VMRDA
FACE OF CHANGE

VISAKHAPATNAM METROPOLITAN
REGION DEVELOPMENT AUTHORITY

DRAFT PERSPECTIVE PLAN VMR, 2051

JUNE 2021

GOVERNMENT OF ANDHRA PRADESH

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1.1 INTRODUCTION

Formulation of a Perspective plan objects and targets of long term time frame of 30 years, growth produced as a written document supported by necessary maps and diagrams proving the state government / VMRDA the goals, policies, strategies and general programmes of the local body regarding spatial and socio-economic development and settlement under its governance.

1.2 PROVISIONS OF APMR&UDA ACT

The Government of AP has constituted VMRDA under the provisions of Section 4(1) of APMR & UDA Act, 2016. , As per Section 11, a Perspective Plan (PP) has to be prepared for the Visakhapatnam Metropolitan Region with a long term time frame preferably not less than thirty years, for the comprehensive physical, economic and social development of the Development Area, having due regard to,- a) Vision for the development area and provide policy framework and directions of growth and identification of thrust areas for development,

b) Target population, employment pattern and GDP,

c) Strategic land use plans, including Greenfield developments and regeneration,

d) Strategic transportation and mobility requirements; and

e) Environmental sustainability.

1.3 ROLE AND PURPOSE OF PERSPECTIVE PLAN

The basic purpose of a Perspective Plan is to provide policy framework for further detailing and it serves as a guide for development authority and urban local authorities in preparation of the Master Plan & ZDP. The scope of this plan covers social, economic and spatial development goals, policies and priorities relating to all those activities that have spatial implications or, in other words, that requires land for their location and desired functioning. It also covers long-term policies regarding development of infrastructure and resource mobilization that are necessary to promote these activities. Great care is always taken in this plan to minimize the conflict between the environmental protection and urban development

1.4 PLAN PREPARATION PROCESS

The Perspective Plan aims at:

- Vision for the development area and provide policy framework and directions of growth and identification of thrust areas for development;
- Target population, employment pattern and GDP;
- Strategic land use, including greenfield developments and regeneration;
- Strategic transportation and mobility requirements; and
- Environmental sustainability.

The perspective plan preparation process involves a series of tasks. Detailed study of the region dynamics has to be taken into consideration including the aspirations of the stakeholders to formulate strategies and goals. The detailed tasks are carried out as given in Figure 1-1.

Figure 1-1: Detailed tasks of Perspective Plan

1.5 STRUCTURE OF PERSPECTIVE PLAN

The Perspective plan gives the outputs in the structure as shown in Figure 1-2. The plan assesses status of each sector of development, analyses the opportunities and challenges in the region and provides strategies for improvement of each sector so that it can achieve the goals and vision of the region.

Figure 1-2: Structure for outputs of Perspective Plan

The report is divided into two parts. Part one presents the analysis of the present situation and the regional context of VMRDA. Part two comprises of the outcomes of the stakeholders consultation and proposed strategies regarding each sector.

PART 1: REGIONAL ASSESSMENT

2 VMR - REGIONAL CONTEXT

2.1 POSITION OF VMR IN THE STATE

Visakhapatnam Metropolitan Region is a significant urban development region in the newly formed Andhra Pradesh. It is connected by National Highway-16 (Golden Quadrilateral), East Coast railway and airport with other States and major cities. Its advantageous location coupled with export-import facilitation by the ports played key role in attracting major investments in industrial, real estate and tourism sectors. Visakhapatnam is a major urban node for all level of facilities in the region and this city serves as a nodal center for Visakhapatnam-Kakinada Petroleum, Chemicals and Petrochemicals Investment Region (VK-PCPIR) as well as Vizag Chennai Industrial Corridor (VCIC).

Recent dynamics in the state reveals the significance of the region at state level, while the international connectivity through major port, airport and proposed airport makes it a gateway to global market. Post bifurcation, Visakhapatnam has been the focus of development and has been in top priority as per the state investment agenda. Located in the north coastal region of the state, Visakhapatnam serves as the administrative headquarter for the zone comprising of Srikakulam, Vizianagaram and Visakhapatnam districts.

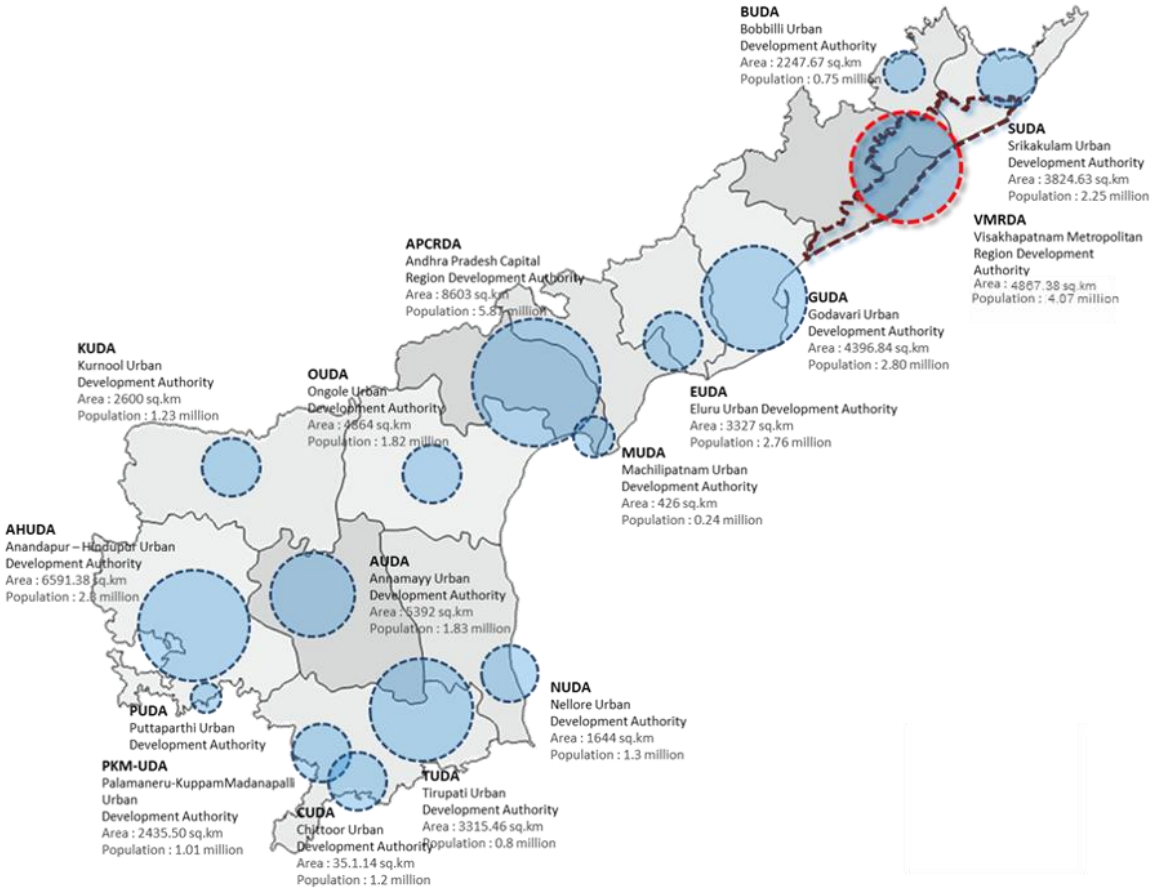


Figure 2-1: Urban Development Authorities of Andhra Pradesh

2.2 TRANSPORT CONNECTIVITY

VMRDA region is well connected with road, rail, air and waterways to hinterland and global market. It is located on the National Highway-16, a part of the 'Golden Quadrilateral', leading to Kolkata and Chennai. Vizianagaram is also connected by National Highway-26 connecting VMR with Chhattisgarh. Other State Highways (SH) and Major District Roads (MDR) act as linkages to the major transport nodes.

Part of Waltair division in East Coast Railway (ECoR) and Vijayawada Division in South Coast Railway(SCR) passes along the region, giving major connectivity to the hinterland from the port and also contribute to a major passenger traffic plying for work or tourism. Though presently air connectivity is limited due to operational restrictions in the navy facilities, the proposed airport in pipeline will cater to huge capacity of air traffic.

The city of Visakhapatnam has developed as a port city, with economies based on port related activities and port-based industries. Visakhapatnam port being a major port has the second highest capacity in the East Coast. Gangavaram port is another port operating under private authority, having separate railway sidings and port connectivity to National Highway.

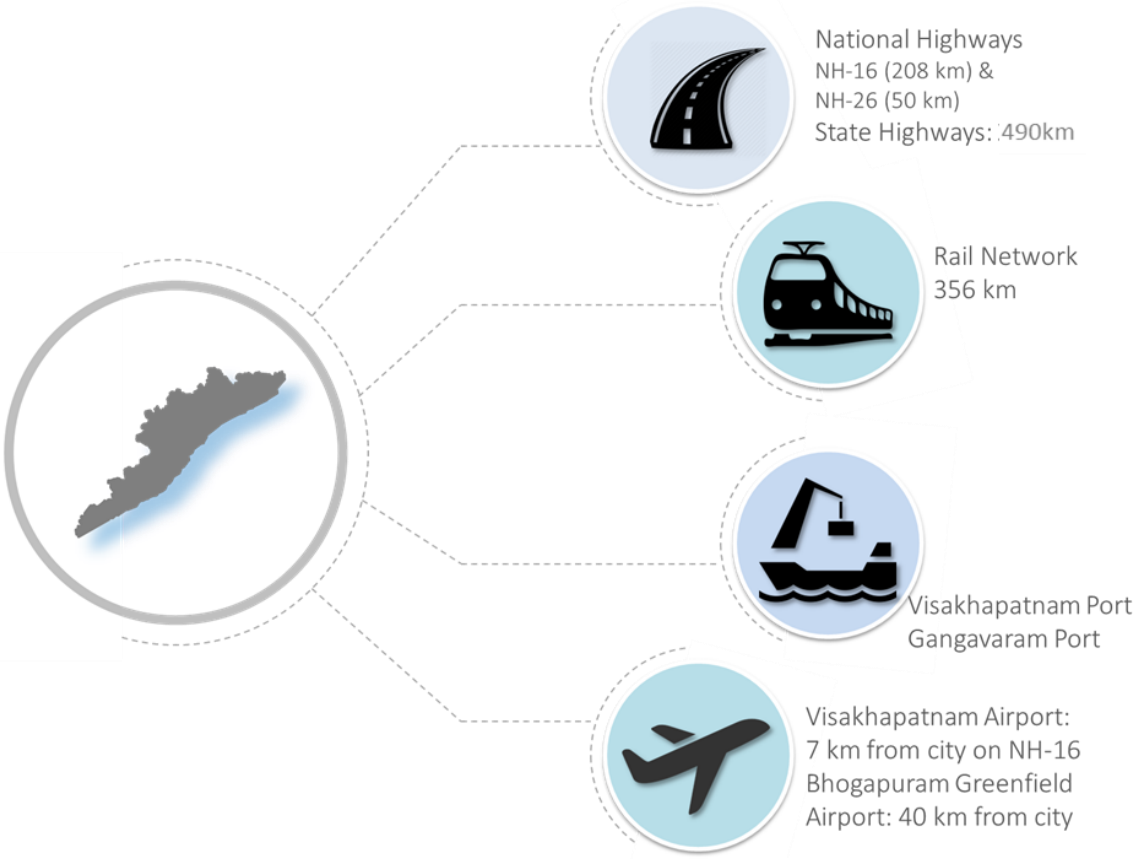


Figure 2-2: Transport connectivity to VMRDA region

2.3 ROLE OF VMR IN STATE'S VISION ON DECENTRALISED DEVELOPMENT

Visakhapatnam has already been acting as a major development center for Andhra Pradesh., Visakhapatnam enjoyed a fair amount of lime light for investment and development. With the new vision of state on decentralized development, the region of Uttarandhra will be having further focus on balanced development to the Vizag city as well as the north coastal districts of Visakhapatnam and Vizianagaram. There shall be emphasis on rural development striking a balance with the urban development. VMRDA will be playing a major role at this juncture. Visakhapatnam Metropolitan Region has 69% of its population living in urban areas and 31% living in rural areas. Apart from these, the extent stretching across the two Uttarandhra districts will make VMR the most vibrant area.

2.4 KEY NATIONAL PROJECTS (VCIC, SAGARMALA, VKPCPIR, BHARATMALA)

2.4.1 Vizag – Chennai Industrial Corridor

Vizag Chennai Industrial Corridor (VCIC), part of ECEC (East Coast Economic Corridor) promoted by Government of India in partnership with Asian Development Bank's (ADB), is the first coastal economic corridor in the country. It is aligned with the golden quadrilateral and covers more than 800 kilometres of the state of Andhra Pradesh's coastline. VCIC is poised to play a critical role in driving India's economy and to further integrate the Indian economy with the dynamic global production network of East and Southeast Asia. Greater connectivity and economic integration between South and Southeast Asia are likely to contribute to significant benefits for both sub-regions and foster regional cooperation. As a coastal corridor, VCIC can provide multiple access points to international gateways to these geographies. Figure 2-3 shows the delineated area of VCIC.

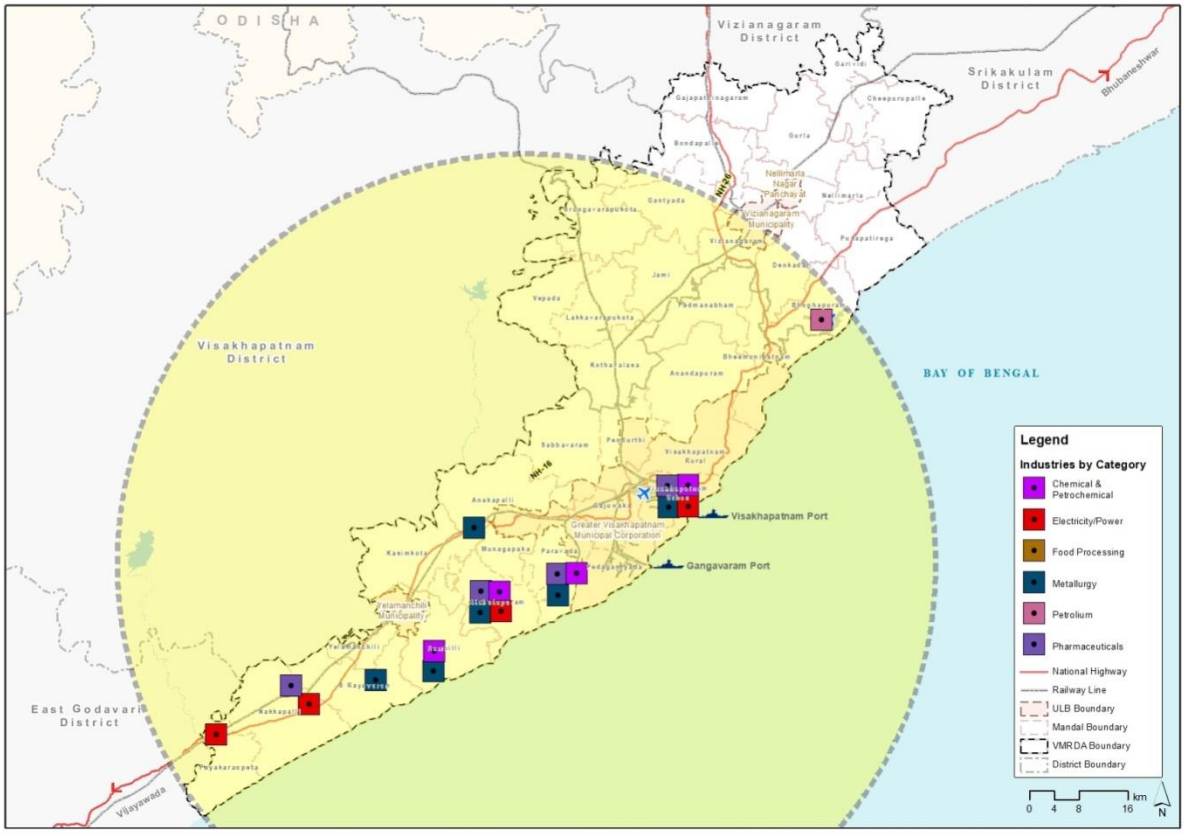


Figure 2-3: Delineation of the VCIC region

The expected impact of VCIC will be an increased contribution of the manufacturing sector to the state's GDP, trade, and employment. VCIC has the advantage of a long coastline, the presence of key ports and urban agglomerations, and a workforce that will help it achieve the following industrial transformation objectives:

Achieve accelerated industrial output

- Expand employment opportunities
- Increase labour productivity & wages
- Diversify the range of manufacturing products
- Expand exports over the next two decades

- Link the corridor with Global Production Networks

These objectives are aimed to be achieved by stimulating economic activities, increased connectivity with global production network and improved transport connectivity.

The current industrial output of the corridor of ~14 USD billion supported through the envisaged interventions under VCIC program is expected to rise to ~USD 295 billion over a period of 30 years in comparison to ~USD 117 billion expected in the business as usual scenario.

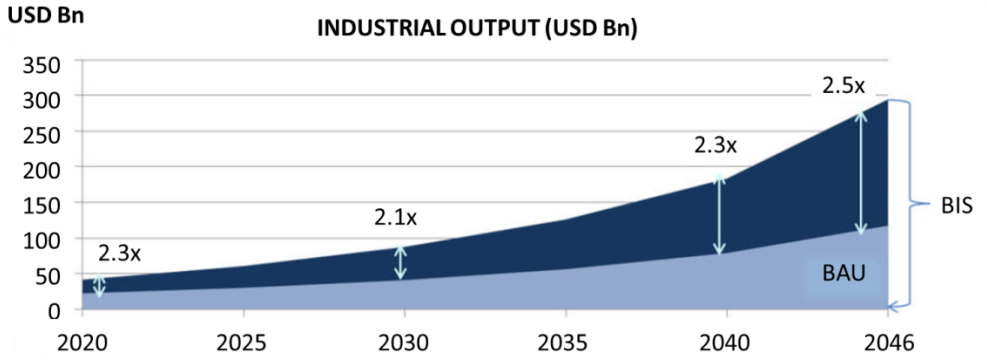


Figure 2-4: Industrial output in Business as usual and Business induced scenarios

VCIC has identified its projected targets as follows:

- Increase the share of manufacturing GDP to 16% by 2020
- Increase the manufacturing GVA (Gross Value Addition) by 30% by the end of projection period
- Generate additional 15 lakh jobs by 2025 in manufacturing sector
- Support the firms to achieve structural scaling up.

As a part of industrial development, the corridor focuses on seven industries that have attracted an investment of more than ₹ 30,000 crore over the past decade with recent shift to high value added industries. The corridor thus emerges as one of the strategic programs to achieve the long term state objectives of industrial development. The focus sectors are:

- Chemical and Petro-chemical
- Metallurgy
- Textiles
- Food processing
- Pharmaceutical
- Automobiles
- Electronics

Based on these priority sectors, VCIC envisages high contribution to the manufacturing GVA of the corridor.

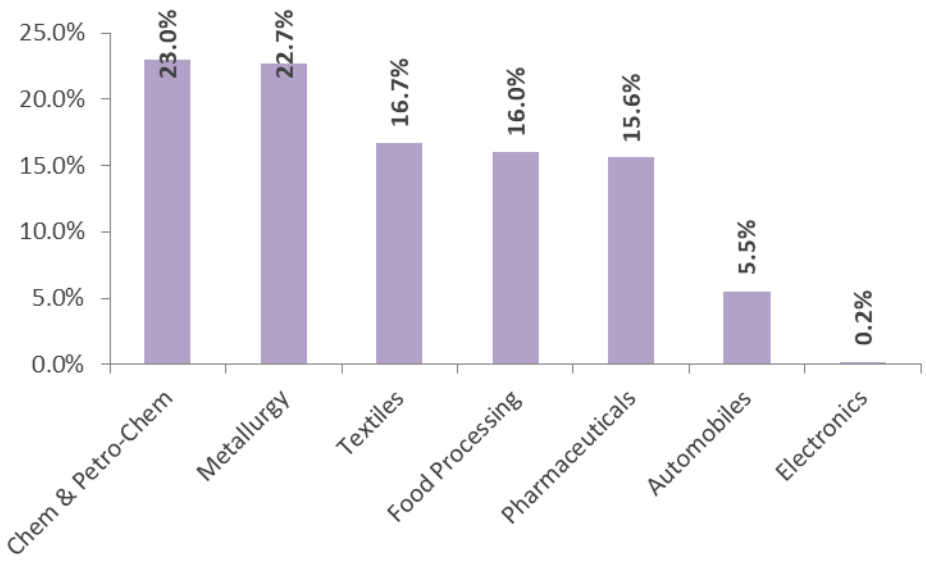


Figure 2-5: Investment in priority sectors in the corridor (2005-15)

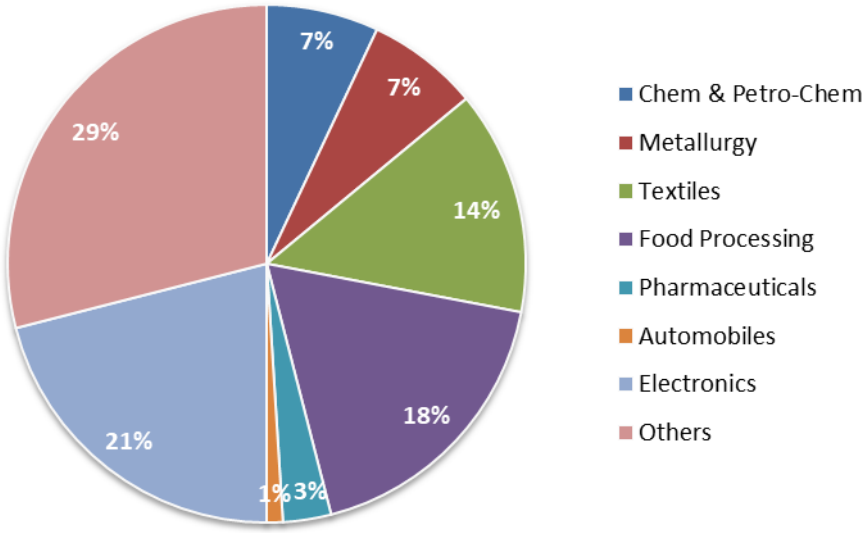


Figure 2-6: Contribution to Corridor's manufacturing Gross Value Addition

In terms of key locations that will drive this output, Visakhapatnam is currently the largest hub for manufacturing sector in the corridor contributing almost 49% of the total industrial output. Though the development of the corridor shall provide the opportunity for dispersing this output, there are nodes identified in VCIC for focused development of industries. Figure 2-7 shows the identified nodes in the corridor out of which the Visakhapatnam node and the Kakinada node are juxtaposing with the VMRDA region.

Visakhapatnam Node: Strategically located with key access points to the eastern and central hinterlands of India, it is located close to Visakhapatnam and Gangavaram ports. Coal, iron ore, and petroleum are the major types of cargo handled by the node. These ports' cluster is expected to reach its capacity threshold by 2025 itself, despite the assumed commencement of the Bhavanapadu port. The existing plans for augmenting the cargo handling capacity of ports in the cluster may thus need to be advanced to handle the forecast increase in throughputs. From the aspect of airport infrastructure, Vizag airport is also the largest airport in VCIC. An airport in Vizag is likely to have the least competition from regional airports (i.e. Hyderabad, Bangalore and Chennai) as they are located more than 400 km away. The proposed airport at Bhogapuram is thus well positioned to cater to the increased air

passenger traffic in the future and become a regional aviation hub for the state. The major concern for the road network is the hinterland gateway connectivity, indicative of poor connectivity to Chhattisgarh and Telangana. The development of the industries in the node has taken place due to the port and national highway connectivity. The present spread of industries is depicted in map.

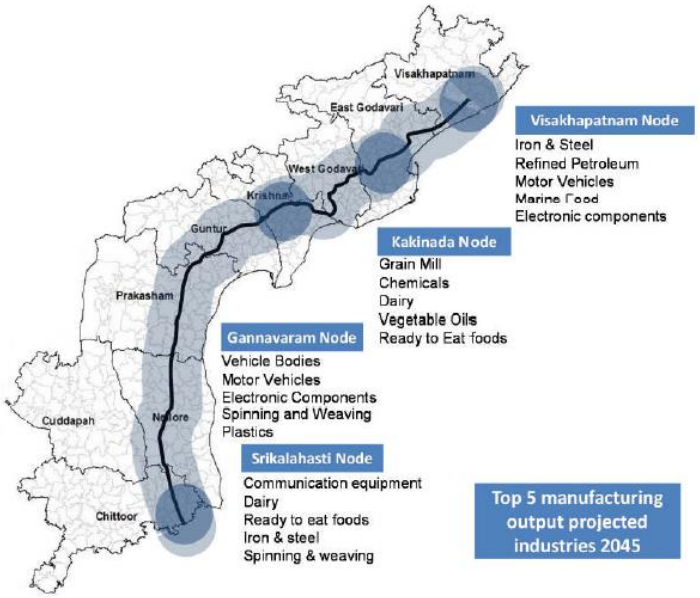


Figure 2-7 VCIC Nodes with priority industries (2045 projection)

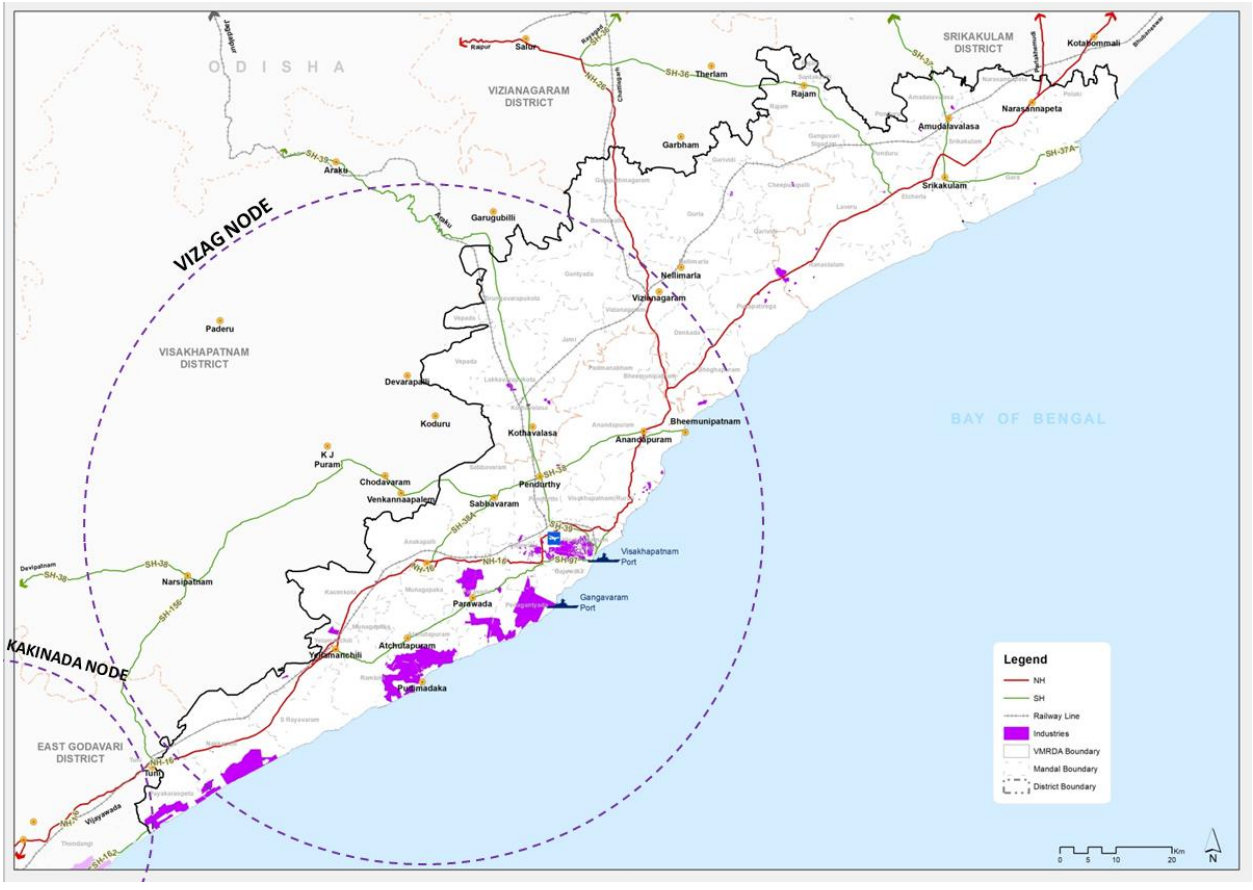


Figure 2-8 Present spread of industries in the Visakhapatnam Node

The airport is foreseen to see steep growth in traffic, with the passenger share among VCIC. As per VCIC report the share of international traffic will increase from current 3% to 10% in overall air passenger traffic by 2045.. The current airport capacity is however expected to be sufficient in the medium term. Immediate intervention is recommended in improving the intra-node road network and connectivity to Telangana in the short-term. The railway sections in the node are among the most congested sections of Vijayawada division, with utilization levels ~140% of charted capacity. The proposed implementation of anti-lock braking system (ABS) for enhancing the track capacities should be prioritized on these sections. In the scenario of increased industrialization and implementation of PCPIR, freight handled by the railways is expected to increase. But the high utilization of existing railway infrastructure will impact the logistic transport system in the node. The benefits of both rail and roadways are present in the node as seen in Figure 2-8.

Visakhapatnam node houses more than 2,700 industries (under the shortlisted sectors) providing employment of more than 190,000 direct jobs. This is the most industrialized node of the corridor presently generating a manufacturing output of nearly 49% of the entire corridor. The district of Visakhapatnam presently contributes maximum to the GSDP in manufacturing sector and also the maximum output of State's manufacturing.

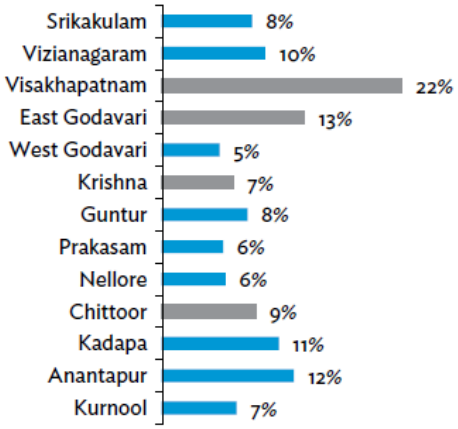


Figure 2-9: Manufacturing sector's contribution to GSDP by District.

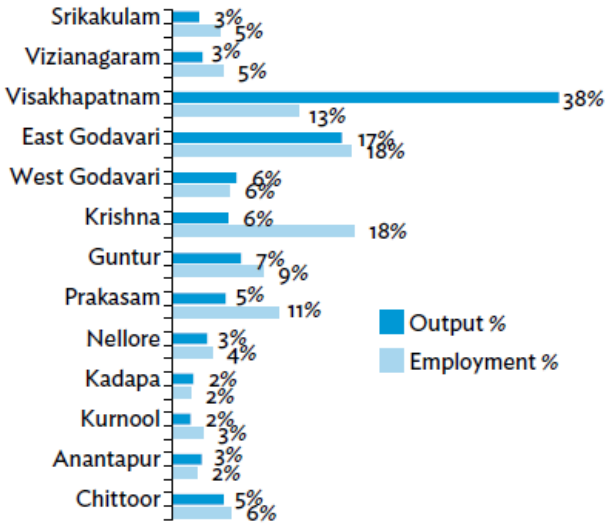


Figure 2-10: Contribution to State's manufacturing output and employment by district

For the targeted growth in the manufacturing sector, the estimation of investment of majorly depending on the incremental demand of industrial land for the manufacturing projects followed by

the investment on infrastructure projects like logistics hubs, transportation projects and water supply projects.

Table 2-1: Industrial Projects at VCIC Nodes (as per various industrial / sectorial policies) influencing VMRDA region

Project Description	Relevant Sector	Mandal	District
Proposed Aerotropolis at Bhogapuram spread over 7500 acres	Aerospace & Defense	Bhogapuram	Vizianagaram
Plan to Develop food testing labs in Sri Venkateswara University in Tirupati, Andhra University in Visakhapatnam and upgradationof testing lab in JNTU, Kakinada	Food Processing		Chittoor, Visakhapatnam, East Godavari
GoAP envisages developing an Information Technology and Investment Region (ITIR) in Visakhapatnam with two clusters to be developed as Electronic Hubs (Visakhapatnam to be developed as electronic Mega Hub of the state)	IT & Electronics		Visakhapatnam
Growth of APSEZ at Atchutapuram spread over 5595 Acres	Multi Sector	Atchutapuram	Visakhapatnam
Development of AP-PCPIR along VCIC covering an area of 250 sq.km. planned for manufacturing facilities	Petroleum, Chemicals and Petro-chemicals		Visakhapatnam and East Godavari (between Visakhapatnam and Kakinada)
Development of Eco-Industrial Parks – within existing 4 industrial parks (based on study done by GIZ under the International Climate Initiative)	Multi Sector (MSME)		Across Corridor
Development of MMPL by VPT on an area of 500 Acres with an estimated investment of INR 600 Crore	Logistics and Supply Chain	Anakapalle	Visakhapatnam

Source: VCIC Development Plan

Beyond the projects stated above, other projects identified by various departments for industrial development proposed under the corridor program have been shown in the list below with their estimated capital cost. These projects have been identified and shortlisted by various agencies like APIIC, GVMC, Department of Industries etc.

Table 2-2: Projects identified by various departments for industrial development

Name of the Project	Description of the Project	Project Cost (INR Crores)
AP SEZ-Water supply distribution	95 MLD Bulk Water Supply and 5 MLD Water Treatment Plant	240.9
AP SEZ-Water supply	Balance Internal Water Supply	7.61

Name of the Project	Description of the Project	Project Cost (INR Crores)
distribution	Distribution System (12.35km)	
AP SEZ-Storm water drains	Balance Storm Water Drainage System (17.5 km)	36.1
AP SEZ-Utility corridor	Utility Corridor/Cable Duct (45km)	134.5
AP SEZ-CETP	Common Effluent Treatment Plant (CETP) – 3 MLD	133.6

Source: VCIC Development Plan

Several industrial clusters have been studied in the node to analyze the potential of development in the sectors. These clusters were Bheemunipatnam Cluster, Pydibheemavaram Cluster, Atchutapuram Cluster and Nakkapalli Cluster among others. Emphasis has been given on the Anakapalle cluster due to its potentials for the factors like connectivity, availability of workforce, surrounding industrial scenario like presence of JNPC and other manufacturing units outside the industrial park.

Priority sectors in Visakhapatnam node include the following with their estimated output and employment potential over the projection period (Table 2-3). Anakapalle shall be one of the major destinations going forward given the limitations that Vizag city may experience that include scarcity of land; limited capacity of trunk infrastructure; shortage of housing for skilled work force; growth in urbanization leading industries to relocate etc.

Table 2-3: Target industries and estimated employment (average output) in Vizag Node

Priority Sectors	Estimated Output (2046) (USD Million)	Estimated Employment (2046) (Nos)	Average Output / Employee (₹ Lakh)
Iron & Steel Industry	16,151	142,102	68
Refined Petroleum Products	13,143	25,289	311
Motor Vehicles	4,600	53,509	52
Marine Processing	3,690	218,790	10
Electronic Components	2,972	139,409	12
TOTAL	**40,556**	**579,099**	

Source: VCIC Development Plan

The challenge faced by the industrial clusters which may be similar in case of the clusters in the node has been identified under the heads of Business operation, Industrial infrastructure and supply chain. For these issues, a list of projects has been recommended.

Projects recommended at Anakapalle cluster for industrial development are:

- Saturating capacity of Vizag port coupled with inadequate land calls for augmenting capacity through high capacity evacuation PEM with least turnaround time
- Minimizing dirty cargo operations by shifting them to Gangavaram port and expanding container cargo capacity at Vizag port
- Augmentation of rail capacity supported by rake availability between Vizag and Gangavaram serving primarily the local region
- Present civil aviation at Vizag airport may be augmented to introduce support facilities for cargo services
- Development of a Common Facilities Center dedicated to sectors like Pharmaceuticals, Iron & Steel, Food Processing, Electronics that provides common facilities like testing centers, R&D labs, common processing areas (pay per use based), incubation center for micro and start-up enterprises with IT facilities (location may be situated between Pedagantyada and Anakapalle
- Prioritize and develop the Raiwada and Yeleru water supply / canal project on fast track to bridge the water demand gap creating a surplus to service future demand

- Industrial water being supplied by VIWSCO to ensure reliability quality and a 100 MLD desalination plant planned at Pudimadaka should be realized faster
- Airport may introduce testing labs and approval facilities to service pharma sector cargo demand
- Restoration and De-silting of the source reservoirs and lakes (Yeleru reservoir, Atchutapuram)

Augmenting the last mile connectivity through following road projects

- 4-lane to 6 lane conversion of entire stretch on NH16 from Vizag to Rajamahendravaram.
- Four / Six Lane conversion of the Anakapalle-Pendurti- Anandapuram bypassing Vizag
- Four / Six lane conversion of existing 48 km stretch bypassing Vizag and providing direct connectivity between NH16 and Vizag Port.
- Improving the linkage between – Bheemunipatnam – Sabbavaram – Narsipatnam – Koyyuru – Addateegala – Rampachovaram – Maredumili – Chinturu - Joining NH 326 connecting to Chhattisgarh
- Improving the linkage between Visakhapatnam – Tallapalem – Narsipatnam –Chintapalli – Sileru - Uppersileru – Donkarai – Mothigudem – Lakkavaram -Chinturu

These projects are aimed at developing the industrial scenario in VCIC and which will in-turn influence the growth in the VMRDA Region in the coming years attracting more investment and enriching the economy of the region. The recommendations can be considered into the perspective plan to turn into implementable projects to achieve the goals envisaged. VMRDA being the authority for development projects through the master plan will lead to an overall development of the entire region including the disjointed projects which comes as government initiatives. The perspective plan will assess the potentials of the entire region than focusing on target clusters and aim for a balanced development throughout the metropolitan region.

2.4.2 Sagar Mala Project

The Government of India with the Ministry of Shipping has rightly identified Sagarmala as a crucial infrastructure initiative whose development has the potential to boost India's GDP by 2%.

With the long coastline of 7,516.6 km, the Indian ports handle 90% of the export-import trade volume. Inspite of this, railways contribute 9% to the GDP, the road sector contributes 6%, whereas the ports' share of GDP is only 1%. This contradiction reflects the vast potential for development of coastal cities and ports.

India has 12 major ports and about 200 non-major ports with the cargo traffic expected to grow from 976 MMT in 2012 to 1,758MMT by 2017. But India suffers from poor port linkages, under performance of existing port infrastructure and lack of developed infrastructure near ports, for value addition of inbound or outbound merchandise. Along with this, an inefficient inter-modal transport

connectivity results in high cost of logistics and exports. The share of merchandise trade in GDP for India is only 42%, quite low as compared to European countries where it is above 70%. The Sagarmala project aims to improve this.

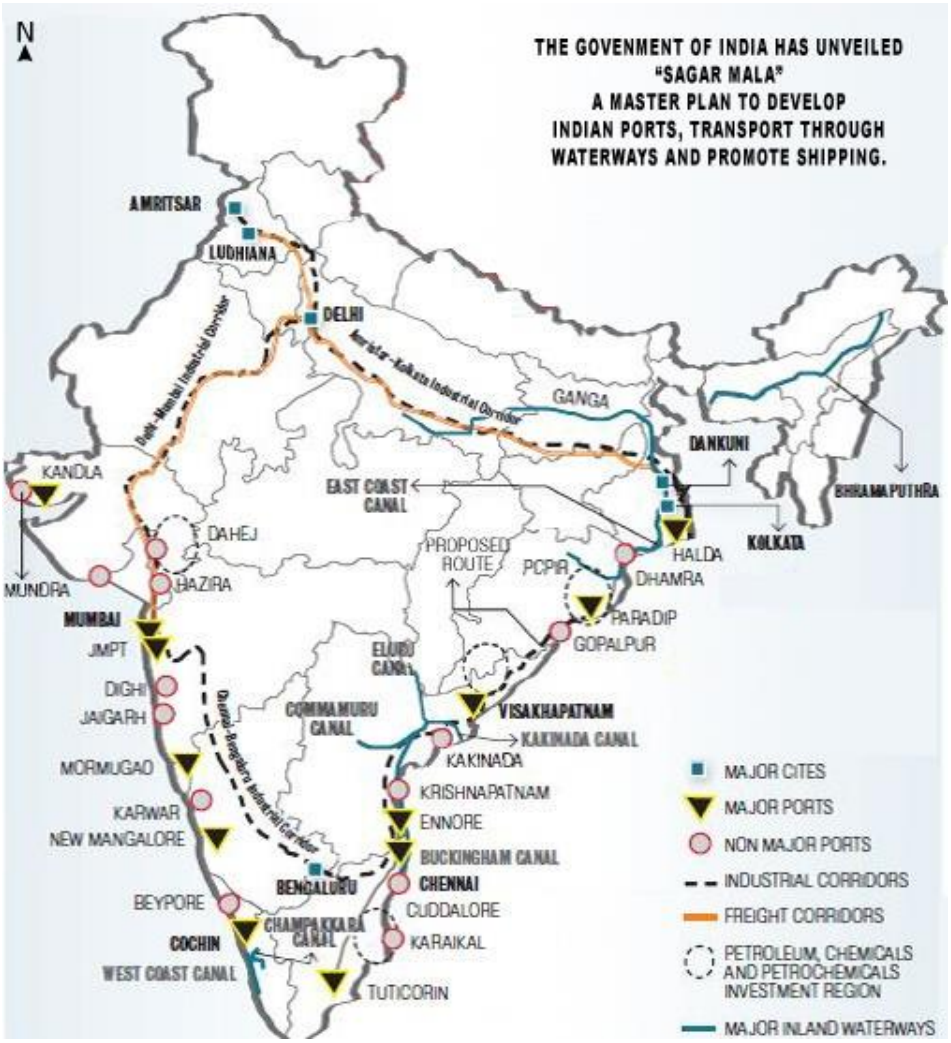
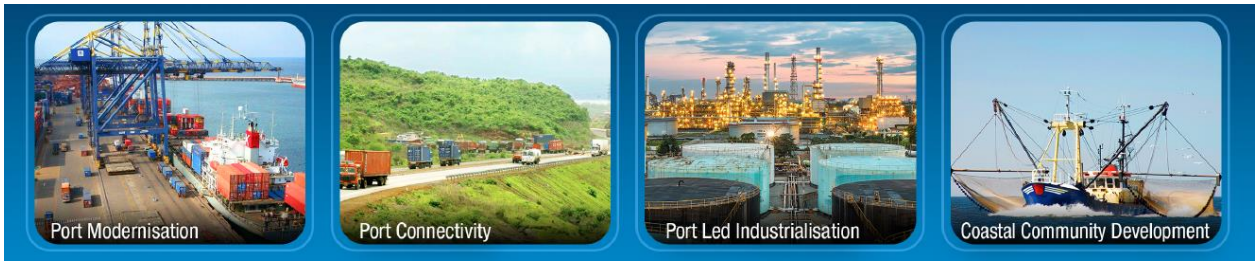


Figure 2-11: Sagar Mala Project Network Map

Source: Sagarmala National Perspective Plan

The Sagarmala Project has three clear objectives:

- Supporting port-led development with pro-active policy initiatives and providing institutional framework to assist all stakeholders.
- Modernizing port infrastructure.
- Developing integrated transport infrastructure for connecting the coast to the hinterland.



Under the project, 12 smart cities will be developed near ports with an investment of ₹ 50,000 crore. These will be integrated townships that will have affordable housing and implement green initiatives for sustainable living.

Giving boost to economic activity near coastal locations, Coastal Economic Zones (CEZs) will be established. These CEZs will be planned with modern support infrastructure and adequate fiscal incentives to attract investment.

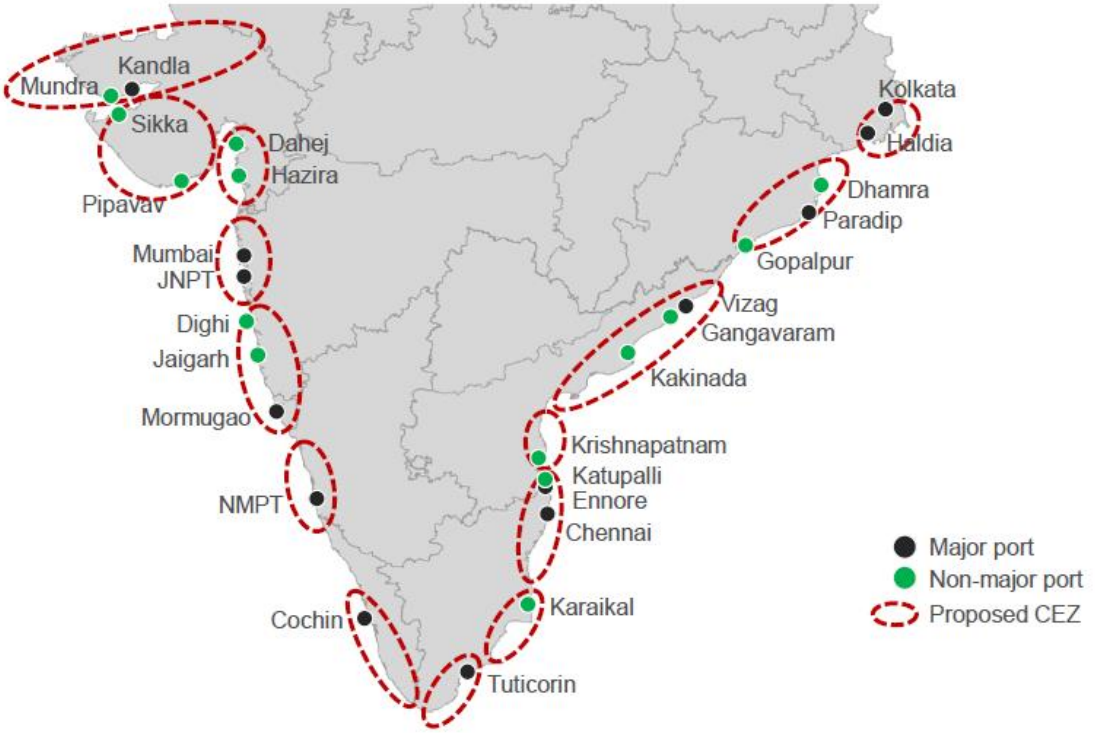


Figure 2-12: Proposed coastal economic zones under Sagar Mala Proposed

Source: Sagarmala National Perspective Plan

The potential benefits that the coastal states will receive from the project are:

Development of Coastal Economy

- Integrating the coastal economy with the ports through development of Coastal Economic Regions & projects with synergies to Coastal Industrial Corridors
- Development of port-based smart cities and other urban infrastructure to improve standards of living
- Implementation of skill development/livelihood generation projects for coastal community development, E.g. – Coastal Tourism Development projects (Lighthouses & Mainland Islands) – Fisheries sector development

Maritime Sector & Infrastructure Development

- Modernization/capacity expansion of existing ports and creation of greenfield ports to reduce bottlenecks for future growth
- Development of port evacuation (road/ rail/inland waterways) and logistics infrastructure to reduce overall logistics cost and to increase cargo movement to-and-from the hinterland

- Development of maritime sector leading to new economic activity in the region - e.g. Ship Building and Repair Cluster

Easing the Project Development Process

- Integrated approach to project identification and implementation through coordination between Line Ministries, State / UT Governments and Private Agencies
- Easing of policy and institutional bottlenecks for – Obtaining project approvals – Accessing project funding and implementation partners – Project implementation and monitoring

Union Minister for Shipping, Road Transport, and Highways announced allocation of ₹ 8,400 crore to Andhra Pradesh under the Sagarmala project. Of the ₹ 8,400 crore, a sum of ₹ 3,000 crore would be spent on LNG terminal at Kakinada, Coastal Food Export berththere at the cost of ₹ 150 crore, ₹100 crore for additional oil jetty at the Visakhapatnam Port. The Union Minister also announced the development of a stacking yard at Visakhapatnam, and facilities at Vadarevu.

Under Sagarmala, the Central Government would spend ₹12 lakh crore in phases – ₹ 4 lakh crore on roads and railway connectivity and ₹ 8 lakh crore on developing 27 industrial clusters.

Andhra Pradesh, with India's second longest coastline of 974 km comprising 1 major and 4 operational non-major ports, has the opportunity to create international gateways with the rest of the world.

Major part of the economy of VMRDA region is dependent on the ports and the supporting logistics. Moreover, the region has a 170.8 km long coastline which will be largely affected by the Sagar Mala project. Making provision for the new proposed ports and the rejuvenation of the existing ports will increase the throughput. This has to be supported with the infrastructure through master plan proposals to make the projects successful as well as to take the maximum benefits of the upliftments. The provision for the increase in flow of traffic will be taken into consideration and the impact of these projects on the urban life to be regulated.

2.4.3 Bharatmala Project

Bharatmala Pariyojana is a project for the roads and highways sector that focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and Green-field expressways.

The highlights of the project are:

- Improvement in efficiency of existing corridors through development of Multimodal Logistics Parks and elimination of choke point
- Enhance focus on improving connectivity in North East and leveraging synergies with Inland Waterways
- Emphasis on use of technology & scientific planning for Project Preparation and Asset Monitoring
- Delegation of powers to expedite project delivery - Phase I to complete by 2022
- Improving connectivity in the North East

Sections in VMR that are to be taken up in the first phase of Bharatmala project are:

- Raipur-Visakhapatnam Economic Corridor development
- Lane expansions and flyover in Visakhapatnam under Chennai Kolkata corridor
- Four lane Beach Road of 30.00 Km connecting Gangavaram Port to the SEZ proposed at Atchuthapuram in Visakhapatnam District

- Development of greenfield bypass road for better connectivity of Gangavaram port in Visakhapatnam District.

2.4.4 Special Development Area around Bhogapuram to Kailasagiri

Bhogapuram international Airport is proposed in the Bhogapuram mandal of Vizianagaram district under VMRDA jurisdiction. This area is envisioned to be developed as an Aerocity with high potential for coastal tourism, significant natural features, proposed Mass Transit Systems, IT related developments and other economic opportunities. This area has very high development potential considering the mentioned factors. Hence, this area needs to be planned separately with special sensitive development.

2.5 KEY CHALLENGES AND OPPORTUNITIES

The area has been developing on its economic base, but in more of an uncontrolled manner. Though there were several attempts in planned development in the city, but they were implemented in relatively smaller areas, forming islands. To keep a balance between urban and rural areas, there are is a requirement of upgrading to best infrastructure and connectivity of rural and urban area. Protection of natural water resources and landwill be more crucial keeping in mind the additional population the region needs to cater for due to the thrust in the development which again needs to be accommodated in a planned urban sprawl and re-densification.

Augmentation of port logistics is required to compete with other ports and logistic hubs. Response to natural calamities is important being a cyclone prone area. Measures to tackle environmental pollution and coastal erosion are also significant concerns.

Lack of Physical Infrastructure

There is a deficit of physical infrastructure supply to the entire demand. The inadequacy and improper distribution of physical and social infrastructure facilities in periurban and rural areas.

- ✓ 53% deficit of Drinking Water
- ✓ 97% deficit of Household Sewerage Connection
- ✓ Zero waste segregation
- ✓ 65% deficit of storm water drainage

Inadequate connectivity to rural area

- ✓ Transport infrastructure and connectivity to the rural areas need further augmentation.

Unplanned Urban Sprawl

- ✓ Unplanned Regional Growth affecting the quality of life and framework/form of the region.
- ✓ Encroachment of water bodies leading to the loss of natural drainage features.

Poor Air Quality

- ✓ Air quality depletion due to open bulk cargo handling at ports and high concentration of industrial activities.

Natural Environment and Resources

- ✓ Depletion of Natural resources and pollution of natural courses due to unscientific mining, deforestation, hillock encroachments.

Natural Disaster

- ✓ Region is prone to various environmental factors like floods, storm surges, cyclones and coastal erosions due to various man-made and natural interventions.

Inadequate Port Logistics

- ✓ Inadequate support logistic infrastructure towards ports expansion

Occupational Shift

- ✓ Occupational shift from primary sectors of economy such as fishing and allied activities due to the decreased yield and lack of proper infrastructure facilities.

Industrial Opportunity Assessment Framework

Based on quantitative and qualitative analysis of the existing industrial strengths of the subject region and mapping of potentially attractive sub-segments for key industrial sectors regionally, key sub-segments conducive for attraction to the subject region have been shortlisted.

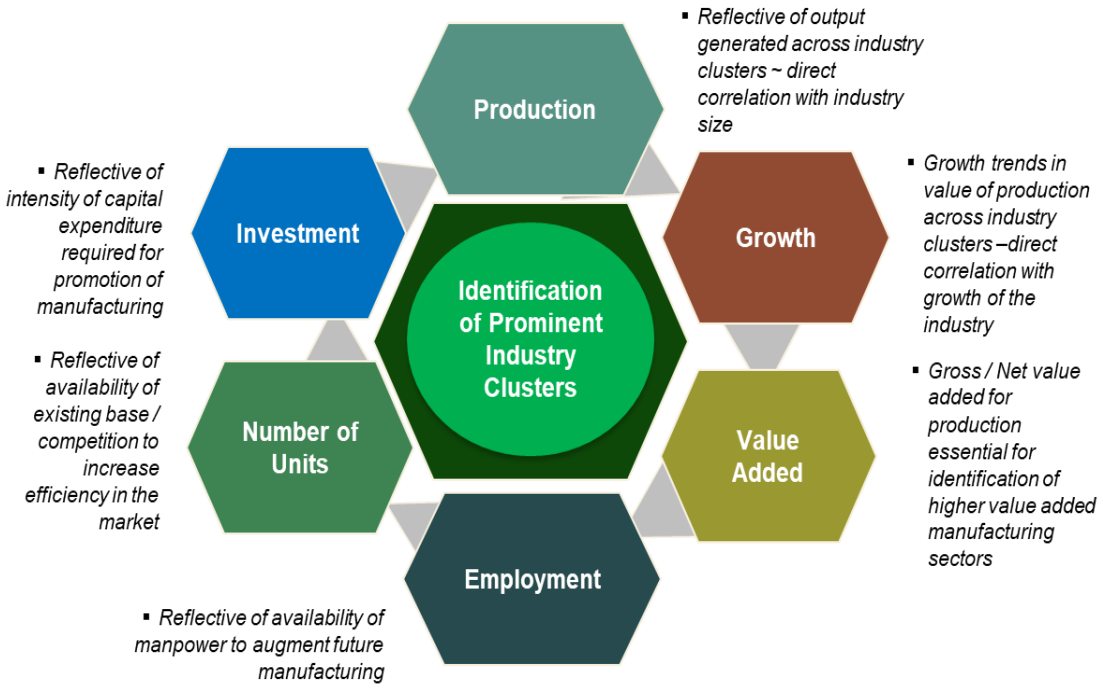


Figure 2-13: Framework for identification of potential industry mix for the area

Potential Future Industrial Growth

Keeping into perspective the existing market dynamics, government thrust and technological advancements expected going forward, the following industries are envisaged to enjoy regional synergies and witness optimal growth going forward.

- ► High Value add manufacturing
- ► Substantial employment generation & investment attraction
- ► Potential to develop self – sustained eco system ~ opportunities across value chain
- ► Support growth across MSME as well as large scale segments

The specific sectors that will have receive the thrust and have better possibilities to grow in the investment and resource environment of the region are:

1. Food & Beverages
2. Non-metallic Mineral Products
3. Aerospace &Defence
4. Shipbuilding and Ship Repair
5. Basic & Fabricated Metal Products
6. Auto and Auto Components
7. Machinery & Equipment
8. Electrical and Consumer Electronics
9. Chemicals and Pharmaceuticals
10. Textiles and Wearing Apparel
11. Leather and Leather Products

3 ECONOMY

3.1 ECONOMIC DEVELOPMENT TRENDS

India is presently the third largest economy of the world having a Gross Domestic Product of ₹ 794.47 lakh crores ($10.57 trillion) based on purchasing power parity as per International Monetary Fund estimates for 2018. Since economic liberation of India in 1991, it has achieved an average growth rate of 6-7% in GDP. It has grown at an impressive rate of 8.2 in the first quarter of FY 2018-2019.

Service sector contributes to the major portion of the Indian economy in 2016-2017 as per constant prices of 2011-12. Total GDP being ₹121.65 lakh crores, the tertiary sector contribution amounts to about ₹60 lakh crores with a share of 53.77% whereas the secondary sector has a share of 31.12% contributing around ₹34.75 lakh crores and primary sector having the lowest contribution of 15.11% and with a gross value addition of ₹16.84 lakh crores. This shows the flourishing of the service sector in India with major economic activities of real-estate and financial services.

According to the current prices, the Gross Value Added by the State of AP is ₹6.75 lakh crores for FY 2016-17 and ₹5.32 lakh crores as per constant price of 2011-2012. This constitutes 5% of the National GVA. The sector-wise contribution shows a similar trend as of India as a whole. Service sector has a leading contribution of 46%. But primary sector is the second largest contributor in the state economy with a share of 28% very close to the secondary sector contribution of 27%. This composition of the state economy will be subject to change due to the influence of rapid urbanisation, the effects of bifurcation of Andhra Pradesh and policy boost from State Government.

Visakhapatnam has taken momentum as a port city and due to the locational advantage; it has gradually evolved as an industrial hub. A rapid growth in the manufacturing sector has been evident in the last four decades starting from major anchor industries like Hindustan Shipyard, Hindustan Petroleum Corporation Ltd., Bharat Heavy Plates and Vessels (now under BHEL), Visakhapatnam Steel Plant, NTPC, etc.With influence from key projects like Vizag Chennai Industrial Corridor, Petroleum Chemical and Petrochemical Investment Region and Sagarmala, there will be a boom in employment generation in manufacturing sector.

Visakhapatnam being a port city and having a good global and hinterland connectivity has evolved as an industrial town with manufacturing sector flourishing around the city. The city by virtue of its urbanization due to the economic activities has also developed the tertiary sector. Manufacturing activity forms the stronghold for the regional economy along with the transportation and logistics. Real-estate sector also comes up as a major contributor to the economy in VMRDA region.

3.2 DISTRICT LEVEL VARIATIONS

Two districts of VMR have been contributing significantly to the domestic product.

Vizianagaram District: Agriculture is the major producer of district income, contributing 11.7% to the district income after Trade and Hotels. The district contributes 3.7% to the Gross State Domestic Product. Because of the new airport which is going to be established in Bhogapuram, the economy is likely to get a boost, especially in areas of industries and tertiary sector.

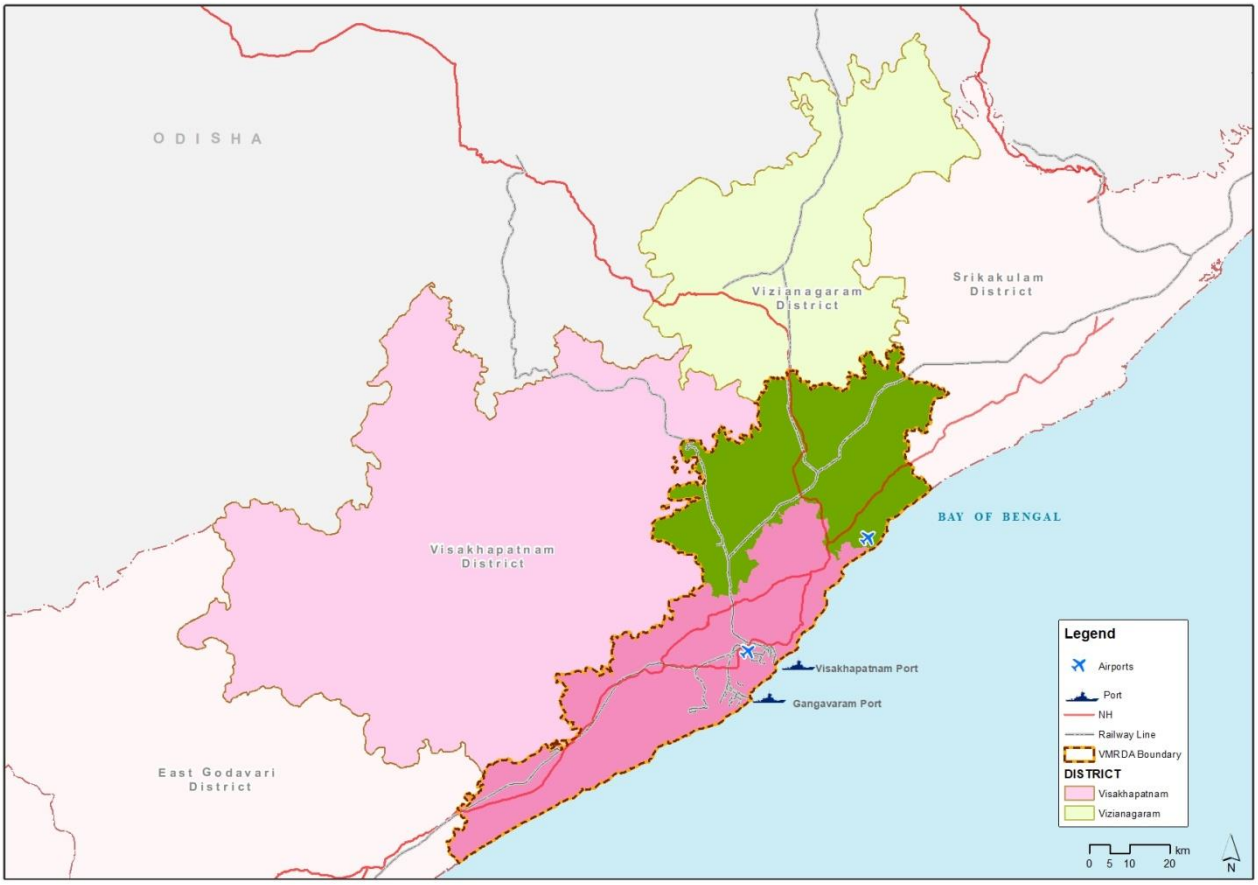


Figure 3-1: VMRDA Region by districts

Visakhapatnam district: This district has better connectivity in this entire region by land, sea and air. Due to the city's ideal location between major road and rail corridors, especially the Chennai - Kolkata corridor, the industrial sector has been showing major development. Further earmarking land for various industries, establishment of various SEZ and IC also contributed to the increase in industries. The district has two major ports of which one has been established recently to reduce the load on the existing port of Visakhapatnam. Agriculture has least share and contributes least to the district income, when compared with the other districts in the region. Overall contribution of the district to the state income was almost 14% in 2012-13, which would have gone up now.

3.3 KEY ECONOMIC BASE IN VMR

3.3.1 Agriculture

The primary sector contributes 23.1% to the GSDP of Andhra Pradesh, of which the project region alone constitutes 8.1% (which includes the entire districts of Vizianagaram and Visakhapatnam). As per Census 2011, nearly 41% of the working persons of these 35 mandals of VMRDA region are engaged in agriculture sector. About 55% of the VMRDA region is under agriculture majorly contributed by Vizianagaram district.

A detailed analysis has been done at mandal level taking the parameters of total Agricultural Area, total Cropping Area, Cropping Intensity, total Irrigated Area, Irrigation Intensity and Land Holdings per farmer.

Visakhapatnam (urban) mandal has zero agricultural activities since it is fully urbanized. Urban farming on roof gardens can be encouraged, which has more potential to increase agricultural activities.

Gajuwaka, Pendurthi and Sabbavaram mandals of Visakhapatnam and Vizianagaram mandal of Vizianagaram district are the least agricultural potential areas in VMRDA region. This can be increased by effective use of resources and utilizing various schemes of state and central government for the seeds and soil fertility.

3.3.2 Fisheries

Fisheries are one of the traditional occupation and major source of economy for coastal population in India. This sector provides 4.93% to GSDP, of which, 6.5% alone is from the project region. The economic contribution of VMRDA region to the State Agriculture sector has increased from 5.8% in 2010-11 to 6.5% in 2012-13.

In VMR, sea food industry is growing over years and is one of the growth engines in Agriculture sector identified by Government of Andhra Pradesh (GoAP). There has been a shift from traditional crafts used for fishing to motorized and mechanized crafts which boosted the economy of the fisheries sector and the livelihood of the fishermen.

VMR has a coastline of 170.8 kms, which is about 20-25% of total state coast length. There are 80 fishing villages depending on fishing as their livelihood. (Marine Fishing Census-2010).

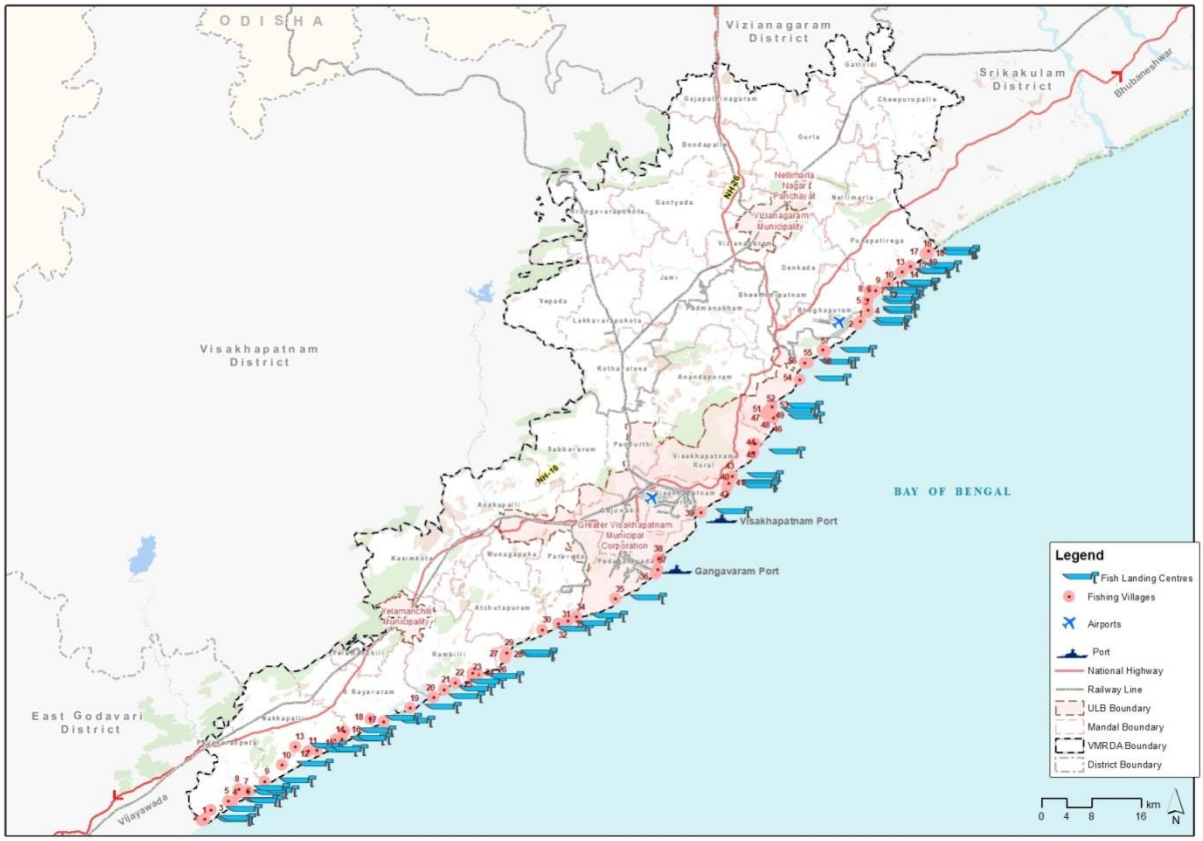


Figure 3-2: Local markets and facilities provided to fishermen community

3.3.3 Industry

Transformation of Visakhapatnam into a large manufacturing hub has taken place over the last four decades along with supporting infrastructure and ancillary base. Major industries such as Hindustan Shipyard, Hindustan Petroleum Corporation Ltd., Bharat Heavy Plates and Vessels (now under BHEL), Visakhapatnam Steel Plant, NTPC, etc., with large base of supporting ancillary industries have been setup in the decades of '81 and '91. This transformation continued with advent of Special Economic Zones (for instance, AP SEZ, in Visakhapatnam district) which has boosted the investment in industries in recent years. Presently, the industrial sector of VMRDA region contributes 22% to the GVA by the industrial sector of state and 5.9% to the total GVA.

The VMRDA Region has a strong industrial base with distinct typology of industries which has been influenced by the factors like the presence of port like the Visakhapatnam port, Gangavaram port and Kakinada deep water port, the availability of resources of agricultural produce like jute, rice, sugar, cashew and even fisheries, minerals in the Eastern Ghats and petroleum in the Krishna-Godavari basin, availability of labor and the exposure to the global market. These have induced the development of industries like metal

and metal fabrication and machinery manufacturing, food processing units, textile industry, petroleum and petrochemical units, and pharmaceutical and allied chemical manufacturing units.

The region has 7,316 manufacturing units, 23 industrial parks, 15 SEZs with total investment of ₹ 71 thousand crores and 2.3 lakhs employment. APIIC has about 25,000 acres of land in the region out of which 38% is not yet allotted and can be used for future developments.

With the help of the initiatives of Andhra Pradesh Government through agencies like APIIC and facilities like single window clearances for setting up manufacturing units, the state is at a leading position at ease of doing business (EoDB) and is attracting large investments even from the global market.

3.3.4 Ports and logistics

There are two sea ports falling within the VMRDA region, Visakhapatnam port and Gangavaram port and Kakinada deep sea port is about 10 km from the region. Hence, within the influence of the project area, three major ports, a container terminal and two fishing harbours are present.

Visakhapatnam Port is located at $17^0$41' N and $83^0$18' E, is almost equidistant from Kolkata and Chennai ports. The port is a premier port in the country, in terms of annual traffic (cargo throughput). There is also a fishing harbour, spread over in 38 ha of area, which is presently being used by local fishermen for fishing related activities and as shelter for their launches/crafts. Visakhapatnam port facilities in inner and outer harbours are presented inTable 3-1.

Table 3-1: Visakhapatnam Port Trust facilities

Sl. No.	Port facilities	Inner Harbor	Outer Harbor
1	Water Spread (Hectares)	100	200
2	Maximum Draft (in meters)	14.50	18.10
3	Length (in meters)	230 LOA	320 LOA
4	Beam (in meters)	32.5	50
5	Vessel Class	PANAMAX	Super Cape (up to 2 lakh DWT)
6	Number of Berths	18	6

Source: Visakhapatnam Port Trust Annual Report, 2018

Visakhapatnam port majorly handles POL, iron ore, Fertilizer, Thermal Coal and Coking Coal. Table 3-2shows the principal commodity wise cargo traffic handled at Visakhapatnam Port for the years 2011-16 (Figure 3-3).

Table 3-2: Principal commodity wise cargo Traffic handled at Visakhapatnam Port (in lakh tonnes)

Sl. No	Period	POL	Iron Ore & Pellets (Export)	Fertilizer		Coal		Container		Others
				Finished	Raw	Thermal (Export)	Coking	Tonnage	TEUs	
1	2011 - 12	184.4	161.54	37.17	8.32	31.89	67.8	42.14	234	100.5
2	2012 - 13	150.4	123.09	20.23	5.65	29.51	68.35	45.54	247	104.56
3	2013 - 14	10.09	129.99	17.71	7.95	27.44	69.28	49.16	262	109.37
4	2014 - 15	146.4	83.01	18.38	7.2	27.79	60.74	43.73	248	99.12

Sl. No	Period	POL	Iron Ore & Pellets (Export)	Fertilizer		Coal		Container		Others
				Finished	Raw	Thermal (Export)	Coking	Tonnage	TEUs	
5	2015 - 16	169.4	59.79	19.96	7.99	33.93	50.81	51.45	293	96.78
6	2016-17	166.04	114.20	18.86	7.76	34.71	42.82	64.28		120.50
7	2017-18	160.50	106.46	19.53	9.20	29.48	57.64	68.35		125.86

Source: Visakhapatnam Port Trust Annual Report, 2018

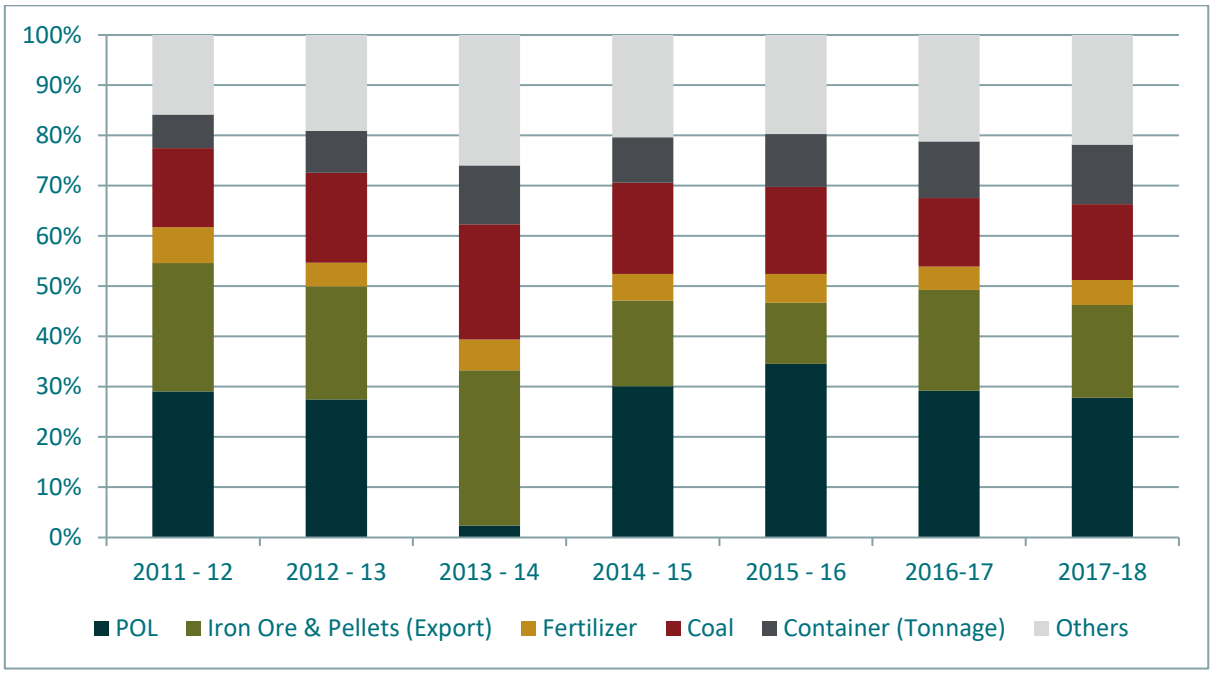


Figure 3-3: Commodity wise cargo Traffic handled at Visakhapatnam Port
Source: Visakhapatnam Port Trust Annual Report, 2018

Major development projects planned/ initiated are as given below:

1. Development of East Quay – 1A berth in inner harbour for handling thermal / steam coal with a capacity of 7.36 MTPA;
2. Upgradation of Ore Handling Complex (OHC) and creation of new facility (West Quay 1) for handling iron ore with a capacity of 23 MTPA;
3. Extension of Visakhapatnam Container Terminal in the outer harbour with a capacity of 0.54 MTEUs and thus, enhancing the capacity to 2 MTEUs;
4. Installation of mechanized fertilizer handling facility at East Quay – 7 berth in inner harbour with a capacity of 5.21MTPA;
5. Development of West Quay North berth (WQ – 7&8) in inner harbour with a capacity of 6.29 MTPA;
6. Replacement of existing East Quay berths to cater to 14.5 meters draft vessels i.e., (E.Q. 2,3,4,5) with a capacity of 6.00 MTPA;
7. Installation of Harbour Mobile cranes at East Quay and West Quay berths;
8. Development of Grade separation at Convent Junction through a flyover;
9. Development of multi model logistic hub as Joint Venture with M/s Balmier Lawrie & Co. in 100 acres of Visakhapatnam Port Trust land;

10. Development of multi modal logistic hub by M/s CONCOR in 100 acres of Visakhapatnam Port Trust land;
11. Establishment of Container Freight station (CFS) on Visakhapatnam Port Trust land by Visakhapatnam Container Terminal Pvt Ltd.;
12. Revamping of R&D yard to Railway standards; and
13. Electrification of Railway tracks of coal terminals.

Gangavaram Port is located within 15 km south of Visakhapatnam Port. It is a newly developed greenfield port which started operation in August 2008. It is a Joint Venture (JV) between the State Government of Andhra Pradesh and a consortium led by Mr.D.V.S. Raju. Exports and Imports Cargo traffic handled by Gangavaram Port from 2009-10 to 2015-16 is given in Table 3-3.

Table 3-3: Exports and Imports Cargo traffic handled by Gangavaram Port

Sl. No.	Year	Imports & Exports in MMT
1.	2009-10	12.58
2.	2010-11	13.91
3.	2011-12	13.99
4.	2012-13	13.10
5.	2013-14	15.81
6.	2014-15	20.74
7.	2015-16	19.33

Source: Gangavaram Port Limited Office

To improve connectivity to port, following proposals were submitted to Government of Andhra Pradesh and Director of Ports.

- Widening of existing 4 lanes road to 6 lane road connecting NH-16.
- From NH-16 to Port entry gate existing 2 lanes to 4 lanes.
- 4 lane beach road of 30 km connecting Port to Atchutapuram SEZ.

Coastal Railway line around 35 km from Gangavaram Port to AtchutapuramSEZ connecting NTPC Simhadri, Hinduja Power Plant, Brandix, Pharma Park and other upcoming industries along the sea coast.

Besides the two functional ports, which are large and medium, two minor ports are proposed within the VMRDA Area.

- Bheemunipatnam about 29 km north east of the port of Visakhapatnam and is proposed to be developed as minor port on the southern bank near the mouth of river Gosthani. It is proposed to develop Bheemunipatnam as a satellite terminal for the Visakhapatnam Port.
- Kalingapatnam is about 83 km north east of the port of Visakhapatnam. The port is proposed on the southern bank of the estuary of river Vamsadhara near its confluence with the sea. It is proposed to be developed as lighterage port which is stated to be suitable for development of good deep water, all weather port by Department of Port, GoAP.
- Nakkapalli is proposed to be commissioned as a minor port situated in Nakkapalli village of Visakhapatnam district within VK-PCPIR region. M/s. ANRAK Aluminum Limited has been permitted for the construction of a captive jetty.

Meanwhile, high-level committee appointed by the Union Shipping Ministry for setting up a second major sea port in the state of Andhra Pradesh. Apart from Nakkapalli, Duggarajapatnam of Nellore District and Ramayyapatnam in Prakasam district are selected as the probable sites for the second major port in the state. If Nakkapalli gets selected as the site for a second major sea port in the state, it could impact the region in a large way.

Visakhapatnam is the only place where logistic hub is located in the region. It has both Container Freight Station and Inland Container depot. Visakhapatnam ICD is a Combined (Both Exim & domestic) container

terminal. Container Freight Station, Visakhapatnam has started functioning in Dec '02. The new depot has started functioning April '05 for both Exim and Domestic Traffic. The Clearing and Forwarding Service (CFS) area is adjacent to VPT and hardly 3 km away from Visakhapatnam Railway Station. It has got a natural advantage in terms of connectivity to both Port and Hinterland.

M/S. Balmer Lawrie & Co Ltd (BL), in joint venture with Visakhapatnam Port Trust, have proposed to develop a Multi-Modal Logistics Hub (MMLH) at Visakhapatnam in an area of 60 acres which is located near NH-16, adjacent to the port connectivity road. As per the officials of Visakhapatnam Port the project is under active consideration of the Govt. of India and is expected to take off soon.

3.3.5 Tourism

The VMRDA region covers a long coast line and a large region comprising various scenic spots, culturally rich religious destinations and several master pieces of great architectural heritage. Along with the urban attractions in tourist destinations, there are untouched rural scenic spots and relatively less exploited heritage structures located in rural hinterland that offer great potential to generate economic and employment opportunities. The city of Visakhapatnam can be considered as the nucleus for tourist activity in this region.

Visakhapatnam experiences a major percentage of foreign tourists' foot fall every year. The city presently has international air connectivity from Dubai, Singapore and Kuala Lampur apart from important metros of India i.e., Delhi, Mumbai, Hyderabad, Bengaluru, Chennai and Kolkata. Visakhapatnam is a major junction on commercially important Chennai - Kolkata Rail line. The city is well connected by rail with New Delhi, Chennai, Kolkata and Hyderabad. Regular bus services are available from Hyderabad, Vijayawada, Bhubaneswar, Chennai, Tirupati and other major cities.

The VMRDA Region offers naturally, ecologically, culturally and religiously diverse variety of tourist destinations that present scope to explore continuously. The tourist destinations that are present in the region can be mainly classified into the following:

- Resorts / Beach front
- Religious Tourism
- Cultural Tourism
- Hill Stations
- Nature / Eco-Tourism
- Adventure Tourism

Andhra Pradesh has devised a special tourism mission and policy for the state which is aimed at increasing the investments, economy and employment in tourism sector. The government plans to increase its revenue from current 14% to approx. 18% from tourism industry. The objective if the Andhra Pradesh Tourism Policy, 2015 is to position the state as a globally recognized tourism destination & preferred choice of tourism investments while preserving the cultural heritage of the state. The policy expects to facilitate investments upto INR 10,000 Crore and 7% increase in GSDP contribution by 2020. The policy aims at creation of 5 lakh additional jobs in tourism industry.

The Tourism policy states the various incentives offered for eligible tourism infrastructure projects (such as Hotels, Resorts, Heritage hotels, Amusement parks, MICE Centres, Golf Courses, etc.,) and eligible tourist services (such as Beachside shores, Water sports, Water ride/sailing facilities, Cruises, Adventure services, etc.). Further, the tourism policy has also defined a set of themes which are Beach and Water Tourism, Heritage Tourism, Eco tourism, MICE tourism, Buddhist Tourism, recreation and adventure based Tourism, Religious Tourism, Spiritual and Wellness Tourism, Medical Tourism.

- Certain fiscal incentives for Private Sector investments in Tourism have also been formulated and these are as indicated below:
- Complementary / Linkage Infrastructure Development Assistance
- Facilitation of transport infrastructure, communication network, health services, security services, etc.
- If conversion of land is permitted by the relevant government authority, GoAP will waive the Non-Agriculture Land Assessment (NALA) tax or Land Use Conversion charge, as applicable

- GoAP will provide 100% reimbursement on Registration and Stamp duty for all Tourism Infrastructure Projects
- 100% exemption on luxury & entertainment taxes
- Marketing support for tourism projects
- Creation of dedicated land bank for undertaking tourism projects on PPP basis

The policy provides incentives for taxation in tourism projects to be taken up in PPP mode. Government of Andhra Pradesh is keen in ushering investments from quality tourism operators. The following Tourism Services have been identified based on the priorities and alignment with the State's aspirations. Beachside shacks, Water sports, Water ride/sailing facilities, Sea/ River/Canal Cruises, Adventure services, Ropeways, Heli-tourism, Farm Tourism Services, Rural Tourism Services, Heritage walks. Investment subsidies are given to the operators for operating the above services. Formation of SPV to be explored for implementation of Mega Tourism projects

The institutional arrangements are made in the policy to enable a conducive environment for the tourism sector. The state tourism promotion board, state tourism promotion committees are formulated to periodically monitor the implementation of Tourism Infrastructure projects and Tourism Services and extension of incentives and concessions. The policy underlies the ways to attract tourists and investors to tourism sector in Andhra Pradesh through marketing and promotions.

3.3.6 Others

Apart from the major economic activities which largely contribute to the development of the region there are certain sectors which have a parallel impact to the economy of the region. Transportation sector generates a lot employment in the region, be it in the road transportation, or the railways department. The Waltair division in the East Coast Railway having its headquarters in Vizag do have a significant impact to the economy. Real estate sector has experienced a boom in the region with rapid conversion of land in rural area into plotted layouts providing basic infrastructure. Land rates and property rates have also increased in urban as well as rural areas. Though there has been ample amount of boost given by the state government to the IT sector, there has not been major development in IT/ITeS. Only a handful of investments have materialised till now devoid of any major players coming in the scenario. There are many other unorganised and household industries which were indigenous to the region like,

- Mango jelly production in Jami of Vizianagaram
- Textile wholesale market in Vizianagaram
- Jaggery wholesale market in Anakapalle
- Lacquer toys in Etikoppaka in Yelamanchili mandal
- Multiple sugar cooperation factories which are operational at specific seasons in the year based on harvest.
- Shrimp hatcheries, producing export quality shrimps have come up in a scatter manner along the coast line.

3.4 CONCLUSION

Visakhapatnam as a region has been developed from a fishing settlement to a major economy based on port and port related activities. The focus on port and industries will continue to be of major significance, but apart from that there should be parallel thinking about the diversification of the economy to make the region more resilient and have a better living quality with diverse livelihood for citizen to choose from.

4 DEMOGRAPHY AND SETTLEMENT PATTERN

4.1 POPULATION GROWTH TRENDS

VMRDA area has witnessed an increase in population from 36.2 lakhs in 2001 to 40.7 lakhs in 2011 according to Census of India. Urban area has an increase in population from 14.8 lakhs in 2001 to 19.41 lakhs in 2011 while rural area has decrease in population from 18.7 lakhs in 2001 to 18 lakhs in 2011

VMRDA experiences annual average growth rate of 1.2% which is same that of the state. Urban area has an average annual growth rate of 2.7%.In the last two decades VMRDA area has experienced a decline in growth rate from 16.4 %(census 2001) to 11.2% (census 2011) which is slightly higher than that of the state's growth rate (9.2%) and significantly lower than that of country's growth rate (17.64%) according to census 2011.

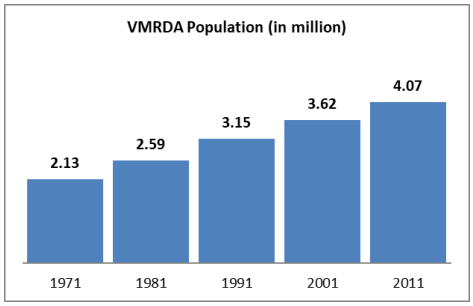


Figure 4-1: Population growth in VMRDA

Dynamic increase in growth rate is witnessed in mandals of, Garividi and Yellamanchili is evident in growth trends of last two decades. By virtue of high number of metallurgical industries in Garividi which also has major connectivity of state highway junction and railways. Yellamanchalli, on the other hand being an urban centre has attracted population by virtue of its connectivity with national highways and presence of urban infrastructure.Visakhapatnam district have higher growth rate due to more concentration of industries which form the main source of employment opportunity and economic activities in this region.

4.2 POPULATION DISTRIBUTION AND DENSITY

VMRDA area has an urban population of 55.8% and rural population of 44.2%. Visakhapatnam district has 70% of VMRDA's population followed by Vizianagaram with 30% Greater Visakhapatnam Municipal Corporation has greater share of Urban population. Visakhapatnam district has highest share of Rural population 51% followed by Vizianagaram 49%

Population density of VMRDA area is 819 persons per sq.km which is much higher than the nation's (382 persons per sq.km) and state's density (308 persons per sq.km) according to census 2011.Visakhapatnam district has higher density of 1058 persons per sq.km owing to its rapid development and highest share of urban area. Vizianagaram has a density of about 536 persons per sq.km followed by Vizianagaram.

Visakhapatnam rural mandal has greater increase in density from 2001 to 2011 which is due to the upcoming projects and two IT hills and non-SEZ located in this region. Pedagantayada mandal experiences burgeoning density while Munagapaka mandal also has significant increase in density due to the establishment of three large scale (chemical, automobile and power) industries near Munagapaka.

4.3 MIGRATION

Visakhapatnam being a port city attracted more industries in the region. In late 80's steel plant was established. Many other industrial giants like HPCL, Andhra petrochemicals, Essars steel, etc., came up in the region. This led to migration in search of employment opportunity during 1991 to 2001 which ultimately resulted in higher population growth rate. During 2001 to 2011 it is observed that not much of big players came into picture, providing bulk employment and the existing industries had already employed the required number of people and did not provide with much additional employment. Hence the growth rate was lower compared to that of the previous decade. IT/ITES which was expected to generate higher employment did not meet the expectation and is still getting delayed to take off. The inadequate infrastructure and current government policies are the greater drawbacks weighing down the venture of IT sector.

4.4 LITERACY LEVELS

According to census, VMRDA has 63% literacy rate which is lesser than the state and national literacy rate of 67.41% and 64.8% respectively. Among the districts Visakhapatnam has higher literates.Significant increase in decennial literacy rate is observed in mandals adjoining the urban areas like Garividi and Cheepurupalli in the north of VMRDA area and Payakaraopeta,Rambilli, Atchutapuram and Munagapaka.

Male and Female literacy rate is higher Visakhapatnam district. Male literates are less in mandals of Nakkapalli (24%) and Pusapatirega (25%) while female Literacy rate is less in Gurla mandal (17.6%) and Pusapatirega (17.9%) in Vizianagaram district.

4.5 OCCUPATIONAL STRUCTURE

Work force participation rate of VMRDA is 41% (Census 2011). Vizianagaram has higher work force participation rate of 46.6% followed by 45.8%.Visakhapatnam district has major work force in secondary and tertiary sector. Other than House hold industries has 72.3% of the workforce in Visakhapatnam district. Visakhapatnam houses more secondary sector industries which is responsible for the huge share of employment. Port, railways and logistics also contributes to considerable employment in tertiary sector. Primary workers (24.3%) constitute of major agriculture and substantial workforce is involved in fishing activities. Vizianagaram(56.6%) has highest share of primary workers. The North of the region is more fertile and majorly an agrarian economy.The secondary sector employment in Vizianagaram has 43.4% of the total workforce.

4.6 KEY CHALLENGES

Visakhapatnam being the biggest urban area in the region acts as a pull factor and attracts more migrants in search of employment and better services. The rural area is experiencing a very low growth rate because of the shift to urban areas for better quality of life and lesser per capita income in the rural areas. Majority of the rural shift will end up in slums by virtue of low cost housing facilities and affordability. Growing population will create load on the current infrastructure facilities and will result in unorganized growth if not planed and organized in prior. The huge availability of human resource is an asset that is not well channelized for the development of the region as a whole.

4.7 CONCLUSION

Urbanisation is skewed in Visakhapatnam in the region. High population growth rates are observed in specific mandals showing increased urbanization induced by the industrial growth.Larger share of Population in the age group of 10 - 25 years is foreseen as potential work force.ULBs are concentrated in Vizianagaram (2) whereas it is dispersed in Visakhapatnam (2).Channelization of available human resource and accommodating the increasing population without compromising on the quality of life is possible only through a planned development considering the future growth of the region.

5 HOUSING AND LAND MARKET

A certain minimum standard of housing is essential for a healthy and civilized existence. Starting from informal settlements to the high end villas, the fundamental function of housing remains the same, i.e. to shelter. Government of Andhra Pradesh has given prime importance for building houses from the past few decades. The Housing sector in VMRDA Region will be discussed in detail with focus on major urban areas like Visakhapatnam, and Vizianagaram.

Real estate sector has a crucial role in any economy. It also impacts various other allied sectors. The expenditure in the real estate sector impacts the expenditure and returns in other sectors atleast upto five times. The patterns of urbanisation in India have an effect on the real estate sector across all its segments of residential, commercial, and hospitality. The region with its bestowed natural beauty and existence of various topographical features along with excellent connectivity, offers opportunities for economic development under various kinds of projects in sectors of tourism, real estate, industries and others.

The increase in work opportunities in many urban areas has attracted the migrant working population. The increase in population has demanded a rise in the available housing stock. The situation is the same in every other region and VMRDA is no exception. The vast potential in this sector is in the waiting for exploitation. The increased need has created demand for housing along with commercial activity. After the bifurcation of the state into Andhra Pradesh and Telangana, the state of Andhra Pradesh has created mandate to attract the investments in the region. The complete assessment of current scenario of real estate industry of VMRDA region is presented in the following sections.

5.1 HOUSING TRENDS AND DEMAND

Housing

The real estate development in housing sector can be segmented into private housing, rehabilitation resettlement housing colonies and public housing. The accelerated growth of IT/ITeS sector witnessed during the last decade across major cities (viz. Mumbai, Bangalore, Chennai, Hyderabad, etc.) has triggered the initialization of IT/ITeS activity in majority of the tier II cities (viz. Coimbatore, Visakhapatnam, Mysore, Pune, etc.) in India. IT/ ITeS development in Visakhapatnam is primarily attributable to factors such as availability of relevant manpower, lower manpower cost, availability of large land parcels at relatively cheaper rates, Government thrust to prioritize the sector, etc.

Over the last 5 – 6 years, the residential activity has witnessed spill over activity to suburban and peripheral locations in the city. This has been triggered with spurt in IT/ITeS led demand. With increasing population, escalating land values in established residential hubs, growth of IT/ITeS segment in Madhurawada – Pendurthi – Gajuwaka region, the real estate development activity in the residential segment is witnessing a gradual transition from the central areas to the suburban areas, and subsequently to the peripheral areas of the city.

Real Estate

VMRDA area is one of the biggest industrial investment regions in Andhra Pradesh having potential for many new ports like Kalingapatnam and Bheemunipatnam in addition to existing Visakhapatnam and Gangavaram ports. Along with the development of IT industries in Class II towns, the presence of industrial giants like Visakhapatnam Port Trust, Gangavaram Port, Vizag Steel Plant, NTPC, Pharma SEZ, Pharma City, APIIC industrial estates, APSEZ, Hetero SEZ, NFCL, GFCL, industrial hubs along with intermittent tourist attractions are main reasons for rapid and significant growth of real estate sector in the project area.

In VMRDA region, the real estate development is being regulated / controlled by various Government Agencies. As per the AP Urban Areas (Development) Act 1975, the Visakhapatnam Urban Development Authority (VUDA) is empowered to regulate the development as per the Perspective Plan and Master Plan. However, VUDA delegated certain development control powers to the Municipal Corporation (GVMC) and municipality of Vizianagaram. Further, the Panchayats are empowered to approve the building plans to 10m

height within the approved layouts and for all other categories VUDA reserves the rights for granting permission.

Real estate is also zooming in the wake of new developments with skyrocketing land prices in Visakhapatnam. Property developers, apart, group of Non-Resident Indians (NRIs) promising handsome investments have now turned their heads towards the port city. With the result, land prices have spiralled by 50 to 75%. What further boosted the rising land prices was the allotment by the State Government of vast stretches of valuable land to industries, software companies and development of Special economic zones (SEZs). Visakhapatnam has grown by leaps and bounds in recent years and improvements can be seen in every sector in the city. Here, the land prices range in between Rs.8,000 to Rs.10,000 per square yard. In the major locations like Dwarkanagar, it is as high as Rs. 30,000 to 40,000 per sq. yard, with the development of several IT units and also the sanction of several new industrial parks such as Brandix Apparel City. The rates are according to the circle rates of AP Revenue department.

Wherever the APIIC industrial estates / industrial areas are declared as Industrial Area Local Authority (IALA) by the Government, are empowered by the VUDA to approve the plans subject to reimbursement of charges/fees to VUDA. Areas outside VUDA boundary and GVMC are being regulated by the Director of Town and Country Planning or Joint Director/Deputy Director as the case may be.

5.2 GROWTH DIRECTIONS

Housing

The public agencies such as VMRDA, APIIC, GVMC, KMC, APSHC, APHB along with private developers play an important role in the real estate development in all the three districts in VMRDA area. The key public players and their role in development of real estate sector are as follows.

VMRDAregulates the development according to the plans and guides the private developers in developing layouts, housing schemes, integrated townships, apartments, commercial buildings/complexes and accords approval. VUDA takes up urban housing schemes, apartments, individual houses and row housing, etc., and developed land pooling schemes and joint venture projects of integrated township over 437 hectares. Out of the 52 layouts developed, few of them are integrated townships such as MVP Colony, Kappulappada, Madhavdhara, Madhurawada, Rushikonda, Kurmannapalem, Babametta and K.A.Petta at Vizianagaram etc. VUDA has developed many tourism projects and these are properties which are maintained and are a source of income to VUDA.VUDA has constructed many commercial complexes at many locations in Visakhapatnam, Vizianagaram, and Anakapalle.

Under housing activity 10, 841 housing units have been constructed and allotted in an extent of Ac.479 to a tune of Rs.68.50 Cr. Under sites services VUDA has developed and allotted 10, 519 plots in an extent of Ac.1718 to a tune of Rs.27.20 Cr.

APIIC is a completely owned undertaking of Government of Andhra Pradesh. APIIC has assumed the role of facilitator and developed / constructed IT Tower (HSBC) at Visakhapatnam. The APIIC is the principle facilitator in mega projects like IT SEZ / APSEZ, VSEZ, VIWSCO, Gangavaram Port, convention centre, mega industrial parks and hardware parks etc.

The A.P Housing Board has constructed houses to provide shelter to the needy people with no loss no profit basis. Since beginning this division has constructed 7,221 houses of different types and allotted to general public. Of the total constructed houses, 4,580 in Visakhapatnam and 993 in Vizianagaram. The housing is mostly MIG in Visakhapatnam while Vizianagaram has mostly LIG category housing.

Andhra Pradesh Township and Infrastructure Development Corporation Limited (APTIDCO) was established as a government syndicate to take up the task of integrated township and Infrastructure development across the state of Andhra Pradesh. It is the state level nodal agency for Pradhan Mantri Awas Yojana (PMAY) with capabilities of holistic planning, development, financing and implementation of affordable housing in the state. At present, APTIDCO is involved in PMAY Housing for All Urban in the state. A total number of 27,806 houses were built in Visakhapatnam and 31,701 houses have been constructed in Vizianagaram under AMRUT, PMAY and PMGAY.

Apart from the public sector organizations there are many private developers who have entered the field of construction. The city has witnessed the launch of a few large-scale residential developments (in excess of 100 units) offering improved amenities in the recent past viz. Indiabulls 'Sierra', Shriram Properties 'Panorama Hills', Oxygen Towers, etc. This trend is likely to gain momentum over the coming years with the entry of several reputed local and national developers, who have already acquired/ or in the process of acquiring lands in the city (viz. Omaxe, India Bulls, Bharat Infratech, etc. Most of the private developers like realtors who majorly work in developing the layouts are registered with Andhra Pradesh Real Estate Developers' Association (APREDA) and the builders who develop and deliver the completed projects are linked with The Confederation of Real Estate Developer's Associations of India (CREDAI) and VABA (Visakhapatnam Apartment Builders Association).

Layouts and development of them since the past 5 years gives a major trend of growth direction in VMRDA region. In Visakhapatnam District maximum new layouts have emerged in mandals like Bheemunipatnam, Anandapuram, Anakapalle, Padmanabham, Parawada, Sabbavaram and Pendurthi with 102 Acres in Bheemunipatnam region only because of the recent spread of the city beyond Madhurawada and its nearness to the upcoming Bhogapuram Airport with a road connectivity along the beach.

Vizianagaram has seen maximum upcoming of layouts in Bhogapuram, Denkada, Kothavalasa, Vizianagaram, Bondapalli, L.Kota and Vepada mandals in the last 5 years with the maximum of 102 acres in Bhogapuram because of its upcoming International airport proposal and connectivity to National Highway.

The highest area of lands in acres in Vizianagaram district comes under Vizianagaram Mandal followed by Bhogapuram, Denkada, Kothavalasa and L.Kota. The layouts mostly belong to Private followed by DTCP and APDPMS.

MANDAL	VIZIANAGARAM	BHOGAPURAM	DENKADA	KOTHAVALASA	L.KOTA
AREA IN ACRES	2198	1589	1204	999	558

The highest area of lands in acres in Visakhapatnam district comes under Visakhapatnam Rural followed by Beeemunipatnam, Anandapuram, Pendurthi, Gajuwaka and Parwada. The layouts mostly belong to Private followed by DTCP and APDPMS.

MANDAL	VISAKHA RURAL	BHEEMUNIPATNAM	ANANDAPURAM	PENDURTHI	GAJUWAKA	PARAWADA
AREA IN ACRES	2982.88	2097.49	1912.06	1482.06	1245.29	968.87

The Present growth trends of layouts show that in the last 5 years most layouts have come up in Achutapuram, Yalamanchali, Anakapalle in the south, Pendurthi, Kothavalasa, Sabbavaram, Anandapuram and Lakkavarapukota in the west and Bheemunipatnam and Bhogapuram in the north. The trend shows the growth towards the proposed developments and projects coming up in future since maximum layouts are coming out towards Bheemunipatnam and Bhogapuram for the upcoming international airport.

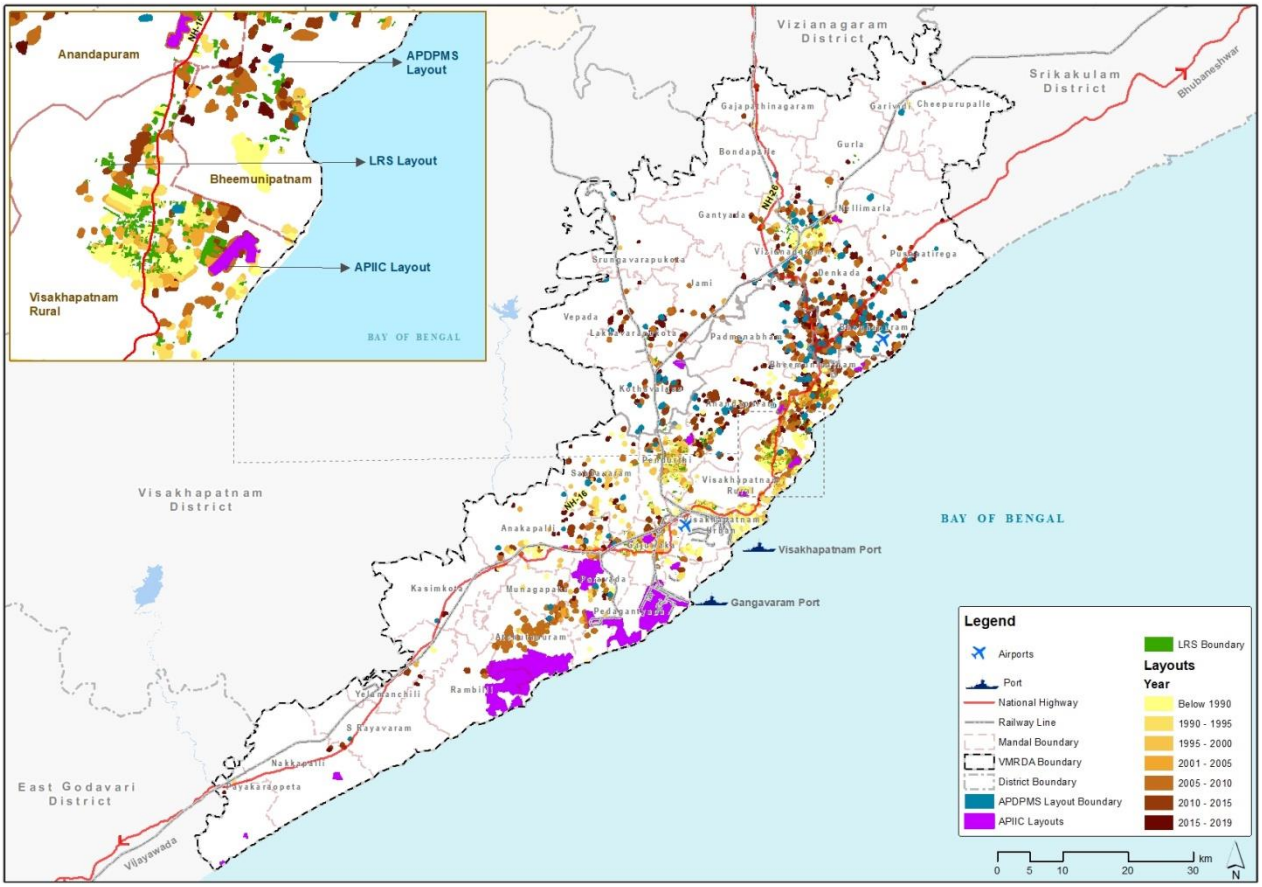


Figure 5-1: Growth trend of layouts in VMR

Real Estate

Property prices in Visakhapatnam got doubled in a span of a year. The most popular area is the stretch along the beach, Rushikonda to Bheemunipatnam. The market value of an acre near to Bheemunipatnam is around Rs. 60 lakh and the registration value is in the order of Rs. 9 to Rs. 15 lakhs. Indeed, the registration value pushed to 75 per cent from 50 per cent from August 2006.

Civil works on the much-awaited six-lining of the 51-km Anandapuram-Anakapalle road via Pendurthi are all set to begin by June, in a major thrust to the construction of a bypass highway that would skirt Vizag city altogether. The state government seems intent on expediting the proposed 900-acre satellite township near Lankelapalem on the outskirts of Visakhapatnam.

Observers are also of the opinion that the satellite townships in the outskirts are the need of the hours to expand the city on all sides, instead of further congesting the core city.

5.3 KEY CHALLENGES

VMRDA with an existing industrial base needs to be more competitive for being a lucrative investment destination. As per studies by CBRE, Development of Integrated 'Industrial Ecosystem' with World Class Industrial Real Estate Infrastructure should be promoted in the region to ensure better living conditions for the workforce who will be moving in based on major investments. Real estate development based on major employment attraction areas will reduce trip lengths and trip costs significantly, making economic theme nodes more successful.

Visakhapatnam region has already focused towards developing large scale Dedicated Industrial Corridors on a cross-country level. With National Highway 16 running along the full length of the region, VMRDA enjoys excellent connectivity to the port as well as the hinterland, facilitating industries to boom in the region. This gives ample hint to the real estate sector on the stretches to be focused on. The concentration of the development authority should also be aligned with the same to avoid scattered developments.

Industrial nodes such as DMIC, AKIC, BMIC with support from Dedicated Freight Corridors has already been figured as successful models in the country. Similar advantages have to be taken from the Vizag Chennai Industrial Corridor, which is a major opportunity for the region to tap investments and growth. VCIC has a node based development strategy which has identified certain nodes in the corridor. Pinpointing industrial land allocations and supporting real estate will accentuate the impacts of VCIC. The approach towards housing and real estate development in the industrial noes should be more of pre-envisaged supply push factor rather than a demand based pull factor.

New township Development and proposal of good quality infrastructure in the townships surrounding the potential industrial nodes should be considered as the key parameter for development in housing and real estate sector.

5.4 CONCLUSION

VMRDA has a vast scope of development in store for the region. Considering the major role it is going play in the near future, housing and real estate are huge potentials and will be cheered by developers and investors. Slums seems to be major concern with the region but with effective implementation of the National and State level schemes to address the issue in slums and help them develop in terms of providing basic physical and social infrastructure, it has the potential to become one of the fast developing regions in India. The kind of economic activity, the state is envisaging for this region, it will perhaps become the most sought destinations for commercial, employment and residential purposes focusing on livable and sustainable futuristic townships around the developing nodes.

6 ENVIRONMENT AND CLIMATE CHANGE

Preservation of existing beauty and diversity of the environment in the project area is necessary along with the desired development. Haphazard development insensitive to the environmental conditions leads to the ecological calamities and disasters. In the process of development, preservation of sensitive natural systems in the area is necessary.

The data in need for this analysis is collected from various secondary sources like district handbooks, ground water data by CGWB, EIA reports in the region prepared for various projects. Oceanography, Ecological sensitivity and Environmental quality of the area is compositely studied considering different parameters such as waves, tides, currents, reserve forests, air, surface, ground and marine water qualities in the study area for better understanding of the existing environmental status. The baseline environment of the study region defined by the physical, natural, and ecological features including the quality of various environmental parameters are studied and presented in the following sections sequentially.

6.1 PHYSIOGRAPHY

This region is classified into two physiographic zones - Plains and Hills. It has Coastal plains along the coastand hilly region of Eastern Ghats. This natural elevation profile of the study area is the physical feature for all the flows of the surface waters and ground water reserves (Figure 6-1). Major rivers flow from NW to SE collecting minerals from upper lands and Eastern Ghats and depositing them in the basins before joining the sea making the area fertile. The chains of hills in the area and part of Eastern Ghats are rich with forests and home for diversified exotic flora and fauna in the region.

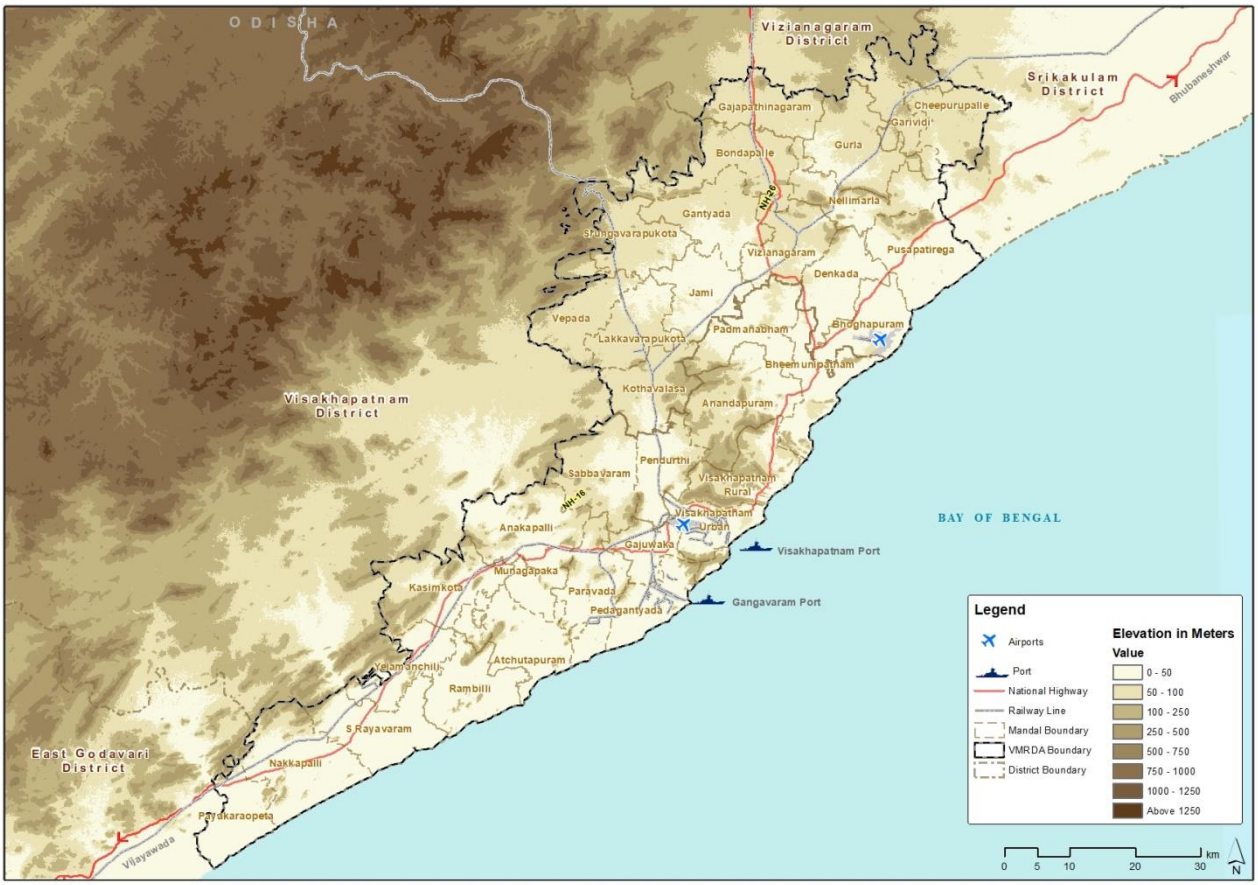


Figure 6-1: Altitude map of VMRDA region w.r.t Mean Sea Level (MSL)

Source: Digital Elevation module of United States geological survey

6.2 WATER RESOURCES

VMRDA region has an abundant source of water in the form of rivers, rivulets and canals passing through the area and in the end draining into the Bay of Bengal of the East Coast. Because of its location of the area on the downhill of the Eastern Ghats surface, ground water and drains have a natural gravitational line of flow. Because of the abundance of the water bodies there is a generous supply of water throughout year by means of surface and ground water. Surface water in the area is mainly utilized for irrigational purposes, industrial purposes and treated drinking water supply for population of ULB's. Municipal administrations of the VMRDA region utilize water from major rivers, and reservoirs in the area to cater to the water demand of the people. Ground water in the area is majorly utilized for the domestic water necessities of the people in rural and semi urban areas, irrigational and industrial purposes.

Surface Water

The minor rivers from south to the north of the VMRDA region are Yeleru reservoir, Pampa river, Thandava river, Varaha river, Sarada river, Meghadri gedda reservoir, Peddagedda, Gosthani river, Champavathi, Kandivalasa gedda, Pedda gedda (Figure 6-2).

The Other principal water sources in this region are Suvarnamukhi, Vegavati, Champavati, Gosthani, Kandivalasa, Mahendratanaya, Bahuda, and Kumbikotagedda. Main canals passing along VMRDA are Yeluru and Polavaram canals

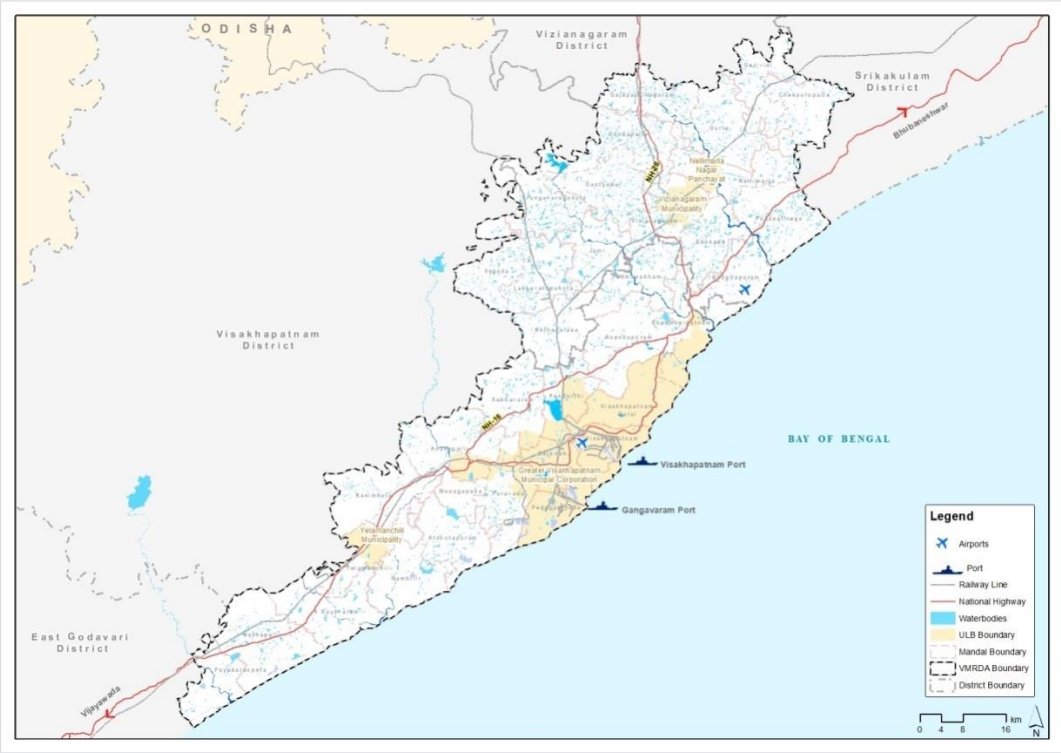


Figure 6-2: Rivers and water bodies in VMRDA region

GroundWater

In Visakhapatnam district Visakhapatnam Rural, Visakhaptnam Urban, Sabbavaram, Pendurthi, Pedagantyada, Parawada, Padmanabham, Nakkapalli, Gajuwaka Bheemili, and Anandapuram, mandals are solely dependent on surface water supplied from ULB's. In Vizianagaram district Vepada, Vizianagaram, Lakkavarapukota, Kothavalasa, Garividi, and Cheepurupalli are not using ground water.

6.3 COASTAL ENVIRONMENT

6.3.1 Coastal Regulatory Zone

Issued under the Environment (Protection) Act, 1986, and in supersession of coastal regulation zone notification 2011, draft CRZ notification 2018; Central government has initiated to conserve and protect the unique environment of coastal stretches, marine areas, livelihood of fisher communities and other local communities.

Coastal stretches have been defined in Coastal Regulation Zone (CRZ) and restrictions have been imposed on industries, operations and processes within the CRZ. The CRZ regulations are imposed on

i. Land areas from High Tide Line (HTL) to 500m on landward side of the sea front

ii. Land ward area between HTL to 50m or width of creek, whichever is less on landward side along the tidal influenced water bodies that are connected to sea and the distance upto which the salinity measured is 5 ppt during driest period of the year

iii. The intertidal zone between HTL and LTL

iv. Water and bed area between the LTL to the territorial water limit (12Nm)

For the better conservation and protection of coastal areas, the CRZ area is classified to four major categories, which are sub categorized further as detailed below.

A. **CRZ-I A**: The areas that are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast such as Mangroves, Corals and Coral reefs, Sand dunes, Biologically active mudflats, National parks, marine parks, Sanctuaries, Reserve forests, Salt marshes, Turtle nesting grounds, Horse shoes crab habitats, etc.

B. **CRZ –I B**:The inter tidal zone between Low Tide Line (LTL) and High Tide Line (HTL)

C. **CRZ-II:** The areas that have been developed up to or close to the shoreline within the existing municipal limits or in other existing legally designated urban areas which are substantially built-up with a ratio of built-up plots to the total plots being more than 50% and has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains.

D. **CRZ-III A**: Land areas that are relatively undisturbed (rural areas) and those do not fall under CRZ-II are considered for CRZ-III. In CRZ-III, the areas with population density more than 2161 per Sq.km as per 2011 census are considered in CRZ-III A

E. **CRZ-III B**: The CRZ-III areas with population density less than 2161 persons per sq.km as per 2011 census are considered for CRZ-III B

F. **CRZ-IV A**: The water area and sea bed area between LTL up to 12 nautical miles on seaward side

G. **CRZ-IV B**: The water area and bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from mouth of water body to influence of sea tide (salinity 5ppt during driest season of the year)

6.3.2 Prohibited Activities in CRZ

The activities elucidated further are in general prohibited in entire CRZ. The activities are

I. Setting up of new industries, expansion of existing industries, operations, processes

II. Manufacture/handling of oil, storage/disposal of hazardous substances

III. Setting up of new fish processing units

IV. Land reclamation, bunding/disturbing natural course of sea water

V. Discharge of untreated waste or effluents from industries, cities or towns and other settlements

VI. Dumping of city or town wastes including construction debris, fly ash and others

VII. Port and harbour activities in high eroding parts of the coast

VIII. Mining of sand, rock and other sub-strata materials

IX. Altering active sand dunes

X. Disposal of plastic and other inert wastes such as glass bottles

6.3.3 Permissible activities in CRZ

A. **CRZ – I A**: Eco tourism activities such as mangrove walks, nature trails etc. as approved in CZMP (Coastal Zone Management Plan). Construction of roads is allowed for exceptional cases such as defence, strategic purposes and public amenities. For effected mangrove or other vegetation covers in the process, three times the area effected is to be taken up for compensatory plantation

B. **CRZ – I B**: Land reclamation activities are permitted for foreshore activities like ports, harbours, jetties, wharves, Quays, Slipways, bridges, and sea links etc. Projects for defence, strategic purposes. Land reclaimed may be permitted for public utilities like mass rapid transit system, construction and installation of all necessary public utilities or infrastructure. Storage of non-hazardous cargo, Hatchery and natural fish drying, treatment facilities for waste and effluents, salt harvesting and desalination plants

C. **CRZ – II**: Construction of building for residential, school, hospitals, institutions, offices, public places etc. shall be permitted only on landward side of existing road or authorized fixed structures. Development of vacant plots in designated areas for construction of beach resorts/hotels permitted as per guidelines. Temporary tourism facilities along beaches such as wash rooms, change rooms, shower panels etc.

D. **CRZ – III**: Agriculture, horticulture, gardens, pastures, parks, playfields, and forestry. Construction of dispensaries, schools, public spaces, bridges, roads, infrastructure facilities as permitted by CZMA. Facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, boat building yards, ice plant, crushing units etc.

E. For CRZ – III areas beyond Non-development Zone (NDZ), development of vacant plots in designated areas for construction of beach resorts/hotels. Public amenities and fishing related infrastructure.

F. **CRZ – IV**: Traditional fishing and allied activities, Land reclamation/bunding for foreshore activities, defence projects, erosion control measures, non-conventional energy sources associated activities, storage of non-hazardous cargo, facilities for intake of cooling water and outfall for discharge of treated waste water from thermal power plants. Weather radar monitoring stations, pipelines, conveying system including transmission lines.

All states and union territories should have a Coastal Zone management Plan (CZMP) devised/prepared for proceeding related to coastal areas.Presently 124 villages are along the coast line in the CRZ of VMRDA region. The CRZ area is needed to be demarcated and only permitted establishments are to be allowed in the regulatory zone. At present any industry, resorts/hotels that are proposed to be constructed in CRZ have to take clearance from the State Pollution Control Board (APPCB) and the conditions fixed for the clearance need to be complied.

The treated effluents of major industries/ SEZ's are being released into the sea at 13 locations (Table 6-1). The disposal of these effluents into the sea is also regulated and monitored by APPCB; the treated effluents of respective industries are stored in designed tanks at the sites. Once in a week /fortnight based on quantity generated; samples are taken from these tanks by Regional offices for quality analysis, and permitted to release if the effluent is as per PCB norms given during clearance.

Table 6-1: Outfall locations in the CRZ of the VMRDA region

Sl. No.	Industry/ SEZ	Latitude	Longitude
1.	Hetero Infrastructure SEZ Ltd	17 21' 07"	82 44'31"
2.	SMS Pharmaceuticals Limited Ltd	18 02'11.24"	83 37'1.22"
3.	Industrial Pharma Complex by Vijaya sri Organics Ltd	18 04'10"	83 40'35"
4.	Lan tech Pharmaceuticals Ltd	18 04'25"	83 41'25"
5.	Hyacinth Pharma Ltd	18 05' 18"	83 04' 51"
6.	GVMC sewage release outfall	17 42' 51.24"	83 19' 26.54"
7.	APSEZ, Outfall I	17 31'35"	83 04'00"
8.	APSEZ, Outfall II	17 31'06"	83 02'45"
9.	APSEZ, Outfall III	17 31'18"	83 03'13"
10.	NKSEZ, Outfall I	17 21'01"	82 43'02"
11.	NKSEZ, Outfall II	17 20'00"	82 41'05"
12.	NKSEZ, Outfall III	17 19'25"	82 39'55"
13.	NKSEZ, Outfall IV	17 21'24"	82 43'51"

Source: From Secondary sources in reports on Study area

Other than these outfall locations a total of 20 projects (industries, ports, jetties, hotels and resorts) are in the CRZ mostly in CRZ– III, in some cases in both CRZ – II, and CRZ – III; As per the projects that have applied for CRZ clearance to the AP Pollution Control Board. In the Coastal regulatory Zone of the Study area in any locations hatcheries, fishermen villages, mega or small industries are observed along the coast line with in 200m of HTL. Presently National Institute of Oceanography (NIO, Visakhapatnam) is preparing a CRZ zones map for the VK – PCPIR part of VMRDA region for further notification and clearance of area as per regulations.

6.3.4 Coastal Erosion and Accretion

The landward displacement of the short line caused by the forces of waves and currents is termed as coastal erosion. Natural forces such as wind, waves and currents are constantly shaping the coastal regions. A regular and cyclic phenomenon like erosion and deposition is prevalent in many parts of Andhra Pradesh Coast. Coastal erosion is one of the major reasons for deterioration of coastal Zones.

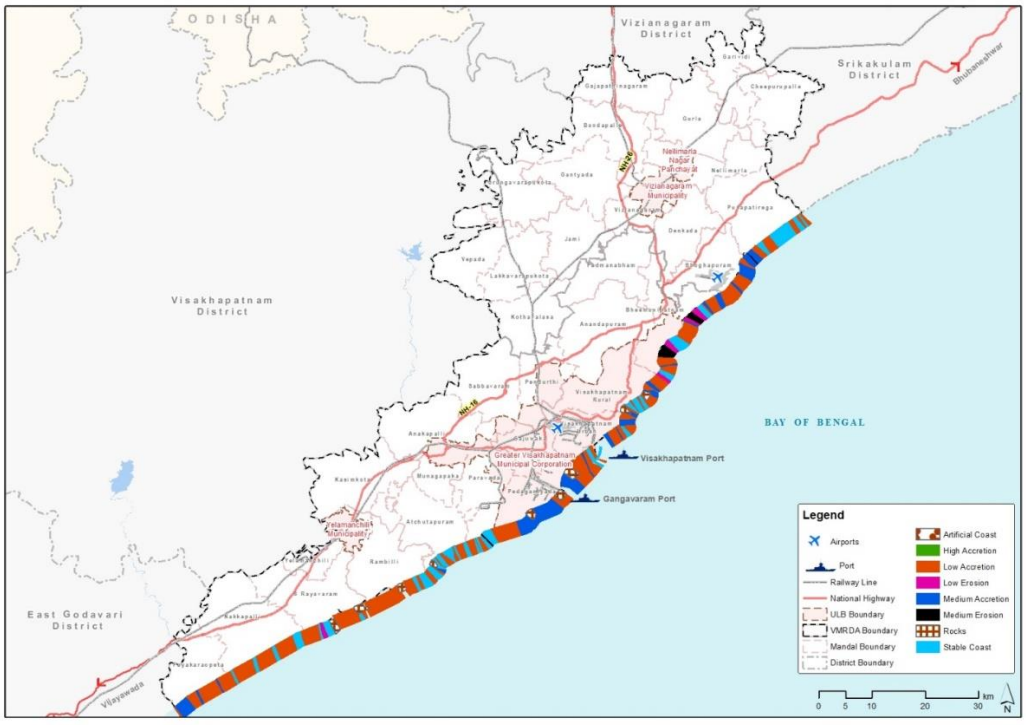


Figure 6-3: Erosion & Accretion along the coastal region of VMRDA region

Source: District-wise shoreline changes in AP from National centre for Sustainable Coastal Management, MoEF & CC

The AP coast has frequently been affected by Cyclone and inundated by storm surges. The Tsunami in 2004 and various cyclones, including Phailin and Hudhud, have drastically changed the beach profiles making them vulnerable to erosion, drowning deaths due to increased slope at the coast, and significant changes in the local wave climate. Many coastal areas along the AP coast are now distorted with the changed scenario.

As per oceanography experts around 9.2 percent of the 973.3 km-coastline in Andhra Pradesh has been facing erosion. Heavy erosion has been noticed at Vizag and Bheemunipatnam beaches in Visakhapatnam district (Figure 6-3).

The coastal line in this region is undergoing both erosion and accretion. Medium erosion is observed in all two districts, Cheepulupada, J. V. Agarharam, Cheepurupalle (east), of Visakhapatnam district; Kongavanipalem of Vizianagaram.

6.3.5 Wave Surge and Floodable Areas

The coast of VMRDA region is highly prone to cyclones, and VMRDA region has many water bodies draining to the coast. In this scenario early warning maps are prepared by Andhra Pradesh State Development Planning Society for facing a probable storm surge, flood, and drought in the state of Andhra Pradesh. Toposheets updated under this section for storm surge, flood prone areas are collected for VMRDA region.

6.3.6 Wave surge

The probable area of the coast in VMRDA region that could be affected by wave surge induced during a Super Cyclonic Storm of wind speed 235 kmph is studied in this section. The information for this observation is collected from Storm surge inundation maps prepared by Andhra Pradesh State Development Planning Society.

Coast line of VMRDA region is not affected by a 65 kmph Tropical cyclone, so the probable area that could be affected by a 235 kmph super cyclone is studied for VMRDA region. As shown in the Figure 6-4, the highly effected areas are coastal mandals and river mouths of major rivers.

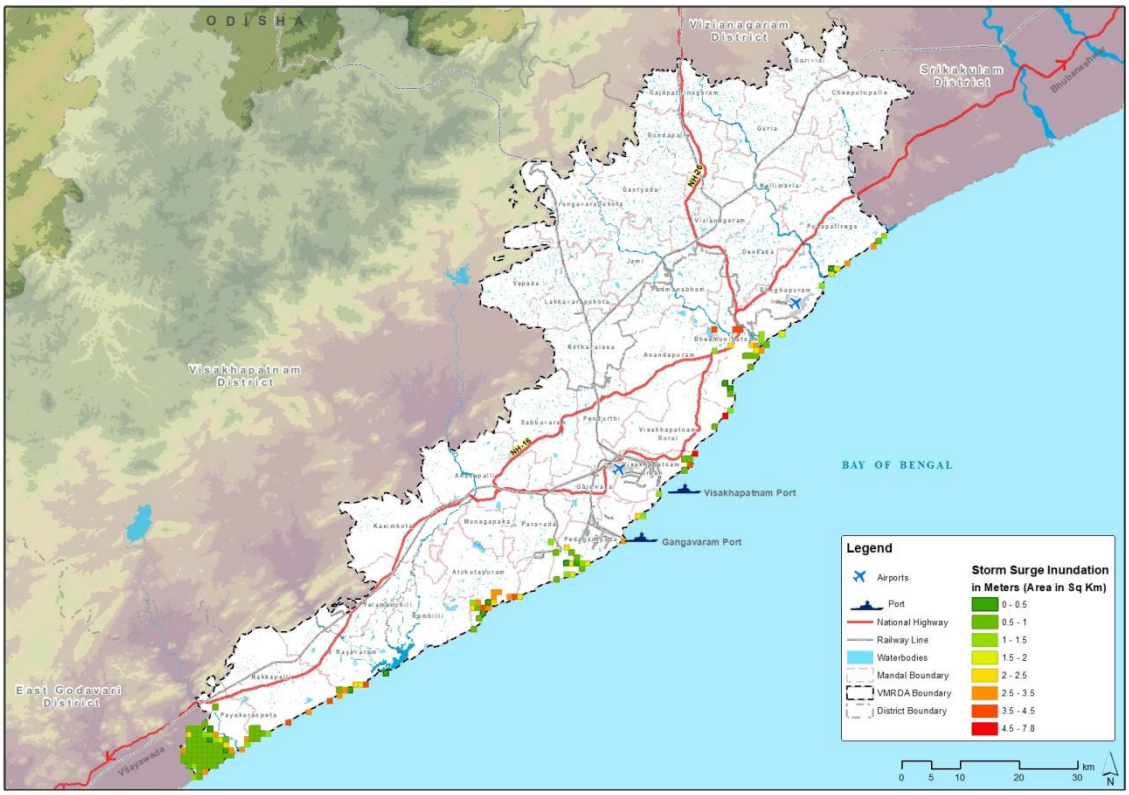


Figure 6-4: Storm surge inundation in VMRDA region in case of super cyclone of 235 kmph speed

Source: Storm surge Inundation map prepared by Andhra Pradesh State Development Planning Society (APSDPS)

In Visakhapatnam district coastal mandals Payakaraopeta, Nakkapalli, S. Rayavaram, Rambilli, Atchutapuram, Parawada, Pedagantyada, Visakhapatnam Urban, Visakhapatnam Rural, and Bheemunipatnam are prone to damage of which Payakaraopeta and Bheemunipatnam show chances for major damage.

Vizianagaram district is the least effected district of VMRDA region because of a storm surge as it only has two mandals, Bhogapuram, and Pusapatirega along the coast. This is also the reason for having no cyclone land fallings along the coast of Vizianagaram district.

6.3.7 Floodable Areas

Minor rivers that pass through the study area are Gosthani, Sarada, Varaha, Thandava, Champavathi, and other major geddas. A probable flood inundation map minor rivers Gosthani, Pedderu, Varaha, Sarada, Thandava, and pampa are prepared for a probable flood of 100 year return period.

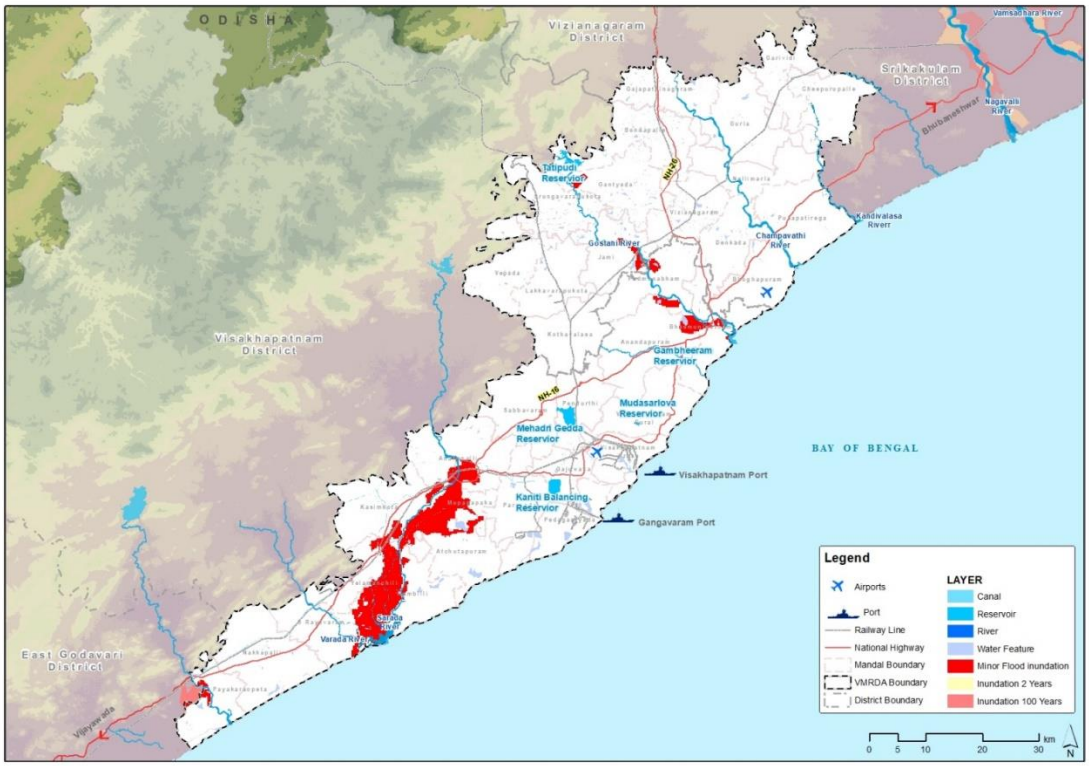


Figure 6-5: Probable flood inundation area for river at peak discharges in VMRDA region
Source: Probable Flood Inundation map prepared by Andhra Pradesh State Development Planning Society (APSDPS)

6.3.8 Drainage

The study region has few minor non – perennial rivers following their natural terrain draining into the Bay of Bengal. As we observed earlier in ground water table lineament in the study are majorly from NE – SW draining in to Sea. The study area also has many geddas collecting water from catchments and follows their natural stream / channel to drain into Bay of Bengal.The study area has many reservoirs like Meghadrigedda, Kanithi, Mudasarlova, Gambheeram, Tatipudi. As VMRDA is monsoon dependent area in case of heavy rains in a short duration Flood prone areas as shown in the Figure 6-5 are likely to be most affected areas in the study area.

6.4 NATURAL DISASTERS

Cyclones

In districts of VMRDA region three districts Visakhapatnam, has a history of experiencing cyclones and storm surges. In India cyclones are classified into five categories as

I. Tropical depressions wind speeds between 31 and 61 kmph (17 to 33 knots)

II. Tropical cyclones if the winds speeds range between 62 and 89 kmph (34 to 48 knots)

III. Severe cyclonic storm when wind speeds range between 89 and 118 kmph (48 to 63 knots)

IV. Very severe cyclonic storm with wind speeds ranging between 119 and 221 kmph (64 & 119 knots)

V. Super cyclonic storm when wind speed exceeds 221 kmph (119 knots)

Cyclone Hud-Hud in October 2014 that had devastated Visakhapatnam city is a very severe cyclonic storm; a total of 9 cyclones had crossed with in the vicinity of coast line along Visakhapatnam.

6.5 KEY ENVIRONMENTAL DESIGNATIONS

The entire VMRDA area is broadly classified into six key designations for its environmental sustainability, protection and conservation. The areas are divided based on its characteristics, physiography, and natural resource. Each zone will have its own development and protection policy and maintaining it will facilitate a better environment and healthy surrounding around VMRDA. The broad environmental designation area as follows;

a) Coastal Zone management

b) Agricultural Land Protection and development

c) Heritage and conservation

d) Water Bodies

e) Disaster management

f) Ecologically sensitive Area

These areas are further categorized with reference to standards and guidelines and based on regulations the areas are proposed for conservation and protection.

6.6 KEY CHALLENGES

The main development potential in VMRDA is port and industries and maintaining the environment while developing then is the key challenge. The pollution of the two primary economic bases creates a huge havoc to the sustainability and maintenance of environmental standards. The way to solve this problem is the primary key challenge. Moreover, with the development of industrial nodes, the population and housing is increasing at a steady pace. The area being a hilly terrain is facing problems of encroachment in the hilly areas which are ecologically sensitive and less developable to provide basic infrastructure. The protection of these sensitive areas remains as the secondary challenge. The development has also encroached upon the natural catchment areas to most of the water bodies located in the area leading them to dry eventually. There is an urgent need of identifying the catchment areas and stop the encroachment to have a sustainable water balance in the future.

The Kambalakonda wildlife sanctuary is located in the center of the region and spreads on the opposite sides of the congested and polluting NH 16, thus leaving the area more prone to pollution and high risk and susceptibility. Furthermore, the entire development area shares a very fine to no buffer with the coast and it spread mostly along the coastal area, leading to high risk of maintaining proper CRZ norms along the coast. This leads to high intensity loss from natural disasters which the area is mostly prone to.

6.7 CONCLUSION

Environmental quality across the VMRDA is studied from the secondary information collected from various studies. As a result, a composite status of air, ground water, surface water, and marine sea water quality levels are obtained. In all the parameters except marine water quality Visakhapatnam is most polluted because of vast industrial cluster concentration which are consuming the existing natural resources at high rate. This is leading to the imbalance in the existing environmental quality of the region. Immediate actions to analyse the existing pollution levels and taking necessary pollution mitigation measures is necessary to avoid further deterioration of environmental quality of the region.

7 HERITAGE AND TOURISM

7.1 HERITAGE

Visakhapatnam and its surrounding region have been governed under various rulers over its long and multi-layered history. Kings of various dynasties have built in a grandeur manner to leave imprint of their regimes in the forms of monuments and properties which over the period has become of historical importance hence heritage of this region. Visakhapatnam port, one of the oldest sea ports in the region, has attracted foreign trade as early as 18th century which had significant impact on morphological evolution of the city. The built evidence of colonial political history, especially of British and Dutch colonial powers, exists till date in the form of monuments and structures and is spread throughout the Visakhapatnam region.Religious and spiritual growth in Hinduism, Islam, Christianity and Buddhism took place through its socio-cultural history with significant magnitude, leaving behind heritage in the form of Temples, Dargah, Masjids, Churches and Buddhist sites.

7.1.1 Categories

The heritage properties of Visakhapatnam Metropolitan Region have been surveyed under two categories. The types of Heritage Properties are defined as:

a. Heritage properties / buildings and
b. Heritage areas / precincts.

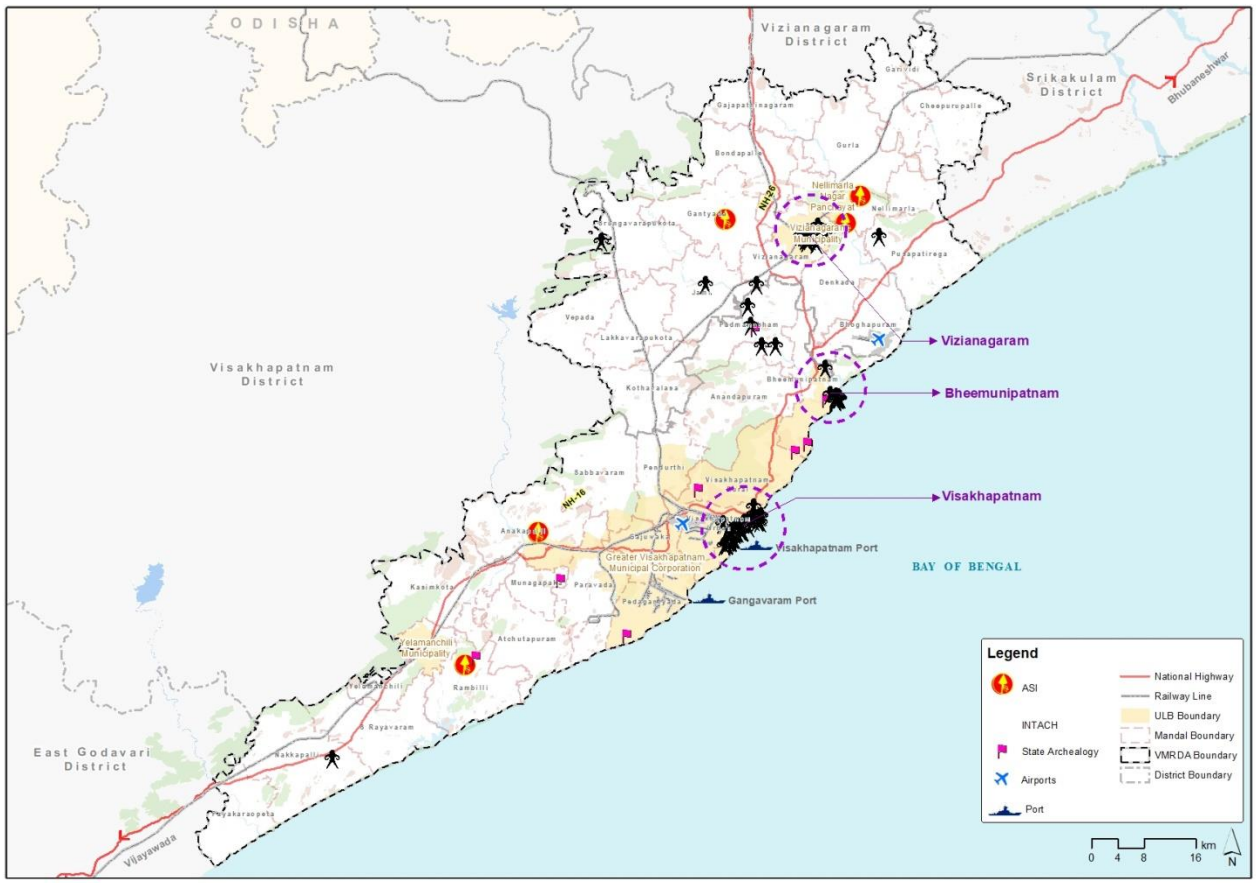


Figure 7-1: Location of major heritage towns in the Region

Heritage sites and monuments have been listed by the number of authorities and agencies like Archaeological Survey of India (ASI), State Archaeological Department (SAD) and non-government organizations.

7.1.2 Assets

Listing of heritage properties in Visakhapatnam region exists but comprehensive approach to protect heritage properties of various levels of historical and cultural significance along with conservation measures and their potential use have not been dealt with till date.

The heritage sites were removed from the list after survey and visiting the sites based on two criteria:

- Properties which does not have significant historical and cultural associational value to the Visakhapatnam region as a whole.
- Properties which are demolished by private owners

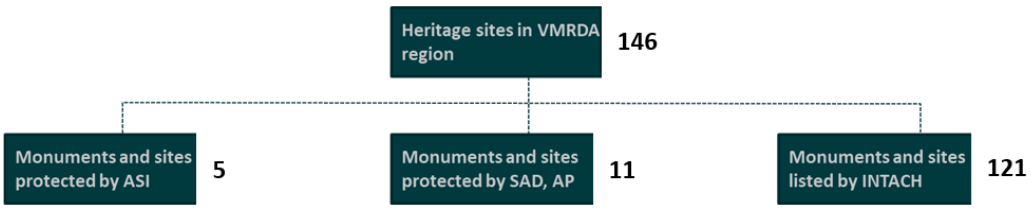


Figure 7-2: Listing of Heritage sites

7.2 TOURISM ASSETS

The VMRDA region covers a long coast line and a large region comprising various scenic spots, culturally rich religious destinations and several master pieces of great architectural heritage. Along with the urban attractions in tourist destinations, there are untouched rural scenic spots and relatively less exploited heritage structures located in rural hinterland that offer great potential to generate economic and employment opportunities. The city of Visakhapatnam can be considered as the nucleus for tourist activity in this region. Visakhapatnam experiences a major percentage of foreign tourists' foot fall every year. The city presently has international air connectivity from Dubai, Singapore and Kuala Lampur apart from important metros of India i.e., Delhi, Mumbai, Hyderabad, Bengaluru, Chennai and Kolkata. Visakhapatnam is a major junction on commercially important Chennai - Kolkata Rail line. The city is well connected by rail with New Delhi, Chennai, Kolkata and Hyderabad. Regular bus services are available from Hyderabad, Vijayawada, Bhubaneswar, Chennai, Tirupati and other major cities.

7.2.1 Assets

The VMRDA Region offers naturally, ecologically, culturally and religiously diverse variety of tourist destinations that present scope to explore continuously. The tourist destinations that are present in the region can be mainly classified into the following:

- Resorts / Beach front
- Religious Tourism
- Cultural Tourism
- Hill Stations
- Nature / Eco-Tourism
- Adventure Tourism

Beach Front

Sprawling along the coastal line with varied topographical features the VMRDA region offers various options for eco tourists. The coastal line embracing the VMRDA region has a variety of beaches that have stark differences from one another. The meeting point of the land and sea is ornamented with bays that offer visual grandeur for urban beach fronts to ride, relatively shallow beaches that are favourable for water sports, rocky beaches that would offer tranquil atmosphere to spend the leisure time.


Rama Krishna Beach


Yarada beach


Rushi Konda Beach

Religious Tourism- Buddhist Sojourn&Temples and Shrines

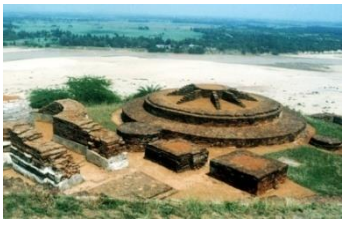
The region was a cradle of Mahayana phase of Buddhism. Many mounds and hills that are near to the rivers or along the sea side were homes to the monks who practiced Buddhism. During their stay the monks built many structures of Stupas and Viharas which stand imposing even today.


Sankaram


Thotla Konda


Bavikonda


Ramatheertham


Salihundam


Kalingapatnam

Temples and shrines of pilgrimage are the important destinations of tourist traffic and are a big source of revenue flow in this region. There are about 978 temples in all the mandals of Visakhapatnam district which are maintained by the endowments department. As the region is historically very old hailing from “Kalinga” period there are many temples which were built under different rulers. On the Banks of the rivers like Gosthani there are many shrines of the Hindu Gods.

The church on the Ross hill and the Dargah called Ishaq Madina in the old city of Visakhapatnam attract many visitors from the city and the regions. The Baba Dargah in the Vizianagaram town is witnessed by many Muslim and Hindu tourists in the three districts of Vizianagaram and Visakhapatnam and Srikakulam.


Simhachalam


Sirimanu in Pyditalli festival


Ross hill Church

Cultural Tourism

The cultural tourism of Visakhapatnam is diverse and can be categorized into 4 segments such as

Arts and Crafts- The Vizianagaram town has been the home to many performing arts like music dance and drama. There are many famous music artists in classical music, Great dancers of Kuchipudi and

Bharatanatyam hail from this place. The Veena handcrafted by the artisans of the Bobbili village is famous worldwide. Etikoppaka is famous for its age-old tradition of wooden carvings, artefacts resembling shapes of items from Mohenjo-Daro and Harappa.

Etikoppaka Toys

Bobbili Veena

Music college in Vizianagaram

Festivals and Fairs- The department of Tourism in Vizianagaram and the district administration celebrate a three day annual festival called Vizianagaram utsavalu where many art and cultural programs are conducted in the different venues. The city is celebrated with many art forms and performing arts which are local to the indigenous people of Vizianagaram. The AP tourism department and the district administration conduct the Visakha Utsav in Visakhapatnam city along the beach road and some other venues. The Folk dance forms and flower show and active stage along the beach road for showcasing different performing arts. As the two districts in VMRDA contain significant tribal population with indigenous knowledge in medicine and art forms annual tribal festivals or "Girijana Utsavalu" are celebrated in Seethammapeta of Srikakulam, Parvathipuram of Vizianagaram, Araku and Paderu of Visakhapatnam. Though these areas are out of VMRDA area, there is a significant regional tourist activity that is associated with the VMRDA region.

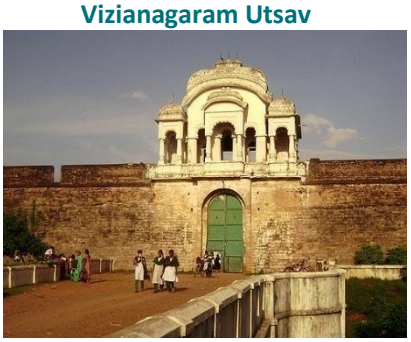
Heritage structures-The region is rich in Buddhist heritage that was dating back to Mahayana period. There are many Religious temples which are great architectural heritage belonging to different time periods.

Visakha Utsav

Vizianagaram Utsav

Sikkolu Sambaralu

Visakhapatnam Collectorate



Vizianagaram fort

Sher Mohammadpuram

Museums-The artefacts and the historical evidences of the three districts are mostly stored in the Visakha Museum located on the beach Road in Visakhapatnam. A 17th century Dutch building in Kirlampudi Layout is converted to Museum in 1991. This houses the great naval history of Visakhapatnam and archaeological objects and the pictures narrating the story of Visakhapatnam. State Archaeology department is opening up a new district museum in Vizianagaram district.

Hill Stations

Araku is one of the most important tourist destinations in Andhra Pradesh. The pleasant hill station is famous for its scenic gardens with lush green nature, valleys, waterfalls and streams. It is situated at a distance of 112 km from Visakhapatnam.

Nature or Eco Tourism

Srikakulam has many scenic spots like water falls in the scenic spaces like Seethammapeta Mandalam and there are other scenic spaces like Gotta Dam on the Vamsadhara River. The other places like Thatipudi reservoir, Thotapalli reservoir, Jhanjhavathi rubber dam are built on the water bodies on the Vizianagaram district are scenic spaces where there are some tourist refreshments that rejoice the tourists in the tourists who come here for short trip. There are facilities like boating and cottages arranged by AP tourism.

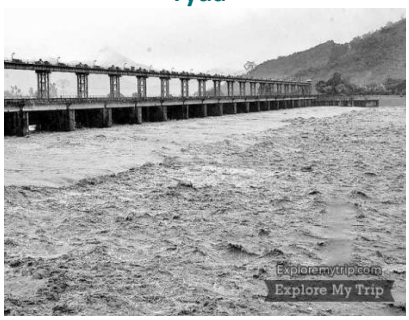
The city of Visakhapatnam and the surrounding scenic spaces attract many tourists for a short retreat. The hill next to the Visakhapatnam Port called Dolphin Nose, Kailasagiri Park on the Kailasagiri hill, Erramatti Dibbalu or Red sand hills and the large reservoir in Mudasarlova are the scenic spots which attract the visitors to the nature from the busy urban areas. The Indira Gandhi Zoological Park in Visakhapatnam and the bird sanctuary in Kondakarla Ava present the experience of Biodiversity to the nature lovers. The forest trial and trekking in the Kambalakonda hills offer a good nature experience to the visitors.

Araku

Tyda

Thatipudi reservoir

Thotapalli barrage



Gotta barrage

Telineelapuram

Adventure Tourism

Apart from the Visual appeal to the visitors the city of Visakhapatnam is also offering other water sports at Rushi Konda Beach Boating and fishing at Visakhapatnam Fishing Harbour. Recently the Scuba Diving also encouraged in the Vizag sea waters where visitors get to experience the fun of scuba diving and see the marine fauna in the months between October to March.

Rushi Konda

Boating near fishing harbour

Scuba diving

7.2.2 Foot fall

The figures of tourist footfall in Visakhapatnam have been increasing at a very high pace for the last 5 years with a significant increase since 2013. More than 10.5 million people visit Visakhapatnam yearly of which more than 64 thousand are foreign travelers.

Table 7-1: Tourist footfall in VMR district

	2013			2014			2015		
District Name	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total
Vizianagaram	1551278	979	1552257	3380542	6274	3386816	3651012	4629	3655641
Visakhapatnam	6700675	57476	6758151	6782784	54272	6837056	10416500	64178	10480678

Source: Tourism department

7.2.3 Infrastructure

Though there is a high tourist footfall in the region especially during the peak seasons, there are no streamlined infrastructure developments for organised tourism facilities. There are fragmented development projects implemented and in pipeline, there is no comprehensive tourism development plan or large tourism related infrastructure project for overall development of tourism in the region.

7.3 KEY CHALLENGES

The tourism sector has been growing every year with increase in footfall. With the increase in capacity, there is a requirement of several other factors to improve the tourism experience in VMRDA addressing which will lead to VMRDA being an all-rounder quality destination place. The primary challenge is to provide standard facilities and infrastructure in all classifications of tourism even in the rural areas. The temple tourism as well as rural tourism has to be incorporated with facilities and evacuation plans to mitigate risk.

Although VMRDA area has such a rich cultural, ecological and natural tourism, it lacks proper planning and connectivity in terms of tourism circuits. Circuit development plan will ensure enhanced tourism all over the region. Along with the development of circuits, the activities in each tourism node has to be identified and developed for example, Eco Tourism activities in Kambalakonda, Sports and adventure activities in Rushikonda and likewise identifying of new potential places to incorporate similar as well as additional activities.

The accessibility to all the tourism sites must be ensured before development to check in the potential and feasibility well ahead. Along with tourism development, there heritage properties need to enabled for many new proposals like heritage tourisms, hotels, villas etc to save then being dilapidated.

7.4 CONCLUSION

The heritage sites in VMRDA region endure lot of negligence even after receiving high visitors' footfall. Though proper listing and documentation has been done, there is an immediate requirement of government intervention to stop further deterioration of the assets. As in many cases heritage and tourism enjoy a symbiotic development, proper conservation and restoration of the sites will be instrumental in generating economy.

8 TRANSPORTATION

8.1 STRATEGIC LOCATION AND TRANSPORT CONNECTIVITY

Transportation is the lifeline for development of VMRDA region. The region is endowed with a very well-developed inter-city transport network by all modes of transport – road, rail, air and sea. Being a coastal region and having natural harbours it has added advantage of three major ports in the region and its vicinity. In terms of road and rail network, the region is well connected by the national highways and trunk rail network. Within region, various sub-regions/ urban settlements are well connected through a combination of NHs, SHs, MDRs, ODRs and Village Roads. Within the urban areas, the road network is reasonably well established.

8.2 REGIONAL ROAD TRANSPORT NETWORK

National Highways

The VMRDA Region spread across two districts has a road network of 2,400 km approximately (Ref. Figure 8-1). NH 16 (erstwhile NH 5) is the major corridor, which connects the VMRDA Region to the rest of the nation. This corridor is the life line for the Project Area, which traverse through the east coast of the states of Andhra Pradesh, Tamil Nadu and Odisha. NH 16 has 6 lane-divided carriageway and this highway forms a part of the Golden Quadrilateral project undertaken under National Highways Development Project (NHDP) by NHAI.

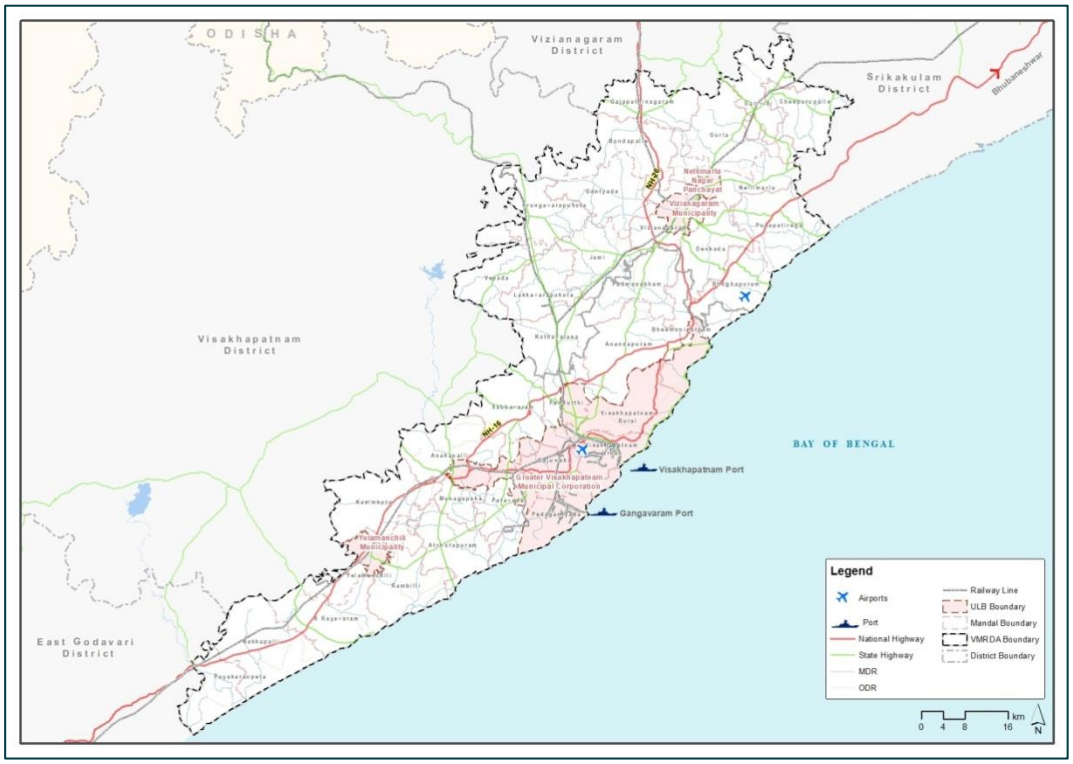


Figure 8-1: Transport Connectivity of the VMRDA Region

Under NHDP Phase V, the Anakapalle-Anandapuram via Sabbavaram road is converted into a six-lane and referred as National Highway (NH 16). It would serve as a by-pass road for the passage of through traffic going towards Visakhapatnam. The former NH 16 stretch, Anakapalle-Visakhapatnam-Anandapuram Highway, passing through the city, would be an urban road under GVMC jurisdiction.

Apart from the NH-16 the other National Highway, which starts at junction on NH-16 near Tagarapuvalasa approximately 50 km north east of Visakhapatnam is NH-26 (erstwhile NH-43). It bypasses Vizianagaram and further leads to Jagdalpur and finally terminates at Raipur in the state of Chhattisgarh (Ref. Figure 8-2).

NH-16 near Visakhapatnam

NH-26 near Vizianagaram

Figure 8-2: National highway traversing through VMRDA Region

State Highways

The VMRDA Area has approximately 490km of State Highways. Major State Highways are as follows:

- SH-157 starting from Gajuwaka and traverses through Parawada and Atchuthapuram to reach Yelamanchili and further to NH-16. It is a two-lane road, which serves the traffic from NTPC, APSEZ, Steel Plant and Pedagantyada IDA.
- SH-39(Visakhapatnam-Ananthagiri-Araku) connects Visakhapatnam City to the Araku hill station and
- SH-9(Bheemunipatnam-Pendurthi-Chodavaram-Narsipatnam) connects Bheemunipatnam town to the Narsipatnam which is divisional headquarters of Narsipatnam. Presently a section of this state Highway between Anandapuram and Sabbavaram is NH-16.
- SH-144 Commonly known as MVP Double Road connects Isukathota Junction and Beach Road. It is a four-lane divided road.

SH-157 near Yelamanchili

SH-39 near Kothavalasa

Figure 8-3: State highway traversing through VMRDA Region

Other Roads

These roads form the major roads for the urban areas and the rest of the settlements in the VMRDA region. The next hierarchical roads such as Major District Roads, Other District roads consist of approximately 1,700 km in the VMRDA region. Figure 8-2 shows the transport network in the VMRDA region.

Port Connectivity Corridors

Visakhapatnam Port has port connectivity road about 12 km (including 4.87 km RoB), developed by NHAI from Convent Junction to Sheela Nagar Junction. This would be further extended by 12.43 km to meet NH-16 at Sabbavaram, under NHDP Phase V. The Gangavaram Port also has port connectivity corridor with 4 lane 3.8 km long road developed by GoAP. Under Bharatmala programme, as a Port connectivity corridor, a four-lane beach road (30 km) will connect Gangavaram Port and SEZ at Atchuthapuram.

8.3 PUBLIC TRANSPORTATION SYSTEM

Public Transport System in VMRDA region is mainly by bus system, operated by APSRTC. A publicly owned public transport system. In the region, APSRTC operate bus services from 9 bus depots. It has 890 bus services on 220 routes and it captures 13% of trips (without walk).

Bus Rapid Transport System (BRTS)

To increase use of public transport instead of private vehicles, to enable commuters to reach their destinations in less time Bus Rapid Transport System (BRTS), a high-capacity public transport system, is introduced in Visakhapatnam. Under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) scheme, this project was approved for two corridors. One of them is Pendhurthi Transit Corridor (PTC) and other Simhachalam Transit Corridor (STC). The total length of these two corridors is 43.36 km (Ref. Figure 8-4). Pendhurthi Transit Corridor (PTC) stretches about 23.24 km, while Simhachalam Transit Corridor (STC) is about 20.12 km.

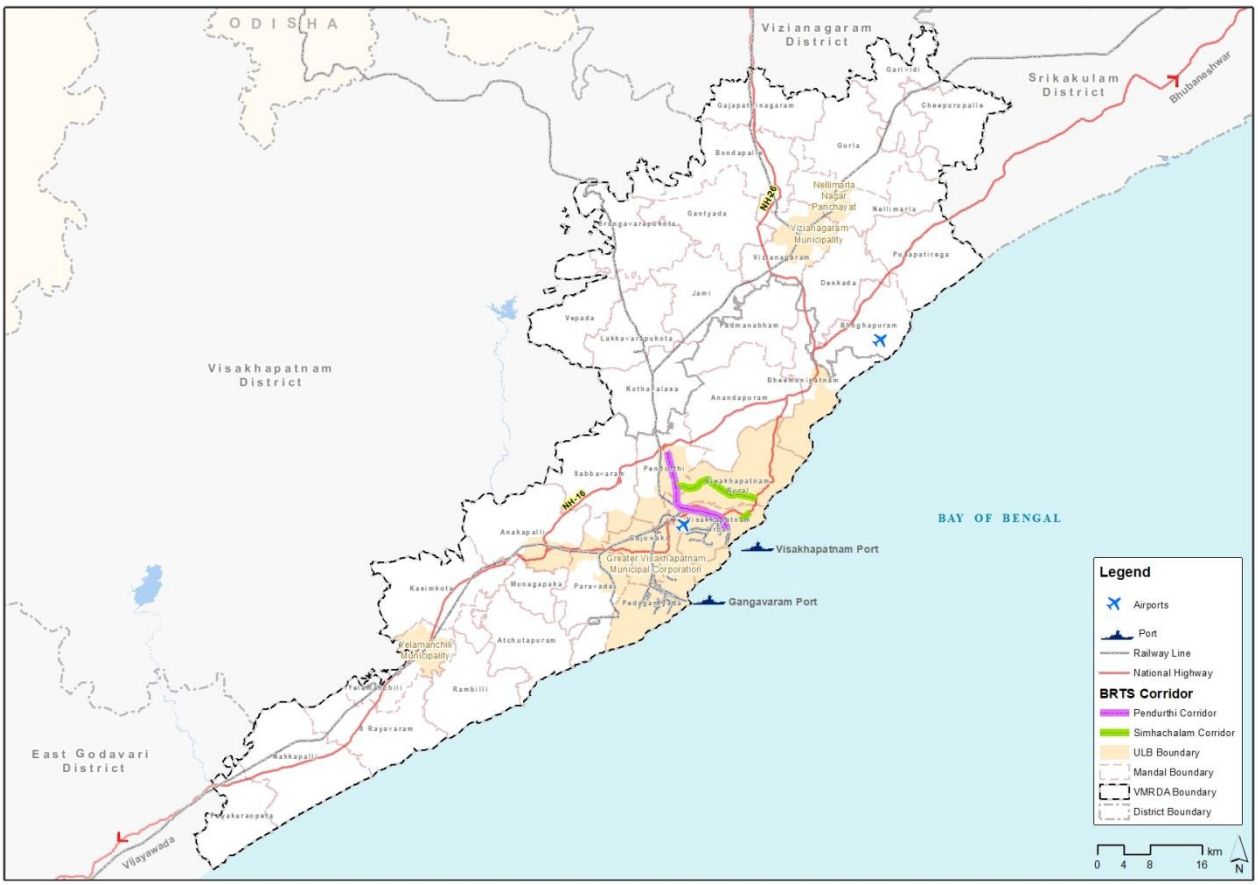


Figure 8-4: Existing Bus Rapid Transport System in VMRDA region

Visakhapatnam Metro Corridor

Andhra Pradesh Metro Rail Corporation Limited (APRC) has prepared a metro rail master plan for the area under the aegis of the Visakhapatnam Metropolitan Region Development Authority (VMRDA). Visakhapatnam Metro Rail Project will be taken up in three phases during which work on corridors in different routes would be commenced. A three-layer intra-city transport network is being considered on these routes in Visakhapatnam.

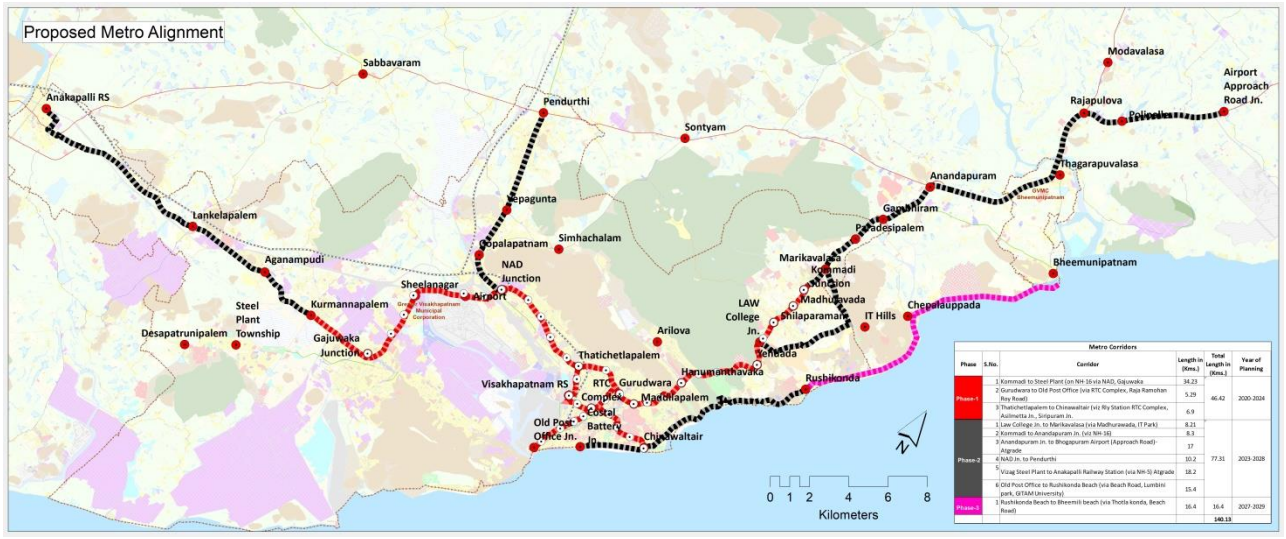


Figure 8-5: Proposed Visakhapatnam Metro Alignments

Firstly, a metro rail is planned stretching along NH-16 connecting the steel plant to the proposed Bhogapuram Airport. This metro line stretch will connect the city's most significant and congested zones like Gajuwaka, NAD Junction, Madhurawada, Kommadi and Anandapuram.

The stretch, as per the plan, will have two tributaries: One from Gurudwara to Old Post Office and another from Tatichetlapalem to RK Beach. The proposed metro stretch along with its tributaries in Visakhapatnam would be 80km long.

Adding to this, the state government is planning to start three tram routes in less congested parts of the city. The proposed tram routes would connect Pendurthi to NAD Junction, Steel Plant to Anakapalli and Old Post Office to Bheemili. The three tram routes would have at least one crossover with one metro station.

The total length of the three tram routes would be 60km. These would be battery operated trams and would hence be environment-friendly.

The third layer of transport network would comprise buses, auto-rickshaws and different types of cabs.

8.4 RAIL TRANSPORTATION SYSTEM

Chennai - Howrah main line of the Indian railways, serves the VMRDA region. Currently,it falls under the jurisdiction of both SCR and ECoR. Figure 8-6shows the railway network within the VMRDA region and its surroundings. Approximately 300 km of railway network and 675 km of railway lines exists within the VMRDA region.

1) SCR has its Jurisdiction from Duvvada in Gajuwaka Mandal towards Rajahmundry under Vijayawada Division;
2) ECoR has its jurisdiction towards Visakhapatnam from Duvvada and further leading to Howrah, under Waltair Division in VMRDA region.
3) In ECoR, Rail network from Chennai Howrah main line branches out at Kothavalasa towards Araku and at Vizianagaram towards Rayagada.
4) Apart from the main line, there are sidings to Visakhapatnam Port, Gangavaram Port, NTPC, CONCOR and Visakhapatnam Steel Plant. Existing Sidings in Waltair Division are given inTable 8-1.
5) South Coast Railway (SCoR) is formed as a new zone with Waltair Division merging with Vijayawada Division along with Guntur and Guntakal Divisions. Visakhapatnam will be headquarters for the SCoR
6) The proposal of new passenger line/goods line sanctioned within the Division is:
    - 3rd line between Vizianagaram to Bhadrak (Andhra Pradesh - Odisha)

- 3rd line between Vizianagaram to Titlagarh (Andhra Pradesh - Odisha) including tieline between Gotlam to Nellimarla
- 3rd line between Visakhapatnam to Gopalapatnam
- 4th line between Kottavalasa to Visakhapatnam
- Doubling of Kottavalasa - Kirandul (Andhra Pradesh - Odisha - Chattisgarh)

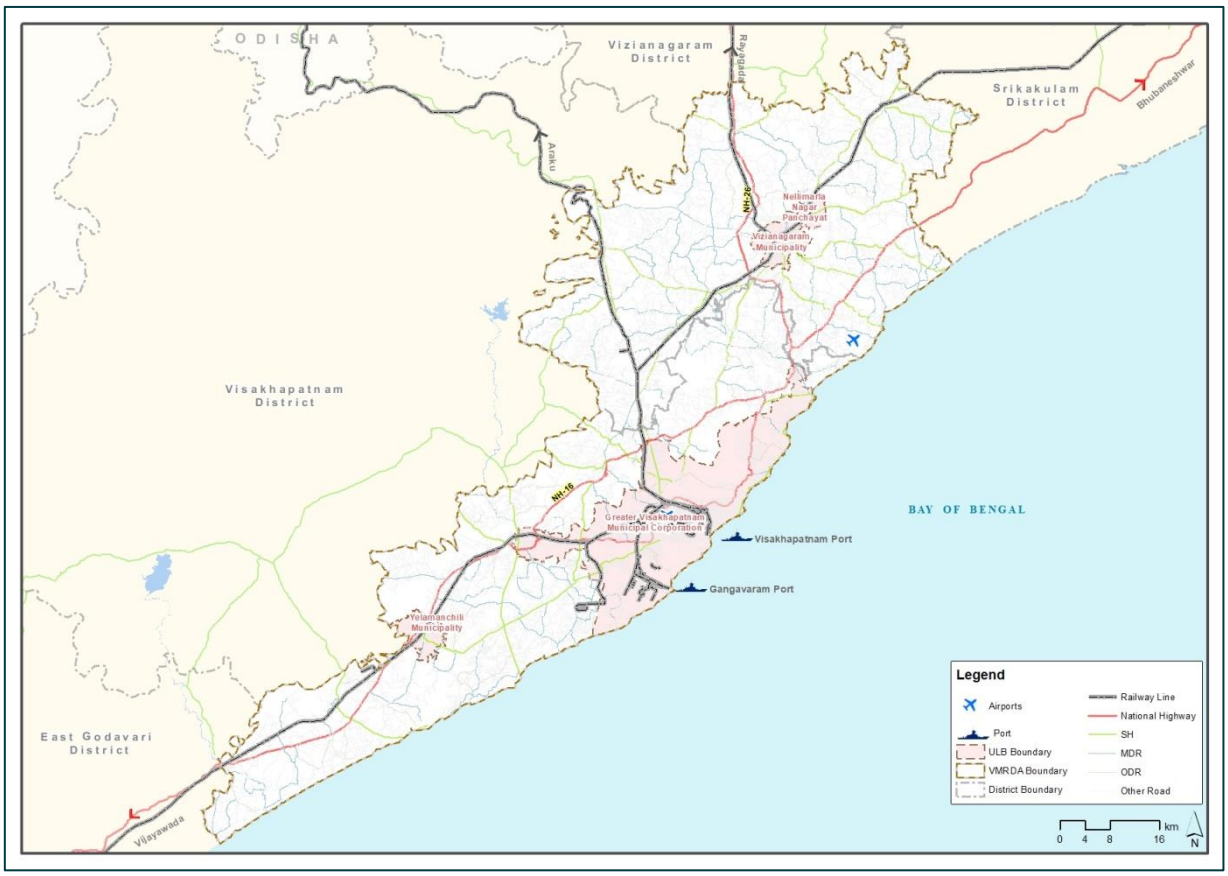


Figure 8-6:Railway Network in VMRDA region

Table 8-1: Existing Sidings in Waltair Division

Sl. No.	Siding Name	Name of the Siding Owner	Serving Station
1	VZP	VPT Railways	Waltair Marshaling Goods Yard (WMY)
2	CONCOR	Containers Corporation of India Ltd	Vishakapatnam Coaching Yard (VSKP)
3	VSPS	Rastriya Ispath Nigam Limited	Visakhapatnam Steel Plant Siding (VSPS)
4	STPP (NTPC)	National Thermal Power Corporation Ltd	Duvvada (DVD)
5	PSAS	Andhra Cements Ltd	Simhachalam North (SCMN)
6	APSWC's Investors	AP State ware Housing Corporation Ltd	Pendhurthi (PDT)
7	FACOR	Ferro Alloys Corporation Ltd	Garividi (GVI)
8	VSPV	Vizag Sea Port Pvt Ltd/VSKP	Visakhapatnam Port (VZP)

Source: Divisional Railway Manager Office, Waltair Division

8.5 PORTS

There are two major sea ports falling within the VMRDA region. Hence, within the influence of the project area, two major ports, a container terminal and one fishing harbour are present.

Visakhapatnam Port is located at 17^{0}41' N and 83^{0}18' E, is almost equidistant from Kolkata and Chennai ports. The port is a premier port in the country, in terms of annual traffic (cargo throughput). There is also a fishing harbour, spread over in 38 ha of area, which is presently being used by local fishermen for fishing related activities and as shelter for their launches/crafts. Visakhapatnam port facilities in inner and outer harbours are presented inTable 8-2.

Table 8-2: Visakhapatnam Port Trust facilities

Sl. No.	Port facilities	Inner Harbor	Outer Harbor
1	Water Spread (Hectares)	100	200
2	Maximum Draft (in meters)	14.50	18.10
3	Length (in meters)	230 LOA	320 LOA
4	Beam (in meters)	32.5	50
5	Vessel Class	PANAMAX	Super Cape (up to 2 lakh DWT)
6	Number of Berths	18	6

Source: Visakhapatnam Port Trust Annual Report

Visakhapatnam port majorly handles POL, iron ore, Fertilizer, Thermal Coal and Coking Coal. Table 8-3shows the principal commodity wise cargo traffic handled at Visakhapatnam Port for the years 2011-18 (Figure 8-7).

Table 8-3: Principal commodity wise cargo Traffic handled at Visakhapatnam Port (in lakh tonnes)

Sl. No	Period	POL	Iron Ore & Pellets (Export)	Fertilizer		Coal		Container		Others
				Finished	Raw	Thermal (Export)	Coking	Tonnage	TEUs	
1	2011 - 12	184.4	161.54	37.17	8.32	31.89	67.8	42.14	234	100.5
2	2012 - 13	150.4	123.09	20.23	5.65	29.51	68.35	45.54	247	104.56
3	2013 - 14	10.09	129.99	17.71	7.95	27.44	69.28	49.16	262	109.37
4	2014 - 15	146.4	83.01	18.38	7.2	27.79	60.74	43.73	248	99.12
5	2015 - 16	169.4	59.79	19.96	7.99	33.93	51.07	51.45	293	96.78
6	2016-17	166.04	114.20	18.86	7.76	34.71	42.82	64.28		120.50
7	2017-18	160.50	106.46	19.53	9.20	29.48	57.64	68.35		125.86

Source: Visakhapatnam Port Trust Annual Report

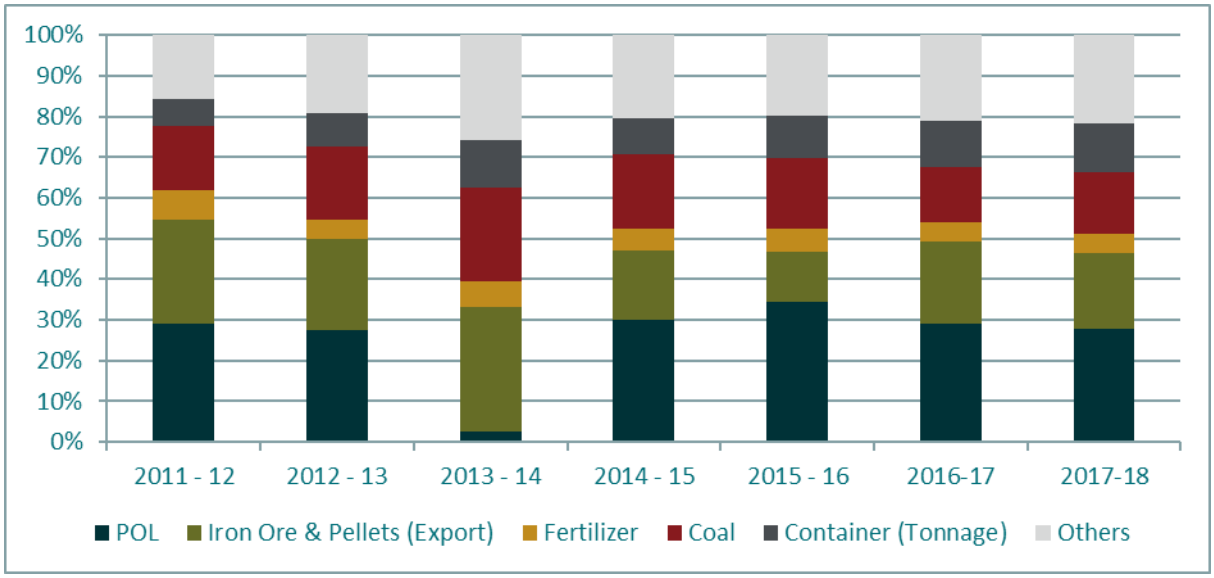


Figure 8-7: Principal commodity wise cargo traffic handled at Visakhapatnam Port

Source: Visakhapatnam Port Trust Annual Report

Port of Visakhapatnam has contemplated the following expansion plans:

1. Extension of Container terminal on DBFOT in the outer harbour
2. Construction of Cruise terminal in the outer harbour
3. Additional oil jetty OR-3 along with OR-I & 2 berths
4. Mechanisation of WQ.7&8 berths
5. Development of Covered Storage for bulk cargoes; and
6. Development of Free Trade warehousing zone

Gangavaram Port is located within 15 km south of Visakhapatnam Port. It is a newly developed greenfield port which started operation in August 2008. It is a Joint Venture (JV) between the State Government of Andhra Pradesh and a consortium led by Mr. D.V.S. Raju. Exports and Imports Cargo traffic handled by Gangavaram Port from 2009-10 to 2015-16 is given in Table 8-4.

Table 8-4: Exports and Imports Cargo traffic handled by Gangavaram Port

Sl. No.	Year	Imports & Exports in MMT
1.	2009-10	12.58
2.	2010-11	13.91
3.	2011-12	13.99
4.	2012-13	13.10
5.	2013-14	15.81
6.	2014-15	20.74
7.	2015-16	19.33

Source: Gangavaram Port Limited Office

To improve connectivity to port, following proposals were submitted to Government of Andhra Pradesh and Director of Ports.

i. Widening of existing 4 lanes road to 6 lane road connecting NH-16;

ii. From NH-16 to Port entry gate existing 2 lanes to 4 lanes; and

iii. 4 lane beach road of 30 km connecting Port to Atchutapuram SEZ.

Coastal Railway line around 35 km from Gangavaram Port to Atchutapuram SEZ connecting NTPC Simhadri, Hinduja Power Plant, Brandix, Pharma Park and other upcoming industries along the sea coast.

Besides the two functional ports, which are large and medium, two minor ports are proposed within the VMRDA region.

7. Bheemunipatnam about 29 km north east of the port of Visakhapatnam and is proposed to be developed as minor port on the southern bank near the mouth of river Gosthani. It is proposed to develop Bheemunipatnam as a satellite terminal for the Visakhapatnam Port.
8. Kalingapatnam is about 83 km north east of the port of Visakhapatnam. The port is proposed on the southern bank of the estuary of river Vamsadhara near its confluence with the sea. It is proposed to be developed as lighterage port which is stated to be suitable for development of good deep water, all weather port by Department of Port, GoAP.
9. Nakkapalli is proposed to be commissioned as a minor port situated in Nakkapalli village of Visakhapatnam district within VK-PCPIR region. M/s. ANRAK Aluminum Limited has been permitted for the construction of a captive jetty.

Meanwhile, high-level committee appointed by the Union Shipping Ministry for setting up a second major sea port in the state of Andhra Pradesh. Apart from Nakkapalli, Duggarajapatnam of Nellore District and Ramayyapatnam in Prakasam district are selected as the probable sites for the second major port in the state. If Nakkapalli gets selected as the site for a second major sea port in the state, it could impact the region in a large way.

8.6 AIRPORTS

The functional airport within the VMRDS region is Visakhapatnam airport (Ref. Figure 8-8); it is a domestic airport where international operations have started recently. . It is connected by flights to major capital cities (Hyderabad, Bengaluru, Chennai, Mumbai, New Delhi, Kolkata, Ahmedabad, Bhubaneswar and Raipur) and other cities (Vijayawada, Tirupati, Coimbatore, Kochi, Mangalore, Agartala, Port Blair) of India. International flights are operated to Dubai, Singapore and Kuala Lumpur. As per the AAI statistics, the number of passengers handled during 2018-19 is 2.8 million, the number of aircrafts handled is 24,182 and cargo tonnage is 3,513. Due to growing air traffic at the airport, the AAI has made plans to construct six additional aircraft parking bays by extending the apron. N5 taxi track will be commissioned in the airport soon. After commissioning with the new taxi track and expansion of the terminal building, aircraft movements and passenger occupancy are expected to rise.

Greenfield Bhogapuram International Airport Limited

Government of Andhra Pradesh has planned to build a Greenfield international airport near Bhogapuram in Vizianagaram District. A Special Purpose Vehicle, Andhra Pradesh Airports Development Corporation Ltd. (APADCL) formerly known as Bhogapuram International Airport Company Limited (BIACL), will implement the Airport Project. The Proposed Airport site is located 45 kms from Visakhapatnam in North East direction on NH-16 and 25 kms from Vizianagaram via NH-26. The site is located in East-West direction near Bhogapuram Village, on the East of NH-16 towards the coast line.

The Greenfield International Airport at Bhogapuram provides the opportunity to the citizens of the region to connect with different parts of the world. The new airport was announced in February 2015. Once Bhogapuram airport becomes operational, Airports Authority of India will close Visakhapatnam airport for 30 years. As part of first phase of project, total land required for Airport construction is 2,624 acres out of which 2,400 acres have already been acquired for which Environmental clearance was issued in April 2017. With this, AP Govt. is yet to award work to commence construction of Bhogapuram Airport.

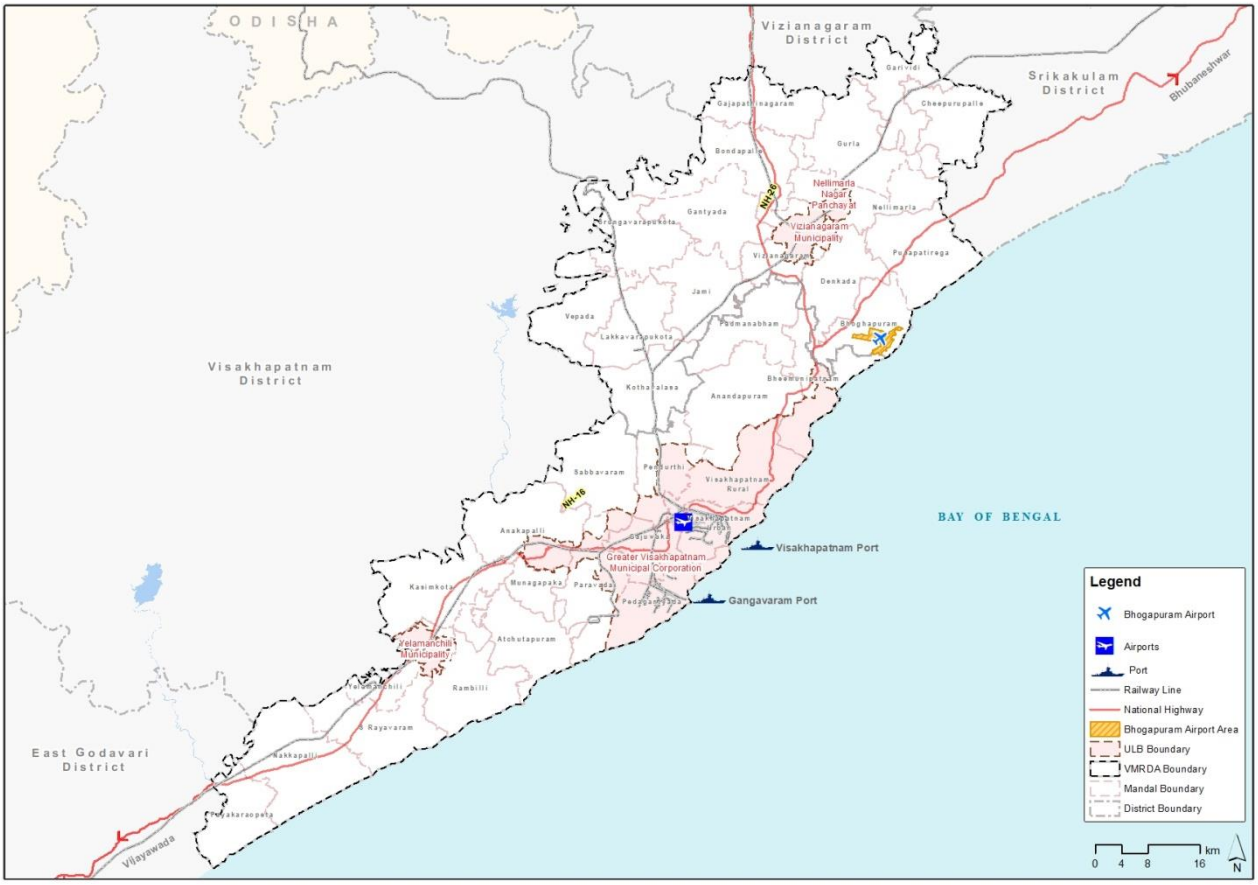


Figure 8-8: Visakhapatnam Airport and Proposed Bhogapuram Airport in VMRDA Region

8.7 LOGISTIC HUBS

Visakhapatnam is the only place where logistic hub is located in the region. It has both Container Freight Station and Inland Container depot. Visakhapatnam ICD is a Combined (Both Exim & domestic) container terminal. Container Freight Station, Visakhapatnam has started functioning in Dec '02. The new depot has started functioning April '05 for both Exim and Domestic Traffic. The Clearing and Forwarding Service (CFS) area is adjacent to VPT and hardly 3 km away from Visakhapatnam Railway Station. It has got a natural advantage in terms of connectivity to both Port and Hinterland.

Visakhapatnam Port Trust has set up a Multimodal Logistic Hub viz., Visakhapatnam Port Logistic Park Ltd., (VPLPL) as a Joint Venture with M/s. Balmer Lawrie & Ltd., in an area of 53 acres of Port land. The Project is operational w.e.f. March, 2019.

Visakhapatnam Port Trust is contemplating to develop a Free Trade Warehousing Zone in area of 100 acres. VPT has entrusted preparation of TEFR to M/s. IPA.

For assessment of the transport network and goods terminal requirements for the horizon period upto 2041, there is a need for estimation of goods vehicle travel demand (external goods travel and internal goods travel) for the base year 2018. Proposed process for assessment of goods vehicle travel demand, URDPFI guidelines for truck terminals/ integrated freight complex, etc. are presented in the following sections.

Truck Terminal Objectives

The major objectives of a truck terminal are:

a) To reorganise office and go-down space of transport companies;

b) To provide for expansion of companies;

c) To reduce parking, loading/unloading instances in CBD (Central Business District);

d) To locate the facilities for vehicle repairs, servicing, rest places, shops etc.;

e) To cater to intercity movements destined to operator's godown and provide for idle parking for trucks waiting for return load; and

f) To function as a rest and halting place for through traffic.

Facilities in Truck Terminal

Within the Truck Terminal area, the facilities that are needed to be allocated are Transport Agencies, Circulation, Parking, Open Space, Petrol Pump, Service Centre, Toilets, Police Station, Restaurant, Shops, Godowns, Weigh Bridge, Stalls / Dhabas, Administration Office, Fire Station, Post office, Dispensary, Bank, Bus Station, Electric Sub-station, Cold Storage, Spare Parts Shops, Body Building Shops and Cinemas.

Location Factors

The following factors are generally considered while locating the truck terminal.

a) They should be located on the main corridor of goods movement;

b) Multimodal connectivity with train corridors and waterways;

c) They are generally located on the fringe of developed lands;

d) They should have proper linkage with other freight generating activities as well as developed areas; and

e) Consideration for intra city goods movement pattern in terms of desire of movement, modes used and the distances over which movement is made should also be kept in view.

Broad Land Use Break-Up of Truck Terminal

The broad land-use break-up in a truck terminal is presented in Table 8-5.

Table 8-5: Broad Land Use Break-Up of Truck Terminal – URDPFI Guidelines

S. No	Description of Land Use	Percentage Area
1	Transport Operators – Office, godown, loading/Unloading	30
2	Service Industry- Petrol pump, Service area, weigh bridge etc.	6
3	Public/Semi-Public like police post, post office, telephone, first aid etc.	3
4	Commercial	3
5	Parking like idle, transit, other vehicles	18
6	Open Space	10
7	Circulation	28
8	Others	2

Integrated Freight Complex – Functions

The major functions of an integrated freight complex are:

a) To provide facilities for regional and intra – urban freight movement;

b) To provide facilities for freight in transit as well as interchange of mode;

c) To provide warehousing and storage facilities and link-link these sites with specialised markets; and

d) To provide servicing, loading and boarding, idle parking, restaurants and other related functions in the complex.

Integrated Freight Complex – Objectives

10. The functional objectives of wholesale complex-cum-truck terminal should be:

a. To provide adequate facilities for wholesale trade activities, these include:

i. Auction areas

ii. Wholesale shops and subsidiary storage capacity

iii. Parking facilities

iv. Wholesales godowns, cold storage, etc. together with handling facilities and equipment, etc.

11. These norms may be modified to be used for Dry Ports, Container Freight Station (CFS), Logistics Hub.

b. To provide adequate parking space and facilities for trucks expected to utilise the terminal. These facilities include:

i. Service/repair facilities

ii. Rest/recreation for drivers

iii. Weighing of trucks, etc.

c. To provide adequate facilities for office/storage activities of trucks operating at the terminal. These include:

i. Godown space

ii. Office space

iii. Loading/unloading facilities

iv. Weighing of goods vehicle etc.

12. Apart from the above mentioned objectives, the complex must provide for a number of associated/ancillary facilities and services, some of which are:

a. Provision for goods movement within the complex in terms of truck movement and loading unloading / stacking of goods.

b. Building and amenities for administration and security measures necessary for complex.

i. Facilities like banking, postal truckers, etc. required for business transactions

ii. Amenities for wholesales, truckers and their employees

iii. Areas for shops, eating houses and other service establishment

iv. Provision of lighting, water supply and garbage, sewerage disposal.

Integrated Freight Complex - Space Norms

The Space norms in terms of quantum handled (kilograms) per square meter area for selected commodities as per Central Warehousing Corporation (CWC) arepresentedin Table 8-6.

Table 8-6: Integrated Freight Complex - Space Norms – URDPFI Guidelines

Commodity	Wt./Area (Kg./sqm)
Food grains	1054
Fruits and Vegetables	721
Hardware and Building Material	1054
Iron and Steel	904
Timber	968
Machinery	968
Auto Parts	968
Textile	968
Chemicalsandfertilisers	968

Integrated Freight Complex - Broad Land Use Break

The broad land use break–up of an integrated freight complex recommended in UDPFI Guidelines 1996 continue to be relevant and are presented in Table 8-7.

Table 8-7: Integrated Freight Complex - Space Norms – URDPFI Guidelines

Sl. No.	Description of Land Use	Percentage Area
1	Wholesale Market	35.0
2	Warehousing	8.0
3	Booking Agencies	2.0
4	Commercial& Public/Semi-Public	5.0
5	UtilitiesandServices	3.0
6	Service Industry	4.0
7	Parking	12.0
8	Circulation	25.0
9	Others	6.0

Area Requirements

As a general guideline, the area required for a truck terminal (Transport Nagar) should be reserved at the rate of one hectare per 300 tonnes of daily goods inflow into the complex. In case of integrated freight complex, the area necessary would be one hectare per 400 tonnes of daily goods inflow into the complex.

8.8 KEY CHALLENGES

Emphasis should be given on a planned advanced transport infrastructure, with increased public shares at a low carbon footprint. The timely implementation of each and every proposed transport will lead to the desired effective transport infrastructure in future. The share of public transit in GVMC area is less than 20%, which is below standards of 50% share for similar cities. There is inadequate economic vibrancy in the regional centers of VMR due to lack of adequate and quality transport connectivity between the Metropolitan City and Regional Centers. The level of public transit infrastructure too is weak within the regional centers. Availability of public transportation to industrial areas, CBDs etc is to be given priority. Increase of public modal share from 13% to 50% can only be envisaged with the upcoming metro corridors from Kurmannapalem to Bhogapuram, Thatichetlapalem to Chinna Waltair and Gurudwara to Old Head Post Office with support of Battery Run trams feeding it from several other directions like Bheemunipatnam, Rushikonda, RK Beach, Chinna Waltair and Old post office.

Addressing the last mile connectivity remains a key challenge. Since the private ridership is huge, planned implementation of Electric Auto-rickshaws is required to shift the focus from private to public transport. A focus on NMT is necessary with improved pedestrian subways and foot over bridges and better infrastructure in pedestrian walkways. New and advanced technologies promise improvements in mobility, safety, efficiency, and convenience.

Facilitating regional connectivity for through traffic to ensure their movement at higher speeds. Providing service roads along National Highways at major settlement areas and providing adequate right of ways for

future widening to decongest the then traffic. Public transport corridors should connect major industrial areas and CBDs. The outer ring road is to be proposed for Vizianagaram considering the future development.

Parking laws should be strictly enforced in the region ensuring all commercial establishments like malls and retails stores to provide their own parking facilities. Provision of providing parking for trucks in Visakhapatnam and Vizianagaram may be considered to cater growing needs of imports and exports in the region.

Improving safety measures with adequate traffic management measures. Traffic congestion due to rapid vehicle growth in core areas and parking spaces issues in commercial areas. Ensuring installation and functioning of traffic signals at critical junctions. Enforcing strict traffic regulations and restricting encroachments on streets through street vending policies. Relocation of Bus stops from junctions, restricting autos near bus stops. Ensuring best traffic management measures and improved roads in VMRDA in consensus with all the stakeholders like GVMC, R&B and traffic Police, RTO etc.

8.9 CONCLUSION

Transportation infrastructure is a major sector which acts as a backbone to all for economic growth. Transport network connects the Region to the world and also intra region connectivity to develop by using its own resources. A greater emphasis must be taken on the transportation network and its utilisation, it requires detailed understanding and analyse the existing situation, its influence. So, this leads to resolve the existing issues and overcome the upcoming problems. This section will give the overall review and summary of this chapter by focusing on the existing situation, issues and upcoming proposals.

The region is endowed with a very well-developed inter-city transport network by all modes of transport – road, rail, air and sea.NH – 16 and NH – 26 connects the Project Area to the rest of the nation. It has approximately 490 km of State Highways and next hierarchical roads such as Major District Roads, Other District roads consist of approximately 1,700 km in the VMRDA Area.

Under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) scheme, BRTS project was approved for two corridors. One of them is Pendhurthi Transit Corridor (PTC) and other Simhachalam Transit Corridor (STC).

Visakhapatnam Metro Rail Project is proposed on three phases. The proposed corridors are Steel Plant to Bhogapuram Airport, Thatichetlapalem to Chinna Waltair and Gurudwara to Old head Post Office. These corridors will be supplemented by batter run trams on corridors like Steel Plant to Anakapalle, NAD junction to Pendhurthi and Old Head Post Office – R.K.Beach-Bheemunipatnam.

Chennai - Howrah main line of the Indian railways, serves the VMRDA region. Currently,it falls under the jurisdiction of both South Central Railway (SCR) and East Coast Railways (ECoR).Approximately 300 km of railway network and 675 km of railway lines exists within the VMRDA region.

There are two major sea ports, Visakhapatnam Port Trust and Gangavaram Port, falling within the VMRDA region. Hence, within the influence of the project area, two major ports, a container terminal and one fishing harbour are present.

The functional airport within the Project Area is Visakhapatnam airport; it is a domestic airport where international operations have started recently. Visakhapatnam airport is located at a distance of 7 km from city close to NH-16.

The Proposed Bhogapuram Airport siteis located 45 kms from Visakhapatnam inNorth East direction on NH-16 and 25 kms from Vizianagaram via NH-26.

9 KEY UTILITIES AND SOCIAL INFRASTRUCTURE

Visakhapatnam to be a global city should provide the adequate infrastructure and amenities to improve the quality of life of the citizens. A vibrant economy with better physical and social infrastructure will make Visakhapatnam a more attractive destination. With major resources available in the region, Visakhapatnam is capable of serving the future population through sustainable utilisation. This section reflects upon the present resources available in the region and the existing capacities of infrastructure facilities.

9.1 WATER SUPPLY

9.1.1 Broad Hydrological Scenario

Rainfall

The annual rain fall data for last 13 years for the districts in VMRDA region is given in Table 9-1. Accordingly, the average rainfall in Vizianagaram district 1,151.4 mm and in Visakhapatnam district 1,113.40 mm.

Table 9-1: Rainfall Data for VMRDA Region for last 13 years

District	Vizianagaram	Vishakhapatnam
Year	mm	mm
2004	1,034.50	989.70
2005	1,336.50	1,490.40
2006	1,273.40	1,279.80
2007	1,224.70	1,130.30
2008	1,069.30	906.80
2009	1,032.40	734.30
2010	1,647.90	1,702.60
2011	1,017.60	867.50
2012	1,296.90	1,217.90
2013	1,028.30	1,082.50
2014	1,204.40	1,092.60
6/15- 11/15	903.60	1,035.60
6/16 - 2/17	895.60	944.20
Average	**1,151.16**	**1,113.40**

Source: CM Dashboard, AP

Surface water

The region is drained through several rivers and streams all originating from the hillocks on North – West side of VMRDA region and draining to Bay of Bengal in the South – East. A map showing all the rivers and water bodies with in and around VMRDA region is being depicted in Figure 9-1.

Accordingly, a district wise list of major water bodies having their influence on VMRDA region has been prepared and shown in Table 9-2:

Table 9-2: District wise list of Water Bodies

District	Rivers	Reservoirs	Streams
Vizianagaram	Champavati	Tatipudi	Kandivalasa Gedda
	Gosthani		
Vishakhapatnam	Sarada	Gambheeram	Gambheeram
	Varaha	Mudasarlova	Mudasarlova
	Thandava	Meghadri Gedda	Narava Gedda
		Kanithi	Thandava Canal (L & R)

District	Rivers	Reservoirs	Streams
		Kondakarla lake	
		Thandava	
East Godavari		Yeleru (Outside VMR but supplying to VMR)	Yeleru Canal
		Pampa	Polavaram Left Canal
		Polavaram (Outside VMR but supplying to VMR)	

Source: ULBs, Irrigation Department

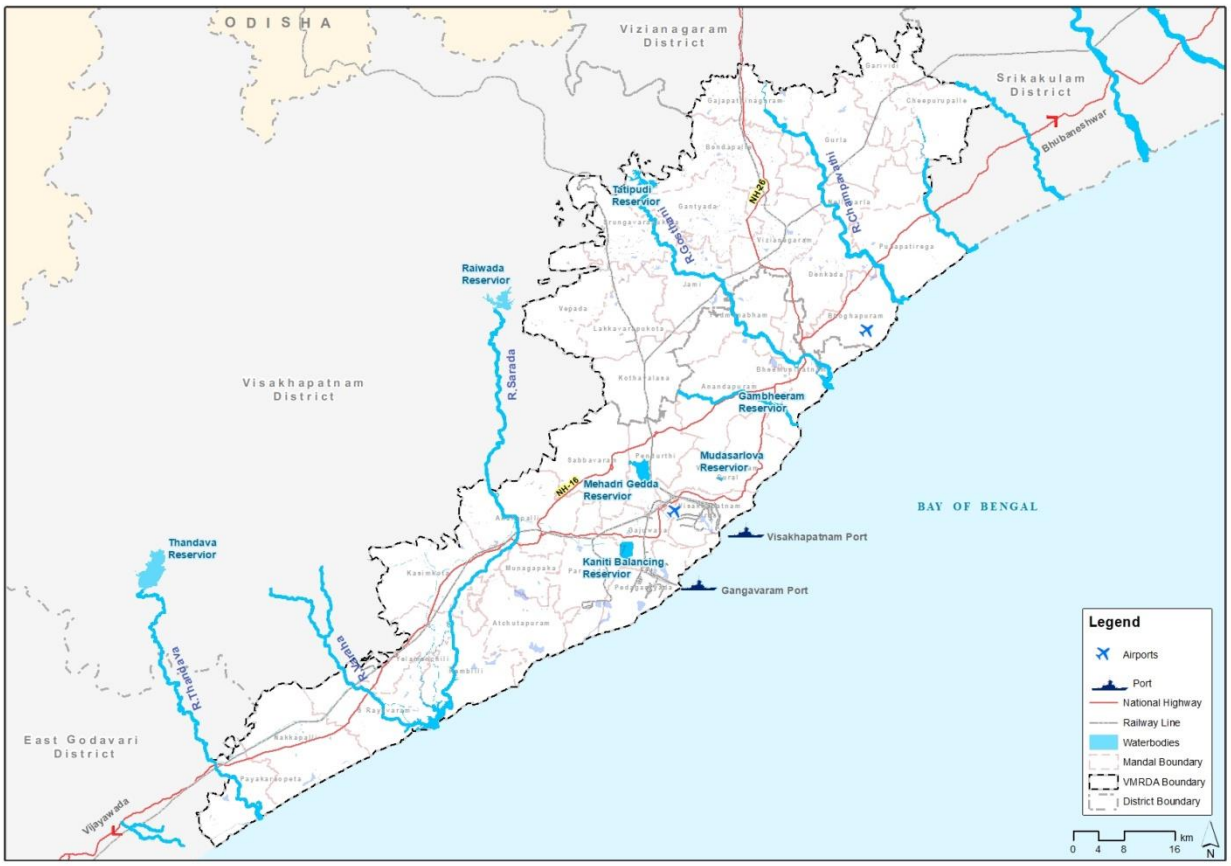


Figure 9-1: Major Rivers / Water bodies in VMRDA Region

In addition, there are several small streams originating from the hills on North West side of VMRDA region. These streams meet the major rivers in the area and discharge in to the Bay of Bengal and some of them discharge in local reservoirs / ponds.

Ground water

A wide variety of geological formations occur in the region, ranging from the oldest Archaean crystalline rocks to recent alluvium. The Charnockites and Khondalites (predominant type of Archaean rocks) occur in an extensive belt of Vizianagaram, and Visakhapatnam districts. They are underlain by Gneissic complex with Crystalline Granites in mostof the area.

The Central Ground Water Board is regularly conducting the Ground Water Level monitoring through scientific surveillance system to observe the periodic and long-term changes in ground water regime. The ground water booklet issued by CGWB, depicts that:

- Depth of water level between 2 to 5 m below ground is more prevalent almost in 80% of the region.
- Water level range of 2 to 5 m bgl is observed mostly in coastal areas of the region.

- Depth of water level varying between 10 m to 20 m bgl is noticed in small isolated patches of Visakhapatnam district.

The ground water occurrence and availability is largely governed by the state of cementation and compaction of formation, which control the pore volume. A sizable proportion of population in the region is dependent on ground water for drinking and other house hold utilities, besides its use in irrigation at large. Due to limited cost effective treatment options for chemically / bacteriologically polluted ground water, the affected source is generally lost for drinking and house hold utilities.

The quality of ground water is some parts of the region, particularly the shallow ground water, is changing as a result of human activities. Though ground water is less susceptible to bacterial pollution, but many unseen dissolved minerals and organic constituents are present in water in various concentrations. The presence of Chlorides, Fluorides and Nitrates beyond acceptable limit is harmful. The Table 9-3 below gives the concentration of various Chemical parameters exists in Ground water for the districts of VMRDA Region. The table is based on the test results depicted in Ground Water Year Book 2014-15 for Andhra Pradesh state, issued by Central Ground Water Board. The table also gives an outlook for acceptable limits for these parameters for ready reference:

Table 9-3: Concentration of Chemical Parameter

District		pH	Cl	NO_3	F
			mg/L		
Acceptable Limit		**6.5 to 8.5**	**250**	**45**	**1.0**
Permissible limit in absence of alternate source		**6.5 to 8.5**	**1000**	**45**	**1.5**
Vizianagaram	Maximum	8.98	4313	248	1.40
	Minimum	7.39	270	0.0	0.20
	Average	8.14	1115	51	0.61
Visakhapatnam	Maximum	9.08	3960	565	2.70
	Minimum	7.54	58	0.0	0.00
	Average	8.12	1068	63	0.49

Source: Ground Water Year Book 2014-15

From above it is revealed that maximum concentration levels are beyond the permissible limit in all the districts. Even the Average values too cross the maximum allowable concentrations, thus the ground water is not suitable for human consumption.

On the other hand some of the mandals in above 2 districts of VMRDA region do fall in Critical / Semi critical and over exploited category. Thus further extraction is not advisable. Table 9-4 shows the number of mandals in each district falling in safe and other categories. Accordingly, it will be seen that, in Vizianagaram district all16 mandals fall in safe category. While in Visakhapatnam district Kasimkota, Munagapaka and Atchutapuram mandals fall in over exploited category with stage of development as 190%, 150% and 140% respectfully. One mandal namely Yelamanchilli falls in Semi critical category with stage of development as 77%. Thus 31 mandals out of 35 in the district fall in safe category.

Table 9-4: Mandals in each district falling in safe and other categories

Sl. No	District	NO.OF MANDALS IN DIFFERENT CATEGORIES				
		Safe	Semi Critical	Critical	Over Exploited	TOTAL
1	Vizianagaram	16	0	0	0	16
2	Visakhapatnam	39	1 No. (Yelamanchilli 77%)	0	3 Nos. (Kasimkota-190%,	43

Sl. No	District	NO.OF MANDALS IN DIFFERENT CATEGORIES				
		Safe	Semi Critical	Critical	Over Exploited	TOTAL
					Munagapaka-150%, Atchutapuram-140%)	

Source: Ground Water Data, CGWB-2008

9.1.2 Water Supply

Urban Water Supply

The VMRDA Region comprises total of four urban local bodies as detailed below:

Municipal Corporations

- Greater Visakhapatnam Municipal Corporation
- Vizianagaram Municipal Corporation

Municipalities

- Yelamanchilli Municipality

Nagar Panchayat

- Nellimara Nagar Panchayat

Norms for water supply in urban centres:

As per CPHEEO manual and URDPFI guide lines issued by Ministry of Urban Development Government of India the norms for domestic water supply to Urban centres at consumer end should be considered as follows:

- For Mega cities (population above 10 lakh) : 150 LPCD at consumer end
- For cities below 10 lakh population where Sewerage System is existing or contemplated : 135 LPCD at consumer end

Water resources to the urban centres are the existing reservoirs and the infiltration wells along the rivers near urban centres. The water sources for the ULBs are listed below respectively.

Table 9-5: Water sources of Urban Local Bodies of VMRDA

Urban Local Body	Water Source
Greater Visakhapatnam Municipal Corporation and related industries	Yeleru Left main canal, Raiwada reservoir, Meghadri Gedda Reservoir, Gambheeram Gedda Reservoir, Mudasaralova Reservoir, Thatipuri Reservoir, Gosthani River & Sarda River
Vizianagaram Municipality	Infiltration wells in River Gosthani and River Champavati
Yelamanchili Municipality	Infiltration wells in River Varaha and Bore wells in town
Nellimarla Nagar Panchayat	Infiltration wells in River Champavati and Open Wells

Source: Urban Local Bodies, Public Health Department

The water supply status in the ULBs has beensummarized in Table 9-6.

Table 9-6: Summary of water supply in Urban Local Bodies

Urban Local Body	Present Population	Desired Service level LPCD	Demand in MLD	Source Capacity MLD	Actual Production MLD	UFW	Supply at consumer end MLD	Gap	Present Service Level LPCD	Capacity of SRs ML		Coverage by HH Connection	WTP Capacity MLD		NRW
										Reqd	Exist		Reqd	Exist	
GVMC (Domestic)	20,35,000	150	305	403	301	15%	192	37%	94.2	107	126	77%	446	358	30%
Floating & Comm			31				13								
GVMC (Small Indstries)			52				51								
Dist. Losses			58												
GVMC (Indus) Bulk			252	252	252		252								
GVMC Total			698	**655**	**553**		**508.0**								
Vizianagaram Municipality	2,70,000	135	37	17.2	17.2	15%	14.6	60%	54.1	12.8	13.7	41%			35%
Yelamanchili	36,700	135	5.0	2.0	2.0	15%	1.7	65%	46.8	1.7	1.6	9%			65%
Nellimarla Nagar Panc.	24,400	135	3.3	2.3	2.3	15%	2.0	40%	81.2	1.1	2.31	64%			45%

Source: SLIP-2017 and "At a Glance" statements from respective Urban Local Bodies, 2019

Inferences drawn from the assessment of present scenario of water supply are as follows:

- Water supply is not adequate in any of the ULBs.
- UFW is not considered by the ULBs other than GVMC, while working out service level in LPCD.
- Capacities of Service Reservoirs are adequate for present supply in all the ULBs.
- Distribution network has different types of pipes (CI, AC, DI, HDPE, etc) resulting high UFW, while it is recommended to provide DI pipes class K-7 to reduce UFW.
- Additional and adequate source of water is required to meet even the present demand, which is possible by getting water from Polavaram Dam project (Through Indra Sagar Left main canal).

Rural Water Supply

Rural Water Supply and Sanitation Department is the nodal agency in the state for providing drinking water facilities in rural areas of state. The drinking water facilities are being provided with various types of schemes such as bore wells with hand pumps/ single phase motors, direct pumping schemes, MPWS schemes, PWS schemes and CPWS schemes (all piped schemes). Almost all the villagers have access to hand pump scheme.

As per 73rd amendment on devolution of powers to local bodies, all Single Village Schemes (SVSS) are being maintained by Gram Panchayats, Multiple Village Schemes (MVS) by Zila parishads and hand pumps are being maintained by Mandal Parishads. RWS Department is providing technical support to these agencies. The Gram Panchayats/ Mandal and Zila Parishads receive 13th Finance Commission Funds for O & M of drinking water supply schemes in their areas. The various water supply schemes instrumental for supplying drinking water to the rural areas are being described below:

Single Village Scheme: In the case of SVS, it is a small dedicated scheme for a single village with local source like open well or bore well.

Multiple Village Scheme:MVS is expected to cover more than one village / Gram Panchayat with a ground / surface source.

The Water Supply Schemes are further classified as:

PWSS: Piped Water Supply Schemes which provide water to single village from source like bore wells and other sources where only chlorination treatment is given.

MPWS: Mini-Protected Water Supply Scheme, which provides water to single village from local source like open well or bore well with a single point distribution.

CPWS: Comprehensive Piped Water Supply Scheme, where source of water is surface source and treated water is supplied to multiple villages under a single project.

Other than the above discussed schemes, the State Government has taken a policy decision to implement “NTR Sujala Pathakam” to provide safe & potable water of 20 litres for Rs.2.00 to each household, to address the issue of drinking water quality in some of the villages,. The program was officially launched on 2nd October, 2014 and so far 618 plants have been installed.

These water supply projects are developed under the rural water supply programmes such as “National Rural Drinking Water Programme (NRDWP)” and “National Bank for Agriculture and Rural Development (NABARD)”.

The district wise coverage of villages with different type of water supply schemes is being illustrated in

Table 9-7, and the graphical representation is shown inFigure 9-2.

Table 9-7: Coverage of villages in VMRDA region under different type of Water Supply Schemes

District	Total Notified Villages	Villages covered with different water Supply Schemes					Villages with HP schemes	% Villages Covered by Water Supply schemes	% Villages Covered by Hand Pump schemes
		SVS	PWS	MPWS	CPWS	Total			
Viziangaram	512		290	97	130	323	189	63.09%	36.91%
Visakhapatnam	403		252	197	17	303	100	75.19%	24.81%
Total	915	0	542	294	147	626	289	68.4%	31.6%

Source: Rural water supply and sanitation, Panchayat Raj

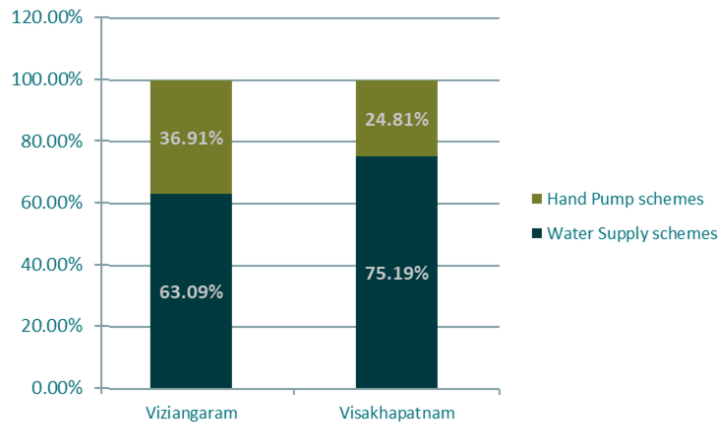


Figure 9-2: Percentage of villages covered under different water schemes in VMRDA region

The status of water supply in rural areas is presently been assessed by Rural Water Supply department based on present service level, which categorise the settlements based on the service level of water supplied in litres per capita per day. The classification used is being shown below:

1. NSS/NC: No Safe Source/Not Covered
2. PC-1: (upto 9 lpcd)
3. PC-2: (10-19 lpcd)
4. PC-3: (20-29 lpcd)
5. PC-4: (30-39 lpcd)
6. FC: Fully Covered

Accordingly it is seen that 40% of villages are fully covered with 40 lpcd service level. The classification of all the villages with in VMR as informed by RWSS in 2019 is shown in Figure 9-3.

The inference from the present scenario of Rural Water Supply system in VMR area is:

- The service level benchmarks considered for rural area is 40 lpcd. However, the benchmark has to be raised to 70 lpcd (as per National Drinking Water Program-2013, issued by Ministry of Drinking Water & Sanitation, Government of India) and the same will be considered for demand assessment in VMR villages.
- Coverage of Villages under Piped Water Schemes is hardly 24 to 55%, while all the villages need to be covered with piped water supply system. The same shall be considered in the infrastructure proposals for VMR area.

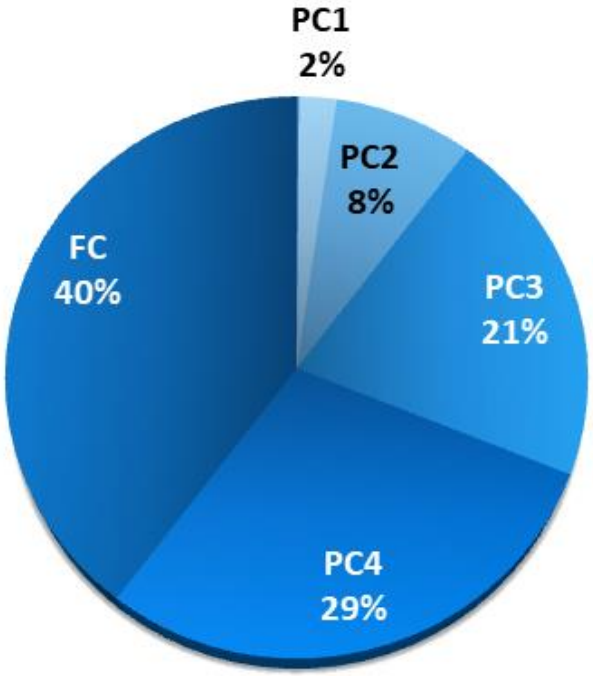


Figure 9-3: Coverage of water supply in rural areas of VMRDA

9.2 WASTE WATER

9.2.1 Urban Sewerage System

Greater Visakhapatnam Municipal Corporation (GVMC)

The present population of GVMC is 20,35,000 peoples. Accordingly the required water supply to the town @ 150 LPCD service level and to industries with in town works out to 388 MLD. Based on this the generation of sewerage is envisaged to be around 310 MLD. But presently only the treatment plants of total 161.5 MLD capacity are operational and hardly 130 MLD of sewage is reaching to these plants for treatment.

The entire GVMC area has been divided into 20 sewerage blocks. These blocks are excluding the areas of Bheemunipatnam and Anakapalle which has been recently added to the municipal corporation area. A sewerage network of 316 km length is spread over the city in 72 wards of GVMC. But only 249 km is connected to Sewage Treatment Plants (existing and under construction). The newly added areas of GVMC are not covered by the collection network. Out of the existing network of 316 km, around 110 km is under sized and need augmentation. It is informed that presently only 20% of the households are connected to sewerage collection system.

There are total 16 number Sewage Treatment Plant in the city, which are operational at present. The total capacity of these plants is 107.50 MLD as shown below:

- At Appughar : 25 MLD
- At Mudasarlova : 13 MLD
- Old City : 38 MLD
- At VPT : 10 MLD
- 13 Mini STPs at different locations : 31.50 MLD
- At Narava (operational) : 54 MLD
- **Total Capacity of Plants working : 171.50 MLD**

In addition to above following new Sewage Treatment Plants are under construction in GVMC, after that the total capacity would be (171.50 + 57) = 228.50 MLD:

- At Narava (under construction) : 54 MLD
- At Pardesipalem : 2.0 MLD
- At Rabulacheruvu : 1.0 MLD
- Total cap of Plants under construction : 57 MLD

Apart from these STPs, there has been DPRs prepared for another 177.69 MLD.

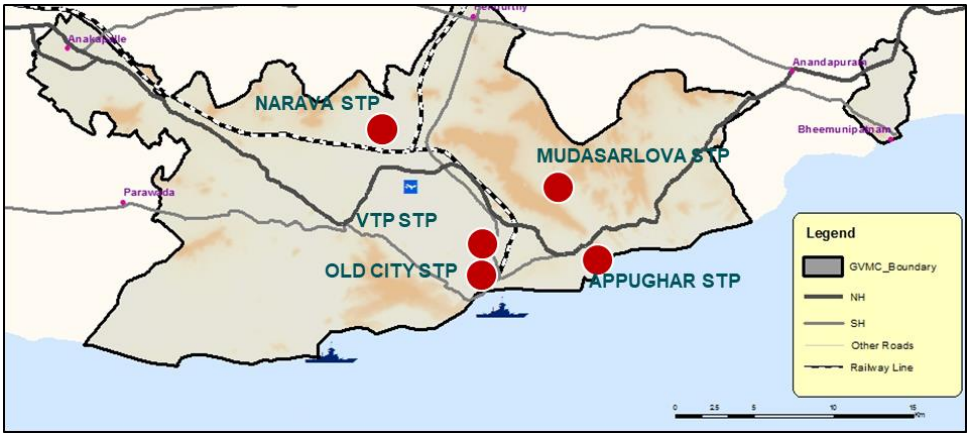


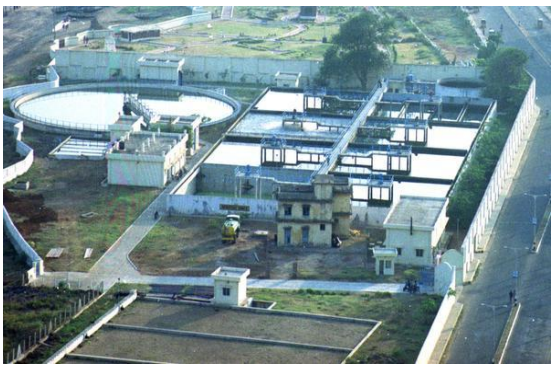
Figure 9-4: Locations of Sewage Treatment Plants in GVMC

Aeration tanks

Clarifier tank

13 MLD STP at Mudsarlova

38 MLD Sewage Treatment Plant at Old City



25 MLD STP at Appughar

Inlet chamber

Screen Chamber

Detrious Tank

Aeration Tank

54 MLD STP at Narava (under construction)

Figure 9-5: Pictures of STPs in GVMC

Apart from Greater Visakhapatnam Municipal Corporation none of the other ULBs presently have sewerage system. At present no separate sewer lines are laid in urban areas. The raw excreta or the outflow from septic tanks is being disposed through open drains. However DPRs have been prepared for extension of sewerage system in GVMC, and new sewerage system in Viziangaram ULB. Other ULBs have prepared DPRs for Septage management through truck transport.

Table 9-8: Present Status summary for Sewerage & Sanitation System in VMRDA

ULBs	STP capacity/Sewage Generation MLD		Sewer lines based on road length		HH coverage	Coverage of latrines
	Reqd.	Existing	Reqd.	Existing		

Greater Visakhapatnam Municipal Corporation (GVMC)	310	161.5	2252	316	43.6%	98%
Vizianagaram Municipality	29.6	0	256	0	0	90%
Yelamanchili Municipality	4	0	95	0	0	88%
Nellimarla Nagar Panchayat	2.6	0	32	0	0	24%

Source: SLIP-2017 and "At a Glance" statements from respective Urban Local Bodies, 2019.

9.3 SOLID WASTE

The Solid waste generated in the region is categorized into three types such as municipal solid waste, hazardous waste and bio-medical waste. Each of these categorized wastes are managed differently by different authorities and treating/disposing units.

Municipal solid waste (MSW) – Waste generated from residential pockets of the region: The MSW generated is managed (i.e., collected, transported, treated/disposed) by local authorities like Municipal corporations, Municipalities, and Nagar Panchayats in urban areas and Gram Panchayat in rural areas.

Major urban centres in the region are dominant waste generators, owing to the high concentration of the population living in them; relatively quantity of waste generated is also high. Generated waste from residential households, commercial areas, market places and road sweeping is collected by Local bodies; urban areas have an average collection efficiency of 95%. Collected waste is transported to the disposal site nearby to the areas. In urban areas with compost plants, the market waste and any segregated wet waste is taken to the compost plant. In others waste is dumped at the disposal site without any other treatment.

Table 9-9: Existing scenario of Solid Waste Management in urban areas

Local Bodies	Waste Generated (MTPD)	Dumping site	Transfer Station	Compost plant	WTE cluster
GVMC	1,000	Yes, at Kapuluppada, Bheemunipatnam	Yes	Yes	Construction commenced byJindal Urban Waste Management, Visakhapatnam Ltd.)
VMC	120	Yes, at Gunupurupeta	Yes	Yes	Recently cancelled
Yelamanchili Municipality	16	Yes, at Seshukonda	No	No	No
Nellimarla Nagar Panchayat	12	Yes, at Gandhi nagar	No	No	Recently cancelled

Source: Respective ULBs

To scientifically treat and dispose the waste in an eco-friendly manner, GoAP has taken initiative and identified Waste to Energy (WTE) clusters by joining nearby urban areas for energy generation and

scientific disposal of waste. VMRDA region has one such WTE cluster proposed in at Kapuluppada for GVMC, however Vizianagaram, and Nellimarla ULBs have been asked by the Govt to join GVMC cluster.

In rural areas,in some of the Gram Panchayats (GP) the solid waste is segregated and biodegradable waste is used for composting. The inert material and recyclable material are stored separately after segregation. While other GPs the waste is crudely disposed on out skirts of the village. Overall 25% of Villages of VMR area has compost pits for management of solid waste in rural areas.

Hazardous waste (HW) –Management of hazardous waste generated by the industries is the responsibility of the particular industry itself. Either the waste is being handled by them or is being sent to other industries/ treatment facilities. The industries have to take authorization from the AP State pollution control board and dispose the waste according to the norms set by them

The hazardous waste generated by industries in VMRDA area is treated by M/s. Coastal Waste Management Facility (CWMP), established by Ramky Enviro Engineers Limited (REEL) located in JNPC Parawada. It provides Treatment, Storage and Disposal Facility. The firm has to collect and transport the hazardous waste generated from the registered members from the districts of VMRDA region. About 260 thousand MT is treated per year in the region. Of the treated waste 26% is landfilled, 18% is incinerated, and 54% is recycled.

Bio - Medical waste

Bio-medical waste generated from healthcare units is considered as potentially hazardous and disposal of such waste without treatment may pose serious environmental and public health risk. Thus it has to be handled in a scientific discriminative manner. The generation of Hazardous waste is nearly 0.1 kg/ bed/ day. Presently nearly 700 MT/year waste is being treated by 2 distinct firms, who have established their plants for treatment of Bio-medical waste. The details of hazardous waste being generated at present per year in two districts of VMRDA and the firm responsible for its treatment is given in Table 9-10below:

Table 9-10: Present agencies for Treatment of Bio Medical Waste

District	BMW generated in MTPA	Operator
Visakhapatnam	645.46	Maridi Eco Industries Andhra Pvt. Ltd
Vizianagaram	72.12	Rainbow industries
Total	**717.58**	

Source: Pollution Control Board, Andhra Pradesh

Presently the BM waste is segregated, weighed and packed in the bags (0.5 kg for red bags, and 2.5 kg for yellow bags) as per BMW disposal rules. Liquid and solid waste is stored separately in plastic bags, and tins. The non-hazardous solid waste generated from the hospitals is collected by the respective ULB's and disposed accordingly.

Conclusion: Inferences drawn from the assessment of present scenario of solid waste management in VMRDA region are as follows:

- Present undergoing waste management scenarios for hazardous waste and Bio-medical waste management in the region are adequate
- For Municipal solid waste management, few issues are identified such as waste not being segregated, composting practices are unhealthy / unmonitored, waste is disposed crudely, some of the dumpsites in use does not have compound walls and waste weight monitoring systems, Burning of waste at the dumpsite, Inefficient use of available infrastructure in both urban and rural areas

9.4 POWER SUPPLY

Present Power Network& future power sources

Power supply is one of the vital factors for development and thriving of the VMR region with its vast Large & Mega industries and MSME industrial parks and pockets. Andhra Pradesh state receives 56% of the power within the state and remaining 44% from central power, Independent Power plants (IPP) and Captive power plants. The bulk power transmission in the state is done by two agencies POWERGRID, and APTRANSCO.

Power Distribution system- APEPDCL

Power distribution in the region is handled by APEPDCL through a huge net-work of HT and LT power lines along with related sub stations. The present net -work of HT and LT lines in the region is being given in Table 1-10 below:

Table 9-11: Existing Power net-work in VMR

LINE	Visakhapatnam	Vizianagaram
400 K.V	1,193.26	0
220 K.V	869.35	80.33
132 K.V	1,502.55	255.64
33 K.V	1,262.5	679.45
11 K.V	4,425.67	6,243.67
Total HT Lines	9,253.33	7,259.09
L.T.LINE	12,725.87	13,063.52
G. Total	21,979.2	20,322.61

Source: APEPDCL

APEPDCL supplies power to different categories through the network consisting of 587 Sub-stations of 33 kV level, 2,322 feeders of 11 kV level and more than 1,27,487 distribution transformers of different capacities in 221 mandals in north coastal part of Andhra Pradesh as shown in Table 1-11 below:

Table 9-12: No. of Sub-stations in APEPDCL Network

Sl.No.	Type of Sub Station	No. of Sub-stations
1	220 kV Sub-stations	15 Nos.
2	132 kV Sub-stations	55 Nos.
3	33 / 11 kV Sub-stations	587 Nos.
4	11 kV / 433 V Sub-stations	1,28,000 Nos

Source: APEPDCL

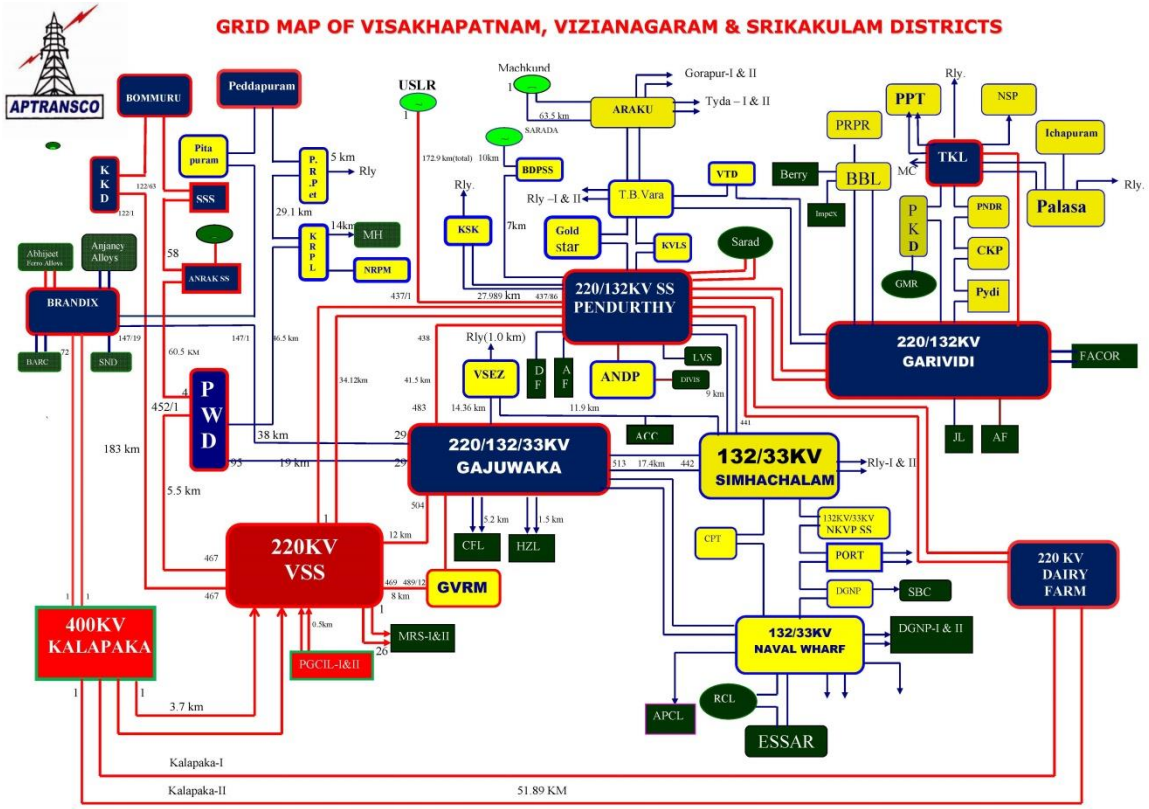


Figure 9-6:Grid Map of VMR districts

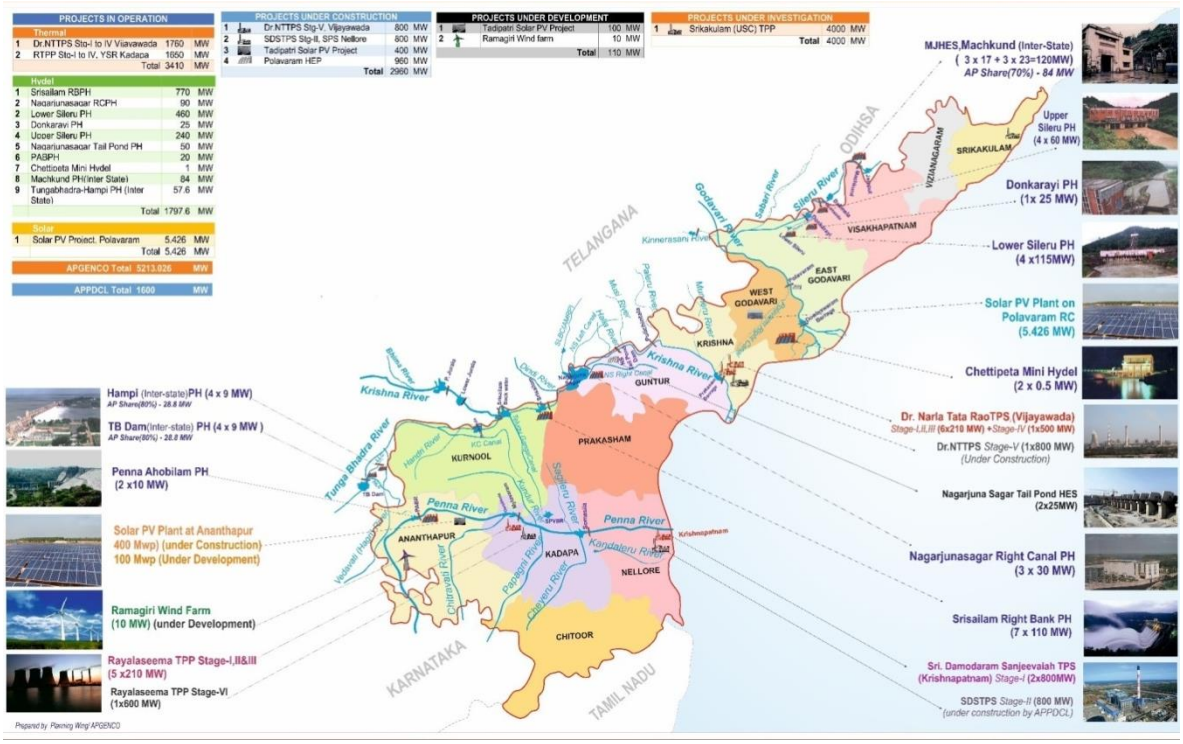


Figure 9-7: Location Map of APGENCO generating stations

9.5 EDUCATIONAL FACILITIES

Education and literacy plays a vital role in development of socio-economic status of the region. Increase in literacy rates enhances both the economic and social indicators. As discussed (Ref section.4.4) Literacy rate of VMRDA area is below the State Average and national average. However, literacy levels of Visakhapatnam is nearly equal to State average while other districts in VMRDA area are below the average state literacy rate

Elementary educational facilities are higher in Vizianagaram district followed by Visakhapatnam district. Amongst the Urban areas GVMC(299) has higher facilities while Nellimarla has the least(31).As far as Rural mandals are considered Vizianagaram mandal have overwhelming school facility accounting for 449 schools.

Elementary educational facility is deficit in all urban areas whereas secondary educational facility is surplus excluding GVMC. GVMC despite of having higher number of infrastructure facilities compared to other urban areas does not cater to the need of the population present in the jurisdiction. Therefore higher demand is observed in GVMC for both primary and secondary school as well.In contrast with GVMC, all the rural mandals has surplus school education facilities in Visakhapatnam district excluding Payakaraopeta mandal which has a demand of 11 primary schools. Anakapalle has more number of primary as well as senior secondary school with senior secondary exceeding primary school. This implies that inadequacy encountered in GVMC is expected to be partially met with the surplus educational facilities in Anakapalle mandal as this mandal is bordering GVMCjurisdiction and Anakapalle urban forms a part of GVMCas well.Amongst the two districts, Vizianagaram district has sufficient facilities.

Table 9-13 Need Assessment for school facilities in Urban VMRDA

District Name	Sub District Name	Primary School			Senior Secondary School			School For Disabled		
		E*	D**	G***	E	D	G	E	D	G
Vizianagaram	Vizianagaram (Municipal Corporation)	89	148	-59	112	37	75	1	5	-4
	Nellimarla (Nagar Panchayat)	13	12	1	18	3	15	0	0	0
Visakhapatnam District	Gvmc	138	1130	-992	161	282	-121	1	41	-40
	Yelamanchili (Municipality)	15	18	-3	29	4	25	0	0	0

*Source for Existing facilities: Town Directory, Census of India (2011), *Existing, **Demand & ***Gap. Demand and Gap are estimated wrt URDPFI Guidelines. Negative (-) values indicates gaps while positive value indicates surplus*
Note: Classification of Pre Primary and Primary has been taken under single category of Primary school

Higher Education

Higher education facilities are distributed across the districts of VMRDA area with among which Vizianagaram district has greater share of colleges (67), medical colleges(4), other professional colleges(38) and nursing institutes (7) while Visakhapatnam has more number of Engineering colleges (19) and Technical education category(A) (49) Concentration of higher education facilities are seen more in the urban centers.

GVMC has adequate degree college, but fails to meet the demand of all other higher order educational facilities. Requirement for medical college and Engineering college prevails in Vizianagaram Municipal Corporation.Vizianagaram Municipal Corporation is over served with colleges and Technical education centre (A). (Table 9-14). Anakapalle followed by Bheemunipatnam and Anandapuram has better concentration of facilities which is in contrast with GVMC as discussed in These mandals has

relatively lesser constraint for land both in terms of cost and availability apart from that it has good connectivity to the city these factors prompts the establishment of higher education facilities here. It is observed that most of the rural mandals of Visakhapatnam district has requirement for Technical education centre.

Most of the rural mandals has higher order educational facilities in the district headquarters. Facilities in the mandal headquarters does not cater to the requirement.

Table 9-14 Higher order Educational Facilities

Sub District Name	College			Technical education centre (A)			Engineering college			Medical college			Other Professional colleges		
	E	D	G	E	D	G	E	D	G	E	D	G	E	D	G
Vizianagaram (Municipal Corporation)	13	1	12	23	4	19	1	2	-1	0	2	-2	2	2	0
Nellimarla (Nagar Panchayat)	2	0	2	0	0	0	0	0	0	1	0	1	0	0	0
GVMC	17	15	2	27	37	-10	7	18	-11	1	18	-17	4	18	-14
Yelamanchili (Municipality)	3	0	3	6	0	6	0	0	0	0	0	0	0	0	0

*Source for Existing facilities: Town Directory, Census of India (2011), *Existing, **Demand & ***Gap. Demand and Gap are estimated wrt URDPFI Guidelines Negative (-) values indicate gaps while positive value indicates surplus.*
Note: Classification of Technical Education centre (A) and Technical Education centre (B) has been taken under single category of Technical Education centre (A).

9.6 HEALTH FACILITIES

The available health related facilities may not be able to cater to this ever increasing population. So it is very important to assess the exiting scenario so that it will not adversely affect the development of these areas. When compared to the urban areas, rural areas of VMRDA have shortage in terms of health care facilities.

Distribution of Healthcare Facilities

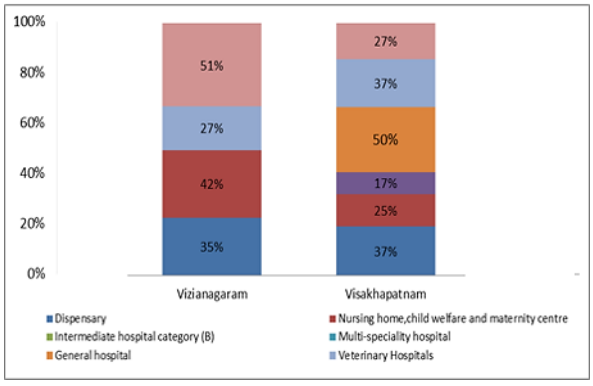


Figure 9-8: Health facilities in VMR

Visakhapatnam district followed by Vizianagaram district shares good proportionality of Health care infrastructure which majorly constitutes of Dispensary and Nursing home facilities. The project area as a whole lacks multi-specialty and specialty hospitals.

As any typical urban center has better infrastructure facility, the health care facilities are also concentrated in urban centers like the educational facilities as discussed in previous section. Though the Urban centers in VMRDA have surplus dispensaries, they face insufficiency in higher order health care facilities.Lower level of health care facility like dispensary is catering to the need of the population whereas higher order facilities lacks in the rural mandals of Vizianagaram district.Nursing home has more requirements in comparison with the other categories in Visakhapatnam district.

Table 9-15 Health Facilities in ULBs

Sub District Name	Dispensary			Nursing Home			Veterinary Hospital		
	E*	D**	G***	E	D	G	E	D	G
Vizianagaram (M + OG)	170	17	153	3	5	-2	1	1	0
Nellimarla (CT)	10	2	8	0	1	-1	1	1	0
GVMC	205	126	79	3	38	-35	3	4	-1
Yelamanchili (CT)	10	3	7	0	1	-1	1	1	0

*Source for Existing facilities: SLAP, *Existing, **Demand & ***Gap. Demand and Gap are estimated wrt URDPFI GuidelinesNegative (-) values indicate gaps while positive value indicates surplus*
Note: Classification of Dispensary and Polyclinic has been taken under single category of Dispensary.

9.7 OTHERS

VMRDA area which is currently experiencing changing demographic characteristics with rapid urbanization ought to have good network of Socio Cultural facilities in the region to carter to the needs of the growing population. Regions with urban characteristics have few socio cultural facilities but still it does not meet the demand in the project area Most of the rural areas are devoid of these facilities.

Socio Cultural Facilities

In VMRDA area Socio cultural facilities are more in Visakhapatnam followed by Vizianagaram district. There is a need for the properly planned distribution of these facilities due to the improper spread of facilities in the project region.

Anakapalle mandal of Visakhapatnam district has more number of Anganwadi and Library while cinema halls are more in Vizianagaram mandal.

Safety Management Facilities

Safety management plays a prime role in protection during the times of unforeseen mishaps happening in the region. This makes it necessary to have essential social infrastructure facilities to be prepared for any calamities.The history of disasters in project areashows that the project area is susceptible to such hazards and calamities. In order to know the existing scenario Fire safety measures in the project area are assessed.

VMRDA area has 11 fire stations and 2 fire outposts. More number of fire station is located in Visakhaptnam district (7-fire station and 1 Fire outposts) followed by Vizanagaram (4-fire station and 1 Fire out posts) has the least number of fire stations.Fire station should be located such that the Fire tenders are able to reach any disaster site within 3-5 minutes. URDPFI norms on safety facilities state that one Fire station can serve for an area of 5-7km radius and Fire post can serve an area of 3-4 km radius around the location of this facility. Assessment based on these guidelines reveals that existing fire infrastructure present in the VMRDA area is insufficient. Deficit of this facility is more in mandals of Vizianagaram district followed by Visakhapatnam district. Fire services are comparatively more in urban centers of GVMC.

Distribution Services

Visakhapatnam has higher share of fuel distribution services among the districts in project.Anakapalle has more number of filling stations. This is due to the large scale mining taking place in Bowluvvada near Anakapalle and the large network of roads in the region which promotes movements of vehicle and transferring of goods.

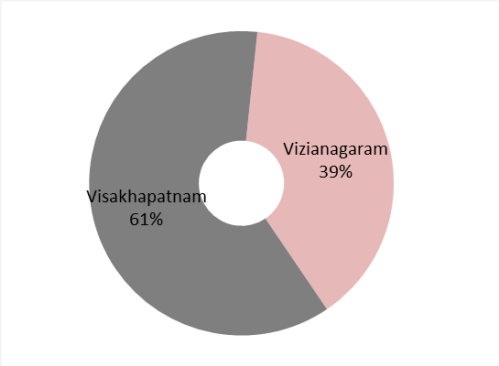


Figure 9-9: Fuel Distribution Services in VMR

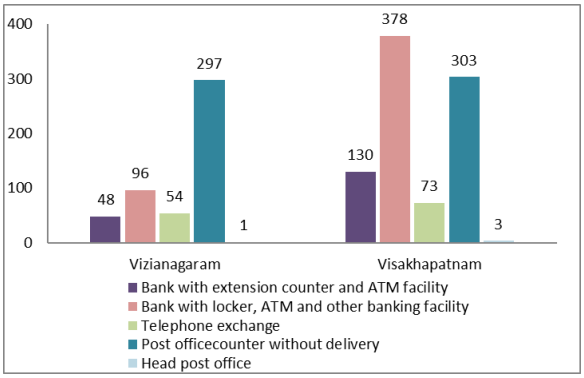


Figure 9-10: Miscellaneous Facilities in VMR

Miscellaneous Facilities

Other social infrastructure facilities play a vital role with advancement in technology. Post and telegraph being the most popular means of communication and other facilities like banks are assessed in this section

In VMRDA region paucity is more in Bank with extension counter and ATM facility followed by the basic postal infrastructure facility

9.8 CONCLUSION

High urbanization is envisaged in VMRDA region in the coming years, which demands for better infrastructure for the future population. In a global city, people will be aspiring for a better quality of life with adequate amenities and infrastructure. Rapid increase in population is going to put pressure on the supply management. This can be tackled with sustainable strategies with planned actions. So that in the future it is not an unforeseen situation which becomes extremely difficult to handle.

10 KEY STRATEGIC SPATIAL DEVELOPMENT CHALLENGES AND OPPORTUNITIES

Strengths

Located on east coast with two ports in VMR and good connectivity to hinterland ports.

Good Global and Trunk Connectivity

Established Industrial Base

Educational Hub

Fin-Tech Valley

Natural Environment and Resources

Recent Projects and Dynamics

VCIC, Smart City, VK-PCPIR

Challenges

Lack of Physical Infrastructure

Inadequate connectivity to rural area

Unplanned Urban Sprawl

Poor Air Quality

Natural Environment and Resources

Natural Disaster

Inadequate Port Logistics

Occupational Shift

10.1 KEY CHALLENGES:

Environmental: The VMRDA region is spread across two coastal districts with a vast coastline, having Bay of Bengal on the east and nestled with Eastern Ghats on the west side of the region. The region is naturally set with many environmentally sensitive areas like forests, hills, water bodies, Coastal Regulatory Zones, etc. The region is sensitive to various environmental natural hazards like floods, storm surges, cyclones due to various manmade and natural interventions. The region covers of about 170.8 Kms coastline, out of the total 974 Kms in Andhra Pradesh which is one of the most effected states on the east coast during cyclones.

Inadequate Basic Infrastructure: The Data analysis of basic infrastructure availability in VMR within urban segments indicates that the water supply coverage is inadequate, sewerage connectivity is low and solid waste collection is satisfactory. It is suggested that, key to any healthy urban economy is availability of quality basic infrastructure in an inclusive manner.

Unplanned and Fragmented Urbanism: Share of Urban population in VMR is close to 50%. Activity of Urban sprawl with inadequate road network and public transit is prevailing on peripheral areas of the mother city and satellite towns in VMR. The current share of public transport is less than 20% in Visakhapatnam city. Due to natural geography of VMR and unplanned approach to urban development, the urban form of cities and towns is highly fragmented. This Fragmentation and sprawl, especially in Metropolitan city of Visakhapatnam, has implication on providing quality urban and transportation services.

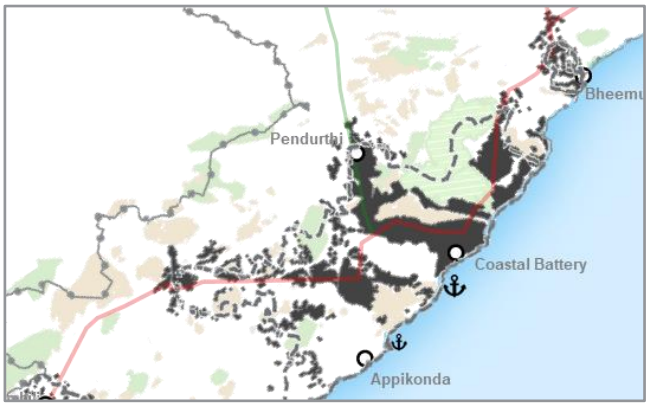
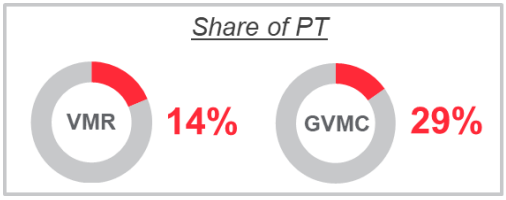


Figure 10-1: Settlement spread of Visakhapatnam



Lack of Transport Connectivity within and between the Metropolitan City and Regional and Sub-Regional Centers: The share of public transit in GVMC area is less 20%, which is below standards of 50% for similar cities. There is inadequate economic vibrancy in the regional centers of VMR due to lack of adequate and quality transport connectivity between the Metropolitan City and Regional Centers. The level of public transit infrastructure too is weak within the regional centers.

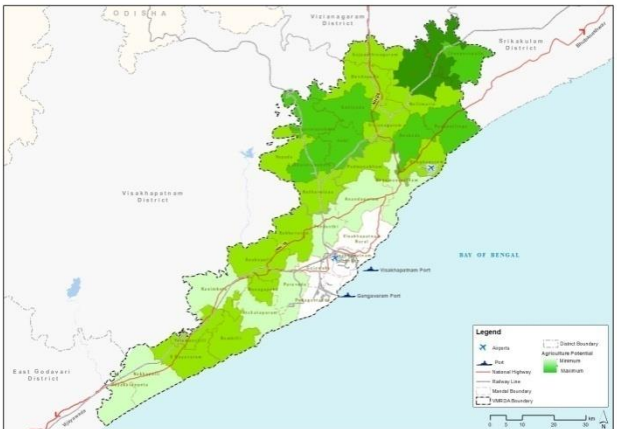


Figure 10-2: Potential agriculture land, 2018

Protecting Agriculture Lands: VMRDA region has vast areas under agriculture practices in the rural areas which are very fertile lands. Measures and regulations should be adopted to ensure in minimizing the conversion of these fertile agriculture lands into other land uses due to the rapid urbanization in the region. This Agriculture land is of high yielding capacity which produces up to two to three crops per year. The current average density in municipal areas in VMR is around 32 pph which is very low urban density, indicating presence of urban sprawl. Protecting agriculture in the light of prevailing urban sprawl and spread of approved layouts is a challenge.

10.2 KEY OPPORTUNITIES

10.2.1 CONNECTIVITY AND LOGISTICS

VMRDA has a well-connected road network with more than 3,055 kms of road length and the National Highway 16 acts as the main spine along the entire region. There is about 300 Kms of Railway network in the region, the Indian railways connect people from various cities and towns from within and outside the VMR. The proposed metro corridor in the city creates a huge impact on the current real estate and promotes new development all along the corridors. The proposed International Airport at Bhogapuram area. The Greenfield International Airport at Bhogapuram provides the opportunity to the citizens of the region to connect with different parts of the country and the world.

The region provides an opportunity to expand existing ports with an extended coastal stretch. Connectivity between the ports and hinterland with good logistic infrastructure plays a major role in industrial growth. The VCIC and VKPCPIR corridor which starts from Visakhapatnam to Kakinada paves a way for stimulating industrial development all along the corridor.

10.2.2 LAND AVAILABILITY

Large portions of land are available in the region which can be developed in a planned manner by land pooling and developing the necessary infrastructure. The land parcels available in the southern part of the region from Visakhapatnam towards Yelamanchili and Nakkapalli can boost development of industrial establishments with the influence of VCIC and VK PCPIR, also utilizing the significantly vacant lands in APIIC. The northern parts of the region are rich agriculture lands with high yielding capacities which should be conserved from urbanization and promote agro based industries nearby.

10.2.3 TOURISM

The picturesque landscape and the fascinating beaches all along the region have a huge potential to attract a large tourist footfall and boost local economies. Along with the natural features, there are many historic and religious places which are present in the region that invites religious tourism. The newly developing health city in Arilova of Visakhapatnam caters to the medical needs of the surrounding states for medical tourism.

11 BENCHMARKING OF SIMILAR METROPOLIS

11.1 MUMBAI

- **Area and Population:** 4,355 sq. km., comprising of three districts (i.e. Greater Mumbai, Thane and Raigarh) with a population of 22 Million in 8 Municipal Corporations.
- **Geographical Features:** The region has an extended coastline of 170.8kms with the Arabian Sea and has a setting of many natural hillocks.
- **Core city Extent:** 438 Sq.Kms with 12.4 Million Population.
- **Density:** Population within the MMR is mostly concentrated in the dense Municipal Corporation areas. The average gross population density within MMR has increased substantially from 3,421 persons/sq km in 1991 to 5,361 persons/sq km in 2011
- **EconomicBase:** Major economy for region is through Entertainment, Fashion, Commercial and Industries. The Net District Domestic Product (NDDP) of MMR districts is primarily generated by the tertiary sector which contributes 70.67% and the secondary sector at 28.05% with a minor contribution from the primary sector at 1.29% as on 2014.

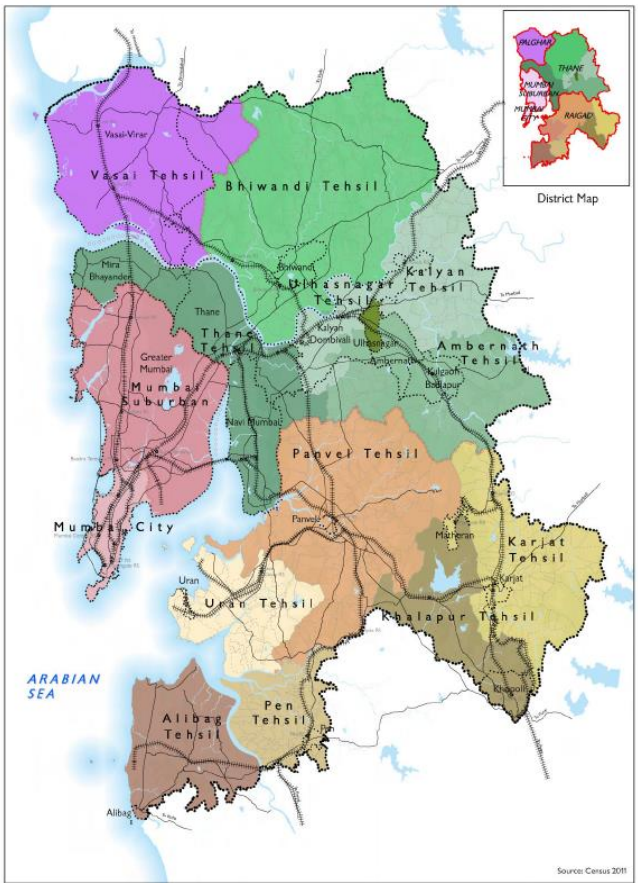


Figure -11-1 Mumbai Metropolitan region map

- **Urban Structure & Form:** A polycentric structure and increasing satellite cities have increased due to shortage of land and deteriorating living conditions in the urban centers. Most of the urbanization is observed beyond Greater Mumbai mainly in Navi Mumbai, thane and along Manori Creeks. There are large urban cores that are formed in the outskirts of the axial growth corridors such as Mira-Bhayandar, Bhiwandi and Panvel. Current growth trends for MMR indicate that there is a decline in the growth rate for the region. This scenario gives a choice to the growing population to either live in the denser conditions in the cities in MMR or in the peripheries of these cities.
- **Sustainable Urban Transport and Logistic Infrastructure:**
  - The length of metro network for the horizon year 2016 and 2021 is 228 km and 318 km respectively, which further expands to 435 km by 2031.
  - Total length of suburban rail network is approximately 248 km which is the most used transportation system in the region. This constitutes to about 37% of total trips in the region.
  - The highway network, which includes higher order transport network (fully access controlled) and arterial corridors for the horizon year 2016 and 2021, is 982 km and 1,229 km respectively.

- Along some of these corridors, Exclusive Bus Lanes (EBL) have been proposed for the horizon years where the travel demands on parallel metro corridors were insufficient to justify investments in a metro line for the time horizons being considered. The approximate length of EBL network proposed by 2016, 2021 and 2031 is 165 km, 112 km and 79 km respectively.

- Key Takeaways for VMRDA Perspective Plan
  - MMRDA covers all existing issues in different sectors like infrastructure, Housing, Transportation, Environment, etc. The uncontrolled growth is addressed by allocating adequate space for new and upcoming development like Navi Mumbai.
  - Recommendations from the City Transportation Study are taken into consideration for better integration of transportation with the overall plan. VMRDA can also integrate the CTS for a holistic plan preparation.
  - MMRDA has identified a large part of the MMR as Green and Forest Zones in order to conserve Agriculture and forest lands within the region. VMRDA too can consider the same in identifying the predominantly agriculture land as green areas and controlling any new development.
  - With the current infrastructure struggling to cater to the growing population, new developments took place in MMRDA. VMRDA can avoid such issues by laying adequate infrastructure to all the newly developing areas beforehand forecasting the future demand.

11.2 CHENNAI

- **Area and population:** Chennai Metropolitan Area extends over 1,189 Sq.kms. includes Chennai City Corporation area, 8 Municipalities, 11 Town Panchayats and 179 villages comprised in 10 Panchayat Unions.
- **Core city Extent:**176Sq.km area consists of 155 divisions within 10 zones with 46.81 lakh population.
- **Geographical Features:** Chennai city has a total coast length of about 19 km, which now has more than doubled with the expanded Corporation limits. The Chennai beach is the second longest urban beach in the world.
- **Economic base:** Informal sector, Fisheries, Automobile, Tourism, Medical tourism and Industries.
- **Migration:** Chennai is a city of migrants like any other metropolitan city in India. According to 2001 Census, migrants to Chennai City from other parts of Tamil Nadu State constitute 74.5 %.
- **Urban structure and form of CMDA:** Chennai is divided into four broad regions: The North, Central, South and West. North Chennai is primarily an industrial area. South Chennai and West Chennai, previously mostly residential, are fast becoming into commercial and mixed use, while the Central part of Chennai is home to a growing number of information technology firms, financial companies and call centres, which are invariably multinational. The city is expanding quickly along the Old Mahabalipuram Road and Grand Southern Trunk Road (GST Road) in the south and towards Ambattur, Koyambedu and Sriperumbudur in the west.

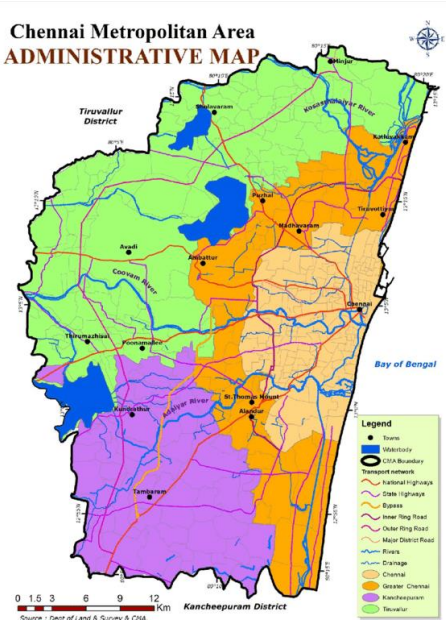


Figure -11-2Chennai Metropolitan

- **Sustainable urban transport and logistics infrastructure in CMDA region**:
  - Chennai has one of the best Bus route network in the country with Bus Monitoring and Passenger information system supported by Electronic Ticket management.
  - Among the city infrastructures, Tele-Communications, Banking, Health Care, Waste Management, Shopping, Cinema and Entertainment, Tourism and Hospitality, and Recreational are the major developed Infrastructure facilities in CMDA region in recent years.
- Key Takeaways for VMRDA Perspective Planning
  - Chennai port is one of the largest ports in India along Bay of Bengal and is one of the key economic growth factor for the region. It is one of the preferred ports for trade, due to its location, proximity to industries, competitive pricing. VMRDA has two major ports at Visakhapatnam and Gangavaram, which can easily emerge as the leading port in the eastern coast using its locational advantage which can cater to most parts of central India.
  - Though being a coastal city, Chennai has seen one of the worst floods in recent years. This is because of poor urban management and not removing encroachments. Majority of the lakes have been encroached and the natural flow of drainage has been blocked. VMRDA also needs take necessary actions to prevent encroachments on natural water bodies and allow free flow of drainage to avoid any future occurrences of such man-made disasters.
  - Chennai has one of the best urban public transport networks in the country with Buses, Metro, sub urban rails and IPT. Chennai's MTC has even introduced Midi Buses to serve as feeder services for parts of the city which are not accessible by larger vehicles. VMR already has a good network of public transport which can be enhanced with the upcoming metro.

11.3 BARCELONA

- **Area and Population:**The Area Metropolitana de Barcelona Metropolitan Region is the sixth most populous urban area in the European Union after Paris, London, Ruhr area, Madrid and Milan with a population of 5.3 Million in a city region of 4268 Sq.Kms. The city extent is limited to 101 Sq.Kms with a population of 1.5 Million.

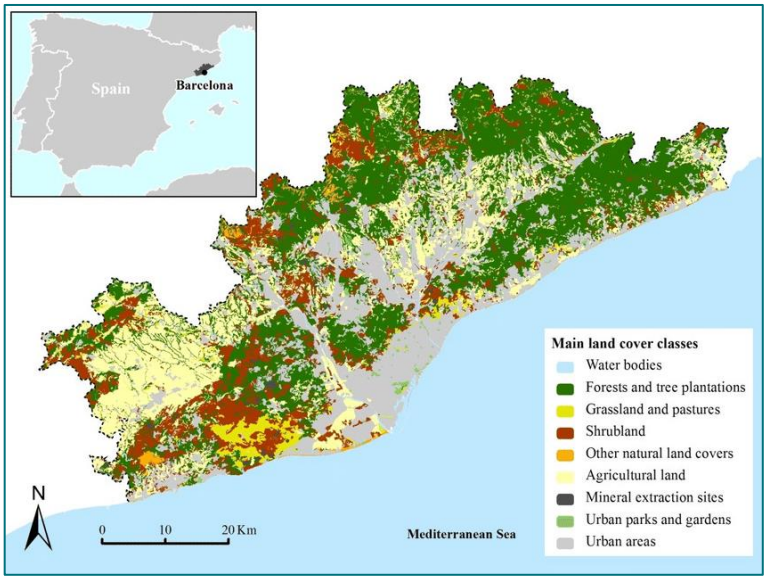


Figure 11-3: Barcelona Metropolitan Region

- **Geographical Features**: Barcelona is located on the Northeastern part of Spain in Calatlonia facing the Mediterranean Sea on a plain limited by the Collserola mountain range, LLobregat and Besos rivers in the north.
- **Density:** The average population density within the city limits is comparatively very high with about 16000 persons per Sq.Km making it one of the densest cities in Europe.

- **Economic Base:**with almost 66% of the people of Catalonia living in the Metropolitan area of Barcelona, the GDP per capita is amounting to €28,400. The region's main economic production comes from the tertiary sector which includes retail and commerce, businesses, tourism, etc. and supported by light/heavy industry and the construction sector.

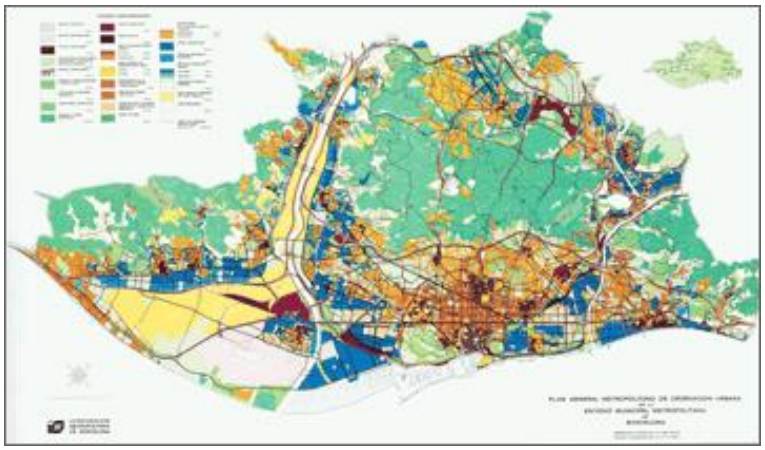


Figure 11-4: General Plan for Barcelona Metropolitan Area

- **Urban Structure and Form:**
  - Barcelona's urban area continues along the Mediterranean coast to the southwest into the comarca of Baix Llobregat, which includes the international airport. To the northwest the urbanization continues along the coast for some distance into the comarca of Maresme. The urbanization then surrounds Tibidabo Mountain behind the city along freeway routes on either side.
  - Much of the most recent growth has been relatively unusual for large Spanish urban areas, which have largely experienced high density expansion, with multi-family buildings, even in the suburbs. However, considerable detached housing has been built in the Barcelona metropolitan area over the past decade.
  - The core city area has a regular grid and easily navigable. There are multiple routes to any destination and regularly spaced choices with its short blocks and orthogonal streets, encourages walking, mixing, and vibrant street life.
- **Sustainable urban transport and logistics infrastructure in CMDA region**

  Public transportation is provided by buses, subways, and surface railways. There are also cable cars. Freeways link Barcelona to the Catalonia highway network, which joins the service up to the Cadí mountain tunnel in the Pyrenees, providing access to the French highway network. The metro rail transports half a billion passengers per year on 12 lines with almost 160 stops. The city bus network operated by Transports Metropolitans de Barcelona covers more than 100 lines reaching almost every corner of the city. There are two independent tram networks in the city with 6 tram lines running on almost 30 Kms of rail network. The integration of Tram, metro, city buses, commuter rail offers a good and modern urban transport system to the citizens.
- Key Takeaways for VMRDA Perspective Planning
  - Multimodal Public Transport: The Barcelona city has an extensive public transport network that allows people to get anywhere within the city in no time. Along with the metro, buses and trams running frequently, there are other transport systems like cable cars, funiculars, railways, sightseeing buses etc. that run in the city. VMRDA can take inspiration from Barcelona to provide more choices of public transport, for the people and also help in decongestion.
  - Infrastructure development: With Barcelona's minimal sprawl development and high density compact development reduces the cost of providing and extending new investments in infrastructure and also makes transportation operation and maintenance, water and sanitation, and energy distribution systems less expensive. VMRDA has dense urban areas can follow Barcelona's example by retrofitting the existing urban infrastructure to accommodate for future needs and making the cities more compact and efficient.

- Urban Design Guidelines: Barcelona has one of the best streets to walk to almost everywhere. The city's streets cater 50% of the space to walking alone and the remaining 50% to other modes of transport. The introduction of the new superblock further aims to give more street space to the public. VMRDA can also encourage more pedestrian friendly streets in dense urban areas with the introduction of new guidelines and regulations.

11.4 BRASILIA

- **Area and Population:** 5,81,400 ha with a population of 2.8 Million
- **Vision:**
  - Planned and developed by Lúcio Costa and Oscar Niemeyer in 1956 to move the capital from Rio de Janeiro to a more central location
  - To relieve the pressure of overpopulation from the old capital Rio de Janeiro
  - To create a renewed sense of national pride and well-planned modern 21st century city
  - *"Idea is to build a new capital to bring progress to the interior of Brazil"* – Oscar Neimeyer
- **Planner Lucio Costa's Vision**
  - Well-ventilated residences near green spaces
  - Separation of residences from workplaces, with industries excluded from the city proper
  - Exclusive space for cultural activities, near residencies
  - Separation of the circulation of vehicles and pedestrians
- Brasília was built in 41 months, from 1956 to April 21, 1960, when it was officially inaugurated
- City's pilot plan (Plano Piloto) resembles the shape of an airplane; often seen as a bird with open wings
- **Pilot Plan & Design Approach**
  - City was designed in four scales of design:
    - Monumental scale
    - Residential scale
    - Gregarious (or social) scale, and
    - Bucolic scale

Figure 11-5: Location map of Brasilia

Table 11-1: Brasilia – Key Facts

BRASILIA – KEY FACTS	
Parameter	**Details**
Area (ha)	**5,81,400**
Founded	**April 21, 1960**
Architect & Urban Planner	**Lúcio Costa & Oscar Niemeyer**
Key Economic Activity	**Services, Construction, Food Processing & Furniture**
Previous Capital	**Rio De Janeiro**

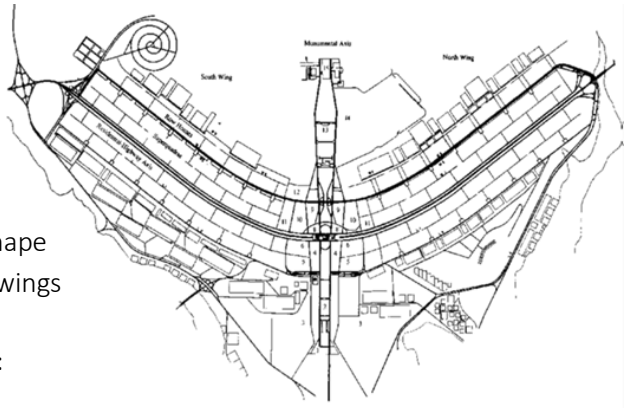


Figure 11-6: Brasilia City Urban Structure

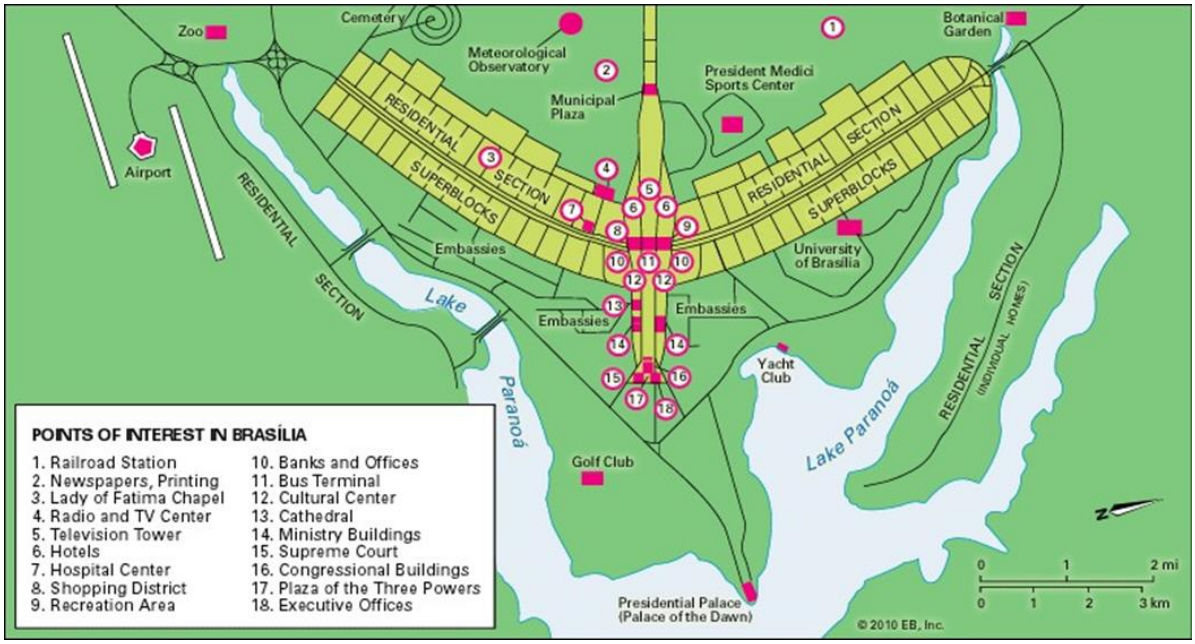


Figure 11-7: Brasilia Plan

Implementation Roadmap / Progress		
1956	Development of Trunk Infrastructure	• Creation of NOVACAP (Company to Urbanize the New Capitalof Brazil) • Initiation of base infrastructure work – including Paranoa Dam to create artificial lake & provision of electrical energy • Setting of water and sewage system • Transportation network to link the new capital city with rest of the nation and especially with the industrial districts • Entry of migrant labour, setting up of slums and development of unorganized construction camps leading to rise in low-income population
1957 – 1961		• Lucio Costa's Masterplan adopted in 1957 • Infrastructure work on full pace • Development of main buildings such as the Congress &the Ministries, Bus Station, bulk of the highway system, superblocks, etc. • Lack of public utilities, prevalent of construction camps and lack of lower income housing
1960 – 1967	Focus of Residential Housing	• Plotted housing (for high-income groups) – ministers, judges and businessmen • Development of housing for mid- income and low-income groups • Illegal towns and settlements legalized
1967 Onwards	Commercial Centre	• Development of City Centre • Government Buildings, Commercial& Retail • Commencement of work on Railway Line

Key Learnings & Considerations – Brasilia		
Parameter	**Key Learning**	**Key Consideration**
Rehabilitation and Resettlement	Massive construction activity led to the rise in migratory labor workforce which further led to formation of slums & unorganized clusters – posed a major challenge at later stages	Essential to have effective measures in place in order to address rehabilitation and settlement of people post land acquisition and rampant construction activity across the Bhogapuram and surrounding zone.
Lack of Social Infrastructure	Retail outlets, affordable schools, health care and entertainment projects are yet to witness completion.	Priority to establish commercial centers, retail malls, markets, education and healthcare facilities to drive population influx to the Bhogapuram and surrounding zone.
Inadequate Housing	Initial phases lacked development residential housing and accommodation – reflective from construction of luxury hotel in initial period (posed serious pressure on the Federal Government to develop housing in Brasilia)	Priority to establish housing for all-income groups in a phased-manner – high-end, mid-end and labour housing to cater to all sections of the society
Lack of Public Utilities	Post inauguration of the new capital of Brasilia, the city lacked basic utilities and witnessed frequent blackouts; further few areas witnessed lack of civic amenities& facilities	Priority to develop the complete eco-system with core infrastructure, transport infrastructure and all basic utilities – power, water, sewage, telecom, gas, etc.
Lack of Economic Activity	Need for employment generation opportunities ~ CBD expected to be developed soon (limited population inflow at Brasilia in the initial phases)	While focus may be development of trunk infrastructure and housing, it is essential to concentrate efforts to establish the commercial, economic and trade centers of the city to be able to attract people to the city

11.5 ROTTERDAM MARITIME CLUSTER

- Rotterdam known as the 'Gate way of Europe' has one of the most competitive and successful maritime clusters in the global market
- Rotterdam Port is ranked 9th in the world and 1st in Europe in terms of total cargo handled during the year 2015 (approx. 466 Mn tons).

- Presence of Renowned Knowledge Institutions viz. Erasmus University Rotterdam, MARIN has imparted requisite technical skill sets and promoted innovation at maritime cluster through close educational institution -industry partnerships
- Rotterdam serves as a leading business location for companies in ship management, ship finance, maritime insurance and risk, maritime law and commodity trading
- Key Maritime Sectors in Rotterdam
    - Shipping
    - Ship Building
    - Off Shore Services
    - Maritime Services
    - Hydraulic Engineering
    - Port and Logistics
    - Maritime Supply Industries

Figure 11-8: Rotterdam location map

Rotterdam Maritme Cluster	
Industry	**Key Players**
Shipping	MAERSK LINE, MOL, NYK LINE
Ship Building	DAMEN, IHC MERWEDE, Keppel Verolme
Off Shore Servies	Allseas, HEEREMA, FUGRO
Maritime Services	ABN·AMRO, ING, Allianz

- **KEY SUCCESS FACTORS**
- Competitive and complete maritime cluster ~ offers complete maritime activities viz. shipping, cargo handling and storage to ship repair, shipbuilding, offshore industry, hydraulic engineering and maritime equipment suppliers and maritime service providers
- Flexible tax regime ~ government offers the shipping companies established in the region to choose the method of taxation viz. fixed tax amount based on tonnagehandled, taxation based on profits achieved during the year
- Focus on Innovation ~ Support from municipality, port of Rotterdam and Rotterdam partners have resulted in establishment of numerous incubation centers viz. Cambridge Innovation center, ECE etc. which has charted innovation on a global map in the region

- Highly developed Port Operations ~ With a draft depth of 24 m and no locks, the port is accessible 24/7 and handles the largest sea-going vessels
- Presence of competitive and complete maritime cluster and exceptional innovation ecosystem has created excellent business opportunity in the region.

PART 2: PERSPECTIVE PLAN, 2051

12 STAKEHOLDERS ENGAGEMENT AND OUTCOME

12.1 CONSULTATION METHODOLOGY

A participatory approach involving various stakeholders in preparation of perspective plan was adopted. Stakeholders were identified based on their influence in development of the region and were further grouped based on their homogeneity. Meetings were scheduled and conducted in all three districts. These consultations were conducted in three stages as follows:

- District Level Workshops
- Community Level Workshops
- Evolving Vision and Strategy

Perspectives of the various stakeholders owing to the development of the region were recorded. The obtained suggestions is carefully analysed and incorporated in plan preparation. The methodology is further elaborated in the chapter.

12.2 OUTCOMES OF CONSULTATION

Consultations in the three districts of VMRDA have been successfully conducted with stakeholders providing their values inputs on the way they want to develop their own areas. Receiving varied suggestions from diverse field of expertise, the Perspective Plan will bear an inclusive planning approach. The outcomes of consultation of each districts has been analysed to have an understanding of the preferences of the stakeholders. Aspirations of the stakeholders have also been noted as their key inputs.

The chapter presents the compilation of the suggestions received through consultation in a very comprehensive and usable manner. The Inputs have been categorised into five broad strategic parameters:

1. Strategic Spatial Development
2. Strategic Economic development
3. Managing Environment
4. Transportation System
5. Infrastructure System

12.2.1 STRATEGIC SPATIAL DEVELOPMENT

Housing Typology

The stakeholders mostly preferred group housing to apartment, gated community and individual plotted housing considering safety, security, and infrastructure facilities available in-group housings.

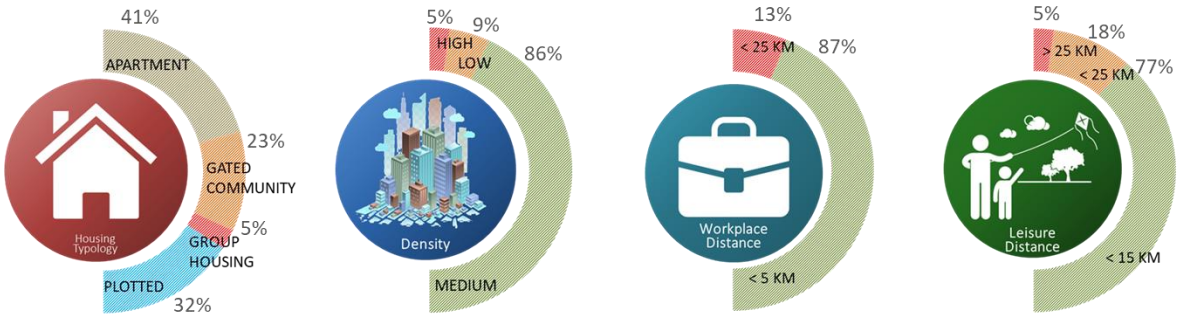
Built-Up density

The stakeholders preferred medium density housing in the region, which is a mix of high, medium and low housing situation. The mix is preferred to be homogenous.

Work place and Leisure distance

The suggestions given by the stakeholders suggest that they prefer to have a workplace distance of less than 5km and a leisure distance less than 15km to bigger trips less than 25km. The suggestions clearly state that they prefer a distributed and decentralised employment all over the VMRDA region.

Some other suggestions given by the stakeholders are as proposals for planned future expansion, action towards unauthorized development, inclusion of projects like Tada-Ichapuram Greenfield development, developing the Anakapalli, Visakhapatnam and Vizianagaram as a Tri-city with growth directions towards Yelamanchili, Payakaraopeta and also to develop residential townships around Anakapalli to facilitate nearby industries and their workers.



Growth Directions

The Urban Landuse components develop preferential attitudes towards selection of direction for growth. The suggestions and consultations which were made during the Stakeholder Engagement process define the vision for the growth direction for future prospects in the region.

Visakhapatnam has the most potential to grow in density as well as spread in the next two decades and stakeholders mostly preferred the growth towards Madhurawada and Anandapuram because of the trend direction towards Bhogapuram Airport region development. There were suggestions of industrial growth towards Lankelapalem and Educational Institutions towards Pendurthi and Kothavalasa.

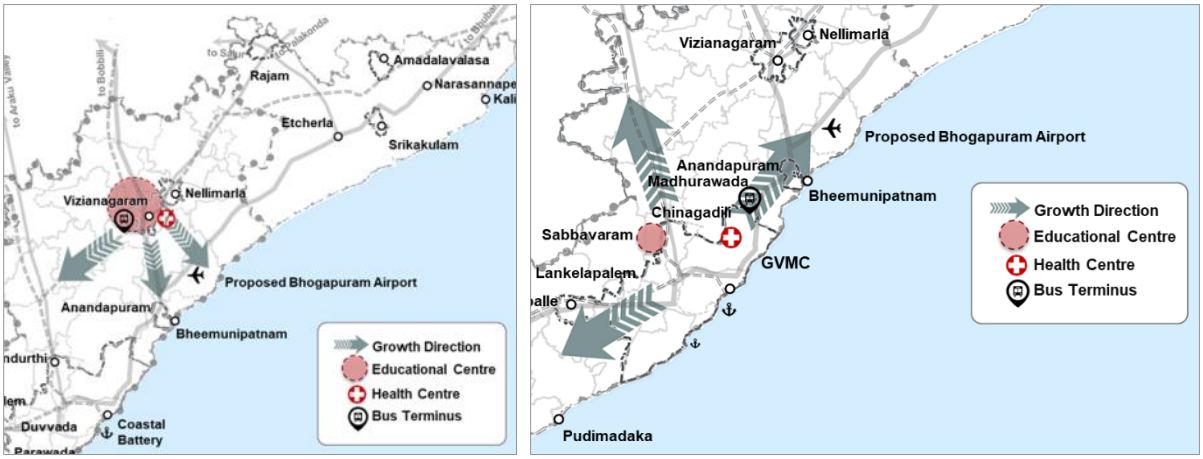


Figure 12-1 Preferred Growth Directions for Vizianagaram and Visakhapatnam

Vizianagaram has the potential to become the satellite town to Visakhapatnam along with growth towards Bhogapuram because of the upcoming airport and Bheemunipatnam because of the fisheries.

Urban Development

The proposed South Coast Railway Head Quarters adds many service buildings to the city which should be incorporated in the Perspective Plan. The existing vertical permissible heights should be reviewed awareness should be created about the same with focus on the airport surroundings. Newly proposed housing projects in Anakapalli, Duvvada, Dabbanda, Cheemalapalli etc. should be incorporated.

Rural Development

Stakeholder consultation has been carried out in revenue villages and fishing Villages to get the perception of the core village groups. The suggestions given by the stakeholders majorly involved the following:

- Creating access roads to villages and hamlets
- Development of physical and social infrastructure for fishing villages
- Protection of agriculture land and village boundaries
- Improving the quality of living in the villages to prevent migration

Figure 12-2: Requirements of rural community

12.2.2 STRATEGIC ECONOMIC DEVELOPMENT

Agriculture

Agriculture plays a major source of livelihood for about 40% of the population in the VMRDA region. The citizens' suggestions were that they do not want to continue agriculture because of its instability, would like to switch to other jobs in a different sector if provided with better opportunities. The agriculture lands are to be conserved from landuse changes.

The line departments suggested in promoting agriculture by providing skill development facilities, alternate sources and reservoirs for water supply for irrigation along with employment opportunities for the local population.

Fisheries

Andhra Pradesh being the leading producer of Fish and Prawns, it contributes about 40% of the total marine exports of India. Fisheries contribute to about 7.4% of the GSDP of Andhra Pradesh. The prominent suggestions for this sector is to increase infrastructure facilities, employment base allied industries, inclusion and proposal of new fishing harbours in areas like Etcherla, Kalingapatnam, Bheemili and Pudimadaka.

Industries

VMRDA region has turned into a major industrial center of South India in the past decade. The major industrial areas are distributed all over the area. The consultation has resulted in valuable suggestions like boosting new clean and green Industrial

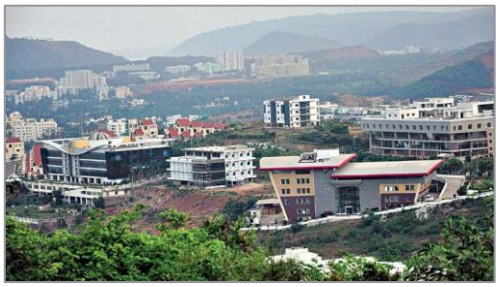
ventures, development of agro base industries and food processing industries which help the regions' agro market economy.

The line departments have also come up with suggestions like provision of appropriate buffer zones for industries following strict zoning regulations and not allowing any conversion from residential to industrial zones along with incorporation of new industrial areas in the perspective plan.

Port

The port of Visakhapatnam is one of the largest cargo handling ports of India. The stakeholders have suggested in tackling the industrial effluents and coal pollution by providing buffer zones. There is also need for developing the transportation network to reduce the vehicular traffic and reducing the congestion caused by the port region.

IT / ITeS



Visakhapatnam being an established IT hub and also with the Fintech valley, the city has already started development in Rushikonda to attract IT companies. The stakeholder consultation has suggestions like improving the existing infrastructure at Rushikonda along with public amenities, identifying new IT industry region for the future like Rajam.

Tourism

Tourism also plays a major role in generating revenue with many tourist destinations within the region. In addition to the huge national and international tourist footfall, there were suggestions for developing eco and wildlife tourism, beach tourism along the coast, heritage tourism circuit with many historic precincts in Visakhapatnam and Vizianagaram, religious tourism (Buddhist Circuit) and adventure tourism (Puspatirega) in and around the region.

12.2.3 MANAGING ENVIRONMENT AND HERITAGE

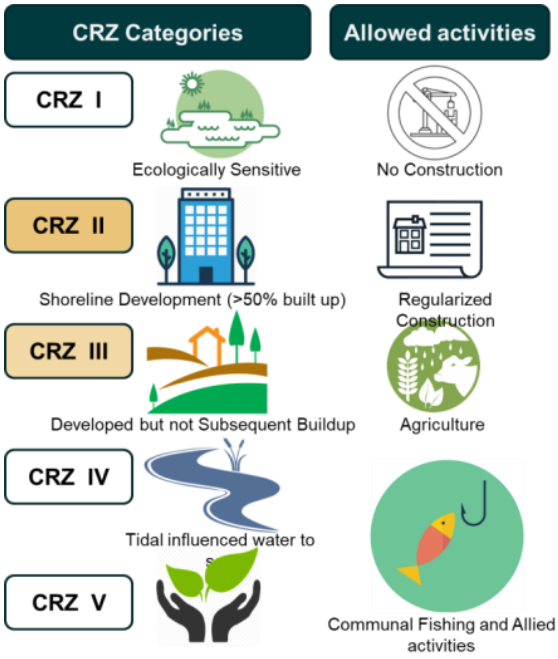
Water Bodies

The conservation of water bodies is an essential part of the region with its vast coastline of about 170.8 Kms, with many rivers and lakes present in the region. The stakeholders have suggested

- Conservation and developing riverfront development.
- Conservation and protection of major lakes and reservoirs like Pedda Cheruvu, Koneru Cheruvu, Tatipudi, Ayya Koneru, Meghadri Gedda, Mudasarlova Reservoir
- Protecting water bodies from getting contaminated by the nearby industries

Coastal Regulation Zone

Due to the increase of coastal erosion, the shore line has reached the village boundaries in some places. The stakeholders suggested preventing illegal encroachment in the coastal areas, changing the Coastal Regulatory Zone from Rushikonda to Bheemunipatnam from CRZ3 to CRZ2 along with installation of weather and environment monitoring stations at regular intervals.



Hills and Forests

Substantial part of the VMRDA region is covered under hills and forest which acts as the backbone for the ecological footprint of the region. The consultation with the stakeholders has resulted in suggestions such as making these ecological forests and buffer zones not permissible for construction, considering new techniques of afforestation along with identifying tourist ecological zones for camping, trekking, etc.

Heritage

Visakhapatnam is known as one of the main tourist destinations in the country. Apart from the famous beaches, caves, wildlife sanctuaries, there are many protected and preserved heritage sites in the VMRDA region. Stakeholders has come up with suggestions like preservation of heritage structures, Nagara Katakam, Dhanthapuri and Gara, conservation of old structures at thotlakonda, Pavuralakonda, Bavikonda, and other prominent buildings in the city like the Queen Mary's School, Old Dutch Cemetry, St. Aloysius School, etc. A Heritage Conservation Committee is to be set up in Visakhapatnam to restore old monuments.

12.2.4 TRANSPORTATION SYSTEM

Transportation and Logistics are one of the crucial sectors of growth in VMRDA with a major railway junction, National Highway-16 running all along the region and the Port. The stakeholders have given their views regarding this sector and how these various projects can be planned for future development.

The outer ring road is to be proposed for Vizianagaram considering the future development.

The internal roads with in the urban areas need to be widened to ease the traffic congestions and allow free flow of vehicles. Flyovers may be introduced to reduce the traffic congestions at Hanumanthuwaka and Gajuwaka Junctions.

The Metro alignment which is already connecting from NAD Jn to Bhogapuram may be extended towards Ranasthalam to cater the employees of the industrial region. It may be extended all along the entire VMR coastline based on the future demand. A light rail transit system or an MMTS may be proposed to connect the other economic nodes like Anakapalli, Vizianagaram, Srikakulam, Aruku and Narsipatnam.

Parking laws should be strictly enforced in the region ensuring all commercial establishments like malls and retails stores to provide their own parking facilities. Provision of providing parking for trucks in Visakhapatnam and Vizianagaram may be considered to cater growing needs of imports and exports in the region.

The railway network will be strengthened with the development of Marripalem Station as the new terminal and other sub urban stations at Palasa, Vizianagaram, Rayagada and tourism terminal at Araku.

Relocation of Bus Stops at junctions and increasing bus depots and terminal to have wider public transport may be considered.

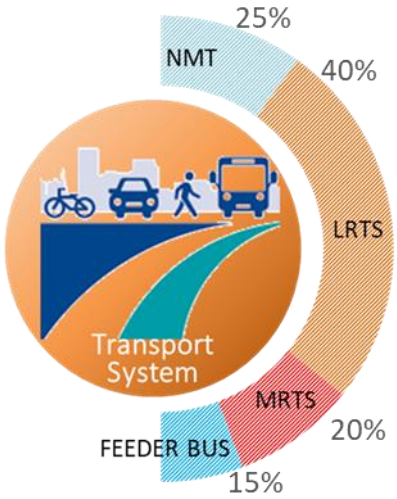
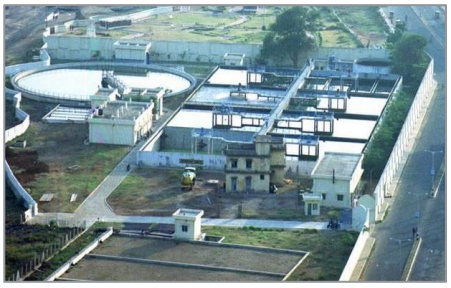


Figure 12-3: Preferred transportation system

12.2.5 INFRASTRUCTURE SYSTEM

Physical Infrastructure

Water Supply



The VMRDA region will attract a huge population in search of better liveability and provision of ample water supply is a key aspect of sustainable development. The stakeholders also expressed the need for showing urgency in improving the capacities in view of the current scenario and cater to the drinking water requirements of the region.

The water tanks should be preserved from encroachment and pollution and strict enforcement of not letting any drains contaminating these tanks. Rain water harvesting should be made taken into consideration.

Sewerage System

Except GVMC, no other ULBs have a drainage network or STPs. Implementation of such projects should be taken place in priority to improve the liveability of the region.

Power (Renewable / Non Renewable)

Andhra Pradesh is the second state in India to achieve 100% electricity. The stakeholders have suggested establishing power corridors for a seamless supply, initiating Green Energy, Energy Conservation, development of infrastructure for Electric Vehicles, installation of solar Panels on High-rise, Public and Government Buildings.

Social Infrastructure

Health

People from Visakhapatnam, Vizianagaram, and East Godavari come to KGH for all kinds of medical emergencies. Keeping this in view, the number of beds in KGH should be increased from 750 to 2000. The routes from the core city to the city centre should be decongested to help patients reach the hospital during emergencies.

New Medical Hub for Visakhapatnam is preferred towards Chinagadili. Suggestions from Vizianagaram are to have Hospitals along the bypass while has an established medical hub in the core city.

Education

Visakhapatnam has many established educational institutions along the fringe areas of Anandapuram and Sabbavaram. Many new educational institutes are expected to come and identifying land parcel for institutes of national and international importance and developing infrastructure beforehand for the future.

13 VISION AND SUSTAINABILITY FRAMEWORK, 2051

13.1 REGIONAL VISION

Visakhapatnam Metropolitan Region (VMR), the lead urban economic region in Andhra is in transition face due to its area expansion and shift in its current economic base is envisaged that VMR will play a greater economic role in globalizing the economy of Andhra Pradesh. The following sections illustrate the key issues and structuring of vision for VMR.

13.1.1 KEY ISSUES

Andhra and VMR, as a whole, had an average annual urban growth rate of 3.1% and 2.7% between 1971-2011 which is lower than the national average annual growth rate of 3.0% to 3.3% between 2011 and 2017. At the same time share of urban population in 2011 in Andhra (Bifurcated part of Andhra) was around 29.5% as against the share of urban population in Maharashtra was 45.2% and in Gujarat 42.6% in 2011. To achieve vibrant urban economy, cities are focus areas for any region and nation. Hence, Andhra's only option is to expand its urban economy and employment potential in towns and cities. VMR faces the same urban issues and agenda as Andhra as a whole, hence must take lead in putting Andhra on a sound urban economy in coming decades. To summarize the lead issues concerning VMR from Existing Situation Assessment of the region are as follows.

Sluggish Economy: The average annual growth rate in GDP of VMR was 5.9% as against 7.25% in Andhra and 8.01% at India Level. In VMR Industry Sector contribution to its GDP is 27.8%, Service Sector as 61.4%, and agriculture as 10.7%. Hence, expansion of industry and service sectors is critical to overall economic health of VMR and its contribution to the state as a whole.

Inadequate Basic Infrastructure: Based on the data analysis of basic infrastructure availability in VMR in urban segments indicate that water supply coverage is insufficient, sewerage connectivity is as 2.5% and solid waste collection is 99%. Key to any healthy urban economy is availability of quality basic infrastructure in an inclusive manner.

Unplanned and Fragmented Urbanism: Majority of population is the share of urban population in VMR. Urban sprawl with inadequate road network and public transit is prevailing features on periphery of the mother city and satellite towns in VMR. The current share of public transport is less than 20% in Visakhapatnam city. Due to natural geography of VMR and unplanned approach to urban development the urban form cities and towns is highly fragmented. Fragmented and sprawl, especially in mother city of Visakhapatnam, has implication on providing quality urban and transportation services.

Lack of Transport Connectivity within and between Mother City and Satellite Towns: The share of public transit in GVMC area is less 20%, which is way below standards of 50% for such cities. There is inadequate economic vibrancy in the satellite towns in VMR due to lack of adequate and quality transport connectivity between the mother city and satellites. Provision of public transit infrastructure too is weak within the satellite towns.

Protecting Agriculture Lands: Significant land in VMR is agriculture land, which is of high yield and is used for double to triple crops. The current average density in municipal areas in VMR is around 32 pph which is very low urban density, hence indicating presence of urban sprawl. Protecting agriculture in the light of prevailing urban sprawl and spread of approved layouts is a challenge.

13.1.2 KEY ASPIRATION OF STAKEHOLDERS

Extensive stakeholders' consultations were carried out in VMR involving citizens, government officials of various infrastructure agencies, NGOs, and political representatives. As part of the stakeholders' aspiration head of the state have been also articulating vision for Visakhapatnam post formation of Andhra after bifurcation. The summary of stakeholders' aspirations is given in Figure 6.4.

Top Development Priorities for VMR as a Whole: • Employment Opportunities • Protecting Agriculture Areas and Coastal Line. • Creating Skill Development Opportunities	Top Infrastructure Priorities for VMR as a Whole: • Safe Drinking Water • Better Sanitation Facilities • Improved Road Conditions
Top Sustainability Goals: • Economic Growth • Clean Water and Sanitation Opportunities • Good Health, Well Being, and Quality Education • Industry, Innovation and Infrastructure	Top Vision Statements for VMR: • Tourism based Development • Clean Industrial Hub including Agro Industries • Educational Hub with Skill Development Focus

Summary of stakeholders' top priorities across the VMR.

The government of Andhra Pradesh has put focus on following areas with respect to Visakhapatnam city:

- Double digit GDP growth
- High potential for growth in IT, Pharma, and Film Industry.
- 100% literacy by leveraging technology, and scaling up skill development infrastructure
- Women Entrepreneur led Industrial Parks

13.1.3 VISIONFOR 2051

The collective vision for VMR is evolved based on extensive stakeholders' consultations. Important aspects of VMR were assessed through Existing Situation Assessment to understand the strengths and weaknesses of the region which are summarized in the SWOT analysis and have been instrumental in forming the comprehensive vision for VMR. The vision statement for VMR which will form essence towards preparing the Perspective Plan for VMR 2051 is articulated below.

"By 2051, VMR will become a vibrant and economic hub as a global investment, tourism and heritage destination and provide improved quality of life in an inclusive manner along with smart, sustainable, green and clean infrastructure and resilient environment"

Within the framework of Vision 2051, Goals, Strategic Focus Areas (SF) and Strategic Blueprint Areas (SBP)are formulated.

13.2 STRATEGIC SUSTAINABILITY GOALS

Strategic goals have been formulated within the framework of Vision 2051. As a whole six goals are identified to structure the Perspective Plan for VMR and summary of the goals and strategies are given in

- Facilitating Global and Competitive Investment Destination

- Ensuring Infrastructure led Planned Urbanism
- Providing Highly connected and Balanced Development in VMR
- Sustaining its environmental richness and diversity
- Managing Inclusive Development
- Establishing a Smart and Resilient Metropolitan Region

Figure 13-1: Strategic Goals to Strategic Focus Areas

Goals and Strategic Focus Areas (SF)under the vision framework have been developed into Strategic Blueprint Areas (SBP) which will articulate the contours of the Perspective Plan for VMR. The strategic blueprints are specific planning and development action areas which will help in grounding the perspective plan.

	Strategic Focus Areas	Strategic Blueprint Areas
Goal 1	• **SF1**-Mega Industrial Cluster Development • **SF2**- Tourism Destination Development • **SF3**-Education, Skill Development, and Health Facilities • **SF4**-Ports and Logistic Infrastructure	**SBP 1:** Develop VMR as a Mega Industrial Region which is expansion of existing industrial areas and new industrial hubs. **SBP 2:** Promote quality industrial infrastructure in Industrial Clusters including plug and play facilities. **SBP 3**: Develop VMR and surrounding region as a Global Tourism Destination by leveraging heritage and cultural sites and natural environment of VMR. **SBP 4:** Expansion and Development of New Education and Skill Development hubs for quality human resource development. **SBP 5:** Development Vishakhapatnam as state of art health facilities and tourism destination by leveraging natural environment. **SBP 6:** Provide quality social infrastructure within residential districts to attract quality human resource in VMR. **SBP 7:** Expand Logistic Capacity and Improve Connectivity to ports along with necessary support infrastructure.
Goal 2	• **SF5**-Good Quality and Hierarchical Road Infrastructure • **SF6**-Improved Public Transit Connectivity within and between Satellite Towns • **SF7**-Theme based TOD Nodes • **SF8**-Green Space Development • SF8(A)-Form Based Planning	**SBP 8**: Provide Hierarchical Road network in VMR with RoWs of 90m, 60m, 45m, 30m, and 24m. **SBP 9:** Expand and Improve Public Transit Connectivity within Visakhapatnam and to Satellite towns through metro and BRTS/Bus based public transit. **SBP 10:** Improve Connectivity to Mandal Headquarters through 30m/24m RoWs Roads. **SBP 11**: Promote Theme based Economic and high density Nodes near TODs along Metro and BRTS corridors.

	Strategic Focus Areas	Strategic Blueprint Areas
		SBP12: Develop Green space network by leveraging existing natural areas and open spaces. **SBP12 (A):** Introduce Form Based Planning for the Area around Boghapuram international Airport and its influence Area to create a coherent built form for upcoming development considering economic and tourist potential of the area.
Goal 3	• **SF9**-Improved Regional Connected between Mother city and Satellites. • **SF10**- Theme based development of Satellite cities/towns • **SF11**-Potential High Speed Rail Connectivity between Vijayawada and Visakhapatnam	**SBP 13:** Improved Regional Connectivity from NHs and SHs and between the towns and cities in VMR and rest of the state. **SBP 14:** Promote Development of Sub Urban Rail to leverage rail connectivity in VMR for inter-city connectivity. **SBP 15:** Expand economic base of the satellite towns in VMR along with improving connectivity with respect to the mother city. **SBP 16:** Promote and plan towards connecting Visakhapatnam to Vijayawada through High Speed Rail. **SPB 17:** Promote ICBTs and other Transit Nodes to improve their efficiency and image of VMR.
Goal 4	• **SF12**-Protecting Natural Geographic Features and Cultural Heritage in VMR • **SF13**-Protect Coastline • **SF14**-Protect Agriculture Lands as much possible	**SBP 18:** identify and Protect natural ecological precinct under the perspective plan. **SBP 19:** List and protect un-protected cultural heritage under the perspective plan. **SBP 20:** Take necessary measures to protect coastline from erosion and coastal environment by sensitive and ecological planning. **SBP 21:** Promote high density development and protect as much agriculture lands as possible.
Goal 5	• **SF15**-Slum Free City • **SF16**-Inclusive Rural and Regional Development in VMR • **SF17**-Housing for all	**SBP 22:** Slum Area improvement through basic and social infrastructure development **SBP 23:** Improve connectivity to villages and mandal headquarters along with provision of skill development and health infrastructure. **SBP 24:** Improve public transit connectivity to villages and mandal headquarters. **SBP 25:** Develop affordable housing in new development areas and near the work places.
Goal 6	• **SF18**- Expand Smart City Infrastructure for safety and Urban Governance Efficiency • **SF19**-No development in potential storm surge and Sea Level Rise Zones • **SF20**-Advance Planning for Disaster mitigation	**SBP 26:** Promote Use of Smart technologies for basic Infrastructure and Mobility efficiency and Improving Safety in VMR. **SBP 27:** Expand use of smart technologies for urban governance and land development management. **SBP 28:** Identify Areas vulnerable to Storm Surge and Sea level Rise and prepare plans for minimizing losses from disasters through scientific studies. **SBP 29:** Involve communities in vulnerability awareness of coastal zones and disaster preventive planning. **SBP 30:** Use smart technologies for disaster management.

13.2.1 Connected and a Global City

Well-connected and global cities like Lisbon, San Francisco, Barcelona metropolitan region and Seoul have state of the art and world class ports, international airport and aero cities, Financial and business districts,

industrial clusters, and tourism infrastructure supported with quality public transit, housing estates, leisure and social infrastructure. For Visakhapatnam to achieve above dimensions need to expand and modernize its industrial clusters, tourism infrastructure, IT and business hubs, knowledge centers along with ports, international airport, public transit, residential and social infrastructure, which is achievable but need greater state's and VMRDA commitment to develop the required infrastructure.

13.3 PROTECTING NATURAL FOOTPRINT OF THE REGION

One of the key advantages VMR has is its location on the coast along with having magnificent natural and environmentally sensitive resources in the form of forest, rivers and water bodies, hills, and wild life sanctuaries. Significant part of VMR Area are natural and sensitive areas which require protection and integration into the human landscape to retain its environment significance.

To achieve Connected and Global City status Visakhapatnam need to promote world class ports, international airport, business and financial center, industrial clusters, knowledge centers and tourism infrastructure. Protecting natural areas and integrated them economically are essential.

13.4 RESILIENT CITY REGION

Being located on the coast, VMR is vulnerable to risks associated with cyclones and climate change. VMRDA and the state has to accept the related threats from natural disasters and plan for minimizing the losses to achieve the state and national aspirations in Visakhapatnam becoming globally and economically integrated city. Miami-Dade Metropolitan Region as a case have vibrant economy and contributes US $840 Billion to the state's GDP, inspite of having high vulnerability to cyclones, storm surges, and sea level rise due to climate change. Visakhapatnam and VMR, as a whole, need to accept and illustrate the threat perception the communities at risk from cyclones and plan for minimizing the economic, human, and urban infrastructure losses in future through citizens involvement.

13.5 INTEGRATED URBAN AND REGIONAL STRUCTURE

Successful cities across the world while being globally connected are also regionally integrated with its hinterland and other cities. VMR to become successful, first need to put priority on integrating the mother city of Visakhapatnam with other smaller cities and towns in VMR. The integration can happen through economic interdependence by promoting theme based economic destinations which are supported with quality and dependable urban and regional transport connectivity.

For state level regional integration connecting major cities in the state with quality and high-speed regional rail transit is important on a medium to long run. Hence, connecting Visakhapatnam to Kakinada, Rajamahendravaram, and Vijayawada through high-speed rail would lead to greater regional integration and economic success for the state, if Andhra is looking for becoming one of the major global investment destinations.

13.6 POPULATION, 2051

The Metropolitan Region will experience higher growth in population considering the increase in migration and influence over the regional centers, by 2051. The central core will also have effect on the outer fringe of the city catering with higher order requirements.

The Vizianagaram Municipality will be serving as regional centers playing a prominent role in the region. The level of services provided will be higher and will cater to their respective districts. Other sub regional and service centers will have their own economic factors and cater to limited urban needs and infrastructure.

The population growth will be majorly effected by the ongoing projects like VCIC, VK PCPIR and other MoUs signed by the government which invite more people to migrate to work in these projects and boosts

indirect employment of the region. Considering a high induced economic growth, the region can expect a population of around 8.5 million by 2051.

13.7 EMPLOYMENT, 2051

VMR has a great potential in becoming a vibrant economy based on growth in primary, secondary as well as tertiary sectors. The development projects in the region including VK-PCPIR, Sagarmala and VCIC will strengthen the current infrastructure and help create ample employment opportunities for the citizens. The newly proposed airport and the expansion of the existing ports will also play a vital role in strengthening the logistics and industrial base in the area. The employment by 2051 is estimated to be 4 million considering the employment potentials of VMR region.

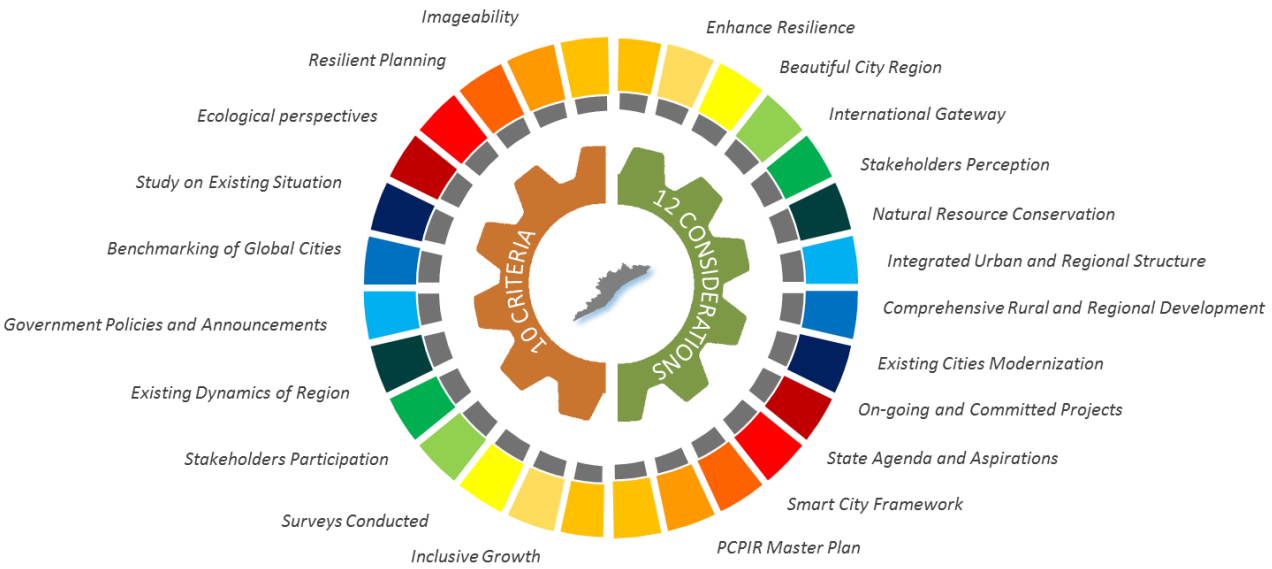
The primary sector can be improved by introducing technology and promoting more agriculture and allied industries. This will also help in conserving the fertile and high productive agriculture lands in the northern part of the region. Skill development and providing fishing infrastructure along with mini Harbours and jetties will increase boost the fishing activity in the region. This sector is spread across the region in rural settlements.

The secondary sector is yet to take full advantage of the significant amount of land available with APIIC. Considering the ongoing and upcoming development programmes, infrastructure will be developed along with better logistics connectivity to the port and Airport which will invite more industrial establishments. Most of the secondary sector employment lies close to the urban core like Gajuwaka, Paravada, Autonagar Etc.

The vast expanse of beaches, natural hillocks, religious and heritage structures in the region attract many domestic and international tourists. The proposed Aeropolis at Bhogapuram will emerge as a prime hub for new Hotel and leisure establishments. With the developing health infrastructure at Arilova, the region can become a hub for medical tourism for the neighboring states. IT/ITES industries will play a vital part of the tertiary economy with supporting infrastructure and simplifying business policies in the region which primarily falls under the urban areas.

14 ALTERNATIVE SPATIAL STRATEGIES, 2051

14.1 KEY ASSUMPTIONS



Visakhapatnam Metropolitan Region is spread over 4,873 sq.km with diversity in geography, livelihood, access to amenities, quality of life, level of urbanisation. It is desirable to bring parity in development throughout the region and at the same time address the specific needs of the region. Alternative spatial structures have been formulated to ensure comprehensive development of the region. To address the diversity in the region, inferences have been drawn based on various criteria:

- Studies on the existing situation of various sectors of development
- Primary surveys on socio-economic characteristics, transportation networks and travelling patterns
- Existing dynamics of the region in the various sectors including proposed and on-going projects
- Vision and priorities obtained from stakeholders through extensive consultations
- Government aspirations for the State and Visakhapatnam
- Conservation of natural resources
- Resilient planning for a cyclone prone region
- Benchmarking of VMRDA Region in India and abroad
- Inclusive growth involving both urban and rural development along all sectors
- To create an image of the region

These criteria of assessment of the scenario have led to 12 assumptions to be considered for the future growth of Visakhapatnam Metropolitan Region.

Stakeholders' Perception

Extensive stakeholders' consultations were carried towards preparation of the Perspective Plan involving citizens groups, politicians representing the region and local bodies, government heads of various land and infrastructure development agencies, NGOs, fishermen communities etc. that led to evolving comprehensive visioning on economic, environmental conservation, future growth directions, development of the VMRDA Region as a whole, improving the existing cities/towns, transportation and basic infrastructure agenda. The outcomes from the consultations are summarized under following themes.

Economic Agenda: In principle, the economic importance of Visakhapatnam Region to the state of Andhra Pradesh as a whole was reiterated, where 58% of the State's current industrial output is located. Strengthening and diversifying the economic role of the VMR appeared unanimous across the stakeholders. Theme based economic hubs/areas to meet the State's and regional aspirations are one of the key aspects for structuring the VMR. The following Figure 14-1 summarizes the economic agenda.

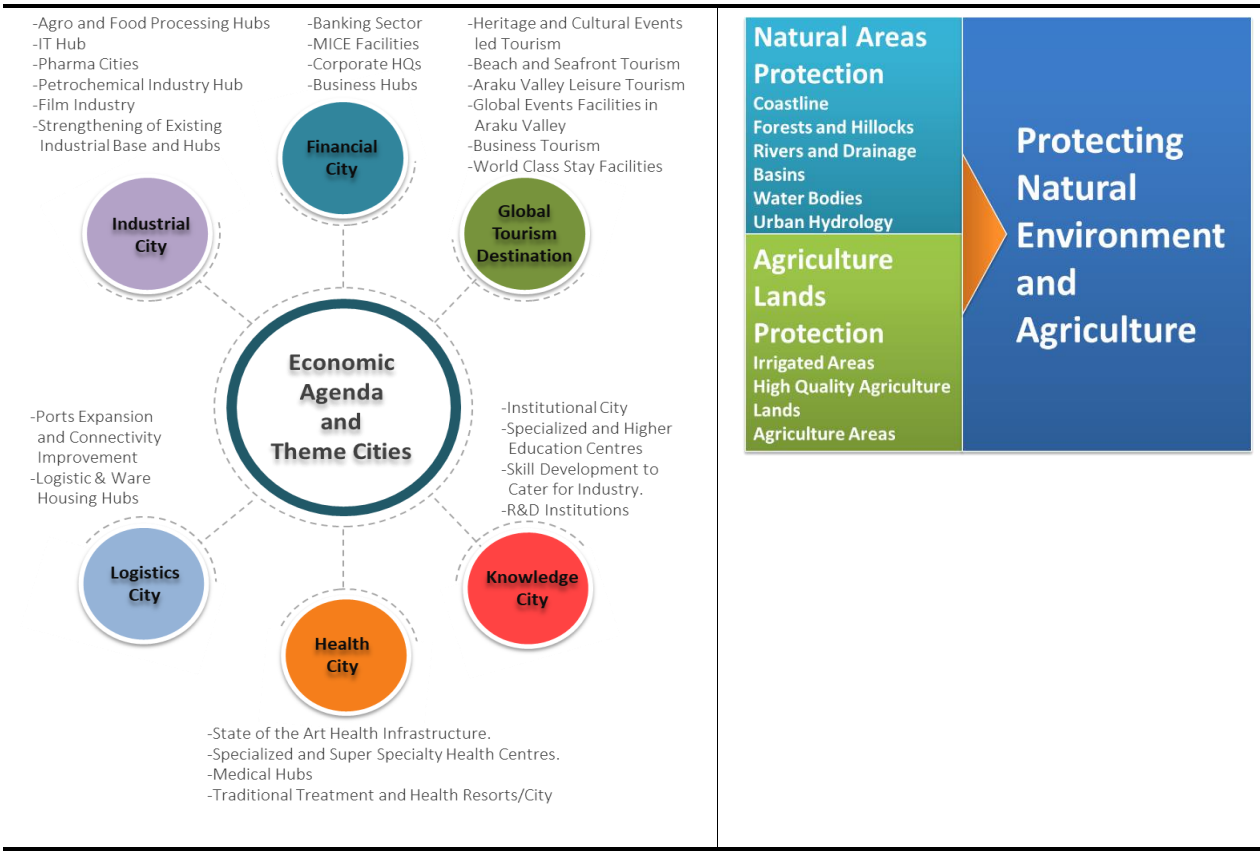


Figure 14-1: A comprehensive economic development agenda and protecting natural areas and agriculture lands emerged as key aspects from the state vision and stakeholders' consultations.

Natural Areas and Agriculture Land Protection: Protecting natural areas such as coastline, rivers and drainage basins, forests, hillocks, water bodies, and improving urban hydrology was one of the key suggestions that came clearly from the stakeholders' consultations. In addition, environmentalists, politicians, and NGOs put emphasis on protecting agriculture lands as VMR contain large irrigated and agriculturally fertile areas. Agro and food processing is one of the key economic base of the region. As a whole agriculture land, natural and environmentally sensitive areas require protection to retain economic, scenic and environmental significance of the region.

Improving Connectivity and Public Transit: In principle, it emerged across consultations that road and connectivity infrastructure needs to be improved significantly. State of the art public transport, walking and cycling infrastructure needs to be developed. Existing roads need improvement to deal with traffic congestions. Suggestions were also given to improve connectivity between beach road and NH-16 bypass. Rural connectivity to villages and mandal headquarters needs improvement along with provision of public transport. Ongoing connectivity improvement to ports needs to be further strengthened to provide efficient access to the ports. There are number of studies already carried out in recent years to improve public transport and NMT infrastructure in Visakhapatnam city which are integral part of preparing the perspective plan for VMR. Currently, only 12% is the mode share of public transport in Visakhapatnam city, which is very low.

Balanced VMR Development and Managing Urban Fringes: Citizens and their political representatives expressed need for balanced economic and urban development in VMR, where sustainable economic and urban development focus is required on cities/towns of Vizianagaram, Anakapalle, and Atchutapuram. Focus

on establishing new towns and developing residential township nears industrial and employment areas were also suggested. City urban governance agencies felt that managing urban fringes and having planned development on perimeter of the city is important.

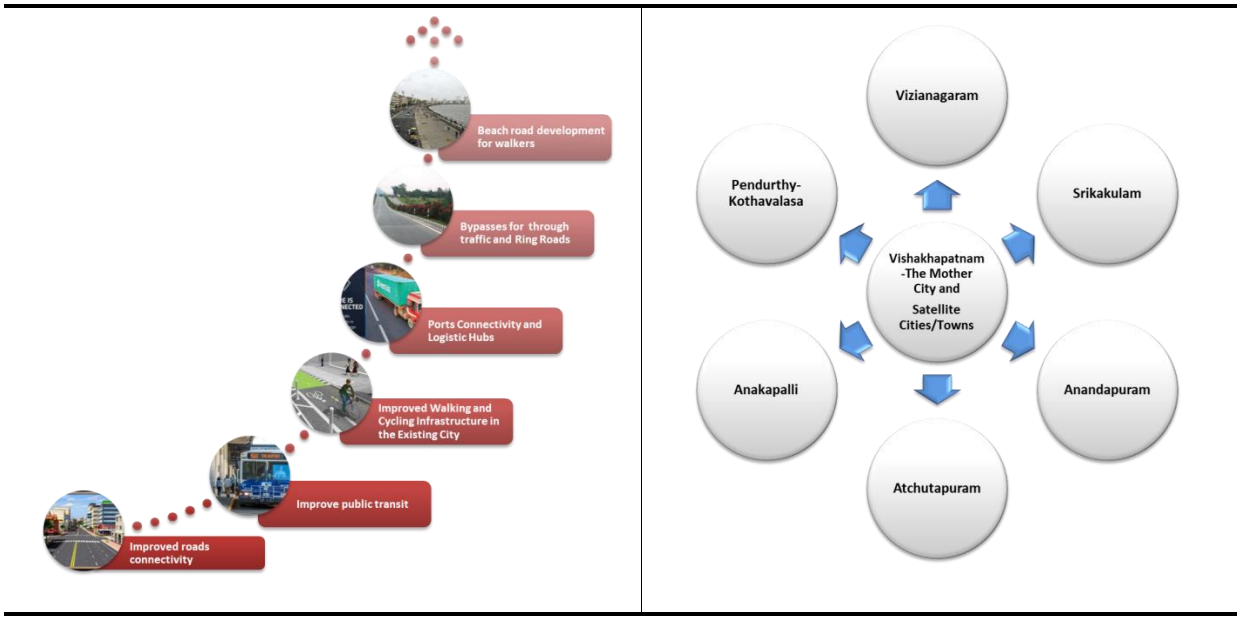


Figure 14-2: Urban transport improvement agenda largely focused on improving roads and transport connectivity and was unifying aspect across the consultations at all levels. Representation from smaller cities/towns from VMR put emphasis on balanced VMR development with economic themes based existing and new satellite cities/towns development.

Urban Growth Directions, Compact City and TOD: In reference to urban growth directions suggestions were to focus along on the roads and highways connecting existing satellite cities/towns to the mother city of Visakhapatnam in VMR. Growth along roads linking to Anandapuram, Vizianagaram, Bhogapuram (International Airport Site), Anakapalle, and Atchutapuram, were seen important for future urban growth. Representative of urban governance agencies suggested compact city model based on Transit Oriented Development (TOD) to create a public transit led city region.

Clean Green and Smart City: This appeared as a common agenda across various cities in VMR to promote the region based on clean, green, and smart city principles. Clean energy sources like solar energy, protecting natural areas and agricultural lands, and use of smart city principles and infrastructure were emphasized. Visakhapatnam city has an image of green and clean environment which needs to be further improved.

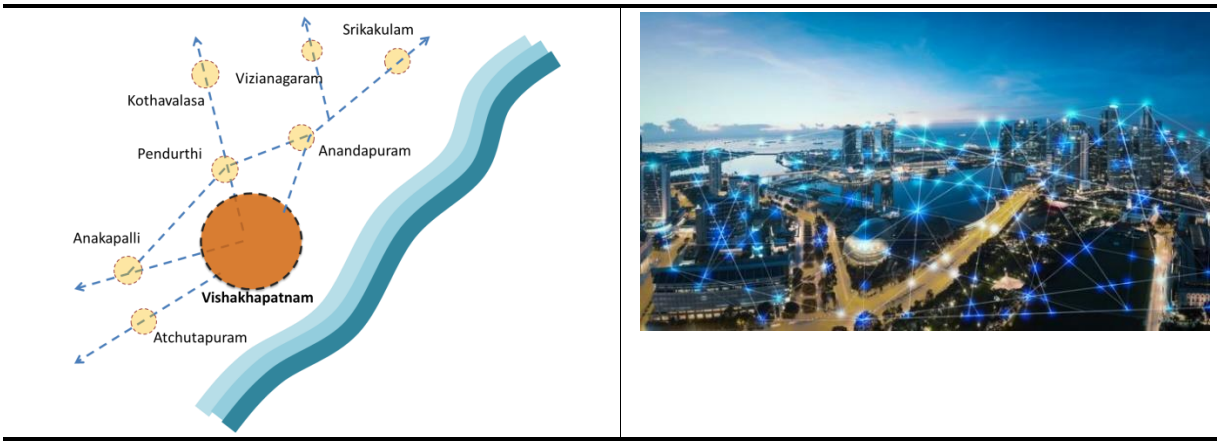


Figure 14-3: Potential urban growth directions as suggesting by the stakeholders and idea of clean, green, and smart city appeared common across the region in the consultations.

State Agenda and Aspirations

AP Government focus on enhancing the Quality of Life of its citizens, through high-quality Education and Healthcare, increased productivity in Agriculture and allied activities, creation of Employment by promoting Electronics and IT, and above all, by providing Good Governance.Leading economic engines in the Andhra Vision 2029 and in context of VMR are Agribusiness and value addition to it, Industrial Nodes and Corridor under VCIC, Tourism, Logistic and Coastal corridor led growth, and Fisheries. Andhra Pradesh is expecting the manufacturing contribution would be 25%-28% and Service Sector contributing 50-52% by 2029. The vision document also aspires to create 1.5 million additional jobs in manufacturing sector by 2029. The state aspires to reach 50% urbanization by 2031 and by 2029 achieve increase public transport share of 50% in mega cities, increase ports capacity to 550 MTPA from the 120 MTPA in 2015, achieve international tourist arrival as 5 million by 2029 as against only 0.07 mn in 2015.

The government of Andhra Pradesh would want Visakhapatnam to become a Global city. It aspires Visakhapatnam city to become high tech, vibrant economy, and major international tourism destination. Under VCIC Atchutapuram and Nakkapalli are proposed as a mega industrial cluster/s. The state's aspirations interpretation clearly indicates that VMR is to become a mega industrial hub, high tech city and IT hub, a major international tourism destination, and a city region which is sustainable and providing high quality place for work and living and become a major global investment destination by 2050.

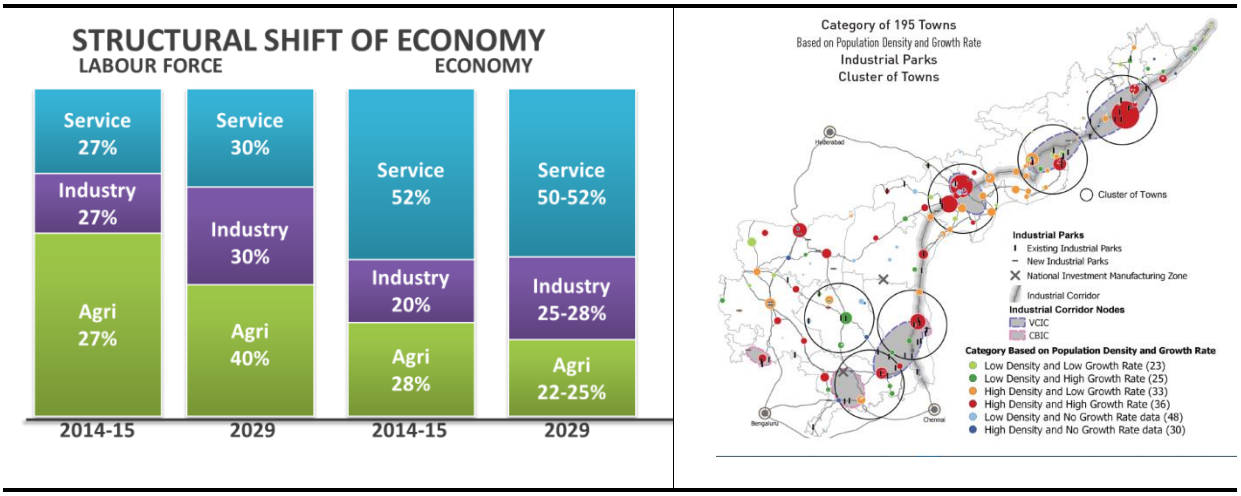


Figure 14-4: Andhra having 50% urban population by 2031, and making Andhra as the best state in India by 2029 requires major contribution from VMR in terms of economic development in manufacturing, tourism, ports and logistics facilities development, value addition to agriculture.

International Gateway

Well-connected and global cities like Singapore, Hongkong, Tokyo, Beijing metropolitan region, Kuala Lumpur, and Soeul have state of the art and world class ports, international airport and aero cities, Financial and business districts, industrial clusters, and tourism infrastructure supported with quality public transit, housing estates, leisure and social infrastructure. For Visakhapatnam to achieve above dimensions need to expand and modernize its industrial clusters, tourism infrastructure, IT and business hubs, knowledge centres along with ports, international airport, public transit, residential and social infrastructure, which is achievable but need greater state's and VMRDA commitment to develop the required infrastructure.

Natural Resource Conservation

One of the key advantages VMR has is its location on the coast along with having magnificent natural and environmentally sensitive resources in the form of forest, rivers and water bodies, hills, and wildlife sanctuaries. Significant VMR Area are natural and sensitive areas which require protection and integration into the human landscape to retain its environment significance.

Figure 14-5: To achieve Connected and Global City status Visakhapatnam need to promote world class ports, international airport, business and financial centre, industrial clusters, knowledge centres and tourism infrastructure. Protecting natural areas and integrated them economically are essential.

Enhance Resilience

Being located on the coast, VMR is vulnerable to risks associated with cyclones and climate change. VMRDA and the state has to accept the related threats from natural disasters and plan for minimizing the losses to achieve the state and national aspirations in Visakhapatnam becoming globally and economically integrated city. Miami-Dade Metropolitan Region as a case have vibrant economy and contributes US $840 Billion to the state's GDP, in spite of having high vulnerability to cyclones, storm surges, and sea level rise due to climate change. Visakhapatnam and VMR, as a whole, needs to accept and illustrate the threat perception the communities at risk from cyclones and plan for minimizing the economic, human, and urban infrastructure losses in future through citizens involvement.

Integrated Urban and Regional Structure

Successful cities across the world while being globally connected are also regionally integrated with its hinterland and other cities. VMR to become successful, first need to put priority on integrating the mother city of Visakhapatnam with other smaller cities and towns in VMR. The integration can happen through economic interdependence by promoting theme based economic destinations which are supported with quality and dependable urban and regional transport connectivity.

For state level regional integration connecting major cities in the state with quality and high-speed regional rail transit is important on a medium to long run. Hence, connecting Visakhapatnam to Kakinada, Rajamahendravaram, and Vijayawada through high-speed rail would lead to greater regional integration and economic success in the state, if Andhra is looking for becoming one of the major global investment destinations.

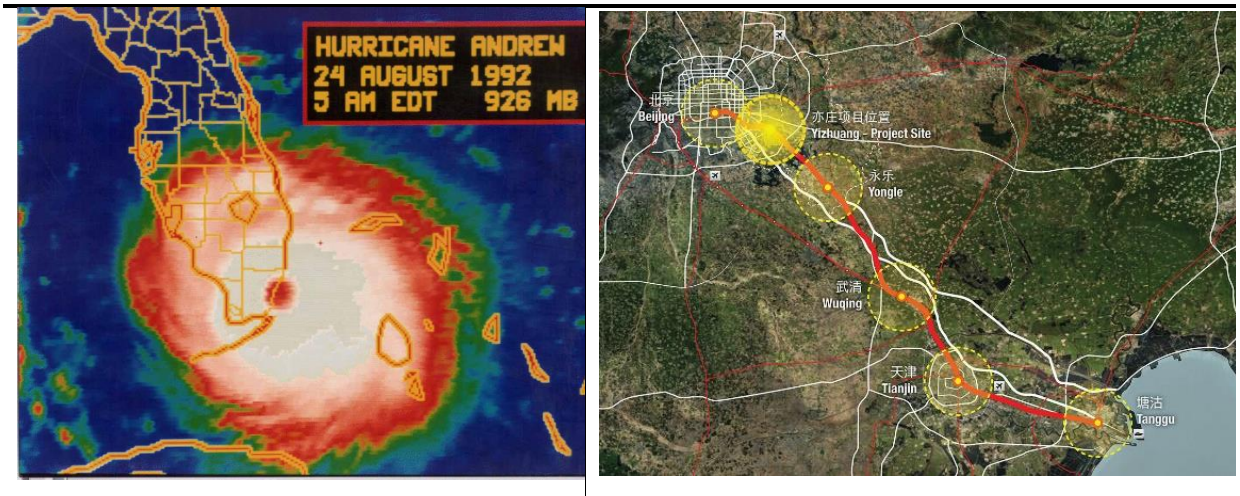


Figure 14-6: Benchmark studies carried out towards preparation of the Perspective Plan for VMR on Miami-Dade Metropolitan Area has vibrant economy through advance planning inspite of high cyclones threats. High-speed rail connection between Beijing and Tianjin Port led to greater economic success in Greater Beijing metropolitan region.

Linking Visakhapatnam-Kakinada-Rajamahendravaram-Vijayawada through high speed rail on a medium to long run can lead to greater economic success to achieve state's aspiration of becoming global investment destination.

VK-PCPIR Master Plan

A Draft Master Plan and ZDPs were prepared for VK-PCPIR in 2014 on an area of 640 Sq. km located between Visakhapatnam and Kakinada and along the coast by VKPCPIR SDA based on Govt. of India Policy for establishing Petroleum, Chemical and Petrochemical Investment Regions (PCPIRs) in India. Industrial clusters were proposed for Petroleum, chemical and petrochemicals integrating existing industrial clusters and SEZs. The project is aimed at 1.0 million population with potential of 0.6 million employment. The master plan is conceived with state of the art transport and logistics infrastructure along with necessary residential and social infrastructure located near to the industrial clusters to create a sustainable industrial region. This Master Plan for VMR is to review and integrate Draft Master Plan for VK-PCPIR with necessary modifications, if need be.

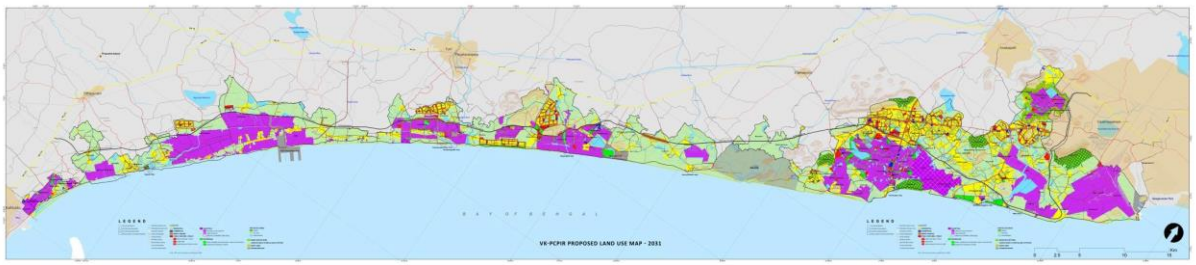


Figure 14-7: Proposed Draft Master Plan for VK-PCPIR by SDA which is to be reviewed and integrated in the Master Plan for VMR with necessary modifications.

On-going and Committed Projects

Studies of committed and proposed project documents and master plans in VMR were carried out towards plan preparation for the VMR and many of these projects are of structural nature and will influence development potential of the region. These projects include Metro in multiple phases, BRTS Expansion Plans, Carbon Neutral Mobility Plan (CNMP) for GVMC Area, Smart City Project Proposals, Beach Road Development, VCIC led Mega Industrial Clusters at Atchutapuram and Nakkapalli, state aspirations of High Speed Rail between Visakhapatnam and Vijayawada and Araku Valley in Visakhapatnam playing the role of a mother city for tourism promotion etc.

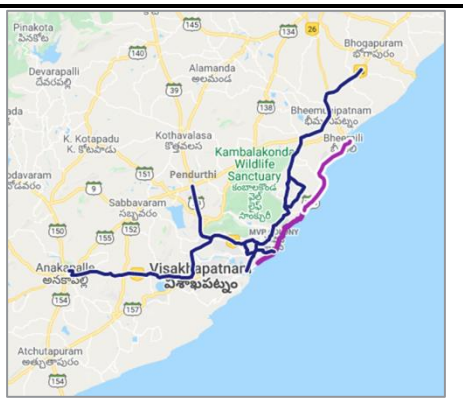


Figure 14-8: Modernizing the existing city cores in Visakhapatnam through public transit, NMT Infrastructure, selective redevelopment of under used lands/sites including lands owned by state and national authorities, and improving basic infrastructure is way forward. In this context integrating proposed and committed projects by various authorities is integral to preparing the Perspective Plan for VMR.

Smart City Framework

GVMC prepared an Integrated Smart City Framework Plan for Visakhapatnam which envisages Visakhapatnam as South and South-Asia Commercial Capital by 2030. The framework envisages four major distinct and economic centres/zones, where Zone-1 involving old city will be the CBD through development of signature projects, Zone-2 is a heavy industrial zone where industrial development would be located south of Dolphin Nose adjoining existing industrial centres, Zone-3 will have IT, Education, and Tourism towards north of Kailasagiri and extending upto Bhogapuram Aerocity, Zone-4 will have light industry between Pendurthi and Kothavalasa with housing. As general strategy for better work home relationship housing, commercial, and mixed use will be located near places of employment.

Upgraded BRT network and ICT innovations are recommended to manage infrastructure to enhance the performance of the city.. Three alternative growth scenarios are visualized in the plan, where Business as Usual Scenario will promote growth with respect to the existing city in ribbon development form along the major roads. Alternative 1 of smart city proposals visualize focus on Infill Development and smaller greenfield development in adjoining existing urban areas. Alternative 2 of smart city proposals focuses on infill development and large greenfield development distributed throughout VMR. Live-work balance and located future growth in lower risk areas is recommended. Smart City Alternative Scenario 1 is preferred scenario in the plan due to its compactness and future growth located next to existing city which can take advantage of existing trunk and urban infrastructure.

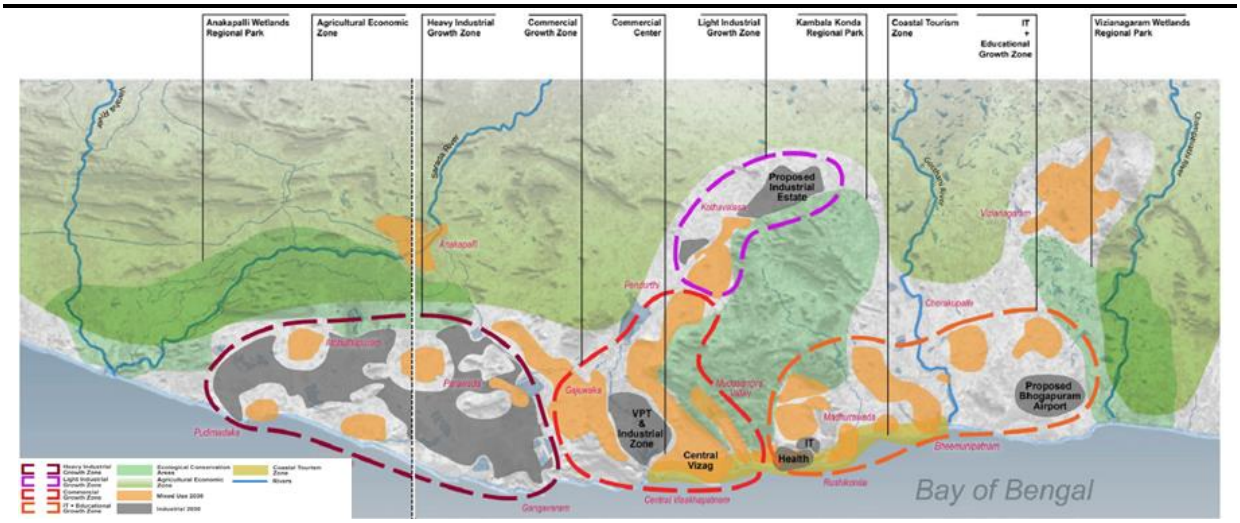


Figure 14-9: GVMC's Integrated Smart City Framework Plan for VMR with three Alternative Scenarios and projected population of 7.5 million by 2030. Alternative 1 is recommended with compact city idea.

Existing Cities Modernization

Just focusing on greenfield and body extension of cities has not led to creating successful and global cities. There are many examples of cities like Singapore, Kuala Lumpur, Hong Kong, London, Seoul etc. where modernizing the existing city cores have been major reason for greater success and globalizing of these cities. Modernizing in this context primary means modernizing urban infrastructure including basic and public transit and redeveloping and retrofitting of existing city cores to become world class business hubs, tourism destinations, and creating quality housing stock. In case of Visakhapatnam too modernizing the existing city core/s through quality public transit, NMT infrastructure, beach road development, redevelopment of obsolete pockets including large land holdings by various state and central government agencies can lead to successful business, logistic hubs, tourism, and quality housing supported with public transit and social infrastructure.

Comprehensive Rural and Regional Development

Currently close to population of VMR is living in rural areas with agriculture and fisheries as main source of employment. To carry out the comprehensive economic and infrastructure development in VMR development of the rural areas is integral to perspective planning of VMR. Under this strategy improvement of connectivity to mandal headquarters, villages, and major resource centre to rural areas is important. Besides protecting the current economy of the rural areas, development of transport connectivity, employment, and improved social infrastructure areas near the nodal villages and mandal headquarters is key to comprehensive rural communities and area development of VMR. Section 16.9 of the report deals with this aspect in a comprehensive way.

Beautiful City Region

There is no doubt that in general perception, even in the stakeholder's view;Visakhapatnam is a beautiful city with abundance of natural areas including long coastline. VMR area hasnatural and environmentally sensitive areas which need to be protected and integrated for tourism and leisure activities. Hills/hillocks in close proximity of the city and long coastline gives romantic and beautiful character to the place. These qualities and characteristics need to be protected to retain their natural qualities and integrated them for greater and quality experience.

Figure 14-10: Visakhapatnam due to its location on the coast and having hills in proximity of the city gives it a romantic and city beautiful characteristics, which needs continuing protection and integration for tourism and leisure activities.

14.2 ALTERNATIVE 1: COMPACT METROPOLIS

Context

Visakhapatnam is the main and mother city in VMR and leading reason for influencing urban growth in the region. The current dominant trend of urban growth is on perimeter of Visakhapatnam city and along the main roads connecting the mother city and satellite towns in VMR. Currently, majority of the key economic, urban and social infrastructure is located within GVMC Area. GVMC Area also has greater national and regional level connectivity with respect to ports, railways, airport, and bus service network.. Urban sprawl is prevalent on perimeter of Visakhapatnam city, in satellite towns, and along the main roads connecting the mother city and the satellite towns. In spite of dominant ribbon development trends along the roads, city's share of public transport is only 12% and average travel distances for various purposes in the city are too high in Visakhapatnam.

The Concept Strategy

In the light of vision proposed for Visakhapatnam to be a Global City and major investment destination by 2051, it is strategic to promote a state of art urban transit and other urban infrastructure that is at par with other successful and global cities across the world. In reference to location of existing major industrial clusters and mega industrial cluster proposed at Atchutapuram and Nakkapalli under VCIC and International Airport coming up at Bhogapuram the north-south urban development axis in VMR will get further reinforced. Hence,

it is important to recognize this future main urban axis and plan VMR in accordance. Role of the mother city of Visakhapatnam will get further cemented in future urban structure of VMR and the satellite towns will play theme based support economic roles to the mother city. Following aspects will become structural in shaping the future urban growth and form of VMR under this alternative spatial strategy.

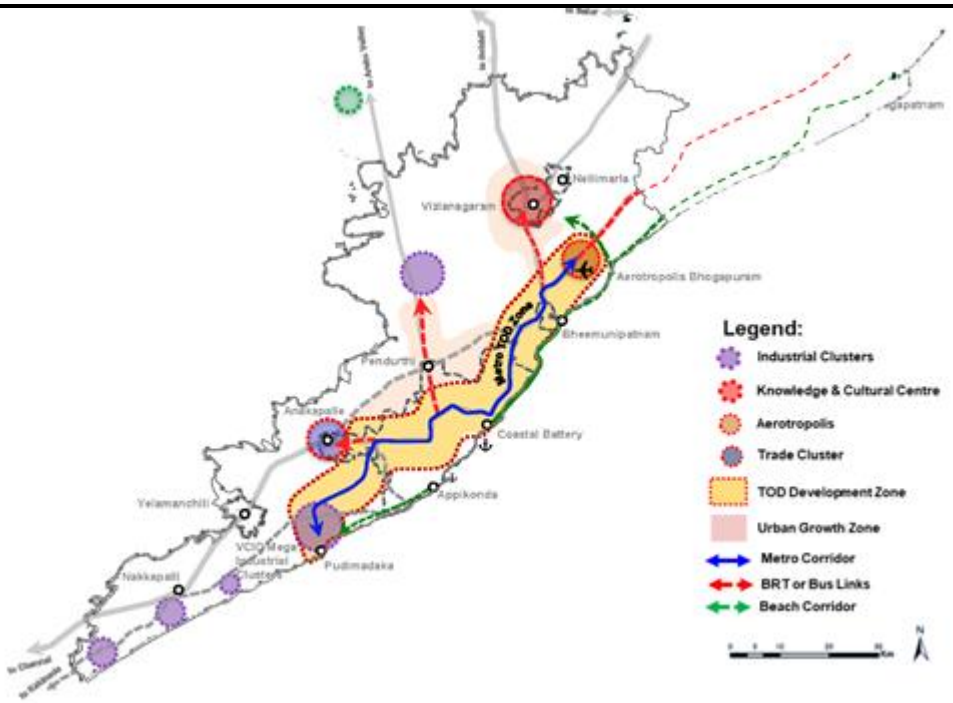


Figure 14-11: Alternative 1 is a mother city and TOD led urban development along the Metro Corridor to create a compact and public transit led mother city and satellite towns in VMR.

- Transit Led Urban Structure: It is desirable and recommended that metro network, which is conceived between Bhogapuram International Airport and Gajuwaka in two phases, is further extended upto Atchutapuram-APIIC SEZ from Gajuwaka to support the emerging urban axis between the airport, existing CBD of Visakhapatnam, and the mega Industrial Cluster under VCIC at Atchutapuram. Existing and expansion of BRTS network can be expanded to provide last mile connectivity and to the satellite towns with respect to the metro network.
- TOD and Urban Development Corridor: To support the metro network between Bhogapuram Aerocity-Existing CBD of Visakhapatnam-Atchutapuram Mega Industrial Cluster, Transit Oriented Development is proposed in 5 km corridor on both sides of the metro corridor with theme based economic and mixed use nodes. Last mile connectivity is to be provide upto 1 km NMT modes and Buses/BRTS upto 5 km on both sides of the corridor. Higher density development at an average of 200 to 300 pph can be promoted in the influence area of the metro corridor in greenfield and opportunity based sites within existing city.
- Theme based Satellite and Connected Cities: The satellite towns of Vizianagaram, Ankapalli, Nakkapalli, Light Industries Cluster at Kothavalasa will become theme based support economic centres connected to mother city and metro network through BRTS and or Bus Public Transit.
- Integration of Committed and Proposed Projects in VMR: This alternative strategy allows integration of all proposed and committed major projects like Bhogapuram Aerocity, Beach Road Tourism Project, VCIC Mega Industrial Cluster at Atchutapuram, ADP at Madhurawada-Beemili-Anandapuram, RTC Complex, BRTS Network, and under implementation bypass to NH-16 will largely play the role of much needed bypass to the city.

Figure 14-12: Metro corridor and theme based nodes through TOD development in the influence corridor and BRTS and or Bus based last mile and satellite towns connectivity will be key urban and image structure of Visakhapatnam city and rest of VMR.

Urban Transport Network

Central to this spatial alternative is public transit led urban structure for the VMR region. To reiterate VMR is and will further expand its key economic base with respect to industry and agro business, IT, financial and Business Services, Knowledge and Health, logistics, and tourism and expected to become a mega and global city. Miami-Dade Metropolitan Region are structured under similar urban planning and urban transport infrastructure. Key urban transport strategies and projects to achieve this alternative are as follows.

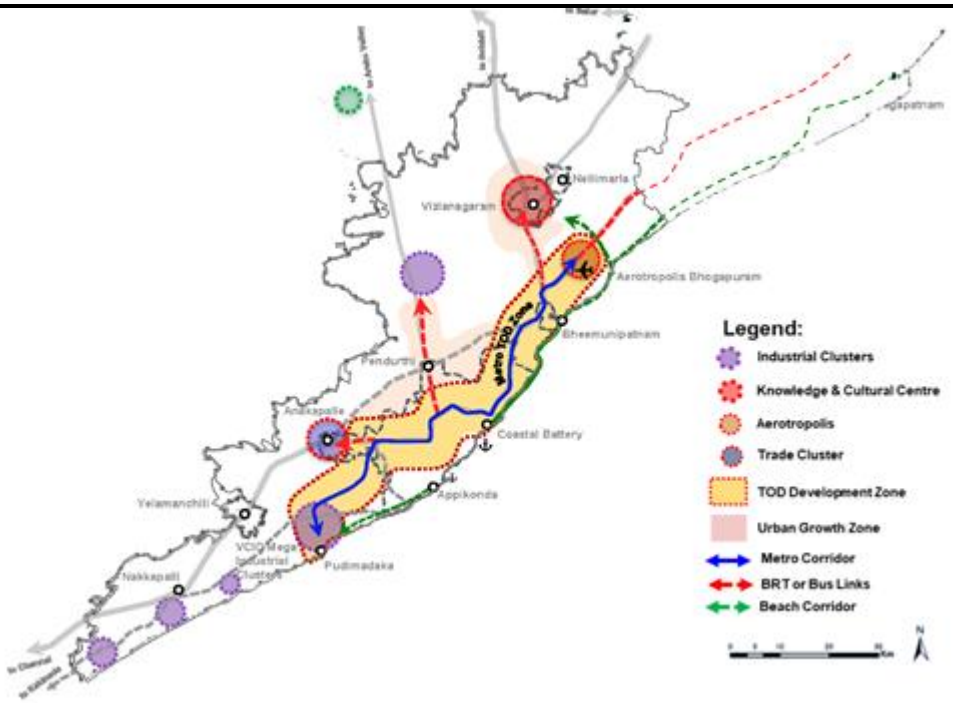


Figure 14-13: Alternative 1 is a public transit led and hinges on metro network development that will bind the linear TOD Corridor between Aerocity at Bhogapuram, Visakhapatnam city, and proposed Mega Cluster of VCIC. The radial corridors to satellite towns are proposed for improvement with BRT or Bus based connectivity.

- Metro and Urban Transit Corridor: Approximately 140 km of metro based public transit network is proposed under this alternative which will promote the north-south urban development axis in VMR. Last mile connectivity and connectivity to the satellite towns would be extended through BRTS and other bus based network linked to the metro transit network.
- Bypass to NH-16: Substantial through goods and other passenger traffic (49%) pass through VMR in north-south directions. Current bypass to NH-16 under implementation will largely function as a National Highway on short to medium run and will help relieve city cores from through traffic under this alternative.
- BRTS Network: Last mile connectivity with respect to metro network will be in the form of BRTS or Bus based public transit loops connecting to metro nodes in 5 km influence area of the metro corridor.

- **NMT Network:** As part of the CMP and Carbon Neutral Mobility Plan (CNMP) for Visakhapatnam NMT network is proposed which will be integrated under this alternative. It is proposed to have additional NMT network within 1km on both sides of metro network to promote walking and other cleaner forms of para transit. In Visakhapatnam more than 50% trips are walk trips.

Figure 14-14: Metro transit corridor planning and development, NMT infrastructure, and quality bypass for through traffic will help modernize transit and urban transport in VMR.

- **Satellite Towns Connectivity:** The satellite towns of Vizianagaram, Anakapalle, Rajam, Kothavalasa, and Nakkapalli would be connected through BRTS or Bus based transit system to metro network and the mother city. 100-150 km of BRTS or Bus based or combination of both networks is likely to be required under this alternative to connect the satellite towns.
- **Connectivity to Mandal Headquarters:** All mandal headquarters in VMR would be connected with improved road RoWs (30 M) with respect to main urban transport network.
- **Port Connectivity Improvement:** Modernization of ports and improving connectivity to ports is important to overall economic expansion and putting the region on global investment platform. To improve connectivity to ports is an ongoing effort in VMR and will be further reinforced as part of the perspective plan. Existing and proposed locations for truck terminals and warehousing would be integrated through improved road network.
- **ISBT and ICBTs:** In context of inter city and region bus based travel demand location of ISBTs and ICBTs would be identified in VMR in the next phase of the master planning.
- **Road Network Improvement:** In Visakhapatnam city and VMR as a whole where traffic conditions of roads are congested and deteriorating hence improved and hierarchical road network of RoWs of 60m, 45m, 30m, and 24 m would be proposed in existing and greenfield developments.

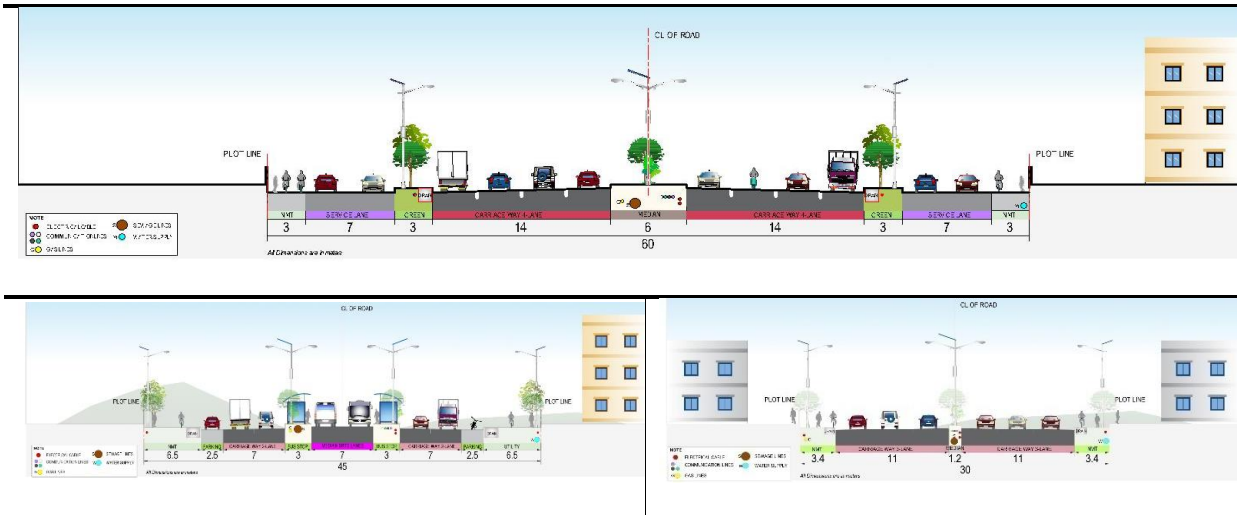


Figure 14-15: Hierarchical road network of RoWs of 60m, 45m, 30m, and 24m will be planned in VMR to streamline the mobility and safety aspects.

Urban Form and Imageability

In principle, this alternative spatial strategy promotes transit led compact city form for the mother city where natural environment surrounding the city and in VMR is to be protected. The satellite towns will develop around theme based economic role and with compact urban form to protect maximum agricultural lands as possible under the scenario. The key aspects of urban form and imageability under this alternative are as follows.

- **Transit led TOD Development:** The north-south Urban Axis between Bhogapuram Aerocity and Mega Industrial Cluster at Atchutapuram will be structured hence form the image ToDs along the corridor. The corridor can accommodate close to 4-5 million populations with average density of 200-300 pph in built up areas.
- **City Beautiful:** VMR and Visakhapatnam has bountiful natural resources including coastline. As an idea to promote transit led compact mother city under this alternative natural areas and maximum agricultural land gets protected to retain the image and characteristic of city beautiful and natural environment of VMR. Idea of health and tourism city is connected with this vary idea.
- **Connected Satellite Towns:** While each satellite town is envisaged with an economic role and developed in a compact and planned manner. Under this alternative Vizianagaram will be knowledge, cultural and tourism town, Anakapalle will grow as business and trade hub and the satellite towns connected to the mother city through BRTS and Bus based public transit hence giving an image of highly connected and public transit led region.
- **VMR as a Global Tourism Destination:** With international airport in the pipeline and VMR and surrounding region having unparalleled natural, heritage, and cultural resources VMR will be promoted as a Global Tourism Destination par excellence. In this scheme tourism development in Araku valley for MICE, Health and Leisure tourism, Tourism Infrastructure Expansion and development of sites to further promote Buddhist Circuit, Hindu Pilgrimage destinations, and Beach tourism is essential pillars to promote VMR as a major international tourism destination.
- **Resilient City:** As stated earlier VMR is subjected to natural disasters from cyclones, floods, and climate change. Planning to reduce economic, human, and urban infrastructure losses would be essential to this alternative as well. Hence, areas prone to floods and storm surge will be identified based on available studies and not subjected to high value and vulnerable urban development. The beachfront development with necessary stringent regulations to resist wind speed of cyclones and destruction from storm surge would create idea of city on a seafront, which is not very imageable at present.
- **Form Based Planning:** Current haphazard development not responding to natural features and topography of the area needs to be addressed considering the high potential land within influence area of proposed Airport, hospitality and tourism projects. It shall have distinct character that justifies its worth. Hence, Form Based Planning is recommended for such area.

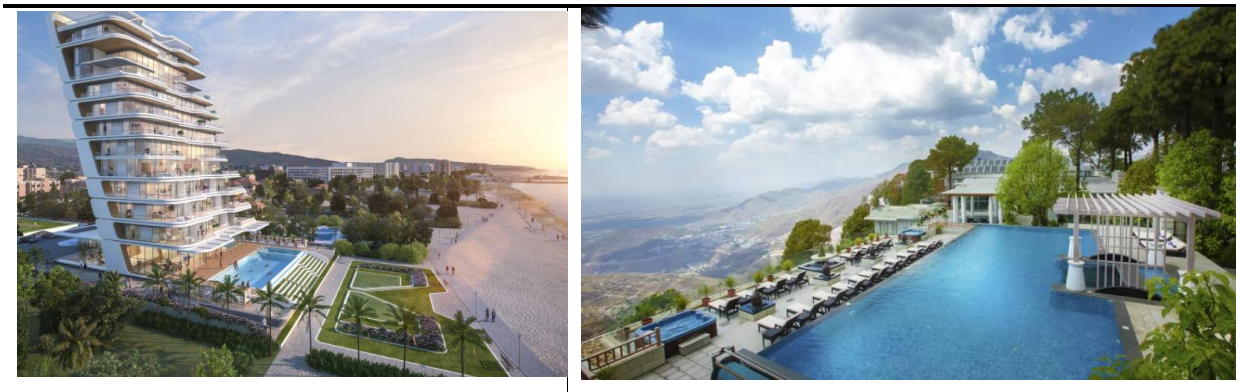


Figure 14-16: Tourism infrastructure along the coast, near beaches, and Araku Valley can help create VMR as a global tourism destination.

Potential Key Project Components

Essential to achieve this alternative are following projects and components which will form critical urban and regional structure of the Perspective Plan for VMR.

- Transit Led TOD Corridor between Bhogapuram Aerocity-Existing CBD-and Industrial Mega Cluster at Atchutapuram under VCIC.
- Theme based economic nodes and TODs along the metro transit corridor.
- Theme base economic and expansion of Satellite towns of Vizianagaram, Anakapalle, Nakkapalli, Bheemunipatnam, and Rajam.
- BRTS and Bus based public transit 7 Radials Corridors connectivity to the satellite towns.
- Tourism destinations development and expansion of Araku Valley, Buddhist Circuit, Hindu Pilgrimage destinations, Beach and coastal tourism, and eco-tourism etc.
- Protection of natural areas and Agriculture lands.
- Resilient city planning and framing related development regulations to reduce losses in vulnerable areas.
- A comprehensive Rural Development Agenda as recommended in the Section 16.9.

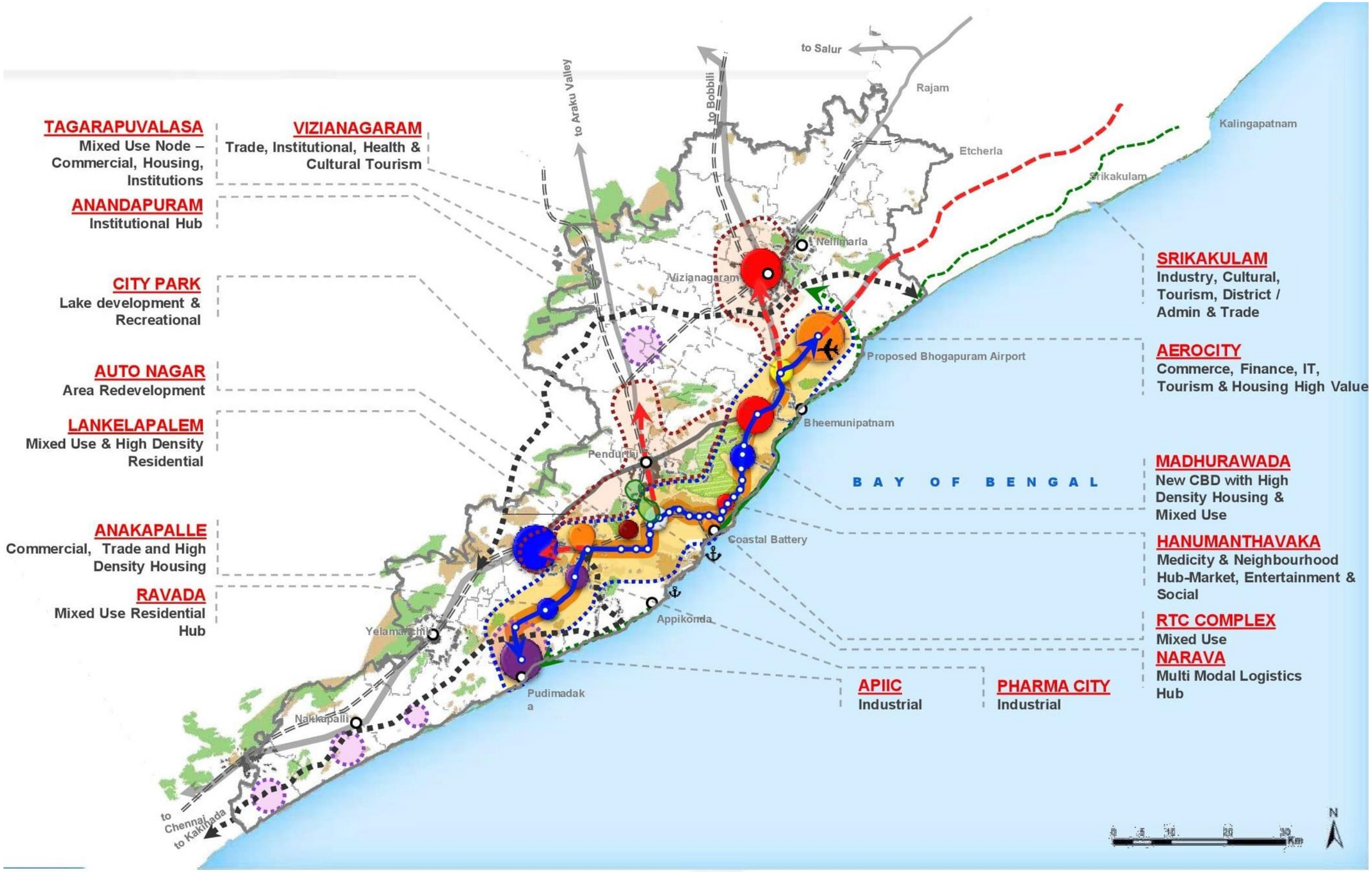


Figure 14-17: Alternative Spatial Strategic Plan -1: Compact Metropolis - Mother City and Public Transit Led Development Scenario in VMR.

14.3 ALTERNATIVE 2: COHESIVE METROPOLIS

Context

The existing city of Visakhapatnam largely developed along the coast and in between Kailasagiri-Rushikonda hills on the north side and Yarada hills (Dolphin Nose Hills) on south side. Large area (40-45 Sq. km) in centre of the city is dedicated to Vizag port, logistic and naval use, which is not currently accessible for general and urban development. Besides close to 65% of the GVMC Area are environmentally sensitive areas and dedicated to large industrial estates. Hence, to achieve an idea of Visakhapatnam as a mega city with future urban growth located in proximity of the existing urban areas in GVMC limit and Satellite towns and along Anandapuram-Pendurthi-Anakapalle-Atchutapuram bypass of NH-16 is a potential.

It may also be desirable, in the light of cyclones led vulnerability of eastern and immediate edges of the city located along the coast, to expand the city on western, north-west and south-west sides of the mother city. Such a move will also help to check urban sprawl and unplanned development on perimeter of the city by promoting a planned approach. Such a new urban axis will also help promote greater economic and social infrastructure interdependence between satellite townships/areas such as Vizianagaram, proposed ADP in Anandapuram (VUDA Township), Pendurthi-Kothavalasa, Anakapalle, and Atchutapuram.

The Concept Strategy

Idea of creating a new and planned city on perimeter of existing city of Visakhapatnam is conceptualized in context that most of the areas (30%) in GVMC are under natural areas (which needs protection) and dedicated to ports and logistics, naval base, and large industrial estates, while immediate areas along the coast are vulnerable to cyclones and threat from the sea due to climate change. Hence, a new greenfield area led urban development axis is visualized between Vizianagaram-Anandapuram-Pendurthi-Kothavalasa-Anakapalle-and Atchutapuram along the bypass to NH-16 and other roads connecting these satellite towns/settlements.

The new urban development axis will be structured through theme based economic centres and sub CBDs weaved through bus based public transit and connected to mother city through improved transit and radial linkages. The new urban development axis will give greater recognition to the satellite towns/areas and help them integrate with the mother city. The following aspects will shape the urban structure and realization of the spatial alternative.

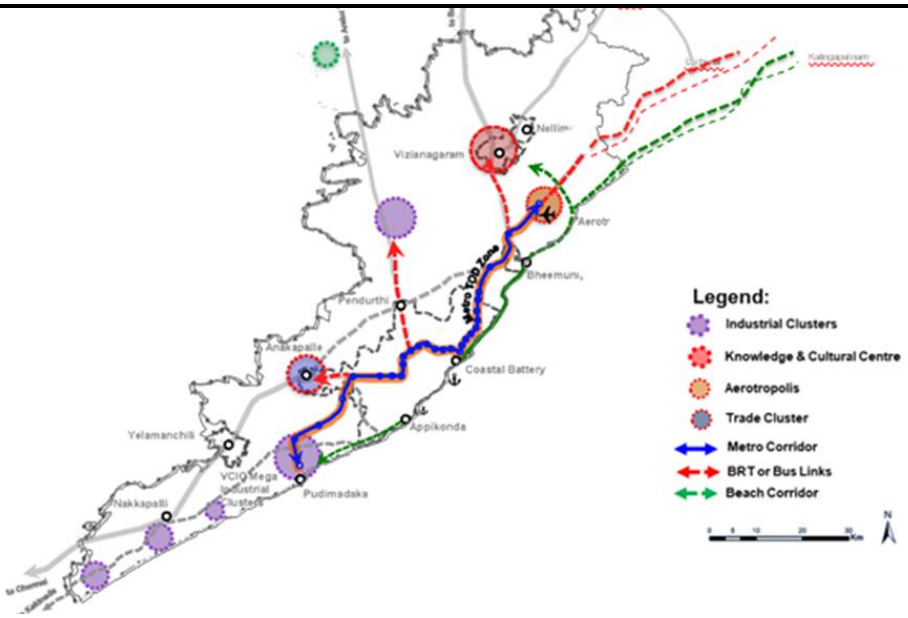


Figure 14-18: Alternative 2 focuses urban growth on city peripheries by developing greenfield sites hence leaving existing city for retrofitting and improvement through select urban renewal and redevelopment projects.

- **New Urban Development Axis:** A New Urban Development Axis through greenfield areas development up to 3 to 5 km on both sides of bypass to NH-16 and other roads connecting Vizianagaram-Anandapuram-Pendurthi-Anakapalle-and Atchutapuram will configure this spatial concept plan for creating new and parallel city on periphery of mother city of Visakhapatnam.
- **Theme based New Economic Nodes and Sub CBDs:** Number of theme based economic nodes and Sub CBDs will be developed along the axis and at nodal locations. Knowledge and cultural city at Vizianagaram, Bhogapuram Aerocity, township in Anandapuram, Pendurthi-Kothavalasa Sub CBD and light industry and residential township, Sabbavaram Knowledge and Mixed Use node, Anakapalle trade and mixed use town, and Mega Industrial Cluster at Atchutapuram under VCIC will be key theme based clusters/nodes to establish the new urban axis.
- **Networked City:** The new urban axis while having urban transit (BRTS) of its own will be networked with the mother city through BRTS or Bus based connections along major radial corridors to the mother city and proposed metro network, hence creating an idea of highly networked city region.
- **Beach Road as a Parallel Leisure and Tourism Axis:** The proposed Beach Road development between RK Beach to Bheemunipatnam can be further extended with select tourism nodes development and networking existing tourism destinations in VMR.
- **Protection of Natural Areas:** The alternative will relieve pressure on existing development adjoining natural sites hence help in protection and integration of natural environment for leisure and tourism activities.

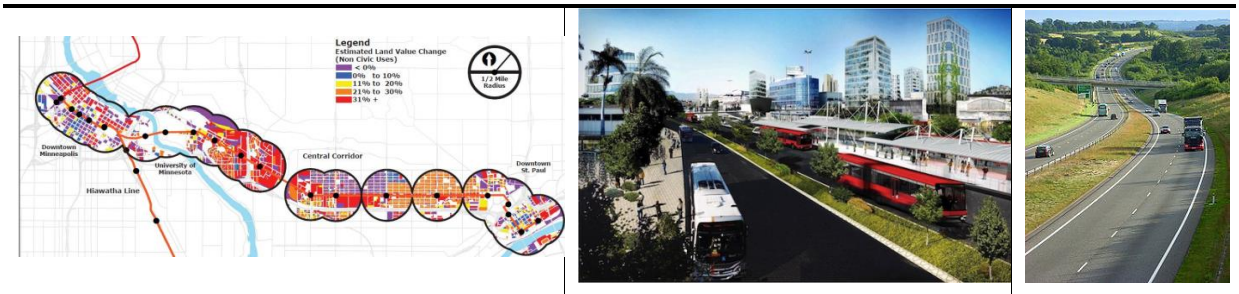


Figure 14-19: Theme based economic nodes and BRTS corridor will form central structure for new urban axis on perimeter of the mother city and a new bypass for through goods traffic.

Urban Transport Network

The alternative strategy is structured by networking existing towns and proposed theme based new clusters located along the greenfield led new urban development axis on perimeter of the mother city. BRTS and Bus based public transit network will be central to achieve transit led mobility in the VMR under this alternative. Seoul Metropolitan Region is structured under similar principles, especially areas across The Han River and connected to existing core city of Seoul. The key aspects and features of the urban transport networking under this alternative will be as follows.

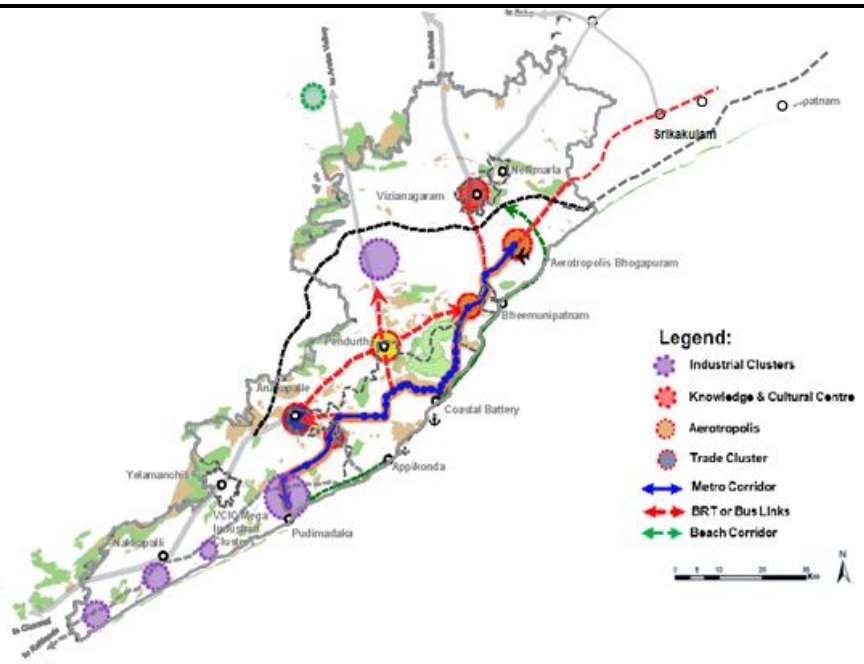


Figure 14-20:Alternative 2 focuses on connecting the satellite cities/towns through BRT and Bus Based Public Transit on urban periphery of Visakhapatnam city. The mother city will connect to Aerocity and VCIC Mega Industrial Cluster through metro network and through Radial Corridors to New Urban Axis and satellite towns.

- Public Transit Led Urban Axis: Public transit led, BRTS, urban development axis connecting theme based economic clusters and sub CBDs. The public transit axis will be supported with NMT and other para transit modes to promote development ranging between 3-5 km influence areas of the axis/corridor.
- Networking the Mother City with the New Urban Axis:Radial corridors having BRTS and Bus based public transit will network the new urban axis and its key locations to metro network in the mother city, hence promoting an idea of highly integrated and networked city that links work, home, social and leisure destinations.
- Regional connectivity and New Bypass: Regional bus and rail based connections to important destinations like Araku Valley, Annavaram, and industrial clusters proposed under the PCPIR at Nakkapalli, Payakaraopeta will be further reinforced and modernized. Keeping in context that new city would be developed along the current bypass hence new bypass is required/recommended on a medium to long term basis under this alternative, which will be aligned with other state level strategic roads development and improvement plan.
- Connectivity to Mandal Headquarters: All mandal headquarters in VMR would be connected with improved road RoWs (30 M) with respect to main urban transport network.

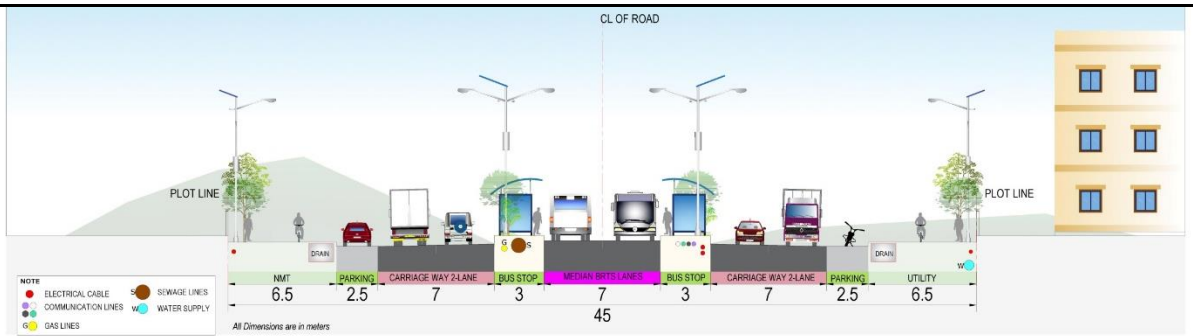


Figure 14-21: Connecting new urban axis between Vizianagaram, Anandapuram, Pendurthi-Anakapalle, Atchutapuram through 7 Radial Corridors to the mother city and metro network.

- **Port Connectivity Improvement:** Modernization of ports and improving connectivity to ports is important to overall economic expansion and putting the region on global investment platform. Existing and proposed locations for truck terminals and warehousing would be integrated through road network improvement.
- **ISBT and ICBTs:** In the context of inter city and region bus based travel demand location of ISBTs and ICBTs would be identified in VMR in next phase of the master planning VMR.
- **Road Network Improvement:** In Visakhapatnam city and VMR as a whole where traffic conditions on roads are congested and deteriorating hence improved and hierarchical road network of RoWs of 90m, 60m, 45m, 30m, and 24 m would be proposed in existing and proposed greenfield led urban growth areas.

Urban Form and Imageability

This alternative strategy creates an idea of a new city and planned greenfield led urban development on perimeter of the mother city which is well supported with public transit. The new urban axis/corridor will link most of the satellite towns/areas along with new economic clusters and sub CBDs into new and parallel but highly imageable urban corridor in VMR. The following aspects will constitute the urban form and image structure of VMR.

- **A New Urban Corridor and a Parallel City:** A new urban corridor upto 3-5 km on both sides of the bypass to NH-16 and connecting roads to the satellite towns on periphery of the existing city by linking Vizianagaram-Pendurthi-Anakapalle-Atchutapuram.
- **Theme based Economic Nodes and Sub CBDs:** To make the corridor economically sustainable new theme based knowledge, mixed use, industrial, and commercial nodes (Sub CBDs) would be developed to promote proximity between work and home in the corridor.
- **Radials Corridors:** To link the new urban axis/corridor to the mother city seven radial corridors are proposed to be developed/improved along with provision of bus based public transit. The key radial corridors will be Kothavalasa-Pendurthi-Waltair Corridor, Sabbavaram-Airport-Vizag Port Corridor, Pendurthi-Simhachalam-Hanumanthavaka Jn Corridor, Vizianagaram-Anandapuram-Madhurawada-Waltair Corridor, Vizianagaram-Thagarapuvalasa-Bheemunipatnam Corridor, Anakapalle-Gajuwaka-Vizag Port Corridor, Anakapalle-Atchutapuram-Pudimadaka Corridor.
- **Theme Based Tourism Destinations**: Araku Valley as a global level MICE, Health and Leisure tourism destination with world class tourism infrastructure and Visakhapatnam playing a role of a mother city, Buddhist Circuit tourism infrastructure improvement, integration of Beach Corridor for Leisure and Coastal Tourism, and Hindu Pilgrimage destinations with tourism infrastructure improvement in, Vizianagaram, Simhachalam, and Annavaram etc., development of Theme Parks, and Eco Tourism near wildlife sanctuaries.
- **Modernizing the Existing City Cores through Retrofitting and Urban Renewal:** To improve the quality of work and living environment in existing city many of ongoing and committed proposals for area development, smart city, public transit, NMT, and redevelopment would be integrated in the master plan along with identification of potential new proposals to modernize the existing city.
- **Resilient City:** Planning to reduce economic, human, and urban infrastructure losses would be essential to this alternative as well due to disaster vulnerability of this region. Hence, areas prone to floods and storm surge will be identified based on available studies and vulnerable zones not subjected to high value and urban development. It is recommended that VMRDA carries necessary studies to frame planning principles and development regulations for such vulnerable areas to natural disasters by involving communities and experts.

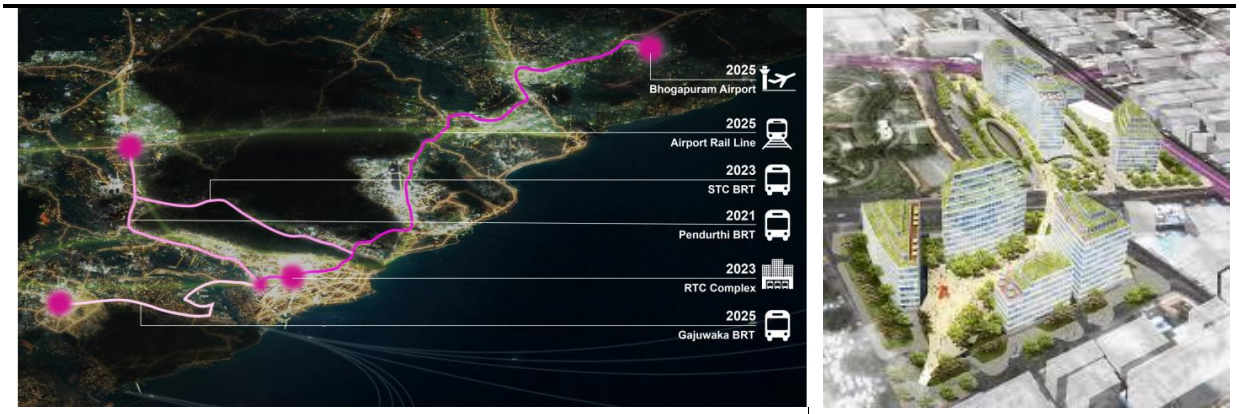


Figure 14-22: Incorporating BRTS committed and other proposed projects and along with redevelopment of select sites will help achieve modernization of mother city.

Potential Key Project Components

Key to realise this alternative are following project components which will form critical urban and regional structure of the Perspective Plan.

- Transit led development of New Urban Axis/Corridor between Vizianagaram-Pendurthi-Anakapalle-and Atchutapuram through land pooling and land development strategies.
- Improvement and Development of seven radial corridors between the new urban axis along the bypass to NH-16, mother city, and the Beach Corridor.
- Theme based economic nodes development along the new corridor.
- Tourism destinations development and expansion of Araku Valley, Buddhist Circuit, Hindu Pilgrimage destinations, Beach and coastal tourism, and eco-tourism etc.
- Modernization of existing city core areas through opportunity based retrofitting, urban renewal, and integration of committed and proposed projects smart city and urban transit improvement studies along the proposed metro.
- Bypass development to VMR on medium to long term basis.
- Protection of natural areas and Agriculture lands.

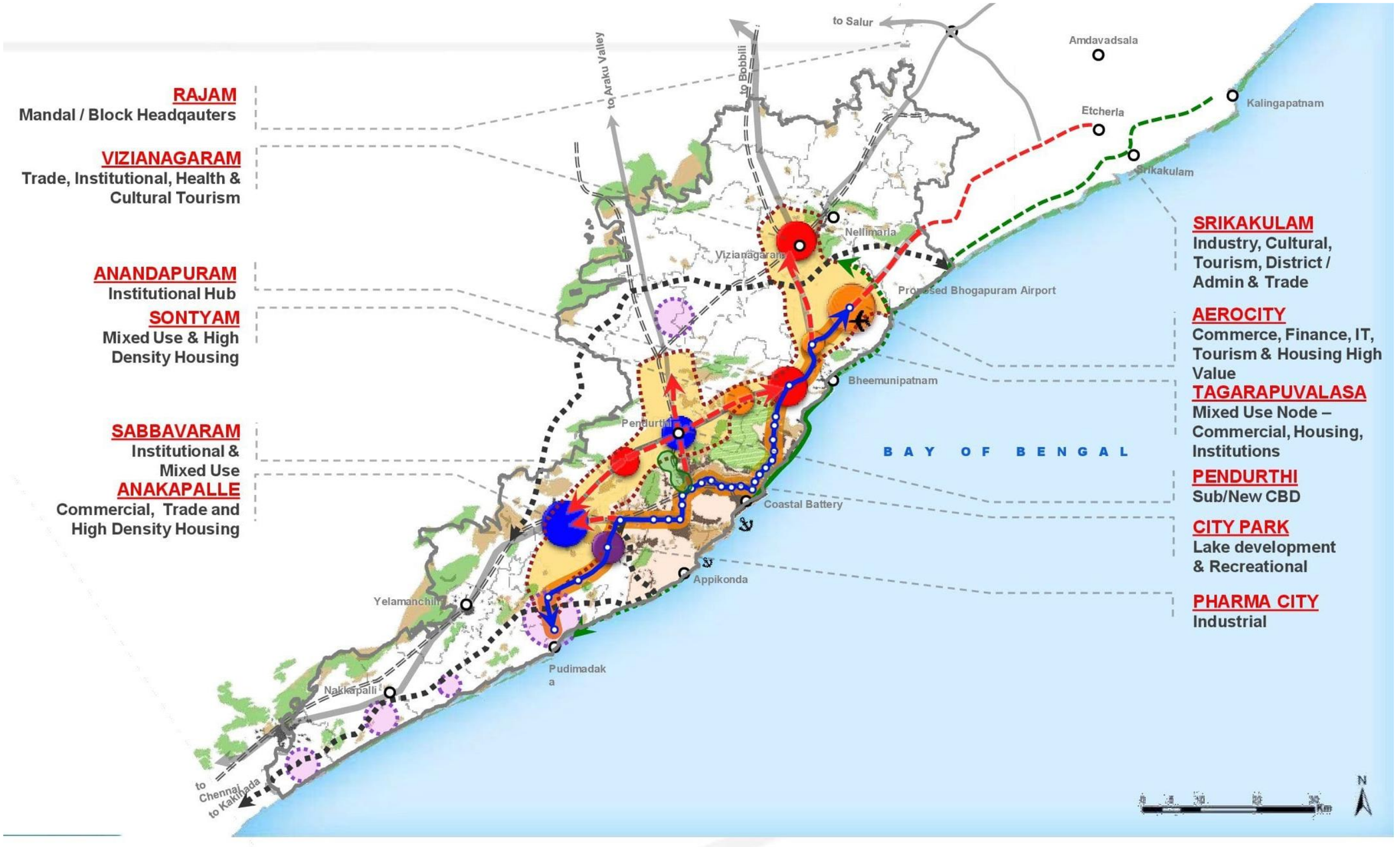


Figure 14-23: Alternative Spatial Strategic Plan -2: Cohesive Metropolis - Greenfield led Urban Development on Periphery of Mother City and other Satellite towns in VMR

14.4 ALTERNATIVE 3: DECENTRALISED METROPOLIS

Context

VMR is a large urban metropolitan region, has a linear form (250 km long), and Visakhapatnam city has been the focus of urban development till date. Other than Visakhapatnam city, there are three larger towns (Vizianagaram and Anakapalle) and four other smaller urban areas/settlements (Bheemunipatnam, Nellimarla, Yelamanchili, and Atchutapuram) in VMR which are developing in an unplanned manner and without adequate economic inputs to create jobs. Close to 40% of the urban population of VMR is located in these satellite towns and urban areas but currently these areas are comparative at disadvantage with respect to the mother city due to lack adequate economic influence and connectivity.

In the light of disposition of new and proposed major economic development projects in VMR in recent past such as mega industrial cluster at Atchutapuram and Nakkapalli under VCIC, International Airport and Aerocity at Bhogapuram, through PPP, and VK-PCPIR between Visakhapatnam and Kakinada throws the opportunities for decentralized development in VMR where the satellite towns and urban areas can play leading role and structuring urban growth in VMR. Such a decentralized approach to urban growth in VMR is also supported by rail and national highway connectivity available in the region.

In addition to Visakhapatnam and Vizianagaram are separate districts and form major part of VMR, hence carrying out balanced urban development in response to stakeholders in these districts in VMR through disposition of economic, connectivity and social infrastructure is desirable and possible alternative strategy.

The Concept Strategy

To carry out balanced and decentralized urban development in VMR to create jobs, skills development, and social infrastructure in and around the satellite towns of mother city of Visakhapatnam. To implement this deliberate and politically correct strategy of creating a balanced urban development in VMR the satellite towns will become cities in their own right by 2051 and can be promoted for theme based economic development supported with adequate residential and social infrastructure.

Central to realizing this alternative is to leverage connectivity with respect to railway network, national highways, new and international airport, proposed Port at Bhavanapadu, and Kakinada port to promote urban growth in the satellite towns/urban areas. The key aspects and components to structure the perspective plan for VMR under this alternative are as follows.

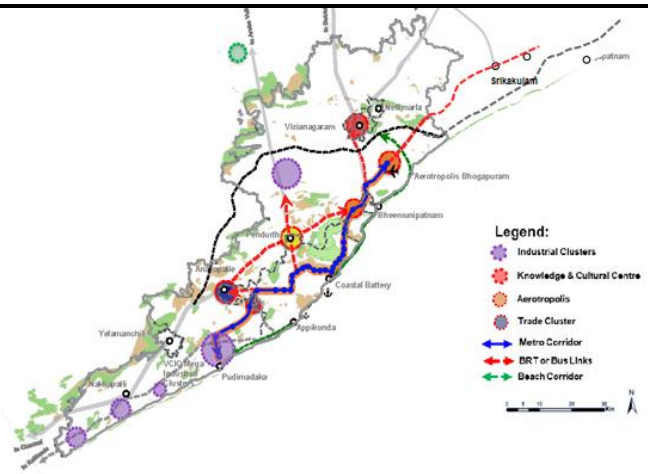


Figure 14-24: Alternative 3 is based on decentralized and balanced urban development in VMR by focusing on theme based development of satellite cities/towns of Vizianagaram, Aerocity at Bhogapuram, Pendurthi-Kothavalasa, and Anakapalle-Atchutapuram. Existing city of Visakhatpatnam will undergo retrofitting and select sites based redevelopment.

- Turning Satellite Towns to Cities: The satellite towns due to theme based economic development and provision adequate residential and social infrastructure will become cities in their own right. In such a scheme of structuring the VMR, Vizianagaram, Pendurthi-Kothavalasa, Anakapalle-Atchutapuram will become cities of importance and each of these having population between 0.3 to 0.8 million.
- Adequate Regional and Public Transit Connectivity: In addition to theme based economic development of the satellite towns, improving connectivity to these towns with respect to national highways, railway, international airport, and ports is critical to their success. Inter-city public transit connectivity and provision of quality public transit within the satellite cities is the essential to economic growth and to this strategy.
- Theme based Economic Development of the Satellite Cities: To promote greater economic interconnectivity and balanced development in VMR theme-based development of these satellite cities is key to success. In such a scenario development of Vizianagaram as knowledge and cultural hub, Bheemunipatnam as Cultural and Beach Tourism Centre, Pendurthi-Kothavalasa as clean and light industry based integrated satellite city, Anakapalle as Trade and Industry Hub, Atchutapuram-Nakkapalli as VCIC and PCPIR led Mega Industrial Cluster is likely economic scenario to promote balanced and decentralized approach to urban development in VMR.
- Mother City: Mother City of Visakhapatnam continues to be most important city of VMR and plays role of main CBD, knowledge centre, tourism and logistics anchor of VMR. Satellite cities needs to be well connected with mother cities to ensure balanced urban development in the region.
- Networked Region: The decentralized approach to urban development requires economic networking between the cities and quality public transit connectivity.
- Beach Road as a Leisure and Tourism Axis: The proposed Beach Road development between RK Beach to Bheemunipatnam can be further extended with select tourism nodes development and networking existing tourism destinations in VMR.
- Protection of Natural Areas: The alternative will help relieve pressure on existing areas adjoining natural sites hence helping in protection and integration of natural environment for leisure and tourism activities.



Figure 14-25:Theme based economic nodes development near the satellite towns along VCIC mega industrial cluster and leveraging new connectivity based on International Airport at Bhogapuram and Seaport and Bhavanapadu in Srikakulam will support the idea of decentralized and balanced VMR development.

Urban Transport Network

Decentralized and balanced urban development in metropolitan regions is only successful if quality public transit connectivity is created between the mother city and the satellite cities. Kuala Lumpur/Klang Valley Metropolitan Region in Malaysia and Greater Beijing Metropolitan Region in China are successful examples of such an approach. To structure urban transport and public transit in VMR under this concept alternative, following aspects are important to implement.

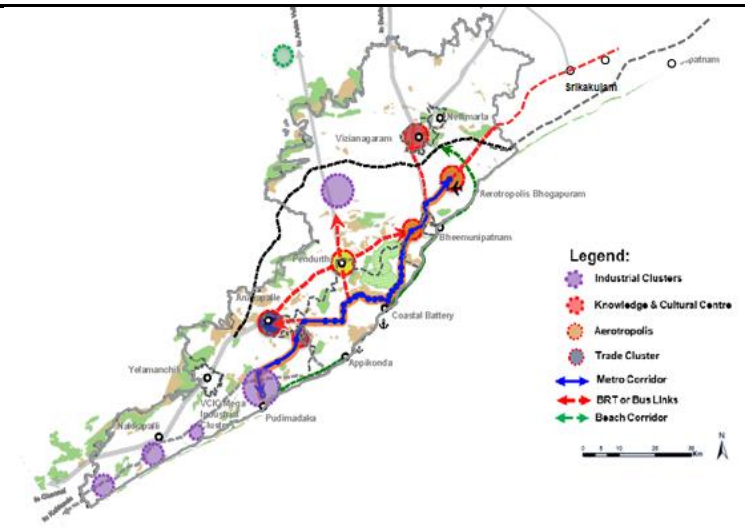


Figure 14-26: The key aspects of urban transport network for Alternative 3 comprises a bypass to VMR, Metro link between Aerocity-Visakhapatnam-VCIC Mega Cluster, and BRT or Bus based public transit on radial corridors connecting to the Satellite city and towns.

- A new Corridor in North and South in VMR linking the Satellite Cities: Since there is substantial focus on economically theming of the satellite cities hence connectivity between the satellite cities will become important. A new and public transit corridor is visualized to link Nakkapalli-Atchutapuram-Anakapalle-Pendurthi-Vizianagaram, Bhogapuram Airport-Bheemunipatnam. The corridor to have 60-90 m RoW along with provision of public transit which connects the satellite cities.
- Bypass to VMR: Current pass to NH-16 only provides partial relief from through goods and other traffic passing through VMR hence there is need to promote new bypass to VMR which is linked to the satellite cities. A conceptual alignment of the bypass is proposed here which can also take into account larger state level strategic road planning and improvement.
- Public Transit Connectivity between and within the cities: To ensure success of the alternative, public transit connectivity between the mother city and satellite cities is important. In addition to the new corridor as proposed above, radial and new public transit corridors connecting the mother city and satellite cities needs to be developed/improved.
- Connectivity to Mandal Headquarters: All mandal headquarters in VMR would be connected with improved road RoWs (30 M) with respect to main urban transport network to achieve improved quality of life in VMR.
- Port Connectivity Improvement: Modernization ports and improving connectivity to ports is important to overall economic expansion and putting the region on global investment platform. To improve connectivity to the ports is an ongoing effort in VMR and will be further reinforced as part of the master plan.
- ISBT and ICBTs: In the context of greater inter city and region travel demand location of ISBTs and ICBTs would be identified in VMR in next phase of the master planning VMR.
- Road Network Improvement: In Visakhapatnam city and VMR as a whole where traffic conditions on roads are deteriorating hence improved and hierarchical road network having RoWs of 90m, 60m, 45m, 30m, and 24 m would be proposed in existing and proposed greenfield led urban growth areas.


Figure 14-27: Metro and Bus based quality connectivity between economic nodes, international airport at Bhogapuram, and satellite cities are important for success of this alternative.

Urban Form and Imageability

The future urban form under this alternative spatial strategy will be that of poly nodal urban system having number of new and self-sustainable cities in VMR, which are well network through intercity and public transit connectivity. However, mother city of Visakhapatnam will continue to be the CBD, main knowledge hub, logistics and tourism anchor for the region. Following aspects are key characteristics of this alternative and will help create a new urban imageability for VMR as a whole.

- Self-Sustainable and Theme Based New Cities: At least four new large cities of 0.3 to 0.8 million populations will emerge under this alternative which are thematically structured and help create truly a poly nodal and new imageability for VMR. These new cities are Vizianagaram, Anankapalli-Atchutapuram, and Pendurthi-Kothavalasa.
- New Corridors Connecting the Satellite Cities: New corridors of 60-90m RoWs and facilitating public transit will connect the satellite cities of Vizianagaram, Pendurthi-Kothavalasa, Anakapalle-Atchutapuram for economic, social, and leisure interactions in the region.
- The Mother City: Mother city of Visakhapatnam, as a whole, will continue to be the anchor city in VMR and undergo retrofitting and urban renewal to modernize its image and role in the VMR as a whole in poly nodal urban structure for VMR.
- Theme Based Tourism Destinations: Araku Valley as a global level MICE, Health and Leisure tourism destination with world class tourism infrastructure and Visakhapatnam playing a role of a mother city, Buddhist Circuit tourism infrastructure improvement, Beach Corridor for Leisure and Coastal Tourism, and Hindu Pilgrimage destinations development with tourism infrastructure improvement in, Vizianagaram, Simhachalam, and Annavaram, development of Theme Parks, and Eco Tourism near wildlife sanctuaries.


Figure 14-28: Combinations of greenfield development near satellite towns and existing city renewal through projects such as RTC Complex and beachfront development will form image of VMR under this alternative.

Potential Key Project Components

The strategic project components for realizing this alternative are as follows which help in creating the poly nodal urban structure in VMR and help realizing the Perspective Plan.

- Development of a 150 km new corridors between Atchutapuram-Anakapalle-Pendurthi-Vizianagaram- having 60-90 m RoW with public transit connecting the satellite cities.
- Improvement of four major Radial Corridors connecting the mother city and new satellite cities.
- Development of a New Bypass to NH-16 which will also incorporate strategic roads conceived under State Roads Improvement Programme.
- Metro Transit Development in Visakhapatnam connecting Gajuwaka and upto International Airport at Bhogapuram.
- Development of Ring Roads on perimeter of Vizianagaram and Anakapalle cities for urban growth.
- Tourism destinations development and expansion of such as Araku Valley, Buddhist Circuit, Hindu Pilgrimage destinations, Beach and coastal tourism, and eco-tourism etc.
- Modernization of existing city core areas through opportunity based retrofitting, urban renewal, and integration of committed and proposed projects such as smart city and for urban transit improve.
- Protection of natural areas and Agriculture lands.

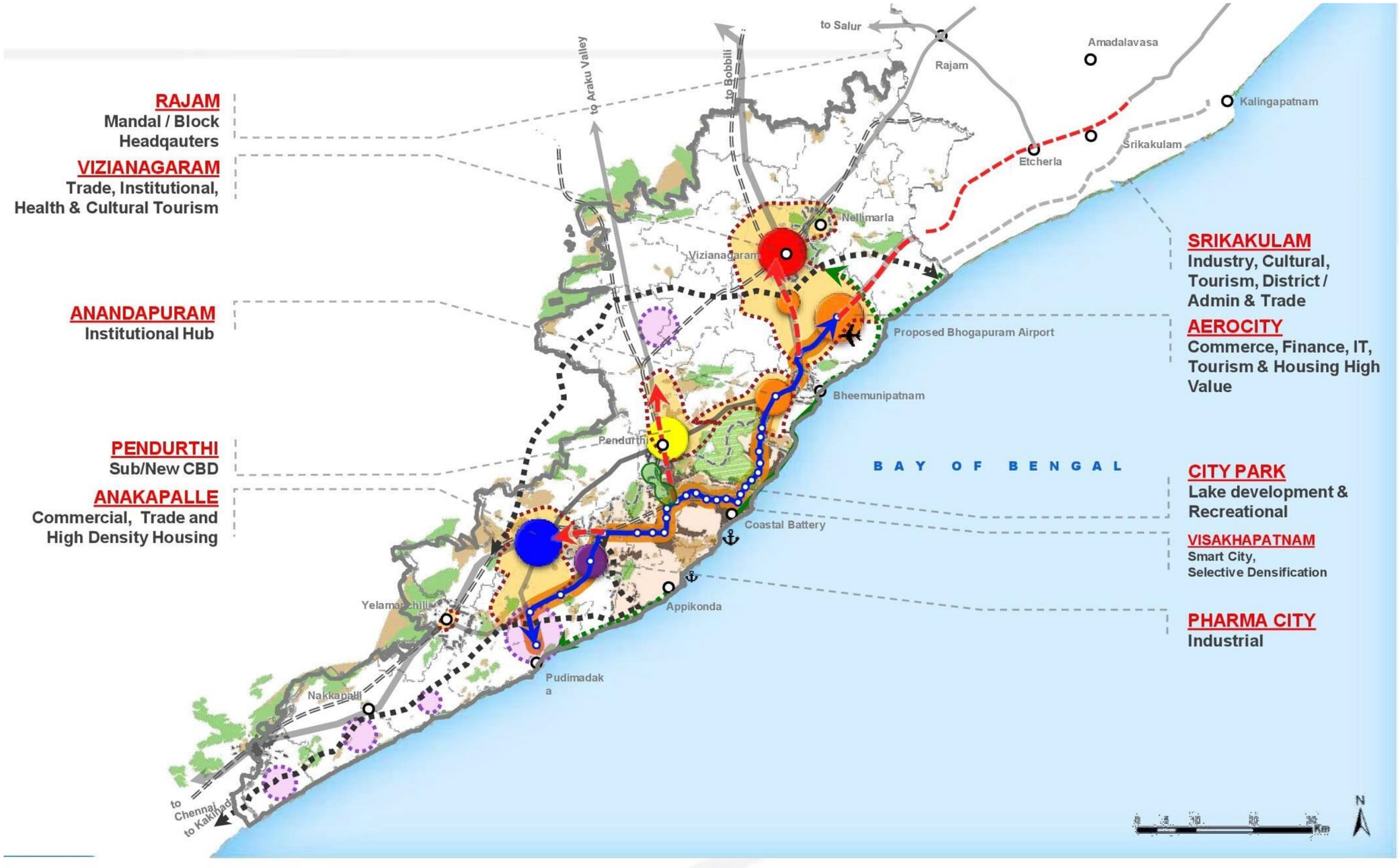


Figure 14-29: Alternative Spatial Strategic Plan -3: Decentralised Metropolis with decentralized and balanced urban development in VMR

14.5 EVALUATION OF ALTERNATIVE SPATIAL STRATEGIES

Evaluation of the alternative spatial strategies has been done based on a Multi-Criteria Assessment Framework which a decision making tool to find the best alternative. Evaluation of the three alternatives has been done within framework considering the following criteria:

- Strategic Spatial Development
- Strategic Economic Development
- Managing Sustainable Environment and Climate Change
- Efficient Transportation System
- Sustainable Infrastructure System

Table 14-1: Multi-Criteria Assessment Framework

Criteria	*Alternative 1*	*Alternative 2*	*Alternative 3*
STRATEGIC SPATIAL DEVELOPMENT			
Overall Focus	Development of Visakhapatnam Core city with TOD	Development of the fringe areas from Anakapalle to Vizianagaram along the NH16 (bypass)	Decentralized urban development strategy
Population Distribution	Visakhapatnam City Core has 26% of total population And 65% of Urban population	Visakhapatnam City Core has 19% of total population And 53% of Urban population	Visakhapatnam City Core has 18% of total population And 44% of Urban population
Development Strategy	Compact high density high rise development supported by mass transit	Distributed Medium density development	Multi nuclei compact development and medium density
Direction of Growth	Vertical and along transit corridor	Radial from the city core	Focus on satellite towns and radial growth from urban centers a
Location of New Employment Areas	Along public transit corridors.	Along NH16 (bypass)	In Satellite towns and multiple sub-CBDswith individual economic theme.
Existing core	Redevelopment and densification of existing core	Regeneration of existing core	Renewal of Existing cores.
Settlement Hierarchy	Visakhapatnam as the main core, with supporting urban centres as Vizianagaram, Pendurthi and Anakapalle	Anakapalle, Pendurthi, Anandapuram and Vizianagaram as emerging Sub-CBDs	Anakapalle, Vizianagaram, and GVMC as urban centers with surrounding settlements depending on it.
STRATEGIC ECONOMIC DEVELOPMENT			

Criteria	Alternative 1	Alternative 2	Alternative 3
Key Drivers of Economy	Knowledge based, health city, Industry, tourism, and logistics	Industry, Trade and commerce, Logistics, tourism, Institutional and Aerocity	Tourism, Administration, Trade and Commerce
Economic Districts	GVMC and Aerocity	Anakapalle, Pendurthi and Vizianagaram	Anakapalle, Vizianagaram, Bhogapuram,
MANAGING SUSTAINABLE ENVIRONMENT AND CLIMATE CHANGE			
Resilient City Region	Core is more prone to disaster	New development away from coastline	Decentralizing and away from coast minimizing risk
Protecting Natural Footprint	Maximum protection of natural footprint	Moderate Greenfield development without disturbing sensitive zones	focus on Satellite cities hence may affect natural environment
Coastal management	Stringent policies required	Stringent policies required	Stringent policies required
Cultural Heritage	Protected	Protected	Protected
Food Security	Lowest disturbance to agriculture livelihood	Moderate greenfield development	Low disturbance to agriculture livelihood
Carbon footprint	Lowest	Highest	Moderate
Pollution	Efficient mechanisms to tackle pollution in manageable spread	Lower SPMs and better air quality	Lower SPMs and better air quality
Ecology Management	Preservation of Kambalakonda and other reserve forests within core area and minimize marine disposal of effluents	Preservation existing areas and demarcating new eco sensitive areas to promote eco-tourism	Preservation existing areas and demarcating new eco sensitive areas to promote eco-tourism
Green Communities	Compact green spaces in communal level	Large green spaces in fringe areas to sustain new development	Large green spaces in fringe areas to sustain new development
EFFICIENT TRANSPORTATION SYSTEM			
MRTS	High Capacity short distance network	Medium Capacity network	Medium Capacity
BRTS	Improving Existing Lines and last mile connectivity	New corridor along NH16 (bypass)	New radial Corridors and connectivity to urban centers
NMT	Enhanced NMT supporting last mile	Improving NMT corridors in core urban areas	Improving NMT corridors
Road Network Improvement	designed ROWs with universal access.	Increased capacity of peripheral and radial roads	Increased capacity of inter-nodal connectivity

Criteria	Alternative 1	Alternative 2	Alternative 3
New Road Development	Minimum	Development of missing radial roads and development of linkages	Development of nodal linkage roads and arterial roads in decentralized urban centers
Logistics development	Improved freight corridors	New freight terminals away from city	Theme based logistic hubs
Regional and Inter-Regional Connectivity	Good Connectivity to region and hinterland	Good Connectivity to region and hinterland	Excellent Connectivity to region and hinterland
ATL	23 (Good)	21 (Better)	18 (Best)
Avg. Speed (kmph)	39.4 (Good)	42.0 (Better)	50.0 (Best)
PT Share	<50% (Best)	25%-30% (Better)	20%-25% (Good)
PT Cost (in Cr.)	42,472 (Better)	43,018 (Good)	42,472 (Better)
Highway Cost (in Cr.)	6,357 (Best)	8,360 (Good)	8,018 (Better)
Environment (CO2 in Tonnes per mill pop)	215 (Best)	282 (Good)	271 (Better)
Safety (Accidents per annum per mill pop)	976 (Best)	1,284 (Good)	1,232 (Better)
SUSTAINABLE INFRASTRUCTURE SYSTEM			
Utilization of Renewable Energy	Lower available area in the city	Higher Catchment Area	Higher Catchment Area
Water Supply	Improvement of existing infrastructure	New infrastructure to be constructed	Improvement in core area
Demand and Location of STPs	Locations has been identified	Land will be available for decentralized STPs	Land will be available for decentralized STPs
Identification of Waste Management Strategies	Yes	Yes	Yes
Expected Cost for New Trunk Infrastructure	Improvement	Investment for Construction of new trunk	Improvement

Source: Consultant's analysis

Table 14-2: Summary of Comparative Ranking for Three Alternative Spatial Strategies

S. No.	Parameters for Evaluation	Alternative-1: COMPACT METROPOLIS	Alternative -2: COHESIVE METROPOLIS	Alternative -3: DECENTRALISED METROPOLIS
1	Parameter 1: Response to Stakeholders' Opinion	Rank 3	Rank 1	Rank 2
2	Parameter 2: Potential of Facilitating a Global City/Metropolitan Region	Rank 1	Rank 2	Rank 3

3	Parameter 3: Protecting Natural Areas and Regional Ecology	Rank 1	Rank 2	Rank 3
4	Parameter 4: Integration with Urban and Regional Transport Connectivity	Rank 1	Rank 2	Rank 3
5	Parameter 5: Balanced and Integration with Regional Spatial Structure	Rank 3	Rank 2	Rank 1
6	Parameter 6: Integration of Heritage and Eco Tourism Network	Rank 1	Rank 3	Rank 2
7	Parameter 7: Urban Image	Rank 1	Rank 2	Rank 3
8	Parameter 8 –Resilient City	Rank 3	Rank 1	Rank 2
9	Parameter 9: Ease of Implementation and Cost Effectiveness	Rank 1	Rank 2	Rank 3
10	Parameter 10: Investment Potential	Rank 1	Rank 3	Rank 2
	Overall Ranking	**Rank 1 (6 Nos. Rank 1)**	**Rank 2 (2 Nos. Rank 1)**	**Rank 3 (1 Nos Rank 1 but max Rank-3)**

Source: - Consultant's' Study

14.6 PREFERRED STRATEGY: VMRDA REGION

Context

The three alternative strategies conceptualized for structuring the VMR, both economic nodes and spatial development, possess merits and address existing ground conditions and potential of the region. These merits have been thoroughly assessed through MCAF based comparative assessment of the alternatives. It is concluded that to arrive at preferred strategy for VMRDA Region ideally should integrate the key qualities and strengths of all the three alternatives. Hence, a preferred strategy for VMR is evolved by integrating strengths and merits of the three alternatives in addressing the potential of the region.

To reiterate, Alternative 1 focus on transit led compact development in the region, while Alternative 2 focus on promoting planned development in areas having propensity for urban growth on urban fringes of the city, and Alternative 3 focus on balanced and decentralized development in the region. Behind the three alternatives there is existing context and ground realities that created the theme based biases to structure the region. Hence, it considered desirable that quality and strengths of the three alternatives are turned into an integrated development strategy/preferred strategy for VMR to arrive at a spatial vision for the region.

The preferred strategy focuses on urban renewal of existing cores of Vishakhapatnam city and other key cities, planned development on urban fringes of existing cities, and economic and urban growth in satellite cities. Such a strategy takes care of stakeholders aspirations, need to modernizing the existing cities through modern transport and urban infrastructure, and capitalizes on areas having propensity for urban growth.

The Concept Strategy

In view of Vishakhapatnam being one of the most important cities of Andhra Pradesh, VMR looks forward to being a city of the future which is a great place to live, work, and leisure. In addition, it is desirable to

promote the region for safety from natural disasters, protects its environmental assets and agriculture lands, and promote balanced and sustainable development. Provision of modern and missing infrastructure in urban centres and rural areas is key to achieve the objective. In the preferred strategy, urban areas and rural settlements in VMR are given strong focus to achieve comprehensive development of the region.

Current urban and regional structure of VMR is established around the mother city of Visakhapatnam and other key cities of Vizianagaram, Anakapalle, and Pendurthi. Current focus of upcoming investments in the region is in Bhogapuram, Anandapuram, Pendurthi, Sabbavaram and Anakapalle and VCIC Industrial Node in Atchutapuram and Nakkapalli, which is likely to turn this region into a high growth trajectory. It is likely that VMR will become an economic power house of the region hence needs structured to achieve planned development.

The urban growth is envisaged in contiguous manner in and around existing urban centres, with present cities and towns acting as theme based centres and sub-CBDs.. The proposed airport, metro lines and the industrial nodes in the south will create a major axis of development. The mother and other important cities in the region will act as economic and human development resource centres along with hierarchical settlement pattern.

The core areas of GVMC and other cities of the region currently has majority of the urban, will undergo major re-densification and urban renewal process to accommodate additional population. This will further boost the role of the proposed metro which would operate through the core areas of its cities. The structure will also emphasize on theme based development of settlements, based on present and proposed economic significance. The planned urban development in the region will possess qualities of being compact urban cities and settlements, served with public transit corridors, with healthy relationship between built and natural environment. Protecting natural environment and making it part of the experience of the region is key essence of the preferred strategy for VMR.

- **Mother City:** Mother City of Visakhapatnam continues to be most important city of VMR and plays role of main CBD, knowledge centre, tourism and logistics anchor of VMR. Satellite cities and regional centers needs to be well connected with core area and new growth areas to ensure balanced urban development in the region.
- **New Urban Development Axis:** A New Urban Development Axis through greenfield areas development up to 3 to 5 km on both sides of bypass to NH-16 and other roads connecting Vizianagaram-Anandapuram-Pendurthi-Anakapalle-and Atchutapuram will configure this spatial strategy in creating a new and parallel city on periphery of mother city of Visakhapatnam.
- **Transit Led Urban Structure:** Public transit led, Metro, urban development axis connecting theme based economic clusters and sub CBDs. It is desirable and recommended that metro network which is conceived between Bhogapuram International Airport and Anakapalle in three phases is further extended upto Atchutapuram-APIIC SEZ from Lankelapalem to support the emerging urban axis between the airport, existing CBD of Visakhapatnam, and the mega Industrial Cluster under VCIC at Atchutapuram. Existing and expansion of BRTS network can be organized to provide last mile connectivity and to the sub-CBDs with respect to the metro network. The public transit axis will be supported with NMT and other para transit modes to promote development in the influence area of 3-5 km along the public transit corridors.

Figure 14-30: Image of a city with a robust connectivity at a Global as well as regional level.

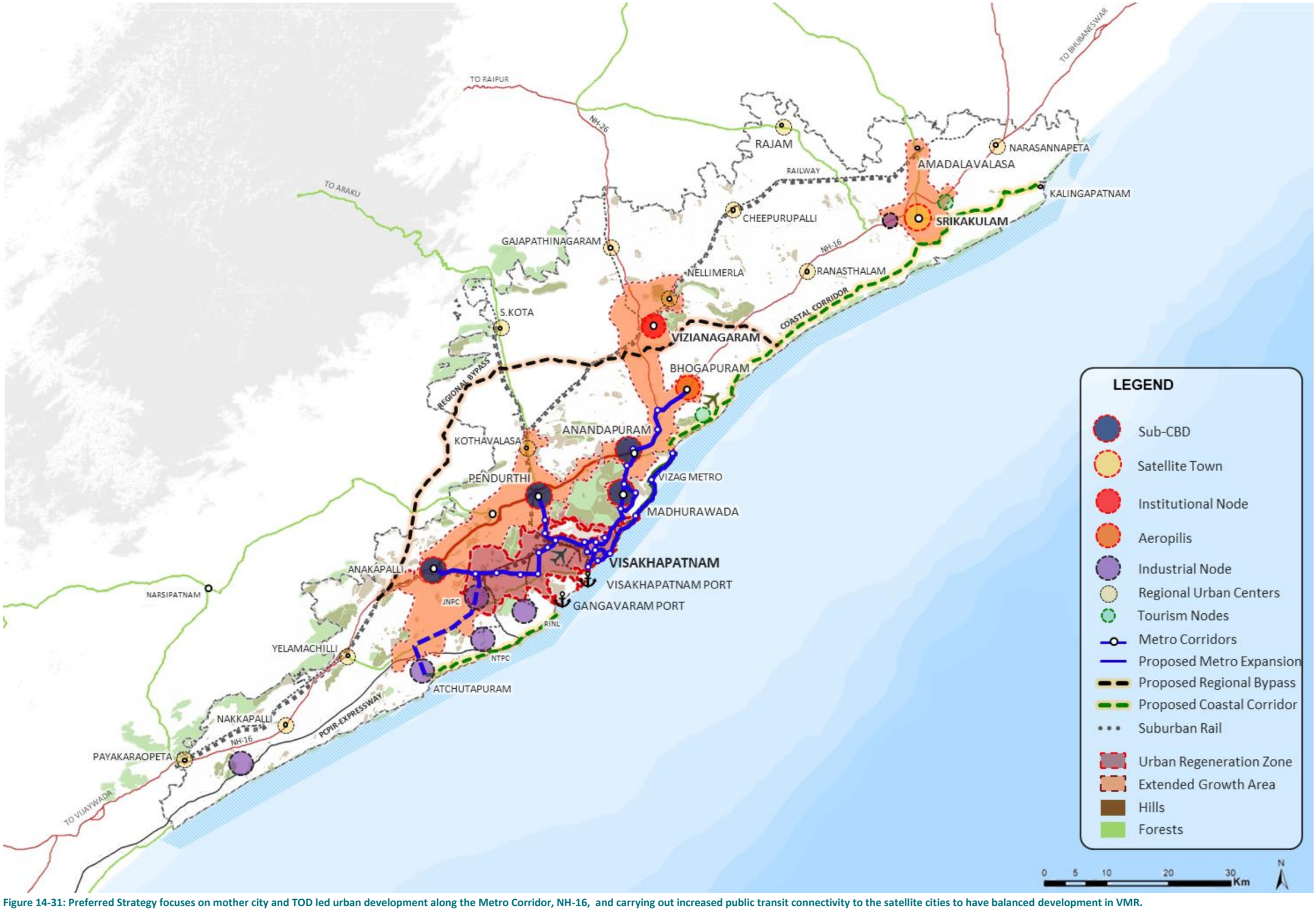


Figure 14-31: Preferred Strategy focuses on mother city and TOD led urban development along the Metro Corridor, NH-16, and carrying out increased public transit connectivity to the satellite cities to have balanced development in VMR.

To support the metro network between Bhogapuram Aerocity-Existing CBD of Visakhapatnam-Atchutapuram Mega Industrial Cluster, Transit Oriented Development (TOD) is proposed in 3-5 km corridor on both sides of the metro with theme based economic and mixed use nodes. Last mile connectivity is to be provided by NMT modes upto 1 km and upto 3-5 km by BRTS/Bus Routes on both sides of the corridor. Higher density development at an average of 200 to 300 pph can be promoted in the influence area of the metro corridor in greenfield and opportunity-based sites within existing city.

Theme based New Economic Nodes and Sub CBDs: Number of theme based economic nodes and Sub CBDs will be developed along the axis and at nodal locations. Knowledge and cultural city at Vizianagaram, Bhogapuram Aerocity, township at Anandapuram, Pendurthi-Kothavalasa Sub CBD and light industry and residential township, Sabbavaram Knowledge and Mixed Use node, Anakapalle trade and mixed use town, and Mega Industrial Cluster at Atchutapuram under VCIC will be key theme based clusters/nodes to establish the new urban axis.

Balanced and Networked City Region: The new urban axis while having urban transit (BRTS) of its own will be networked with the mother city through BRTS or Bus based connections along major radial corridors to the mother city and proposed metro network, hence creating an idea of highly networked city region. Commuter rail and radial roads will connect the regional centres to the mother city integrating the whole area within the network.

Beach Road as a Parallel Leisure and Tourism Axis: The proposed Beach Road development between RK Beach to Beemunipatnam can be further extended with select tourism nodes development and networking existing tourism destinations in VMR. Reinforce connectivity between NH-16 and Beach Road and in process restructure mobility in the already development areas.

Integration of Committed and Proposed Projects in VMR: This preferred strategy integrates proposed and committed major projects like Bhogapuram Aerocity, Beach Road Tourism Project, VCIC Mega Industrial Cluster at Atchutapuram, ADP at Madhurawada-Beemili-Anandapuram, RTC Complex, BRTS Network, Vizag metro and under implementation bypass to NH-16 will largely play the role of much needed bypass to the city.

Hierarchical Regional Development: Balanced and hierarchical development in VMR by promoting economic and planned development in second order cities and regional centres to cater for both urban and rural areas. Networking of urban and rural resource centres through hierarchical road and public transit is important and will enable balanced development of the region.

Protection of Natural and Agriculture Areas: The preferred strategy will relieve pressure on existing development adjoining natural sites hence help in protection and integration of natural environment for leisure and tourism activities. Protecting agriculture lands is integral to protection of agro economy of the region.

Figure 14-32: Sustainable urbanisation of the region with a balance between natural resource conservation and their utilisation

Urban Transport Network

Mobility corridors in VMR linking mother city and other urban centers: The mobility structure of VMR is based on the following major corridors

- **Turning old National Highway to Public Transit Corridor**: The major axis for the whole region, including the section going through the core city and to be converted into a public transit corridor.
- **Current National Highway Bypass becoming Urban Corridor**: Connecting Anandapuram, Pendurthi, Sabbavaram and Anakapalle, will be a parallel and major urban corridor serving the future growth areas and the sub-CBDs having BRTS based public transit.
- **Beach Corridor:** The existing beach road from Coastal Battery to Bheemunipatnam will be extended till Kalingapatnam in Srikakulam via Bhogapuram along the coastline.
- **PCPIR Expressway**: Serving all the heavy industries clusters in the PCPIR area along with the planned townships, the express will be major alternative to the National Highway 16, with regular connectors to the highway.
- **Regional Bypass to VMR:** Current bypass to NH-16 only provides partial relief from through goods and other traffic passing through VMR hence there is need to promote new bypass to VMR which is also provide regional connectivity to the satellite cities. A conceptual alignment of the bypass is proposed here which can also take into account larger state level strategic road planning and improvement. The Regional Bypass starts from south of Anakapalle, stretching northwards via Lakkavarapukota, bypassing Vizianagaram and joining the beach corridor at Chintapalle village in Pusapatirega mandal.
- Radial Roads: The radial roads will connect the mother city with the satellite and regional urban centers. Major State Highways has been identified for widening to the towns of Cheepurupalli, Gajapathinagaram, Srungavarapukota and Parawada. Seven radial corridors are identified for improving public transit within VMR in east-west direction.
- **Regional Connectors**: Regional urban centers will be inter-connected by regional connectors, by widening identified MDRs and ODRs to connect rural settlements, nodal villages, and mandal headquarters.
- **Suburban Railway**: Utilisation of railway connectivity from VMR to towns of Amadalavalasa, Srungavarapukota and Tuni.
- **Metro and Urban Transit Corridor:** Approximately 150 km of metro based public transit network is proposed under the preferred strategy which will promote the north-south urban development axis in VMR. This includes the revised alignment of phase wise development of metro corridors branching towards Bhogapuram, Pendurthi and Anakapalle with a proposed extension till Atchutapuram which is a major employment node. Last mile connectivity and connectivity to other regional centers would be extended through BRTS and other bus based network linked to the metro transit network.
- **BRTS Network:** Last mile connectivity with respect to metro network will be in the form of BRTS and Bus based public transit loops connecting to metro nodes in 5 km influence area of the metro corridor. The network will be extended till nodes beyond metro connectivity. Routed towards Ranasthalam after Bhogapuram, towards Vizianagaram and along the National Highway BRTS will operate to integrate the fringe development area in the transit network.
- **NMT Network:** As part of the CMP and Carbon Neutral Mobility Plan (CNMP) for Visakhapatnam NMT network is proposed and will be integrated under this alternative. It is proposed to have additional NMT network within 1km on both sides of metro network to promote walking and other cleaner forms of para transit.
- **Connectivity to Mandal Headquarters:** All mandal headquarters in VMR would be connected with improved road RoWs (30 M) with respect to main urban transport network.
- **Port Connectivity Improvement:** Modernization of ports and improving connectivity to ports is important to overall economic expansion and putting the region on global investment platform. To improve connectivity to ports is an on-going effort in VMR and will be further reinforced as part of the master plan. Existing and proposed locations for truck terminals and warehousing would be integrated through improved road network.

- **ISBT and ICBTs:** In context of inter city and region bus based travel demand location of ISBTs and ICBTs would be identified in VMR in the next phase of the master planning.
- **Road Network Improvement:** In Visakhapatnam city and VMR as a whole where traffic conditions of roads are congested and deteriorating hence improved and hierarchical road network of RoWs of 90m, 60m, 45m, 30m, and 24 m would be proposed in existing and greenfield developments.

Figure 14-33: Sustainable urbanisation of the region with a balance between natural resource conservation and their utilisation

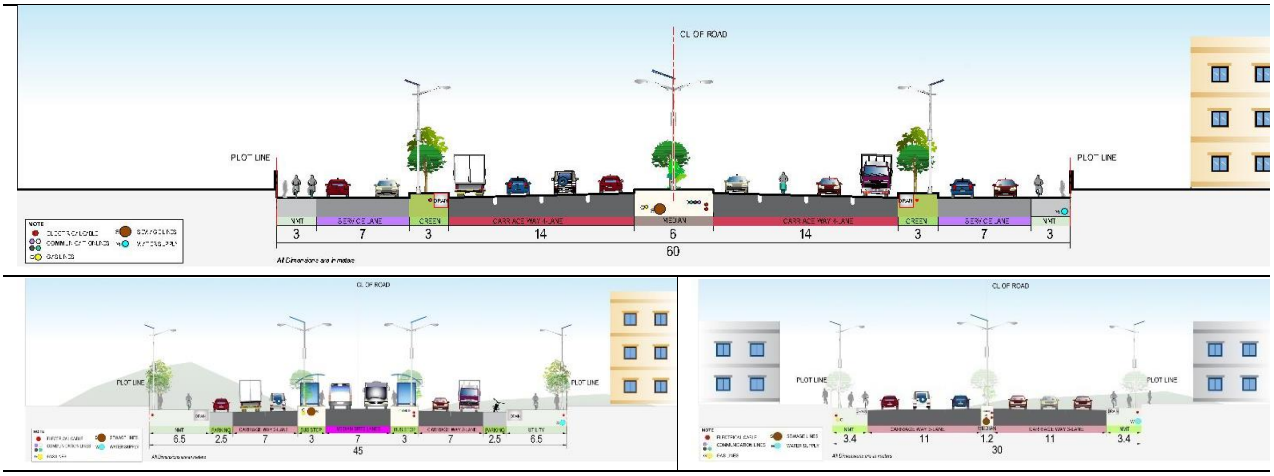


Figure 14-34: Hierarchical road network of RoWs of 60m, 45m, 30m, and 24m will be planned in VMR to streamline the mobility and safety aspects.

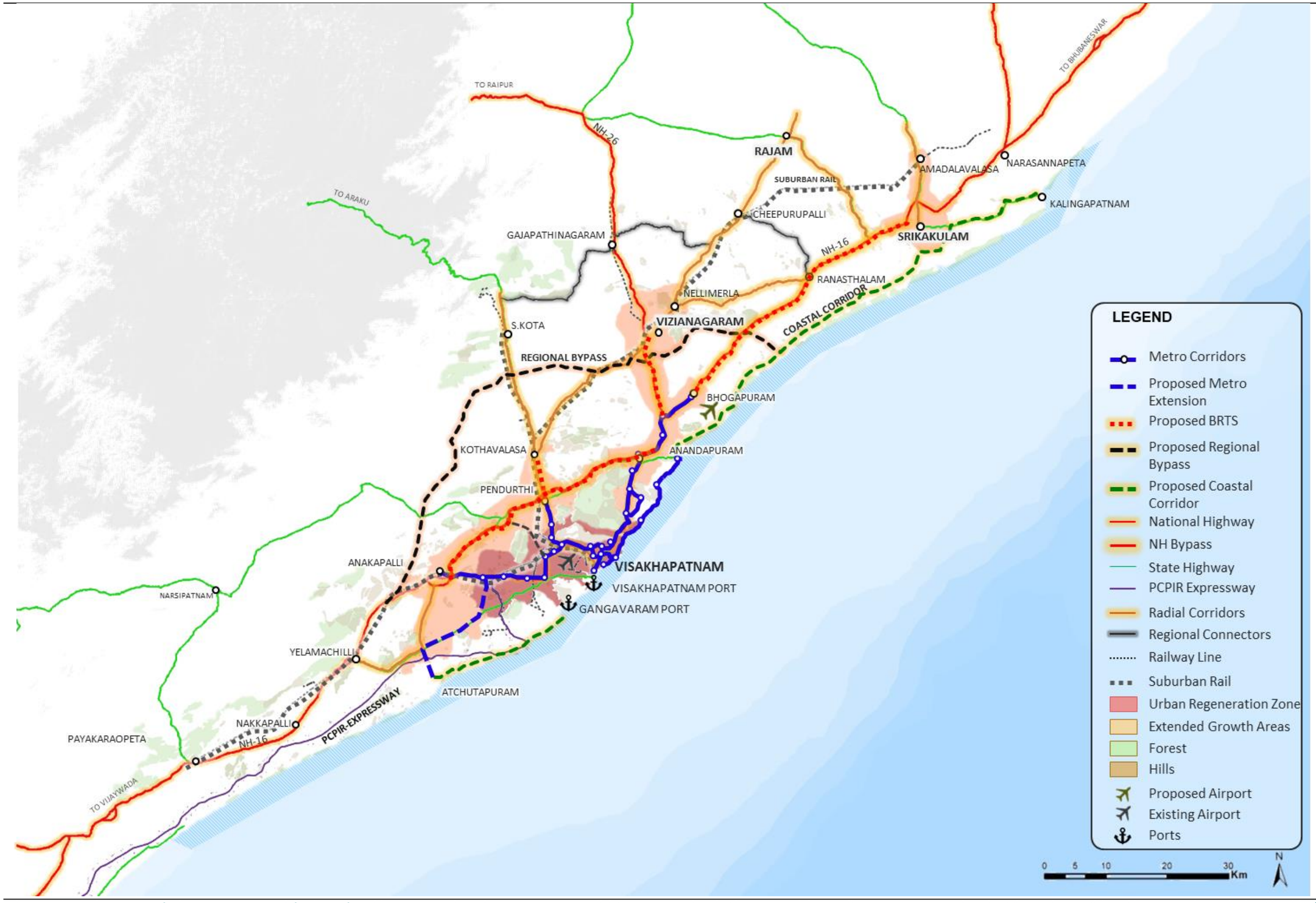


Figure 14-35:The key aspects of urban transport network for the Preferred Strategy comprises a bypass to VMR, Metro link between Aerocity-Visakhapatnam-VCIC Mega Cluster, and BRT or Bus based public transit on radial corridors connecting to the Satellite cities/towns.

Urban Form and Imageability

In principle, the preferred strategy promotes transit led compact city form for the mother city and protects natural environment around the mother city. The satellite towns will develop around theme based economic role with compact urban form to protect maximum agricultural lands as possible under the scenario. Urban densities of 200 pph upwards are desirable in the satellite towns and cities. The key aspects of urban form and imageability under this alternative are as follows.

Transit led TOD Development: The north-south Urban Axis between Bhogapuram Aerocity and Mega Industrial Cluster at Atchutapuram will structured hence form the image ToDs along the corridor. The corridor can accommodate close to 2 million population with average density of 200-300 pph in built up areas.

Radial Corridors: To link the new urban axis/corridor to the mother city seven radial corridors are proposed to be developed/improved along with provision of bus based public transit. The key radial corridors will be Srungavarapukota-Kothavalasa-Pendurthi-Waltair Corridor, Sabbavaram-Airport-Vizag Port Corridor, Pendurthi-Simhachalam-Hanumanthavaka Jn Corridor, Gajapathinagaram-Vizianagaram-Anandapuram-Madurawada-Waltair Corridor, Gajapathinagaram-Vizianagaram-Thagarapuvalasa-Bheemunipatnam Corridor, Anakapalle-Gajuwaka-Vizag Port Corridor, Anakapalle-Atchutapuram-Pudimadaka Corridor.

City Beautiful: VMR and Visakhapatnam has bountiful natural resources including 170.8 km of coastline. As an idea to promote transit led compact mother city under this alternative natural areas and maximum agricultural land would be protected to retain the image and characteristic of city beautiful and natural environment of VMR. Idea of health and tourism city is connected with this vary idea.

Modernizing the Existing City Cores through Retrofitting and Urban Renewal: To improve the quality of work and living environment in existing city, many of on-going and committed proposals like area development, smart city, public transit, NMT, and redevelopment would be integrated in the plan along with identification of potential new proposals to modernize the existing city.

Connected nodes and Regional centers: While each node is envisaged with an economic role and developed in a compact and planned manner. Under this alternative Vizianagaram will be knowledge, cultural and tourism town. Anakapalle will grow as business and trade hub and the satellite towns connected to the mother city through BRTS and Bus based public transit hence giving an image of highly connected and public transit led region.

Theme based Economic Nodes and Sub CBDs: To make the corridor economically sustainable new theme based knowledge, mixed use, industrial, and commercial nodes (Sub CBDs) would be developed to promote proximity between work and home in the corridor.

Theme Based Tourism Destinations: Araku Valley as a global level MICE, Health and Leisure tourism destination with world class tourism infrastructure and Visakhapatnam playing a role of a mother city, Buddhist Circuit tourism infrastructure improvement, integration of Beach Corridor for Leisure and Coastal Tourism, and Hindu Pilgrimage destinations with tourism infrastructure improvement in Vizianagaram, Simhachalam, and Annavaram etc., development of Theme Parks, and Eco Tourism near wildlife sanctuaries.

Resilient City: As stated earlier VMR is subjected to natural disasters from cyclones, floods, and climate change. Planning to reduce economic, human, and urban infrastructure losses would be essential to this alternative as well. Hence, areas prone to floods and storm surge will be identified based on available studies and not subjected to high value and vulnerable urban development. The beachfront development with necessary stringent regulations to resist wind speed of cyclones and destruction from storm surge would create idea of city on a seafront, which is not very imageable at present.

Form Based Planning: Current haphazard development not responding to natural features and topography of the area needs to be addressed considering the high potential land within influence area of proposed Airport, hospitality and tourism projects. It shall have distinct character that justifies its worth. Hence, Form Based Planning is recommended for such area

Potential Key Project Components

Essential to realise the preferred strategy for the VMR following projects and development components will form critical urban and regional structure of the Perspective Plan for VMR.

- Transit Led TOD Corridor between Bhogapuram Aerocity-Existing CBD-and Industrial Mega Cluster at Atchutapuram under VCIC.
- BRTS led development of New Urban Axis/Corridor between Vizianagaram-Anandapuram-Pendurthi-Anakapalle-and Atchutapuram through land pooling and land development strategies.
- Improvement and Development of seven radial corridors between the new urban axis along the bypass to NH-16, mother city, and the Beach Corridor.
- Development of a 150 km new corridors between Atchutapuram-Anakapalle-Pendurthi-Vizianagaram-having 60-90 m RoW with public transit connecting the satellite cities.
- Theme based economic nodes and TODs along the metro transit corridor.
- Theme base economic and expansion of Satellite towns of Vizianagaram, Anakapalle, Nakkapalli, and Beemunipatnam.
- Tourism destinations development and expansion of Araku Valley, Buddhist Circuit, Hindu Pilgrimage destinations, Beach and coastal tourism, and eco-tourism etc.
- Tourist Circuits at local and regional level shall be identified considering potential of the tourist places within VMRDA.
- Beach Road development for recreational, tourism, and other mixed use development between Visakhapatnam and Srikakulam.
- Resilient city planning and framing related development regulations to reduce losses in vulnerable areas.
- A comprehensive Rural Development Agenda as recommended in the Section 16.9.
- Modernization of existing city core areas through opportunity-based retrofitting, urban renewal, and integration of committed and proposed projects smart city and urban transit improvement studies along the proposed metro.
- Bypass development to VMR on medium to long term basis. A conceptual alignment for the bypass is proposed in the preferred strategy.
- Urban development corridor along New Bypass to NH-16 which will also incorporate strategic roads conceived under State Roads Improvement Programme.
- Development of Ring Roads on perimeter of Vizianagaram, and Anakapalle cities for urban growth.

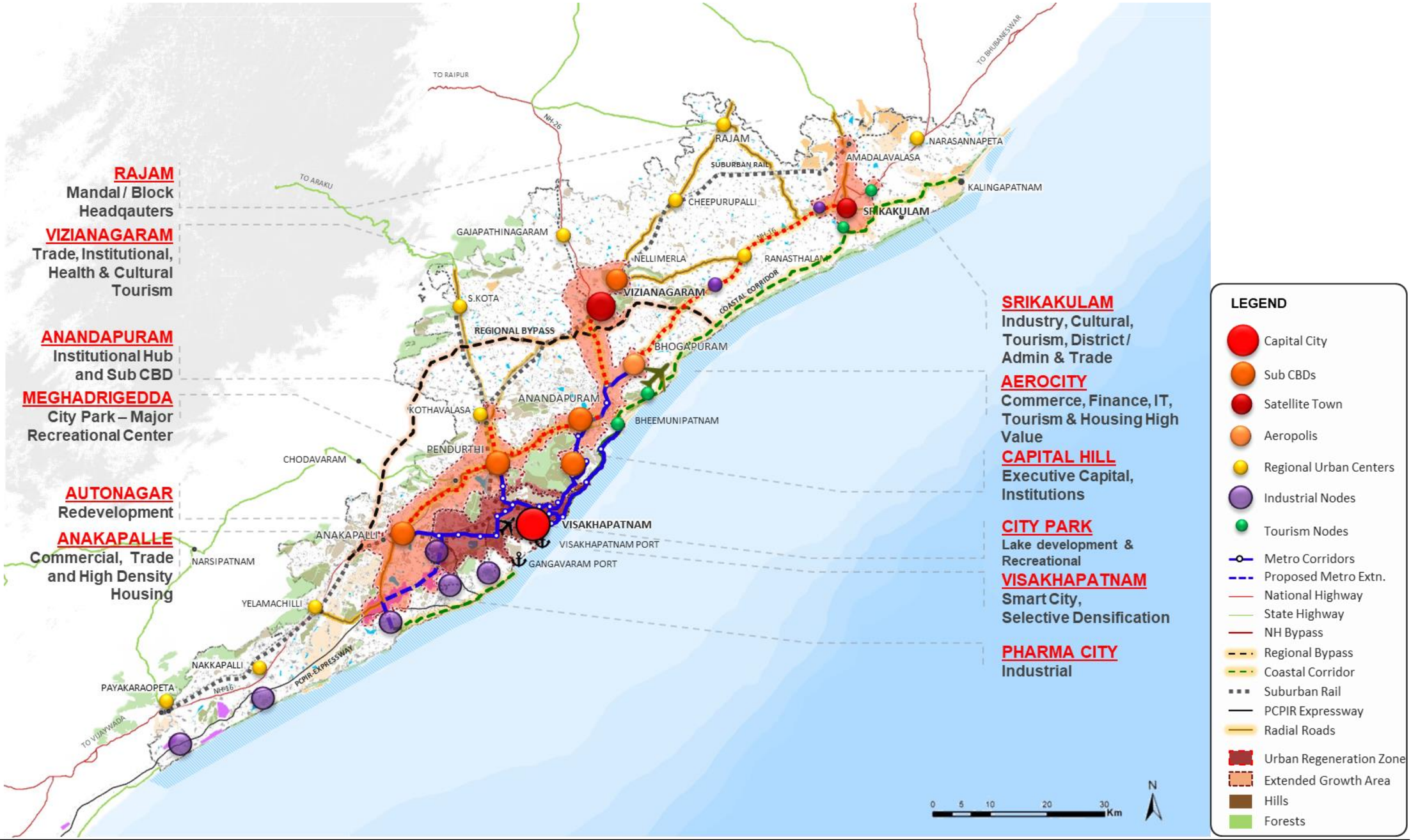


Figure 14-36: Preferred Strategic Plan to focus on compact cities and balanced regional development.

15 STRATEGIC ECONOMIC DEVELOPMENT, 2051

15.1 STRATEGIC ECONOMIC DEVELOPMENT/DIVERSIFICATION OBJECTIVES

The region has great potential in all the three sectors of economy. The manufacturing units have long existed in the region with great support from ports and logistics. It is observed that the region can house more large and mega industries with strengthening of logistics and compete in the global market. On the other hand the region also has great potential in primary sector with its fertile land and existence of more number of fishing villages. The planning has been strategically done considering the two contrast potential of the region. Secondary sector is more prominent in the south of the region whereas the north of the region is prominently agricultural economy(Figure 15-1). Therefore the secondary sector will grow in the south of the region and intervene less in the North. The north with potential agricultural land will be conserved. Few exiting clusters will continue to exist but further industries and secondary sector investments will not be advocated.

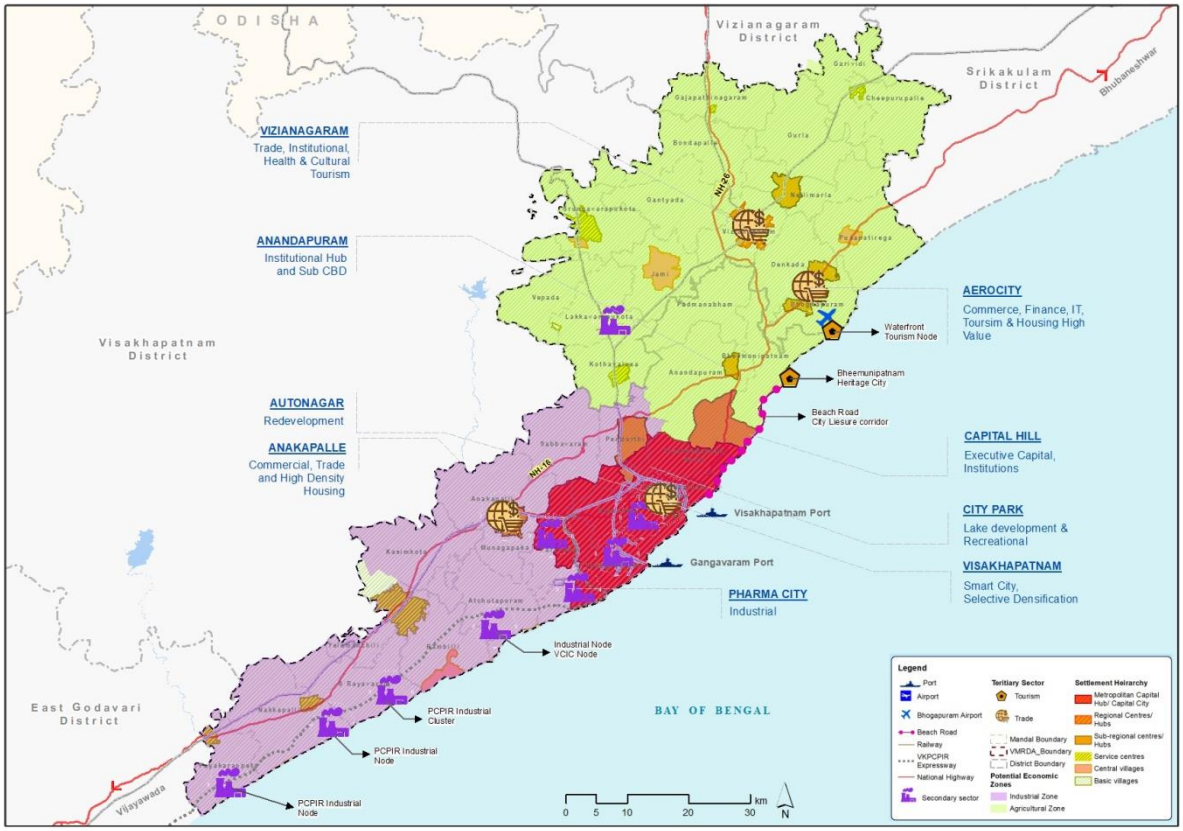


Figure 15-1: Key economic activities

15.2 KEY DRIVERS OF ECONOMY

Proposed VK-PCPIR, Sagarmala and VCIC

The development projects like VK-PCPIR, Sagarmala and VCIC improve the infrastructure and attract more investors resulting in accelerated industrial growth. Ample employment opportunities will be created for the large labour resource available in the region. Increase in labour productivity and wages increases the per capita income. Integration of transport network connecting the hinterland with industries and port is required.

New airport, ports and proposed expansions

VMRDA region has a strong industrial base and logistics play a vital role in enhancing the movement of cargo. The Current Airport has less cargo handling facilities making the import/Export limited. The proposed Airport at Bhogapuram is located in the close vicinity of National Highways. This supported by logistics will enhance the Air cargo handling capacity in the region. Visakhapatnam being a port city handles huge cargo. The proposed expansion of port coupled with modernising the port infrastructure will increase the cargo handling capacity and strengthens the economy. The international movement of goods provide immense opportunity to stimulate new industrial growth and enhance the existing industries to compete in the global market.

Government Policies encouraging MSME, FDI and SEZ

Central and State government encourages the growth of Industries by promising policies. Single window clearance, Ease of doing business, increasing the Minimum alternate tax(MAT),reduction of income tax for MSME, Investor friendly FDI policy, skilling of labour, better infrastructure and up gradation of infrastructure are some of the initiatives taken by the government. These initiatives attract both the local and foreign investments which will inflate the economy.

Exposure to Global Market

The region is envisaged in becoming a manufacturing hub with export and importlinking with the global network. This would pave way to meet the global competition by raising the industrial standards and attracting foreign investments. Intangible sides like tourism can increase the economy with world class tourism infrastructure and promotion of religious tourism by tapping the potential Buddhist circuit and leisure tourism vowing to the pristine beaches and hills.

15.3 FOCUS OF ECONOMIC SUB-SECTORS

Primary sector

Encourage sustainable agriculture with improved economic base by adopting technology and increasing productivity. Conserve fertile agriculture land and optimum use of available resource without hindering the rural fabric. Providing required infrastructure and easy access to markets will boost the local economy and aid in easy transfer of commodity. Skill development and provision fishing infrastructure will boost the declining active fishermen. Provision of mini harbors or jetties will increase the no of crafts which eventually increase the economy of fisher folks.

Secondary sector

Manufacturing sector comprising of big players and supporting ancillary industries have formed a framework to an extent. However this does not take complete advantage of the available opportunity. The huge land bank of APIIC land is substantially vacant. Owing to the envisaged logistic connectivity, proposed development plans, availability of land with infrastructure. Availability of raw materials, import/export facility makes the region advantageous for industrial establishments.

Tertiary

The long coastline embedded with beaches and the physiographical features like hills is a retreat to both international and domestic tourists. The presence of religious and heritage sites opportune heritage tourism. Tourism potential has to be tapped by providing tourism infrastructure catering to the needs of both domestic and international tourists. The proposed airport in Bhogapuram envisaged as aerocity will emerge as hub for business; finance increasing the economy of tertiary sector. The region will have medical tourism by acting as a medical hub for the neighbouring state.IT/ITES still is not growing due to the stringent government policy and lack of supporting infrastructure.

15.4 KEY EMPLOYMENT AREAS

Tertiary sector is expected to constitute higher share of employment for the horizon year. City core/Urban area with mixed, commercial, transportation, communication and institutional land use will act as employment generators. Port, logistics, railways and airport will be the major source of employment in transportation use. IT/ITES will provide substantial employment in communication use. Educational, public/government buildings, hospitals will be major generators in institutional use.

Industrial clusters and parks will be rich source of secondary employment. The region has well established large and mega industries with expansion proposals and more new establishments are foreseen in the manufacturing sector creating room for more jobs. Existing unorganized sector consisting of agro based, household and other industry is also promising to create substantial employment at a local level. Agriculture, Fisheries, livestock, will increase the workers in rural and fishing villages with provision of required infrastructure. Major generators of employment in VMRDA are represented in Figure 15-1.

16 STRATEGIC SPATIAL DEVELOPMENT, 2051

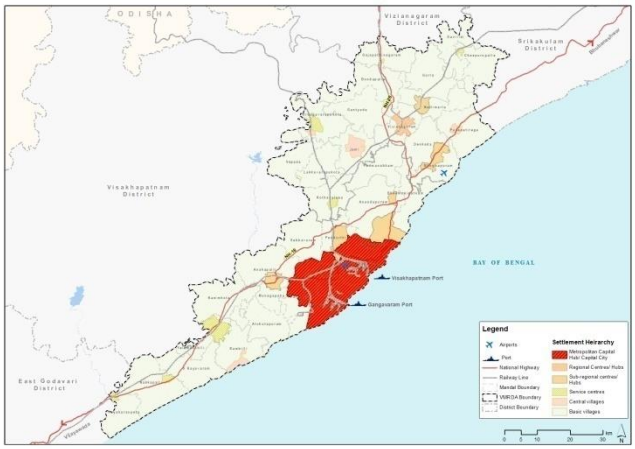
16.1 STRATEGIC URBAN AND RURAL DEVELOPMENT OBJECTIVES

The heterogonous urban and regional fabric is bound by retaining their unique functionalities without compromising on their requirements. The concept adopted for horizon year is crafted by giving due importance to diverse features resulting in a comprehensive metropolitan regional plan.

16.2 OVERALL FOCUS OF DEVELOPMENT

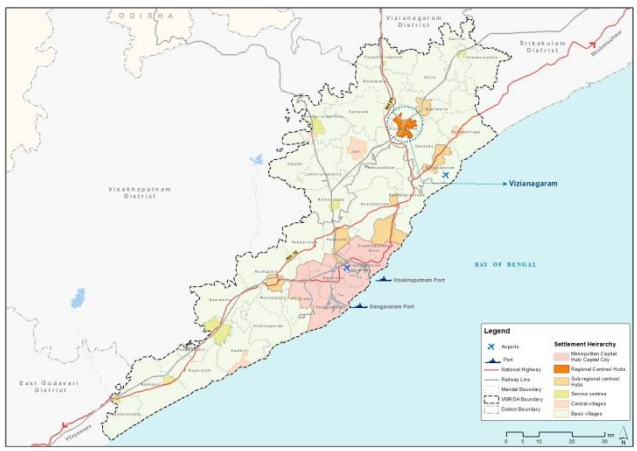
Perspective plan focuses on developing the urban region and also planning for the betterment of disadvantageous rural area by providing basic amenities and infrastructure within accessible range. The development will be comprehensive focusing on multiple sectors like infrastructure, economy, and transportation. Prime importance is given on not neglecting any regions or making it devoid of services. The huge potential of employment generation (Ref.Chapter-15) makes the region economically more vibrant and attracts migration. The urban centres will act as growth poles to absorb the migration. The economy of Rural regions is also given due care to boost the per capita income by adopting techniques like cropping rotation and increasing the cropping intensity and provision of markets. This will limit the shift from rural areas to urban areas in search of better income.

16.3 SETTLEMENT HIERARCHY AND ROLE OF KEY SETTLEMENTS



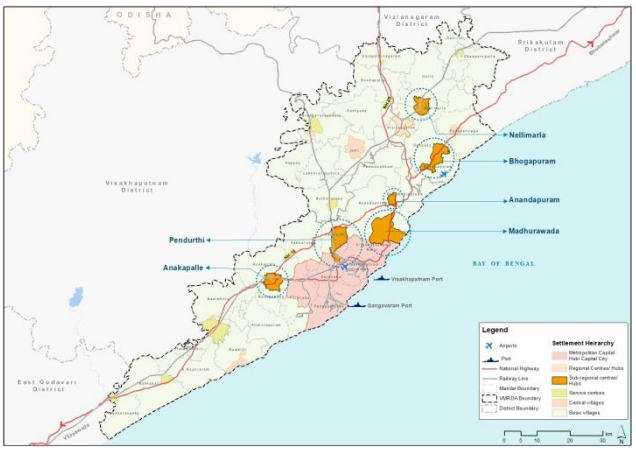
Metropolitan Hub/ City - 1,000,000+Population

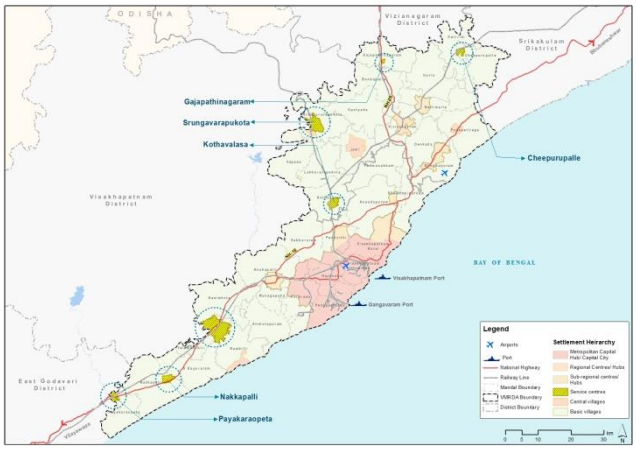
On considering the natural increases and migrant population, Metropolitan Hub is envisaged to have population of about 3 million in 2051. Hub will continue to be the mother city and will have dominant role to influence the growth of the region.Higher order facilities will be providedto cater to the need of huge population that would be accommodated. Sphere of influence of core is the largest and would cater to all higher orders requirements of lower order settlements that follow. It will also continue to provide higher order services for regions of Chattisgarh and Orissa as well.

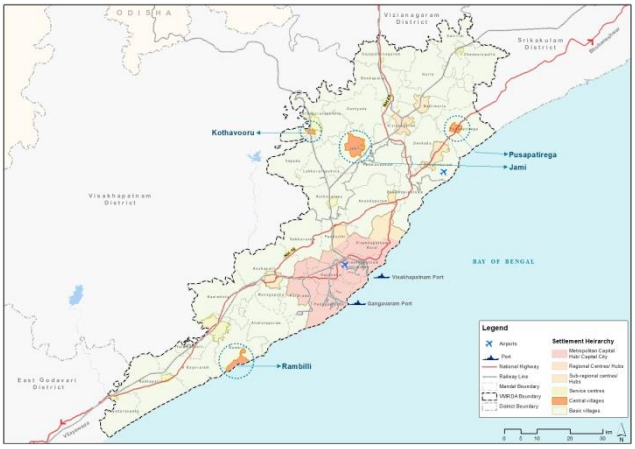


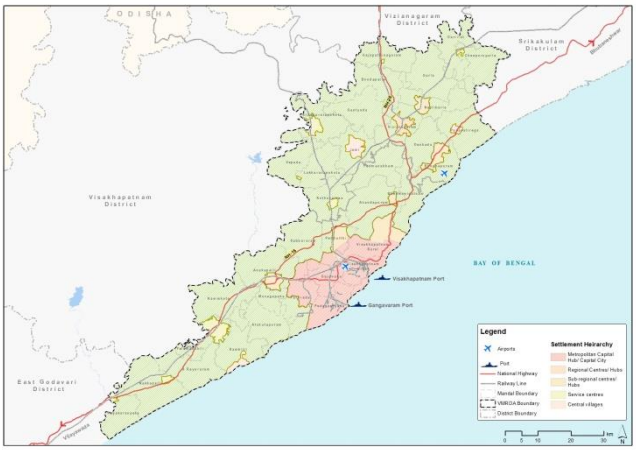
Regional Centres/ Hubs-300,000 – 500,000Population

VMRDA region with huge geographical spread has two major urban local bodies which has a prominent role to play in the district. Vizianagaram municipality, apart from being the district headquarters and prominent ULBs in their respective districts, they will act as regional centre and provide the higher most services and infrastructure in their respective districts. However, the facilities provided are lesser than that of the core and would satisfy the requirements at a regional level.









Sub-regional centres/ Hubs 100,000 – 300,000Population

The core will be lined with three Sub-regional centres Anakapalle, Pendurti and Anandapuram and is well connected with the mother city. Nellimarla which is in close proximity to VIzianagaram will be another Sub-regional centre. These are provided with infrastructure facilities to self-sustain and address the needs of the settlements in their proximity. Aeropolis at Bhogapuram will also be a self-sustained Sub-regional centre with world class infrastructure and high value housing facility to meet the needs of envisaged business hub. Pendurti as it is contagious with the core will have an higher population than that of the range specified for Sub region. But, as far as its role is concerned is only limited to that of a Sub region and therefore is considered under this category.

Service centres 20,000 – 100,000Population

Service centre are major urban pockets dispersed in the region. These are the lowest order urban settlements and will house lowest order of urban infrastructure and services. Services centres will be well connected with the sub regional centres or regional centres. It will extend its services to many central villages under its umbrella.

Central villages 15,000 – 20,000

Central villages are the highest order of rural settlement hierarchy. The Central villages will have higher order infrastructure facilities at rural level. It will act as nodal point to provide services to the basic villages under its influence area.

Basic villages Less than 15,000

Basic villages are lowest order in the settlement hierarchy. Provision is made for basic amenities and infrastructure for sustainable development.

16.4 EMPLOYMENT AREAS

Urban settlement provides secondary and Tertiary employment in large scale. Tertiary employment pockets lies within the urban region while secondary employment area is little away from the settlement but lies within the accessible range. In case of Visakhapatnam alone, secondary employment area lies within the core. Gajuwaka, Pedagantayada, Paravada and Autonagar are few such areas that have large manufacturing giants. Primary sector also has substantial employment due to the presence of fishing villages along the coastline. Unorganized sectors like agro-based industries and other house hold industries are scattered in lesser proportion across the region contributes to marginal employments in the local area and upcoming development of Green Field International Airport in Bhogapuram is expected to create employment opportunities in Bhogapuram influence area.

Rural settlement around the industrial clusters and unorganized industries is exposed to secondary employment. Majority of the rural areas of VMRDA depends solely on primary sector. The fishing villages lining the coast depend on fishing and allied activities.

16.5 DENSITY OF DEVELOPMENT

The metropolitan hub as discussed in earlier part of this chapter (Ref Section 16.3) will have to accommodate ta population of about 3 million. To control the sprawl and maintain its prominence of mother city, the metropolitan hub population for horizon year will be accommodate by further densification of the area. Fringe areas of Metropolitan hub, regional centres and sub-regional centres will be densified to accommodate the increasing population. The areas adjacent to the transit corridors in the above category would have even higher densities owing to their close proximity to transit corridors.

Rural areas density will be minimal. It will only continue to grow in the natural way without experiencing any induced growth.

16.6 URBAN FORM AND NEW URBAN EXPANSION AREAS

Urban form of the region is linear with urban areas extending from core following the pattern of major roads traversing VMRDA area.

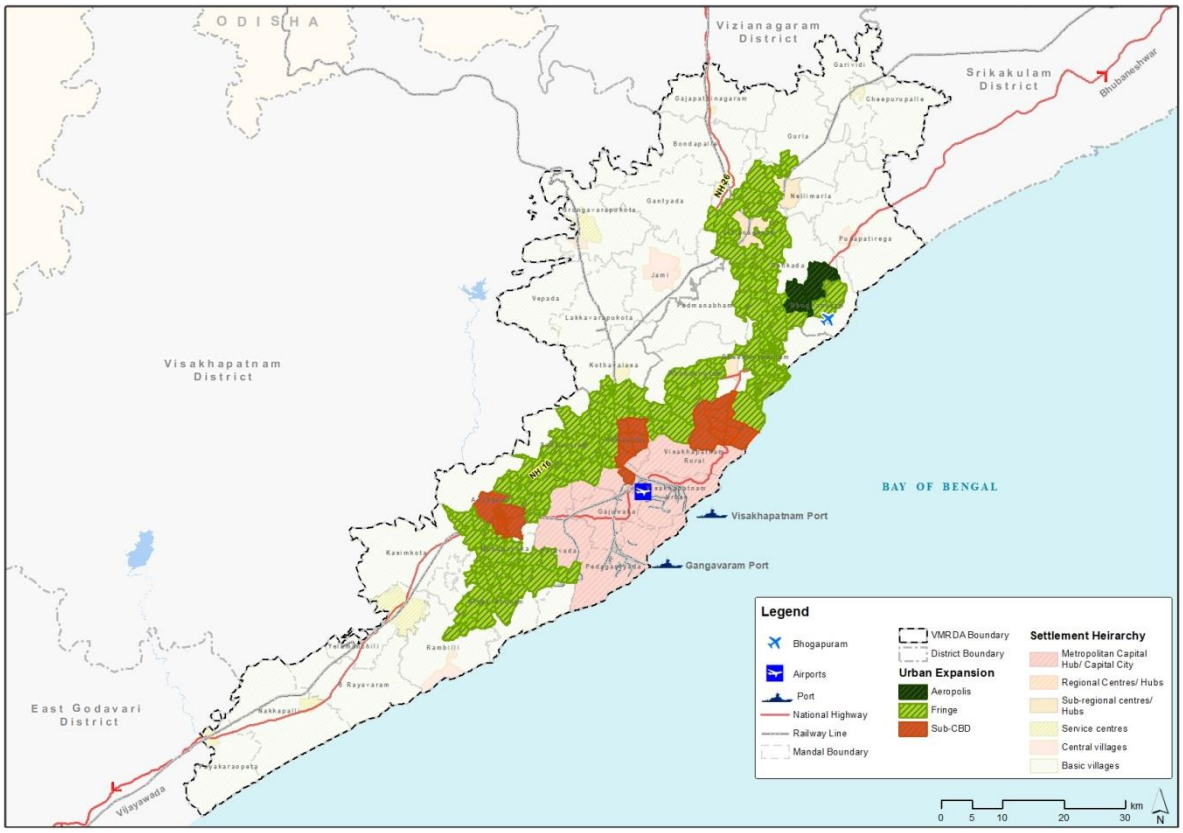


Figure 16-1: Urban expansion areas in VMR

16.7 TRANSIT ORIENTED DEVELOPMENT (TOD)

Objective of Transit Oriented Development (TOD) is to encourage the use of public transportation through strategic developments along the transits. This results in decrease in private vehicle volumes and increase in public transport share. With TOD policy enforcement measures, providing access to transits to users by densification and enhanced transit corridors.

TOD is generally characterized by compact, mixed use development near new or existing public transportation infrastructure that provides housing, employment, entertainment and civic functions within walking distance of transit. Pedestrian-oriented design features of TODs are essential to encourage residents and workers to drive their cars less and ride public transit more.

TOD planning can be achieved by structuring the strategies and implementing them. For this, a safe, reasonable and efficient public transport and other modes of transport should be made accessible and thus discouraging use of personal vehicles. Ensuring good quality of life by providing high density mixed use, mixed income and employment in the vicinity of transit corridors. Also taking care of environmental issues and maintaining ecological balance by preserving water resources, green area, open areas and coastal areas.

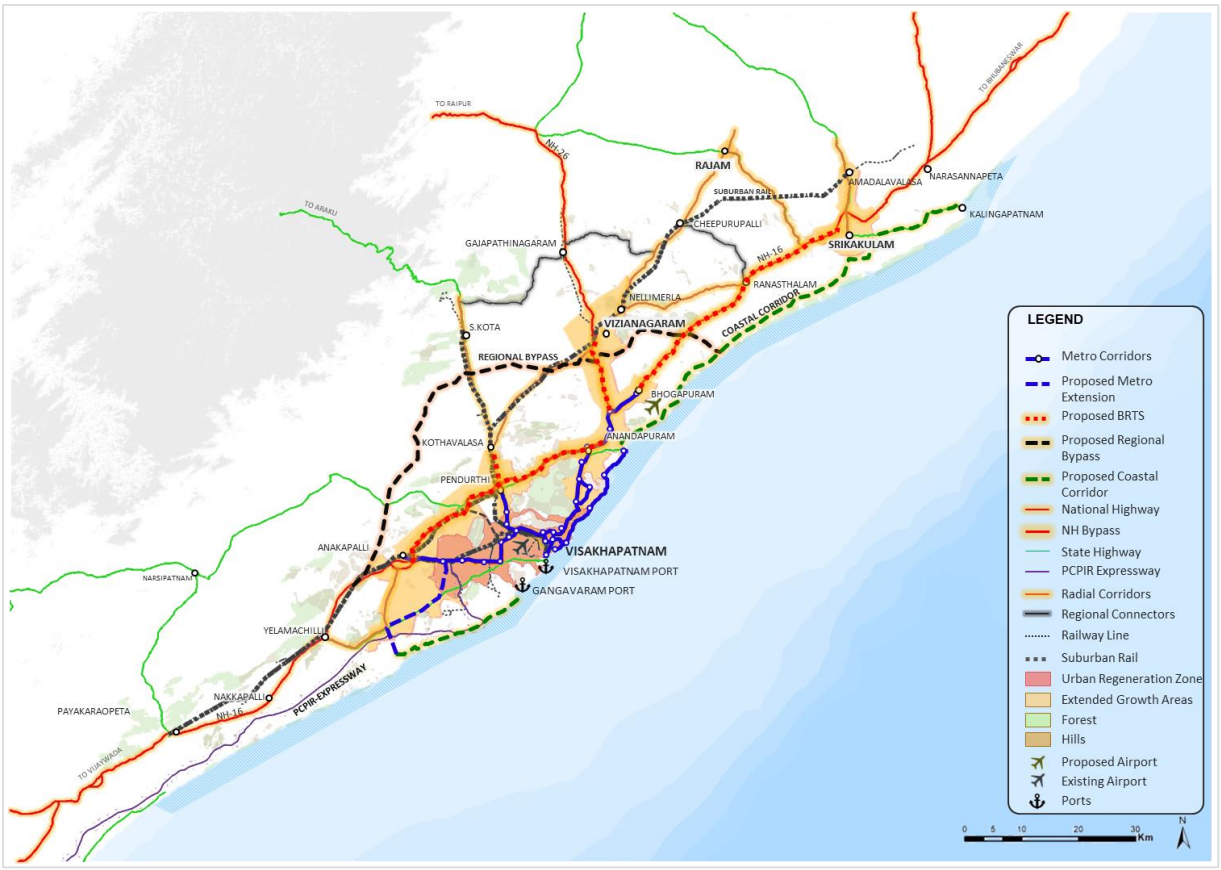


Figure 16-2: Growth Areas along transit corridors

16.8 DEVELOPING SMART, LIVEABLE, INCLUSIVE AND SUSTAINABLE COMMUNITIES

The perspective plan focuses on building smart communities adopting advanced technologies and green concept. Building resilient economy by optimum utilization of available resources and tapping the embedded potentials. Regional disparities are addressed by catering to the requirement of less advantageous area. Average trip length is curtailed, by reducing the Work-home distances and providing better transport connectivity. Strategies to create liveable spaces with better quality of life are adopted. Sustainability has been an under lying concept across all sectors to provide sustainable infrastructure, transport and economy.

16.9 RURAL DEVELOPMENT

The region has a rich rural resource as well. The rivers meandering the region, makes the land more fertile and creates great potential for Agriculture. The stakeholders' consultations also revealed that people preferred to conserve the agricultural region. Observing the potential of the region and taking into account the interest of Stakeholders, measures has been taken to conserve the agriculture land and at the same time boost the economy of rural region by adopting techniques in agriculture to increase cropping and increase higher household wages. Harmony of the rural area is not disturbed by urbanization but provisions for better infrastructure facilities like skill development Centre, agricultural markets, connectivity to central villages, access to basic amenities are done to improve the quality of life in the rural region.

The development in the rural areas can be achieved fostering infrastructure facilities at the in villages based in their hierarchy. The provision of economic and infrastructure facilities have financial constraints which can be addressed by providing these facilities at central villages which are located at

appropriate locations. The smaller villages will have less population which is not sufficient for proper and full utilization of services. Thus, the location of facilities should be in view of minimum threshold population. In this way, the central villages which provide the economic and infrastructural facilities can generate growth in the adjoining basic villages. However, for an integrated development, spatial and functional integration is necessary between the central and basic villages. The local economies should also be taken into consideration for a holistic approach to improve quality of living with provision of basic infrastructure facilities like safe drinking water, road connectivity, health facilities and education along with employment programmes for the poor.

Figure 16-3: Rural Development structure

Facilitating growth in economy of the region through encouraging small scale agro-based industries using local produce can improve the livelihood of the rural communities. The agro based industries not only boost the economy of the region, but also create employment opportunities for the local communities.

Agricultural land Protection: With the rapid urbanization in the region many agricultural lands are being converted for other purposes. Most of the agricultural lands in the region are very fertile and produce two to three crops per annum. Regulatory measures need to be taken to preserve these high productive agriculture lands from being converted to other uses. Agriculture land conversion may be permitted only to low crop yielding lands for Agro-based and allied industries.

Household / Cottage Industries: Household based industries or cottage industries are an integral part of rural areas. These small scale village industries which are primarily agro based or artisanal entrepreneurships are key economic remedies for landless farmers and wage labour. With proper connectivity to the central villages and regional centres in the region, these industries tend to reach a wider market place and boost the local economies of the region, alleviating poverty in the villages through employment of non-skilled labour.

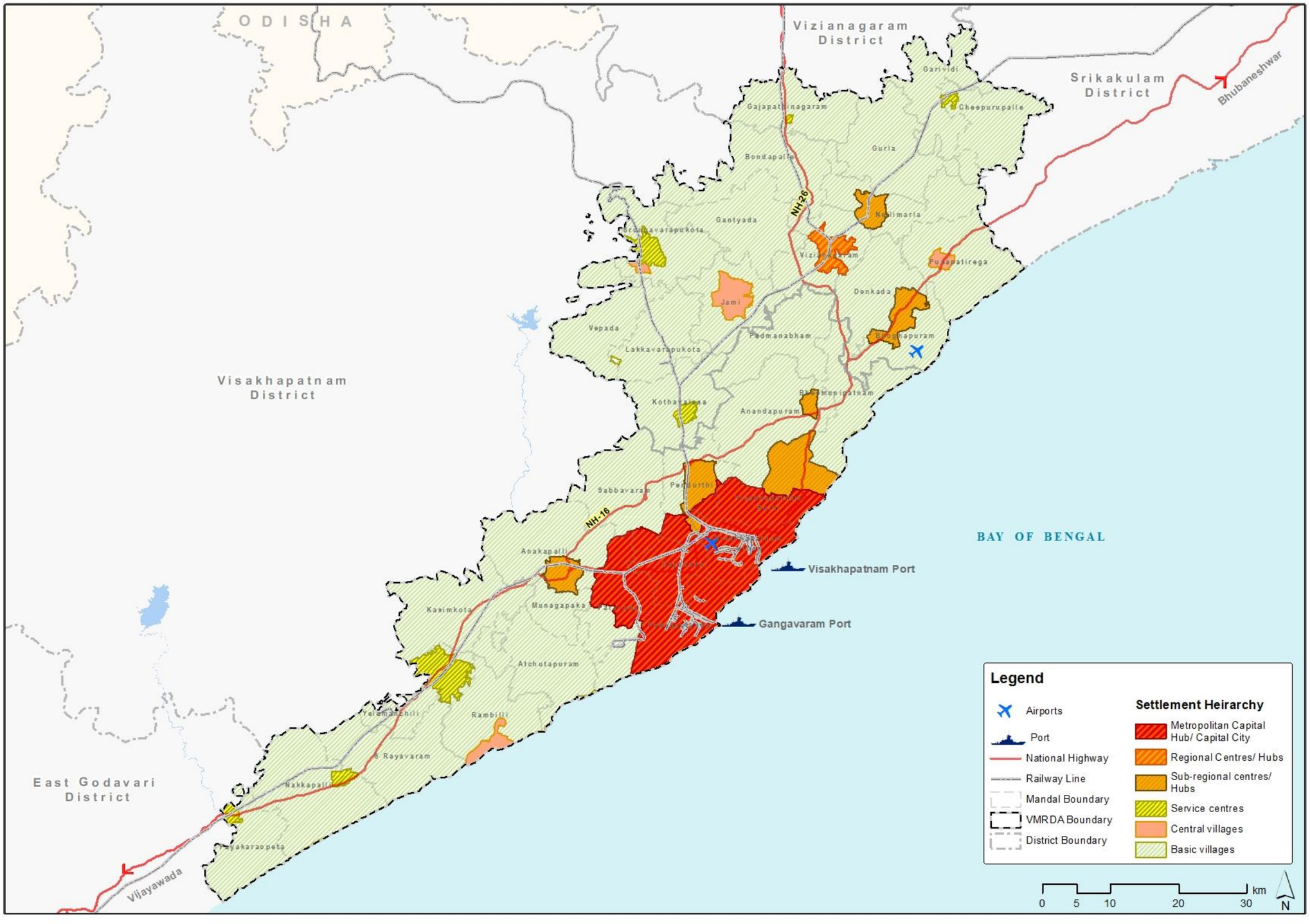


Figure 16-4: Settlement hierarchy in VMR, 2051

17 MANAGING ENVIRONMENT AND RESPONSE TO CLIMATE CHANGE, 2051

17.1 STRATEGIC OBJECTIVES

India's eastern coast offers a picturesque landscape circling the tropical teal waters of the Bay of Bengal, magnificent beaches and hilly terrain all over the Eastern Ghats. VMRDA fortunately has all the beauties that this part has to offer. The area covers a costal length of 250 km with almost 27% of the land covered by natural hills and forests, and 28% open agricultural spaces. The other natural features include coastal sandy areas, mangrove forests, rivers, water bodies and open spaces.

Implementation of strategies is required to have a sustainable development and protection of the natural features in the long run and the perspective has to be envisioned now. To have an upright perspective, for a holistic approach to planning environmental management in VMRDA, a concept and process that based on Strategic Environmental Goals and Objectives is required. The strategic are prepared based on innumerable environmental standards, policies and guidelines such as EPTRI research, Environmental act 1986, National Environmental policy 2016, Environment Protection Acts, ENVIS-AP etc. The objectives are based on 7 broad environment parameters related to sustainable development. They are as follows;

- To provide for protection and improvement of Environment
- Prevention of Hazards to Human Beings, other living creatures, plants and property
- Prevention and control of Environment Pollution
- Laying Standards for quality of environment
- Restriction of areas for location of industries
- Safeguard for handling hazardous substances
- Research Related to Environmental pollution

17.2 FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT OF KEY SENSITIVE DESIGNATIONS

The entire VMRDA area is broadly classified into six key designations for its environmental sustainability, protection and conservation. The areas are divided based on its characteristics, physiography, and natural resource. Each zone will have its own development and protection policy and maintaining it will facilitate a better environment and healthy surrounding around VMRDA.

The principal framework and policy are enumerated below. These framework relate to current perceptions of key environmental challenges. They may, accordingly, evolve over time:

1. **Conservation of Critical Environmental Resource**- To protect and conserve critical ecological systems and resources, and invaluable natural and man-made heritage, which are essential for life support, livelihoods, economic growth, and a broad conception of human well-being.
2. **Integration of Environmental Concerns in Economic and Social Development**- To integrate environmental concerns into policies, plans, programmes, and projects for economic and social development.
3. **Efficiency in Environmental Resource Use**- To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output, to minimize adverse environmental impacts.

4. **Environmental Governance-** To apply the principles of good governance to the management and regulation of use of environmental resources.
5. **Enhancement of Resources for Environmental Conservation-** To ensure higher resource flows, comprising finance, technology, traditional knowledge, and social capital, for environmental conservation.
6. **Decentralization-** Decentralization involves transfer of power from a Central Authority to State and Local Authoritiesto address these issues.
7. **Integration-** Integration refers to the inclusion of environmental considerations in sectoral policymaking charged with the implementation of environmental policies.
8. **Environmental Standard Setting-** Environmental standards must reflect the economic and social development situation in which they apply.
9. **Preventive actions-** It is preferable to prevent environmental damage from occurring in the first place, rather than attempting to restore degraded environmental resources after the fact.
10. **Regulatory reforms and Policy and Legislative framework-** The regulatory regimes for environmental conservation comprise a legislative framework, and a set of regulatory institutions.
11. **Demarcating environmentally sensitiveZones-** Environmentally Sensitive Zones may be defined as areas with identified environmental resources having Incomparable Values which require special attention for their conservation.
12. **Promoting Biodiversity, Traditional Knowledge, and Natural Heritage-** Natural heritage sites, sacred groves and landscapes, are sources of significant eco-system diversity, and the latter are also an important basis for eco-tourism.
13. **Pollution reduction-** The impacts of pollution may differentially impact the poor, or women, or children, or developing regions, who may also have relatively low contributions to its generation, and accordingly the costs and benefits of reduction may benefit them.
14. **Conservation and protection of Heritage-** Manmade heritage reflects the prehistory, history, ways of living, and culture, of a people. In the case of VMRDA, such heritage is at the core of state identity. At the same time, considerable economic value, and livelihoods may be derived from conservation of manmade heritage and their sustainable use, through understanding of their tourism potential.
15. **Setting up Environmental Standards-** Environmental standards must reflect the economic and social development situation.
16. **Clean technological innovations-**Innovation of clean technologies, rather than treating the waste after generation.
17. **Research and Development-** Set up a mechanism to network technology research institutions both public and private, for cooperation in technology research and development and adaptation, information, and evaluation of clean technologies.
18. **Implementation-** Prepare and implement a strategy for enhancing environmental awareness among the general public.
19. Terrain Sensitive Guidelines- Prepare terrain sensitive guidelines for the development to minimize further adverse impact on the existing hill slopes and hill tops.
20. Dense Vegetation- Identify the existing large pockets of dense vegetation and Green cover for enhancing Urban Greens in the urban expansion area.

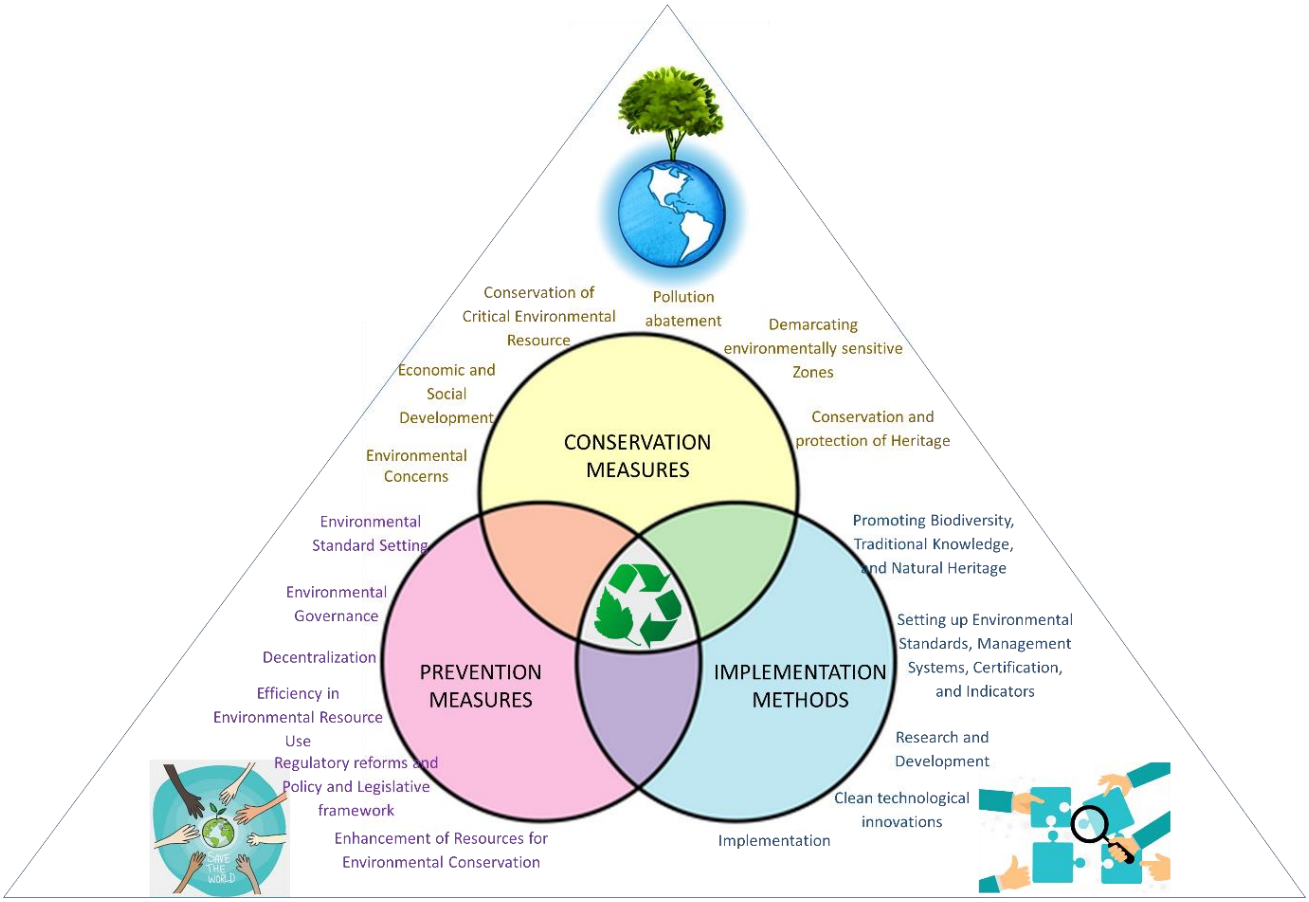


Figure 17-1: Environmental Management Framework

17.3 COASTAL ZONE MANAGEMENT STRATEGIES

The coastal zone comprises a narrow strip of coastal lowlands and a vast area of coastal waters. It has become a major site for extensive and diverse economic activities. Many of the countries developing on the coasts depend heavily on the scarce coastal resources for their economic growth. Coastal resources are used and exploited for economic and social objectives: urbanization, industry, tourism and recreation, fisheries and aquaculture, energy production and transportation. VMRDA has a coastlineof about 250 km which varies from open sea to semi closed (creeks, lagoons) coastalwaters and shows significant diversity in environmental and demographic features.

Continuous increase in population coupled with economic growth, rapidurbanization and infrastructure development have resulted in pollution, deterioration ofecosystem health, habitat losses, resource depletion, and invasion of exotic organisms. On the other hand natural hazards like cyclonic storms, tsunamisand sea ingression are the major coastal environmental issues. These coastal environmentalissues have become a major threat to economic sustainability and environmental quality;creating social unrest and destabilising the national economy. To balance anthropogenicactivities and ecosystem health and environmental protection, a comprehensivemanagement scheme is urgently required in the coastal zone on a sustainable basis. In thisregard, a coastal zone management program, which addresses the management of all aspects of the coastal zone, is imperative. The issues prevailing in VMRDA main coastal issues are identified as follows

- Pollution & Solid Waste along the urban areas and city limits through canals.

- Urbanization and Settlement/Encroachment without following norms and regulations towards the coastal areas.
- Excessive uncontrolled Tourism and Recreation without proper infrastructure
- Mangrove Degradation in areas like Pentakonda mangrove swamp, PudimadakaMangroove swamp, Sarada River estuary mangroves, Visakhaptnam mangroves, Sabbammapeta mangroves.
- Coastal Erosion along the beach road leading to breakage of compound walls and roads
- Salinity intrusion where Seawater intrusion takes place into groundwater aquifers due to increase in development of buildings and decrease in ground water level.

To address the issues, the three stages of Vulnerability assessment, implementation, and protection Strategies comes up with few state and central policies and guidelines integrating which to the perspective plan can improve the issues to some extent.

1. Maintaining CRZ Policies
2. Coastal Zone Management at State Level
3. Local Level Coastal Regulation Zone Maps
4. Coastal Vulnerability Index
5. Pollution Control and Waste Management
6. Tourism Management and Planning
7. Fisheries Management
8. Coastal Habitat Restoration
9. Community Participation

Promotion of tourism and ancillary development considering the Proposed Bhogapuram Airport and Scenic value of Coast shall be explored

17.4 STRATEGIES FOR AGRICULTURE PROTECTION

The fear of losing right, title and ownership over one's own land by leasing out discourages the landowners, even when they are themselves unable to cultivate, to lease out their parcels of land. This is the cause behind substantive extent of land remaining fallow or being developed to buildings or other landuses. It is further known, that a lot of land remains fallow for many do not opt to offer their piece of land on oral lease. It is, therefore, necessary that lease is legally recognised by enacting a suitable law. However, it should explicitly and emphatically protect the interests of the land owner, in supersession of any other provision of law that may be in force. The Model Land Lease Act, 2016 prepared and approved by the NITI Aayog offers an appropriate template for the states and UTs to draft their own piece of legislations, in consonance with the local requirements and adopt an enabling Act. Legalise land helps to promote agricultural efficiency, equity and power reduction. This will also help in much needed productivity improvement in agriculture as well as occupational mobility of the people and rapid rural change.

Providing a buffer limit of village expansion area around villages and hamlets will stop uncertain landuse change in future with protected agricultural land. Providing better facilities like gowdowns, cold storage, shades, machine storage areas and Kisan Vikas Kendras will encourage the villagers to continue agriculture instead of shifting to other occupation.

One of the main causes of change in agricultural land is no proper guidelines on approval of LRS on layouts in agricultural lands that has already started developing. People sell the land and start development on them to get permission in future but leading to destruction of good agricultural lands. Stringent guidelines need to be developed and passed under the competent

authority on approval of LRS on agricultural land. This will lead to less conversion of land and encouragement of better agriculture produce.

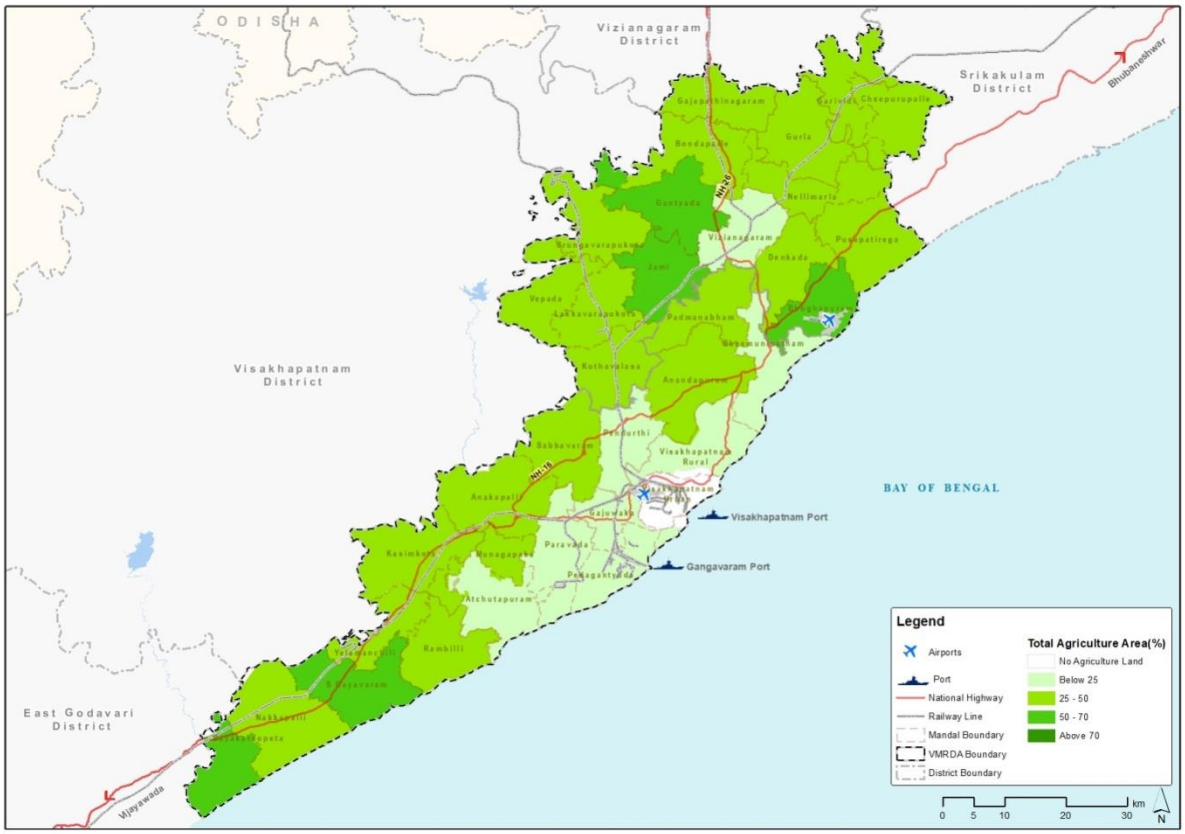


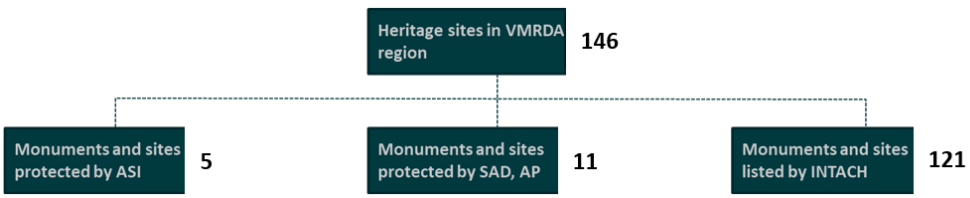
Figure 17-2: Percentage share of Total Agriculture Area of VMRDA region by mandals

17.5 STRATEGIES FOR MANAGEMENT OF HERITAGE CONSERVATION AREAS

The conservation project of built heritage is a complex process, dealing with an extremely heterogeneous range of elements and different substrates with a large variety of conservation conditions. In recent years, its sustainability has become a relevant issue, due to the general limitation of resources and unique features of cultural heritage assets.

Visakhapatnam region has rich cultural and religious traditions that defined its socio-cultural landscape. Religious and spiritual growth in Hinduism, Islam, Christianity and Buddhism took place through its socio-cultural history with significant magnitude, leaving behind heritage in the form of Temples, Dargah, Masjids, Churches and Buddhist sites.

In order to conduct the heritage survey, the list of various heritage properties and precincts have been prepared by compiling the list of heritage sites from 3 organizations instrumental in keeping record of the heritage properties which are:



Along with Listed Heritage Buildings or Listed Heritage Precincts it will also include those natural feature areas of environmental significance or of scenic beauty including, but not restricted to, sacred groves, hills, hillocks, water bodies (and the areas adjoining the same), open areas, wooded areas, points, walks, rides, bridle paths (hereinafter referred to as 'listed natural feature areas') which shall be listed in notification(s) to be issued by the State Government / identified in Master Plan. The strategies to be adopted for Heritage Management are as follows

- The buildings owned by private party should be maintained and restricted from development; reconstruction etc. and the property belonging to the government shall be taken care. Penalty should be imposed on violation the norms.
- Road widening and improvements and any changes in master plan should consider heritage precincts be it natural or structural, in the first case to be protected from development/destruction.
- Proposal of incentive usage of heritage can generate revenue for protection of the property and increase its historic importance.
- Management of regulation in a heritage area by maintaining the skyline and keeping an architectural harmony in the area can enhance the value of the heritage and view of the historic area.
- Grading of historic buildings and precincts of national importance, state importance and aesthetic importance can help to strategize the tourism potential of heritage structures.
- Improvement of infrastructure including access, signage, and street furniture can accentuate the heritage area.
- Corporate sponsorship in heritage buildings can bring significant impact in maintenance as well as popularity of a heritage site.
- Heritage Conservation Committee to be formed by VMRDA

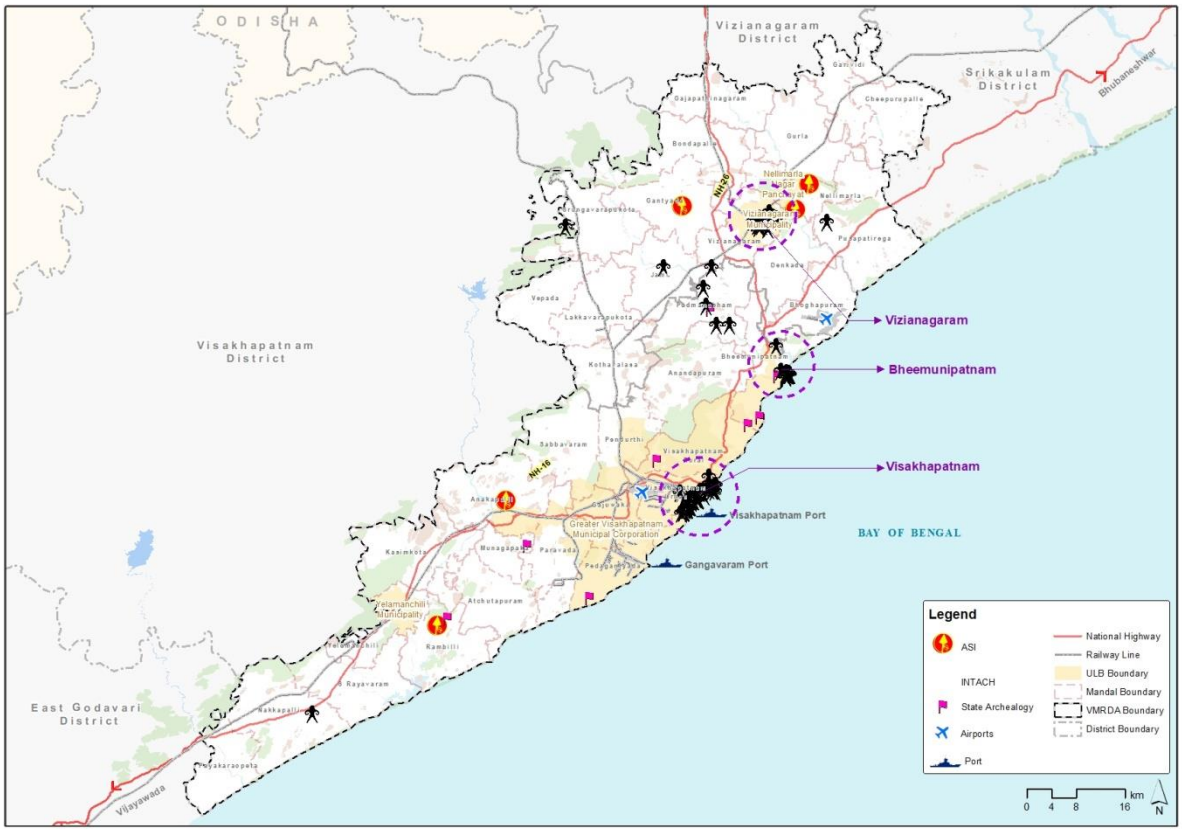


Figure 17-3: Location of major heritage assets in the region

17.6 STRATEGIES OF PROTECTION OF WATER RESOURCES

In Andhra Pradesh, the number of water bodies is not increasing. The reason is due to not taking up the formation of new water bodies. Due to continuous drought and deficit rain fall prevailing in last few years, along with continuous development on the catchment area blocking the inflows to the water bodies decreased considerably, as such some of the water bodies located very adjacent to the habitations were being encroached which leads to decrease in water bodies.

Protect all lakes and lakefronts under G.O.Ms.No.119,Dt.28-03-2017by MA&UD, APProvide additional protection buffers around key lakes, which can be used as open andrecreational spaces under the master plan.Protect all critical drainage channels of the lakes through mandatory open and green buffersunder this perspective plan along with Improve water quality of lakes and lakefronts through well-defined projects. Develop important lakes, lakefronts located within GVMC area for recreational, and tourismwithout compromising their ecological aspects.

Buffer around Water bodies according to GO 119 AP

a) No building / development activity shall be allowed in the bed of water bodies like river or nala and in the Full Tank Level (FTL) of any lake, pond, cheruvu or kunta / shikam lands. Unless and otherwise stated, the area and the Full Tank Level (FTL) of a Lake / Kunta shall be reckoned as measured and as certified by the Irrigation Department and Revenue Department.

b) The above water bodies and courses shall be maintained as Recreational/Green Buffer Zone and no building activity shall be carried out within:

1. 100m from the boundary of the River outside the limits of Local Authorities and 50m within the limits of the Local Authorities. The boundary of the river shall be as fixed and certified by the Irrigation Department and Revenue Department.
2. 30m from the FTL boundary of Lakes / Tanks / Kuntas of area 10Ha and above.
3. 9m from the FTL boundary of Lakes / Tanks / Kuntas of area less than 10Ha / shikam lands;
4. 9m from the defined boundary of Canal, Vagu, Nala, Storm Water Drain of width more than 10m.
5. 2m from the defined boundary of Canal, Vagu, Nala, Storm Water Drain of width up to 10m.

c) Unless and otherwise specified in the Master Plan/Zonal Development Plan.

1. In case of (b) (i) & (ii) above, the buffer zone may be utilised for road of minimum 12m width, wherever feasible.
2. In case of (b) (ii) above, in addition to development of recreational / green belt along the foreshores, a ring road or promenade of minimum 12m may be developed, wherever feasible 3.6m walking / cycle track within the 30m buffer strip may be provided. (iii)
3. The above buffer zone to be left may be reckoned as part of tot lot or organized open space and not for setback requirements.

d) In case of areas along the seacoast, the Coastal Regulation Zone Regulations shall be followed.

e) Considering the existence of significant natural water bodies within the project area, the subsequent detailed planning stages may demarcate the green buffer around the existing water bodies and specify appropriate uses for the same

17.7 DISASTER MANAGEMENT STRATEGY

Cyclone

The Bay of Bengal accounts for seven percent of the annual tropical cyclone activity worldwide; the recorded frequency of cyclones per year along the Bay of Bengal is four and inevitably one of the four transforms into a severe cyclone causing human and property losses. Although the percentage of cyclonic activity along the coast is relatively low, the level of human and property loss that cyclones cause around the Bay is very high. More than 103 Cyclones have affected the State this century. During that period, Cyclonic landfall usually leads to very heavy rains accompanied with high-speed winds and eventually translates into floods.

While the entire coast of Andhra Pradesh (2nd largest in the country) is vulnerable to Cyclones, nine coastal districts are most vulnerable and have recorded ample amount of landfall in the last century. When cyclones and resulting floods occur, the loss of crops, irrigation infrastructure due to severe inundation and cyclonic damages is significant in the coastal districts of Andhra Pradesh. The cyclone vulnerability is being addressed by the State Govt, through execution of National Cyclone Risk Mitigation Project (NCRMP). The Revenue Department of Andhra Pradesh is the facilitator for the same. Further Andhra Pradesh State Development Planning Society (APSDPS) is also supplementing towards the same through EDSS model, by which the cyclone vulnerability can be analyzed. The Annexure 12(i) may also be referred for further information purpose.

Tsunami

Tsunami of December 26, 2004 affected nine coastal districts of Andhra Pradesh (Nellore, Prakasam, Guntur, Krishna, East Godavari, West Godavari, Visakhapatnam, Vizianagaram and Srikakulam). A total of 301 coastal villages and 2,11,670 people from these districts were affected due to the December 2004 tsunami. While 107 people were reported to have lost lives due to tsunami, 1,554 houses were damaged; predominantly fishermen community was the worst affected in Andhra Pradesh due to tsunami. A total of 2,418 boats were completely lost; 8,976 traditional boats and 180 mechanized boats were damaged. It was reported that 47,370 fishing nets that are crucial to livelihood of fishermen were lost due to tsunami. Tsunami warning system has been proved very useful to address this important aspect in the region.

Figure 17-4: Disaster management framework

Key Mitigation Measures

- Creating network of knowledge institutions
- Creation of physical infrastructure for mitigating impact of cyclones: by monitoring of construction of cyclone shelters, missing road links and bridges, saline embankments, coastal canals, mangroves plantation etc.
- Technical assistance for capacity building on the hazard risk management, damage assessment and long-term strategy, followed by the project management and monitoring by Revenue DM Department. The same is being executed by the Panchayati Raj and Rural Development Department

17.8 STRATEGIES TO PROTECT ECOLOGICALLY SENSITIVE AREAS

Ecological Sensitive Areas or Ecologically Sensitive Zones refer to those areas which have been notified by the Ministry of Environment, Forests and Climate Change as areas around the Wildlife Sanctuaries, National Parks and Protected Areas as requiring more protection due to their sensitiveness.

Protection of forests and hills will help local communities preserve forests in critical areas through community forestry and management plans; improve agricultural practices through irrigation and mixed cropping; and better manage livestock to reduce overgrazing.

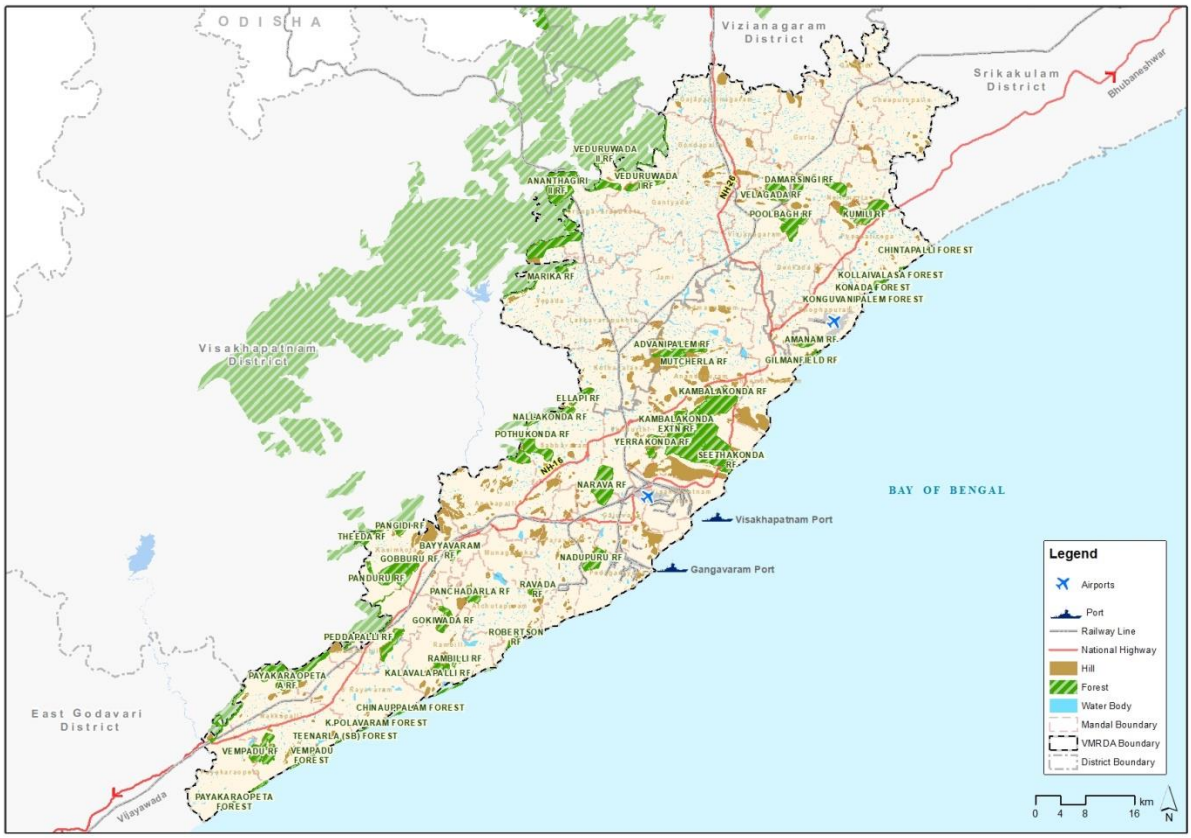


Figure 17-5: Ecologically Sensitive Areas in VMR

The strategies involved in protection of forest as given by the AP GO 119 are as follows.

The vegetation cover of the forest areas in India are classified into 6 types. They are,

i. VDF – HL: Very Dense Forest in Hill Areas
ii. PF – HL/WB: Other than very dense forest in hilly areas or 20m buffer around streams or water bodies
iii. VDF – PL: Very dense forest in Plain areas
iv. MDF – PL: Moderate dense forest in plain areas
v. OF/SF – PL: Open/Scrub forest in plain areas
vi. NF – PL: Non Forest in plain areas

Table 17-1: Vegetation cover in the forest of VMRDA region by circles

Division/ Circle	VDF-HL	PF-HL/WB	MDF-PL	OF/SF-PL	NF-PL	Total (Ha)
Visakhapatnam	1.12	24048.73	2778.99	8222.35	3404.43	38455.62
Vizianagaram	0	11303.35	1731.48	2407.58	406.16	15848.57
Total	1.12	35352.08	4510.47	10629.93	3810.59	54304.19

Study area has highest area of its Forest vegetation cover as (PF HL/WB) Other than very dense forest in hilly areas or 20m buffer around streams or water bodies.

VMRDA region has 1.12 Ha of its area as VDF-HLin Nakkapalli mandal; 36794. 91 Ha PF-HL/WBwith highest area in Srungavarapukota mandal (4471.81 ha) and smallest in Anakapalle (1.06 ha); 14900.24 ha of OF/SF – PL, highest in Anandapuam (1639.13 ha) and lowest in

Bhogapuram mandal (2.17 ha); 5578.74 ha in NF - PL highest in Gara mandal (591.39 ha) and lowest in Gantyadamnadal (0.18 ha).

Strategies to protect forest

(a) Maintain order in forests and protected areas.
(b) Increase revenue returns from authorized activities.
(c) Prevent damage to forest resources resulting from unwanted resource violations.
(d) Meet sustainable yield targets.
(e) Involve the public through information and education programs to prevent violations and damage to forests and protected areas.
(f) Increase skill levels of forest technicians and forest managers in prevention, detection and monitoring programs.
(g) Reduce susceptibility or vulnerabilities that can create opportunities for unwanted activities to occur.

Green Cover

State of Forest Report 2017 released by the Forest Survey of India reveals that the forest cover of the country is 21.54% of the total geographical area showing a marginal increase from the assessment in 2015 at 21.34%. The bulk of the increase has come from the improvement in forest covers in three states, one of which is Andhra Pradesh along with Karnataka and Kerala.

At present the total landuse covered by recreation, forest and hills makes a significant green coverage of 12% of VMRDA area and if the plantation around lakes and rivers is considered it becomes a green cover of 17% which is much lower than the state and national average.

The strategies that can be incorporated to increase the green cover are as follows

1. Development of green belt spanning the core area
2. Embark open spaces in residential area
3. Afforestation in open spaces like around lakes waterbodies canals etc
4. Avenue plantation

At present VMRDA has a stretch of 220 km National Highway, 490 km State Highway, 1,700of Major District Roads and other district roads. At present only 11% of the total road length having medians has plantation. Considering plantation along the road to about 50% can improve the greenery and green cover to a huge extent.

18 STRATEGIC TRANSPORTATION SYSTEM, 2051

18.1 STRATEGIC TRANSPORTATION AND MOBILITY OBJECTIVES

VMRDA Region has privilege of having inter-city transport network of all modes – rail, air, sea and good road network and public transport system serving the intra-city travel demand. For 2051, a planned transport network needs to be developed for enablingsafe and quick movement of all types of vehicular modes. Providing Hierarchical road network connecting different points of region with adequate right of ways will ensure smooth transition of vehicles.

Improved Regional Connectivity between Mother City and Satellites from NHs and SHs and between the towns and cities in VMRDA region and rest of the state.

Public transport has an important role to play for a socially and environmentally sustainable region. With proper plan, there will be modal shift from private vehicles to public transport, thus leading to reduced traffic congestion. It results in socio-environmental benefits including reduced pollution, transport costs, and travel time, as well as increased accessibility and mobility.

18.2 STRATEGIC REGIONAL ROAD NETWORK

For a region like VMRDA region, where connectivity should be strong enough to cater horizon year traffic, improved and hierarchical road network of RoWs of 80m, 75m, 60m, 45m, 30m, and 24 m would be proposed in existing and proposed greenfield led urban growth areas. For vehicle movements that are not destined in VMRDA region and for speedy movement of vehicles through the region, hierarchical networks viz., National Highway 16 and Regional Bypass will cater the movement; for those bound to the region, Proposed Coastal Corridor and PCPIR Expressway connects major activity centres in the region. These hierarchies are followed by the Regional Connectors and Regional Corridors connecting large number of growth centres, collecting and distributing from and to them. Other roads take off from these roads providing complete accessibility in the region. Description on the proposed transport network is presented in the following sections.

National Highway 16: NH16 (Kolkata to Chennai) passes through VMRDA from Pydibheemavaram in Vijayanagaram District to Payakaraopeta in Visakhpatnam District. In between it connects Anandapuram, Pendurthi, Sabbavaram and Anakapalle. It is one of the major corridors serving the future growth areas and the sub-CBDs. Development of a New Bypass to NH-16 which will also incorporate strategic roads conceived under State Roads Improvement Programme.

Development of proposed Boghapuram Airport and Metro corridor will trigger the development along NH-16 in the area opened up for development between Airport junction and Anandapuram Junction. Hence, it is recommended to develop a new bypass from Airport Junction to Neellakundeelu to divert freight and regional traffic from the future urbanizable areas.

Proposed Regional Bypass: As the urban growth will spread over NH16 bypass in the near future, the regional bypass will be the used to avoid the urban area interference with the freight movement. Current bypass to NH-16 only provides partial relief from through goods and other traffic passing through VMR hence there is need to promote new bypass to VMR which is linked to the satellite cities. A conceptual alignment of the bypass is proposed here which can also consider larger state level strategic road planning and improvement. The Regional Bypass starts from south of Anakapalle, stretching northwards via Lakkavarapukota, bypassing Vizianagaram and joining the beach corridor at Chintapalle village in Pusapatirega mandal. Development of this 150 km new corridor having 80 m RoW will have public transit connecting the urban areas.

Proposed Coastal Corridor: The existing beach road from Coastal Battery to Bheemunipatnam will be extended till Chintapalle village in Pusapatirega mandal via Bhogapuram and meets Regional Bypass along the coastline having 70 m RoW. The proposed Beach Road development has tourism nodes and existing tourism destinations in VMR.

PCPIR Expressway: Serving all the heavy industries clusters in the PCPIR area along with the planned townships, the expressway of 75m RoW will be a major alternative to the National Highway 16, with regular connectors to the highway.

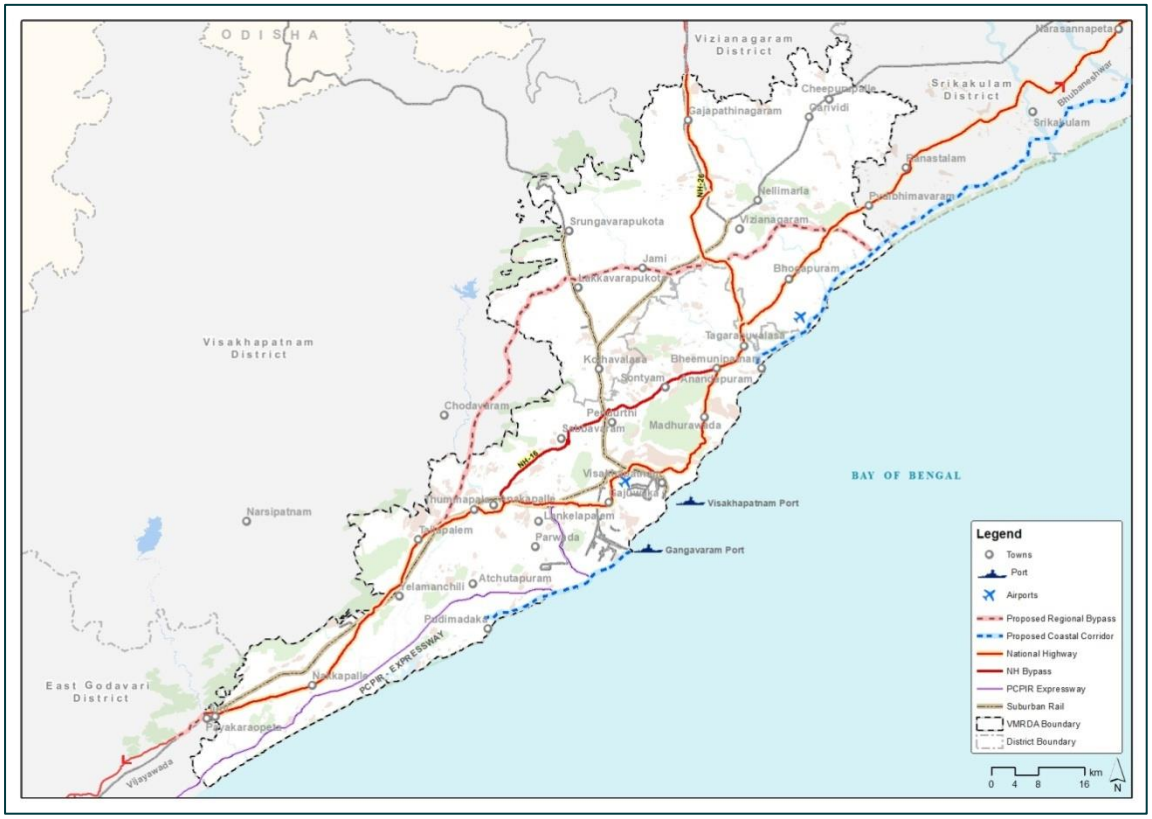


Figure 18-1: Strategic Regional Road Network

Regional Connectors: Regional urban centers will be inter-connected by 45m RoW regional connectors, by widening identified MDRs and ODRs. These connect from S.Kota to Gajapathinagaram and Gajapathinagaram to Cheepurupalli.

Radial Corridors: These 45m RoW roads will connect the mother city with the regional centers located more inlands. Major State Highways has been identified for widening to the towns of Cheepurupalli, Gajapathinagaram, Srungavarapukota and Parawada.

To link the new urban axis/corridor to the mother city seven radial corridors are proposed to be developed/improved along with provision of bus based public transit. The key radial corridors will be Vizianagaram-Cheepurupalli, Vizianagaram-Boppadam Junction, Kothavalasa-Vizianagaram, Hanumanthuwaka-Vepagunta, NAD junction-S.kota, Visakhapatnam Port Trust-Sabbavaram, Anakapalle-Pudimadaka, Atchutapuram-Yelamanchili and Anandapuram-Bheemunipatnam.

Figure 18-2: Strategic Regional Road Network

18.3 ENHANCED PUBLIC TRANSPORTATION SYSTEM

The mass transit network forms part of the Perspective Plan's integrated public transport network. To address future needs, high quality mass transit should be integrated with wider public transport system. The development of this public transport system considers how different modes contribute different parts of the public transport offering to meet VMRDA region needs. This is best represented as a public transport hierarchy which provides the steps to development of the complete, integrated public transport system. As outlined in this chapter the proposed public transport hierarchy for VMRDA region include metro rail for the highest demand corridors and longest journeys, supported by Suburban Rail, BRT and then the conventional bus network and finally walking and cycling for the shortest journeys. The following sections outline the proposals for each.

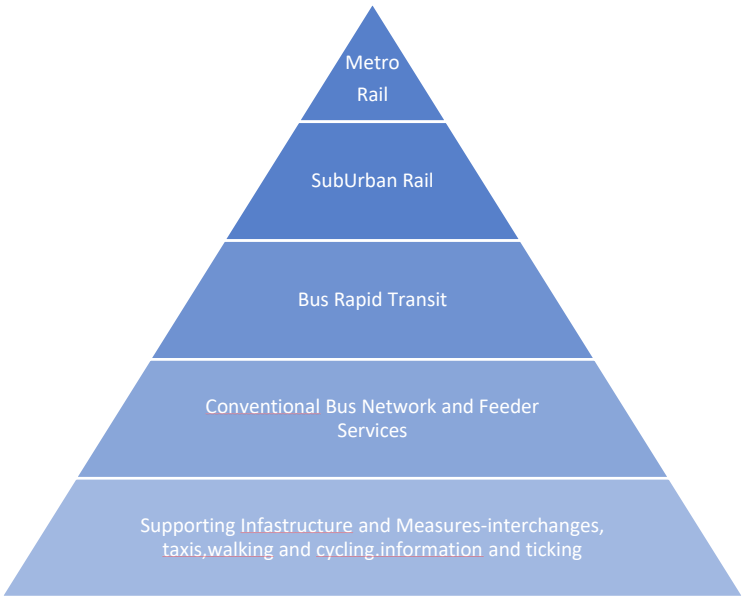


Figure 18-3: Public Transport Hierarchy

METRO/SUBURBAN RAIL: A full-fledged passenger railway can transport passengers in a congested urban area from one point to another in the largest number and in the shortest time in comparison with other modes of transport such as private vehicles, and buses, and even BRT. This is particularly true during peak periods when a large number of workers commute between their home and workplace, consequently creating traffic congestion. These can carry a large number of passengers at a high speed, undisturbed by traffic congestion. An illustration of the system is presented in Figure 18-4.

Due to a rail system's ability to attract a large number of trip makers along a fixed corridor, land use along the corridor often becomes denser (particularly at nodes). Land use becomes more concentrated along the corridor. This Transit Oriented Development (TOD) is in line with the public transport policies already outlined and therefore is a key component in making rail a successful component of the integrated public transport system.

When development sites have improved access to other parts of the urban area through the delivery of the passenger rail system, land prices and property values will increase from competition to locate activities along the corridor. Railways are expensive to build, but if increases in property values can be captured and pay for the cost, at least in part, the overall cost to the provider can be much lower. This practice of "value capture" is most prominent in Japan.

Figure 18-4: Rail Transport System

Metro and Urban Transit Corridors: Approximately 140 km of metro based public transit network is proposed under this alternative which will promote the north-south urban development axis in VMR. It is proposed in three phases

Table 18-1: Phase-wise development plan of Visakhapatnam Metro Alignments

Phase	S.No	Corridor	Length in kms.	Total Length in kms
Phase-1	1	Kommadi to Steel Plant (on NH-16) via NAD, Gajuwaka	34.23	46.42
	2	Gurudwra to Old Post Office via RTC Complex, Raja Ram Mohan Roy Road	5.29	
	3	Thatichetlapalem to China Waltair via Railway Station, RTC Complex, Asilmetta Jn, Siripuram Jn	6.9	
Phase-2	1	Law College Jn to Mariakvalasa via Madhurawada, IT Park	8.21	77.31
	2	Kommadi to Anandapuram Jn via NH16	8.3	
	3	Anandapuram Jn to Bhogapuram Airport - Approach Road (At grade)	17	

	4	NAD Jn to Pendhurthi	10.2	
	5	Vizag Steel Plant to Anakapall Railway Station (At grade)	18.2	
	6	Old Post Office to Rushikonda Beach via Beach Road, GITAM University	15.4	
Phase-3	1	Rushikonda Beach to Bheemili beach via Thotla Konda, Beach Road	16.4	16.4
				140.13

Figure 18-5: Visakhapatnam Proposed Metro Alignments

It is desirable and recommended that metro network which is conceived between Bhogapuram International Airport and Anakapalle in three phases is further extended upto Atchutapuram-APIIC SEZ from Lankelapalem to support the emerging urban axis between the airport, existing CBD of Visakhapatnam, and the mega Industrial Cluster under VCIC at Atchutapuram. Metro being the major public transit corridor, existing and expansion of BRTS network can be organized to provide last mile connectivity and to the sub-CBDs with respect to the metro network. The public transit axis will be supported with NMT and other paratransit modes to promote development ranging between 3-5 km influence areas of the axis/corridor.

Extension of Metro Rail along coast: Considering tourism potential and upcoming development towards proposed Boghapuram Airport, proposed Metro along the coast (Rushikonda Beach to Bheemili beach via ThotlaKonda, Beach Road) shall be extended from Bheemunipatnam to Kongavanipalem Village to smoothen the movement along proposed Extension of Beach Road

Sub Urban Rail:For passenger transit in VMRDA region, utilisation of railway connectivity from Visakhapatnam to towns of Vizianagaram, Srungavarapukota and Tuni Sub urban rail system will facilitate.

Figure 18-6: Suburban Rail Network

BUS RAPID TRANSIT (BRT):

As identified in the proposed public transport hierarchy, BRT has an important role to play in providing the mass transit network required for VMRDA region. This form (Figure 18-7) of low-cost mass transit has proved to be pivotal in many cities around the world including Indian cities, aiding cities in moving away from the model of public company bus transport, with its associated problems (e.g., overstaffing, underfunding, problems with spare parts), and away from a poorly regulated private sector based on second hand minibuses.

The new urban axis while having urban transit (BRTS) of its own will be networked with the mother city through BRTS or Bus based connections along major radial corridors to the mother city and proposed metro network, hence creating an idea of highly networked city region. Commuter rail and radial roads will connect the regional centres to the mother city integrating the whole area within the network.

Figure 18-7: Bus Rapid Transport System Infrastructure

BRTS Network: Last mile connectivity with respect to metro network will be in the form of BRTS or Bus based public transit loops connecting to metro nodes in 5 km influence area of the metro corridor.

Existing BRTS has two corridors: Pendhurthi Transit Corridor (PTC) and Simhachalam Transit Corridor (STC). Adding to Metro Corridors, for last mile connectivity and connectivity to the satellite towns BRTS would be extended and other bus based network will be linked to the metro transit network. For this, Pendhurthi will be connected to Kothavalasa (45m RoW), NH16 bypass – Anakapalle to Anandapuram (60m RoW), Tagarapuvalasa to Vizianagaram (60m RoW) and Bhogapuram to Pydibheemavaram (60m RoW) as proposed BRTS corridors. Proposed BRTS system in the study area is presented in Figure 18-8.

Figure 18-8: Proposed Bus Rapid Transport System

Conventional Bus Services:

The third tier of the proposed public transport network hierarchy (after mass transitsMetro, sub urban rail and BRT) is the role of conventional bus services, which will be vital in ensuring an effective network and accessibility of the wider area. The route network for the conventional bus system will, in turn, depend on the nature of the high-capacity mode network (Rail and BRT). It is possible to design a route network for the complementary bus services when the networks for these other modes are finalized in detail. It is pertinent to mention here that, till higher order transport systems i.e. rail and BRT gets implemented, the conventional bus services can act as good public transport system. As the demand for public transport increases in the region, planning and development of higher order mass transport corridors i.e. BRT and Suburban rail along with feeder systems i.e. last mile connectivity needs to be carried out.

The route network should be redesigned based on a set of basic principles including, but not limited to, the following:

a. The redesigned route network should strike a balance between the aim to maximize passenger convenience by providing direct links between origin and destination for the majority of passengers, and optimizing vehicle utilization;

b. Whilst in some cases it will be necessary for passengers to interchange during their journeys, it is desirable to minimize the number of interchanges to be made by passengers;

c. Although the current practice of arbitrary route cutting by seven-seater drivers is deplorable, it is rational to vary the service frequency on different sections of a route to match variations in demand. Typically, the demand for a bus route increases as it approaches the central area. The frequency can be varied, or tapered, accordingly by scheduling some buses to operate over only part of the route; on long routes it may be necessary to provide terminal facilities at several intermediate points where buses may turn short; and

It is also generally desirable to minimize the need for bus terminal facilities in the city centre area. Terminals require large areas of land, which in city centres is scarce and expensive. Often the only space available is inconveniently located, so that passengers must walk further to and from their destinations, and buses may lose time in accessing and leaving the terminal; such movements frequently add to traffic congestion. It is therefore recommended that wherever possible, bus routes should extend beyond the central area and in many cases should operate from one outer suburb to another, via the central area.

SUPPORTING INFRASTRUCTURE AND MEASURES

1) Intermodal Hubs

While reducing the need to interchange (transfer) is a key factor in the effective planning of the public transport and land use networks, there will still be the need for interchanges, particularly at key hubs in between modes. At present, many changes Auto Rickshaw/Maxi cab/Seven-seater Auto's to reach final destinations. Mass transit must be designed to allow for convenient transfers to other mode. The following are basic principles for designing intermodal facilities.

Stations in the urban area should be designed to provide for easy transfers to the BRT network. Better connectivity to other public transport modes will result in higher efficiency of the urban transport system as a whole. For that purpose, stations should be located near intersections with the BRT network and station entrance/exit gates should be placed near the BRT station.

The primary concern for suburban stations is transfers to/from the bus network. Buses/ Auto Rickshaws collect passengers in surrounding residential areas and deliver them to the station. Stations therefore should be located at places where access roads are secured. A bus terminal plaza should be prepared at each station to make transfers easy. Taxi ranks located at these interchanges also help maximise integration and accessibility.

These hubs offer new travel options in order to capture potential public transport demand. This infrastructure is normally called an Integration Terminal or Interchange and should be located in relation to the present transport demand as well as the planned development structure of the region.

These allow passengers in the city centre to take the first arriving trunk unit without waiting for a specific route number, which reduces waiting times and queues. The waiting/station areas needed on the central area trunk sections are therefore relatively small.

2) Rail Stations

The roles of passenger railway stations are different in central/urbanised areas and in suburban areas. The basic principles for locating stations are described below.

Central/Urbanized Areas: Stations in central/urbanized areas are direct access points for neighbouring business and commercial facilities and also function as transfer points for other public transport modes. Stations in these areas are therefore placed at intervals of about 1.5 km and at junctions with other public transport modes.

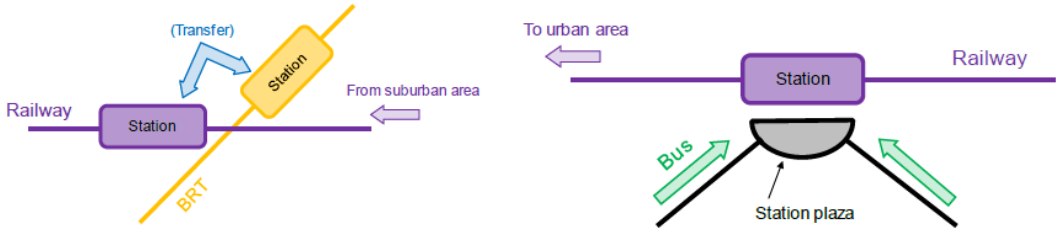


Figure 18-9: Intermodal Hubs

Suburban Areas: Stations in suburban areas are primarily points from where commuters in the surrounding residential areas are transported to the urban centre. Residents of surrounding areas reach the station on foot (or) by Feeder Buses/IPT Modes. Therefore, stations are placed at intervals of about 5 km and at locations where access roads can be secured.

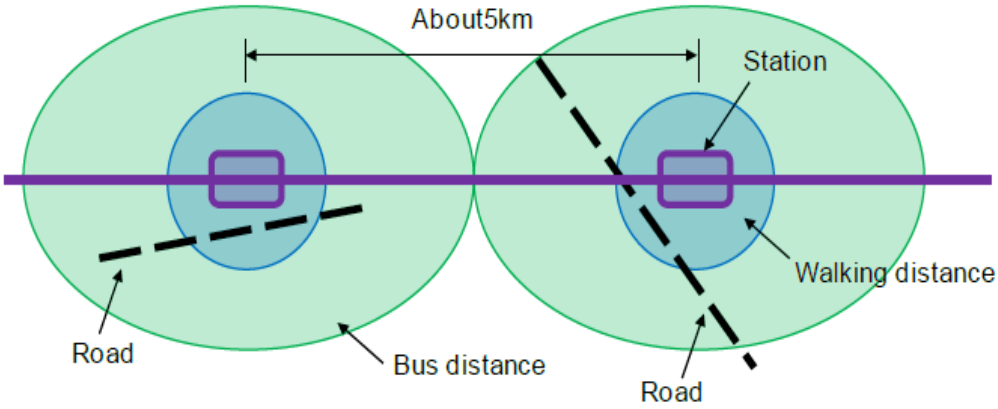


Figure 18-10: Stations in Sub Urban Areas

Station and Station Plazas: At-grade stations are considered to minimise costs. Footpath overpasses for passengers to cross tracks would be included. In suburban areas, station plazas (providing bus services in front of the station) would be developed to facilitate intermodal transfers.

Figure 18-11: Concept of Station Plazas

BRT Terminals/Interchanges:

Building an interchange allows bus services to be segmented into trunk routes, feeder routes and inter-district routes, offering new travel options and thus capturing the "repressed" public transport demand which does not use the bus as the route network does not comply to the passenger's needs.

Integrated Terminals serve as the primary tool for rationalizing the entire bus system in a way that allows for the provision of transport to be quickly and accurately adjusted to the real demand in each part of the bus network. The frequency and regularity of bus services on each of the routes that serve Integrated Terminals maybe increased considerably in many cases, particularly within urban centres where there is the greatest concentration of riders.

The consolidation of centre-bound trips at Integrated Terminals can significantly improve the flow of buses in the central area, while reducing the inconveniences often associated with boarding, alighting, and waiting for buses.

Through optimising the use of the bus vehicles, both in terms of capacity and efficient scheduling, the overall costs of providing transport can be reduced, and likewise the total capital investment required in fleet.

Finally, the concentration and consolidation of passenger activity at Integrated Terminals encourages the consolidation of commercial sub-centres at these locations.

From these hubs, passengers can choose from various route options:

Trunk Routes:The trunk routes in an Integrated Urban Transport System share several common characteristics: They operate at high frequencies (normally less than 6 minutes) along the main transport corridors of the city, linking the city centre with major Integration Terminals. They also feature enhanced ITS traffic signalling, geometric and/or bus priority measures, and stations set at intervals compatible with increased operating speeds.

Feeder Routes: Most of the bus routes that serve (or "feed" into) the Integration Terminals are formed by conventional routes on the outskirts of the city or system. Once at the terminal, the feeder route passengers are offered access to the entire Integrated Urban Transport System, including the variety of trunk lines described above as well as all of the other feeder lines that converge there – without having to pay another fare. Feeder routes use conventional buses at intervals selected to both minimize passenger waiting times and passenger crowding.

Inter-District Routes:These routes link the major BRT corridors, allowing passengers to transfer from one corridor to another without having to pass through the city centre.

3) Conventional Bus Stops and Terminals

There will also be a requirement for designated bus stops, with appropriate facilities such as passenger shelters and bus laybys, along the length of every bus route. The stops must be located conveniently for the majority of passengers but must also take into account safety considerations and the requirements of other road users.

The existing bus stops in some rural areas do not even have the basic infrastructure. A quick programme to improve the bus stop with in the VMRDA region to promote increase of public transport share is required.

4) Complementary Measures

In addition to the key measures identified for each of the elements of the public transport hierarchy – passenger rail, BRT, and bus systems – there are also a series of complementary measures required. These include ensuring that the public transport network is highly accessible by walking and cycling via safe, convenient, and clear routes, particularly from major public transport hubs. These should be planned and implemented directly as part of the integrated transport network for sustainable modes. Consideration of an improved pedestrian realm should be an integral part of land use planning in VMRDA region.

Other measures include integrated ticketing, information, and marketing. Such measures are not outlined in detail in this Plan, but they are important for development of a sustainable transport system

In order to improve public transport:

a. Improving Rail terminals and Bus route network with exclusive Bus lanes along with Bus terminals and bus stops;

b. Improvement of Intermediate Public Transport(IPT); and

Integrating of NMT along the public transport system with pedestrian and bicycle friendly infrastructure.

18.4 TRANSIT ORIENTED DEVELOMENT CORRIDOR

TOD and Urban Development Corridor: To support the metro network between Bhogapuram Aerocity-Existing CBD of Visakhapatnam-Atchutapuram Mega Industrial Cluster, Transit Oriented Development is proposed 5 km on both sides of the metro corridor with theme based economic and mixed use nodes. Last mile connectivity is to be provided upto 1km NMT modes and BRTS upto 5 km on both sides of the corridor. Higher net density development at an average of 200 to 300 pph can be promoted in the influence area of the metro corridor in Greenfield and opportunity based sites within existing city.

18.5 INTER-CITY RAIL NETWORK WITH MAJOR RAILWAY STATIONS

VMRDA is having rail network connecting important nodes. Intra-city suburban rail operations on the inter-city railway network within VMR by utilisation of railway connectivity from Visakhapatnam to towns of Vizianagaram, Srungavarapukota and Tuni. To increase public transport share along with improving existing bus system and metro corridors running Sub Urban Train services on Tuni-Vizianagaram section of Chennai-Howrah main line.

Indian Railway Station Development Corporation (IRSDC) is planning to modernise the Marripalem Railway station (though they are naming as Modernisation of Visakhapatnam Railway Station). Once proposed Marripalem Rail Terminal is developed, many trains originating and terminating at Visakhapatnam Railway Station will be diverted to Marripalem Rail Terminal. All the

trains, which are being by passed through Duvvada Railway Station, will be extended to Visakhapatnam Railway Station. Four new railway lines, with two main lines, will be laid and all the lines will be integrated into a terminal connected to the existing Visakhapatnam Railway Station. Marripalem is located close to NAD junction and it is 8 km away from Visakhapatnam RTC Bus Station. The aim of new terminal is to decongest traffic at the existing railway station.

Duvvada railway station would become major railway station in the future and it can be shown as major railway terminus. It is the gateway to Visakhapatnam and caters travel needs people living in industry belt and surrounding areas. It is proposed to develop as a "Satellite Station", which earned "Adarsh Station" tag.

The region is served by Chennai-Howrah main Railway line. Due to constraint experiencing in expansion of Visakhapatnam railway Station, a railway line was proposed from Anakapalle to Kothavalasa. This line is expected to rationalize rail movements avoiding critical area of Visakhapatnam.

18.6 MAJOR TRUCK TERMINALS/ LOGISTIC PARKS

A truck terminal is an intermittent rest area with in-built facilities caters to long and short haul goods vehicles passing through highways. These truck terminals are required for the efficient movement of freight vehicles within the VMRDA region so that congestion is limited. Truck Terminals need to be provided near various sensitive areas which attract heavy vehicles and also at the outskirts. Classified traffic volume count and OD surveys of commercial vehicles carried out at Outer Cordon locations and forecasts of intercity travel by bus warrants for truck terminals in VMRDA region. The identified locations for truck terminals are mentioned in the following section.

There is a huge truck movement in VMRDA Region and due to presence of Visakhapatnam Port Trust, Gangavaram Port, Steel Plant, NTPC and various major industries, where most of the truck movement is destined to these facilities. Approximately, equal share of entry and exit of goods traffic is observed with highest share is observed at OC-4 at Payakaraopeta location on NH-16 with 48% followed by OC-14 near Parlakhemudi Junction near Narsannapaeta with 28%.In terms of tonnage, the highest share is observed at OC-4 at Payakaraopeta location on NH-16 with an 14,221 tons followed by OC-3 on NH-16 near Tuni towards Vishakhapatnam with 12,385 tons and also at OC-14 near Parlakhemudi Junction near Narsannapaeta with 7,026 tons .For the estimated trucks for 2050, the land requirement for major truck terminals is 150 hectares in 2050 is given in Table 18-2 and the locations for these proposed Truck Terminals shown in Figure 18-12. Additional to these 35 hectares of minor truck terminals are required to facilitate goods movement within VMRDA region for various industrial purposes. 5 hectares of the land is required for each of these Proposed Minor Truck Terminals in VMRDA region for 2050 are estimated and locations for these terminals are shown in Figure 18-12. Further project preparatory works needs to be carried out for timely implementation of the proposed truck terminals.

Table 18-2: Proposed Major Truck Terminals and Land requirements for 2050

Sl. No.	Road	VMRDA Region Destined Trucks in 2050	Tonnes	Land required in ha
1	OC- 4, NH-16 (Near Payakaraopeta)	13,000	36,000	50 ha
2	OC-9, SH 39, North of Bowdara Junction			50 ha
3	Oc-10, Jeypore - Vizianagaram Rd	2,000	11,000	50 ha

Table 18-3: Proposed Minor Truck Terminals

Sl. No.	Road	Proposed Area in Hectares (ha)
1	OC-5, Tuni-Narsipatnam road, D Polavaram	5
2	OC-6, Narsipatnam-Darlapudi Road	5
3	OC-7, Narsipatnam-Anakapalli Road	5
4	OC-8, Chodavaram - Anakapalle Road	5
5	OC-10, Jeypore - Vizianagaram Rd	10
6	OC-11, SH 36, Rambhadrapuram - Rajam Road	5

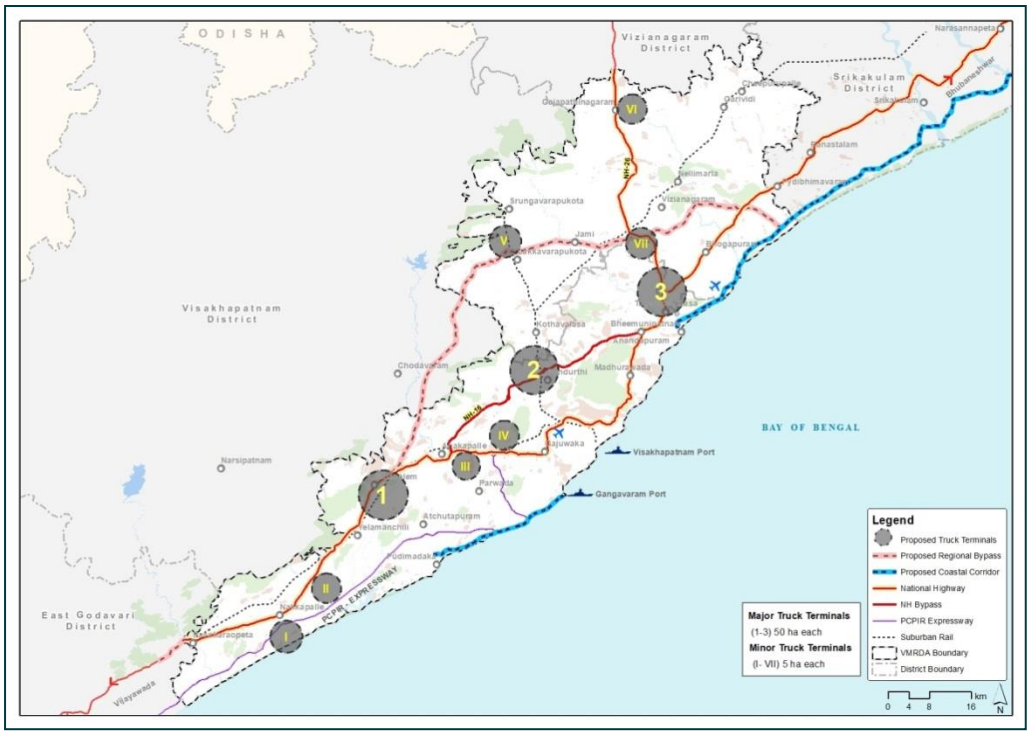


Figure 18-12: Proposed Major and Mini Truck Terminals for the horizon period upto 2051

18.7 INTER CITY BUS TERMINALS/ INTER STATE BUS TERMINALS

There are 4,900 buses per day are coming from various places from outside of VMRDA Region entering daily. All these buses come to various bus stands in the VMRDA Region viz., Visakhapatnam, Vizianagaram, Anakapalli and S.Kota Bus Stands. With the increase in travel demand and increase in passenger trips, additional intercity terminals are required to cater horizon year demand. These interstate and intercity buses can be stopped outside of the respective areas by providing Inter City Bus Terminals (ICBTs) on all the routes. Route wise estimated bus trips and Passenger trips for the period upto 2050 are presented in Table 18-4 and Table 18-5 respectively.

Table 18-4: Route wise projected Bus trips for 2051

Location Name	2018		2030		2041		2051	
	ENTRY	EXIT	ENTRY	EXIT	ENTRY	EXIT	ENTRY	EXIT

OC-4,NH-16 (Near Sitampeta)	720	761	944	998	1,150	1,216	1,397	1,476
OC-5,Tuni-Narsipatnam road, D Polavaram	111	107	126	122	140	135	154	149
OC-6,Narsipatnam-Darlapudi Road	23	23	36	36	50	50	68	68
OC-7,Narsipatnam-Anakapalli Road	186	185	225	224	258	257	295	294
OC-8,Chodavaram - Anakapalle Road	316	291	330	304	341	314	353	325
OC-9,SH 39, North of Bowdara Junction	59	59	83	83	106	106	136	136
OC-10,Jeypore - Vizianagaram Rd	296	298	444	447	597	601	803	808
OC-11,SH 36, Rambhadrapuram - Rajam Road	123	103	185	155	249	209	336	282
OC-12,Rajam-Palakonda Road	179	179	260	260	342	342	450	450
OC-13,SH-37, Palakonda - Srikakulam Road	81	79	124	121	169	165	232	226
OC-14,NH-16 (Near Parlakhemundi Junction)	361	364	520	525	680	686	891	898
Total Buses	**2,455**	**2,449**	**3,277**	**3,273**	**4,084**	**4,081**	**5,115**	**5,112**

Table 18-5: Route wise projected Passenger trips for 2051

	2018		2030		2041		2051	
Location Name	**ENTRY**	**EXIT**	**ENTRY**	**EXIT**	**ENTRY**	**EXIT**	**ENTRY**	**EXIT**
OC-4,NH-16 (Near Sitampeta)	11,220	11,786	18,759	19,705	27,488	28,874	39,282	41,263

OC-5,Tuni-Narsipatnam road, D Polavaram	2,238	2,535	3,641	4,124	5,223	5,916	7,309	8,278
OC-6,Narsipatnam-Darlapudi Road	166	230	311	431	493	683	753	1,043
OC-7,Narsipatnam-Anakapalli Road	4,255	4,361	6,801	6,971	9,610	9,850	13,193	13,522
OC-8,Chodavaram - Anakapalle Road	2,682	4,240	3,935	6,222	5,216	8,246	6,742	10,658
OC-9,SH 39, North of Bowdara Junction	1,554	1,153	2,691	1,996	4,055	3,009	5,962	4,423
OC-10,Jeypore - Vizianagaram Rd	6,250	10,471	11,283	18,902	17,529	29,368	26,515	44,422
OC-11,SH 36, Rambhadrapuram - Rajam Road	2,255	1,951	4,072	3,523	6,339	5,485	9,620	8,323
OC-12,Rajam-Palakonda Road	4,552	3,727	8,064	6,602	12,370	10,128	18,483	15,133
OC-13,SH-37, Palakonda - Srikakulam Road	1,840	1,771	3,356	3,230	5,265	5,068	8,060	7,757
OC-14,NH-16 (Near Parlakhemundi Junction)	4,668	5,280	8,223	9,301	12,551	14,196	18,693	21,144
Total Passengers	**41,680**	**47,505**	**71,135**	**81,007**	**106,140**	**120,823**	**154,610**	**175,967**

Presently the bus stands are congested with present demand and needs to be upgraded with world class facilities to meet the future needs particularly on special occasions.

As per past experiences of the consultant the standards considered for estimating the terminal demand are one inter-city Bus Terminal for 0.5 lakh passengers/ day and area requirement of 3 hectares per unit.

For a population of 8.5 million and 10,000 bus trips (2051), expected number of bus passenger-trips comes out to be around 3.3 lakhs per day. Currently there are 4 nos. of existing bus terminals

facilitating inter-state buses. For 2051, additional 3 nos. of bus terminals will be required for horizon year demand.

18.8 . PASSENGER RAILWAY STATIONS

For rail passenger transit, utilization of railway connectivity from Visakhapatnam to towns of Vizianagaram, Srungavarapukota and Tuni Sub Urban rail system will facilitate 2051 VMRDA Region. Currently, 30railway stations including A category and Non- suburban category railway stations. With introduction of Sub Urban rail system, 5 nos. of A category and 50 nos. of Non-suburban category railway stations will operate the Sub Urban, Passenger and Express trains.

18.9 ROAD CONNECTIVITY BETWEEN MAJOR SETTLEMENTS

All mandal headquarters in VMR would be connected with improved road RoWs (30 M) with respect to main urban transport network. Modernization of ports and improving connectivity to ports is important to overall economic expansion and putting the region on global investment platform. To improve connectivity to ports is an on-going effort in VMR and will be further reinforced as part of the master plan. Existing and proposed locations for truck terminals and warehousing would be integrated through improved road network. In Visakhapatnam city and VMR as a whole where traffic conditions of roads are congested and deteriorating hence improved and hierarchical road network of RoWs of 80m, 75m, 60m, 45m, 30m, and 24 m would be proposed in existing and greenfield developments.

19 STRATEGIC INFRASTRUCTURE SYSTEM, 2051

Provision of state of the art physical infrastructure is important for achieving desired quality of life in VMR area. The aim is to develop new physical infrastructure for adequately meeting the demand for water supply, sewerage network, solid waste management and Power. In principle, it is aimed to provide independent infrastructure network within the VMR for new areas proposed for development as well as to fulfil the gaps of existing system in ULBs / rural habitations/ Industries. This will facilitate VMR authority to take up required infrastructure independently at his level. The demand assessment for all the major components has been worked out based on the best engineering practices. The major trunk infrastructure components considered for development of proposed VMR area are water supply, sewerage, solid waste management and Power.

19.1 WATER SUPPLY

Availability of sustainable source of water with related infrastructure facilities is prime necessity for any modern and sustainable development. But prior to exploring for a sustainable source it is utmost necessary that actual water demand is worked out precisely based on alternate standards, bench marks and acceptable norms. The piped water supply is required to be designed to provide adequately for:

1. Domestic needs: Including drinking, cooking, bathing, and washing, flushing of toilets, and individual gardening / air conditioning.
2. Demand for the employment in various work places: For Institutional needs.
3. Industrial use: For existing and proposed industries.
4. Horticulture needs: For public parks and urban greens.
5. Fire Fighting needs.
6. Unaccounted for Water: Including distribution losses, treatment losses and transmission losses.
7. Since the proposed source of water supply to VMR area shall be the canal system, transmission losses to the tune of 15 percent need to be considered while working out demand of raw water at source.

Adopted Norms and Standards

Domestic Water Demand (Urban):

The quantity of water required in the houses for drinking, cooking, bathing, washing etc. is termed as domestic water demand. The Environmental Hygiene Committee suggested certain optimum service levels for communities based on different population groups. The code of Basic Requirements of Water Supply, Drainage and Sanitation (BIS: 1172), as well as the National Building Code recommends a minimum of 135 lpcd service level for communities where the residents are provided with full flushing system for excreta disposal. The Manual of Water Supply and Treatment, issued by CPHEEO (Central Public Health and Environmental Engineering Organization), Ministry of Urban Development, Government of India as well as URDPFI Guide line –2014 have recommended the domestic water demand for urban population as given in Table 1-1 below.

Table 19-1: Norms for Domestic Water Supply (Urban Population)

S No	Classification of Town / cities	Recommended water supply levels (LPCD)
1	Towns provided with piped water supply but without sewerage system	70

2	Cities provided with piped water supply where sewerage system is existing /contemplated	135
3	Metropolitan and Magha cities provided with piped water supply where sewerage system is existing /contemplated	150

Source: CPHEEO Manual-1999

The URDPFI Guide Lines-2014, issued by Ministry of Urban Development, Government of India has given classification of Urban Settlements in Table- 1.2, where in the cities having population 10 lakh to 50 lakh are classified as Metropolitan city Class-I. Thus the demand for urban population in VMR region has been taken as 150 LPCD as per above table.

Domestic Water Demand (Rural):

The Ministry of Drinking Water and Sanitation, Government of India, under National Rural Drinking Water Program has issued Guide Lines (2013) for Drinking Water Security in Rural India. These Guide Lines have prescribed the Norms for providing potable drinking water in rural areas. The policy states to cover all rural house-holds with safe piped drinking water supply @ 70 liters per capita per day. Accordingly a service level of 70 LPCD has been adopted for all rural habitations of VMR.

Demand for floating Population& Employment:

The water requirement for the floating population (without stay) and employment in secondary and tertiary sector with in VMR has been taken as 45 LPCD as per CPHEEO norms.

Norms for Industrial Water Demand:

The Industrial Demand varies upon type of Industries likely to be established in the region, based upon the market assessment, raw material availability, logistics and other support facilities. The industries manufacturing leather & leather products, fine quality paper, beverages, steel, gas and steam generation, basic chemicals, textile dying industries etc. are termed as high water intensive units. While the industries involved in manufacture of cotton textile (spinning / weaving), silk and man-made fiber, jute and other vegetable fiber, printing and publishing, rubber and plastic products, non-metallic mineral products, basic metal and alloy industries, metal products and parts, electronics etc. are termed as low water intensive units. While the demand for high water intensive units goes as high as 60,000 to 1,00,000 liters per hectare, the demand for low water intensive units' ranges between 10,000 to 30,000 liters per hectare.

For assessment of water demand for industries in VMR area, the type of industries existing, proposed expansion of existing industries and the industries likely to come in the region has been assessed and demand worked out.

Horticulture Water Demand:

Provision has also been kept for horticulture water demand for green parks and urban greens proposed / existing in the region. As per Table- 8.3.1.5 of URDPFI guide lines a demand of 22,500 liters per hectare has been taken for all urban greens in the region.

Fire-Fighting Demand:

As per CPHEEO manual the fire-fighting demand is to be taken based on the formula:

Fire-fighting demand in kl/day = 100 x P^0.5
(Where P is the population in thousands)
Thus the same has been worked out as per above standards and added to total demand

Recycling and Reuse of Water

To reduce the fresh water demand recycling of domestic and industrial wastewater is considered. The sewage and sullage generation has been taken as 80% of the water supplied for domestic use, as suggested in the Manual of Sewerage and Sewage Treatment, issued by CPHEEO, Ministry of Housing and Development, Government of India. The waste water from industries is taken as 65% of the water supplied to industries. Provision has been kept for losses in STP and Tertiary Treatment Plants, while working out availability of water for recycling. The recycled water is proposed to be used primarily to meet the horticulture demand for urban greens, firefighting and balance water is to be supplied to industries for washing and for flushing purposes in proposed new residential/ commercial development.

Gross Water Demand& proposed source for additional demand:

Based upon the existing and proposed residential, commercial (employment), Industrial, horticulture and firefighting demand, the gross water demand for the VMR area has been estimated. For working out fresh water demand at consumer end, the quantity of recycled water from Tertiary Treatment Plants after subtracting the losses in the supply system has been deducted from the total demand. For estimating gross water demand 15 percent losses have been considered in distribution system (as mentioned in URDPFI guide lines) and 3 percent losses in treatment plants. In transmission system losses have been considered as 15%, with a view that source of water shall be long canal system.

Demand Forecast

Based upon above norms and standards, the water demand for total VMR area has been worked out and shown in Table 19-2. The present water supply from existing sources has been deducted and additional water demand has been shown in the table. Accordingly it is seen that:

- Fresh water demand considering recycling of waste water : 1,629 MLD
- Yearly demand considering recycling of Waste water : 21.0 TMC
- Allocation in Polavaram dam for Visakhapatnam area : 23.40 TMC
- Fresh water demand without considering recycling of waste water : 3,229 MLD
- Yearly demand without recycling : 41.7 TMC.

Table 19-2: Gross Water Demand for VMR area, 2051

Particulars of users		Rate of Supply in LPCD	Water Demand (MLD)
Particulars of users	Population / Area Ha		
Urban Population (Metro/Mega city area)	49,08,500	150	736.28
Urban Population (Below 10 Lakh population)	29,17,600	135	437.64
Rural Population	26,82,600	70	187.78
Employment	33,96,800	45	152.86
Floating Population (Stay a day or 2)	1,56,522	150	23.48
Floating Population (Leaving on the same day)	3,79,555	45	17.08
Industrial demand	19,178	60,000	1,150.68
Fire-fighting demand 1%			27.06
Urban Greens including Road Side Greens	11,058	22,500	248.81
		Total	**2,981.65**
Sewage/ Waste Water Generation			1,992.03
Recycled Water available to be used for Urban greens, fire-fighting, Industries & flushing (Excluding the sewage from rural area)			1,338.53
Net Fresh Water Demand at consumer end			1,643.12
Distribution & Treatment losses 18% (15+3)			295.76
Total Demand with recycling			**1,938.88**

Present Water Supply including bulk supply to industries	**554.00**
Additional Water Demand	**1,384.88**
Additional Water Demand at source including transmission losses 15%	**1629**
Demand if recycling is not considered including all losses	**3229**
Yearly Net Water Demand in TMC with recycling	**21.02 TMC**
Yearly Net Water Demand in TMC if recycling of water not considered	**41.66 TMC**
Allocation in Polavaram Dam for Visakhapatnam	**23.4 TMC**

Source: Consultant's analysis

Strategies for Sustainable Water Supply

Following strategies are essentially to be adopted for sustainable and resilient water supply system in VMRDA region:

- Since existing sources of water supply in the region are fully exhausted, a new reliable source of water supply shall essentially be required for proposed development in VMRDA region. The work of Polavaram dam and Polavaram canal is already in progress, and 23.4 TMC of water is allocated for water supply to Vishakhapatnam area. The demand of water for the region has been worked out as 21 TMC, thus the proposed source of water for the VMRDA for future needs is proposed as Polavaram dam.
- The proposed demand of 21 TMC is calculated after considering recycling of treated sewage and waste water. Thus, it is utmost necessary that hundred percent of treated sewage and waste water is recycled and reused for non-potable usage. If recycling is not considered, the demand goes as high as 41.7 TMC. It is not possible to meet such a huge demand from available/ proposed/ possible sources of water in the region.
- The proposed Polavaram canal meets the Yeleru canal near Singhavaram, thus water of Polavaram dam shall be available for VMRDA region through Yeleru canal itself. Thus, the capacity of existing Yeleru canal need to be enhanced to cater the proposed demand.
- Presently losses in this canal are very high, thus lining of canal has to be undertaken on priority basis. This will reduce the losses as well as enhance the capacity by improvement in run off coefficient.
- Presently the losses in distribution system are very high, while Singapore has brought it down to 3 percent. As per URDPFI guide line losses have to be limited to maximum 15 percent. Thus, to bring the losses to this level, it is proposed to:
    1. Replace old and worn out pipes and fittings.
    2. Avoid use of uPVC and A.C. Pressure pipes.
    3. Installation of Bulk meters in each production and distribution zone.
    4. Provide SCADA system for monitoring the operation and maintenance of complete water supply system.
- For sustainable water supply system, it is essential to collect the revenue for 100 percent water supplied to consumers. For this it is essential that smart consumer metering system is adopted.
- Preservation of reservoirs pertaining to water supply in the region is utmost necessary. Thus, it is suggested that no development should be permitted in the catchment area of these reservoirs. To enhance the capacity of these reservoirs de-silting must be taken up.

19.2 WASTE WATER

The Sewage Collection and recycling system is planned and designed to collect, treat, and recycle all the domestic sewerage and industrial effluent generated in VMR area (other than rural

area). For rural area community septic tanks have been considered, and treated effluent is proposed to be used for local irrigation.

The sewage and effluent generation has been assumed as prescribed in CPHEEO manual. While working out sizes of collection system and capacity of Sewage Treatment Plant, provision has been kept for 5% infiltration through sewer lines. However, while calculating the water available for recycling, the infiltration has not been considered, assuming that during summers and winters the infiltration shall almost be negligible. The Tertiary Treatment Plant (TTP) shall comprise pre-chlorination chamber, rapid gravity sand filters, post chlorination and activated carbon filter mechanism. The TTPs are designed to receive an inflow of 90% of Sewage/ Waste Water generated assuming 10% losses in treatment. The losses in TTP are taken as 5%. Accordingly, the sewage generated capacity of STPs and Tertiary Treatment Plants required has been worked out and shown in Table- 1-3 below:

Table19-3: Required capacity of STPs/ CETPs and TTPs

Particulars	Capacity in MLD
Sewage generated (Other than rural)	1,093.86
Total capacity of Sewage Treatment Plants required	1,148.56
Capacity of existing STPs (Including under construction)	225.50
Net capacity of STPs required after subtracting cap. of existing STPs	923.06
Say	**925.0**
Waste Water generated	747.94
Total capacity of Waste Water Treatment Plants (CETPs) required	822.74
Say	**825.0**
Total capacity of Tertiary Treatment Plants required	1,685.46
Say	**1,686.0**
Tertiary Treated Water available for recycling	**1,338.53**

Source: Consultant's analysis

Strategies for sewage collection treatment and reuse of Tertiary Treated Water:

- No land or off-shore disposal of treated sewage is proposed in the project. All treatment plants are envisaged to provide tertiary treatment to enable recycling of waste water.
- All Group housing schemes and all commercial/ educational establishments shall treat the grey water generated, within their campus and recycle it within campus itself for gardening and non-potable uses.
- All major industries shall have to follow zero discharge policy, and shall be bound to recycle the waste water within their campus after required treatment.
- The sewage generated from existing areas, black water from group housing schemes and sewage from individual houses shall be collected and treated through community sewage treatment plants and tertiary treatment plants. The treated effluent shall be supplied for horticulture use, road side gardening, industrial use and non-potable use in residential/ commercial areas, through dual piping system.

- The sewage generated from a group of nearby villages/ rural settlements shall be treated through community septic tanks and the effluent shall be utilized for local irrigation after proper disinfection.

19.3 SWM

To achieve nearly a zero waste target, utilization of waste is proposed as much as possible. It is recommended to use bio-degradable waste for power generation and to use the residual heat energy in steam from power plant and incineration plant, for heating and cooling in nearby industries.

The Solid waste generation for plan horizon year has been calculated as per Solid Waste Management Manual - 2000, published by the CPHEEO.Generation of solid waste has been classified under various uses like residential, industrial, commercial, institutional, construction demolishing and street sweeping. Total quality of Waste generated in plan horizon year is calculated as 7028 Metric Ton per day as shown in Table below.

Composition of Waste: As per MOUD-CPHEEO Manual-2000, the physical composition analysis of the mixed municipal solid waste in proposed planning area has been worked out on the basis of following categorization as per CPHEEO manual:

- *Recyclable Waste:* 15% of the total waste is considered as recyclable waste.
- *Bio Degradable Waste*: 50% of total MSW (as per manual, 40-60%) has been considered as Bio-degradable waste. This includes mainly Kitchen waste, Waste from Food processing industries, from Fruit / vegetable market, from Fish/ meat market, Garden waste and other possible organic waste.
- *Non-Biodegradable:* Rest of the waste (35% of total) is considered under Non-Biodegradable / hazardous / inert matter category. (Out of this 50% is taken as combustible waste (fit for Incineration) and rest 50% is proposed for landfill site.
- *Construction& Demolition Waste:*10% of the total Solid waste has been considered under C&D (Construction Demolition waste). Most of the item shall be recyclable in nature like metal, tiles, timber, broken glass, cardboard, plastic etc., while the rest would be having sand, masonry, broken concrete piece etc., which could be used for filling low lying area, roadside and other construction places and in landfill site.
- Based upon above guide lines and standards given in CPHEEO manual the total solid waste generation along with classification for different type of waste is being given in Table 19-4 below;

Table 19-4: Solid Waste Generated and its Physical Composition in VMR area

Particulars of users	Persons	SW Generation in Gram/ Day	Total SW Generated in MT / Day
Urban Population	5,931,000	450	2,668.95
Rural Population	1,399,000	250	349.75
Employment (Industrial)	12,76,100	800	1,020.9
Employment (Institutional & Commercial)	21,20,700	200	424.1
Street Sweeping (Employment + Population)	1,39,05,500	100	1,390.6

Total	5,854.3.0

Source: Consultant's analysis

As discussed earlier the physical composition of solid waste generated per day shall be as follows (as per SWM manual issued by CPHEEO):

- Bio-degradable waste : 3,514 MT
- Recyclable waste including C & D waste : 1,054 MT
- Non-Bio-degradable (Combustible) : 1,230 MT
- Non-Bio-degradable (For land fill site) : 1,230 MT

Proposed strategy for SWM:

- To achieve nearly a zero-waste target, utilization of waste is proposed as much as possible. It is recommended to use bio-degradable waste for power generation and to use the residual heat energy in steam from power plant and incineration plant, for heating and cooling in nearby industries.
- Solid waste management in general includes three steps.
    1. Segregation of waste at sourceitself up to household level.
    2. Primary collection (door to door collection) and Secondary collection system.
    3. Treatment of waste.
- The collection system shall have dual bin system. It is proposed to switch to 100% door-to-door collection at household/ institution/ commercial establishments level which shall be collected through dual bin tricycles/ mini trucks/auto rickshaws, and transported to community bins. The waste from community bins shall be loaded directly in to compactors and transported to designated treatment/ land fill sites.
- As per Solid waste management rule 2016, following colour code shall be applied for collection bin
    1. Green Bin: Bio degradable Waste (Household Waste, kitchen waste, garden waste)
    2. Black Bin: Other waste (Industrial, Other inert matter, Recyclable waste)
- It is proposed to use sensor-based community bins, where from the waste shall be further transported to waste processing depot/ center.
- The trippers/ compactors used for collection shall be GPS enabled vehicles. The wet waste shall be used for energy generation through Bio-methanation plants.

The process of solid waste management in VMRDA area is being depicted from the infographic in Figure 19-1below:

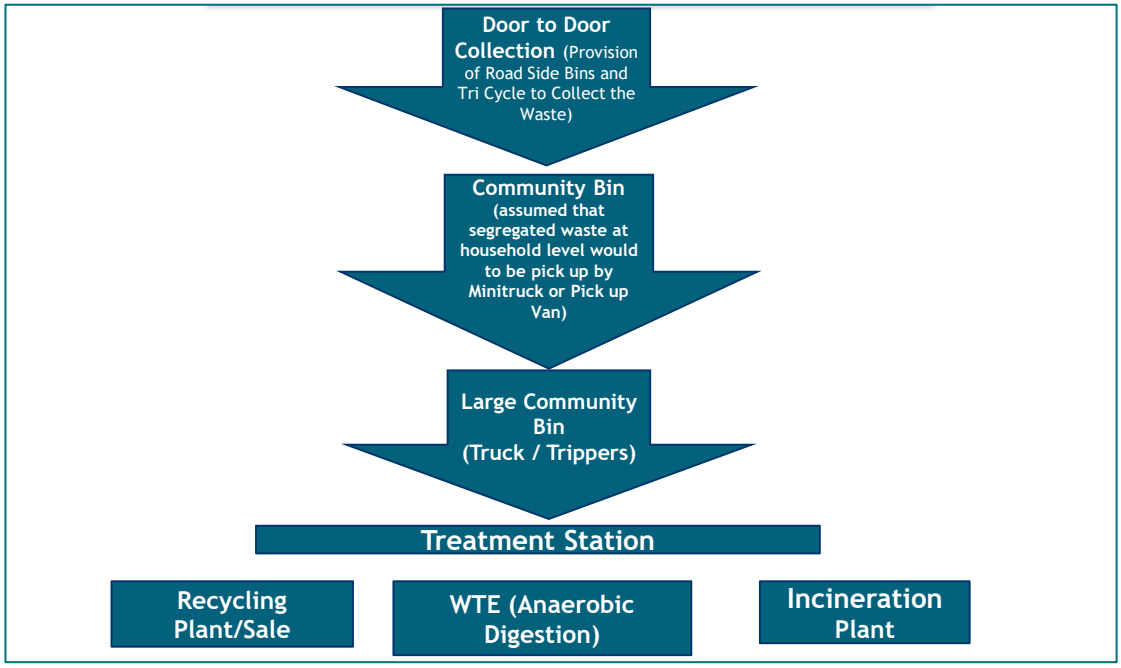


Figure 19-1: Proposed process for SWM in VMR area

19.3.1 WASTE TO ENERGY POTENTIAL IN VMR

As mentioned earlier the biodegradable waste shall be used to generate energy through Bio Methanation technique. Waste to Energy plants shall be installed at Solid Waste Treatment sites, which shall include the Waste to Energy Plants, Incineration Plants, and land fill site. Residual heat from the steam of energy plant can also be used for heating/ chilling plants in nearby industrial areas. The energy potential through Bio Methanation technique in VMR is being given in Table 19-5.

Table 19-5: Energy potential from Waste to Energy Plant in VMR

Particulars	Standards/Units	UNIT	Quantity
Total Organic / Volatile Solids in MSW	50%	MT	3,514.0
Organic Biodegradable fraction	66% of Volatile solids (VS)	MT	2,319.2
Typical Digestion Efficiency	60%	MT	1,391.5
Typical Biogas Yield Cum (B)	0.80 M^3 /kg of VS destroyed	Cum	11,13,229.7
Calorific Value	5000 KCAL/M3		
Energy recovery Potential KWh	B x 5000/860	Kwh	64,72,265.4
Power generation Potential KW	Kwh/24	KW	2,69,677.7
Typical Conversion efficiency	30%		
Net Power Generation Potential (KW)	KW*0.3	KW	80,903.3

Total Energy Generated per day kWh	Kwh	19,41,680

Source: As per MOUD manual SWM 2000 page 265, Consultant's analysis

19.4 POWER

Demand Forecast

Based upon above norms and standards, the power demand for total VMR area has been worked out and shown inTable 19-6. Accordingly it is seen that:

- Total Power Demand : 3,500 MVA

Table 19-6: Energy demand forecast for VMR, 2051

Land Utilisation	Present Utilisation-2018	Unit	Power Demand in KW per Ha	Total in MW	Proposed Area in Ha-2051	Unit	Power Demand in KW per Ha	Total in MW
Urban Area - Built-up	50,344.77	Ha	12.00	604.14	63,506.85	Ha	12.00	762.08
Rural Area - Built-up	29,529.46	Ha	8.00	40.00	51,165.88	Ha	8.00	409.33
Industrial Area	15,221.39	Ha	35.00	532.75	19,178.25	Ha	35.00	671.24
Commercial	1,181.84	Ha	30.00	35.46	6,719.25	Ha	30.00	201.58
Institutional	4,675.11	Ha	25.00	116.88	12,478.60	Ha	25.00	311.97
Residential	41,834.30	Ha	12.00	502.01	43,195.17	Ha	12.00	518.34
Recreational	623.63	Ha	12.00	7.48	17,278.07	Ha	12.00	207.34
Transportation	15,755.65	Ha	10.00	157.56	18,565.03	Ha	10.00	185.65
Bhogapuram Airport Area		Ha			1,425.00	Ha		25.00
Total Area in Ha	**1,59,166.15**				**2,33,512.10**			
Metro Corridors		Km			140.00	Km		50.00
			Total Demand-2018	**1,996.27**			**Total Demand-2051**	**3,342.52**
TOTAL DEMAND in MVA				**2,100 MVA**				**3,500 MVA**

Source: Consultant's analysis

Key issues and opportunities

Power Supply to this VMRDA is provided by AP Transco and APEPDCL. The Present Electrical Transmission network consists of 400KV/220KV/132KV Transmission lines as well as Sub-Stations managed by AP Transco. The Distribution network consisting of 33KV/11KV / LT overhead lines/underground cables by APEPDCL.

From the development point of view, new sub-stations are to be planned in proposed industrial and residential clusters. Necessary power corridors are to be catered in the developmental plans to avoid ROW issues in future.

Provision for alternate Non-Conventional/Renewable power sources like solar and wind energy plants to be provided and necessary place to be allocated for the same. Floating solar plants need to be considered on the existing Lakes/Tanks in the region .Roof top solar plants are to be planned on all the Government buildings like offices/schools/hospitals and other social welfare buildings available in the region.

Energy conservation opportunities in the proposed region:

- All the buildings in the region should be designed as per ECBC 2017 to optimise the use of electricity in the buildings.
- Solar pump sets: Wherever possible small size solar parks to be provided to Cater power to the agricultural pump sets in that region with on grid / off grid arrangements.

Major Power source for the newly developed areas:

There is no state owned Power plants in the proposed region except Simhadri Power run by NTPC. Now, the Central Government proposed 6600 MW Atomic Power Station at KOVVADA in Srikakulam district started construction work and will be ready by 2025.Out of 6600 MW power generated from the plant, 3300 MW power will be allocated to Andhra Pradesh and will provide the power at lowest cost and cater to all the needs of the North Coastal districts of Andhra Pradesh.

Underground Cabling System for Power Distribution:

With the success of Vizag City Underground Cabling system, all the proposed new areas for development shall be provided with underground cabling system which is safer and provide un-interrupted power during natural calamities.

Pollution Control Measured using Electrical Vehicles:

- With the availability of abundant Electrical Power, Eco friendly Electric Cars and E-Rickshaws shall be encouraged in the region. For this purpose, electric Charging stations shall be proposed along the Highways and other urban and sub-urban road side areas.
- As a green initiative, certain zones in the proposed layout.Only electrical/solar powered vehicles shall be allowed to control pollution.

Ground Mounted Solar Parks and Floating Solar Stations on Lakes/Tanks:

- With the availability of new breed of solar panels with 330wp to 400wp capacity. the area required for 1MWp solar plants greatly reduced to 1 to 1.25 Hectors .
- The available Roof top are of 386.98 Ha on public /semi-public building., if 20% 0f the area is catered for solar generation., a minimum 50MW power can be installed and solar power can be generated in the region.
- Similarly, with the available area of 1246.62 Ha Reservoir and Dam areas .if 30% Area is catered for solar floating plants, a 300MWp plants can be installed and can be added to the grid.

Measures to reduce Transmission and distribution losses:

At Present, the following are the T&D losses born by the Utilities.

Table 19-7: Transmission and Distribution Losses

Voltage Level	APSPDCL	APEPDCL
33kV	3.25%	2.78%

11kV	3.30%	3.15%
LT	4.28%	3.99%

The proposed New transmission lines and sub-station may be designed by adopting latest Indian standard codes for energy efficient transformers and transmission line conductors for reducing line losses and adopting SCADA based high accuracy energy measurement systems upto consumer level to reduce measurement losses and errors.

Strategy to reduce system demand:

Most popular method of reducing peak demand in power supply system is Demand side management (DSM). This technique effectively plans the utilization of power by proper strategies.

In addition to the above, the demand on the system can be reduced by the following measures:

1. Use of energy efficient equipment/gadgets in the household appliances like 5 star rated air conditioners and other high power appliances.
2. Use of LED lamps for all the public utility buildings, schools, offices, hospitals.
3. Use of smart Grid systems for proper prediction of demand and use of control measures.
4. Agricultural pump sets shall be fed through separate feeders and linking the same with solar power plants to reduce peak demand on conventional thermal stations.
5. Use of High efficiency chilled water systems for air conditioning of office buildings
6. Use of Solar hot water systems for Hotels and hospitals and other places where hot water is needed.

Renewable Energy potential in the Proposed VMRDA

As per the National Institute of Solar Energy (NISE), the scope for possible installation capacity of solar power in Andhra Pradesh is 38.44GWp.

In VMRDA area, the following areas are available for solar power Generation:

1. Reservoirs & Dams : 1246.62 Ha
2. Public & Semi-public Areas : 386.98 Ha
3. Land with /Without Scrub :12,335.07 Ha
4. Barren /Rockey Hill Areas : 30,043.61Ha
5. The total Area is coming to 44,012.28Ha.

If 20% of the Area is considered for Solar power Generation, the available area is 8,802,45 Ha. The area required for 1MWp is around 1.5 Ha and the potential for solar power generation is 5,868MWp i.e., 5.86GW. Considering the huge potential for Solar Power, a minimum of 2GWp(2,000MWp) provision must be made in the VMRDA .

20 WAY FORWARD

20.1 ACTION PLANS

Keeping in the backdrop of key strategy focus areas, it is envisaged to draw out certain key Action Plans which may be initiated by the respective Planning Authorities/ULBs and parasternal organizations.

Strategic Spatial Development

- Prepare Master Plan under the APMR&UDA Act within the framework of Perspective Plan
- Prepare Zonal Development Plans (ZDP) under the APMR&UDA Act within the framework of Master Plan
- Prepare Development Promotion Regulations within the framework of Perspective Plan or Master Plan or ZDP.
- Prepare and implementdevelopment schemes within the framework of Master Plan or other development plans.
- Prepare policy on Change of landuse (CLU)

Strategic Economic Development

- Improving land pooling schemes and clearances for better investment environment
- Prepare better sanctioning policies for ease of doing business
- Improvement of tourism infrastructure and heritage management to boost tourism economy
- Commissioning Heritage Conservation Committee(HCC) under the aegis of VMRDA & District Collectorate
- Augmentation of tourist facility Infrastructure at all important tourist attractions, duly addressing the boarding & lodging requirements, apart from allocating washroom facilities for all user groups.
- Drawing up overall plan to address wayside amenities and facilities all along the stretches of major corridors of the VMR Region.

Heritage and Tourism has a socio-economic correlation that needs attention

Managing Sustainable Environment and Climate Change

- Prepare development scheme policies to preserve agricultural and ecologically sensitive areas
- Demarcate CRZ categories within VMR boundary for ready reference in cases of approvals
- Provide buffers to waterbodies for protection.

Efficient Transportation System

Regional Railway:

- Prioritization of development of Decentralized Passenger Terminals with phasing.
- Planning & Development of dedicated freight line bye-passing Visakhapatnam Main Station.

Suburban Railway Network:

- Feasibility studies to propagate suburban Passenger services using the additional lines on existing corridors.

Metro Rail & Metro lite:

- Undertake feasibility & DPR studies for examining the suitability of specific mode choice to address commuter needs in the Region.

Regional Freight Railway Coridors

Suburban Rail

Metro

Highways and Major Arterials:

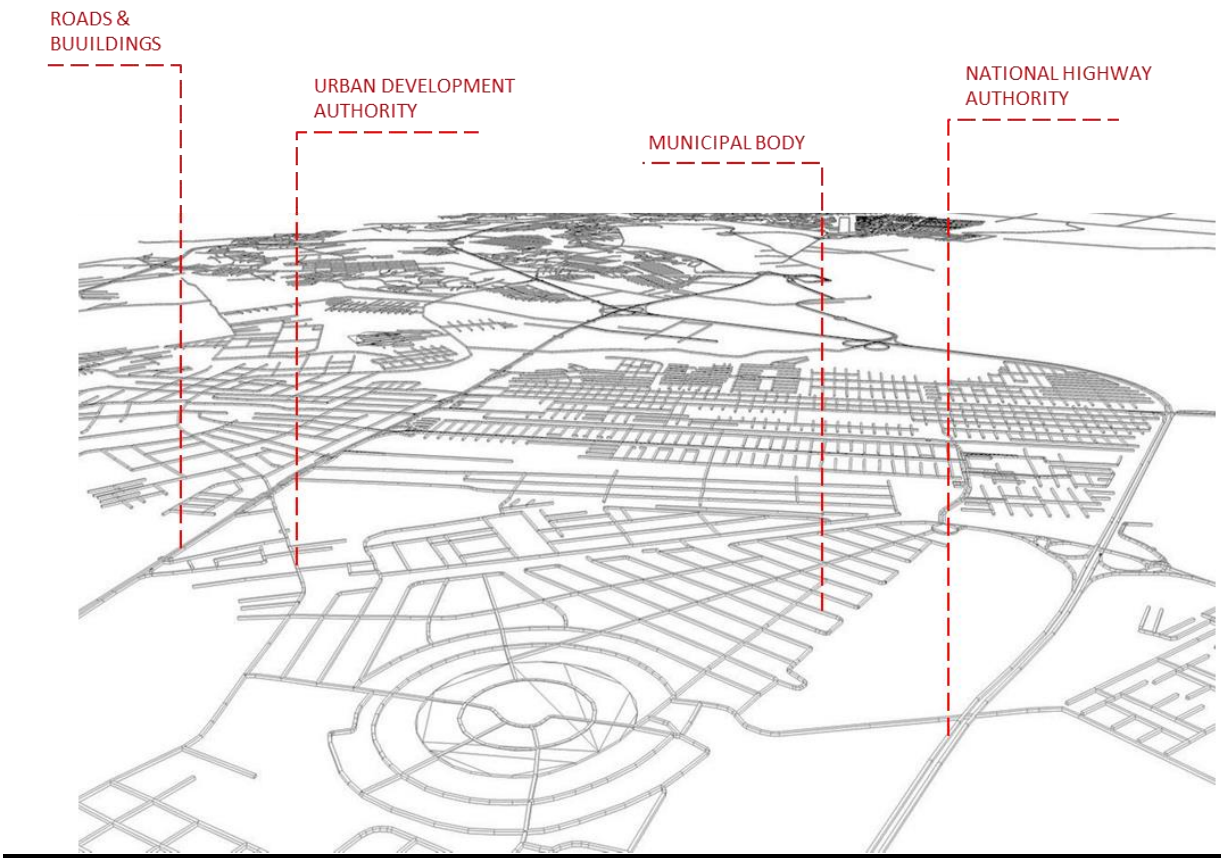
- Augmentation of regional and major arterial Network, duly taking up DPR studies for Ring Roads, wherever necessary.

Master Plan Roads:

- Master Plan Roads with implementation phasing

Port Roads:

- Integrate Port roads interfacing with city roads with appropriate RoWs.



Government institutions involved in developing roads

Coastal Stretch Roads:

- In order to attract major qualitative global investments, identify greenfield corridors alignments at least 800-1000 metres away from the HTL, at least in the stretches free from existing settlements, so as to meet CRZ stipulations.

VK-PCPIR:

- Integrate proposed landuse and major arterials, duly connecting to National & State highways in the region.

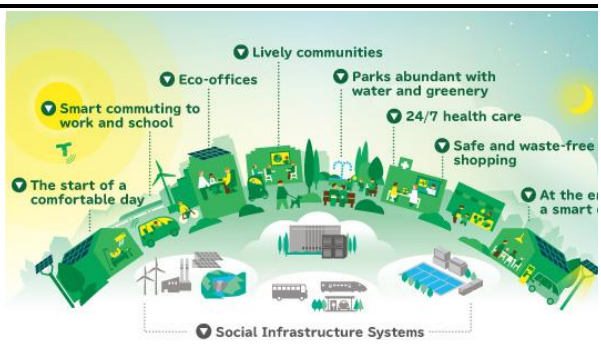
Right of Way for Roads:

- Draft out specific Right of Ways for both Urban and Rural roads, duly addressing the needs of all user groups.

Sustainable Infrastructure System

- Prepare Infrastructure Network Plan under the APMR&UDA Act within the framework of Master Plan

- Prepare Infrastructure Development Plan under the APMR&UDA Act within the framework of Perspective Plan or Master Plan or ZDP



Power

- Taking up feasibility studies for generation of Power through Non-conventional sources of energy, at least one in each Planning Zone.

Water Supply, Sewerage & Strom water Drainage:

- Prioritizing better operation of sewerage treatment and laying dual pipeline system to facilitate water recycling to reduce fresh water demand.

Leisure and Recreation:

- Planning & development of large size recreation parks in each planning zone to facilitate lung spaces.

Form Based Planning:

- For the Area around Bhogapuram international Airport and its influence Area to create a coherent built form for upcoming development considering economic and tourist potential of the area.

Hospitality & tourism:

Planning & development of tourism facilities for the potential tourism destinations in VMR Planning zones.

Sports & Physical Fitness:

- Planning & development of large scale Sports Centres, at least one each in VMR Planning zones.

20.2 WAY FORWARD

VMR Perspective Plan(2051) addresses broad framework of regional development, policies, duly identifying certain strategies for each sector. The Plan also focuses on broad Regional Structure and Economic Nodes.

After due consensus, the plan has guided and dovetail Preliminary Master Plan's Vision, locational Priorities of various Nodes, Spatial Spread, Development Promotion Regulations and land use allocations. The process would further consolidate while dovetailing the Draft Master Plan and Zonal Development Plans for the Region.