International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Densification of Metro Corridors - A Case of Lucknow

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Abstract: ***The rapid growth in urbanization directly influences urban development processes such as housing, built up area, transport, network etc. This results into better transportation connectivity and amenities in the city. Mass rapid transit system is an accepting conveyance in urban development of metropolitan cities these days especially in India. The streets are narrow and blocked for miles by the local vehicles and public transportation. It was learnt in past itself that mass transportation and personal transportation cannot mix together. Mass transportation is a need at present. MRTS is a better option as compared to any other mode. The other mode like bus, auto-rickshaw, and share taxi to assist as a feeder service to MRTS and has equal importance to improve the catchment area. Bolstering public transport is an absolute necessity as relentless growth of private travel is just not sustainable. The study evolves around understanding the need of densification of metro corridor according to the metro policy of 2017. A study has been done on the building use, built form, street character of the study area of Lucknow to analyses the gap and the potential sites where alternative product mix could be generated to increase the zonal development and the metro ridership vice versa. The transit oriented development is taken into consideration for parameters like walkability, healthier lifestyle, reduced traffic congestion, increased transit ridership, greater mobility, better environment and places to live and work.***

Keywords: Metro, Mixed Use Development, High F.A.R, Transit Oriented Development, High Density, Transportation, Connectivity

1. Introduction

Urban areas have been recognized as “engines of inclusive economic growth”. Out of 121 crore Indians, 83.3 crore live in rural areas while 37.7 crore stays in urban areas, i.e. approx. 32% of the population. (Insights of India, 2019)
Urbanization has its impact on all aspects of day – to – day life.

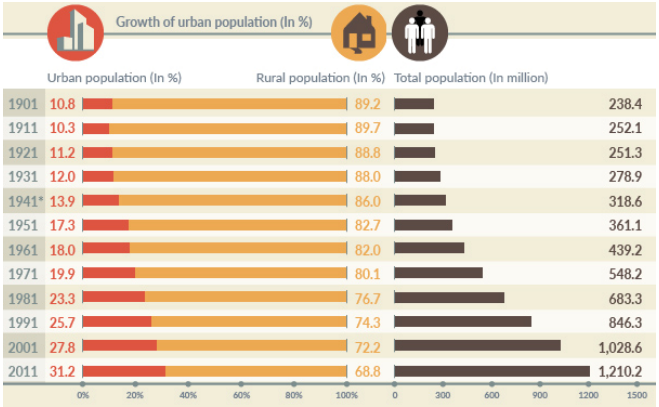

Figure 1: Urbanization Growth in India
Source: (India, 2011)

2. Urban Development

Urban Growth directly influences the urban development processes such as housing, built up area, transport, network etc. Urban development is a state subject. It is generally conceived of as the physical foundation of the city or, as one historian graphically put it, the “technological sinews” built to meet the needs of society. More precisely these are transportation networks, power grids, utility systems, and tele communicative linkages that deliver the heat, light, water and power that are central to urban life. (Perry, 2001)

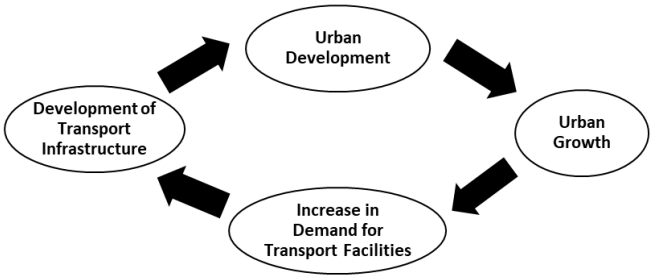

Figure 2: Development Cycle
Source: (Kant, 2019)

3. Role of Metro in Urbanization

Transport plays an important role in the development of urban areas by providing options for travel and transport and by influencing the economic development through accessibility which it provides. Megacities and Metropolitan cities are in need of rapid, less polluted, congestion free transit system. Urban growth and transport are closely related as development of transport infrastructure leads to urban development in one way and the urban growth causes increase in demand for transport facilities in another way. (Alijoufie, Zuidgeest, Brussel, & Maarseveen, 2011)

3.1 Metro Policy

Metro Rail systems need to be seen not merely as a transportation project, but as urban transformation projects that help a city move from sprawled development to greater compactness leading to sustainable cities. Lower travel distances, vastly reducing energy consumption and significantly lowering emissions should be the objective of such investments, along with faster mode of travel. Under TOD, city densification will be promoted along mass transit corridors through vertical construction by substantially

enhancing FARs (Floor Area Ratio) backed by promotion of Non-motorized Transport Infrastructure for walking and cycling to transport stations, development of street networks in the influence zone of transit corridors, multimodal integration, effective first and last mile connectivity through feeder services to enable people access public transit in 5 to 10 minutes from home and work places.

Dense living along transit corridors besides resulting in enhanced living and travel experience, will also improve ridership of mass transit systems. If properly executed, TOD could emerge as a means of financing mass transit project, for which the demand is growing. TOD promotes integration of land use planning with transportation and infrastructure development to avoid long distance travel in cities through compact development as against the present pattern of unplanned and haphazard urban growth.

Under the new Metro Policy, TOD has been mandatory while under Green Urban Mobility Scheme, TOD has been made an essential reform and is given priority for receiving central assistance. TOD Policy also aims at inclusive development by ensuring mixed neighborhood development in the form of a range of housing choices including affordable housing and ensuring spaces for street vendors. (Affairs, 2017)

4. Lucknow Metro

Corridor	Elevated (km)	Underground (km)	Total Length (km)
North- South Corridor (CCS Airport to Munshi Pulia)	19.438	3.440	22.878

Number of Stations

Description	Underground	Elevated	Total
North- South Corridor (CCS Airport to Munshi Pulia)	3	19	22

Source: (Metro, 2015)

Table 4.1: Projected Daily Ridership of Lucknow Metro

Year	Corridor Length (km)	PHPDT	Daily Passenger km	Daily Ridership	Average Trip Length (km)
North-South Corridor : CCS Airport to Munshi Pulia					
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

Source: (Metro, 2015)

Table 4.2: Daily Loading Station Wise

Station	Station Name	2015	2020	2025	2030	2041
1	CCS Airport	1170	1260	1340	1400	1520
2	Amausi	4700	5020	5370	5610	6070
3	Transport Nagar	2530	6690	9280	12330	18460
4	Krishnagar	10340	24050	29780	56570	74850
5	Singar Nagar	5780	10780	16240	19370	26990
6	Alambagh	13180	18840	21000	26250	35040
7	Alambagh Bus Stn	12340	20990	28410	37580	63020
8	Mawaiya	50990	61889	63180	72600	87180
9	Durgapuri	25980	35910	56450	59330	88130
10	Lucknow Rly. Stn	77650	143030	186620	241260	332350
11	Hussain Ganj	36760	44940	60180	78300	88620
12	Sachivalaya	11370	14800	17510	23410	26710
13	Hazarat Ganj	17380	21440	25170	31600	37070
14	KDSinghBabuStadium	4550	6720	10060	16450	14280
15	Vishwavidyalaya	5540	10580	14340	20810	18710
16	IT College Junction	10210	17500	24830	30870	27480
17	Mahanagar	50420	68100	88720	103210	118720
18	Badshah Nagar	13480	26270	36640	44000	61990
19	Lekhraj Market	21220	32100	41980	56330	71860
20	Ram Sagar Mishra Nagar	10410	16470	21360	27930	37240
21	Indira Nagar	15930	21310	29050	38030	53270
22	Munshipulia	27320	35970	45730	51050	54410

Source: (Metro, 2015)

5. Transit Oriented Development

Transit oriented Development Means Transit Services/ development around stations which is dense, compact and mixed use, walking distance from transit stop / station and encourages walkability or use of public transport mode rather than private vehicles.

5.1 TOD Zone Marking

Mass Rapid Transit System / MRTS, Transit / Metro Corridor's effective Area is marked under Masterplan / Zonal Development Plan by the development authority. The outer Limit of the TOD Zone is 500 meters on both sides of MRTS Transit/ Transit / MRTS Corridor whereas around the metro station the local situations and development potential visualization the exterior limit could be more than 500 meters.

5.2 Mixed Use Building Bye- Laws

Table 5.2.1 Building Byelaws for Mixed Use in TOD Zone

Building Development Expectations	Developed Areas	New/ Un-Developed Areas
Minimum Area of Land	0.5Hectare	4.0 Hectare
Minimum width of access road	18 meters	30 meters
Basic F.A.R	2.0	2.5
Purchasable F.A.R	4.0	55.0
Ground Coverage	50%	40%
Setback	Acc. To Building Byelaws	
Parking	Every 100sqm per 105 E.C.S Every residential unit in vertical mixed use 2 sqm for 1 cycle parking	

6. Study Area (Airport – Awadh Chauraha)

It is a 4.73 Km stretch wit 5 metro stations on it namely, CCS, Amausi, Transport Nagar, Krishna Nagar & Singar Nagar. These metro stations have the least daily ridership credibility. Due to which there is less commuters to this zone of Lucknow. Despite of having big residential areas on the

stretch. Transport Nagar is also the hub for logistics and transportation. Despite of several attractions this area has visitors only from nearby catchment area. The other side of the city is well established with all kind of amenities and spaces which lacks the interest of citizens living on other side of the river Gomti.

Figure 3: Study Area Stretch
Source: (Kant, 2019)

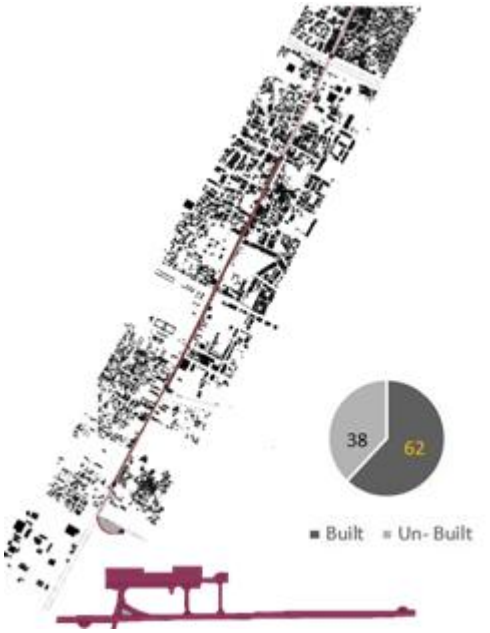

Figure 4: Built - Unbuilt Map (Study Area)
Source: (Kant, 2019)

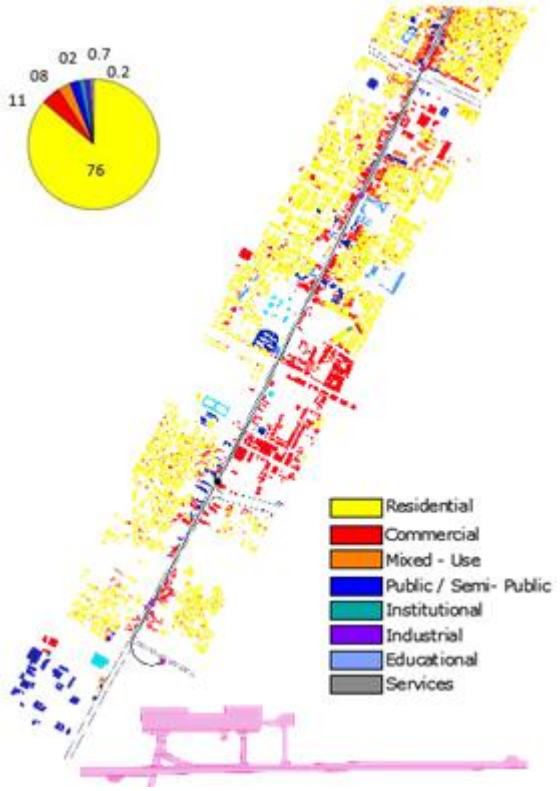

Figure 5: Building Use Map (Study Area)
Source: (Kant, 2019)

Figure 6 Building Height Map (Study Area)
Source (Kant, 2019)

7. Analysis of deficiency in existing spaces as per URDPFI guidelines at neighborhood level, ward – wise

Figure 7: Map of Zone 5, Lucknow
Source: (Kant, 2019)

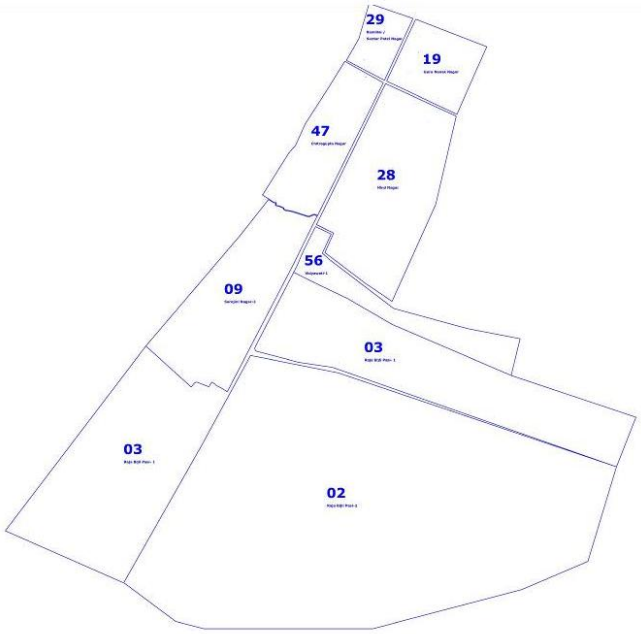

Figure 8: Wards in the Study Area
Source: (Kant, 2019)

Table 7.1 Ward- Wise Population

Ward Number	Ward Name	Population
Ward No.02	Raja Bijli Pasi – 2	41971
Ward No.03	Raja Bijli Pasi – 1	17988
Ward No.04	Sarojini Nagar -1	22717
Ward No.09	Sarojini Nagar -2	50574
Ward No.19	Guru Nanak Nagar	23588
Ward No.28	Hind Nagar	25218
Ward No.29	Ramlilal/ Sardar Patel Nagar	22318
Ward No.47	Chitragupta Nagar	32543
Ward No.56	Vidyawati -1	16353
		253270

Source: (Kant, 2019)

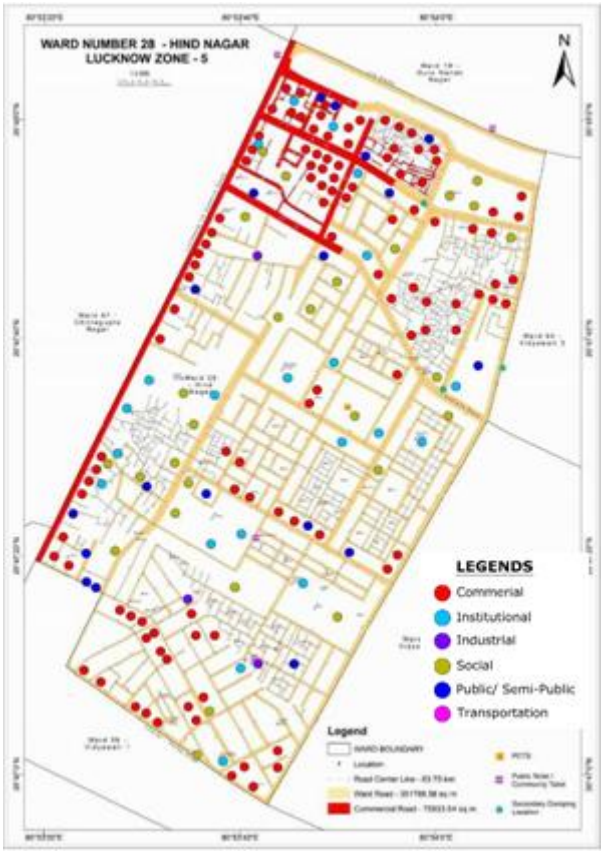

Figure 9: Ward No. 28 Hind Nagar, Zone 5- Lucknow
Source: (Kant, 2019)

Figure 10: Ward No. 29 Ramlilal/ Sardar Patel Nagar, Zone 5 - Lucknow
Source: (Kant, 2019)

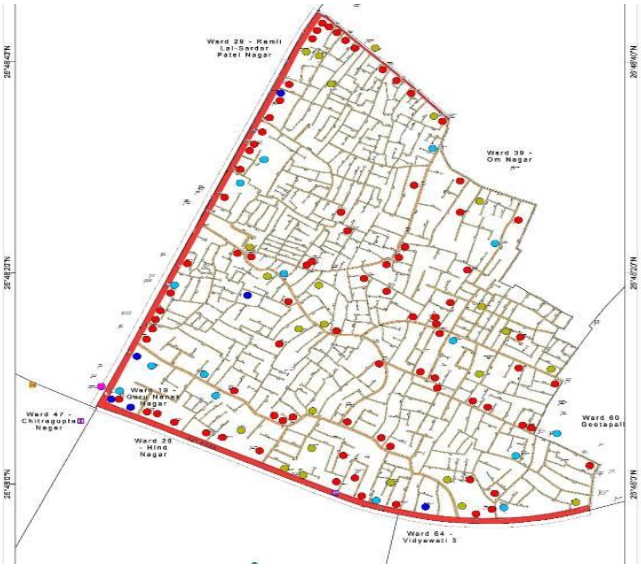

Figure 11: Ward No. 19 Guru Nanak Nagar, Zone 5- Lucknow
Source: (Kant, 2019)

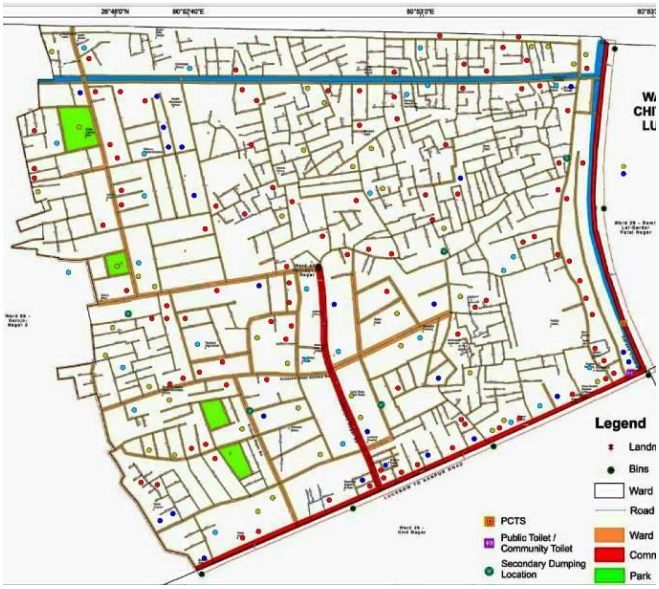

Figure 12: Ward No. 47 Chitragupta Nagar, Zone 5 - Lucknow
Source: (Kant, 2019)

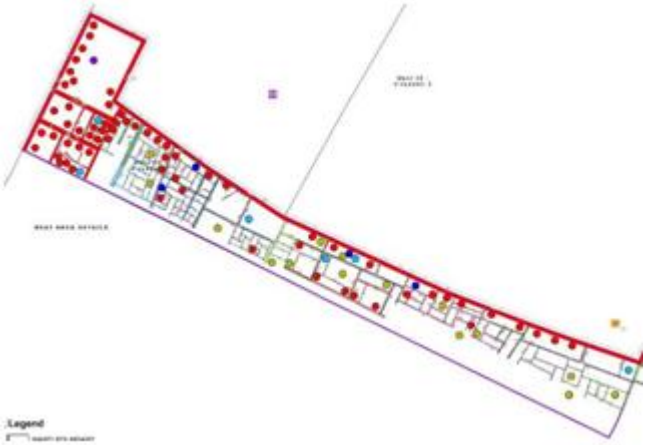

Figure 13: Ward No. 56 Vidyawati-1 , Zone 5- Lucknow
Source: (Kant, 2019)

Figure 14: Ward No. 03 Raja Bijli Pasi 1, Zone5 - Lucknow
Source: (Kant, 2019)

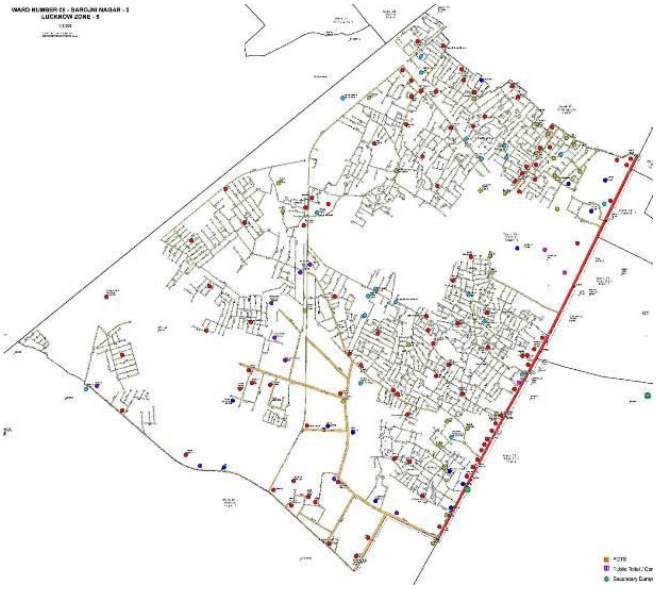

Figure 15: Ward No. 02- Sarojini Nagar 2, Zone 5 Lucknow
Source: (Kant, 2019)

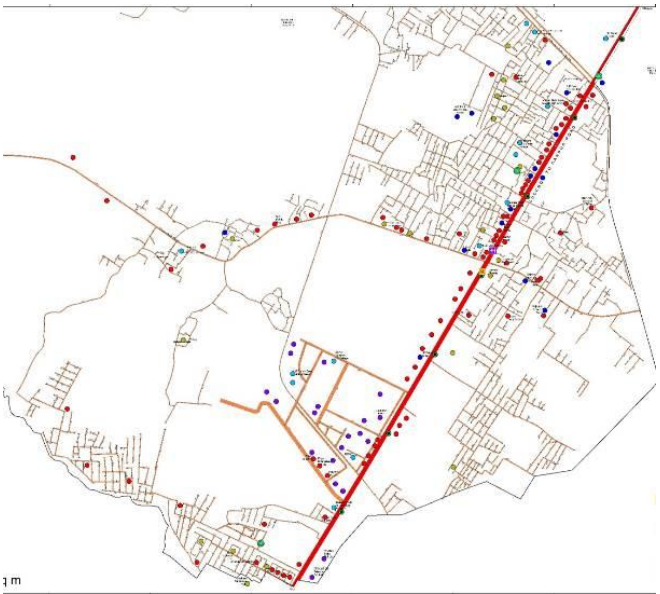

Figure 16; Ward No.04- Sarojini Nagar 1, Zone 5- Lucknow
Source: (Kant, 2019)

Figure 17: Ward No. 02- Raja Bijli Pasi-2, Lucknow
Source: (Kant, 2019)

8. Potential Sites along the Metro Corridor in Study area

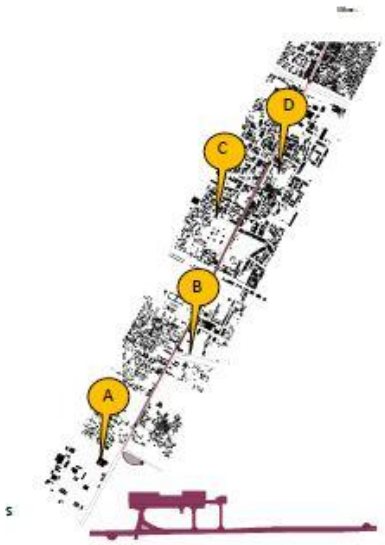

Figure 18: Location of Potential Sites
Source: (Kant, 2019)

a) Amausi Bus Depot Workshop and Uttar Pradesh Drugs Pharmaceutical Limited

Figure 19: Amausi Bus Depot and UPDPL, Potential Site.
Source: (Kant, 2019)

Amausi Bus Depot is 8.63 Acres of land which is currently being used as UPSRTC Bus Depot Workshop only.

Co-ordinates – 26^0 45' 55" N 80^0 52' 25" E.

This site is not developed in a planned way not utilized in maximum potential. UPDPL is a 16.70 Acres of land with massive vegetation all over as the production unit has been terminated in 2016 and from then onwards this huge production plant structure is being into abandoned conditions.

Figure 20: Bus Depot Workshop
Source: (Kant, 2019)

Figure 21: UPDPL, Lucknow
Source: (Kant, 2019)

b) Transport Nagar

Figure 22: Transport Nagar Potential Site
Source: (Kant, 2019)

Co-ordinates – 26^0 77' 78" N 80^0 88' 26" E.

This is 20.83 Acres of land exactly behind the Transport nagar metro station. It belongs to the Airport authority of India. It is a barren land with massive vegetation on it. Green field development could be much easier for the mixed use development. Due to metro station attached to site increases the accessibility factor.

c) Literacy House, Lucknow

Co-ordinates – 26^0 47' 16" N 80^0 53' 11" E.

Literacy House is a prominent project by architect Laurie Baker. It was started by M.K Gandhi and Welthy Honsinger Fisher in 1956 and became for its effectiveness. The Site is developed with scattered buildings in a radial planning and brick jail concepts. The premises is spread on 31. 67 Acres of land with good landscaping around. At present there runs a primary school, a bank, small library along with some residential quarters in living conditions. More than 2/3 of the site is being used as a playing ground.

Figure 23: Literacy House, Potential Site.
Source: (Kant, 2019)

Figure 24: Literacy House Campus, Lucknow
Source: (Kant, 2019)

d) Polytechnic College, Krishna Nagar

Figure 25: Polytechnic College, Krishna Nagar
Source: (Kant, 2019)

Co-ordinates – 28^0 39' 28" N 77^0 17' 25" E.

Polytechnic College, Krishna Nagar is in functional state with one new building, but the premises have multiple old abandoned G+2/3 structures in a dilapidated condition. Premises has huge chunk of barren land also. Amidst of residential zones, site is surround by multiple activities and uses. The site is just behind the Krishna Nagar Metro Station which again gives the easy accessibility to the site from all axis of the city.

Figure 26: Polytechnic College
Source: (Kant, 2019)

9. Conclusions from the Surveys

Various analysis had been made through two surveys i.e. Metro riders surveys done at all the metro stations in the study area & Surveys from the localities in the neighborhood.

The following conclusions have been made from metro rider's survey:

- The maximum riders are of age group between 30-50 of service class and students.
- Maximum riders are from service class followed by professional and students.
- 52% of the surveyors ride metro on daily basis.
- 33% of the rider's approaches metro from 2-5Km of distance followed by 30% within the walking distance.
- The maximum riders commute to work and leisure activities.
- These riders opt metro as a primary mode of transportation.
- They use feeder services and public services like E-Rickshaw, Autos and Buses to access metro.

Conclusions of localities from neighborhood surveys:

- The majority of residents are staying there from past 6-10 years.
- Most of the residents got migrated due to the employment.
- Mixed use activities are appreciated by the locals of the neighbourhood.
- Most suitable mixed use activities are commercial spaces and Corporate Offices, IT Hubs and Trade Centres.
- Reduced car dependency and encouragement to walk is the most beneficial parameter of mixed use compatibility.
- Residents feels safe at night due to active streets in the neighbourhood.
- Bye- Pass traffic, encroachment by hawkers and commercialization are the reasons for congested streets.

- The majority of the residents visits other CBD's of the city once in a week for their needs.
- The residents are interested in more influx of tourists and visitors.
- The locals are in favour of redevelopment for the urban upliftment.

10. Salient findings from the study

- Metro has the potential to induce & guide development in urban areas.
- Metro corridor is eventually densified due to easy accessibility.
- Metro reduces the dependency on cars and encourages public transport, which indirectly reduces the pollution.
- Mobility pattern can be rapidly analysed, through urban structure analysis.
- Mixed land use is prominent in the case studies post densification of metro corridors.
- Densification of metro corridors requires mixed use and Transit Oriented Development.
- Densification can be done horizontally or vertically.
- Densification in metro corridor till the radius of 500 meters gives higher FSI
- The development controls and bye laws have been changed without considering masterplan with the implementation of MRTS in the case studies.

11. Recommendations

- There is a need to provide better Commercial / Institutional in the study area.
- The encroachment by vendors needs to be taken into design parameters by providing them a proper space.
- The mobility pattern of last mile connectivity and feeder services needs to be re planned,
- The parking and pick – drop point for feeder services needs to be provided.
- Reduction of Heavy Vehicle traffic from the highways, before entering into city.
- Form Based Code Regulations for the new development.

12. Alternative Product Mixes on different Potential Sites

The vision for the whole project is to develop the Takia Sharif complex with an inclusive planning scheme keeping the beautification and workability into parallel concern. The Kothis in the complex can be utilized for visitors to stay and the complex could be transformed into a "hospice" for the

Table 12.1 Alternative Product Mixes.

Potential Sites	Product Mixes
Amausi Depot / UPDPL Area – 9.2 Hectares	• Ware House • Truck- Terminal • Multi- Modal Hub
Transport Nagar Area – 8.43 Hectares	• Trade Centre • Convention Centres • Business Parks
Literacy House Area – 12.8 Hectares	• Embassy Parks • Habitat Centre • Corporate Office
Polytechnic College Area – 4.68 Hectares	• Education Park • Boarding House/ Lodging House

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