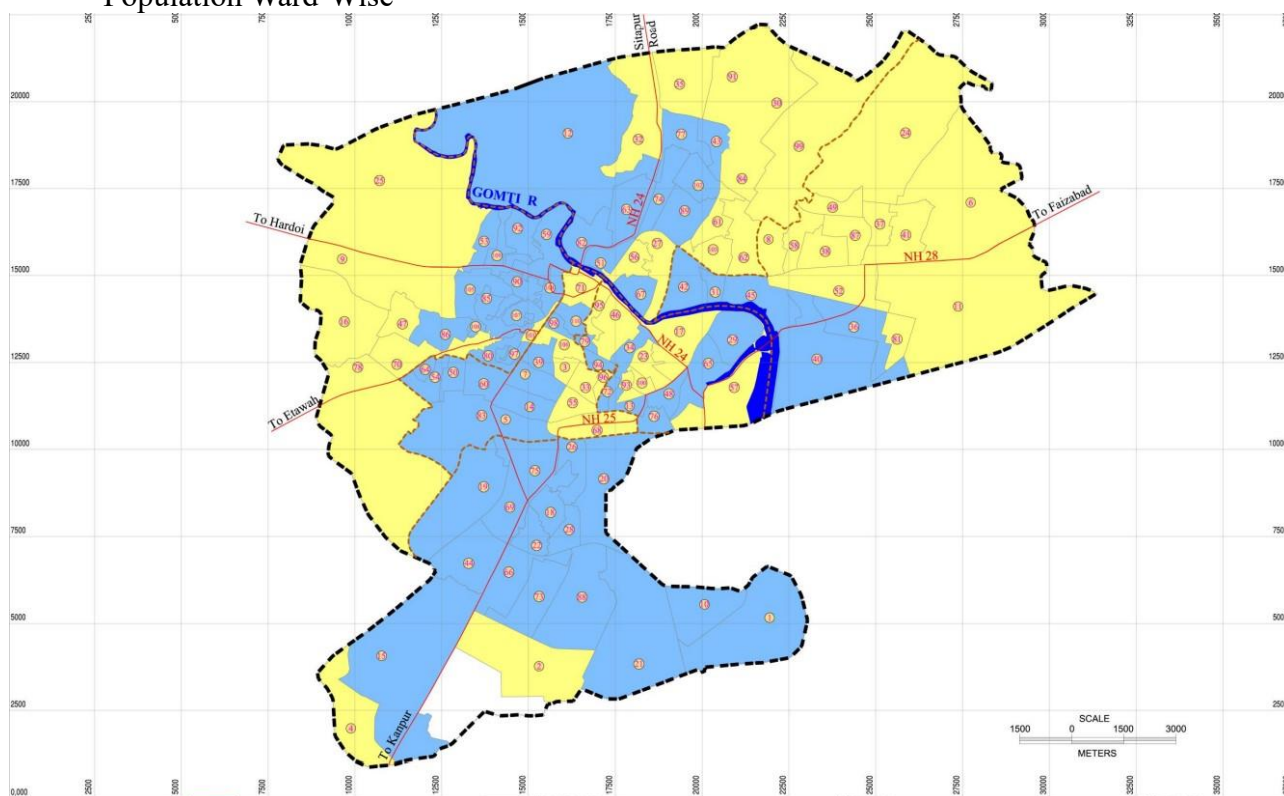
* BASE YEAR for all the data used has been considered as 2011

1) RIDERSHIP

By volume/capacity ratio

	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5	VOLUME/CAPACITY
						NON PEAK
Nadan Mahal Road	✗	✓	✗	✓	✓	1.1
Tulsidas Marg	✗	✓	✗	✗	✓	0.86
Talkatora Road	✓	✗	✓	✗	✓	1.18
Gangaprasad Road	✗	✓	✗	✓	✗	0.85
M.G. Road	✓	✓	✗	✓	✗	1.13
Motilal Nehru Road	✓	✗	✓	✗	✗	0.87
Ashok Marg	✓	✗	✓	✗	✗	1.41
Faizabad Road	✓	✗	✗	✓	✗	1
Kanpur Road	✓	✗	✓	✗	✗	1.7
G.B Road	✗	✗	✗	✗	✓	1.12
Total v/c ratio	7.49	3.94	4.58	4.08	4.26	
Assigning weights	1	9	3	7	5	

Population Ward-Wise



Source- Lucknow master plan by LMC

Ward name	Ward population
Ambedkar Nagar Ward	44250
Raja Bijli Pasi 2 Ward	42909

Raja Bijli Pasi 1 Ward	18390
Sarojni Nagar Ward Part 1	23225
Ibrahimpur Ward 1	22451
Sharda Nagar Ward 1	39780
Saheed Bhagat Singh Ward	19424
Lal Bahadur Shastri Ward Part 1	26124
Sarojni Nagar Ward Part 2	51705
Malviya Nagar Ward	38904
New Haidarganj 3	55732
Sharda Nagar Ward 2	56462
Sadatganj Ward	20108
Ibrahimpur Ward 2	20392
Bala Ganj Ward	47087
Jankipuram Ward Ist	56808
New Haidarganj 3	16431
Aishbagh Ward	23813
Gurunanak Nagar	24115
Alam Nagar Ward	19480
Hazratganj-Ramtirth Ward	70536
Keshri Kheda Ward	27614
Paper Mill Colony Ward	19694
Lalkunwa	36192
Kanhaiya Madhopur 2	36102
Indra Priydarshani Ward	20411
Vikrmaditya Ward	18736
Hind Nagar Ward	25782
Ramji Lal Nagar- Sardar Patel Nagar Ward	22817
Kharika 2 Ward	54829
Shankarpurva 2 Ward	11312
Daliganj-Niralanagar Ward	53498
Ram Mohan Rai	17609
Tilak Nagar- Kundri Raqabganj Ward	16186
Chinhat 1 Ward	32466
Guru Govind Singh	27394
Kanhaiya Madhopur 1	21681
Vidyawati Ward 2	21003
Om Nagar	15161
Jai Shankar Prasad Ward	32114
Colvin College-Nishantganj Ward	35683
Rani Lakshmi Bai Ward	17192
Faizullahganj 2	25519

Jagdish Chandra Bose Ward	29924
Rafi Ahmad Kidwai Ward	29685
Golaganj Peer Jaleel Ward	24807
Chitrugupt Nagar Ward	33271
Babu Kunj Bihari	22034
Chinhat 2	21493
Kharika 1	18603
Ayodhya Das Ward 2	22688
Ismailganj Ward	22429
Ismailganj Ward 2	29655
Faizullahganj 1	17468
Babu Banarshi Das Ward	17469
Vidyawati 1	16719
Babu Jagjeevan Ram	17396
Jankipuram Ward 2	23820
Lala Lajpat Rai Ward	22568
Geeta Palli Ward	18776
Gomti Nagar	17603
Mankameshwar Ward	24578
Shankarpurva 3 Ward	31426
Vidyawati 3	18320
Bhartendu Harish Chandra Ward	15931
Mahatma Gandhi Ward	33615
Mahanagar	21294
Mauthli Sharan Gupt Ward	15077
Rajiv Gandhi 1	25324
Kunwar Jyoti Prasad Ward	35019
Labour Colony Ward	13666
Triveni Ward	18052
Faizullahganj 3	40498
Hardin Rai Ward	23776
Faizullahganj 4	16679
New Haidarganj 1	20503
Lohiya Nagar Ward	20816
Gola Ganj Pirjaleel	36982
Mallahi Tola 1	19961
Kadam Rasool Ward	20959
Rajaji Puram Ward	26638
Sheetla Deci Ward	38645
Rajendra Nagar	16619
Basheeratganj- Ganeshganj Ward	26687
Shankarpurwa 1	27576
Indira Nagar Ward	24999
Mallahi Tola 2	22649
Yadunath Sanyal Ward	26803
Husaunabad Ward	22764

Daulat Ganj Ward	25043
Lal Bahadur Shastri Ward Part 2	35120
Nazarbag	28521
Gadi Pir Khan Ward	14088
Vivekanand Puri Ward	18000
Acharya Narendra Dev Ward	13769
Rajiv Gandhi II	19705
Amberganj Ward	23283
Begum Hazrat Mahal Ward	14663
Maulvi Ganj Ward	38306
Asharfa Bad Ward	17741
Maulana Kalbey Abeed Ward Ist	19583
Mashk Ganj Ward	14706
Kashmiri Mohlla Ward	17390
Yahiya Ganj Ward	19208
Raja Bazar Ward	42846
Ayodhya Das Ward	19509
Bhawani Ganj	24250
Chowk Kali Ji Bazar Ward	12468
Ali Ganj Ward	23697
Maulana Kalbey Abeed Ward 2nd	18816
TOTAL POPULATION	2880097

	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5

WARD NO	45,44,69,62,22 ,75,18,42, 8,58,26,68,13, 48,76, 23,17,65,29,31 ,42,08,39,97,8 8,10,86,57,61.	50,44,60,80,7, 97,101,98,110, 46,34,79,23,17 ,29,40,36.	45,44,69,62,22 ,75,18,42, 8,58,26,68,13, 48,48,76, 23,17,65,29, 31,42,27,89,74 ,27.	23,17,65,29,31 ,42,08,39,97,8 8,10,86,57,61, 23,17,29,40,36 .	72,59,62,65,76 , 101,82,96,94,9 5,79,110,91,90 ,95,104,105,10 6.
POPULATION	5,90,090	3,53,140	4,61,850	4,09,489	4,23,529

Note:- By assuming volume/capacity and population have equal weightage and population data ward-wise is showing similar trend as per volume/capacity ratio so above assigned weight holds.

2) Land acquisition

Weightage here is assigned on the basis of private land acquired for depot and alignment of route.

In route 1- minimum land is acquired as alignment mostly elevated and passes alongside with current road network.

In route-2 – Most land will be acquired as terminal is planned as elevated option and is located in densely populated areas and for bridge construction, resettlement of eldeco colony was required.

In Route-3- Due to terminal at Mohabullahpur lies along densely populated areas with less ROW to construct stations so land requirement is more than Route-1 and route-5.

In Route 4- Route has major stretch along with route 2 so initial requirement of land requirement on temporary basis would high as it passes through old lucknow region.

In Route-5- Most of section is underground along major road and elevated section is planned of 3way divided carriageway so land is required only for Depot.

Weights to be assigned

CRITERIA	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
LAND ACQUISITION	1	9	5	7	3

3.)Cost

	Route-1	Route-2	Route-3	Route-4	Route-5
Length	22.8	18.8	17	17	11
total	7592.4	6260.4	5661	5661	3663

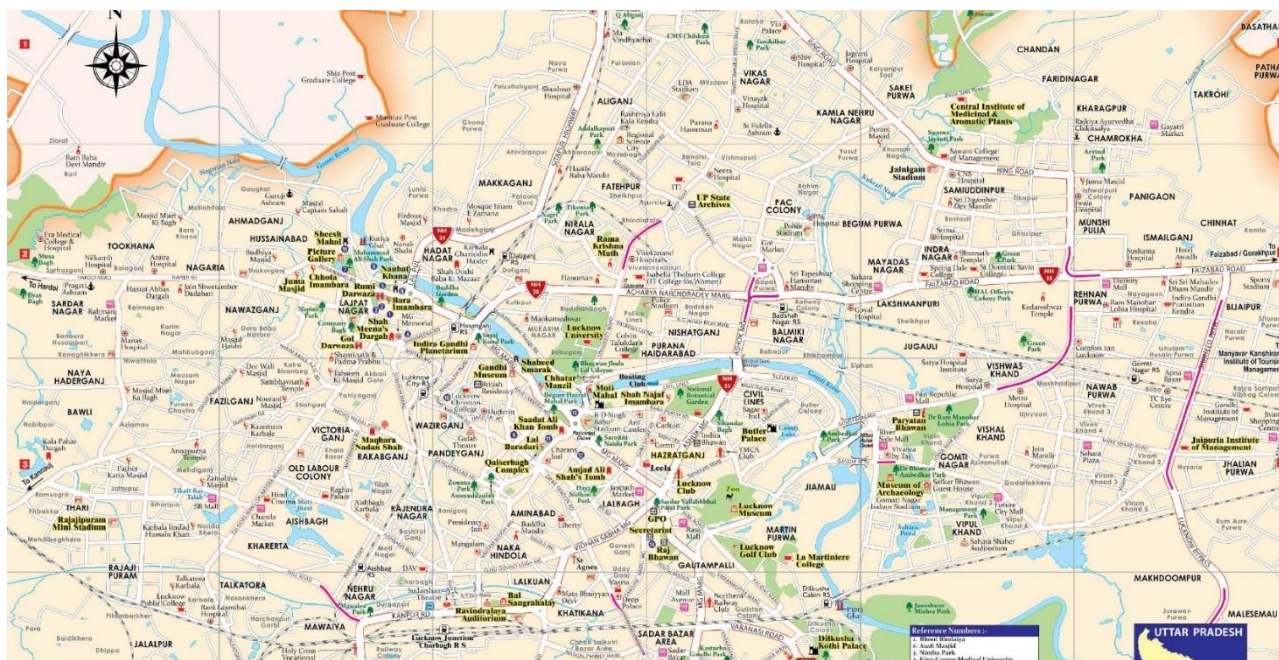
*Assuming 333cr per km as thumb rule calculated in lucknow mobility plan 2012.

Factors to consider-

- Due to Awadh rotary , mawaiya bridge and bridge over flyovers cost must be applied to route-1, route-3 .

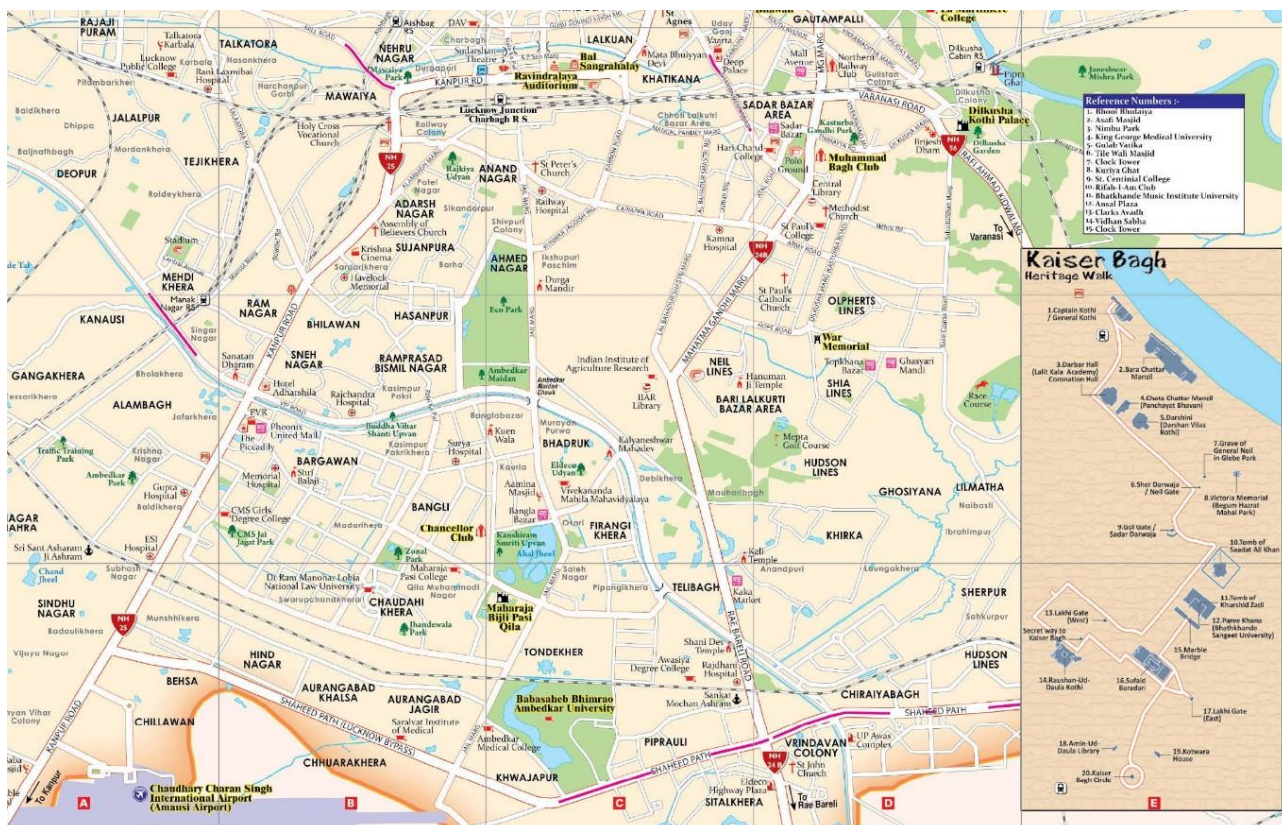
CRITERIA	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
COST	9	5	7	3	1

4.) RIGHT OF WAY



MAP-1

MAP OF LUCKNOW STREET ABOVE CHARBAGH



MAP-2 MAP OF LUCKNOW STREET BELOW CHARBAGH

ROUTE 1- The alignment is planned along NH25(MAP-2) and then went underground in Charbagh and then underground for 3 stations and then along MG road to university road and meets acharya dev Narayan Marg at IT Chauraha which meets Faizabad road at Polytechnic Chauraha. So ROW is available at every place to due NH And Arterial streets present.

ROUTE 2- It starts from Rajajipuram as an elevated option and then underground upto botanical garden and then follows along butler road and cross Gomti river at upstream side of lohia marg and then enters gomti nagar

ROUTE 3:-It starts from krishan nagar near awadh rotary and detaches itself from Route-1 at IT Chauraha and ends up at muhibullahpur.

ROUTE-4:- It has complexity of both Route-2 and Route-1.

Route-5 :- It starts at lucknow railway station underground and follows subash road till Lajpat nagar then an elevated alignment upto vasantkunj by following hardoi road which is a 6 lane road.

CRITERIA	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
ROW	1	7	5	9	3

5.) ACCESSIBILITY

It is decided by the major attraction covered by the alignment.

	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
CHARBAGH RAILWAY STATION	✓	✗	✓	✗	✓
AIRPORT	✓	✗	✓	✗	✗

ALAMBAG ISBT	✓	✗	✓	✗	✗
KAISERBAG ISBT	✗	✓	✗	✓	✓
TRANSPORT NAGAR	✓	✗	✓	✗	✗
GOMTI NAGAR MARKET	✓	✗	✗	✓	✗
MARKETS(LEKHRAJ+MAHANAGAR+INDRANAGAR)	✓	✗	✗	✓	✗
HERITAGE SITES	✗	✗	✗	✗	✓
AMINABAD MARKET	✗	✓	✗	✓	✓
HAZRATGANJ MARKET	✓	✓	✓	✗	
LOHIA PARK	✗	✓	✗	✓	✗
RESIDENTIAL	✗	✓	✗	✓	✗
OLD LUCKNOW MARKET	✗	✓	✗	✗	✓
DUBAGGA SUBZI MANDI	✗	✗	✗	✗	✓

CRITERIA	ROUTE-1	ROUTE-2	ROUTE-3	ROUTE-4	ROUTE-5
ACCESSIBILITY	1	5	7	9	3