



Research Paper

## A Study of Planning Aspects of Mysore city With respect to Green Concept

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**ABSTRACT:-** The Mysore city a two tier, second biggest city in Karnataka was ruled by Wodeyar dynasty. During this dynasty the Maharajas had constructed architectural significance heritage monuments hence Mysore city also as Heritage City tag. The Maharajas of Mysore had a great vision, eco friendly approach and efficiently planned infrastructure such as wide roads, drainage system, water supply etc., Thus Mysore city was also known as pensioner's paradise. But at present Mysore city is losing its vibrant charm and significance due to urbanization, over utilization of resources, haphazard growth and unhealthy atmosphere. Therefore, Important planning aspects in Mysore city such as Land use, Transportation, Water supply, Solid waste Management etc., has been analyzed and green recommendation as been put forwarded to make Mysore has a green city.

**Keywords:** Central Business District; JnNURM; Municipal Solid Waste Management; Urban Local Bodies; Zero waste management.

### I. INTRODUCTION

The city of Mysore is considered the cultural capital of Karnataka. Since 14<sup>th</sup> century with the establishment of Wodeyar dynasty by Yaduraya, the city of Mysore is developing as a centre of arts, culture and tourists. The rulers of Mysore State have given more attention for the socio-cultural infrastructure because of pleasant climate and accessibility throughout the year.

### II. STUDY AREA

To study the planning aspects with respect to green concept Mysore city is considered as the study area. In Mysore city Central Business District, Ramakrishna Nagar one of the biggest residential layout and Bannimantap industrial layout i.e., different land uses as been analysed. The scope of the study is restricted to the above areas. The main aim is to bridge the gap between the past and present missing links so that the city will be sustainable.

### III. METHODOLOGY

In order to collect the data of various planning aspects field study has been conducted by observation. Along with field study random survey was also carried out in order to know the history and growth of Mysore city. The following aspects are considered to analyze the problems and recommendations are given with respect to green concept.

### IV. RESULTS AND FINDINGS

#### 4.1. Land Use

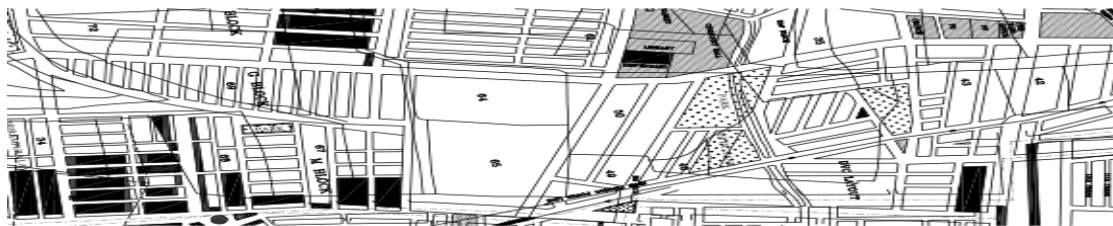
Observations

- In 1865 the city existed within the fort area. By 1902 the development of residential areas around the fort can be traced. The main heritage structures present in the city today dates back to 1930. By 1995 the major changes took place to present form of city. In 2009 the cities growth was towards North West with the establishment of industrial areas.
- The central business district (CBD) covers a total area of 300.15 hectares. The three major land uses are Public and semi public (Palace, K.R.Hospital, Market, Cinema theatres etc.), Traffic and Transportation (roads, intra city bus stand, mofussil bus stand, private bus stand) and residential, followed by commercial uses. The green space represented by parks is mainly surrounding the palace, freedom fighters park,

J.K.Grounds, etc. However, the main land use in terms of economic activity continues to be commercial and it is spatially concentrated on either side of the arterial roads such as Sayyajji Rao Road and Ashoka Road [1].

- The visual observation conducted in the study area reveals that 40% of the buildings are in good condition, 50% in moderate state and 10% in dilapidated state such as Devaraja Market, Lands Downe Building, Clock tower, etc.,
- The buildings in core area are G+1 stories, absence of setbacks with building defining street edge hence the ground coverage is 100%. But as per byelaws maximum coverage in core area for commercial use is 80%.
- The land values are high in the core area, thus to cater to the demand the buildings are constructing abutting to each other leading to lack of light and ventilation and violating the norms.

**Fig 1: Ramakrishna Nagar Map**



- Predominantly residential land use in Ramakrishna Nagar as shown in Fig 1.
- Along with residential land use ancillary facilities such as parks, police station, schools, temple, church, bank, clinics, community halls, unauthorized shops are functioning.
- As there was no sufficient designated commercial area earmarked in this layout, the main street in Ramakrishna Nagar called as Dakshineswar Road front portion of the sites facing towards this road is converted from residential into commercial to provide basic amenities such as vegetables, provision shops, chats centre, bakery, cloth show rooms, salons etc.
- The road is wide compared to the other roads in this locality and also easily accessible.
- It is observed that there are a few unauthorized slums like developments in Bannimantap industrial area.

#### **Analysis**

- As new developments are planned in piecemeal. The area required for most crucial activities such as pedestrian path, cycle track, area for collection of garbage, energy conservation, water conservation, also environmental aspects like natural topography, slope and valleys are not considered.
- For basic amenities (neighbourhood shops) commercial areas also should be earmarked in the residential layout plan so that the development will not grow in a haphazard manner and also revenue can be generated.
- Along with industrial activities other ancillary activities such as canteens, shops area is not earmarked. Hence on the footpath unauthorized petty shops, canteens have come up eating away the pedestrian path and creating unhygienic condition
- At the time of planning itself basic infrastructures should be taken care so there are no problems and developed quiet efficiently.

#### **Proposals**

- As Mysore city is considered to be heritage city, existing Urban fabric should be retained by upgrading the systems such as street lights by using solar energy/energy efficient luminaries, street furniture, etc.,
- As core area is thickly populated, requires thinking about creating the soft and hard infrastructure that can support such concentration for instance public spaces become very important in order to provide space to people to interact and /or get relief from the strains of dense living. An important aspect that would be considered while preparing the plan would be to maintain landscape of the city.
- As the city bus stand is not working efficiently and causing traffic jams, air and noise pollutions should be shifted. The activities which gets and is required like information centre, traditional small scale handicrafts, handloom shops, parking for vehicles, canteen, and toilets (recycled water for flushing) drinking water facilities may be accommodated in city bus stand so that tourists can be attracted and economic sustainability can be achieved.
- The selling of wholesale products may be shifted from Srirampet and Manars market to Bandipalya on Nanjungud Road so that heavy motor vehicles can be restricted to outskirts of Mysore city. Instead of wholesale products retail shops can be encouraged with full fledged facilities.

- The Indian Heritage City Network has worked out a proposal for redevelopment of Devaraja market and Lansdowne considering the heritage aspects and has submitted the same to the Mysore City Corporation (M.C.C), it should be implemented.
- The informal sector such as hawkers, vendors found in core area is proposed to reallocate them towards eastern side of Town hall and northern side of K.R. Hospital (Irwin Road).
- During the development of new layouts infrastructure such as solid waste management, sewerage treatment plant, water distribution over head tank, commercial, educational, recreational, Multi level parking facilities should be earmarked based on wind direction, sun orientation, natural slope etc.
- Also while planning existing physical features (such as trees, valleys, slopes) and all the basic amenities in terms of social, environmental, economical factors should be considered to make the city green. The activities should be decentralized so that it is easily accessible by all the public. Judicious use of resources should be encouraged.
- Along with main land use activity ancillary activities to support the main activities should be earmarked in the planning stage so that it is easily accessible and convenient for the public.
- Some of the industries produce noise and air pollutions, such industries should mandatorily have buffer zone to reduce pollution.
- If change of land use is permitted from industrial to residential such changes should be only for high rise developments.

#### **4.2 Housing**

##### Observations

- Mysore has always been considered as pensioner's paradise due to its laid back life. It provides a restful environment to all residing population. But now the scenario is changed.
- In core area along with commercial and institutional buildings there are residential buildings of compact planning with one or two stories. Maharajas had planned Agraharas/Mohall's type of housing.
- In residential layout along with 20'x30' there are 30'x40' and 40'x60' dimension sites and less number of (Upcoming) high raised buildings.
- Majority of the buildings are of G + 1 story.
- There are non-notified slums which are existing in vacant lands in Bannimantap Industrial Layout.
- The total population living in slums is 261. Average households size of these slums is 5.5. Absence of basic infrastructure such as ventilation, light etc. For water they depend on public taps, bathing in temporary area made up of coconut leaves thus waste water runs in front of their houses giving room to unhygienic condition and for toilets open defecation system is in practice.
- Also in the outskirts of Bannimantap industrial area there is slum rehabilitation Jawaharlal Nehru National Urban Renewal Mission- (JnNURM) scheme, high density –Apartment (G+2) residential flats as been constructed from MCC. Some of the beneficiaries in this apartment have given their flats for rent and are staying in slums.

##### Analysis

- The household were of joint family system initially but over a period of time with sub division of property, nuclear family system is in practice. Hence this has led to acute shortage of, infrastructures, scarcity of water, air, etc.
- In 20'x30' plots setbacks as been encroached.
- As there is availability of vacant land with less density of population and is accessible for their work place non notified slums in Bannimantap Industrial layout is existing.

##### Proposals

- Adopt Weather factors, including wind, sun, water flow, topography features while planning. Buildings arranged in clusters provide shade for the streets and interiors of the building.
- The existing buildings in good condition should be conserved.
- The creation and development of community facilities, including work and leisure facilities, as well as good public transport Infrastructure, can be used effectively.
- The dweller can have the trees and birds brought into the centre of housing and working areas. Through a change in the scale on which it is based, so that city can encourage an intimacy that has been in a society based on fossil energy use.
- To maintain building line, sight of vision, harmony, strict implementation of byelaws should be implemented.
- Slums should be evicted and by identifying the right beneficiaries, they may be accommodated in slum rehabilitation JnNURM project located in that area. Also the flats which are rented should be vacated. The

present slum area may be converted into good lungs space which is very much essential for the residents and workers of the industries to relax in their leisure time.

- Buffer zone should be provided wherever there is noise and air pollution.
- Industries should mandatorily undergo emission test to check the air, noise, pollution levels.

#### 4.3 Transportation

##### Observations

- The city bus route network consists of 195 routes with average route length of 14.5kms. The bus route network of the city is based on 'Hub and Spoke' pattern with routes starting from various parts of the city operating on radials which are fanning out from the city centre and terminating at the city bus terminal so all the passengers who are destined for places other than CBD have to come to CBD to take a change over as all the routes terminate at the city centre. This creates acute congestion at the city centre [2].
- Pedestrian traffic is highest along Sayyajji Rao Road followed by DevarajUrs Road. It is also observed that the pedestrian traffic is at its peak during holidays/weekends at Sayyajji Rao Road, Devaraj Urs road and Palace road. The volume of pedestrian traffic is highest between 10am and 11am in the morning and between 6 pm and 7 pm in the evening.
- The rise in car ownership and the encouragement of low density settlements has ensured that households have increasingly become dependent upon the car to negotiate sprawling urban landscape. The demand for space for the car only reduced the room in which it could maneuver. The consequence is that city designed to a human scale, are now choked with traffic.

**Fig 2: Photographs showing the roads of core area**



- The main roads in core area are Sayyajji Rao Road, Devaraja Urs Road, Albert Victor, Fig 2, K.T Street, Ashoka Road, etc.,. In all these roads vehicles are parked on the street (On-street Parking) reducing the carriage way. The road width varies from 15 to 18 mts. Internal roads are of 6 mts. to 12 mts. There is a specific activity pronounced in each area/street. The internal roads are highly congested.
- Devaraja Urs Road and Sayyajji Rao Road are considered to be the major shopping hubs in Mysore city. The Kalama Temple Street, popularly known as K.T.Street located in the heart of the city, is a synonymous with electronics, because of the numerous shops all along the length of the street dealing from a small switch screw to the latest electronic gadgets. The street is extremely narrow and congested but it is totally another kind of shopping experience for people. Earlier, the area was famous for Devanga community and also goldsmiths, who belong to Vishwakarma community. It is said that along with Kalama temple, there is also a Chowdeshwari temple, which is popular among Devanga community. The street which starts from Dashprakash Hotel circle near Prabha Theatre joins Pulakeshi Road in Mandi Mohalla. It is around 1.4kms, it lacks basic amenities. This being a narrow road, there is no sufficient parking facilities that are being made for the commuters Fig 3.

**Fig 3: K.T. Street Map**



- Roads are encroached by shop owner's vehicles due to inefficient parking lots thus creating traffic congestion
- Hawkers in large number in CBD have scattered all round in prime locations of the city encroaching footpaths. Hawkers are mainly selling perishable goods such as fruits, vegetables, flowers, small household items, clothes etc.
- Important circles in core area are K.R.Circle, Chamarajendra Circle, Harding Circle, etc.
- The basement floor which are meant exclusively for parking in some buildings are used for commercial purpose to earn profit thus adding more traffic congestion.
- In residential layouts the roads are of 9mt, 12mt and 15mts wide asphalted with 'L' type open storm water drain on either side of the road.

#### Analysis

- The main problem in the core area is traffic congestion due to movements of buses in turn creating pollutions, disturbances to the other activities and incompatible use.
- As the core area as mixed land use activities, too much crowd along with traffic making chose.
- One of the effective ways to reduce transport exclusion is through investments in people physical mobility. However, the increasing trend in car ownership and its link to oil dependence have had negative impacts on the environment. Transport contributes to global warming and environmental degradation. The consumption of fossil fuels, such as petrol, diesel and natural gas, by motor vehicles and the resultant emissions are considered a main cause of climate change.
- Due to movement of heavy motor vehicles, roads are in bad condition. The industrial area as scope for road widening and storm water drain, as there is good setback area in front of the Bannimantap industrial plots.
- The petty shops are creating lots of problems by encroaching footpath in Bannimantap industrial area.

#### Proposals

- Pedestrian path plays a vital role in CBD due to the presence of mixed land uses. As most of the activities buying fruits, vegetables, and safety pins is very easy to accessible when we are in foot. Apart from encouraging people to walk will bring down dependency on vehicles, interactions and liveliness. Hence core area should be pedestrianised to address the changing need for clean and favourable environment.
- Along with walking in the core area Mysore traditional transport Tonga can be implemented for physically challenged, old age people.
- Provide pedestrians crossing facilities, proper pedestrian's surface and pay and use umbrellas.
- Native plants to absorb and filter water may be planted thus impervious surfaces can be reduced. Provide ample shaded public space. A vegetal cover of the ground keeps it comparatively cool and contributes to a cooler outdoor micro-climate.
- Sayyajji Rao Road, Devaraja Urs Road, Albert Victor Road, Manaras Market Road, Srirampet Road, Lands Downe Building surroundings, vehicles traffic should be banned only for loading and unloading of goods between 9 pm to 7 am vehicles may be allowed. Also through these main roads procession, walkathon, marathon passes so that there is wide space to accommodate.
- Mono rail corridor mass rapid system is proposed for transportation. It is necessary to properly integrate this corridor with bus transportation system. Adequate lands to facilitate location of rail station and bus transportation local terminals are suggested at important junctions.
- The K.R. Circle area which is the heart of the CBD has acute parking problems. There is scope for exploiting CBS for providing public parking. Parking at town hall which provides for basement parking facility under JnNURM scheme is in progress.
- Parking is proposed in Wellington lodge vacant land situated in Irwin road in consideration of heritage aspect as Wellington lodge is notified monument and necessary concurrence from the concerned department be obtained.
- Nanjaraja Bahaddur Choultry located at the junction of Vinoba Road and Dewans Road has adequate vacant land. This can be used for multi level car parking (MLCP).
- A MLCP is proposed in Bangalore Mysore Road Doddakeremaidan, in the vacant land between JLB Road and the railway property near the Railway Station.
- In K.R.Hospital premises off street parking facilities may be provided and also in J.K.Grounds.
- The Gun house complex could be used for parking of vehicles.
- Provide multi level car parking in corporation vacant land, will certainly reduce parking problem to greater extent, e.g., next to Shantala theatre. So, that the nearby residents can park their cars on paying monthly

basis instead on roads. Also office, shop owners situated in Chamaraja Double road and visitors who come to Raghavendraswamy Temple located near to this place also can park their vehicles. Installation of automated parking meters to save time, space, ensure safety, fairness viability in parking fees may be implemented.

- In Narayana Shastry Road the stretch from Sadvidhya circle to junior Maharani's college circle may be pedestrianised to avoid accidents from 9 am in the morning to evening 6 pm.
- Introduce Liquefied Natural Gas (LNG) driven buses in cities and reduce emission of pollutants from diesel driven vehicles.
- Encourage eco-friendly bio-fuel school buses/cycles. Ban usage of scooter for student's up to 18 years. In a week one day all government officials should compulsorily use cycles. Similarly one day all educational institutions should be encouraged to use cycles likewise each day may be dedicated to different organizations.
- Those who violate the rules punishment as to be imposed by marking absent etc. In case those who do not use cycles may choose walking, non- motorized transport, Mass rapid transit to avoid traffic congestion, air and noise pollution.
- Urban flooding near Arch Gate junction, Albert Victor Road, Ashoka Road and B.N. Road should be rectified by giving proper drainage. Main critical junction is Gun House circles which as to be overcome.
- Gandhi Square and Hardinge Circles are inefficient thus proper rotaries with medians should be designed. Also the roads which are under road widening proposals as per MCC building byelaws -1994 should be implemented to accommodate the traffic of peak hour.
- With the supply of higher grade fuel and new combustion the pollution may be brought down. Public transport of the most energy efficient kind such as biofuel/renewable fuel transport, transit rapid, metro will need to provide the backbone of the system.
- Keep travel issues to a minimum, and can lead to a long-term reduction in pollution and reduced private car can be considered to make a comprehensive planning.
- The transport system serving future urban systems would not only have to serve economic development, but also protect the environment and sustain future quality of life. Such a transport system would probably give priority to public transport, cycling and walking, with reduced dependency on the private car.
- By regular maintenance of roads smooth movement of vehicles is possible.
- Roads as to be widened to 15 mts. to 18 mts. (internal and main road) so that good carriageway, footpath with plantation of trees for shade, screening, direction and framing views and storm water drain also must be provided.
- In storm water drainage at regular intervals recharge pit may be provided so that water table can be increased.
- All the road side petty shops should be evicted and designated area should be earmarked for refreshments, shopping etc.
- Footpaths are encroached by ramps, steps by the residents in front of their houses. Footpath should be made free along with tree plantation for shade, visual relief, so that people are encouraged to walk.

#### 4.4 Water Management

##### Observations

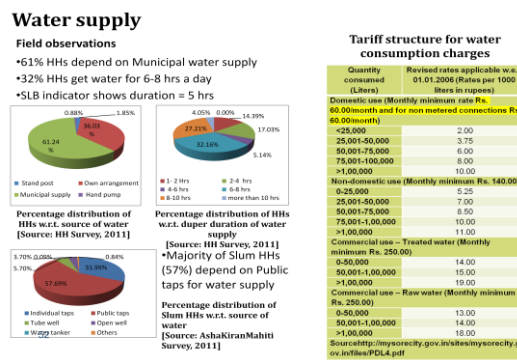
- Water is the basic need for every human being. Vani Villa's Water Supply is responsible for the supply and maintenance of water to Mysore city.
- Safe drinking water and basic sanitation are intrinsic to human survival, well - being and dignity!
- Water is critical natural resource upon which all social and economic activities and ecosystem functions depend.
- Energy is required for humans to make use of water-to lift, move, and process and treat it at every phase of its extraction, distribution and use.
- Mysore is situated between the river Kaveri and Kabini, which are a source of drinking water to the city. The city got its first piped water supply when the Belagola project was commissioned in 1896. At present, water is supplied to Mysore at the volume of 42.5 million gallons per day from three projects; Hongally (III Stages), Belagola and Melapur and this reaches 85% of households. Mysore sometimes faces water crises, mainly during the months of summer and in years of deficient rainfall. In some wards water is supplied 2 days once [3].
- The 24x7 water supply to the city with required safe method to reduce the causes of ill health will be achieved under JnNURM schemes by remodeling the water supply, distribution network. The contract was given to JUSCO Company. So, that every house gets 24x7 Water Supply Scheme.

- Waste water consists of grey water and black water. Black water is water from the toilets not suitable for on-site treatment. Grey water is that waste water coming from bathing areas, washbasins, washing machines, kitchen sinks.
- As per Karnataka Urban Service level Benchmarking Ranking Report for the State says that Mysore secures 3<sup>rd</sup> place among all the urban local bodies.
- Rain Water harvesting system is not effectively implemented.

**Analysis**

- Managing water sustainably supports the overall objectives of a green growth and also satisfies critical social imperatives.
- Climate change is a central external driver that affects water and demands for all uses directly mitigation measures are concentrated around the reduction of energy consumption and carbon emissions.
- Implementation of 24x7 water supply scheme on trial basis is efficiently functioning,
- The trenches excavated for laying water supply pipe lines is not been closed properly due to which there are problems such as accidents, etc.,
- The workers are not carrying out the water supply work efficiently.
- There is wastage of water than required and also the water taken from the source is not sufficient to cater to the demands of Mysore city as shown in Table 1.
- In core area there is no water scarcity and only in few buildings like Mysore Palace, K.R.Hospital, MCC premises as rain water harvesting facility.

Table 1



**Proposals**

- Water is the most essential commodity for the mankind and it is to be supplied to the public by the local authority both in urban and rural areas. Both the quantum and quality of water supplied is of the major concern. It is very common phenomenon that most of the urban local bodies are depending on ground water as the main drinking water source i.e. bore wells and open wells by installing motor/pumps. The water is stored in a service reservoir and then pumped to the public distribution network. The improper maintenance and management of the entire system leads to high operation and maintenance cost. Operation and maintenance cost is one of the important aspects in water supply which needs to be tracked by the Urban Local Bodies using proper formats and updating precise date periodically.
- Supplying of water and waste water services and Municipal solid waste is a burning problem requiring immediate attention and care. The waste generators are used to throw the waste directly on streets, open plots and drains thereby causing problems for health, environment and aesthetics. Many municipalities are functioning in an adhoc way without proper management plan for collection, transportation and disposal system for solid waste. The weaker sections of the community and children are most affected due to unhygienic condition. Though essential and important this service has been neglected by the local bodies there by worsening the issue. It is a high time that Urban Local Bodies have to look into these issues scientifically and handle it effectively.
- Rainwater harvesting should be compulsorily implemented in all the plots, so that the same water can be reused in the premises for washing, flushing, etc.
- Decentralized storm water collection, treatment, reuse system should be implemented.
- The state mandatory reforms have to be implemented effectively such as water quality should compliance with Beaur of Indian Standards 10500-1991.
- The workers involved in the JnNURM scheme should be trained and as well as assisted by the concerned.
- Water pipe lines should be laid in accordance with natural gradient so that water may be pumped under gravity.

- There should be regular monitoring of water pipeline leakages, faulty water connections, and water meters.
- The diameter of water pipe line must be increased and the pending works under JnNURM scheme should be completed before the stipulated period.
- During planning stage care as to be taken to provide pervious layers in each plot so that rain water percolation takes place. Also by providing recharge pits, water table will be increased.
- Before every rainy season silts should be removed from water bodies and in vacant lands weeds should be removed so that rain water percolation takes place.
- Per household water supply quantity should be earmarked to check over usage of water. If, the quantity of usage of water exceeds double the rate as to be levied.
- Centralized waste water treatment systems are costly and use a lot of land, energy and resource to treat sufficiently before disposal to surface waters. In plots where more waste water is generated, Sewerage treatment plant and recycled water usage must be made mandatory.
- Rainwater Harvesting is the activity of direct collection of rainwater. The water collected can be stored for direct use or recharged into ground water. Rain water can be harvested from roof tops, paved and semi-paved areas and storm water drains should be made compulsory so that takes off pressure from municipal water supply. In case of smaller plots community rain water harvesting and sewage treatment must be encouraged.
- Installation of water purification facilities, improvement of drainage, waste water treatment, sewerage treatment and further advanced treatment.
- Integrate water bodies which reduce the temperature and improve micro-climate. While preparation of master plans consider the group interest.
- An ideal situation for water use in cities that aspire toward sustainability is that all grey water from buildings in localized areas can be reused. This would mean in practice that water from baths and showers and from kitchens could be fed through a filter and a storage tank, perhaps contained underground or stored in a building basement, could be used for watering private or public garden areas, or even Mysore City Corporation (MCC) parks. As grey water constitute about 70% of waste water and if separated can be treated on site minimally can be used for non-potable uses.
- The total quantum of water available at different horizon years is well above the demand and the per capita water supply is above the CPHEEO standards.
- The storage capacity of the existing service reservoirs within the MCC limits is found to be 35.60ml, to meet the CPHEEO standards 31 numbers of new elevated service reservoirs have been proposed inside MCC limits with a total capacity of 40.00 ml.

#### 4.5 Waste Management

##### Observations

- Municipal solid waste Management (MSWM) is an obligatory function of the urban local Bodies (ULB's). Under Karnataka Municipalities Act 1969 also the Municipal solid Waste Rules 2000 made it mandatory for urban local bodies (ULB's) to practice sanitary treatment and disposal of the solid waste generated. Government of India has selected one such project identified in the master plan under JnNURM project for management of Municipal Solid Waste in the city.
- The types of solid wastes generated are organic waste (peels of vegetables, fruits, and garden waste), inorganic waste (paper, glass, and metals), 'E' waste (cd's, electronic hardware), construction waste (broken bricks, paints).
- Mysore is generating around 405 TPD of waste out of which 280 tons of organic waste every day is produced and from which we can generate approximately 5.2 million cubic meters of methane which can be used for cooking. At present there is no practice of segregation of waste in Mysore city except in 2 wards. The waste is collected at 5 acres of land in sewage form, Vidyanarayapuram Compost Plant but out of 405 tons of waste only 200 tones waste is scientifically composed and the remaining is dumped next to this plant on an open land in the landfill site. Trees are planted around the Compost plant to create buffer zone. One more plant is proposed at Rayanakere. The operation and maintenance of the compost plant is outsourced to M/S IL and FS Company on PPP basis. They are paying rent and royalty of Rs.6/- Lakhs per annum to MCC. Also MCC has taken up development of sanitary landfill site and capping of existing waste. Composting of wet waste is done using windrows composting method [4].
- Under JnNURM Scheme, integrated Solid Waste Management (SWM) plan has been approved and an amount of Rs.29.98 Crores is released with a proposal to
  - 1) Stream lining of MSW collection and transportation system.
  - 2) Rehabilitation of existing compost plant
  - 3) Development of sanitary Landfill Site and capping of existing garbage scientifically.



- Various activities have been taken up to streamline the existing municipal solid waste management in Mysore City as per MSW rules 2000. Mysore City Corporation has taken up the following awareness programmes to implement segregation of waste at household level and also defining the roles and responsibilities of various stakeholders.
- Mysore City Corporation has been carrying out primary collection of wastes from all the 65 wards. For this purpose, 255 No. of Containers (both 3.0cum & 4.5 cum containers) are purchased under 12<sup>th</sup> finance & placed in all the 65 wards each container covering 1000 households approximately. However, Segregation of waste was not addressed so far. In order to stress more importance on segregation, MCC has decided to use already placed containers for collection of wet waste & to procure additional number of containers (with 4 compartment provision for collection of plastic, metal, glass & hazardous wastes) & place it in all the wards in the ratio of 4:2 (Biodegradable : Non-biodegradable). So, these 255 No. of containers used for wet waste collection will be taken to compost plant and the 130 No. of 4 compartment containers used for dry waste collection will be taken to zero waste management plant.
- At present there is only one slaughter house and tanneries located at Kurimandi Rajendranagar, Kesare with a capacity of 300 to 400 small animals per day. The animal wastes turn into manure when buried. Measures have been taken to bury the waste deep by deploying a heavy duty Hitachi land-digging machine and spraying bio-chemicals to control foul smell emanating from the spot. Separate vehicle is used to transport animal waste and market vegetable waste to Pinjarapole to feed cattle's.
- M/s. Sree Consultants a private authorized by KSPCB has set up a bio medical waste incinerator at Varuna near Mysore at capacity 100 kg/hr where it receives 0.5mtpd of waste from the hospitals nursing homes. K.R. and PKTB hospitals have the facility to treat infected liquid waste.
- Also children's movement for civic awareness appointed by MCC as trained 200 children in 900 sessions in 40 high schools in the year 2008-2009. This activity has been extended to 60 more schools (6000 children).
- All SWM vehicles are equipped with Global Positioning System (GPS) units which enable the route optimization, monitor the movement of vehicles from collection point to disposal point and have improved the collection efficiency, saving on fuel. Totally in MCC there are 772 permanent and 1412 out sourcing pourakarmikas for SWM work. Daily garbage cleaning and other complaints from public are recorded through control room using toll free numbers and they are forwarded to concerned person. Along with tax SWM cess is collected.
- In Devaraja Market, Mutton market, inner commercial streets there is lack of solid waste management as debris and waste is littered on the roads and open areas.
- For cleaning purpose in each ward the roads are categorized as 'A', 'B', 'C' and for cleaning of every one kilometer one pourakarmika is considered. Out of 65 wards in Mysore city 53 wards has been out sourced for waste collection and management. Per year expenditure on SWM is Rs.52.28 Crores.

#### Waste water management

- Wastewater is any water that has been generated by the water users, which is let off after the use by the various kinds of consumers like domestic, commercial, industrial etc.
- Sewage is correctly the subset of wastewater that is contaminated with feces or urine, but is often used to mean any waste water. Sewage includes domestic, municipal or industrial liquid waste products disposed of, usually via a pipe or sewer or similar structure, sometimes in a cesspool emptier. The physical infrastructure, including pipes, pumps, screens and channels etc, used to convey sewage from its origin to the point of eventual treatment or disposal is termed as sewerage system.
- Reuse and Recycle tertiary treated wastewater can be reused as drinking water, in industry (cooling towers), in artificial recharge of aquifers, in agriculture and in the rehabilitation of natural ecosystems.
- Where there is no regular cleaning and collection of garbage's, are dumped on roads.

#### Analysis

- As the roads are in bad condition, cleaning the roads is very difficult.
- Due to Shortage of funds and pourakarmikas, cleaning is not carried out effectively.
- Lack of public co-operation and awareness about SWM is creating problems.
- Segregation of waste is not happening at households hence unnecessary more load on centralized solid waste management situated at Vidyananyapuram compost plant.

#### Proposals

- Regularly roads must be cleaned and maintained.
- Implementation of 3R's (Reduce, Reuse, Recycle) and decentralized waste management system and ban plastic bags.
- Through effective segregation, much of the waste that reaches landfill can be diverted away. Staggering of waste collection will help pourakarmikas to give attention towards all the localities.

- The organic waste should be compost more frequently so encourage kitchen gardens so that composting of waste and use of the same may be ensured.
- Implementation of “Pay Polluters scheme”. Those who throw the waste on the roads should be penalized with heavy fines.
- As per CPHEEO manuals and field data for the medium income cities, the putrescible organic matter (food waste) amounts 20-60% of the total weight of the waste 15 to 45% of the waste is recyclable like paper, plastic. Hence around 80% of the total waste produced can be used as a raw material for the production of a useful by product like organic manure, paper, plastic and rests needs to be disposed scientifically in the sanitary land fill site. Steps also need to be taken for early completion of proposed landfill sites.
- Introduce volume based household waste charge.
- Mandatory segregation of biodegradable, non-biodegradable waste and hazardous waste at household levels should be implemented.
- Decentralized Sewage treatment plant and solid waste management plants like, In ward no-28 Kumbarakoppal, 3 tones of segregated wastes are being collected and handled, which is a self sustaining system, also creating employment for physically challenged, hence it is called Zero waste management (ZWM) system and is generating Rs 30000/month. For other areas also suitable area should be identified so that transportation and load on centralized plant will be reduced.
- Waste segregation is being done in ward-28 for Door to Door Collection, Workers are provided with 2 compartment Auto tippers to collect the segregated waste from the household itself.
- After collection of wet and dry waste from household, it is transferred to ZWM, where secondary segregation of these waste take place. Wet Waste is composted and dry waste sent to recycling.

#### 4.6 Energy Management

##### Observations

- There is a need for energy efficiency as energy resources are limited and depleting and there is increasing demand for energy (Oil will last for 45 years, Gas will last for another 65 years, World coal reserves will get exhausted by 200 years).
- Mysore city is selected under solar city project. Ministry of non-conventional and renewable energy is providing subsidy for implementation of renewable energy projects. To implement this project Mumbai based company is been appointed.
- In core area convention energy system is still in practice. MCC under solar city project as implemented solar grid system for lighting.
- Most of the houses have solar water heating system but absence of solar lighting /alternate energy.

##### Analysis

- Increasing demand for energy is due to urbanization and enhanced quality of living. (India needs to augment primary energy supply by three to four times and electricity generation capacity by 6 times in order to deliver a sustained economic growth of 8 to 9% through 2031-2032.)
- The residents should be given orientation programme towards energy management so that they will become sensitive towards energy.

##### Proposals

- Renewable energy sources are environmentally clean and non exhaustible. They offer a solution to the issues of depleting fossil fuel reserves and increasing green house gas emissions.
- Conventional energy may be conserved by using minimum fossil fuels and encouraging the use of non-conventional and renewable and alternate energy for example to heat water solar energy and for lighting luminaries which consumes less energy may be adopted. Reduce the use of electric gadgets, encourage the events to be conducted during daytime so that in terms of safety and security also it will be good.
- Energy efficiency through energy saving, reduction in energy usage as to be taken care as 1 unit saving in consumption saves 2 units in productions (there is 1 unit loss in transmission and distribution).
- Provide solar panels on terrace of Devaraja market, Vishweshwara Tower, Makkaji Chowk commercial complex situated in core area, school buildings such as Sadvidya, Marimalappa, Maharanis etc. so that solar energy can be captured and the same can be utilized for street lights, school lightings etc.
- Bio gas plant by using kitchen waste in function halls etc should be made compulsory.
- Replace ordinary bulbs by LED bulbs. LED bulbs are highly efficient and have high efficacy value. LED based lighting is 90% efficient compared to incandescent and 70% efficient than Fluorescent based lighting. Efficacy is measured in terms of lumens per watt. LED bulbs have more than 100 lumens per watt. LED bulbs have life span of 100000 hours compared to Fluorescent (10000 hrs.) and incandescent (1000 hrs.). These bulbs can be repaired like normal electronic gadgets and put back into use.

- Implementing of solar lighting and heating wherever required should be made compulsory. The main problem with solar heat is the difficulty of storing it. In response to this, the German company UFE solar, together with the Fraunhofer solar energy institute, has developed technique whereby heat can be stored within a small volume for several months by means of silica gel. Solar collector equipped with this system would be able to meet domestic heating and hot water requirements all year round.
- Encourage Solar Photovoltaic; it converts incident solar radiation to electricity using semi-conductor devices. They can be stand-alone systems, grid-interactive or hybrid systems, grid-interactive or hybrid systems. Stand alone systems can generate store and deliver power without depending on a grid. They can be used in home lights, street lights, garden lights, and signage boards.

#### 4.7 Appropriate technology/materials

##### Observations

- Green materials and technologies are those that are environmental friendly during their entire lifecycle. Green materials are low embedded energy materials e.g., Rice husk bricks. Green technologies/materials can be best assessed using the concept of life cycle assessments.
- Green technologies are developed through application of science to environmental chemistry for conserving the natural environment and resources and to curb the negative impacts of human involvement. Green technologies lead to green performance such as energy saving, water saving, sewage treatment, air purification, recycling waste, renewable energy generation etc.
- Most of the buildings are made up of conventional bricks and RCC roofs.

##### Analysis

- In housing schemes the Fast Track Technology used to construct the monolithic buildings. Which saves the time and cost in construction of houses was used in slum rehabilitation program effectively. For this technology MCC has got the National award.

##### Proposals

- Use of technology/materials which would consume minimum energy to maintain desired human comfort conditions should be adopted.
- There are international standard management systems like environmental management system (ISO 14001) and occupational, Health and safety Assessment series (ISO 18001) specifically addressing these issues.
- The standard leads to reduction in cost, green house gas emissions and other environmental impacts, through systematic management of energy. It is applicable to all types and sizes of organizations irrespective of any geographical cultural or social conditions. The organizations are trying to improve their management practices towards sustainability.
- In core area old heritage buildings are existing hence utmost care as to be taken while conserving these buildings with suitable alternate technology/materials in such away so that the originality is retained.
- By using best technology and locally available eco-friendly materials a good structure may be created.

#### 4.8 Heritage / Tourism

##### Observations

- The city core area consists most of the buildings which are of heritage importance.
- The Dasara festival (Navarathri festival) is the biggest event celebrated in Mysore as shown in Table 2. It is 10 days festival and on the 10<sup>th</sup> day on the auspicious occasion of Vijayadashami the grand Jumboo Savari led by the idol of Goddess Chamundeshwari set in a golden Howdah (weighs about 750 Kg.) mounted on the caparisoned elephant, Tableaux, folk artists starts from Amba Vilas Palace and passes through the procession route and reaches the Torchlight Parade Ground in Bannimantap. On the same day in the evening a torch light parade, laser-beam show, cultural fiesta etc is arranged at the Bannimantap grounds.

Table 2: Shows the Revenue generated and visitors during Dasara festival

Revenue generated during the 10-day festivities			Visitors during the 10-day festivities	
2010	Rs. 40.00	Lakhs	1.38	Lakhs
2011	Rs. 43.81	Lakhs	1.13	Lakhs
2012	Rs. 46.41	Lakhs	1.22	Lakhs
2013	Rs. 63.37	Lakhs	1.35	Lakhs

Source: District Commissioner Office, Mysore.

##### Analysis

- As the city core area consists of most of the heritage buildings hence it needs to be developed, so that tourists may be attracted and economic development can be achieved.

##### Proposals

- Special regulations for the heritage area need to be considered for a better planning and urban conservation within Mysore. To safeguard the old structures and the constructions of new structures in accordance to the already existing for e.g., Lands down building, Gun house should be given attention to revive and conservation of these dying buildings.
- Declaration of Heritage roads along Dasara procession route.
- Do not permit construction of buildings within 100 m radius around heritage buildings, which is considered adequate to ensure the identity of these heritage structures. Such measures will not only attract tourist but also generate revenue for its maintenance and adds availability of open spaces with in core.
- And this clear space around the heritage structure can be considered adequate which could be landscaped, this results in attraction of tourists.

#### 4.9 Environmental Aspects

##### Observations

- Parks and gardens offer opportunities to enrich the quality of life for persons of all ages and abilities strong evidence shows that when people have access to parks, they exercise more. Regular physical activity has been shown to increase health and reduce the risk of a wide range of diseases including heart disease, hypertension, cancer, and diabetes. Physical activity also relieves symptoms of depression and anxiety, improves mood and enhances psychological well being. Beyond the benefits of exercise, a growing body of research shows that contact with the natural world improves physical and psychological health. Older adults who participate in a variety of social and recreational opportunities benefit from the social connections and interactions that are fundamental to their well being.
- Today we realize that parks and gardens are more than recreation and visual assets to communities they are valuable contributors to larger community policy objectives, such as public health, youth development, Job opportunities, social and cultural exchange and community buildings.
- Environment preservation, noise and vibration control, hazardous chemical substances and environmental-pollution damage-dispute mediation.
- Environment is deteriorating due to high population, over usage of resources, pollution of air, water etc. Thus Environmental Impact: Population x Consumption x Technology.
- Green spaces in the midst of urban areas benefit us in two ways - firstly the social aspect, of places to relax, walk, perhaps play sports or exercise, and secondly the environmental aspect. Green spaces, with a mixture of trees, grass, plants and other vegetation, can absorb some of the carbon produced in the local areas, acting as a sponge for pollution. Parks and gardens help to break the urban monotony of buildings, and they also have the effect of allowing air and light to flow more freely, which produces healthier humans as well as healthier buildings.
- There are quite a number of open spaces and parks but among them Lingambudi park located in a calm spot with a rustic setting, which has an attractive footpath is yet another place admired by walkers. One can enjoy a nice 20 minutes walk on the path admiring the beauty of the fresh water lake, its surroundings, a wide variety of birds and colourful butterflies, developed around Lingambudi tank. It as an extent of 220 acres catering to all age groups of Ramakrishna Nagar for recreation, morning walks, community get together etc. It has thick plantation, pathways, gazebos, water body, animals and birds. It is maintained by MCC and also Horticulture department has further plans to still develop.
- Lingambudi tank catchment area is 4500ha (35.4 km). It covers the major portion of the western region of the city and this catchment area is the largest of all the areas. Three minor tanks catchments Hinkal, Rayarakere, Mariyappana tank forms part of this catchment area. Belavadi, Hootagalli, Vijayanagara, Manasagangothri, Bogadi, Tonachikoppalu, Dhattagalli, Ramakrishnanagara, Srirampura, J.P. Nagar, Ajjaiahnundi and Mudhuvana etc., forms the contributory area of this tank. There are about 16 numbers of drains comprising a drain length of about 35 Kms. and majority of the length is lined with masonry wall. But only small quantity of rainwater can be seen in the lake. Six island formations are within the tank bed for the promotion of bird's habitation and wild life in that area. A unique feature of the lake is the Herbal Park.
- There are ugly spots and unhygienic condition due to formation of slums in Bannimantap industrial area.

##### Analysis

- The air pollution is within permissible limits except in CBD due to high air and noise pollution because of traffic.
- Natural biodiversity with lush greenery as created a good environment in Ramakrishna Nagar layout. Trees in the park is protecting the soil, modified the microclimate and a relationship between man and nature is existing.
- Formation of slums in some locality in Bannimantap is the main cause of deterioration in the environment.

#### Proposals

- To propose a simple green approach to the creation of city would therefore be as native as some of the proposals of the past. The planting within the city can affect the overall energy balance. Planting at present has only an amenity value and although local levels of carbon dioxide are reduced around areas of urban planting further reduction in global carbon dioxide levels could be achieved through substitution of plants. Thus wide roads with avenue of trees, boulevards, vistas can be achieved, so that the city imageability can be created and overall environment can be improved.
- Pay and use system with regular maintenance and by providing good facilities such as bird watching will generate revenue and responsibility.
- By encouraging traditional handicrafts, pottery making, weaving industries along with other industries the culture is carried forward and importance will be given for artisans who are involved in this sector.
- Open space/parks should be maintained well so that people get a good environment and formation of slums can be avoided.
- Environmental law such as precaution, prevention, remedy at source, “polluter pays” should be implemented
- Develop efficient technology for environmental pollution treatment.
- Development of technological infrastructure for the manufacture of cutting edge environmental products.
- Secure the basis for environmental hazard assessment.
- Develop technology for environmental pollution monitoring.
- Develop mid-term strategic environmental technology.
- Develop technology for environmental hazard assessment.
- Develop integrated environmental monitoring component and systems technology.
- Develop key future environmental technology.
- Develop advance technology for pollution prevention.
- Develop original environmental hazard assessment technology.
- Develop nano-environmental pollutant monitoring technology.

#### 4.10 Governance

##### Observations

- Strict enforcement of building regulations is observed in all the earlier phases of construction when buildings were never allowed to encroach upon the public thoroughfares. It is only at the latest levels that the rigidity slackened, converting streets and lanes into built-up areas. In town – planning, however, the first thing that strikes the eye is the street-planning. A principle of coordinated measurement used to be stubbornly followed in the construction of the streets so that the largest-about 45ft. wide was twice the width of the smaller, and three or four times that of the side lanes. The alignment of the streets from east to west and from north to south at Mohenjo-Daro is thought to have been purposely made for keeping the urban area properly ventilated under the prevailing north-south winds. The cities are furnished with an elaborate underground drainage system. House drains are connected with the street-drains by earthenware pipes and the latter used to be cleared through manholes. The city’s sewage finally found its way into soak-pits which ultimately emptied into the river. All these signify the existence of a strict municipal vigilance. The excellence of the masonry is testified by the brick-linings where the joints even today are hardly visible. Large brick culverts with corbelled roofs built in the outskirts of the cities for carrying away the storm water is another important feature of this drainage system [5].
- Infrastructure is central to the socio-economic development and the well being, prosperity of society. Thus the concerned authorities as to plan at the right time suitable infrastructures to the city to prevent further hazards.
- Publish public disclosure law in which information that was formerly not known to the general public is willingly presented or disclosed to the populace. Also it gives accountability and displays information such as annual statements, financial parameters etc.

##### Analysis

- Inefficiency in staff working pattern, ignorance, lack of awareness, political interventions is making the governance from not functioning efficiently.

##### Proposals

- Taxes as to be revised after upgrading the systems in order to further maintain the systems such as pay and use toilets etc.
- Strict implementation of rules and regulation such as in core area no hoardings should be allowed, as it is declared as hoarding free zone as per Mysore City Hoarding Policy.

- Mysore city Zoning regulations and building bye laws as to be revised so that new amendments can be included, example sewage treatment plants, biogas, bio-fuel usage etc., in lines with green concepts so that city will be greener.
- If the above factors are adopted in efficient way social, economic, environment aspects of green concepts will be streamlined.

#### **V. CONCLUSION**

In ancient time we can see that eco friendly, green concept aspects were used in cities such as Harappa and Mohenjadar. Due to industrial revolution, urbanization, haphazard growth, the cities lost its vibrant aspects. Mysore is one of the city which as a salubrious climate hence it accommodates all type of people. The major sector which generates economy in the city is through tourism. Hence, sustainable infrastructure is the need of the hour to support heritage city tourism which needs to be implemented on priority and phase wise.

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