

# Physical Infrastructure Planning and Management for Sustainable Development in Ramtek Town

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**Abstract:** *Infrastructure is the basic physical and organizational structures needed for the operation of a society necessary for an economy to function and physical networks that support society. Socio-economic growth of a town is motivated by means of socio-economic and more so with the physical Infrastructure development in the town. It prerequisites the input in the form of working on land resource and physical infrastructure viz. roads, rail, water supply, drainage and solid waste management. Urban Local Agencies then become responsible for fulfilling the physical infrastructure requirements thus developing the area with every development stage. Many times Urban Local Bodies overlook the sustainability aspect while working on physical growth of a town as they do not contemplate of the quantity and the quality of the resources available. This bring in the issues of unsustainability of physical infrastructure affecting the overall sustainable development in town. Hence, Architect planners should consider the carrying capacity of the resources available in the vicinity of the town while planning the development so that local agencies can work for sustainable development.*

**Keywords:** Physical growth, Infrastructure Development, Resources Management, IDSMT, PURA, Sustainability

## 1. Introduction

Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. Planning is an attempt to formulate the principles that should guide us in creating a realized physical background for human life, *Thomas Sharp*. Infrastructure is the physical framework of services, facilities and amenities in the development planning. It can be divided into following types: i) Physical, ii) Social, iii) Economic, iv) Electronics, v) Ecological, vi) Defense, vii) Hazard/ emergency. It is one of the most important driving forces for economic development. A strong correlation between growth and infrastructure stocks is usually expected (World Bank, 1994; Canning, 1998; Fay and Yepes, 2003). Infrastructure Planning and Management can be termed as the optimization of the use of different resources in order to achieve the thoughtful planning in a way to have sustainable development.

Handling sustainability of Infrastructure in large urban areas is very complex issue as it has manifold activities and number of systems integrating for forming an urban agglomeration. Instead, the small and medium towns are as such having the population with in control limit. These towns usually have few growth poles around which the development of the town usually happens to continue.

During 6<sup>th</sup> Five Year plan of planning commission, Government of India has stated the aim for IDSMT i.e. Integrated Development of Small and Medium Towns. It had mentioned the need to divert the population from large urban agglomerations thereby allowing the facilities provision at small and medium towns. Former President of India, Late Dr. A. P. J. Abdul Kalam has also specified the need of PURA i.e. Planning of Urban amenities in Rural

Areas. Dr. A. P. J. Abdul Kalam had stated that facilitating required infrastructure in rural base areas will allow the growth of these regions thereby reducing out migration and further maintaining the infrastructure in large urban areas due to reduced or no in migration.

Considering the above, research was worked on physical infrastructure planning and management for sustainable development of the small town in the rural region having a large urban agglomeration very nearby to attract the migrants. Area selected for the research formulation is Ramtek. Ramtek is „c“ category town having historic and pilgrimage importance with the population around 22,310 (Census of India 2011) on Northeast of Nagpur city from Vidarbha region of Maharashtra, India. The geographical location of Ramtek shows coordinates of Ramtek as 21° 24" North Latitude and 79° 20" East Longitude with the altitude of 315.3 metres above Mean Sea Level.

Historic Development of Ramtek shows organic growth with the settlements from different religious and cultural background. It is an important site in the Vidarbha Region. The area is rich in natural resources with the presence of water bodies, forest, flora and fauna, black cotton soil etc. The occupation of the people in the historic period was mainly agriculture and allied activities with the use of appropriate materials for the household activities and for construction of buildings. Today Ramtek has undergone development in various stages as a religious centre, administrative centre, educational centre, industrial centre and commercial centre. To start with it observed the spread from hill i.e., *gad'* to foothills. Increase in the population has given Physical growth of Ramtek in different phases.



**Figure 1:** Development Plan 2013 of Ramtek marking its Spread

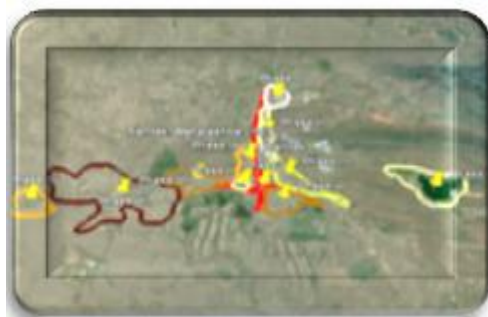
The town has seen two Development Plans till date, Development Plan 1971-91 and Development Plan 1993-2013. The Development Plan 2013 is continued further. The Development Plan 1(1991) had defined the boundary for the Urban Local Body. Development plan 2 (2013) has stated the fringe development for socioeconomic growth as it has already been using the urban infrastructure.

Looking in a spectrum the Ramtektown observes the organic growth.

Physical growth in Ramtek can be observed in phases as follows.

*Phase I:* Early settlement on north of the hill at Jain Temple. *Phase II:* Settlements at the western side foothills and near the water bodies (Lakes). *Phase III:* Extension of settlements along the south side of the foothill. *Phase IV:* British period settlements and government offices on the far west of the foothills and near Railway Station. *Phase V:* Bazar area, Extension of road from Bazar to Jain Mandir across Gandhi Square. *Phase VI:* Area near New Bus Stand thus extending from Gandhi Square to Bus Stand. *Phase VII:* Contemporary/ Modern Developments beyond Bus Stand i.e. beyond the boundary of original development plan. .

The growth pattern shows that the growth was made from foothills to uphill area and on the outside. With time the pattern of growth has changed due to growth centres.



**Figure 2:** Phase wise growth pattern of Ramtek shown on Google image

### 1.1 Objectives

With the aim to formulate planning and management strategies for sustainability of physical infrastructure

considering sustainable development of a town Ramtek the objectives are framed as below:

- To study the guidelines and regulations for infrastructure development and its sustainability for small and medium towns.
- To review and analyze the research and practices on sustainable infrastructure development.
- To identify the challenges related to physical infrastructure development & its sustainability in general and particularly in case town.
- To determine the parameters to develop the strategies for sustainable development of physical Infrastructure in small and medium towns.

### 1.2 Research questions

- 1) Is development happening in Ramtektown?
- 2) Whether Development of case town Ramtek is conducive to Sustainable Development?
- 3) Does Development of a town complement to Sustainability of Physical Infrastructure?
- 4) How the infrastructure can continue to be Sustainable?

### 1.3 Methodology

An empirical and field investigation method has been adapted to carry out analytical study for the case. The Questionnaire was formed and answered by different group of users including regular users of the physical infrastructure, Development Agencies' Officials, NGO's and non-officials. Using statistical analysis for the data based on opinions of the users the analysis is computed.

## 2. Literature Review

On the population growth and world's development at the international level United Nations give the need for a holistic approach to urban development and human settlements that provides for affordable housing and infrastructure. It observes the need to prioritize slum upgrading and urban regeneration.

The MDG's for sustainability of the world's nations asks for the sustainability of Infrastructure through goal numbers 6, 7, 9 and 11 which are devoted to ensure availability and sustainable management of water and sanitation for all, Ensure access to affordable, reliable, sustainable and modern energy for all, Make cities and human settlements inclusive, safe, resilient and sustainable. The World Bank reviews the growth towards sustainability on regular basis. The various issues are being discussed continuously through summits held at different places in the world to ensure the sustainable development throughout the nations.

TERI, under Ministry of New and Renewable Energy, Govt. of India, N. Delhi has given the guidelines for sustainability under heading GRIHA for Large Developments which can be considered for checking the sustainability of town. The sustainability through site planning, Energy, Water and waste water, solid Waste Management, Transport will help checking the social sustainable Development.

Literature reviewed to understand the trend in Physical Infrastructure Planning, Management for sustainability of town give observations as below:

- The development of town should be in line with the geography and the natural resources availability. Development of town should go with the resources cycle.
- There needs to have management and administration along with the planning for sustainable development of Physical and other Infrastructures in town,
- Conservatory design and layouts of Physical Infrastructures: Road, Water supply, Drainage, Sewerage and Solid Waste Disposal should be adopted.
- Support system/s for Physical Infrastructure Planning and Management should be developed by the town in the town.
- Large Urban center or an urban agglomeration should be within reach from the town sustainability of growth of town.

### 3. Physical Infrastructure Study

#### 3.1 Water Supply

Ramtek Town is provided with tax water supply. The source of water is from Ram sagar (Khindsilake) 6 km. away from Municipal limit. The water is taken to two reservoirs one at Ambala of 2,25,000litres capacity and other to the south of Ram Giri Hill and at the foot of Dumreshwar temple with 22,500 litres capacity. Filtration plant is provided for purification of water. This scheme is designed for population of 30,000 souls providing water supply consumption of litres per capita per day for the town and 22.5 litres per capita per day pilgrims. The water survey scheme is under control and management of Maharashtra Water Supply and Sewerage Board. However, it is to be handed over to local planning authority i.e. Municipal Council as per decision of State Government.

Water supply scheme is sustainable for Ramtek as it is designed for the population projection up to 30,000 souls. The source of water would be available in quantity sufficient for next 2 decades as per the today's growth rate. The water supply line network extension to cover the newly developed areas is under progress.

#### 3.2 Drainage and Sewerage

There is no underground drainage scheme in the town for systematic arrangements of drainage and sewerage disposal. The Municipal Council has constructed open drains by the sides of roads. However, along with some 7 main roads pucca covered drains are provided. The Houses in the town have latrines with septic tank. Municipal Council has constructed public latrines at different locations suitable to poor section of the society. Drains of Ramtek are naturally flown into the water tanks and others are flown to rivers Sur and Kapila through artificial drain nalas on the South West of Ramtek.

The individual house in Ramtek observes septic tanks for the Sewage collection and the evacuation of the tanks is carried by the Municipal Council representatives. There are public

latrines are provided at certain public locations but need more numbers along with the maintenances.

#### 3.3 Solid Waste Management

The urban solid Waste is collected through waste bins located at different places in the town. By means of tractor trolley it is being carried and dumped in the Municipal land earmarked for compost depot on Bye pass road near shantinath. Solid Waste Management is thought by the urban local body. The collection of solid waste is started towards sustainability. The recycling of waste generated is being worked towards power generation.

#### 3.4 Power Supply

Maharashtra State Electricity Board supplies electricity to Ramtek town. The substation of the Maharashtra State Electricity Board is situated outside Municipal limit on Mansar road, 7kms. Away from the town. The source of electricity is obtained from koradi Thermal Power Station.

#### 3.5 Road

Mansar –Tumsar along E-W road and Shantinath Temple road along N-S, are important routes of the town. The most of commercial activities are concentrated on these two roads. Similarly, other existing roads are narrow, zig-zag with topographically up and down. The bypass road provides decongestion of traffic shantinath Temple Road from western side joining Mansar-Tumsar Road on one end while Muswadi Road (Shantinath Temple Road) on other end, is under completion as per the Development Plan proposal as per the alignment proposed in the Draft regional plan of Nagpur. In all 47.48 % of villages in the Ramtek region are having connectivity to Ramtek by pucca road and 57.83 % of villages are having bus stop. Distance of villages vary between 1-15 kms. All of these villagers use the physical infrastructure in Ramtek town on regular basis.

Road width for main roads and internal roads is observed as inadequate. There are plan proposals in the regional plan for widening of the main roads.

### 4. Analysis

For the analysis Random sampling method is used. For data collection assessment and interpretation of perceptions of respondents, the researcher has distributed questionnaires among the 441 regular users and 98 Development representatives. The respondents include regular users of the physical infrastructure in Ramtek, Development Agencies' Officials, NGO's and non-officials. With these questions and their answers the significance of the hypothesis made before the research is tested. The statistical method has been used for the data calculations and analysis. The data analysis is done by computation. The analysis has proved helpful to assess the physical infrastructure sustainability in Town and its relevance.

The summary of responses of the regular users and the development representatives from the sample survey is given below in Table 1 and Table 2. There is a tendency to

show high value for the positive values as the graphs show high values towards left of central tendency. In the tables below the neutral (middle) opinion is rejected to avoid central tendency. The average of first two responses viz.,

strongly agree and agree are compared to last two responses (disagree and strongly resist) and are taken in percentage scale to observe the perceptions of regular users and development representatives respectively.

**Table 1:** The average of first two and last two responses of Regular users for development of physical infrastructure and overall sustainability of town

Particulars	Strongly agree	Agree	Total	%	Disagree	Strongly disagree	Total	%
Road	235	180	415	94.1	4	3	7	1.5
SW M	206	166	372	84.35	14	4	18	4.08
Water S	116	142	258	58.5	75	27	102	23.12
Drainage	230	145	375	85.03	13	11	24	5.44
Sewage	150	158	308	69.84	49	10	59	13.37
Average	187.4	158.2	345.6	73.36	31	11	42	9.502

**Table 2:** The average of first two and last two responses of development representatives for development of physical infrastructure and overall sustainability of town

Particular	Strongly agree	Agree	Total	%	Disagree	Strongly resist	Total	%
Road	43	28	71	72.44	12	1	13	13.26
SWM	42	26	68	69.38	11	03	14	14.28
Water S	27	32	59	60.20	17	10	27	27.55
Drainage	23	28	51	52.04	29	9	38	38.77
Sewage	20	29	49	50.0	27	11	38	38.77
Average	31	28.6	59.6	60.81	19.2	6.8	26.0	26.53

The data is analyzed through advanced Statistical method. Chi-Square Test of Independent issues to analyze the frequencies of two qualitative variables is used for comparing frequencies (count) of nominal or ordinal level data for two samples across two or more subgroups.

From the sample survey data and the opinions of the representatives the observations are formulated and using the chi square method the calculations are done to test the hypothesis. The analytical calculations show that majority of the regular users and development representatives agree of the development of physical infrastructure and sustainability of town, whereas few of the users and development representatives do not agree of the same, thus intuitively, from the bar diagrams and the tables, the null hypothesis is rejected and the alternative hypothesis is tested using Pearsons' contingency coefficient for association.

Hypothesis H<sub>1</sub> and H<sub>2</sub> is tested and concluded by finding coefficient of association (Strength). It gives Physical Infrastructure development for Sustainability of town as positive but the degree of association as less than 5 i.e. showing low performance. Pearson's Contingency Coefficient (C) for both regular users and for Development representatives is **low and moderate association** respectively. This gives the analysis that Physical Infrastructure development for Sustainability of town is positive but not perfect.

## 5. Conclusion and Suggestions

### 5.1 Conclusion

The Ramtek town shows Development trend. The Development is positive towards sustainable growth of the town. The physical infrastructure is available for the need of

the town. It observes development but not at par with the demand.

**Water supply:** Water is available in required quantity for the population. To maintain it the conservation measures must be adapted Separate pipelines for Water supply to urban and rural areas have been made.

**Solid Waste management:** The collection of the waste is well done by the trolley and it is disposed of in the outskirts of the town.

For **Sewerage collection** there is no layout provision made in this region hence every house has its own septic tank. The provision of layout for sewage may reduce the construction area for the separate Septic Tanks.

**Roads** are undergoing widening.

With the growth of settlements there is observed an encroachment on the natural settings.

**Cleanliness of environment:** To maintain the surrounding environment neat and clean the local agents are working out the ways as under:

- **Encroachment Removal:** To remove the encroachments if any along the streets which is creating obstruction for the public traffic. Under this the encroachments along the main cross road of Gandhi Square (main square near central Bazar) and the encroachments of the shop keepers and their residences on the „Ramgad“ which is a property of the private trust and the government are all removed during 2010-12.
- **Tree Plantation:** Under Environment protection mission the tree plantation was done by the local agencies. The targeted and completed are is 6 Sq. Kms. The total number of trees planted under this mission are 12,225 as

targeted in 2010-11, and around 20,000 in this season (rainy) 2016 .

- Under protection of natural forest and Wild animals the work was undertaken in Pench Reserved forest.

## 5.2 Suggestions

Local Agencies have been working actively for the Management of the infrastructure with multi fold activities but the problems are continued further. The suggestions to overcome the problems may be as follows:

- **Public Private Participation:** Actively involving the people who are any ways related to the particular infrastructure.
- **Conservation Management of resources:** Using the principles of sustainability of resources Reduce, Reuse and Recycle all the resources viz. land, water, forest and environment be used.
- **Infrastructure Development: Development of Infrastructure as per the need of the population.** Promote use of alternative resources for the infrastructure

## 6. Summary

Organic growth of the settlement results in inadequacy of infrastructure in the long run. This is faced by both inhabitant and development representatives affecting the sustainability of town. This inadequacy of the infrastructure can be judged and understood before actually facing it. IDSMT and PURA are the solutions to reduce the difficulty of managers as administrators who work for the whole life in solving the problems due to inadequate planning. IDSMT stands for „Integrated Development of Small and Medium Towns“ whereby the development is planned and promoted in an integrated manner for both small and medium towns in order to reduce the load on the infrastructure in urban agglomerations. PURA meaning „Planning of Urban amenities in the Rural Areas „also allows the development of the rural base areas with the distribution of infrastructure convenient with it. Ramtek though being a small town and a taluka centre is no more an exception for this but Sustainable Development can be achieved with the solicitous planning and stringent administration.

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