

1. INTRODUCTION

1.1 BACKGROUND

Varanasi is the fifth most populous city in the state of Uttar Pradesh and it is often referred to as "the holy city of India" or "the religious capital of India". Varanasi is well connected by road, rail and air with other parts of the country. The city is surrounded by Jaunpur and Azamgarh in north, Bhadoi and Allahabad in west, Mirzapur and Robertsganj in south & Mughal Sarai and Ghazipur in east. Varanasi is a tourist centre with ghats, temples, educational and archaeological sites as main attractions. Varanasi is a UNESCO declared heritage city attracting sizable population of tourist from across the world each year. The city also has a strong cantonment base along with Diesel Locomotive Works (DLW) and Bharat Heavy Electrical Ltd. (BHEL) as major industrial units.

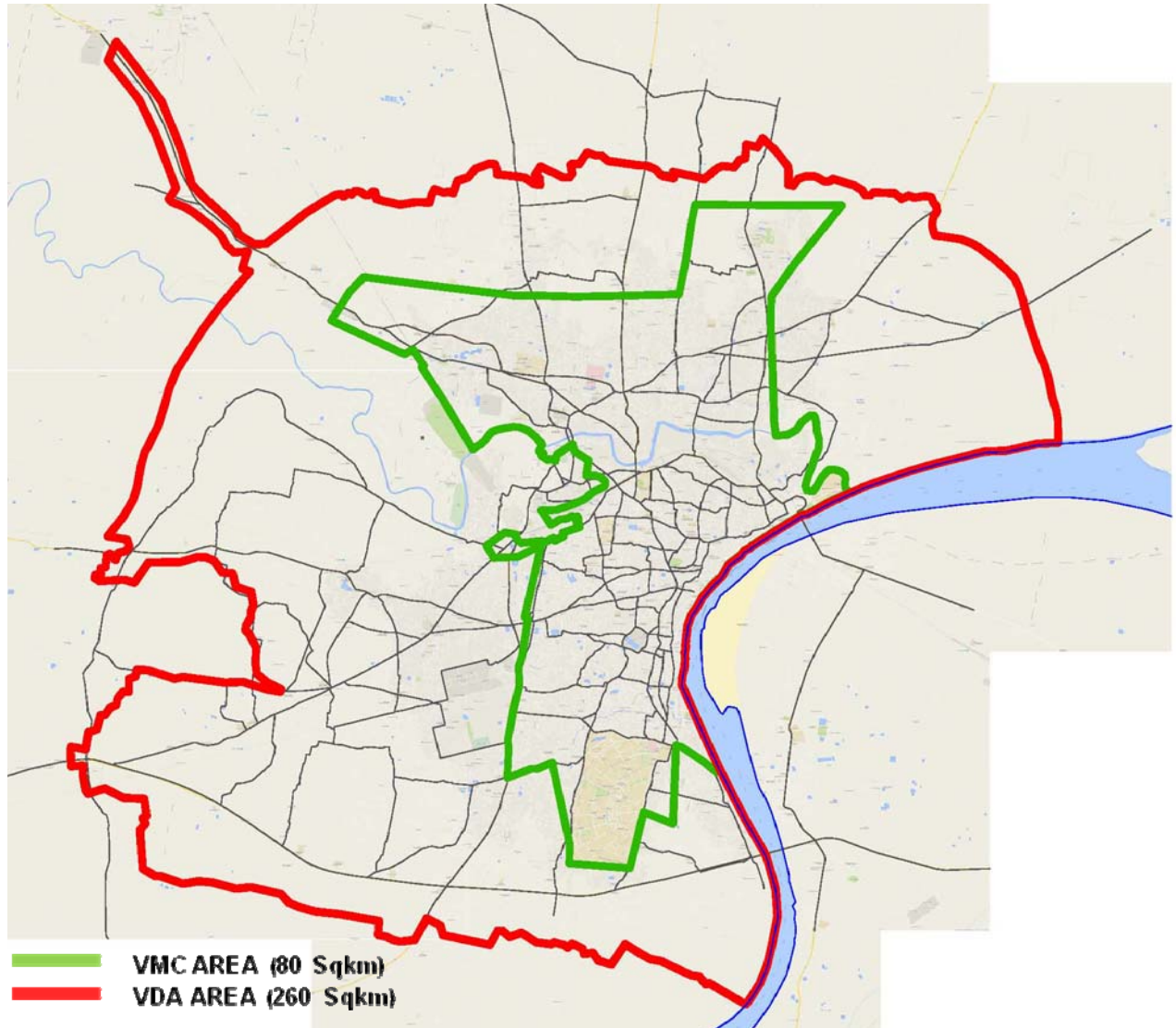
As per the National Urban Transport Policy (NUTP), Comprehensive Mobility Plan (CMP) for Varanasi was prepared in 2009 which lays out a set of measured steps that are designed to improve transportation scenario in the city in a sustainable manner. The CMP proposes a total of 57.5 km length of rail based mass rapid transit system (MRTS) network in Varanasi. 25.9 km of the proposed network was to be completed in Phase II (2015 – 2019) and the remaining network to be completed in Phase III (2020 – 2029) of implementation programme.

The State Government has now decided to introduce an efficient, safe and high capacity rail based transport system in Varanasi. RITES Ltd. has been engaged to prepare Detailed Project report (DPR) of Rail Based Mass Rapid Transit System (MRTS) in Varanasi.

1.2 STUDY AREA AND PERSPECTIVE

The study area for current assignment is boundary of Varanasi Urban Agglomeration or the administrative boundary of Varanasi Development Authority (VDA) for which the Master Plan 2031 has been prepared. The study area expands over 260 SqKm.

The study area includes Varanasi Municipal Area, Varanasi Cantonment Board, Manduadih Railway Settlement, Phulwaria, Shivdaspur and Kandwa. **FIGURE 1.1** presents the Varanasi Urban Agglomerate which will be considered for the present study and major centres therein.

FIGURE 1.1: STUDY AREA - VARANASI DEVELOPMENT AUTHORITY AREA

1.2.1 Population Trends

As per Census 2011, the population of Varanasi Municipal Corporation is about 11.9 lakh. The population of Cantonment, Census Towns and surrounding villages is about 5.8 lakh. The average decadal growth for the past 6 decades stands at 27.8% while average annual growth rate is 2.5%. The population growth in the last decade is observed as 2.8%. The decadal population growth of Varanasi Urban Agglomeration during the last six decades is shown in TABLE 1.1.

TABLE 1.1: DECADAL POPULATION GROWTH IN VARANASI URBAN AREA

Year	Population	% Decadal Growth
1951	3,55,771	-

1961	4,89,864	38%
1971	6,17,934	26%
1981	7,73,865	25%
1991	10,00,747	29%
2001	11,70,897	17%
2011	15,40,000	31%

Source: Varanasi Master Plan, 2031

The study area population for base year 2015 has been estimated considering the growth rates assumed in Master Plan 2031 and is presented in **TABLE 1.2**.

TABLE 1.2: POPULATION IN VDA AREA- 2015 (IN LAKH)

SN	Area	Population
1	VMC	13.7
2	Cantonment + Census Towns + Villages	6.9
Total		20.6

1.3 STUDY OBJECTIVES

- i. Phased development of the MRTS network in order to optimize its ease of implementation, financial viability and progressive growth to match the growing demand and ensuring the concurrent growth of new MRTS related initiatives to improve quality of life in urban areas
- ii. A sustainable public transit plan for the city, recognizing a hierarchy of transport demands, out of which the MRTS network is at the core and fore-front
- iii. Optimum usage of land available
- iv. Minimal adverse impact on environment
- v. Minimal adverse impact on the local population due to construction of the MRTS

1.4 SCOPE OF WORK

- i. Review of CMP & CDP Recommendations and Feasibility Study
- ii. Review of relevant study reports, Master Plan and secondary data collection for assessing the demographic, socio-economic and transport characteristics.
- iii. Study of CMP and CDP recommendations, particularly relating to Mass Transit Systems and corridors.

- iv. Development of transport demand model taking into consideration future population, land use, employment and new developments proposed in the study area.
- v. Traffic & Transportation surveys including Household interviews for estimation of Transport Demand and projection of sectional and station traffic loads for various horizon years. About 1.5% sampling of urban population shall be considered when carrying out house hold surveys, ensuring coverage of entire cross section.
- vi. Origin-Destination study will be conducted to firm up MRTS corridor, based on the house-to-house enquiries and traffic pattern studies, etc.
- vii. Mid block and screen line counts will be carried out for validation of model. Pedestrian counts and parking surveys will be carried out in the influence area of proposed metro stations, to plan for intermodal integration facilities.
- viii. Identification of current /future points of attraction in the city (Health, Education, Transport, Business, Industry, Transports etc.).
- ix. Reconnaissance surveys and confirmation of recommended MRTS corridors, stations and estimation of ridership on the corridors.
- x. Examining merits and demerits of various mass transit mode and facilities successfully demonstrated elsewhere.
- xi. Feasibility Report would finalise the priority MRTS corridors in consultation with the VDA/ stakeholders. It will also bring out the competitive profile of the suggested system in comparison to other mass transit modes. The Feasibility Report would indicate the cost effective solution in terms of both the Transit system cost and the Transit operation & maintenance cost of the system along with alternative models for financing directly or indirectly such initiative. Non-fare revenue sources (advertisement, densification of corridor, TOO, etc.) will be listed and implementation possibility closely examined in this context.

1.4.1 Preparation of DPR for Rail Based MRTS

This will be done for agreed priority corridors and scope will cover:

- i. Reconnaissance surveys and studies for identified corridors
- ii. DPR will examine integration/interchange requirements with other mode of transport including proposed projects as identified in Feasibility study and CMP.

- iii. Estimate sensitivities of the project, i.e. the factors which could alter the utility, nature, reliability, adequacy etc. of the Project. (Example: Development of an alternative mass transit system, further expansion of the city in different directions, alternative in the Zoning patterns of the city during construction/operation stages, which could affect the viability of the project etc.).
- iv. Identify locations for utility diversion and traffic management plan during construction period.
- v. Land requirement for routes, stations, depots and Transit Oriented Development (TOD) with cost.
- vi. Integration of multimodal system including feeder system with special emphasis on River transport system.
- vii. Modalities to adopt BOT/PPP format for financing the project, if it is otherwise bankable, GOI guidelines for PPP project will be applicable.
- viii. Guidelines for preparation of detailed projects issued by MoUD will be used to the extent applicable.
- ix. Within the overall framework as indicated above, consultants are free to make recommendations for improving the project viability, acceptability, constructability and operational efficiency to provide better quality of service.
- x. Planning for system, power supply and other support infrastructure.
- xi. Social, Environmental and Traffic impact assessment studies.
- xii. Requirement and operation of feeder buses in catchment area as part of the DPR.
- xiii. Regulation/compliance requirements.
- xiv. The DPR would bring out explicitly the competitive profile of the suggested system in comparison to other mass transit systems. DPR would indicate the cost effective solution in terms of both – the system cost and the operation & maintenance cost of the system along with alternative models for financing such a system. The earning from FAR sale, advertisement, densification of corridor will also be taken into account.

1.4.2 Civil Works – Alignment

- i. Alignment Selection – Study of different alignment, review of general alignment of the corridor and horizontal and vertical profile of the recommended alignment.

Minimum clearance above road level for any OH structure will not be less than 5.5m. If the alignment crosses any other existing/proposed rail corridors, clearances will be provided as per Railway Rules.

- ii. Projections for traffic demand shall be worked out through traffic demand modeling for the year of commissioning and horizon years. Sectional loading and station loading shall be worked out based on these projections.
- iii. To carry out detailed topographic surveys along the final alignment.
- iv. To conduct geotechnical investigations along the alignment to determine structural requirements for the viaduct. One Bore-hole/km will be sufficient for the purpose. If any abrupt change of strata is noticed, additional hole may be necessary.
- v. For the underground section, the geotechnical investigations shall be done in sufficient details to determine the technical feasibility of the proposed tunneling methodology.
- vi. To collect data about the existing -underground/overhead utilities along the alignment from various agencies and identity such utilities likely to be affected permanently requiring diversion or temporally during construction.
- vii. Geometric design of the route alignment covering horizontal as well as vertical profile.
- viii. To identify station location taking into account catchments area, adequacy of R.O.W., feasibility of entry/exit facilities, availability of parking areas and any other factor having impact on constructability and functioning of the station.
- ix. Identity locations for car maintenance depot(s).
- x. Ascertain land acquisition requirements for the project for facilities like station areas, electric substation (TSS and RSS) maintenance Depot and construction depots, Govt. and private Lands should be identified separately. R & R requirements based on State Government policy be determined.
- xi. Study the impact of MRTS corridor on the overall drainage of the area both during the construction and operations phase, especially in flood-prone areas.
- xii. To review the impact of proposed metro corridor and the required road improvement works along the alignment and recommend change, if any, needed for proper integrations.

- xiii. Check for any other data/information not specifically mentioned but needed to determine the feasibility of the corridor.
- xiv. To prepare preliminary structural design for the viaduct as per standards of loading specified by relevant IS/ international codes of practice. Consultants will however review and recommend if any changes are considered appropriate.
- xv. For the viaduct width, the Consultant will make proposal based on designs in vogue for similar systems, keeping in view the proposed structural arrangement. The recommended section will be supported by calculations for centre-to-centre distance of tracks; required clearances and design to be adopted as per schedule of dimension/prevaling practice.
- xvi. The emergency evacuation arrangements in the event of mid-section train failures are an important factor to determine viaduct width. Snapping of high voltage OH conductor, breaking of pantograph, etc. are also to be considered to ensure safety.

1.4.3 Track Structure

Consultants will recommend suitable track structure including Type of Rails, Method of Welding, Fastening System, Type of Points and Xing's etc. Ballasted Track can be considered for Depot area.

1.4.4 Stations

To prepare site-specific typical stations layouts to handle the projected traffic will be prepared. Stations will follow 'closed system' with complete access control through AFC. Lifts/escalators will be provided for the comfort of passengers especially physically challenged passengers. Stations may have single/double entry. Layout should provide adequate facilities for all operational, commercial and technical requirements.

- i. So far as possible, stations will be accommodated within R.O.W. In exceptional cases, additional land requirements may be indicated.
- ii. If any real commercial development is proposed at stations, the same should be included in layouts.
- iii. Station layout will take security concerns into account.
- iv. Integration with other modes of public transport at interchange stations will be provided for adequately.

- v. Requirements of public information system, passenger amenities, signage etc. will be considered to enable realistic estimation.
- vi. Exploring feasibility & integration of PPP development mode in the construction of the stations.

1.4.5 Train Operation Plan

The train operation plan will include operation philosophy, preparation of the hourly train operation plan to handle the projected ridership and recommend its phased implementation. Based on the train operation plan, requirement of rolling stock (year wise rack requirements) will be worked out. Design parameters will be finalized as per relevant Indian Standards /International codes of practice.

1.4.6 Traction System & power Supply

As per system requirement, suitable traction system will be proposed to be adopted. Power requirement and source of power supply will be indicated. Consultants will recommend in sufficient detail the power supply arrangements, preliminary design of Overhead / Other traction system as per standards for viaduct and underground section as applicable and will estimate electrical load that needs to be contracted with different alternative modes of traction.

1.4.7 Signalling

Consultants will propose suitable signalling system to serve the Train Operation Plan effectively. The recommended system has to be cost-effective.

1.4.8 Rolling Stock

Suitable size Rolling Stock and appropriate traction is to be proposed. Consultants will recommend suitable Rolling Stock with optimal life-cycle cost. Suitable passenger density for normal operations and for peak traffic hours is to be determined.

1.4.9 Communication

Consultants will recommend appropriate communication system to serve all the operational requirements of the system. Suitable operation control system will also be proposed.

1.4.10 Non- Motorized Transport

Provision shall be made for Non- motorized transport infrastructure development in the influence zone of the Metro.

1.4.11 Planning for Feeder Service

Planning for feeder service shall be the part of the Metro project. Planning for provision of proper facilities for feeder buses and other means of transport at the Metro station shall be provided for last mile connectivity to the commuter.

1.4.12 Maintenance facilities

- i. Consultants will propose suitable Car Depot layout with required maintenance facilities as per recommended schedules of rolling stock maintenance. The depot will also have facilities for rolling stock maintenance. The depot will also have facilities for maintenance of Track, OH/other Traction, Signalling & Communication, AFC, Station Services etc. Operation Control Centre will be located in depot area.
- ii. Consultants will also recommend plant and machinery required for effective maintenance of rolling stock and all other assets.

1.4.13 Environment and Social Impact Assessment

- i. Consultants will conduct Environment and Social Impact Assessment (EIA) study along the alignment and propose Environment Management Plan (EMP) for construction and operation phase. Study will devote special attention to noise pollution during construction/ operation phase, impact on traffic during construction, any adverse impact on the adjacent properties, business in the area and impact on general quality of life in the project influence area.
- ii. The study will include mapping the existing and expected noise level (during execution of project) along the corridor. The noise data will be collected at noise monitoring stations at varying intervals-morning, afternoon and evening-during peak and off peak hours. The Consultants study will cover the impact of increase in noise level, mitigation measures etc.
- iii. The EIA study will clearly bring out if any clearances are required under existing Regulations with requisite details.
- iv. The Socio-economic impact in the area will be realistically assessed and suitable mitigation measures recommended.
- v. The benefits of metro from societal perspective (both social and economic) supported by description in qualitative terms and quantification of these benefits to the extent possible. At the same time adverse impact from societal perspective (both social and economic) should also be evaluated and quantified accordingly.

Both direct and indirect societal impact should be evaluated. Based on social cost benefits analysis economic internal rate of return (EIRR) shall be arrived.

1.4.14 Cost- Estimates

The project cost should cover distinct elements such as land acquisition/ site development cost, construction cost, cost of shifting utilities, cost of consultancy services for design, supervision, quality assurance, finance/ interest cost during construction, contingency, any other.

For all cost elements, assumptions (rates, methods of calculations, etc.) are to be clearly given either in the main text or as an attached appendix of the DPR.

- i. Consultants will propose suitable car depot layout with required maintenance facilities as per recommended schedules of rolling stock maintenance. The depot will also have facilities for rolling stock maintenance. The depot will also have facilities for maintenance of track, overhead/other traction, signaling & communication, automatic fare collection, station services etc. Operation control centre will be located in depot area.
- ii. The consultant will prepare realistic base cost-estimates for all the project elements including taxes and duties. The details in support of cost-estimates will need to be furnished.
- iii. The completion cost will be worked out based on phasing of expenditure during construction and appropriate escalation factor.
- iv. The Interest during Construction (IDC) should also be worked out based on adopted mode of funding.
- v. Maintenance cost including periodical maintenance, annual maintenance and long-term maintenance

1.4.15 Financial Analysis

- i. The consultant will prepare detailed financial analysis to work out the FIRR based on project cash flows.
- ii. The DPR is to provide financial analysis for (Net Present Value) NPV and (Internal rate of Return) IRR defined in the following two ways:
 - a) NPV& IRR (overall): examines overall project viability, including finance cost and asset replacement cost.

b) NPV& IRR (O&M): examines only O&M viability.

The complete supporting project cash flows projections along with underlying assumptions have to be presented.

- iii. For the purpose of financial analysis, Consultant will assess realistic O & M expenditure under 3 subheads viz. staff, energy consumption and assets maintenance.
- iv. The capital expenditure on additional assets for capacity augmentation replacement costs for assets etc. will be assessed.
- v. The financial model shall be prepared in such a way that some part of capital expenditure should be proposed to be recovered through property development and at least 12.5% of operation and management cost through recurring source of revenue other than fare.
- vi. Fare box revenue will be worked out based on ridership forecast and proposed fare structure. Revenue from other sources viz advertisement, real estate and other commercial activities will be considered as applicable.
- vii. Consultant will also carry out sensitivity analysis for cost over-run and/or variations in Revenue Streams.
- viii. For BOT/PPP option of financing (including raising debts, securing external assistance) Consultants will carry out financial analysis to assess the VGF requirement, Return on equity (post-tax) etc. Sensitivity analysis will also be carried out to assess impact of variations.
- ix. Based on the analysis and review of the financial projections assets and develop the following: flexible financial model to compute expected returns, financial viability of the project, identify key revenue drivers and conduct sensitivity analysis to assess the impact of changes in the key revenue drivers to the viability of the project.
- x. Preparation of financial feasibility which includes estimation of revenue components, operating expenses, capital expenditure to be incurred for development of various stages of the project.
- xi. The Consultant will review the incentives, various exemptions, concessions, operating subsidies, available under the Central Government and State Acts and under different schemes, subsidies etc.

- xii. Carry out financial analysis, examine legal aspects & framework and recommend suitable implementation strategy including appropriate PPP structure or otherwise;
- xiii. Recommend implementation strategy and institutional mechanism;
- xiv. A detailed risk analysis will be done and the Consultant will determine the optimum level of the risk. Issues to be addressed in the risk analysis include:
 - a) Construction risk
 - b) Political risk
 - c) Risk from environmental issues and social impacts
 - d) Revenue risk
 - e) Specific project risk.

As a part of the risk analysis the Consultants will:

- a) Propose appropriate inclusions in the cost for the risk and contingency.
 - b) Assess risk and classify them.
 - c) Assess probability of risk occurrence and range of potential cost consequences.
 - d) Compile a probability distribution and most likely whole life cost.
- xv. Develop financing plan for the project as a whole and its major components, indicating the proportion of debt, equity, quasi-equity etc. and the issues on feasibility and bankability that need to be addressed to achieve financial closure.

1.4.16 Project O & M Planning

Long term project sustainability requires that long term O & M is planned in terms of institution framework including billing and collection and tariff and user-cost recovery strategy. This chapter should include the institution to be engaged in the O & M of metro infrastructure, brief description/ analysis of the key issues and obstacles in regard to O & M, the scope of private entity to be involved in defined aspects of O & M.

The DPR will also cover tariff and user- cost recover, the price mechanism, the escalation in price and its repercussion.

1.4.17 Fare Policy

A report shall be prepared on the fare structure to be adopted for Varanasi Metro and the revenue collection for the projected traffic demand shall be worked out.

1.4.18 Economic Analysis

The Consultants will carry out Economic Analysis for the project as per prevailing and also the required sensitivity analysis.

1.4.19 Institutional Arrangement

The DPR needs to clearly specify the institutional arrangements details, roles of different institutions involved in the construction phase of the project, manner of undertaking construction works, involvement of the construction entity in the subsequent O & M activities, areas of involvement of the private sector in the construction phase. The entire project should be divided into packages such as station construction etc. and for each package description should be given along with its cost. The requirement of man power, their responsibility along with responsibility matrix should form part of DPR.

1.4.20 Implementation Schedule

Planned schedule need to be prepared for tendering, for financing, for obtaining all clearances, for shifting of utilities etc. Since the metro project shall have many components, therefore, component-wise implementation schedule should also be prepared. All the scheduling should also be presented in the form of PERT and CPM diagrams in addition to Gantt charts.

1.4.21 Miscellaneous

- i. The DPR will be prepared keeping in view the guidelines issued by MoUD in this regard. Consultants will finalize the DPR format in consultation with Competent Authority.
- ii. The project influence area shall be the entire Varanasi Development area having a population of about 15.40 Lakhs (Census 2011).
- iii. The progress of preparation of DPR shall be monitored by a Monitoring- cum- Advisory Committee.
- iv. The Geo-technical Report, EIA and SIA Reports will also be submitted as separate volume(s).

- v. Alignment Plans, Station Layout drawings, Car Depot, layout, Viaduct/Tunnel drawings and any other drawings forming part of DPR, shall be prepared using only standard software.
- vi. The DPR will provide requisite information - both technical and financial in sufficient details to pilot the project for approvals of Competent Authority. Consultants will include in the FR/DPR any information considered essential but not specifically included in scope of work.
- vii. The consultants will examine the techno-economic feasibility of the proposal. Consultants may propose phasing of work for the purpose of implementation. Necessary financial & economic analysis will also be carried out for the said option.
- viii. Techno-Commercial, Techno-Economical analysis, financing of MRTS projects, structuring possible funding mechanism at competitive rates with minimum asset liability mismatch, provision of investment banker financial advisor, raising of any quasi equity and subordinate debt of the project.
- ix. The consultant will also examine disaster risk assessment and counter measures to mitigate disaster.
- x. Any other survey proposed/ suggestions given by GOUP/GOI for comprehensiveness /sustainability of the project would be incorporated in the FR/DPR by the consultant.
- xi. Based on the house-to-house enquires and traffic pattern studies, etc. Origin-Destination study will have to be conducted to validate/update the MRTS routes proposed.
- xii. Identification of various approvals and other pre-requisites for the project at all stages including Construction, Operation and Maintenance Stage.
- xiii. Specific recommendation to be given in respect of Routes, Station configurations, Maintenance Depot configuration, Gauge of construction, mode of traction and other such parameters which are likely to have a major impact on the Construction and life cycle costs of the Project.
- xiv. The consultant will also work out methodology for quality assurance including independent supervision to guarantee state of the art construction. He will also examine the role of 3rd party involvement in supervision.
- xv. Consultant will organize two workshops for presentation - one for Draft Final Report and one for draft Detailed Project Report.

1.5 STUDY AREA TRANSPORT CHARACTERISTICS

1.5.1 Transport Network and Linkages

Varanasi is well connected by road, rail and air with other parts of the country. The distance from the major cities are Delhi-750 km, Lucknow-286 km and 125 km from Allahabad. There are three national highways i.e. NH-2, NH-56 and NH-29 and four state highways i.e. SH-87, SH-73, SH-74 and SH-98 passing through heart of the city.

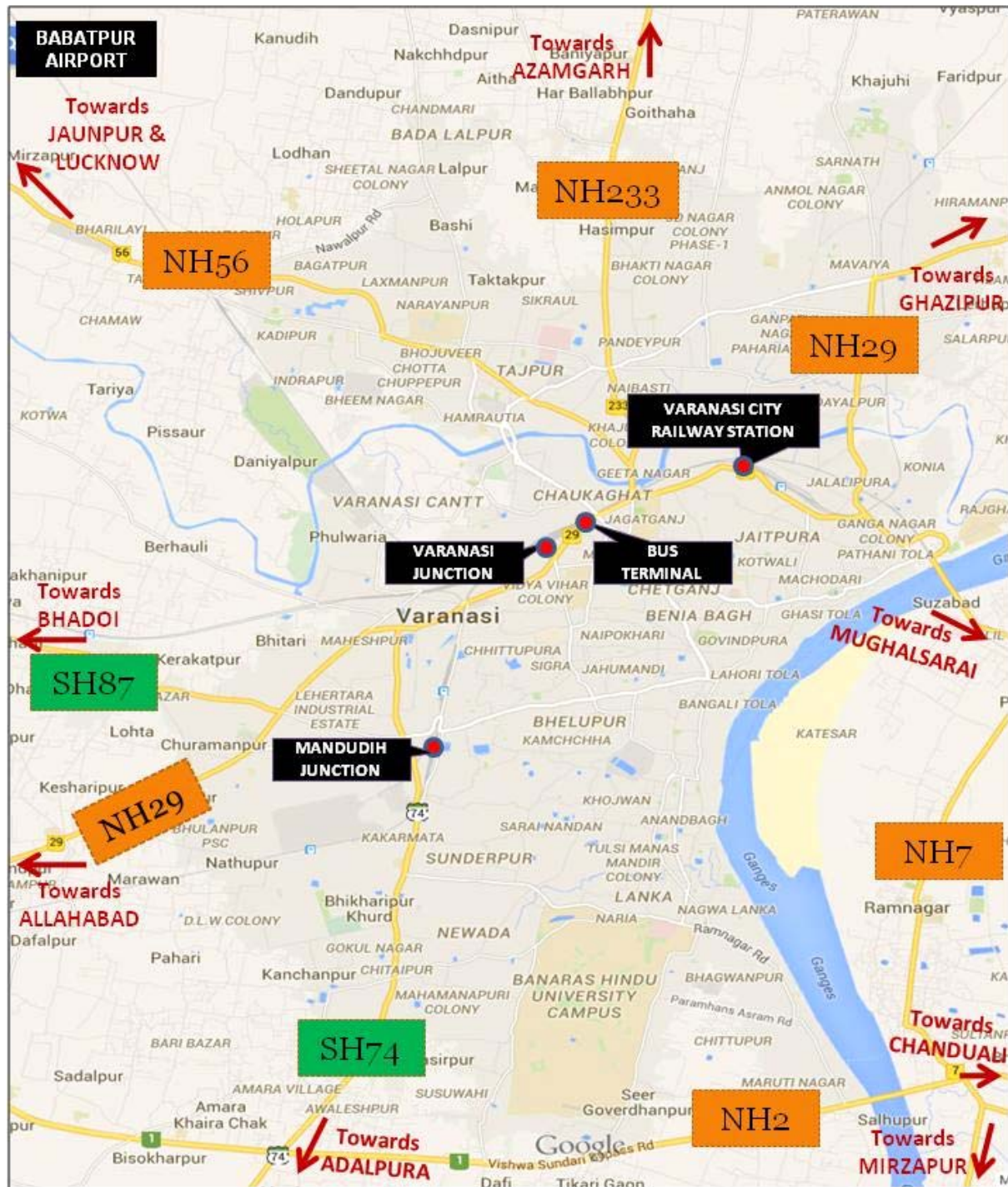
Varanasi is well connected by railways with broad gauge. There are three rail lines entering to the city from Lucknow, Bhadoi and Allahabad and is diverted in two lines to Gorakhpur and Mughal Sarai. The city lies on Delhi-Kolkata rail route of North Eastern Railways, which is the broad gauge. A rail line connects the town with Sarnath. . The other cities having good connectivity through railways are Patna, Guwahati, Chennai, Mumbai, Gwalior, Meerut, Lucknow, Kanpur and Allahabad.

The city has an airport namely Lal Bahadur Shastri International Airport. It is located at Babatpur, 18 km northwest of city. There are flights to Delhi, Mumbai, Kolkata, Khajuraho and Kathmandu. There are also seasonal flights to Colombo and Bangkok from Varanasi airport. There are flights to Varanasi from Agra, Bhubaneshwar, Gorakhpur, Lucknow, and Raipur. It is on a regular aviation route of Delhi to Kolkata and Bhubaneshwar.

Figure 1.2 shows the existing regional transport connectivity of Varanasi. Public Transport is the key anchor of a city's transportation system serving all segments of the society. In the absence of regularised PT system in form of buses, the intermediate public transport (IPT) had emerged as the key public transport option in Varanasi. The city is predominantly dependent upon shared auto rickshaws or tempos and private buses for the intra-city passenger travel. The principal modes of travel are auto rickshaws and cycle rickshaws in the core city. The intercity transit provided by Uttar Pradesh State Road Transport Corporation (UPSRTC) buses connecting various regions to Varanasi, also caters to the intra-city transport needs on few stretches.

IPT in Varanasi city consists of point to point auto-rickshaw and manually operated cycle rickshaws. While cycle rickshaws add to the mobility of passengers in the core area, they often lead to congestion on account of their manoeuvrability and non-observance of regulations. Auto rickshaws on the other hand have slightly longer trip lengths (around 6-7 km), operate on high fares and do not have proper stands for waiting period. Major auto stands in the city are Cantt railway station, Lanka/BHU, DLW, Pandeypur and Kachehri.

FIGURE 1.2: REGIONAL TRANSPORT CONNECTIVITY OF VARANASI



Varanasi due to its historical nature has characteristically narrow roads and lanes. Traffic jams and heavy congestion on the roads are largely caused due to sizable tourist population and intra-city movement of local population. Apart from this, on-street parking has been observed on all roads in the city which reduces the efficiency of road carriageway leading to the road congestion throughout the city. Other reasons for congestion include encroachment of road space by street vendors, unauthorized

movement of auto-rickshaws and tempos which have not been regularized. Existing road characteristics along major arterial roads is presented in **FIGURE 1.3**.

FIGURE 1.3: EXISTING ROAD CHARACTERISTICS ALONG MAJOR ARTERIAL ROADS



Lack of Pedestrian facilities at Raja Bazaar Road near Cantt Chowk



Pedestrian vehicular conflict near Varanasi Junction (NH-29)



Traffic Jam condition near Lahartara Chowk (SH-74)



On-street parking of vehicles near Bangali Tola (NH-56)

1.5.2 Master Plan 2031 for Varanasi Development Authority Area

In Master Plan 2031, about 3350 Ha land has been allocated under traffic and transport use which is around 12.85% of total proposed added land. Around 89 Ha for Bus Terminals/Stands and 285 Ha for Transport Nagar and Truck Terminal have been proposed. The proposed ring road has been assigned 203 Ha of land. 5 Ha have been also proposed for Water Transport Terminal. The major transport infrastructure proposals as per Master Plan 2031 are:

- Widening of roads as per the availability of space.
- Inner Ring Road from Ramnagar Under-construction Bridge to Ramnagar Pepa Ka Bridge via BHU, DLW, Lahartara, GT Road, Cantt Railway Station, Padav Crossing Via NH 7.

- Ring Road of about 59 Km of 60m ROW from Bikharipur to Village Jhansi at Chandauli via Jaunpur Marg, Azamgarh Marg and Gazipur Marg.
- In addition to 2 existing bus terminals, 6 more Bus Stands/Terminals have been proposed to meet the city travel demand.
- At present Varanasi is not having any regulated truck terminal/Transport Nagar. Master Plan 2031 proposed 5 Truck Terminals and 2 Transport Nagar along major travel corridor to meet the freight traffic demands.
- Water Transport Terminal is also proposed in Master Plan.
- 15 no. Railway over Bridges (ROB) and 3 over bridges on River Varuna.
- Four Metro Rail Corridors of about 58 Km have been proposed in Master plan. These are 1) Cantt to Lanka (7.5 Km), 2) Cantt to Sarnath (9.5 Km), 3) DLW to Mugal Sarai (22.5 Km) and 4) Kachehri to Babatpur (18 Km).
- 6 parking locations one each at- Sarnath, Cantt Railway Station, Godowlia, Benia Bagh, DLW and Kachehri are proposed.

1.6 TOURIST TRAFFIC

Varanasi owing to its rich traditional fabric, temples and ghats attract both domestic and international tourists all over the year. The city is an important centre for religious tourism in India and is also a gateway to the Buddhist Circuit, with significant foreign tourist coming from Japan, China, Malaysia, etc. Dashaswamedh Ghat, Harishchandra Ghat, Manikarnika Ghat, Panchaganga Ghat, Assi Ghat, Kashi Vishwanath Temple, Sankat Mochan Temple, Tulsi Manas Temple, Banaras Hindu University, Sarnath, Ramnagar Fort are some of the major tourist destinations in and around the city. **Table 1.3** presents monthwise number of Indian and foreign tourists for the last three years.

TABLE 1.3: MONTH WISE TOURIST ARRIVAL IN VARANASI

Sl.no	Month	2012			2013			2014		
		Indian	Foreigner	Total	Indian	Foreigner	Total	Indian	Foreigner	Total
1	January	508290	32541	540831	557812	24748	582560	432595	30960	463555
2	February	465289	31640	496929	496032	40953	536985	222143	32273	254416
3	March	328874	22455	351329	512235	24895	537130	185844	41592	227436
4	April	305765	17543	323308	225663	10235	235898	189696	19376	209072
5	May	290357	15241	305598	121443	13776	135219	252072	8151	260223
6	June	221230	11261	232491	12252	13744	25996	182486	8916	191402
7	July	203904	10578	214482	118527	6525	125052	207695	9550	217245
8	August	189155	9874	199029	84010	8970	92980	236205	13669	249874
9	September	348348	13457	361805	705945	32417	738362	960397	16292	976689
10	October	522319	38624	560943	739916	45972	785888	1076655	20482	1097137
11	November	680633	39747	720380	771908	46190	818098	1077339	47643	1124982
12	December	718848	35612	754460	510418	16827	527245	179109	38857	217966
	Total	4783012	278573	5061585	4856161	285252	5141413	5202236	287761	5489997

Source: Varanasi Tourism Department, Varanasi

In 2014, a total of about 55 lakh tourists visited Varanasi which is about 15000 daily tourist in the City.

1.7 STUDY PROGRESS AND SUBMISSIONS

The Study was awarded in February, 2015 and an Agreement was signed in third week of May, 2015. The first deliverable 'Inception cum Options Report' was submitted in the third week of May, 2015. After discussions and detailed joint site visits with Varanasi Development Authority (VDA) and Lucknow Metro Rail Corporation (LMRC) officials, the second deliverable 'Feasibility Report' was submitted on 8th September, 2015. The progress of the Study is summarized in **TABLE 1.4**.

TABLE 1.4: STUDY PROGRESS

Deliverable	Duration of Deliverable	Submission Date as per Agreement Signing (23rd March, 2015)	Actual Date of Submission	Remarks
Inception cum Options Report	One Month from Start	22nd June, 2015	22nd May, 2015	
Traffic and Data Report	Four Months from Start	–	31st July, 2015	
Feasibility Report	Four Months from Start	22nd September, 2015	8th September,	
Draft DPR	Six Months from Start	22nd November, 2015	6th January, 2016	Due to frequent change in alignment, finalization of Kashi Vishwanath station at Chitraranjan Park, land requirement at Ganeshpur Depot & Akashwani Depot and extension of alignment till Sarnath
Final DPR	Two Weeks after receiving Draft DPR comments	Two Weeks after receiving Draft DPR comments	Two Weeks after receiving Draft DPR	

In addition to these specific deliverables the presentations/ site visits were made frequently with VDA and LMRC officials to finalise the alignment and station locations of priority corridors of Varanasi MRTS. A summary of important stakeholder consultation / presentations/ submissions/ joint site visits is presented in TABLE 1.5.

TABLE 1.5: IMPORTANT PRESENTATIONS/ SITE VISITS/ REVIEW MEETINGS

Meeting/Site Visit	Date of Meeting
Joint Site Visit with LMRC and VDA officials and meeting with Commissioner	27th February, 2015
Meeting with Dr. E. Sreedharan / MD, LMRC	12th March, 2015
Meeting with Secretary VDA	31st March, 2015
Meeting with Secretary VDA	22nd April 2015
Meeting with Secretary VDA for signing of Agreement	6th May 2015
Joint site visit with LMRC and VDA officials and meeting with Commissioner	17th May 2015
Progress Review Meeting Presentation to Chief Secretary, Government of Uttar Pradesh, Lucknow	19th June, 2015
A technical note on Landuse Parameters, Estimation and Traffic Zone Wise Distribution	29th June 2015
Presentation on Inception cum Options Report to Commissioner	5th August, 2015
Joint Site Visit with LMRC & VDA Officials for finalizing Station Locations for Priority Corridors	25th August, 2015
Meeting with Secretary VDA	26th August, 2015
Progress Review Meeting Presentation to Commissioner	21st September, 2015
Meeting with Secretary VDA	29th October, 2015
Joint Site Visit with LMRC & VDA Officials and progress review meeting with Commissioner	3rd November, 2015
Progress Review Meeting with VC, Varanasi	20th November, 2015
Joint Site Visit with LMRC & VDA Officials and progress review meeting with VC, Varanasi	5th December, 2015
Meeting with Dr. E. Sreedharan / MD, LMRC	16th December, 2015
Meeting with MD, LMRC	15th January, 2016
Progress Review Meeting with VC & Commissioner Varanasi	28 th January, 2016
Meeting with Dr. E. Sreedharan / MD, LMRC	2 nd February, 2016

1.8 COMPOSITION OF REPORT

The report has 11 chapters with the following contents:

- i. Chapter 1 gives the overall study background, study area, study objectives, scope of work and existing traffic characteristics.
- ii. Chapter 2 detail out the four stage travel demand modelling process and ridership assessment of Phase-I metro corridors for horizon years.
- iii. Chapter 3 discusses the system design and includes components permanent way, traction system, signalling and telecommunication systems, fare collection system, rolling stock and ventilation & air conditioning system.
- iv. Chapter 4 gives the civil engineering details covering alignment planning & feasibility principles, geometric design, alignment design, geotechnical investigations, utilities & its diversion, details of land and property requirements.
- v. Chapter 5 details station planning and intermodal integration characteristics covering planning parameters, transit oriented development, intermodal integration and dispersal facilities.
- vi. Chapter 6 gives train operation plan which will cover traffic demand, train information systems, headway and operation plan and rolling stock requirement.
- vii. Chapter 7 gives maintenance depot covering planning and maintenance facilities, rolling stock maintenance, depot cum workshop planning and other required infrastructure.
- viii. Chapter 8 gives details about power supply system addressing power requirements, sources of power supply, substations and related infrastructure facilities.
- ix. Chapter 9 gives details about environment and social impact assessment with repair & rehabilitation plans.
- x. Chapter 10 discusses the cost estimates and financial details including capital costs, O&M costs, financial and economic analysis & funding options, implementation and institutional arrangements.