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Effective Sewerage & Drainage for Smart City

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Abstract: *The effective sewerage or drainage is a system in which sewage can flow with self cleansing velocity and waste will flow without any hindrance to the main sewer or outfall. In a Smart City concept the effective sewerage and drainage are the two most vital and important components under building of physical infrastructure of a "Smart City". A Smart City should have own sewerage and drainage system and in the total sanitation system the waste should be 100% recycled. The "Liquid Waste'' or "Refuse (Solid waste)" is considered as the "Resource" for "Reuse" in the form of "Renewable" energy like bio-gas or fossil fuel or may be used as nutrient to the agricultural field nearby. To build an effective sewerage and drainage in a smart city the ULB or the maintaining authorities should be strengthened with skills and resources so that they can efficiently maintain that modern and innovative technology- based assets. So, when the combination of both the efforts of strengthening of ULBs and creation of modern and innovative technologies in different aspects then a city can be emerge out as a Smart City.*

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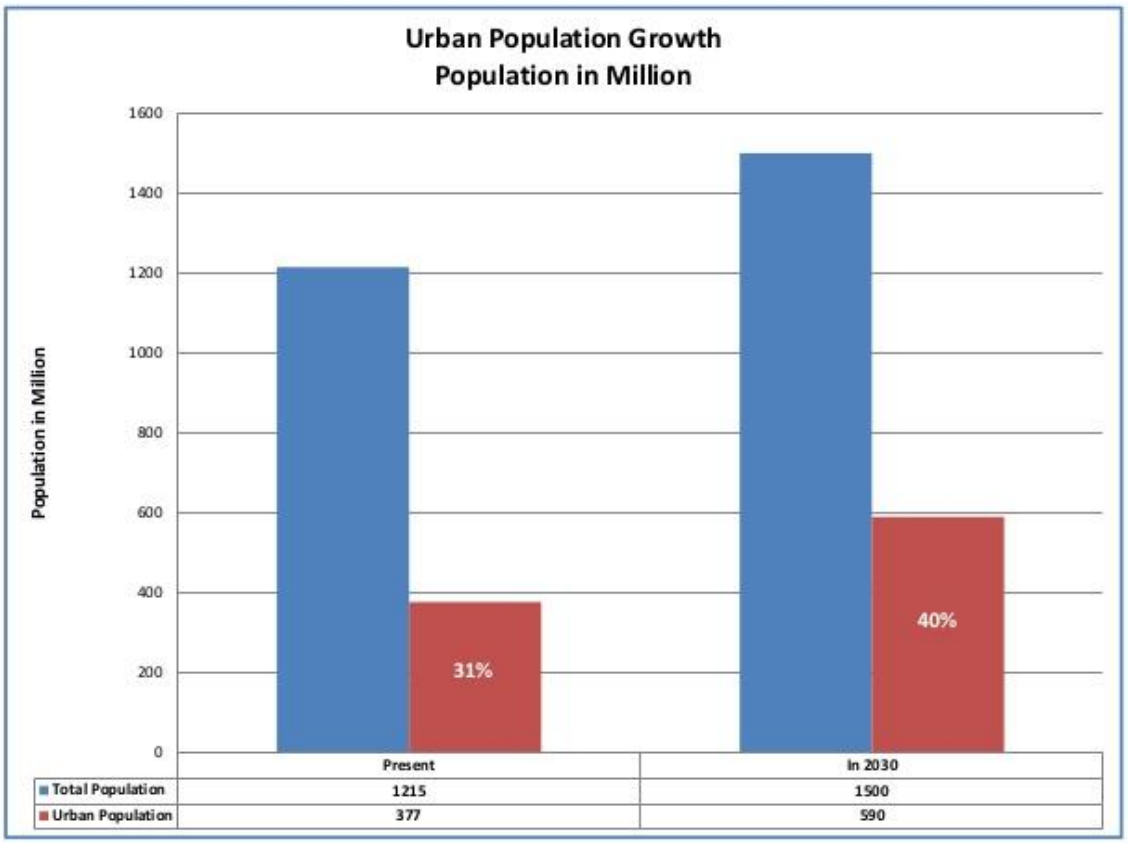
I. Introduction:

The Public Health Engineers are often faced a very common question from the local people that the sewer pipeline islaid, but water logging problem in the area has not been removed.There is a difference between drainage pipelines and sewer lines, we all know. The drainage pipeline or surface drains are carrying the storm water in a locality and discharge it to nearby any water body or any canal or river directly. But in case of sewer line it carries the sewage to a treatment plant and after treatment the treated effluent is discharged into the nearby water bodies. The drainage system in an area is designed considering the rainfall intensity in that area and the diameter of pipeline in case of storm water drains are rather large in comparison to sewer line which is basically designed in the line of population basis in that area.

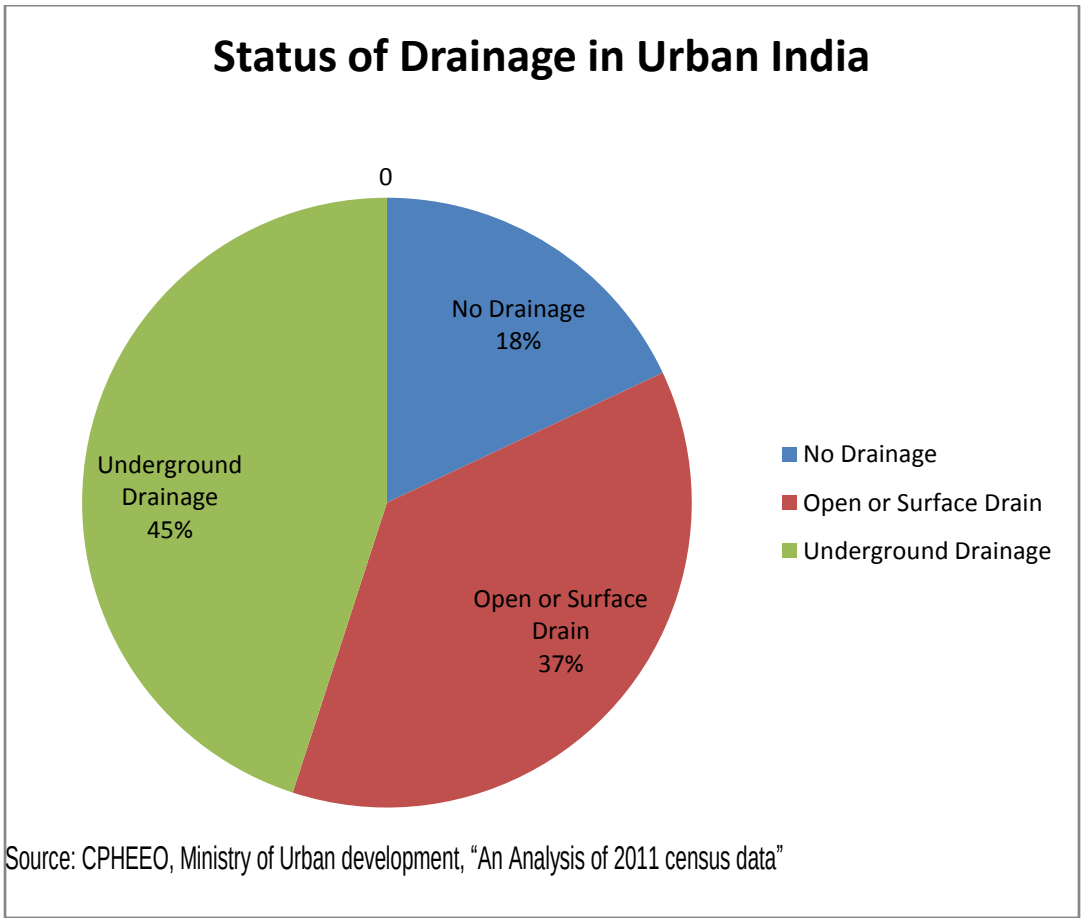
In urban areas and cities as the road width is used for laying different public utilities like water supply, gas, telephone, etc, hence combined sewer system was adopted which carries both storm water and dry weather flow simultaneously. In Kolkata different areas have combined sewerage system but in case of Municipalities nearby Kolkata the separate sanitary sewerage are now being constructed. The effective drainage is capable of flowing with self-cleansing velocityto ensure the wastewater passes freely through the system to the main sewer. Velocity is determined by a combination of gradient and pipe diameter. Drains operate most efficiently when the ratio of the liquid to air in the pipe is 65:35. This ensures adequate ventilation through the system and allows drains to flow at a rate to allow them to self-clean.

The Indus Valley Civilization in Asia (1900 BC) shows early evidence of sanitation system. The urban areas of Indus Valley Civilization included public and private baths. Sewage was disposed through underground drains and in the drainage system drains from houses were connected to wider public drains. In prehistoric age the people preferredto settle near any water body like river or ocean which they used as disposing area of sewage which would be satisfactorily diluted and dissipated.In prehistoric days or at the time of Indus Valley Civilization the population outburst was not so acute in comparison to problems now a day.

Presently due to huge population growth and rapid urbanization, industrialization aggravated the problem of drainage and sanitation. A recent study showed that the sewerage system typically reduced the water borne diseases by about 30 % or perhaps enhance as much as 60% when there is combination of water supply system. The presence of efficient drainage and sewerage system is a major factor in prevention of water borne diseases.



As per census 2011, in India the population growth in urban area has been increased from 28% in 2001 to 31.2% in 2011 and no. of towns has increased upto 8000 in 2013 and among the urban population only 32.7% of urban households are connected with sewer system whereas 38.2% have septic tanks for disposal of their waste and 8.8% households are having pit or pour flush latrine and 1.7% households are having other type of latrines like connection of their latrines to open drains or manual scavengers are used for removing the night soil. About 18.6% of urban households still do not have latrines where about 6% use public latrine and 12.6% are practicing open defecation. In Karnataka only half of 52 towns were served by sewerage system while in West Bengal out of 60 nos. of towns 2350 MLD sewage is generated out of which only 500 MLD sewage is treated (source CPCB Report, 2007). In 1875 by the British rulers, underground sanitation network in eastern India was built, at the time, matched only by the systems in London and Hamburg, Germany.In Kolkata, the sewerage system exist in majority of the areas, mostly of them are combined sewers, but in some added municipal areas still have no sanitary sewer system and they disposed of the sewage through either by septic tank or some areas by cess pool system, however recently by an environmental improvement program sewerage facilities are being building up in some added municipal areas. In this program development of storm water drainage system including pumping stations, wherenecessary are being constructed.



Efficient Waste management in Smart City:

Waste management is the generation, prevention, characterization, monitoring, treatment, handling, reuse and efficient residual disposition of waste may be solid or liquid. Sanitation is important for all urban residents. Absence of sanitation may cause outbreaks of different health disorders epidemics and shoots up the mortality rate high in general and among the poor in particular. It is an essential part that cities should have 'City wide sanitation plan'. The plan is expected to be based on the concept of decentralized sewerage, drainage and solid waste management plan. Each and every family should have toilet facility so that no public is allowed for open defecation. Lack of storm water drainage system, deposition of solid waste, plastics and siltation in the surface drains causing water logging during monsoon months. Due to absence of proper maintenance lead to outbreak of various vector borne diseases like malaria, dengue, etc. Therefore need of adoption of storm water management approach. This would include preserving and maintaining the natural hydrological cycle, ground water recharge, natural drainage system, etc. in Smart City approach laid by the Prime Minister in the year 2015 all those approaches were adopted for implementation in selected cities in India.In Smart City there is a need for 100 percent recycling in the sanitation system.

In case of smart sanitation system the waste water should be treated as a "resource".The waste water in the smart city should be reused efficiently so that the use of fresh water could be reduced to a great extent. The waste water after treatment, in some cases upto tertiary treatment may be adopted, so that the reclaimed sullage water could be used in gardening, park beautification, road-side plantation, etc and reusing the waste water returning nutrients and organic matter to nearby agricultural field and may be the source renewable energy, e.g. production of bio gas or fuel. The storm water may be stored up partially for using it in cleaning roads, washing purposes and watering to the plants, fire-fighting etc.In a smart city automation of all sewage pumping stations and trapping of sewage from storm water drainage to be adopted by using SCADA System which include various type of sensors and centralized control room for monitoring the sewage flow, leakages resulting efficiency of operation. In drainage system the water level in the manhole can be detected by the help of sensors in SCADA System which will prevent water logging in an area and efficient drainage management can be achieved.

Institutional infrastructure including governance, physical infrastructure, social infrastructure and economic infrastructure are the four pillars on which a city rest. In a smart city the citizen is the centre of attention of the city regardless their social status, income levels, age, gender, etc. Institutional infrastructure

refers to the activities that relates to the governance, planning and management of the city which are citizen-centric, efficient, accountable and transparent. Physical infrastructure refers to cost efficient and intelligent physical infrastructure such as water supply, sewerage, drainage, solid waste management, sanitation facilities, etc through use of innovative and modern technology.Social and economic infrastructure relates to those components such as development of education, health care, entertainment and social life of the citizen of smart city.

New Town, the Smart City in West Bengal:

New Town, Kolkata is newly built up town adjacent to Salt Lake has been declared potential "Smart City" by the Govt. of India in May,2016. In the beginning Govt of India will provide Rs.200 crores in first year and Rs. 100 crores each in next three subsequent years and Govt of West Bengal and ULB will provide the same amount. New Town consists of three major Action Area I, II & III for habitation and as well as business centre is also growing up there. New Town has separate sewer system. The total length of sewer lines in Action Area – I is about 80 Km and for Action Area – II & III is 99 Km and 59 Km respectively. The drainage line in Action Area-I,II & III is 113.5 Km, 116.5 Km and 81 Km respectively. All the above sewerage and drainage system has been mostly completed. There are provisions of 18 nos. of drainage pumping stations in New Town area out of which presently 12 nos. are working to lift the storm water and discharged into Bagjola canal and Kestopur canal respectively. 19 nos. intermediate sewage lifting stations are proposed to be constructed out of which 17 nos. are functioning. Sewage treatment plants are now in construction phase, one existing STP of approximate 15 MLD capacity of anaerobic pond system is now functioning presently at "Diller Bheri". The main problem in New Town area is that the storm water from the Airport area which is at higher elevation is now accumulated and getting inundated some parts ofNew Town area through Ghurnia canal and ultimately the outfall is at Bagjola canal.

In New town, Kolkata, the newly built up town has its own drainage and sewerage system in which Bagjola and Kestopur canal are being used for outfall for drainage system. But in case of sewer system the main outfall is DillerBheri though Sewage Treatment Plant of about 72mld capacity is being constructed. Now 200 lpcd treated water is available in 24x7 basis to every citizen.

II. Conclusion and Recommendations:

In conclusion it may be stated that building of new sewerage or drainage or any type of new pollution management infrastructure alone will not help to build a smart city. Already there are several Sewage Treatment Plants or STPsarelying inactive because of financial constraints. The Urban Local Bodies (ULB) are unable to run those plants as they are not even in a financial position to pay the electricity bills. The sewage networks carry only a fraction of sewage load as because house to house connections have not been built up. So, most of the STPs are running underfed. So from past experience the ULB or the Regulatory Bodies or Development Authorities should be strengthened with skills and resources to operate and maintain modern infrastructures.The sustainability of investments in building new and modern infrastructures will depend as much on adopting innovative models and to finance them as on efforts to build the capacities of ULB and development authorities managing these facilities. If these measures can be combined the cities could emerge as "Smart Cities".In smart city the following activities are recommended:

- Decentralized waste water management system mainly on site disposal facilities may be adopted including possibilities of segregation of sullage water and reuse or recycle that spent water within the households in different activities.
- House to house connection should be ensured so that there is no inadequate sewage feeding to the sewage treatment plants.
- Adequate quantity of sewage generation and transportation to the treatment unit should be ensured for financially sustainable waste recycling system.
- Revenue earning from the reclaimed sewage water should be encouraged.
- Manure from the sludge and sullage water may be supplied to the nearby agricultural field may be the sources of revenue generation.
- In Kolkata and some old cities the storm drainage system has been designed considering the rainfall intensity as 6 mm/hr with 2 months frequency. If possible in the smart city the rainfall intensity should be considered minimum as 12 mm/hr with 4 months frequency which will substantially remove the water logging problem.
- In smart city emphasis to be given for providing of separate system for sewerage and drainage so that the dry weather flow and the storm flow to be collected separately. When properly installed, operated and controlled the separate system is most effective, as it reduces the amount of sewage to be treated, avoids the problems of discharges from combined sewer overflows (CSOs) and deals more effectively with periodic and potentially large volumes of urban runoff which occur under storm conditions.

- For sustainable sewerage and drainage systemin smart city potable water supply system when added to it that will reduce water borne diseases about 60%.

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