

**Geospatial Examination of Infrastructure Development in Maharashtra: A Comprehensive Analysis**

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**Introduction: -**

Infrastructure is the basic physical and organizational structures needs for the operation of society or enterprise, or the services and facilities necessary for an economy to function. The term typically refers to the technical structures that support a society, such as roads, water supply, sewers, power grids, telecommunications and so forth viewed functionally, infrastructure facilitate the production of goods and services; for example, roads enable the transport of raw materials to a factory, and also for the distribution of finished products to markets. In some contexts, the term may also include basic social services such as schools and hospitals. In military parlance, the term refers to the buildings and permanent installations are necessary for the support, redeployment and operation of military forces. Present study, infrastructure will be used in the sense of technical structures or physical networks that support society, unless specified otherwise.

Urban or municipal infrastructure refers to systems generally owned and operated by municipalities, such as streets, water distribution, sewers, etc.

**Objectives:-**

1. To understand levels of infrastructural development in Maharashtra.
2. To categories district wise spatial distribution of infrastructural facilities and amenities.
3. To analysis of the infrastructural development.

**Study Area:-**

The state of Maharashtra is the most industrialized, the second most urbanized and judged by the per capita income, the second richest state in India. It is spread over a total area wise; it is the third largest state in India after Madhya Pradesh and Rajasthan. Mumbai, the state capital, is considered the financial and commercial capital of the country.

The state is located between 15° 45' north to 22° 01' north latitudes and 72° 45' east to 80° 45' east longitudes and falls in the western part of India, the Arabian Sea. With and expansion of about 800 km from the east to west and 700 km from north to south, it has an area of 3, 07,713 sqkm which about 1/10(one tenth) of that of India. The state of Gujarat and the Union Territories of Daman, Dadra and Nagar Haveli are to the North-West; Madhya Pradesh is to the north ;Chhattisgarh to the East; Andhra Pradesh to the South-East and Karnataka and Goa lie to the South of Maharashtra. A 720 km long coastline stretches from Daman in the north to Goa in the south, which falls in resource development zone called the Western plateau and hill regions of

India. Physical division of the state comprise of three parts based on its physical features, viz. Maharashtra plateau, the Sahyadri Range and the Konkan Coastal strips as explained below.

**Maharashtra Plateau:** The major physical characteristics of the state include many small plateaus and river valleys. in the north plateau is flanked by Satpuda ranges, which run in the East-West direction in Maharashtra. The river Narmada flows along the north boundary of Maharashtra and other major rivers like Krishna, Godavari, Bhima, Penganga-Wardha and Tapi-Purna have covered the plateau in alternating broad river valleys and intervening highlands.

**The Sahyadri Range:** The Western Ghats of Maharashtra known as the 'Sahyadri' mountain ranges have an average elevation of 1000-1200 meters above the mean sea level. The Sahyadri hills run parallel to the seacoast, with many offshoots branching eastwards from the main ranges (Satmala, Ajanta, Hrishchandra, Balghat and Mahadeo). The special features are the hills of Trimbakeshwar, Matheran and the Mahabaleshwar plateau. Its high peak is Kalsubai at an altitude of 1650 meters. Most of the rivers in Maharashtra originate in the Sahyadri and then divide to join the eastward and westward flowing rivers. These ranges are also characterized by number of Ghats, the important ones being Thal, Bor, Kumbharli, Amba and Amboli.

**The Konkan Coastal Strips:** The narrow strips of coastal land between the Sahyadri and the Arabian Sea are called the Konkan coastal strip. It is barely 50 km in width; it is wider in the north and narrows down in the south. River creeks and branches of the Sahyadri, which reach right up to the coast, dissect this coastline. The important creeks in Konkan, Terekhol, Vijaydurg, Rajapur, Raigarh, Dabhol, Daramathar, Thane and Vasai. The rivers of Konkan rise from the cliffs of Sahyadri and have a short swift flow into the Arabian Sea. Some important rivers are Ulhas, Savitri, Vashishthi and Shastri.

Maharashtra has been divided into six divisions for administrative purposes viz. Amravati, Aurangabad, Konkan, Nagpur, Nashik and Pune. The state consists of 35 districts, 33 Zilla Parishads, 353 Tehsils, 27,946 Grampanchayats, 349 Panchayat Samitis, 222 Municipal Councils, 22 Municipal corporations, 3 Nagar Panchayats, 7 Cantonment Boards, 41,095 Inhabited Villages, and 535 Towns. Further, on socio-cultural basis, the state is divided into five regions, namely Greater Mumbai, Marathwada(Aurangabad division), Konkan, Vidarbha(Amravati and Nagpur division) and Western Maharashtra (Pune and Nashik division) (Census, 2011 GoM).

The area and climate of the districts of the state Ratnagiri records the highest average annual rainfall followed by the other districts in the Konkan region. Amravati, Akola and Nandurbar are regions with dry climate and have recorded lower average annual rainfall.

**Data Base And Methodology:-** Present study is totally based on secondary source of data, which is collected from Census of India, Statistical abstracts of Maharashtra and India, National Sample Survey Organization etc. Statistical methods and composite index has been used as a methodology.

The indicators of infrastructural development are transport (roads, railways), postal and telegraphic, drinking water, educational, godowns, public latrine and electricity (power supply). All these indicators are calculated for each amenity and facility, relates to composite score of the area and population covered.

Statistical methods have been used in working out a system of weightage, divided from observed data matrix, 'Z' square analysis on objective method for summering the information of a large number of indicators in a fewer number of score; has been used for this purpose. The data matrix in the duration form is obtained by subtracting columns mean (X) from observations in their corresponding columns. This method obviously, has a serious limitations as it begins by equalizing the variances, it seek, to explain. It has been observed that important infrastructure developmental indicators tend to be mutually correlated and show high degree of dispersion in their distribution.

#### **Indicators of Infrastructural Development:-**

1. Road
2. Railway
3. Electricity
4. Post Offices
5. Drinking Water
6. Latrine Facility
7. Godowns
8. Schools
9. Hospitals

The district wise spatial distribution of infrastructural facilities and amenities has been categorized at five levels viz., very high, high, medium, low and very low level on the basis of availability of infrastructural facilities and amenities in the state of Maharashtra. In following paragraphs, district-wise distribution has been discussed with a view to examine the concentration of infrastructure facilities and amenities.

#### **Infrastructure Development Indicators: District wise Dispersion of The State: -**

The overall distribution of infrastructural facilities is very unequal in the state of Maharashtra. It is found that, there were 3.36 crore census houses in the state, of which 2.98 crore were occupied. The proportion of vacant census houses was 11.30 per cent, of the total number of census houses 52.2 per cent were in the rural areas and 47.80 per cent were in the urban areas out of all occupied census houses 77.80 per cent were exclusively used for residential purpose, 1.80 per cent for both residential and non-residential purposes and the rest 20.40 per cent census houses were used only for non-residential purposes. (State Development Report 2001)

**Road network: -**

Road network is one of the major infrastructural features for the growth of any region. Roads not only enable the masses to use the public road transport at economical prices but also help in smoothening inter-regional disparities of prices across regions. Inadequacy of roads due to disproportionate growth between the number of vehicles and the growth of road length also has resulted in poor quality of roads in the state. The road length per 100 sq. km geographical area in the state was 87.40 kms. Out of 40412 inhabited villages in Maharashtra, 93 percent by fair weather roads. The remaining 2.23 per cent villages did not have any road connectivity whatsoever. (State development report Maharashtra) The highest proportion of road transport per 100 sq. km is having Sindhudurg, Bhandara and Sangli 2.35, 2.01 and 1.83 score respectively, while the lowest proportion was found in Mumbai, Gadchiroli, Buldhana and Yavatmal district.

**Rail connectivity:-**

Rail connectivity is one of the second major infrastructural features for the growth of any region. That is an important source of poor people for travels and main heavy large transportation. The highest proportion of rail transport per 100 sq. km is of Mumbai, Raigad, Nagpur and Jalgaon having the score of 49.57, 3.71, 2.70 and 2.01 respectively. Within these districts the lowest proportion was found in Gadchiroli, Kolhapur and Beed districts calculating the score as 0.00, 0.03, 0.03, 0.10 and 0.13 respectively.

**Electricity:-**

Electricity as the main source of lighting was reported by 83.90 per cent households in the state. Kerosene was the second main source of lighting, but proportion of households reporting use of Kerosene was found to only 14.50 per cent in the state. In urban areas 96.20 per cent and in rural areas 73.80 per cent households reported electricity as source of lighting. The lowest proportion of households reporting electricity as source of lighting individual score was found in Parabhani (0.11), Nanded (0.12), Beed (0.13), Osmanabad and Sindhudurg (0.16). The maximum quantity is found in Raigad (6.71), Mumbai (6.39), Thane (5.30) etc.

**Post offices:-**

Post offices are good and major infrastructural features for the connectivity of communication of any region. That is important source of communicate to each other in people. It is found that the highest proportion of post offices having Mumbai, Pune, Nagpur, Raigad, Kolhapur, Ratnagiri, Nashik and Thane districts, the score calculated of 23.77, 7.34, 3.60, 3.18, 2.57, 2.50, 2.22 and 2.02 respectively. While the lowest proportion was found in Jalna, Gadchiroli, Latur, Osmanabad, Parbhani, Beed, Wardha and Nanded districts the score calculated of 0.03, 0.04, 0.06, 0.07, 0.11, 0.11, 0.11, 0.13 and 0.13 respectively.

**Tap water:-** Tap water was the major source of drinking water having 67.90 per cent. The proportion of households using tap water as main source of drinking water in urban area was 89.10 per cent and in rural areas it was 50.20 per cent. Lowest proportion of households having tap water as main source was reported in Bhandara, Gadchiroli and Sindhudurg districts 0.11, 0.22 and 0.27 respectively. While the highest proportion was found in Mumbai (2.68), Jalgaon (2.24), Kolhapur (2.07), Thane (1.86), Pune (1.85) and Amravati (1.72) calculated score.

**Latrine facility:-**

About 46.90 per cent households in the state did not have latrine facility within their premise 62.00 per cent rural households and 28.70 per cent urban households. About 34.00 per cent households were resorted to the open detection and 12.90 per cent households reported use of public latrine. The peak proportion of households having latrine facility within the premises was found in Beed (2.18) and while the lowest ratio was found in Sindhudurg (0.23) score.

**Godowns:-**

Godowns are one of the major infrastructural features important of growth of trades and transport is also agricultural and other necessities of life storage. It is found that the highest proportion of godowns having Dhule, Akola, Solapur, Jalgaon, Satara and Ahmadabad districts score calculated of 2.92, 2.62, 2.52, 2.34, 2.34 and 2.25 respectively while the lowest proportion was found in Wardha, Sindhudurg, Mumbai, Kolhapur and Jalna districts the score calculated of 0.20, 0.23, 0.26, 0.32 and 0.36 respectively.

**Schools:-**

Schools are one of the major infrastructural features important in the growth of overall development in the region. It is found that the highest proportion of schools having Thane, Pune, Nashik and Ahmadnagar district the score calculated of 4.57, 3.88, 2.45 and 2.34 respectively. While the lowest proportion was found in Wardha, Osmanabad, Sindhudurg, Jalna and Gadchiroli districts the score calculated of 0.19, 0.26, 0.29, 0.37 and 0.38 respectively.

**Hospital:-**

Hospital is one the major infrastructural features in the life of human development in the region. On the basis of calculations and observations it is found that the highest proportion of hospitals are in Thane, Mumbai, Nagpur, Kolhapur, Satara, Pune and Jalgaon district, which calculates the score 13.66, 6.48, 5.72, 3.97, 3.1, 2.39 and 2.33 respectively, while the lowest proportion was found in Gadchiroli, Osmanabad, Wardha, Chandrapur, Beed and Nanded districts. The score calculated of 0.02, 0.03, 0.05, 0.07, 0.08 and 0.10 respectively.

**Composite Index:** - As mentioned earlier, the composite index for the infrastructural development indicators such as road, railway electricity, post offices, drinking water, godowns, schools and hospitals, taken as per the source of infrastructure statistics of Maharashtra 2009-10

The levels of infrastructural development have been calculated on the basis of composite score of infrastructural amenities of each district. The levels of development have been categorized in five category viz., very high, high, medium, low and very low. It is observed that category of high development is found in few districts of the state as given ahead.

#### Very High level: -

It is observed that only three districts viz., Mumbai, Thane and Pune districts come under this category. The composite score of infrastructural development is 91.07, 31.41 and 21.94 respectively, which are the total score of all indicators. It is noted that Mumbai district ranks first for all the amenities, followed by Thane and Pune, which shows the very high level development of infrastructural amenities and facilities in the districts.

**Table 1**  
**Infrastructure Development In Maharashtra 2011-12**

Rank	District	Road Transport Per 100 Sq.Km	District	Rail Transport Per 100 Sq.Km	District	Electricity Consumption of Per Capita Units/KWH	District	No. of Post Offices
1	Sindhudurg	2.35	Mumbai	49.57	Raigad	6.71	Mumbai	23.77
2	Bhandara	2.01	Raigad	3.71	Mumbai	6.39	Pune	7.34
3	Sangli	1.83	Nagpur	2.70	Thane	5.30	Nagpur	3.60
4	Aurangabad	1.56	Jalgaon	2.01	Satara	3.88	Raigad	3.18
5	Nanded	1.56	Thane	1.78	Wardha	2.70	Kolhapur	2.57
6	Kolhapur	1.53	Chandrapur	1.45	Pune	2.64	Ratnagiri	2.50
7	Satara	1.53	Akola	1.37	Nagpur	2.10	Nashik	2.22
8	Nashik	1.37	Bhandara	1.35	Kolhapur	2.00	Thane	2.02
9	Pune	1.34	Ratnagiri	0.96	Nashik	1.40	Sangli	1.83
10	Solapur	1.34	Solapur	0.80	Aurangabad	1.31	Satara	1.66
11	Ratnagiri	1.31	Latur	0.79	Chandrapur	1.22	Solapur	0.86
12	Beed	1.29	Wardha	0.79	Jalna	1.16	Ahemadnagar	0.74
13	Jalgaon	1.23	Nanded	0.76	Ratnagiri	0.75	Amravati	0.74
14	Nagpur	1.09	Sindhudurg	0.70	Ahemadnagar	0.74	Jalgaon	0.66
15	Dhule	1.06	Parbhani	0.67	Sangli	0.72	Akola	0.49
16	Latur	1.06	Pune	0.64	Solapur	0.61	Aurangabad	0.40
17	Osmanabad	0.98	Amravati	0.57	Jalgaon	0.60	Sindhudurg	0.37
18	Ahemadnagar	0.96	Sangli	0.56	Bhandara	0.40	Bhandara	0.27
19	Raigad	0.93	Nashik	0.47	Amravati	0.31	Chandrapur	0.22
20	Thane	0.93	Satara	0.27	Buldhan	0.26	Yavatma	0.20

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21	Parbhani	0.82	Ahemadnagar	0.26	Dhule	0.23	Buldhan	0.18
22	Chandrapur	0.72	Yavatmal	0.23	Latur	0.22	Dhule	0.18
23	Wardha	0.68	Jalna	0.21	Akola	0.22	Nanded	0.13
24	Jalna	0.62	Dhule	0.19	Gadchiroli	0.21	Wardha	0.13
25	Akola	0.54	Aurangabad	0.19	Yavatmal	0.18	Beed	0.11
26	Amravati	0.50	Buldhana	0.13	Sindhudurg	0.16	Parbhani	0.11
27	Yavatmal	0.48	Osmanabad	0.10	Osmanabad	0.16	Osmanabad	0.07
28	Buldhana	0.40	Beed	0.03	Beed	0.13	Latur	0.06
29	Gadchiroli	0.35	Kolhapur	0.03	Nanded	0.12	Gadchiroli	0.04
30	Mumbai	0.01	Gadchiroli	0.00	Parbhani	0.11	Jalna	0.03
SD		0.53		8.94		1.85		4.42
		147.72		0.28		293.22		10.03
CV		12.15		0.52		17.12		3.17
MH		1.08		2.44		1.43		1.89

Source: Infrastructure Statistics of Maharashtra 2009-10 &amp; 2010-11

## Infrastructure Development In Maharashtra 2011-12

Rank	District	Tap Water % of HH Having	District	Public latrine % of HH Having	District	No. of Godowns	District	No. of School
1	Mumbai	2.68	Beed	2.18	Dhule	2.92	Thane	4.57
2	Jalgaon	2.24	Gadchiroli	2.07	Akola	2.62	Pune	3.88
3	Kolhapur	2.07	Osmanabad	2.03	Solapur	2.52	Nashik	2.45
4	Thane	1.86	Dhule	1.91	Jalgaon	2.34	Ahemadnagar	2.34
5	Pune	1.85	Parbhani	1.87	Satara	2.34	Solapur	1.78
6	Amravati	1.72	Yavatmal	1.85	Ahemadnagar	2.25	Mumbai	1.32
7	Nagpur	1.66	Nanded	1.74	Ratnagiri	1.98	Dhule	1.29
8	Raigad	1.55	Buldhana	1.63	Pune	1.58	Satara	1.29
9	Satara	1.53	Jalgaon	1.62	Nanded	1.37	Raigad	1.28
10	Dhule	1.41	Jalna	1.57	Nagpur	1.23	Nagpur	1.12
11	Sangli	1.29	Latur	1.51	Buldhana	1.16	Kolhapur	1.05
12	Wardha	1.15	Akola	1.40	Beed	0.98	Ratnagiri	1.02
13	Nashik	1.14	Kolhapur	1.34	Raigad	0.98	Nanded	0.98
14	Aurangabad	1.11	Chandrapur	1.25	Yavatmal	0.98	Yavatmal	0.93
15	Ratnagiri	1.04	Ahemadnagar	1.13	Thane	0.86	Beed	0.89
16	Latur	0.97	Nashik	1.10	Amravati	0.81	Jalgaon	0.85
17	Solapur	0.92	Aurangabad	1.01	Osmanabad	0.81	Aurangabad	0.84
18	Osmanabad	0.91	Amravati	0.83	Chandrapur	0.76	Akola	0.78
19	Buldhana	0.83	Wardha	0.73	Parbhani	0.76	Parbhani	0.77
20	Ahemadnagar	0.72	Bhandara	0.73	Bhandara	0.70	Bhandara	0.75
21	Akola	0.71	Mumbai	0.60	Nashik	0.70	Amravati	0.68

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22	Nanded	0.63	Raigad	0.56	Sangli	0.56	Sangli	0.67
23	Yavatmal	0.55	Sangli	0.48	Aurangabad	0.52	Chandra pur	0.52
24	Beed	0.51	Thane	0.42	Gadchiroli	0.43	Latur	0.52
25	Jalna	0.49	Ratnagiri	0.36	Latur	0.43	Buldhan a	0.45
26	Chandrapur	0.47	Satara	0.32	Jalna	0.36	Gadchir oli	0.38
27	Parbhani	0.42	Pune	0.27	Kolhapur	0.32	Jalna	0.37
28	Sindhudurg	0.27	Solapur	0.25	Mumbai	0.26	Sindhud urg	0.29
29	Bhandara	0.22	Nagpur	0.23	Sindhudu rg	0.23	Osmana bad	0.26
30	Gadchiroli	0.11	Sindhudurg	0.23	Wardha	0.20	Wardha	0.19
SD		0.65		0.65		0.81		1.00
		91.82		78.48		41.41		3245.33
CV		9.58		8.86		6.43		56.97
MH		1.10		1.11		1.13		1.15

Source: Infrastructure Statistics of Maharashtra 2009-10 &amp; 2010-11

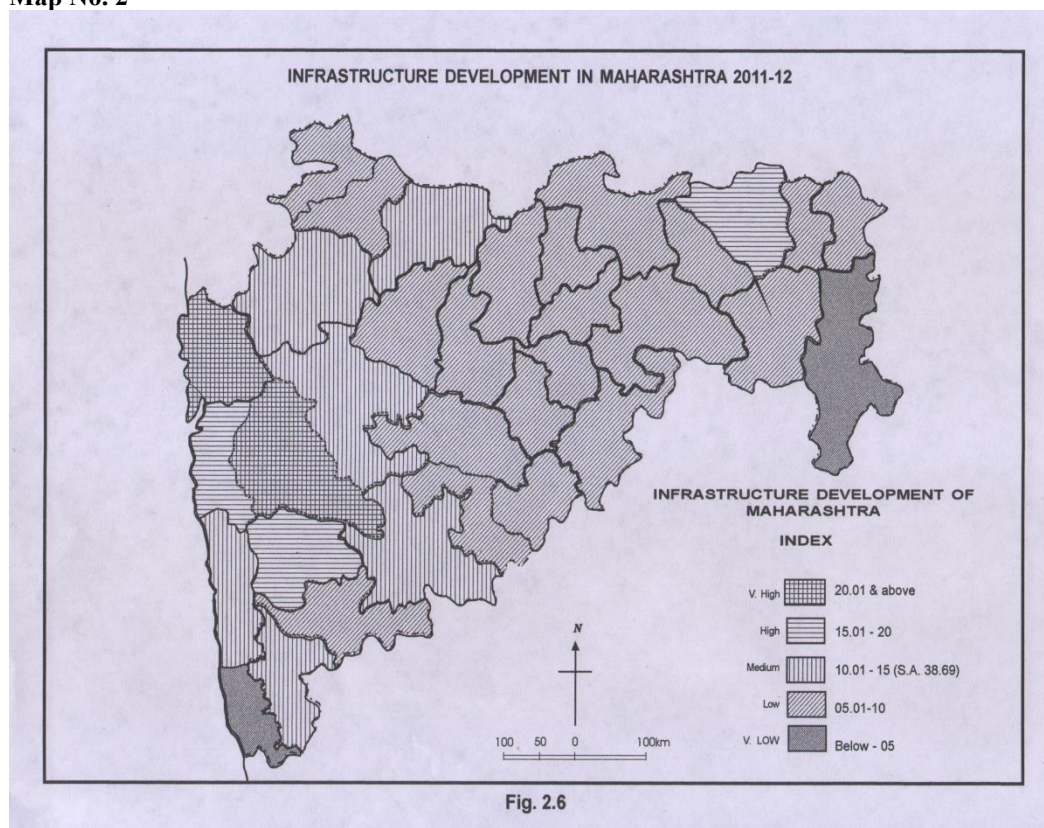
## Infrastructure Development In Maharashtra 2011-12

Rank	District	No. of Hospitals	District	Comp. Index
1	Thane	13.66	Mumbai	91.07
2	Mumbai	6.48	Thane	31.41
3	Nagpur	5.72	Pune	21.94
4	Kolhapur	3.97	Raigad	19.47
5	Satara	3.01	Nagpur	19.43
6	Pune	2.39	Satara	15.82
7	Jalgaon	2.33	Kolhapur	14.89
8	Solapur	1.16	Jalgaon	13.86
9	Jalna	1.11	Nashik	11.90
10	Nashik	1.04	Solapur	10.24
11	Ahemadnagar	1.02	Ratnagiri	10.23
12	Amravati	0.64	Ahemadnagar	10.14
13	Aurangabad	0.63	Dhule	9.69
14	Sangli	0.61	Akola	8.69
15	Akola	0.57	Sangli	8.56
16	Raigad	0.56	Aurangabad	7.57
17	Latur	0.55	Nanded	7.38
18	Yavatmal	0.52	Amravati	6.79
19	Dhule	0.50	Chandrapur	6.69
20	Buldhana	0.46	Bhandara	6.67
21	Sindhudurg	0.40	Wardha	6.62
22	Parbhani	0.35	Beed	6.20
23	Ratnagiri	0.30	Latur	6.12
24	Bhandara	0.24	Yavatmal	5.93
25	Nanded	0.10	Jalna	5.91



26	Beed	0.08	Parbhani	5.89
27	Chandrapur	0.07	Buldhana	5.51
28	Wardha	0.05	Osmanabad	5.36
29	Osmanabad	0.03	Sindhudurg	4.99
30	Gadchiroli	0.02	Gadchiroli	3.62
SD		2.80		15.99
		105.00		0.81
CV		10.25		0.90
Maharashtra		1.62		12.95
Source: Infrastructure Statistics of Maharashtra 2009-10 & 2010-11				

Map No. 2



### High level:-

The area under high level of development includes of districts, namely Raigarh (19.47), Nagpur (19.43) and Satara (15.82). The districts in this category do not form a belt. The map indicates all districts of high level infrastructural development influenced by proximity large urban centres of Raigarh, Satara and Nagpur.

### Medium level:-

For this level the composite score vanes from 10.01 to 15.00. Out of six districts are found in the medium level of infrastructural development in the state. It includes Kolhapur

(14.89), Jalgaon (13.86), Nashik (11.90), Solapur (10.24), Ratnagiri (10.23) and Ahemadnager (10.14) districts. These districts lie in the north and western part of state. The maximum score is observed in Kolhapur (14.89) district and minimum in Ahemadnager district (10.14).

**Low level:-**

It compares of a Dhule (9.69), Akola (8.69), Sangli(8.56), Aurangabad (7.57), Nanded (6.79), Chandrapur (6.69), Bhandara (6.67), Wardha (6.62), Bid (6.20), Latur (6.12), Yavatmal (5.93), Jalna (5.91), Parbhani (5.89), Buldana (5.51) and Osmanabad (5.36) indicates, that all the districts of low level category, are situated in the drought prone region of the state.

**Very Low Level:-**

There are only two districts in this category, which includes Sindhudurg and Gadchiroli. The minimum score of infrastructural development is found in Gadchiroli (3.62) and maximum is observed in the Sindhudurg district.

The above analysis brings out the fact that those districts, which are located very far from economical capital of state similarly, the remote areas of the region come under low levels category. The south-western parts of the state are having very low level of development, where the mountainous undulating tracts effect the infrastructural development of amenities.

On the other hand high level of infrastructural development is observed, in the north-east and northern part, similarly, western part, which are the locations of urban centers besides of river, national and state highways. The Krishna, Panchganga and his tributaries basin origin of fertile soils to grow food similarly, the developing process of various industries, facilitate provide drinking water amenities and the wide space needed for large settlements. Topography facilitates development of transport network.

**Conclusion:-**

The disparity in infrastructural development is observed in Maharashtra, which is indicating that, some parts of the state are having tremendous development due to developed infrastructural facilities, and some parts are lagging behind, having the reason of lacking all the infrastructural facilities and amenities. Physiographic structure and climate of Maharashtra state has also become dominant factor in determining these levels. It is observed that very high development is only in three districts of Maharashtra. Low level of

development is observed high in the state. So there is need of balanced development to mitigate this inequality.

#### **Suggestions:-**

Integration of some of the infrastructure schemes such as constructions of roads with the employment and income generation programmes may help in the alleviation of poverty. Medical facilities and provisions in rural and urban areas should also upgrade. The infrastructure facilities especially power, ports, tap water, public latrine, godowns, telecommunication, transportations, post offices, schools and hospitals should be improved. This would require enlarging the scope of the private sector, which may improve both availability of infrastructural and efficiency through competition. Stakeholders and political willingness to implement the reforms can enable the state to access more funds from the central schemes as has been the case with some other state governments.

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