Evaluation of Rating of IIT-Roorkee Campus Under Swachh Bharat Abhiyan

A Dissertation

Submitted in partial fulfilment of the
requirements for the award of the degree
of
Master of Technology
in
Environmental Management of River and Lakes

By
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CANDIDATE DECLARATION

I hereby declare that the work is being presented in dissertation report, entitled **"Evaluation of Rating of IIT Roorkee Campus Under Swachh Bharat Abhiyan"** in partial fulfilment of the requirement for the award of the degree of **Master of Technology** with specialisation in **"Environment Management of River and Lakes",** submitted in **Department of Hydro and Renewable Energy, Indian Institute of Technology Roorkee** is an authentic record of my own work carried out during the period from July 2018 to June 2019 under the supervision of **Dr. M.P. Sharma, Professor, Department Of Hydro And Renewable Energy, and Dr. V. Devadas, Professor, Department of Architecture and Planning, Indian Institute of Technology Roorkee India**.

I have not submitted the matter embodied in this dissertation report for award of any other degree.

Dated: June, 2019

Place: Roorkee. **(KETAN SONKAR)**

CERTIFICATE

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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ABSTRACT

An attempt is made to evaluate the ranting of IIT Roorkee campus under Swachh Bharat Abhiyan has been made to reflect the level of cleanness, solid waste and waste water processing within the campus. The study is based on the set of parameters developed by referring literatures and government norms to evaluate the cleanliness of campus and also reflects the ongoing collection, transportation and disposal practices of waste. The set of parameters have been applied on various premises and spaces of campus to rank it on an index. The parameters were developed to address, and collect information regarding solid waste management, sanitation and cleanliness of toilets and other spaces within the campus. The campus had been categorised into various zones on the basis of functionality of area. Survey and interactions were done for collecting data on the basis of list of parameters developed for various zone. The overall campus rating found as 3.8/5 due to bad SWM practices. Individual scoring of various aspects found are 3.88/5 for cleanliness of toilets and other spaces, 4.32/5 for resource availability, 3.93/5 for manpower availability, 4.13/5 for resource availability, 2.54/5 for solid waste management, 4.05/5 for light and ventilation and 3.73/5 for infrastructure maintenance. It was significantly observed that the number of toilets doesn't meet the prescribed norms of NBC 2005 in most of academic departments. The condition of the toilets are unhygienic and fixtures used are inefficient. The segregation of waste is not manged as per Solid Waste Management rules 2016. The hospital waste is not managed according to Bio Medical waste management rules 2016. The score for various spaces can provide quick view of the level of cleanliness which is useful for making an appropriate diagnosis of the spaces/campus cleanliness, and is the first step in decision making and Service Optimization Process. The study will helpful in revisiting the areas where improvement is required to further improve level of cleanliness and improve the overall clanliness of the campus.

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ABREVATIONS AND NOTATIONS		
SBM	-	Swachh Bharat Mission
SBM-U	-	Swachh Bharat Mission-Urban
SBM-R	-	Swachh Bharat Mission-Rural
CRSP	-	Central Rural Sanitation Programme
TSC	-	“Total Sanitation Campaign” (TSC)
IEC	-	Information, Education and Communication (IEC),
HRD	-	Human Resource Development (HRD),
BPL	-	Below Poverty Line (BPL)
IHHL	-	individual household latrines (IHHL)
NGP	-	Nirmal Gram Puraskars (NGP)
NBA	-	Nirmal Bharat Abhiyan” (NBA)
ODF	-	Open Defecation Free (ODF),
MoUD	-	Ministry of Urban Development (MoUD).
MoDWS	-	Ministry of Drinking Water and Sanitation
IITR	-	Indian institute of technology Roorkee
SWM	-	Solid waste management
NBC 2005	-	National building code 2005
MSW	-	Municipal solid waste
IEC	-	Information, education, communication
WWT	-	Waste water treatment
UNICEF	-	United Nations Children's Fund
GDP	-	Gross domestic product

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Chapter 1
Introduction

1.1 General

Swacchta that is the cleanliness is state of being clean and the habit of achieving and maintaining that state. Cleanliness may imply a moral quality, as indicated by the aphorism "cleanliness is next to godliness", and is regarded as contributing to other ideals such as health and beauty. In Hinduism, cleanliness is an important virtue and the *Bhagavad Gita* describes it as one of the divine qualities, which everyone must practice.

On a practical level, cleanliness is related to hygiene and diseases prevention. When we talk about hygiene and diseases it is necessary to add drinking water and sanitation with it. Without proper sanitation one can't keep surroundings clean and prevent ourselves from diseases The valuation of cleanliness, therefore, has a social and cultural dimension beyond the requirements of hygiene for practical purposes.

Mahatma Gandhi said "Sanitation is more important than independence". He made cleanliness and sanitation an integral part of Gandhian way of living. His dream was total sanitation for all. He used to emphasize the cleanliness as the most important for physical wellbeing and a healthy environment.

1.2 Background

In 1954 first rural sanitation programme was introduced in India. It was the part of the First Five Year Plan of the Government of India. The Census 1981 disclose rural sanitation coverage was limited to only 1% population. The International Decade for Drinking water and Sanitation during 1981-90, started to emphasize on rural sanitation. (1) Primarily with the objective of improving the quality of life of the rural people and also to provide privacy and dignity to women. Government of India introduced the Central Rural Sanitation Programme (CRSP) in 1986. After 1999, a "demand driven" outlook under the "Total Sanitation Campaign" (TSC) emphasized more on Human Resource Development (HRD), Information, Education and Communication (IEC), Capacity Development activities to increase and. enhance awareness among the rural and urban people and generation of demand for sanitary facilities. This increased people's potential to choose appropriate options through various delivery mechanisms as per their economic condition. (1)

To create awareness on cleanliness, Nirmal Gram Puraskar (NGP) was honored for ensuring full cleanliness coverage and recognizing achievements and efforts made at the GP level to get other indicators of defecation free GPs in the open. (1)

The "Nirmal Bharat Abhiyan" (NBA) the successor programme of the Total Sanitation campaign, was launched wef 1st March 2012. The main objective was to accelerate sanitation coverage in rural areas so that the rural communities could be covered widely through new strategies and saturation approach. There were a number of major schemes of the government of India dealing with rural sanitation and solid waste management. They are listed down in chronological order in Table-1.1.

Table-1.1 Sanitation programmes in India before Swachh Bharat Abhiyan (2)

Sr. No.	Timeline	Efforts for sanitation.
1.	1954	First five year plan of the Government of Indian National water supply and sanitation programme introduced in the health sector.
2.	1972	Aceelerated rural water supply program (ARWSP), designed to provide fund for problem villages (tribal peoples schedule caste and backward classes).
3.	1977	ARWSP introduced.
4.	1981	Beginning of the international drinking water and sanitation of international drinking water supply and sanitation programme Government of India meet its first sanitation target.
5.	1986	Central rural sanitation programme launched the focus of CRSP launched. The focus of CRSP was on supply (providing toilet) subsidy driven.
6.	1991	National Technology mission rename the Rajiv Gandhi National drinking water mission (RGNDWM).
7.	1996-97	Knowledge, attitude and practices survey (KAPs) administered by RGNDW-highlighted the convenience and privacy as main motivational factors rather than subsidies for toilet construction.
8.	1999	CRSP restructured and TSC launched.
9.	2003	Nirmal gram Puraskar launched, incentive scheme to encourage Panchayati Raj Institutions to become open defecation free.
10.	2005	Mahatma Gandhi National Rural Employment Guarantee Act (MANREGA).
11.	2007	MGNREGA was Converse with NBA.
12.	2012	TSC is rename the Nirmal Bharat Abhiyan (NBA) set targets for 100% coverage of sanitation in rural areas by 2020.
13.	2014	Swachh Bharat Abhiyan (SBA) replaced NBA, new target to make India 100% clean by 2019.

To achieve universal sanitation coverage sooner with focus on sanitation, the Prime Minister of India Narendra Modi launched the Swachh Bharat Mission on 2nd October, 2014. The Mission shall be coordinated by Secretary, Ministry of Drinking Water and Sanitation (MDWS) with two Sub-Missions, the Swachh Bharat Mission (Garmin) and the Swachh Bharat Mission (Urban), with objective of achieving clean India by 2019, as a tribute on 150th Birth Anniversary of Mahatma Gandhi, which is being identified in rural areas by improved levels of cleanliness, through Solid and Liquid Waste Management activities and making Gram Panchayats Open Defecation Free, clean and sanitized.

1.3 Need of Swachh Bharat Abhiyan

To carry Clean India mission the need of the hour is:

1. According to a UN report published in May 2012, open defecation is practised by 60% of population, which puts them at risk of diseases like cholera, diarrhoea, typhoid etc. (2)
2. Economic loss are also faced by India due to of poor hygiene and sanitation practices in the country, World Bank report in 2006 revealed that India losses 6.4 % of GDP annually because of the aforementioned reason. (2)
3. World bank Reports say that India is a gold medallist in open defecation and nearly 60 % of Indian population clear their bowels in the open. This 60% is roughly 58% of the people who practise open defecation all over the world. (2)
4. Open defecation and lack of proper sanitation facilities India lead to loss of at least 1000 children a day to diarrhoeal deaths. (2)
5. Reports also reviled that, water of river Ganga is unsafe for bathing because it contains faecal coliform bacteria (120 times higher than the permitted levels) and again the reason is open defecation in our country. (2)
6. Poor hygiene and sanitation facilities costs India 600,000 lives annually because of diarrhoea. Lack of toilets and proper facilities also expose 33% of country's women to the risk of sexual assault and rape. (2)
7. World Health Organization and UNICEF reported in May 2014 that India accounts for about 60% of the world's residents without toilets.(2)
8. Swachh Bharat's is related to the economic activity of the country. Advocating the idea of Clean india, Prime Minister, Narendra Modi had said, "The pursuit of cleanliness can be an economic activity contributing to GDP growth, reduction in healthcare costs and a source of employment." (2)
9. If India and its tourist destinations are clean, it will bring more people and will also bring about a paradigm shift in the country's global perception. (2)

If proper hygiene and sanitation do not become a practise in our country then nobody will be able to save the country from the health hazards and losses that will loom over the Indian populace in upcoming future.

1.4 Swachh Bharat Abhiyan

Swachh Bharat Abhiyan is a national cleanliness campaign established by the Government of India. This campaign is covering 4041 statutory towns in order to clean roads, streets, and infrastructure of the India. It is a mass movement has run to create a **Clean India by 2019**. It is a step ahead to the Mahatma Gandhi's dream of Swachh Bharat for healthy and prosperous life. This mission was launched on 2nd of October 2014 (145th birth anniversary of Bapu) by targeting its completeness in 2019 on 150th birth anniversary of Bapu. The mission has been implemented to cover all the rural and urban areas of the India under the Ministry of Urban Development and the Ministry of Drinking Water and Sanitation accordingly.

SBM is being implemented separately for urban and rural areas. SBM (Urban) is being delivered by the MoUD, while SBM (Rural/Gramin) is being implemented by the Ministry of Drinking Water and Sanitation (MoDWS).

1.4.1 Swachh Bharat Mission in Urban Areas

The swachh bharat mission of urban areas aims to cover almost 1.04 crore households(2) in order to provide them 2.6 lakhs of public toilets(2), 2.5 lakhs of community toilets together with the solid wastes management in every town. Community toilets have been planned to be built in the residential areas where availability of individual household toilets is difficult and public toilets at designated locations including bus stations, tourist places, railway stations, markets, etc. Cleanliness programme in the urban areas (around 4,401 towns)(2) have been planned to be completed over five years till 2019.

1.4.2 Swachh Bharat Mission in Rural Areas

Swachh Bharat mission (Gramin) is implementing cleanliness programmes in the rural areas. The Nirmal Bharat Abhiyan (also called Total Sanitation campaign, TSC) which was established by the Government of India during 1999 to make rural areas clean however now it has been restructured into the Swachh Bharat Mission (Gramin). This campaign is aimed to make rural areas free of open defecation till 2019. There is a vision of converting waste into useful energy forms and bio-fertilizer. This mission involves the participation of Gram Panchayat, Panchayat Samiti and Zila Parishad.

1.4.3 Objectives of Swachh Bharat Abhiyan

The main objectives of the SBM(G) are as under: **Swachh Bharat Mission (Rural)** (2)

I. To improve quality of life of people living in the rural areas.
II. Motivate people to maintain sanitation in rural areas to complete the vision of Swachh Bharat by 2019.
III. To motivate local working bodies (such as communities, Panchayati Raj Institutions, etc) to make available the required sustainable sanitation facilities.
IV. Develop advance environmental sanitation systems manageable by the community especially to focus on solid and liquid waste management in the rural areas.
V. To promote ecologically safe and sustainable sanitation in the rural areas.

The main objectives of the SBM(U) are as under: **Swachh Bharat Mission (Urban)** (2)

I. Elimination of open defecation
II. Eradication of Manual Scavenging
III. Modern and Scientific Municipal Solid Waste Management
IV. To effect behavioural change regarding healthy sanitation practices
V. Generate awareness about sanitation and its linkage with public health
VI. Capacity Augmentation for ULBs to create an enabling environment for private sector participation in Capex (capital expenditure) and Opex (operation and maintenance

1.4.4 Duration

The Mission will be in force till 2nd October 2019 (2) i.e. 150th birth anniversary of Mahatma Gandhi. Till now significant improvement have been made in terms of accessibility of toilets that can be examined from the Table-1.2, which shows the percentage of households having access to toilets during different decadal period.

Table-1.2 Household having access to toilet during different decadal census of India [05]

Year	%
1981	1
1991	9
2001	22
2011	32.70
9th June 2019	99.20

The table-2 shows that from 1981 till 2011 access to toilet was only risen from 1% to 32.70%. but after 2011 there was significant increase in accessibility of toilets and by 9th June

2019, 99.20% of households were having access to toilet. The target is to achieve 100% accessibility by 2nd oct 2019.

1.5 Difference Between Earlier and Present Program

Some of the differences between the earlier and present approach has been identified as follows.

1. Earlier approach was community led but not a mass movement thus lacks the enthusiasm which can be seen today. Little participation of community thus leads to failure of the targets.
2. Restricted only to centralized management practices for both solid waste and waste water, Larger proportion of which being collected, transported and disposed of at landfill sites and river respectively.
3. There were no IEC activities that focuses on behavioural change, change of rural people mindsets, and collective mentality of the official workers towards the cleanliness.
4. But now we have totally change our approach for achieving the goal and move a step forward.
5. Present policies focus on segregation of waste at source, reduce, reuse and recycle, adoption of decentralized household and community level practices for management of the waste, Adoption of composting, waste to energy technologies.
6. Government approach towards achieving green and healthier environment.
7. SBA has a strong redressal mechanism via app.
8. Strong implementation and monitoring mechanism.
9. Sensitization of people towards fore-coming environmental threat and benefits of cleaner and healthier environment.

Last but not the least the word Swachh that is cleanliness is in itself very exhaustive and dynamic term, not restricted to SWM and WWT. It may be possible that instead of efficient and effective SWM and WWT one may not have cleaner and healthier environment. Thus it has a much wider perspective than the earlier programs.

1.6 Swachh Survekshan

As a beginning to encourage cities to improve urban sanitationan and solid waste management practices, Ministry of Housing and Urban Affairs (MoHUA) initiated and conducted 'Swachh Survekshan-2016'-- survey for the rating of 73 cities in January 2016 followed by 'Swachh Survekshan-2017', conducted in January- February 2017 ranking 434(3) cities. In a effort to widened the coverage of the ranking exercise and encourage cities to

positively execute mission initiatives in a timely and innovative manner, MoHUA conducted its third survey 'Swachh Survekshan - 2018' covering 4203 Cities Including 61 Cantonment Boards(3). The 'Swachh Survekshan - 2018' ranking of the Cities, was performed separately with a population of one lakh or more (national ranking) and those below one lakh (state and zonal rankings), which was based on assessment of progress achieved from January 2017 till December 2017 (in case of cantonment board extended till January 2018 only) under Swachh Bharat Mission-Urban (SBM-U). (3) the Fig-1.1 shows the cities that ranked first during different year of Swachh Survekshan.

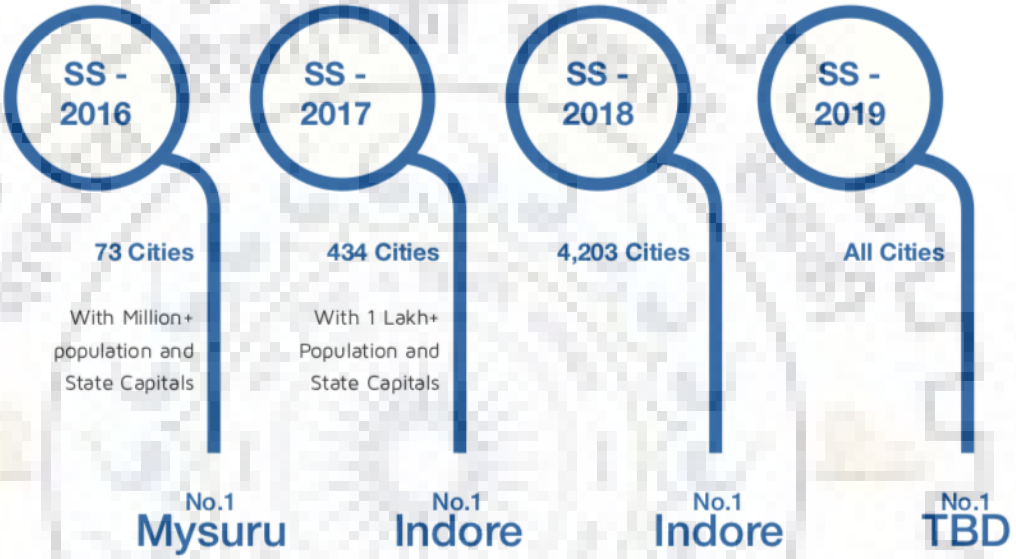


Fig -1 .1 Top rankers during different years of swachh survekshan (3)

The third round of Swachh Survekshan in 2018 was a quantum leap of scale - conducted across 4,203 cities, in a record time of 66 days, and became the largest ever Pan India Sanitation Survey in the world, impacting around 40 million people. The Swachh Survekshan 2019 will be conducted across all cities and towns across the country between 4th – 31st January 2019. The weightage given for different activities for ranking has been provided in Fig-1.2. (3)

The distinctive features of the survey are geared towards encouraging large scale citizen participation, ensuring sustainability of initiatives taken towards garbage free and open defecation free cities, providing credible outcomes which would be validated by third party certification, institutionalizing existing systems through online processes and creating awareness amongst all sections of society.

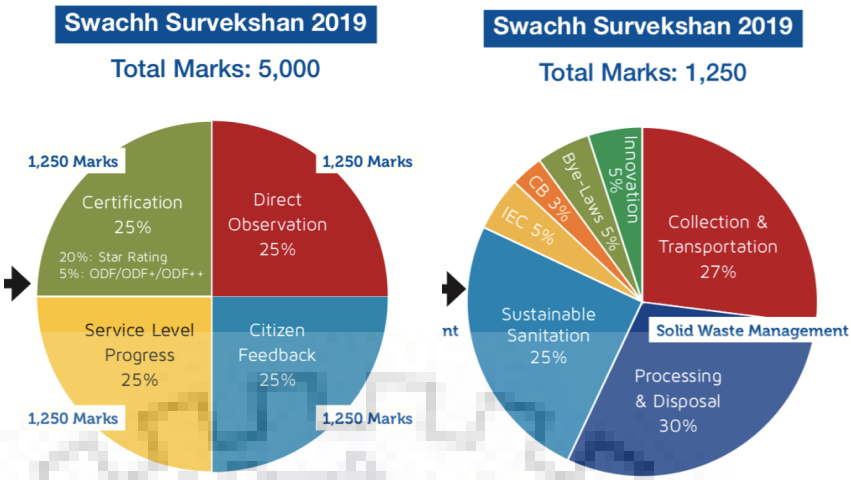


Fig-1.2 Assessment weightage of swachh survekshan 2019 [05]

1.6.1 Objective of Swachh survekshan

The main objective of the survey is to create awareness amongst all sections of society about the significance of working together towards making cities and town a better place to live in and encourage large scale citizen participation.(3) In addition, the survey intends to promote the spirit of healthy competition among cities and towns so that citizens can be provided services to make clean cities.

1.6.2 Limitations

Its mostly limited towards open and common public places like bus stand, railway station and parking areas. Thus, does not take into account the cleanliness and waste management practices within the buildable habitats and premises like, hospital, workshops, schools, administrative offices, residential buildings, residential households, clubs, recreational areas, etc. its also inclined more towards SWM and Sanitation practices leaving behind other aspects of cleanliness.

1.6.3 Cleanliness

In Clean India' campaign the Cleanliness is defined as more than removal of dirt and is a relational concept encompassing the distinctive ideas of display, disinfection, and deodorization. The world cleanliness has a very wide perspective. It might be possible that 100% solid waste and waste water management may be achieved, but still the environment in which one is living is not clean and hygienic and can give rise to the various disease causing germs, bacteria, virus and fungus. Infectious diseases are spread to vast areas and make people ill and sometimes death. The term cleanliness has such a wide meaning that at one point of time it can encompass the hygienic environment and reach to the degree of aesthetic. It is a sign of standard

of living. In this present dissertation an attempt is made to create a set of parameters on the basis of which the cleanliness can be defined in context with clean India campaign.

1.7 Solid waste management technologies in India and abroad.

Population of India has been increased five times in last six decades to 485.35 million (Indian Census,2011) overloading the burden of solid waste management on municipal corporation. The waste load has increased to such a level that their management has become very difficult due to life style change, rapid urbanization and population growth. Per capita waste ranges from 0.2-0.6 kg per day in Indian cities amounting to 42 million tonnes annually. It is also estimated that by 2047 solid waste generation will exceed 260 million tonnes.(4) The Fig-1.3 gives the pathways as to the waste processing technology to be opted for a given type of waste.

Fig -1.3 Waste processing line diagram (5)

1.7.1 Typical technologies for Treatment, Processing and Disposal of waste in India.

India is far behind in the proper treatment processing and disposal of waste according to government norms, only 24% of waste is treated and rest of the waste are typically dumped at landfill sites and in most of the cities these land fill dumping sites are also not properly assigned and maintained scientifically. That leads to unhygienic conditions and contamination of underground water. Recently on the account of SBA Government of India has published an Advisory on On-Site and Decentralized Composting of Municipal Organic Waste also. Centralized and decentralized practices being started and to be practised in India are listed below.

1.7.1.1 Centralized practices:

1. Bio composting

    a) Windrow Composting
    b) Vermi-Composting
    c) Aerated Static Pile Composting
    d) In Vessel Composting
    e) Pit Composting
    f) Mechanized Organic Waste Composter

2. Bio-methenation

The bio-degradable waste can be treated using biological conversion by Composting or bio methanation. Bio fertilizers are produced during composting , whereas Bio methanation will lead to production of biogas which can be used for production of electricity.

1.7.1.2 Decentralized practices:

Waste to compost systems for individual Households, small communities, apartments etc. up to 10 Households

1. Pit Composting
2. Pot Composting
3. Tri Pot Composting
4. Bio-Composter
5. Ring Composting
6. Kitchen Bin Composting
7. Mose Pit Composting
8. Blue HDPE Digester
9. Eco Pots
10. Drum Composting
11. Rotary Drum Composting (Small)
12. Composting Basket/Bin

Waste to compost systems for medium sized communities, apartments, - for 11 – 300 Households; medium sized offices, medium hotels, resorts, medium schools, canteens, marriage halls

1. Vermi Composting
2. Portable Household Bio Bin
3. Aerobic Bin Composting
4. Centralised Masonry Biotank Composting
5. Organic Waste Composting Machine
6. Byobin
7. Orbin
8. Solar Composter
9. Aaga
10. Bokashi
11. Plastic crates
12. Steel Mesh Composter
13. FRP Aerobic Digester
14. Drum Composting
15. Wet Waste Composter

Waste to compost systems for large communities, apartments, high rise buildings for 301 – 1000 Households; large Offices, large Hotels, large schools

1. Organic Waste Composting Machine
2. Marigold
3. Soil and Health SWM consultant Aerobic and Anaerobic Composter
4. Large Scale Composting Pits

Waste to compost systems for Decentralized Plants for above 1000 Households operated by UlBs / institutions / Outsourced agencies

1. Windrow Composting
2. Rotary Drum Composter (Large)
3. Vermi Composter
4. Tallboy

1.7.2 Typical technologies for Treatment, Processing and Disposal of waste in abroad.

Following are certain technologies that are typically practised in Abroad for waste management.

1. Composting
2. Vermi Composting
3. Biomethanation and Anaerobic Digestion
4. Incineration
5. Pyrolysis and Gasification
6. Plasma Pyrolysis
7. Pelletization/Production of Refuse Derived Fuel (RDF)
8. Sanitary Landfills and Landfill Gas Recovery

A Brief account of the efficiency, impact and applicability of these technologies is discussed below:

1.7.2.1 Composting

This is the most common biodegradation process of India. Composting can be defined as decomposition of organic matter by microbes in aerobic and anaerobic environments. Compared to agricultural waste, the compost of odd urban wastes is more nutritious. Because of its simple and cheap low cost method its practice can be identified in many cities of India. The soil textures are improved as they are backed to the soil. But composting is only limited to dry waste. Open manure plants get spoiled in the rainy season. The lack of awareness about the huge land requirement and the use of fertilizer among the farmers assumes the technology a small scale application. If organic waste is not isolated at the source level, then the likelihood of mixing toxic substances in soil increases through fertilizer. There is need of removing the toxic material from the organic waste otherwise there is chances of mixing it into the ground.(5)

1.7.2.2 Vermi Composting

Under this biodegradation process the organic matter are disintegrated by insects, and worms shown in Fig-1.4 which are nutrients rich in nutrients called Vermin compost, these are good soil conditioner and very good natural fertilizer. Extreme bad odour and toxic environment for growth of insects can be created if process performed in anaerobic condition.

Fig-1.4 Vermi composting (9)

1.7.2.3 Bio methanation and anaerobic digestion

Under this process biogas and compost are produced as by product due to anaerobic digestion of biodegradable solid waste materials. Collection of gas is easy with an attached system, release of odour is also less, and less land is occupied. Biogas is an source of electricity. Typical steps in bio methanation has been shown in Fig-1.5. It requires a large-scale utilisation because the set-up cost of the plant is too high and the waste is also required in bulk for anaerobic digestion. Liquid mud generated as by product can be used as fertilizers. The process gets difficult when the organic compounds contain large amount of oil, yard waste.

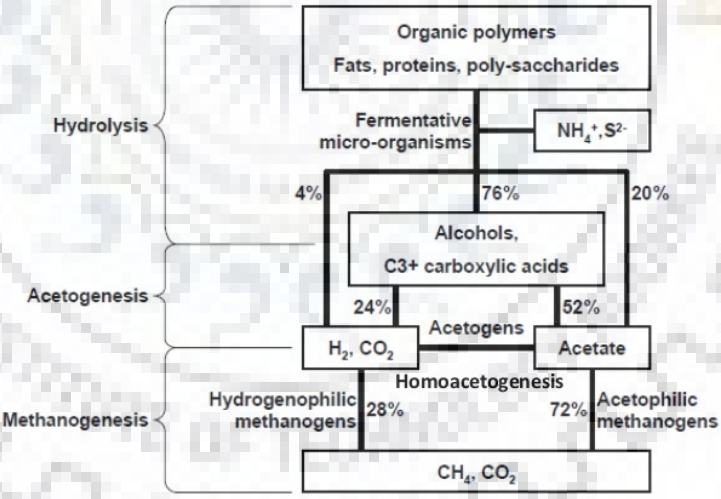


Fig- 1.5 Anaerobic treatment process (9)

1.7.2.4 Incineration

Under this process both biodegradable and non-biodegradable waste like paper, plastic, packaging and pathological waste are burnt at 1400C and are converted into non harmful material like ash and steam. Its one of the most typical method of developed countries. The generated steam are utilized for generating electricity from turbine. However, the cost of installation, operation and maintenance of such plants is very high. It is a noiseless and hygienic method. Waste transportation cost can be cut to a large extent by establishing the reservoir within the city.

Residual ash comprises of pollutants and toxic substances, which is a matter of environmental concern. Skilful labour is required for the operation and maintenance of such plants.

1.7.2.5 Pyrolysis and Gasification

In this gasification process, the homogeneous organic matter and biomass are reacted at a high temperature under controlled oxygen, which result into production of synthesis gas called a syngas, which is a type of fuel. The limitation is to stop supply of pure oxygen as gasification agent, to stop high-power consumption for pre-processing waste and timely service plants for cleaning. Syngas again used for generation of electric power.

1.7.2.6 Plasma pyrolysis

Electric arc gasifier is used at a high temperature for the decomposition of waste material in a oxygen less environment of the gaseous substances is plasma pyrolysis. It reduces the slag and used to generate electricity. It is suitable for dry waste because it costs more to process electricity.

1.7.2.7 Pelletization/Production of Refuse Derived Fuel (RDF)

This is a method for the processing of solid waste of mixed municipalities, which produces a rich fuel feed for RDF accumulation and thermal processes like industrial furnaces. RDF is one of the substitute of the coal which can be easily transported and stored. It's also limited only to dry waste. If RDF pellets are contaminated by hazardous materials, pellets are not safe to burn in the open.

1.7.2.8 Sanitary Landfills and Landfill Gas Recovery

It is the method for all types of waste such as industrial and commercial wastes, residual sludge and inorganic waste. Which can't be recycled or used in the future. It doesn't require skilled labour for maintenance its very cost effective method.

Landfill gas used for direct thermal applications as domestic gas can be used. Treatment of organic waste before the disposal in India is compulsory because it is prohibited by dumping the law. Therefore, the recovery of landfill gas in India is minimal.

1.7.3 Adoption

All technical options are analysed, their main features and cost implications are kept in mind. Environmental implications and suitability are studied for the bio-physical environment of India. Research shows that fertilizers, bio methanation and worm-composting are the preferred

method. Type of waste determines the type of techniques. Vermic composting for homogeneous waste. Manure and biogas generation is most suitable for waste and fish market waste. Sanitary Land Filling is the easiest option. However, pyrolysis, plasma pyrolysis and palletisation in India are rare and are not widely used. No technique is perfect. They all have qualifications and demerits. Therefore, the selection of technology will be judiciously performed.

1.8 Classification of solid wastes

There may be variety of waste such as Domestic waste, Factory waste, E-waste, Construction waste, Waste from oil factory, Food processing waste, Agricultural waste, Bio-medical waste, Nuclear waste, etc. Table-1.3 shows the classification of the waste on the basis of source. The table also depicts the major component of the waste comprises-of when generated from different types of sources.

Table-1.3 Typical waste generated from various sources (5)

Source	Typical waste generator	Solid waste content
RESIDENTIAL	Single and multiple households/ dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, batteries, oil, tires), and household hazardous wastes.
COMMERCIAL	Shops, Stores, Hotels, Restaurants, Markets, Office, Malls etc.,	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
INSTITUTIONAL	Schools, Hostels, Hospitals, Government and Private Office Complexes	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.
CONSTRUCTION AND DEMOLITION WASTE	Construction sites, road repairs, renovation sites, demolition of buildings	Wood, Steel, Concrete Debris, Glass, Sand, Tiles, Bituminous Concrete etc.
MUNICIPAL SERVICES	Street Sweeping, landscaping, Cleaning of parks, beaches, other recreational areas	Street sweepings; drain silt; landscape and tree trimmings; wastes from parks, beaches, and other recreational areas

In table-1.3 waste contents can be further classified on the basis of their nature i.e. biodegradable, non-biodegradable, biomedical waste, wet and dry waste, hazardous and inert waste. Thus in table-1.4 solid waste are depicted on the basis of their physical and chemical nature.

Table-1.4 Waste identification (5)

Nature of waste	Solid waste	Nature of waste	Solid waste
Wet waste	Cooked and uncooked food, plant leaves, compostable materials, coffee powder, tea powder, meat and poultry waste etc.	**Biomedical waste**	Human Anatomical waste, animal waste, microbiology and Biotechnology waste, water sharps, solid waste, item contaminated by blood waste, body fluids etc.
Sanitary waste	Menstrual cloth, disposable diapers, sanitary napkins, bandages, etc.	**E-Waste**	Mobile phone, batteries, pen drive, CDs, electronic equipment, CFLs, tube lights etc.
Dry waste (paper)	All type of paper, paper plates, ticket, bills, telephone bills, wrappers, leaflets, flyers, etc	**Dry waste (others)**	Metal items, tetra pack and aluminium foils, aluminium cans, thermocol, bottle, plates, utensils, packaging materials etc.
Dry waste (plastic/glass)	All type of plastic, plastic bags, coke bottles, Water bottles, garbage bags, milk packet, pouches, bangles, crockeries, etc.	**Garden waste**	Plant leave, dry and wet cut branches, kitchen waste etc.
Dry waste (hazardous)	Used syringes, discarded medicines, insecticides and containers, battery cells, household Chemicals, etc.	**Inert waste**	All type of construction materials, cement, mud, sweeping dust.

Till now discussion about various types of solid waste, their sources, various centralized and decentralized practices for manging them were done. As we know that SWM, Sanitation and Toilets are three basic pillars of Swachh Bharat Mission. Now in subsequent headings the state of art techniques are discussed that can enhance the efficiency of toilets, make it hygienic, clean and highly usable.

1.9 Conventional Toilets

Various components of a typical toilet are discussed to make it perfectly viable for use. Earlier only brick walls for partition were used, which after certain periods show the sign of leakages and make the toilets look ugly but with the advancement in the materials and technology, we have developed such dry materials, which can be used for construction of toilets. Such as GRPF, bottle traps, prismatic taps, auto sensor flush systems, sensor lights, self-cleansing wash basins, auto odour controller etc. which not only effective and efficient but also reduces down the human effort. Make the environment of toilets fresh and soothing.

Various typical component of a typical toilet are given and discussed as follows.

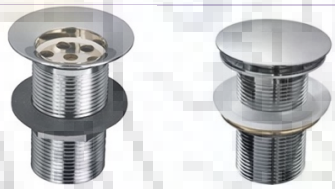
1. Wash basin
2. Urinal bowl
3. WC seat
4. Other accessories

   Each one of them are discussed now

1.9.1 Wash Basin

In the table-1.5, all component of a sophisticated wash basin are shown. Though there are other options for down pipe, taps, coupling, and other components but those components which make the toilets most effective for use are shown in table-1.5. For example instead of down pipe , bottle traps that plays a major role in preventing the foul smell of sewage to get back into bathroom can be used. Pressmatic taps that saves large amount of unnecessary water wastage.

Table-1.5 Typical wash basin component.

TYPICAL WASH BASIN COMPONENTS		
 Bottle trap	 Wash Basin	 Pressmatic tap
 Coupling	 Connecting pipe & Angle cock	 Dispenser
 Tissue dispenser	 Mirror	 Hand dryer

1.9.2 Urinal Bowl

In the table-1.6, all those component are shown which a sophisticated urinal bowl should have for its effective use. A pressmatic urinal flush or automatic flushing system is more

preferable as compared to traditional manually operated tap because it requires little manual maintenance.

Table-1.6 Typical urinal bowl component.

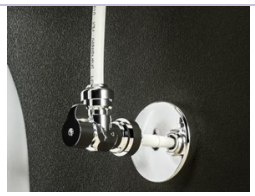
TYPICAL URINAL BOWL COMPONENTS		
 Bottle trap	 Urinal bowl	 electronic flush valve
 Coupling		 Pressmatic flush valve

1.9.3 Water Closet

In the table-1.7 all those components are shown which a sophisticated WC should have for its effective utilization.

Table-1.7 Typical Orissa pan/wc component.

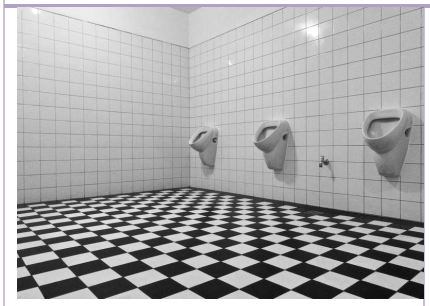
TYPICAL ORISSA PAN COMPONENTS		
 Cistern	 Orissa pan	 Health faucet

 Tap		 Connecting pipe
TYPICAL WESTERN WC COMPONENTS		
 Health faucet	 Westen wc	 Jet
 Toilet paper & dispenser	 Cistern	 Tap

1.9.4 Miscellaneous Items

In the table-1.8 all those component are shown which a sophisticated toilets should have for its effective use.

Table-1.8 Other component of toilet.

TYPICAL TOILET COMPONENTS		
 Tilled surface	 Bins	 Sanitary napkins Incinerator

 Sanitary vending machine	 Cockroach jali	 Exhaust
 Towel	 Air freshener	 Cubicles

These are the various fixtures that are supposed to be provided in a sophisticated toilet. By the utilization of these elements the environment of the toilets can be always kept clean and soothing.

1.10 Literature review

A number of studies have been carried out by different researchers on the cleanliness indicators, Swachh Bharat Abhiyan, sanitation and solid waste management. The work is done both on centralized and decentralized practices which are being now days focused by government. In table-1.10, literature are being studied for understanding the issues , conflicts, loopholes, gaps and upcoming potential for adopting cleanliness practices.

Table-1.10 Literature review

S. No.	AUTHER & REF. NO.	TITLE	ABSTRACT/WORKDONE	FINDINGS
1	**Himanshu, 2015 [7]**	Swachh Bharat Mission: A Step towards Environmental Protection.	He focused his studies in impact of swaach bharat abhiyan on health and environment and why after longstanding efforts still the situation remained unchanged for decades.	Reason for stubborn situation is because many people in rural India actually prefer open defecation to using affordable latrines. Because of lack of behavioural habit.
2	**Aman, 2015 [8]**	ICT perspectives on sanitation improvements under Swachh Bharat Abhiyan	He studied about why this campaign faces significant implementation challenges, and risks being stymied due to a fragmented administrative environment and an information deficit faced by stakeholders. how the use of Information and Communication Technology (ICT) tools could result in higher quality and timelier decision-making, thus improving the overall implementation outcome of government	This potential can be realised only if such projects are implemented sustainably, with due attention paid to local environments, community norms, technology access and political scenario. Rather than political orientation it has to have rational orientation
3	**Sadhan kumar, 2016 [9]**	Swachhaa Bharat Mission (SBM) – A Paradigm Shift in Waste Management and Cleanliness in India	The study reviews the present status and sustainability of the activities undertaken and proposes some improvement scopes in the schemes under the SB mission for effective SWM in India.	The success of the mission will depend on the implementation of the laid down procedures, regular monitoring and based on the monitoring results the actions taken.

4	**Aparna, 2015 [10]**	Clean india	He studied about real time monitoring, clean market,FDI, cleaning apps.	In order to make trash free city there is need of reducing it at the source only by following zero waste technique which will also reduce pollution and further burden on upcoming processes in the channel of SWM.
5	**Alka, 2017 [11]**	Swachh Bharat Mission- Need, Objective and Impact	The study, is an attempt to find out the need, objectives and impact of Swachh Bharat Mission on overall economic development of India.	This mission cannot be successful without the support of each and every Indian. PM also asserted that Swachh Bharat Abhiyan should be a combined effort of government as well as people.
6	**SarahDickin 2018 [12]**	Understanding sustained use of ecological sanitation in rural Burkina Faso	The study focuses that the safe agricultural reuse of nutrients can provide a strong motivation for long-term adoption of improved sanitation among rural smallholders.	Use of organic manure and water retaining plants of C4 and cam types techniques with wise use of cropping pattern can reduce the loads on water pollution.
7	**MarijnPoortvliet, 2017 [13]**	Acceptance of new sanitation: The role of end-users' pro-environmental personal norms and risk and benefit perceptions	The study focuses on Current sanitation systems are inherently limited in their ability to address the new challenges for waste water management that arise from the rising demand to restore resource cycles. These challenges include removal of micropollutants, water (re)use, and nutrient recovery. New opportunities to address these challenges arise from new sanitation,	Choosing new and low cost vernacular sanitation techniques in rural areas where the availability of materials and technician is low should be enhanced.

8	**Kathleen, 2014 [14]**	The toilet tripod: Understanding successful sanitation in rural India	The study reviews Building toilets and getting people to use them is critical for public health. We deployed a political ecology approach specifically to identify the multi-scalar political, economic, and environmental factors influencing toilet adoption in rural India	The elements of successful sanitation adoption depended on three factors (1) multi-scalar political will on the part of both government and NGOs over the long term; (2) proximate social pressure, i.e., person-to-person contact between rural inhabitants and toilets; (3) political ecology, i.e., assured access to water, compatible soil type, and changing land use.
9	**Sriroop, 2017 [15]**	Rural-urban spatial inequality in water and sanitation facilities in India: A cross-sectional study from household to national level	He studied about major obstacle for the developing nations to meeting the United Nation's Sustainable Development Goals (SDG: 2015–2030) for WaSH (Water-Sanitation-Hygiene) is the appalling rural-urban inequality in infrastructural facilities that lead to regional/spatial differences in livelihood.	(1) sociocultural dogmas leading to open defecation practices in rural India and (2) the notion of 'improved' water sources, which calls for further region-specific investigations in future.
10	**Gessler, 2008 [16]**	The challenge of economic regulation of water and sanitation in urban India	Through comparisons with the electricity sector, this study considers how economic regulation might challenge the public providers of water in Jaipur, Rajasthan and possible effects on the needs for water and sanitation of the poorest.	Private sector involvement and the development of economic regulation has been not took place in sanitation water supplying methods.

11	**López, 2017 [17]**	Developing an indicators plan and software for evaluating Street Cleanliness and Waste	The study focuses on Specific methodologies for calculating and evaluating 59 indicators have been developed to obtain information regarding the status of the different elements of the service.	This information can be obtained numerically and/or graphically. The final goal is to provide information to the managers and the public sector through

		Collection Services		the different platforms that have been developed for the management of Smart Cities
12	**Rattan, 2018 [18]**	Transforming waste into resources for the Indian economy	Th study is about an integrated systems approach towards waste policies and practices, the paper provides examples of innovative practices and emerging technologies that can help to ameliorate the situation	There are a variety of instruments include regulatory requirements, market based incentives such as subsidies, taxes, or cap and trade schemes, payments for enhancement of essential ecosystem services such as recarbonization of soil, and information campaigns to encourage voluntary initiatives.
13	**Oregib, 2015 [19]**	Environmental assessment of four Basque University campuses using the NEST tool	It is an evaluation consisted of analysing baseline environmental impacts of the four campuses, and then, in order to reduce environmental impacts, the authors presented numerous refurbishment scenarios for the campuses, according to national and international declarations concerning sustainable development in higher education.	The evaluation carried out at baseline has helped to identify the critical environmental impacts and, therefore, to define the key action areas.
14	**Rodrigues , 2018 [20]**	Developing criteria for performance assessment in municipal solid waste management	This paper addresses the problem of managing solid waste in small cities, and based on an in depth case study that is used to illustrate the application of a performance measurement assessment exercise.	With this interpretation, the manager is allowed to monitor the discrepancies and development of improvement actions that meet the competitiveness objectives of service operations. it presented a systematic assessment process for solid waste management.

15	**Zaman, 2014 [21]**	A comprehensive review of the development of zero waste management: lessons learned and guidelines	His study id to identify priority areas of zero waste strategy and to develop national zero waste guidelines. it stimulates sustainable production and consumption, optimum recycling and resource recovery.	The findings of this study are important for policymakers who develop zero waste policies, as the study identified the key gaps and trends in current zero waste studies.
16	**Permana, 2015 [22]**	Sustainable solid waste management practices and perceived cleanliness in a low income city	He focused on assessing waste separation and recycling practices were carried out by field observations, focus group discussions, interviews with the actors, and a questionnaire survey.	The primary result of this study shows that the presence of community practices on waste reduction and waste separation was strongly correlated to a sense of cleanliness in the community. This result implicitly indicates that by a using positive environmental image and performance within a locality, the community can become enthusiastically involved and push for sustainable SWM practices
17	**Sevilla, 2013 [23]**	An index to quantify street cleanliness: The case of Granada (Spain)	In this paper, the suitability of a Cleanliness Index has been checked, for the case of Granada (South of Spain), in order to contribute to the proper management of public expenditure, improving the quality and cost of an essential service for any municipality.	The city exhibits a good level of cleanliness, although the standard of cleaning varied from one area of the city to another. The Cleaning Index fits well to the general situation of the different districts of Granada

1.10.1 Gaps Identified

The major loopholes are majorly on the part of lack of emphasis on the post process of waste collected from the source and are given below:

- Inaccurate supply chain, awareness on handling the waste and cleaning is lacking.
- Lack of knowledge and training to the employees regarding the term cleanliness.

- Unawareness among the citizen about benefits of segregation of waste and decentralized practices.
- More focus on centralized waste management than the decentralized practices creating huge pressure on municipal bodies for collection, transportation and disposal of waste.
- Poor regulatory mechanism and imposing of penalties on breaking the rules.
- Lack of optimal utilization of the resources assigned to municipal bodies.
- In sanitation the main focus is on building of the sanitation facilities, but the maintenance part is often poor.
- Standard of defining a clean locality is still based on old norms.
- Construction of toilets without technical know-how on sewage handling guidelines can intensify the hygiene problems.
- A better and well taken emphasis on setting up waste to energy initiatives should be up taken.
- Lack of knowledge and techniques on decentralized practices for waste management.

1.11 Objectives of dissertation

Based on the literature and gaps identified, the following objectives are formulated.

1. To study the current status of waste management system in the campus.
2. To identify the parameters, for calculating the rating of cleanliness of Indian Institute of Technology, Roorkee campus based on ranking index system.
3. To collect, process, analyse and interpret the data collected.
4. To evaluate overall cleanliness index of IITR campus.
5. To analyze the existing technology available for waste management in India.
6. To evolve a set of guidelines for improving the overall rating of cleanliness of the campus.
7. To suggest the measures that needs, to be adopted for further augmenting the cleanliness of the campus.

1.12 Methodology Adopted

Following methodology has been adopted for the survey and collection of data.

- For the identification of different aspects considered important for the evaluation of cleanliness of the campus, set of parameters are considered which are relevant for the evaluation of level of cleanliness in campus.

- Conducting survey, observations and feedback mechanism, based on indicators for various areas within the campus.
- To process analyse and interpret the data as input are used to select evaluate the index system for assigning the rating.
- The measures are suggested to be adopted for further augmenting the cleanliness of the campus. Line diagram in Fig-1.6 depicts the steps adopted for rating the campus and compilation of the dissertation.

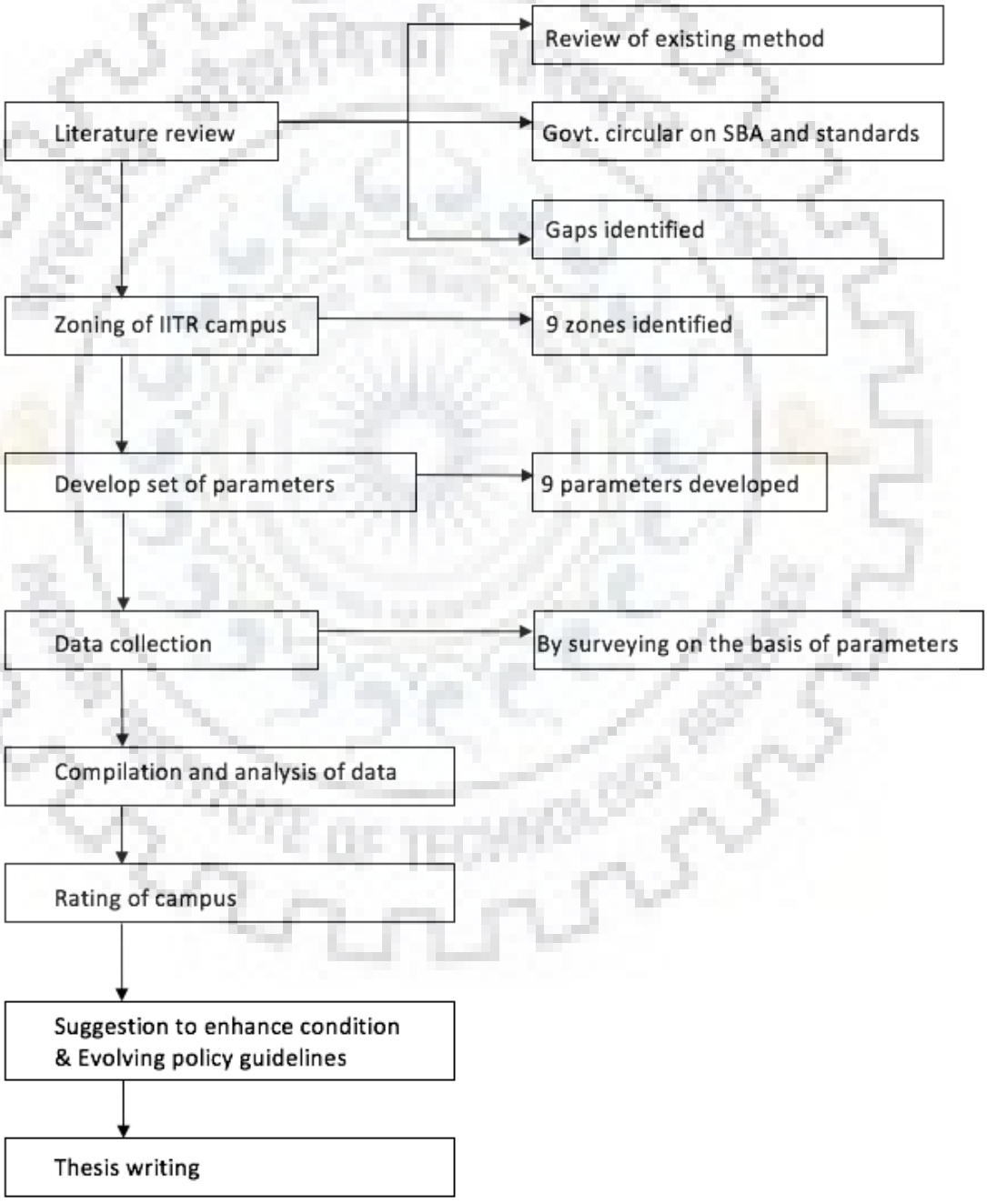


Fig -1.6 Methodology line diagram.

The line diagram of Fig-1.6 shows the steps that is followed for the collection of data and compilation of the dissertation report.

1.12.1 Data collection

A total of 75 buildings are identified within the campus along with roads , parks, lawns, and playground. These are categorized into 9 types on the basis of their function and for each, set of parameters are developed to ascertain the level of cleanliness of an area or premises. The parameters developed are attached as annexure shown below.

S.No.	Zones	Annexure No.
1.	Academic areas/administrative areas.	Annexure- 1
2.	Residential areas.	Annexure- 2
3.	Hostels.	Annexure- 3
4.	Green spaces/parks.	Annexure- 4
5.	Roads.	Annexure- 5
6.	Recreational areas.	Annexure- 6
7.	Hospital.	Annexure- 7
8.	School.	Annexure- 8
9.	Religious buildings.	Annexure- 9

Each annexure is further divided into following 7 parts. Each part consist of set of questionaries' on the basis of which the cleanliness was checked within the premises.

1. Cleanliness
2. Frequency of cleaning
3. Manpower
4. Resource availability
5. Solid and waste management
6. Light and ventilation
7. Infrastructure maintenance

1.12.2 Analysis

A detailed survey and visit are conducted on the basis of the parameters for allotting the score on a 5 point scale as given in table-1.11.

Table 1.11 Cleanliness rating index(25)

5 Points Scale				
Least Clean (Very Poor)	Lower cleanliness level (Poor)	Average	Good	Very Good
1	2	3	4	5

These rating has helped to identify the specific lacunas in the buildings limiting the scores and suggest steps to be taken for further improving the conditions. After collecting the scores for various parameters they are combined for respective building to get individual rating. Mean value

of all the zones were compared partially and wholly with the cleanliness index to give overall rating of the campus. The range of rating colour code is given in table-1.12.

Table 1.12 Cleanliness index for cities.(25)

Score	Area category	Description
1-2	PINK	Area requires urgent action to improve cleanliness.
2-3	YELLOW	Area needing priority actions to improve cleanliness.
3-4	GREEN	Area is performing well but needs more efforts.
4-5	WHITE	Clean areas.

The comparison of the score of respective cleanliness aspects with cleanliness index help us to assign a colour code, on the basis of which I find out that which are the aspect corresponds to a parameter requires urgent action to improve cleanliness and what are the areas which are performing well.

In this chapter we have seen various aspects of cleanliness, SBA, types of solid waste and adopted technologies for solid waste management in India. On the basis of objectives of SBA, literature study and gaps identified objectives of the dissertation were formulated. The methodology that is adopted in this dissertation is discussed in heading 1.12. Now in the next chapter data is collected on the basis of parameters developed to find out the existing scenario of SWM, sanitation, toilets and cleanliness to cognate it with the cleanliness index and provide a rating to the campus, along with it the lacunas and gaps are also identified in next chapter.

Chapter 2
Selection of IIT Roorkee Campus and Collection of data

2.0 Site Selection

Indian institute of technology, Roorkee has been selected as study area because it's a replica of all those functions, which are present in a city, such as hospitals, schools, religious buildings, houses, flats, administrative buildings, clubs, hotels, etc. It will be helpful for me to create a set of parameters for various kind of functions to evaluate the level of cleanliness.

Indian institute of technology, Roorkee is located at the foothill of the Himalayas, in Hardwar district, of the state of Uttarakhand as shown in Fig-2.1. Roorkee town is of moderate size and is located on the banks of the upper Ganga Canal.

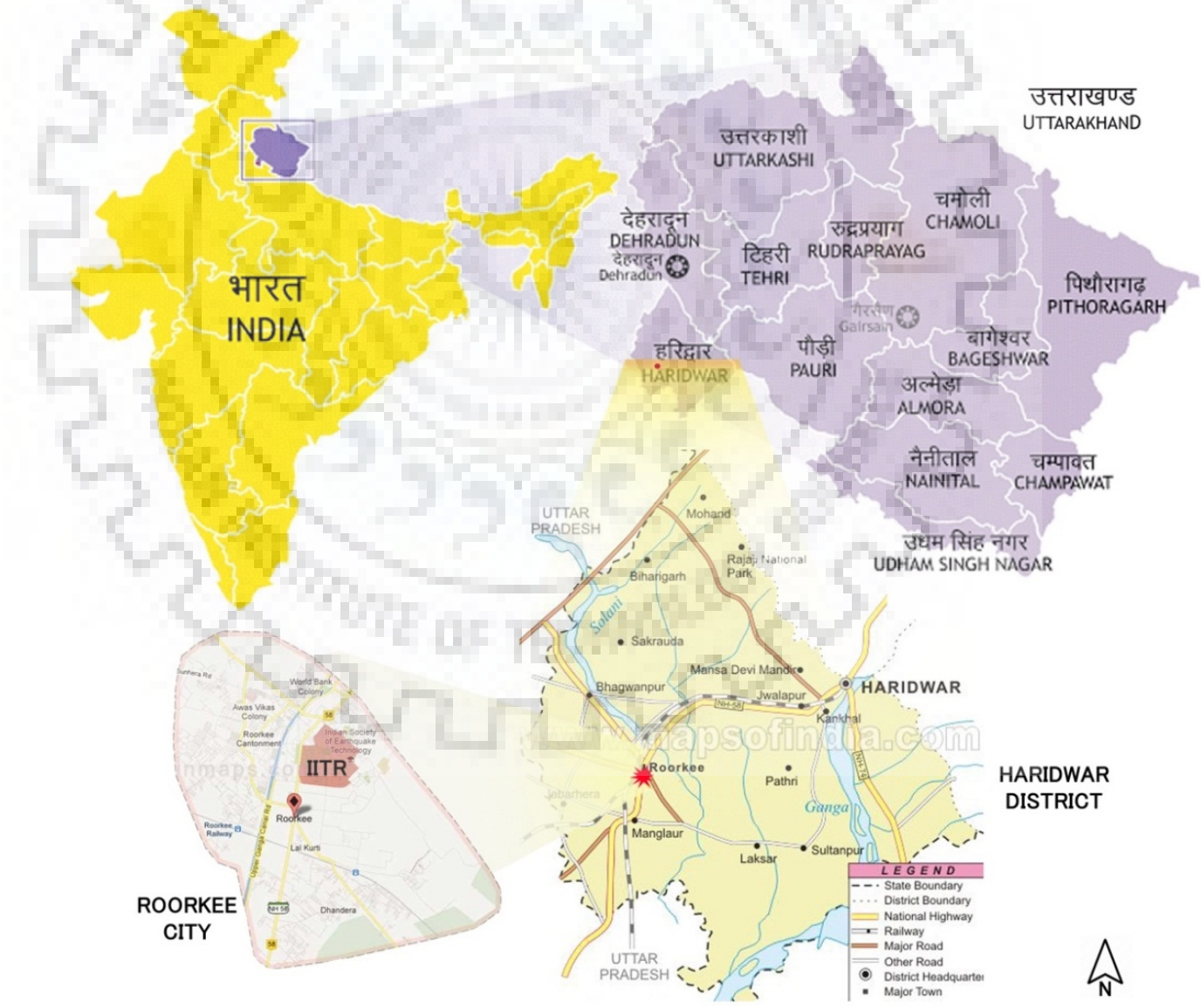


Fig -2.1 Location of IITR campus

IIT Roorkee is one of the biggest technical institutions in the country having the largest number of academic units. It has 21 academic departments covering engineering, humanities & social sciences, applied sciences, and management programmes, 3 centres of excellence, 1 academic centre, 5 academic service centres. The campus at Roorkee is spread over 356 acres of landscaped lush greenery as shown in Fig-2.2. Nestled within this are several heritage buildings, modern academic departments, twelve hostels, messes, hospital, school, banks, community centres, indoor and outdoor sports facilities which include a modern swimming pool, three sports stadiums, students' clubs, yoga bhawan, and several activity centres and other buildings.(24)

Fig -2.2 IITR campus site map [30]

2.1 Climatic data

The climate is extreme during winters as well as summers. During winters, the temperature falls down to as low as 1–20° C. while in summers as high as 41–43° C. The rainfall is average and the downpour is heavy in the months of July and August.

Roorkee has a typical climate as in the plains of Northern India with a touch of the winter chill-a clear effect of the proximity to the hills. Summer months are between March and mid-June when the temperature goes up into the high 30° C and it is quite dry and sunny. This is followed by a spell of the famous Indian monsoon till the end of July. Beyond this time, till late

October, the weather remains generally bright and sunny with temperatures in the pleasant 15-25° C range with rain and storm when the temperature and humidity rise.

2.2 Population of the campus

The population of the area is the basic determining factor for the estimation of infrastructural demand in an area. Moreover the idea of population is important for making a decentralized plan for provision of sanitation services required and ensuring proper infrastructure as per the standard norm. The population of the campus has been determined on the basis of total number of staff households, married students and hostel students residing in the campus as reported in table-2.1 and table-2.2. Apart from this small percentage of floating population has also been added on account of those services which are being outsourced from the private sector like banking facilities, post office, medical facilities, safai workers etc and reported in table-2.3.

Table-2.1 Strength of staff quarters

S No.	STAFF QUARTER	Total no. of household	Total population (assuming 4 per family)
1.	Canal View Apartment	54	216
2.	Amod Kunj	13	52
3.	Govind Puri	18	72
4.	Niti Nagar	28	112
5.	Ravindra Lok	24	96
6.	Saraswati Kunj	80	320
7.	Solani Kunj	120	480
8.	Sheel Kunj	50	200
9.	New Teachers Hostel	24	96
10.	Old teacher hostel	31	124
11.	Vikas Nagar	86	344
12.	Vigyan Kunj	8	32
13.	Shivalik	54	216
14.	Hillview	56	224
15.	Vikas kunj	244	976
	Total	890	3560

There are total 15 staff residential zones within the campus out of which 10 zones are for teaching and A Class staffs, 4 zones where B and C class workers reside, one i.e. vikas kunj for D class workers. Campus has a total residing capacity of 890 households. The total population of the staff both teaching and non-teaching staff including its family members residing within the campus is reported to be 3560.

Table 2.2 Strength of students living in hostel

S No.	HOSTELS	Total no. of household	Total population (assuming 4 per family in case of married)
1.	Ganaga Bhawan	NA	567
2.	Radhekrishna Bhawan	NA	632
3.	Rajendra Bhawan	NA	890
4.	Cautley Bhawan	NA	961
5.	Rajiv Bhawan	NA	675
6.	Azad Bhawan	NA	460
7.	Govind Bhawan	NA	636
8.	Jawahar Bhawan	NA	642
9.	Ravindra Bhawan	NA	509
10.	Sarojini Bhawan	NA	400
11.	Kasturba Bhawan	NA	700
12.	GP hostel	132	396
13.	MR Chopda hostel	276	828
14.	Azad wing	57	171
15.	D.S. Barrack	24	72
16.	K.I.H.	NA	117
17.	Himgiri hostel	NA	320
	Total	489	8976

There are total 17 hostels out of which 9 are boys hostel, 2 girls hostel, 4 hostels for married couples, and 2 hostels is assigned for international students. The strength of the students residing within the campus is 7998 and total strength including the family of married couples is 8976. Hostel wise population is given in table2.2.

There are also certain number of daily workers and staff within the campus. Table 2.3 reports the strength of daily workers within the campus.

Table 2.3 Floating population within the campus

S No.	Floating population	Total population (assuming 4 per family in case of married)
1.	SBI	22
2.	PNB	15
3.	Post Office	3
4.	Canteen Worker	68
5.	Safai Workers	163
6.	Anushruti school	1529
7.	Abn school	114
8.	Horticulture dept	70
	Total	1984

The total no of floating population is 1984 that includes staffs of SBI, PNB, post office, canteen workers, safai workers, horticulture dept workers, and teachers of Anushruti and ABN school.

Table 2.4 Total population of the campus

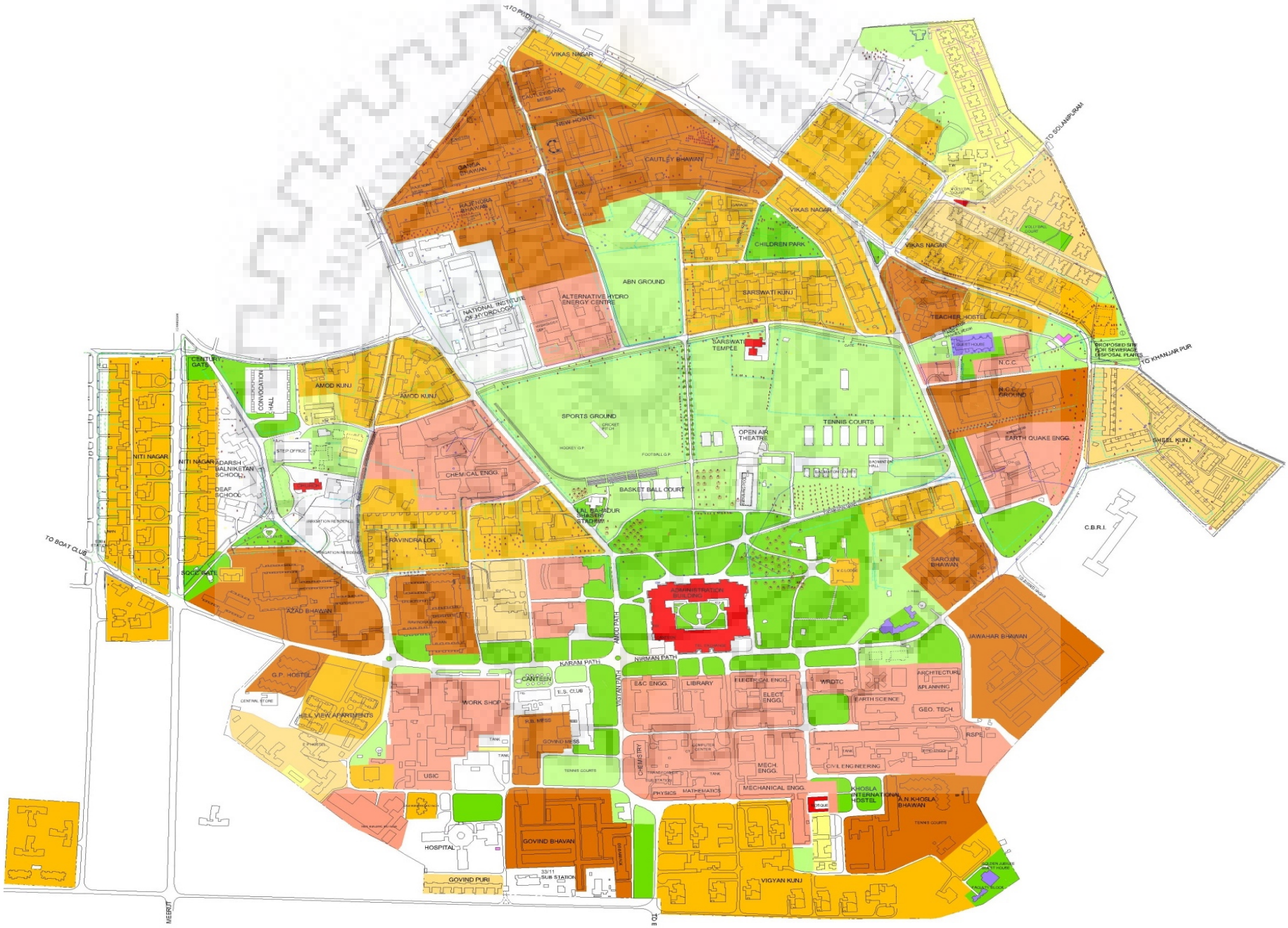
Resident population (hotelite + staff quarter)	12536
Floating population	1984
Total population	14520

Resident population of campus is 12536 and floating population is 1984 including staff, students and daily workers in the campus as shown in table-2.4. Thus overall population of the campus is 14520

2.3 Zoning Of Campus

The campus has been divided into 10 zones depending on the functionality of the area. Figure-2.3 and shows the zoning of the campus on next page. Residential areas ‘A’, ‘B’, ‘C’, and ‘D’ types, hostel area, academic area, green active area, green passive area, heritage building (admin block), central facilities and guest house has been identified in the site plan. This will be helpful for creating set of parameters according to functionality of the area, surveying and collection of data.

Fig-2.3 Zoning of campus



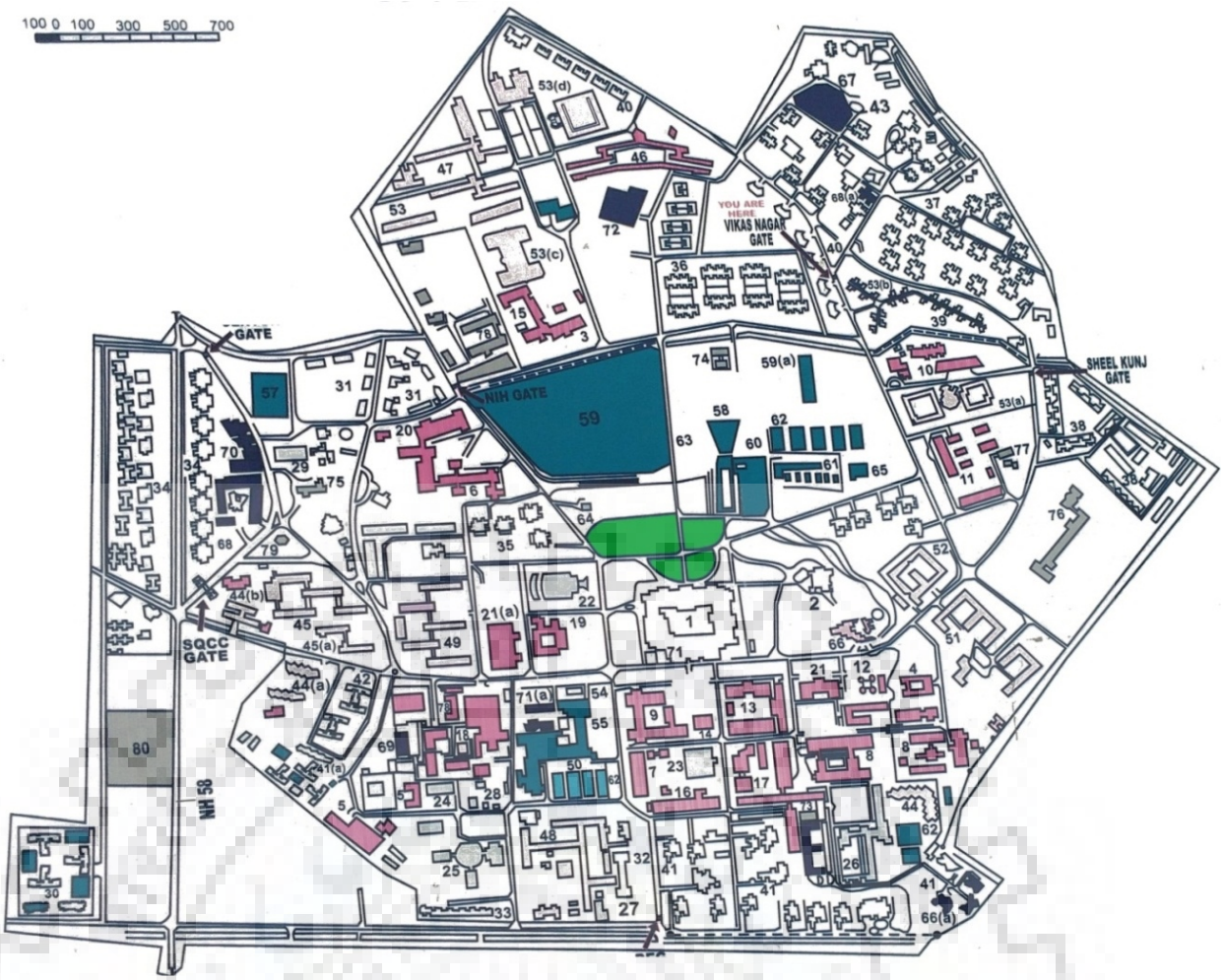


Fig-2.4 IITR campus legends (24)

The location of the various amenities and spaces have been shown in the Fig-8 along with the numbering that are listed down in the table-2.5. These were helpful while identifying and surveying each buildings.

Table-2.5 Legends list (24)

ADMINISTRATION

1. James Thomason Building
2. Director Lodge

ACADEMIC DEPTTS. & CENTRES

3. Alternate Hydro Energy Centre
4. Architecture & Planning
5. Biosciences and Bio Technology
6. Chemical Engineering
7. Chemistry
8. Civil Engineering
9. Computer Science & Electronics
10. Continuing Education
11. Earthquake Engineering
12. Earth Sciences
13. Electrical Engineering
14. Humanities & Social Sciences
15. Hydrology
16. Mathematics And Physics
17. Mechanical & Industrial Engg.
18. Mechanical Workshop
19. Management Studies
20. Metallurgical & Material Engg
21. WRD&M
21.(a) Lecture Complex

CENTRAL FACILITIES

22. Central Library
23. Computer Centre/ Information & Super Highway Centre
24. Institute Instrumentation Centre
25. Hospital
26. Khosla International House
27. Electric Substation
28. Vehicle Garrage
29. STEP Office

STAFF RESIDENTIAL AREAS

30. Canal View Apartments
31. Amod Kunj
32. DS Barrack
33. Govind Puri
34. Niti Nagar
35. Ravindra Lok
36. Saraswati Kunj
37. Solani Kunj
38. Sheel Kunj
39. New Teacher's Hostel
40. Vikas Nagar
41. Vigyan Kunj
41(a) Shivalik Apartments
42. Hill View Apartments
43. Vikas Kunj

STUDENT HOSTELS AND MESSES

44. Khosla Bhawan
44. (a) Ghananand Pande Hostel
44. (b) M R Chopra Bhawan
45. Azad Bhawan 45(a) Azad Wing
46. Cautley Bhawan
47. Gangs fitfiewap.
48. Govind Bhawan
49. Ravindra Bhawan
50. Ravindra Bhawan &_Govind Bhawan Mess
51. Jawahar Bhawan
52. Sarojini Bhawan
53. Rajendra Bhawan
53. (a)Kasturba Bhawan
53. (b)Kasturba Bhawan Extension
53. (c)Rajiv Bhawan

RECREATIONAL AND SPORTS FACILITIES

54. Engineering Students Club
55. Hobbies Club
56. Swimming Pool
57. Convocation Hall
58. Open Air Theatre
59. Lal Bahadur Shastri Stadium
59. (a) Major Dhyan Chand Stadium
60. Gymnasium
61. Sqaush Courts
62. Tennis Courts
63. Volleyball & Basketball Courts
64. Sports Pavilion & Sher Bhawan
65. Badminton Hall

COMMUNITY FACILITIES

66. N. C. Nigam Visitor Hostel
66. (a) Jai Krishna House / Faculty Home
67. Community Centre
68. Anushruti
68. (a) Asmita
69. Milk Dairy
70. Adarsh Bal Niketan
71. State Bank Of India
71. (a)PNB & Post Office
72. Multi Activity Center

RELIGIOUS BUILDINGS

73. Mosque
74. Saraswati Mandir
75. St. Johns Church

A total of 75 buildings are identified within the campus along with roads , parks, lawns, and playground as shown in fig 2.4. These are categorized into 9 types on the basis of their function and for each, set of parameters are developed to ascertain the level of cleanliness of an area or premises. The parameters developed are attached as annexure shown below.

S.No.	Zones	Annexure No.
1.	Academic areas/administrative areas.	Annexure- 1
2.	Residential areas.	Annexure- 2
3.	Hostels.	Annexure- 3
4.	Green spaces/parks.	Annexure- 4
5.	Roads.	Annexure- 5
6.	Recreational areas.	Annexure- 6
7.	Hospital.	Annexure- 7
8.	School.	Annexure- 8
9.	Religious buildings.	Annexure- 9

Now in the next data is collected on the basis of parameters developed to find out the existing scenario of SWM, sanitation, toilets and cleanliness to cognate it with the cleanliness index and provide a rating to the campus.

2.4 Water supply

2.4.1 General

The safe drinking water is one of the most crucial necessity for the well-being of the society. The water supply system basically comprise of source of water, water purification, water storage and water pumping station through network of pipes to settlements.

500 Kld infront of architecture dept

500 Kld near old dairy

500 Kld behind church

Fig -2.5 Water tanks within campus

2.4.2 Sources of water supply

The water supply demand has been projected considering 135 lpcd for census population and 40 lpcd for floating population according to IS 1172:1993 as 1.75 MLD for the present (2019) total assigned population of campus. The water supply is met by the 7 elevated water tanks of 500KLD each for distribution in the surrounding settlements within the campus. The supply of the water is 24x7 directly to consumers. The water are being supplied to the premises under gravity. Capacity of each water tank is 500kl. Some of tanks are shown in the Fig-2.5. The source of the water is underground water. No treatment of underground water is done prior to the supply. These tanks are being cleaned at an interval of a year.

2.5 Waste water generation and treatment

2.5.1 General

The water supplied to the settlement after it is use ultimately get converted into waste water or sewage. The waste water is generally rich in nutrients like phosphate and nitrate along with highly biodegradable contents and harmful pathogens. So its advisable to treat the water before finally disposing off to land surface or water bodies in order to prevent environment free from infection disease and damage.

2.5.2 Existing waste water generation and treatment

The campus has sewerage system to dispose sewerage generated within the campus. About 80% of total water supply i.e. 1.36 MLD is available as waste water but the campus doesn't have any treatment facility for water except 160 septic tanks serving as one of the major means of safe disposal of domestic sewage. Fig- 2.6 depicts one of the septic tank. Its finally disposed off into Sonali river directly. A sewage treatment plant of 3MLD based on SBR technology is under construction.

Septic tank of Cautley bhawan

3MLD STP Plant

Fig -2.6 Septic tank and proposed STP plant.

2.6 Municipal solid waste management

2.6.1 General

The municipal solid waste comprises of all the solid waste like Wet waste, Sanitary waste, paper , plastic , glass, hazardous waste, biomedical waste, E-waste, garden waste, Inert waste generated from various sources such as residential, commercial, institutional, hotels and restaurants, construction and demolition waste.

2.6.2 Sources of municipal solid waste

The MSW consist of all solid waste generated from residences, institutions, commercial centres, road sweeping, and treated biomedical waste except for hazardous waste. The municipal solid waste generation rate is assumed to be 385 gm/capita/day for the resident population and 180gm for the hostel population after literature review and consultation with sanitary supervisor, IIT Roorkee. The average food waste generated by mess of various hostel per person is tabulated in table-21 i.e. 106 gm /person/day. 74gm of waste is generated per person within the hostels. The average waste generated from the campus is higher than the standard norms prescribed in the manual on municipal solid waste management NEERI 1995. The total amount of solid waste generated within the campus is 2919kg.

Table 2.6 : Source wise municipal solid waste generation

S. NO.	Source	Approx. weight of MSW generated (kg/day)	% Contribution to total MSW
1.	RESIDENTIAL	1711	58.6
2.	STREET SWEEPING	50	1.7
3.	MESS AND HOSTEL	1078	37
4.	CANTEENS AND RESTRO	75	2.5
5.	BIOMEDICAL WASTE	15	.2
	TOTAL	2919	100

The table-2.6 clearly depicts that the major source of MSW is residential quarters and hostel with their mess. The above source wise MSW generation is represented in Fig-2.7.

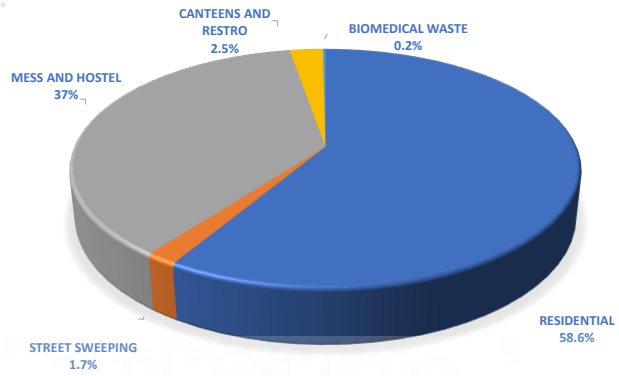


Fig -2.7 Source wise contribution to solid waste generation

According to government Solid waste management rules-2016 campus is a Bulk Generator thus it should Segregate and store 100 % of waste generated in three separate streams namely – (i) bio-degradable (wet waste); (ii) non-biodegradable (dry waste); and (iii) domestic hazardous wastes in suitable bins/containers. But there is a gap of 40% waste segregation.

2.6.3 MSW sample collection and analysis

MSW samples were collected from auto tippers that collected the dry and solid waste separately from residential areas. The samples were segregated after drying and their composition in terms of percentage are tabulated in table-2.7. It was found that on an average the waste generated from the residential staff quarters and married couple hostel is consist of 65.7 biodegradable material the can be composted and 34.3 % dry waste that can be reused or recycled.

Table 2.7 Composition of waste from residential staff quarters.

S No.	Type of waste:	Component	QTY %	QTY %	QTY %	QTY %	%(W/W)
			Day 1	Day 2	Day 3	Average	
1.	Biodegradable	Compostable /Food	40.0	30	27	32.3	
2.		Food	12.6	7.5	9.7	9.9	
3.		Wood	0.75	2.5	1.2	1.4	65.7
4.		Textile	0.85	8.1	2.0	3.6	
5.		Paper	24.4	14.1	17.1	18.5	
6.	Non-Biodegradable	Recyclables	10.5	21.0	11.6	14.6	
7.		Plastic	9.1	14.1	20	14.4	
8.		Rubber glass thermacol	0.7	0.5	11.2	4.4	34.3
9.		Tin/metal	0.7	2.0	0	0.9	
10.		Dirt/ash/brick/stone	0	0	0	0	
		Total	100%	100%	100%	100%	100%

The composition of waste generated by Cautley, Azad, RKB bhawan has reported in table-2.8, which will help us to adopt appropriate measures for dumping off waste and its

utilization if possible. Average composition of municipal solid waste from hostel areas are analyzed by taking the samples from Cautley, Radhakrishnan and Azad hostel. The content of dry waste is 67.38% which is higher as compared to waste from residential blocks. Thus there is potential for reuse and recycling these waste at source.

Table 2.8 Composition of waste in hostels

S No.	Type of waste:	Component	QTY %	QTY %	QTY %	QTY %	% by wt
			Cautley	Azad	RKB	Average	
1.	Biodegradable	Compostable	6.6	10	1.8	6.26	
2.		Food	12.4	.66	1.5	4.86	
3.		Wood	0	1.6	0	0.53	32.62
4.		Textile	0	0	0	0	
5.		Paper	26.2	15.0	21.6	20.97	
6.	Non-Biodegradable	Recyclables	22.6	11.6	30	21.43	
7.		Plastic	16.9	16.6	13.3	15.63	
8.		Rubber glass thermacol	15.0	4.36	21.6	13.66	67.38
9.		Tin/metal	0	40	10	16.66	
10.		Dirt/ash/brick/stone	0	0	0	0	
		Total	100%	100%	100%	100%	100%

The total biodegradable food waste generated by mess of all hostel is shown in table-2.9. The average food waste per capita per day is 106gm. These data are collected from the mess manager of respective hostel messes and are average of a 30 days of this year.

Table 2.9 Average food waste per person generated by various hostel

Sr. No.	Bhawan mess	Avg food waste (Kg per day)	Avg per student waste (gms per day)
1	Rajendra	102	114
2	RKB	87	137
3	Rajiv	68	100
4	Cautley	138	144
5	Ganga	49	86
6	Ravindra	33	65
7	Azad	21	46
8	Govind	64	101
9	Jawahar	75	117
10	Sarojini	52	130
11	Kasturba	85	121
	Total	**774**	**106**

All these wastes are carried away by the local butchers for feeding there animals specially pig as reported by the mess manager. There is no facility available for treatment of food

waste within the campus. These wastes can be composted within campus and utilized by horticulture department as manure.

2.6.4 Collection, Transportation and Disposal

The collection, transportation and disposal of municipal solid waste, is an obligatory function of the campus which is majorly done by the private contractors. For the sweeping and cleaning of the hostel administrative buildings and staff residential areas the workers are outsourced. Presently the waste are collected from the concrete bins of various hostels, administrative and academic buildings without segregation by the assigned tractors and being dumped at municipal dumping site at Saliyar as told by sanitary supervisor. Whereas the wet and dry waste from the residential quarters are being collected separately by auto tippers. The typical composition of wet and dry waste from residential staff quarters are reported in table-19. The waste segregation at hostel and academic premises is nill except some areas where its being done by the safai workers at there own level else are being carried away directly to the municipal dump site Saliyar as told by the sanitary supervisors.

2.6.5 MSW management infrastructure

The equipment and vehicle owned by campus is already listed down in table 2.10. From hostels and other areas except residential quarters, solid waste transportation is being carried out by open vehicles whereas solid waste collection from the residential quarters are done by autotippers. Autotippers collects wet and dry waste separately. The waste collected by autotippers are transferred to tractors and transferred to dumping site without prior segregation. The number of trips made by autotippers is once a day and by tractor is twice a day. The condition of the vehicles are satisfactory as shown in Fig-2.8.

Table 2.10 MSWM infrastructure.

S. No.	Discription	No.s	Capacity	Trip/day	Total collection capacity
1.	Tractors	1	2mt	2	4
2.	Auto tippers	2	1mt	1	1
3.	Concrete bins	58	9cum	--	--
4.	Small Bins	38	--	--	--

Tractor type a

Tractor type b

Floor cleaner type a

Autotippers

Floor cleaner type b

Concrete bins

Fig -2.8 SWM vehicular infrastructure of the campus

2.7 Toilets

2.7.1 General

The success of SBM is majorly concern with the accessibility of toilet to everyone. Mere construction of toilets for meeting the demand in numbers, doesn't ensure its accessibly if its not provided at the required location. The hygienic condition of the toilets also plays a major role in its usability, a toilet with lot of foul smell, lying faecal materials, crawling cockroaches and flies, with improper fixture is never preferred by the users.

2.7.2 Existing scenario of toilets in academic blocks

As Swachh Bharat Abhiyan is mainly concerned with the toilets and its use, so total no of toilets which are being provided in various dept and other areas are being identified and listed down in table 4. It was majorly identified that the number of department doesn't provide the female toilet at each floor as such it creates problem for them. Even there was absence of incinerator for sanitary waste in female toilets. There was absence of soap dispenser dryer and air fresher in most of the toilets that are not used by staff but students. Most of the toilet walls are untilled which shows the patches of leakages and algae on them. Some toilets were lacking proper cross ventilation. Table 2.11 to table 2.30 gives a brief overview of number of toilets and its component on various floor for each department and other habitable space.

Table 2.11 Toilet fixture details in department of **Architecture and planning**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
1.	**Architecture and planning**										341/42
		Gr.	1	1	2	1	2	2	1	2	
		Gr. Mez.	2	2	4	3	x	x	x	x	
		1st	1	1	2	1	2	2	1	2	
		1st mez.	x	x	4	2	x	x	x	X	
		2nd	x	x	x	x	1	1	1	1	
	Total		4	4	12	7	5	5	3	5	

Table 2.12 Toilet fixture details in **Department of hydro and renewable energy**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
2.	**Department of hydro and renewable energy**										112/25
		Gr.	1	1	2	2	1	1	1	1	
		1st	1	1	2	2	1	1	1	1	
		2nd	2	2	2	2	1	1	1	1	
	Total		4	4	6	6	3	3	3	3	

Table 2.13 Toilet fixture details in department of **Biotechnology**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
3.	**Biotechnology**										335/30
		Gr.	3	3	3	3	3	3	1	3	
	Total		3	3	3	3	3	3	1	3	

Table 2.14 Toilet fixture details in department of **Chemical engineering**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
4.	**Chemical engineering**										612/38
		Gr.	1	1	3	1	1	1	1	1	
		Gr. staff	1	1	1	1	x	x	x	X	
		1st	1	1	3	1	1	1	1	1	
		1st staff	1	1	1	1	x	x	x	X	
		2nd	1	1	3	1	1	1	1	1	
	Total		5	5	11	5	3	3	3	3	

Table 2.15 Toilet fixture details in department of **Chemistry dept.**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
5.	**Chemistry dept.**										213/28
	A block	Gr.	1	1	2	2	2	2	1	2	
		1st	1	1	2	2	1	1	1	1	
		2nd	1	1	2	2	1	1	1	1	
	B block	Gr.	x	x	x	x	x	x	x	x	
		1st	x	x	x	x	x	x	x	x	
		2nd	x	x	x	x	x	x	x	x	
	C block	Gr.	1	1	2	2	2	2	1	2	
		1st	1	1	2	2	x	x	x	X	
		2nd	1	1	2	2	x	x	x	X	
		3rd	1	1	2	2	x	x	x	X	
	D block	Gr.	1	1	2	2	x	x	x	x	
		1st	x	x	x	x	x	x	x	x	
		2nd	x	x	x	x	x	x	x	x	
		3rd	x	x	x	x	x	x	x	x	
	Total		8	8	16	16	6	6	4	6	

Table 2.16 Toilet fixture details in department of **Earthquake engineering.**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
6.	**Earthquake engineering**										189/12
	Main block	Gr.	1	1	2	2	3	3	1	2	
		1st	1	1	2	2	x	x	x	X	
		2nd	1	1	2	2	3	3	1	2	
	Lecture block	Gr.	1	1	2	1	x	x	x	X	
		1st	1	1	2	1	3	3	1	1	
	workshop	Gr.	1	1	2	1	1	1	1	1	
		Gr.	x	x	x	3	x	x	x	X	
	Total		6	6	12	12	10	10	4	6	

Table 2.17 Toilet fixture details in department of **Earth science.**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
7.	**Earth science**										370/40
	Main block	Gr.	1	1	2	2	1	1	1	1	
		1st	1	1	2	2	x	x	x	X	
		2nd	1	1	2	2	x	x	X	x	
	Meusem block	Gr.	1	1	1	1	x	x	x	X	
		1st	1	1	2	1	1	1	1	1	
		2nd	1	1	1	1	unisex				
	Total		6	6	10	9	2	2	2	2	

Table 2.18 Toilet fixture details in department of **Electrical engineering**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
8.	**Electrical engineering**										793/66
		Gr.	5	5	10	8	2	2	1	2	
		1st	5	5	8	6	1	1	1	1	
		2nd	3	3	4	5	1	1	1	1	
	Total		13	13	22	19	4	4	3	4	

Table 2.19 Toilet fixture details in department of **Humanities and social science**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
9.	**Humanities and social science**										66/19
		Gr.									
		T1	1	1	2	2	1	1	1	1	
		T2	1	1	1	1	1	1	1	1	
		1ST									
		T1	1	1	2	2	1	1	1	1	
		T2	1	1	1	1	1	1	1	1	
		2ND									
		T1	1	1	2	2	1	1	1	1	
		T2	1	1	1	1	1	1	1	1	
	Total		6	6	9	9	6	6	6	6	

Table 2.20 Toilet fixture details in department of **Hydrology**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
10.	**Hydrology**										55/8
		Gr.									
		T1	2	2	2	2	2	2	1	1	
		T2	1	1	3	2	2	2	1	1	

		1ST									
		T1	2	2	2	2	2	2	1	1	
		T2	1	1	3	2	2	2	1	1	
	Total		6	6	10	8	8	8	4	4	

Table 2.21 Toilet fixture details in department of **Metallurgical and materials**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
11.	**Metallurgical and materials**										537/44
	Main block	Gr.									
		T1	1	1	1	1	1	1	1	1	
		T2	1	1	3	2	1	1	1	1	
		1st									
		T1	1	1	1	1	1	1	1	1	
		T2	1	1	3	2	unisex				
		2nd									
		T1	1	1	1	1	1	1	1	1	
		T2	1	1	3	2	1	1	1	1	
	Other block	Gr.									
		T1	1	1	2	2	1	1	1	1	
		T2	1	1	5	3	x	x	x	x	
		1st									
		T1	1	1	2	2	1	1	1	1	
		T2	1	1	5	3	x	x	x	x	
	Total		10	10	26	19	8	8	8	8	

Table 2.22 Toilet fixture details in department of **Management studies**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
12.	**Management studies**										275/22
		Gr.	3	3	3	2	3	3	1	2	
		1st	3	3	3	2	3	3	1	2	
	Total		6	6	6	4	6	6	2	4	

Table 2.23 Toilet fixture details in department of **Mechanical and industrial engineering**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
13.	**Mechanical and industrial engineering**										701/46
		Gr.									
		T1	x	x	2	1	x	x	x	X	
		T2	1	1	3	2	1	1	1	1	
		1st	2	2	4	2	x	x	x	x	
	Total		3	3	9	5	1	1	1	1	

Table 2.24 Toilet fixture details in department of **COEDMM**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
14.	**COEDMM**										67/27
		Gr.	3	3	3	3	3	3	1	3	
	Total		3	3	3	3	3	3	1	3	

Table 2.25 Toilet fixture details in department of **C TRANS**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
15.	**C TRANS**										42/8
		Gr.	3	3	3	3	3	3	1	3	
	Total		3	3	3	3	3	3	1	3	

Table 2.26 Toilet fixture details in department of **NANOTECH**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
16.	**NANOTECH**										60/22
		Gr.	3	3	3	3	3	3	1	3	
	Total		3	3	3	3	3	3	1	3	

Table 2.27 Toilet fixture details in department of **WRD&M**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
17.	**WRD&M**										62/11
		Gr.	1	1	2	2	1	1	1	2	
		1st	1	1	2	2	1	1	1	2	
		2nd	1	1	2	2	1	1	1	2	
	Total		3	3	6	6	3	3	3	6	

Table 2.28 Toilet fixture details in department of **Mathematics and physics**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
19.	**Mathematics and physics**										
	Main block	Gr.	1	1	3	2	x	x	x	X	
		1st									
		T1	1	1	3	1	1	1	1	1	
		T2	1	1	2	3	2	1	1	1	
		2nd	1	1	2	3	x	x	x	x	
	Bose audi	Gr.	x	x	3	1	1	1	1	1	
		1st	x	x	3	1	1	1	1	1	
		2nd	x	x	3	1	1	1	1	1	

		3rd	x	x	3	1	1	1	1	1	
	Total		4	4	22	13	7	7	6	6	

Table 2.29 Toilet fixture details in **IIC**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
20.	**IIC**										65
	Admin block	Gr.	1	1	1	1	1	1	1	1	
	Nuclear block	Gr.	1	1	1	1	unisex				
	As-1	Gr.	1	1	1	1	unisex				
	As-2	Gr.	1	1	1	1	unisex				
	Total		4	4	4	4	1	1	1	1	

Table 2.30 Toilet fixture details in **Mg library**

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Student strength / staff strength
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
21.	**MG library**										580/30
	main	Gr.	2	2	4	2	4	4	2	2	
		1st	2	2	4	2	4	4	2	2	
		2nd	2	2	4	2	4	4	2	2	
	Reading room	Gr.	1	1	1	1	unisex				
	Total		7	7	13	7	12	12	6	6	

2.7.2.1 Analysis of deficit and key issues of toilets in academic buildings

After the survey of the no of toilets and their conditions in the academic departments it was found that total number of WC, wash basin, and urinal bowl in the academic buildings are not as per the NBC 2005 guidelines. The table 2.31 reports the gap in no of toilets and fixtures in respective departments.

Table 2.31 Gap identification of toilet fixtures in all departments.

S No.	DEPARTMENT NAME	Fixtures in male toilet						Fixtures in female toilet			
		Present availability			Required			Present availability		Required	
		Wc	Urinal bowl	Wash basin	Required wc	Required urinal bowls	Required wash basin	Wc	Wash basin	Required wc	Required wash basin
1.	Architecture and planning	4	12	7	9	17	6	5	5	2	1
2.	Department of hydro and renewable energy	4	6	6	3	6	3	3	3	1	1
3.	Biotechnology	3	3	3	9	17	6	3	3	2	1

4.	Chemical engineering	5	11	5	15	30	10	3	3	4	2
5.	Chemistry dept.	8	16	16	6	11	4	6	6	3	1
6.	Earthquake engineering	6	12	12	5	10	3	10	6	1	1
7.	Earth science	6	10	9	9	18	6	2	2	2	1
8.	Electrical engineering	13	22	19	20	40	13	4	4	5	3
9.	Humanities and social science	6	9	9	2	4	1	6	6	1	1
10.	Hydrology	6	10	8	2	4	1	8	4	1	1
11.	Metallurgical and materials	10	26	19	13	27	9	8	8	3	2
12.	Management studies	6	6	4	7	14	5	6	4	2	1
13.	Mechanical and industrial engineering	3	9	5	17	35	12	1	1	4	3
14.	COEDMM	3	3	3	2	4	1	3	3	1	1
15.	C TRANS	3	3	3	1	2	1	3	3	1	1
16.	NANOTECH	3	3	3	2	3	1	3	3	1	1
17.	WRD&M	1	2	2	2	3	1	1	2	1	1
18.	CS and electronics	6	11	5	12	25	8	3	3	3	2
19.	Mathematics and physics	4	22	13	10	21	7	7	6	2	2
20.	IIC	4	4	4	2	4	1	1	1	1	1
21.	MG library	7	13	17	14	29	10	12	6	NA	NA
	Total	104	200	155	148	295	114	86	76	47	32
	Total gap				44	95	0			0	0

Thus in table-2.31 depicts a gap of total 44 WCs and 95 urinal bowls in male toilet. The female toilets though were sufficient in most of department but department of chemical engineering requires more number of female toilets. There are no proper legends that shows the location of the toilet within the premises.

Back water problem mainly during monsoon seasons have been also identified on ground floor toilets. The problem increases more during the monsoon period. Which indicates the the sewerage system has lost the capacity of collecting and discharging the waste water to main sewer lines.

The walls of number of toilets has growth of algae that are clear sign of leakages of either water supply lines or grey water lines. The urinal bowl and wash basin of majorly all department except humanities and social sciences and management studies department are not having bottle trap and are majorly using simply down pipe which results into lot of foul smell within the toilets. Proper gradient has been not provided within the toilets which result into stagnation of water. The toilets with western wc are not having hangers as such it make the use of the toilet not useful for some people. Very few no. of the toilets have been found free from leakages as such it creates

unhygienic environment. Its advisable to have tiles on the walls of toilets or have cubicle units which are easy to operate and maintain.

2.7.3 Existing scenario of toilets in central facilities

The number of toilet provided in central facilities of the campus such as SBI, PNB, post office etc are depicted in table-2.32 Though there was no gap but the condition of the toilet in post office and student club doesn't meet the NBC 2005 Norms. The scenario of condition of toilet was similar as discussed in 2.8.2.

Table 2.32 Toilet fixture details in central facilities

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
23.	**SBI**										22
		Gr.	3	3	2	1	X	X	X	X	
		1st	X	X	X	X	3	3	1	1	
	Total		3	3	2	1	3	3	1	1	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
24.	**PNB**										15
		Gr.	1	1	1	1	1	1	1	1	
	Total		1	1	1	1	1	1	1	1	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
25.	**POST OFFICE**										3
		Gr.	1	1	X	1	UNISEX				
	Total		1	1	x	1	x	x	x	x	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
26.	**Student club**										161/5
		Gr.	1	1	2	1	1	1	x	1	
	Total		1	1	2	1	1	1	x	1	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
27.	**Convo. hall**										1200
		Gr.	4	4	6	2	6	6	x	4	
	Total		4	4	6	2	6	6	x	4	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
28.	**Lecture hall complex**										5760
		Gr.									
		T1	2	2	12	3	4	4	1	3	
		T2	2	2	8	3	4	4	1	3	
		1st									
		T2	2	2	12	3	4	4	1	3	
		T2	2	2	8	3	4	4	1	3	
		2nd									
		T2	2	2	12	3	4	4	1	3	
		T2	2	2	8	3	4	4	1	3	
		3rd									
		T1	2	2	12	3	4	4	1	3	
		T2	2	2	8	3	4	4	1	3	
	Total		16	16	80	24	32	32	8	24	

S No.	Name of Department	FLOOR	Male toilets				Female toilets				Population of Department
			Toilet seat	Ablution tap	Urinal bowl	Wash basin	Toilet seat	Ablution tap	Sanitary disposal dustbins	Wash basin	
29.	**MAC**										
	A block	Gr.	4	4	3	2	4	4	1	2	
		1st	4	4	3	2	4	4	1	2	
		2nd	4	4	3	2	4	4	1	2	
		3rd	4	4	3	2	4	4	1	2	
		4th	4	4	3	2	4	4	1	2	
	B block	Gr.	6	6	5	4	6	6	1	4	
		1st	6	6	5	4	6	6	1	4	
		2nd	6	6	5	4	6	6	1	4	
		3rd	6	6	5	4	6	6	1	4	
	Total		44	44	35	26	44	44	9	26	

The number of toilets in central facilities were found to be adequate as per table-2.32 but the conditions of the toilets of student club and post office are very unhygienic and demands immediate renovation works.

2.7.4 Existing scenario of toilets in hostels

There are total 17 hostels out of which 9 are boys hostel, 2 girls hostel, 4 hostels for married couples, and 2 hostels is assigned for international students. The number of toilets components provided in these hostel are listed down in the table-2.33.

Table 2.33 Detail of toilets fixture in students hostels

S No.	Name of Hostel	Total of all floors	Male toilets							Student strength. Residing/ Total capacity
			Male wc seat	Ablution tap	Urinal bowl	Wash basin	Bathroom	Drinking water fountain	Dustbin	
1.	**Ganga Bhawan**									494/525
	Hostel									
		Total	71	71	46	76	68	46	X	
	Mess									
		Total	x	x	4	4	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
2.	**RKB Bhawan**									598/632
	Hostel									
		Total	84	84	84	112	84	42	x	
	Mess									
		Total	1	1	6	9+3	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
3.	**Rajendra Bhawan**									855/890
	Hostel									
		Total	93	93	90	93	84	39	x	
	Mess									
		Total	1	1	x	9	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
4.	**Cautley Bhawan**									891/961
	Hostel									
		Total	111	111	102	102	139	40	x	
	Mess									
		Total	x	x	4	6+1	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
5.	**Rajiv Bhawan**									660/675
	Hostel									
		Total	138	138	207	138	138	48	x	
	Mess									
		Total	x	x	x	7	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
6.	**Azad Bhawan**									426/460
	Hostel									
		Total	78	78	51	66	66	24	x	
	Mess									
		Total	1	1	1	1+7	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
7.	**Govind Bhawan**									604/636
	Hostel									
		Total	81	81	54	57	69	28		
	Mess									

		Total	x	x	4	8	na	na	X	
	Canteen									
		Total	x	x	x	x	x	x	x	
8.	**Jawahar Bhawan**									557/600
	Hostel									
		Total	64	64	64	64	64	24	x	
	Mess									
		Total	x	x	5	8	na	na	x	
	Canteen									
		Total	1	1	2	2	x	2	x	
9.	**Ravinder Bhawan**									440/500
	Hostel									
		Total	93	93	79	85	100	32		
	Mess									
		Total	1	1	4	6	na	na	x	
	Canteen									
		Total	1	1	2	2	X	2	x	

S No.	Name of Hostel	FLOOR		Female toilets						Student strength Residing/ Total capacity
			Female toilet seat	Ablution tap	Cleaner sink	Wash basin	Bathroom	Drinking water fountain	Dustbin	
10.	**Sarojini Bhawan**									352/400
	Hostel									
		Total	57	57	18	42	57	21	18	
	Mess									
		Total	2	2	x	8	na	na	x	
	Canteen									
		Total	2	2	x	2	x	2	x	
11.	**Kasturba Bhawan**									700/725
	Hostel									
		Total	140	140	28	70	140	34	28	
	Mess									
		Total	2	2	x	8	na	na	x	
	Canteen									
		Total	2	2	x	2	x	2	x	

2.7.4.1 Analysis of deficit and key issues of toilets in hostels

The fixtures in the toilets of Rajender Bhawan, Cautley Bhawan, Govind Hhawan, Jawahar bhawan and Sarojini Bhawan in comparison to NBC 2005 are almost adequate with little variation. The table-2.34 depicts the gap in toilet fixtures of the hostels. It has been identified majorly in old Bhawans that the toilets in ground floor are having issue of back water because of which some of the toilets becomes non-functional. The problem increases more during the monsoon period. Which indicates the sewerage system has lost the capacity of collecting and discharging the waste water to main sewer lines. The walls of number of toilets has growth of algae that are clear sign of leakages of either water supply lines or grey water lines.

Table 2.34 Gaps in toilets

S No.	Hostel	Presently avaliable				Required	
		Wc	Urinal bowl	Wash basin	Bathroom	Required wc/wash basin/bathroom	Required urinal bowls
1.	**Ganga Bhawan**	71	46	76	68	66	21
2.	**Rkb Bhawan**	84	84	112	84	79	25
3.	**Rajendera Bhawan**	93	90	93	84	111	35
4.	**Cautley Bhawan**	111	102	102	139	120	38
5.	**Rajiv Bhawan**	138	207	138	138	84	27
6.	**Azad Bhawan**	78	51	66	66	57	19
7.	**Govind Bhawan**	81	54	57	69	79	26
8.	**Jawahar Bhawan**	64	64	64	64	75	24
9.	**Ravinder Bhawan**	93	79	85	100	62	20
10.	**Sarojini Bhawan**	57	NA	42	57	66	NA
11.	**Kasturba Bhawan**	140	NA	70	140	120	NA

The mess of jawahaar bhawan, cautley bhawan, rajiv bhawan, ganaga bhawan also do not provide facility for WC in washroom areas. Toilets in the bhawans have directly supply of the water from the water tanks but there is no valve provided for any toilet which can stop the supply in case of leakages and maintenance work with in toilets. The one which is provided, will stop the supply of all the toilets of respective hostel of which maintenance work has to be carried out.

2.8 Roads and open spaces

The total length of the road is 16.81km. The roads are well maintained. Sweeping is done once a day and garbage from the waste storage depots are being taken away on regular basis. It has been identified at various location the doors of concrete dustbins and the height are such that they are unable to restrict the entrance of dogs inside the chamber. As such the large amount of waste are being dragged outside the concrete bins on road. The issues is also with the open drain shown in Fig-2.9 which are on either side of the road get choked because of the garbage and litters on account of runoff water and at certain points it was found that the sweeper purposely dump the the dirt into drains moving along the road. Which decreases water taking capacity and also chokes the drain at some point. The no of dustbins which are located are sufficient but at only 13 % location twin dustbins have been installed for segregation of waste at source. There is certain location identified which demands dustbins and has been shown in Fig - 2.9. A poor habit of not putting the garbage within the waste storing bins have been found at

certain location and specially near the new night canteens. Table 2.35 pic shows depots were the construction materials are lying. Certain location where heap of garbage is lying is shown in table 2.35 and location is numbered in Fig-2.9.

As far as green spaces and lawns are concerned, they are lacking the requisite no of dustbins as per the norms. The dustbins in this location are cleaned after every 3 days which result into foul smell in surroundings.

Fig -2.9 Location of dustbins and other components in campus

Various location within the campus that were found inadequate are numbered in fig-2.9 and their issues are number wise tabulated in Table-2.35 with supporting photographs.

Table 2.35 Photographs of sites within campus

	
1.Manual scavenging	**2. Heap of sludge**

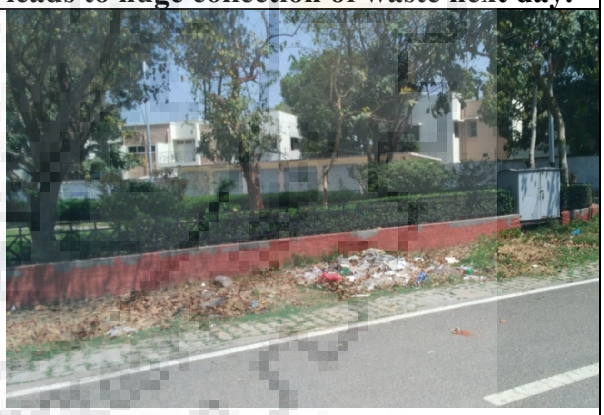
3. Heap of garbage in front of azad bhawan

4. Sludge lying aside the road and leads to foull smell

5. Garbage lying in front of mac

6. Non availability of kitchen for small fn. leads to huge collection of waste next day.

7. Heap of garbage beside Cautley bhawan.



8. Garbage lying on footpaths.

9.Damaged door lock

10. Unavailability of dustbin for SAC

11. Garbage lying outside the dustbins

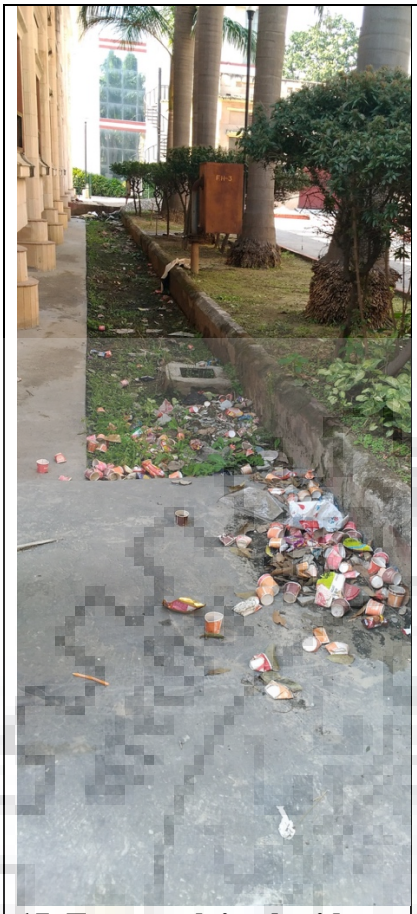
12. After 3 weeks demolished waste was removed

13. Garbage lying outsode the bin

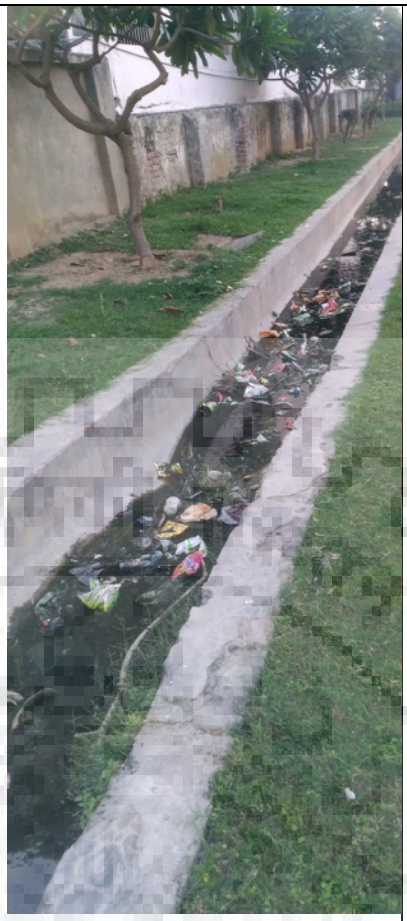
14. Garbage lying outside the bins

15. Garbage lying outside the bins and watchman room used for storing garbage.

16. Heap of garbage near SAC



17. Tea cups lying beside road.



18. Waste blocked the open drain.

19. Open drains.

20. Open drain

21. Open drain

22. Open drain

23. Construction and demolition waste lying since last 2 months

24. Dry leaves lying outside the dustbins.

25. Heap of garbage

26. Excess construction material lying.

27. Improper trimming of grasses

28. Construction material heap

29. Sign of dry waste burning

30. Damaged doors

31. Garbage at gate no 8

32. Improper foothpath

33. Sweeping of foothpaths

34. Improper hedging of grasses

In this chapter , the practices are identified to carry out cleanliness, SWM and WWT in the campus. The amount of solid waste generated within the campus was estimated and the available mechanism and infrastructure for their disposal are identified. The gaps in the infrastructure needed to improve the proper collection, segregation and disposal, identified. The loopholes identified is the lack on the emphasis on the post process of waste collected from the clean-up. The accurate supply chain and awareness on handling the waste after cleaning needed to be defined. The source wise contribution to solid waste generation was analyzed also. Each premise and open space is analyzed on the basis of developed parameter, to find out their adequacy, are discussed in next chapter. The other vital area is the sanitation issue, apart from the emphasis on building toilets the maintenance issue is also needed. The shortage in the number of toilets for female and male users in various premises are estimated. The conditions of the toilets were found very poor and unhygienic that requires immediate attention for improvement on priority basis for success of the Swachh Bharat Mission.

Chapter 3
Results and Discussion

3.1 General

On the basis of the parameters and individual rating of each aspect listed in the annexures, the combined rating are obtained for each hostels, administrative building, academic building, residential areas, other group of supportive buildings and open spaces that reflects the degree of cleanliness within each premises. The values also reflect the frequency of cleaning, manpower, solid waste management, light ventilation and infrastructure maintenance level of each premises. The general lacunas of the premises needs to be taken on the priority are also discussed zone wise.

3.2 Hostels

There are total 9 boys hostel, 2 girls hostel, 4 married hostel and 2 guest house. After analysing each of the hostel with respect to parameters developed the result has been discussed- The analysis result of the study sites are given in table-3.1 and Fig-3.4, which takes into account level of cleanliness, frequency of cleaning, manpower, resource availability, efficiency in SWM, availability of proper light and ventilation in toilets, rooms, corridors, staircases, etc and how effectively the infrastructure are maintained. The lower the score the more the improvement required to effectively tackle the shortcomings. The shortcomings have been discussed in subsequent headings.

Table 3.1 Rating of hostels

HOSTEL	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
Ganaga	3.3	3.6	3.4	3.5	1.9	4.4	3.5	*3.37*
Radhekrishna	3.3	4	3.4	3.5	1.9	4.4	3.5	*3.43*
Rajendra	3.4	3.3	3.6	3.5	2.21	3.6	3.75	*3.34*
Cautley	3.62	4.6	3.3	3.75	2.5	3.8	4	*3.65*
Rajiv	3.63	3.6	3.7	3.5	2.6	3.6	3.75	*3.48*
Azad	3.62	4.6	3.3	3.75	2.5	3.8	4	*3.65*
Govind	3.56	3.6	4	3.25	2.36	3.6	4.75	*3.59*
Jawahar	3.69	4.66	3.5	3.5	2.47	4.2	2.75	*3.54*
Ravindra	3.77	4.6	3.6	3.5	2.5	3.4	3.75	*3.59*
Sarojini	3.68	4.5	3.6	3.75	2.47	4.2	2.75	*3.56*
Kasturba	3.7	4.33	3.6	3.75	2.36	3.8	3.75	*3.61*
Khosla guest house	4.8	5	4.8	4.5	2.5	4	4.5	*4.30*
NC Nigam	4.8	4.8	4.3	4.2	2.3	4.5	4.8	*4.24*
GP hostel	3.79	4	3.4	3.5	2.4	3.6	3.5	*3.46*
MR Chopda hostel	3.54	4.3	3.6	3.75	2.57	3.8	2.6	*3.45*
D.S. Barrack	3.61	4.6	3.7	3.5	2.57	3.8	2.6	*3.48*
K.I.H.	4.8	5	4.2	4.25	2.3	4.4	4	*4.14*
Himgiri hostel	5	5	4.2	4.5	2.4	4.4	5	*4.36*
All HOSTEL	**3.87**	**4.34**	**3.73**	**3.75**	**2.38**	**3.96**	**3.74**	***3.68***

3.2.1 Toilets:

The graph in Fig-14 shows the no. of toilets and drinking water fountain deficit in each hostel With respect to National Bulding Code 2005 and IS1172:1993. The fixtures in the toilets of Rajender bhawan, Cautley bhawan, Govind bhawan, Jawahar bhawan and Sarojini bhawan in doesn't meet NBC 2005 standards. The gap in the fixtures of the toilet are given in Fig-3.1. It has been identified majorly in old Bhawans that the toilets in ground floor are having issue of back water because of which some of the toilets becomes non-functional. Sanitary supervisor of campus told that its due to inner lining of old sewer pipes they have lost their carrying capacity. The problem increases more during the monsoon period. Thus the sewerage system has lost the capacity of collecting and discharging the waste water to main sewer lines. The walls of number of toilets has growth of algae that are clear sign of leakages of either water supply lines or grey water lines. The condition of the toilets can be predicted from the Fig-3.3.

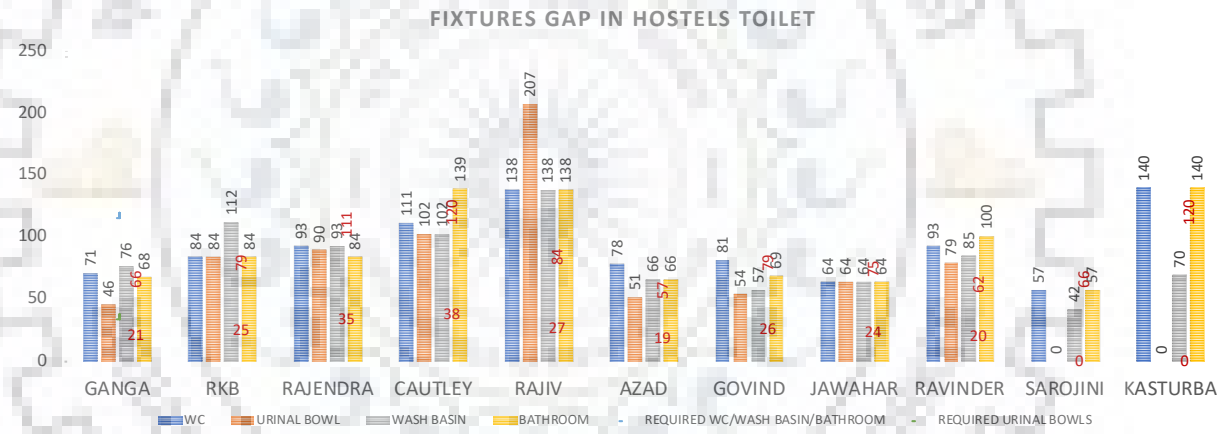


Fig -3.1 Graph showing gap with the fixtures of toilet.

The urinal bowl and wash basin of majorly all hostels are not having bottle trap and are majorly using simply down pipe which results into lot of foul smell within the toilets. In all the hostel open drain carrying urine waste were identified. The toilets of Cautley Bhawan , RKB, have soap dispenser but hey are never filled. None of the hostel common areas have separate toilet for females. The mess areas of Jawahaar Bhawan, Cautley Bhawan, Rajiv Bhawan, Ganaga Bhawan also do not provide facility for WC in washroom areas. Toilets in the Bhawans have directly supply of the water from the water tanks but there is no valve provided for each toilet which can stop the supply in case of leakages and maintenance with in toilets.

The corridors are though regularly cleaned but the floors are full of spots. These spots are not been cleaned by the workers, the mopping is done only for dust as shown in Fig-3.2. The

sewer line and the unsealed manhole which are in line with the periphery of buildings leads to lot of foul smell on ground floor rooms as shown in Fig-3.2.

Fig -3.2 Picture depicting lacunas in hostels.

3.2.2 Frequency of cleaning, manpower and resource availability

The aim and objective is to provide a clean, hygienic and presentable look to the entire area all the time. No mechanism was there so that the General Section could monitor the cleanliness of the entire area all the time, The supervisor was not ensuring that the staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly. It was also identified that cleaning of corridors and staircases with disinfectant in Cautley, Sarojini, Ganaga Bhawan were not on a regular basis. Even the stains were removes partially

from the floors. Wastage from the dustbins should be removed twice in a day but it was not observed.

1. & 2. Algae growth inside the bathroom.	3. Stains on the wall of staircase
4. Dust collection aside staircase	5. Cobwebs on the lights of the celling.
6. Dust collecting on the damaged net	7. Large amount of garbage collecting.
9. Dust collecting on window sill.	8. Conditions of the wash basins.

Fig -3.3 Location of dustbins and other components in the campus

3.2.3 Solid waste management

As far as solid waste management and segregation at source is concern no twin dustbin provided for dry and wet waste as such all the waste are being collected together and dumped at dumping zone provided in each hostels from where they are being taken by the garbage vehicles to the municipal dump site without pre segregation. No colour coding of the dustbins has been

followed according to norms. In none of the mess food waste disposer were found that eliminate the need of storing biodegradable kitchen waste on the premises. Poor training of all management and tenant staff in the use of the waste system and any equipment. Legal obligation and penalty imposition techniques for proper management of litter was absent in any of the hostel. Even the bulk garden and horticulture waste was being disposed off directly to landfill site, which has huge potential of composting at site. It has been also identified that dogs which are wandering in hostels, damages the dustbins and scatter the waste all round.

3.2.4 Light, ventilation and infrastructure maintenance

The light and ventilation provisions were adequate in the room. But the students of ground floor of Ganaga Bhawan, Cautley Bhawan, Ravinder Bhawan and Sarojini Bhawan keep there windows shut most of the time along with the ventilators which unknowingly effects there health. The reason behind was the foul smell from the manholes and septic tank which need to be solve at priority basis. The maintenance of toilets is very poor because after making the complaint it took a week and in certain cases a month time to resolve the issue.

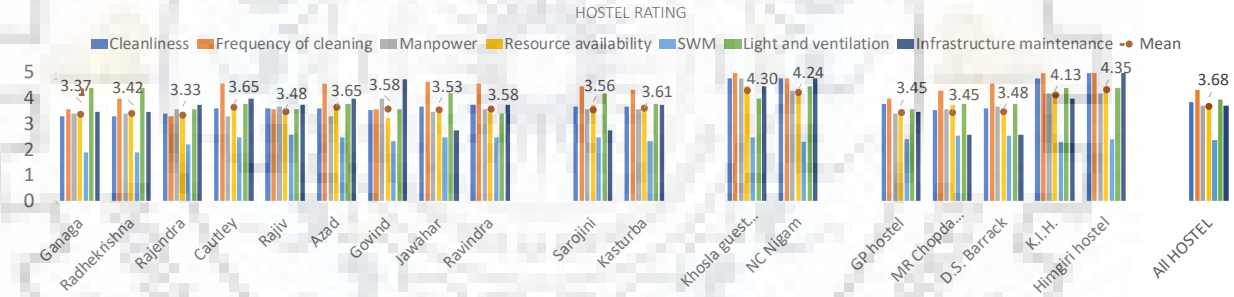


Fig 3.4 Rating of individual hostel

Thus Fig-3.4 shows the individual and overall rating of the hostels that is 3.68. It was repeatedly observed that the poor SWM practices and poor conditions of the toilets in old hostel were the major cause of poor rank.

3.3 Staff Residential Areas

There are total 15 residential blocks within the campus. There are total 9 residential blocks of faculty, 3 residential blocks of B and C type, and 2 residential areas for D grade workers. The analysis results of individual blocks cleanliness on the basis of the developed parameters are given in table-3.2 and Fig-3.5. The findings have been discussed with respect to cleanliness of toilets and apartments, solid waste management, frequency of cleaning, manpower, available resources and light and ventilation subsequently.

Table 3.2 Rating of staff residential areas

STAFF QUARTER	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
Canal view apartment	4	5	3.55	4.75	2.4	4.2	3	*3.84*
Amod kunj	3.77	4	3.55	4.25	2.7	4.2	3	*3.64*
Govind puri	3	4.5	3.2	4	3	3.2	3.7	*3.51*
Nitit nagar	3.67	4	3.7	3.25	3	3.18	4	*3.54*
Ravindra lok	4.66	5	4.88	4.5	3.15	4	4.5	*4.38*
Saraswati kunj	4.22	4	3.88	3.25	2.6	3.6	3.5	*3.58*
Solani kunj	3.5	4	3.22	3.5	2.7	3.2	4	*3.45*
Sheel kunj	3.85	4	4.1	3.75	2.3	3.8	3.5	*3.61*
New teachers hostel	4.51	5	4.8	4.75	2.7	4	5	*4.39*
Vikas nagar	4.32	3.5	3.3	3.75	2.4	3.4	3	*3.38*
Vigyan kunj	4.3	3.5	4.2	4.75	2.6	3.4	3.5	*3.75*
Shivalik	3.93	5	4.4	4.25	3.2	4.6	3.5	*4.13*
Hillview	3.83	3.5	4.2	4.75	3.15	4.2	3.5	*3.88*
Vikas kunj	3.19	2.5	2.7	3	2.5	3.8	2.5	*2.88*
ALL STAFF QUARTER	**3.91**	**4.11**	**3.83**	**4.04**	**2.74**	**3.77**	**3.59**	***3.71***

As far as residential quarter is concern the quarters of A and B types are far better than the C and D types residences that are Solani Kunj and Vikas Kunj respectively, in almost all The aspects of parameters that can be identified from the table-3.2.

3.3.1 Toilets

As D types residential areas toilets have leakages to such a level that household have to ask for maintenance every second year. All else is fine up to large extent as they are being maintained by household, but the common toilet facilities for the worker was not adequate.

3.3.2 Frequency of cleaning, manpower and resource availability

The aim and objective is to provide a clean, hygienic and presentable look to the entire area all the time. The residences of Solani Kunj which falls outside the campus across the Khanjarpur road have been identified with certain blocks which have encroached the common places for their self use. In this scenario the cleanliness and maintenance work is not able to be performed by the workers. The supervisor was not ensuring that the staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly. It was also identified that cleaning of corridors and staircases with disinfectant are not performed by the cleaners even once a week. Even the stains were removed partially from the floors. Wastage from the dustbins should be removed twice in a day but it was not observed so. The workers are also not clearing off the waste from drain lines.

3.3.3 Solid waste management

Auto tippers have been allotted for door to door collection of waste but While conversation with the household of C and D type it was found that they prefer to use more central larger dumping bins rather than segregating the waste and then throwing it in auto tippers because of the timing issues. As the auto tippers collect the waste only once a day. Thus in order to check

this practise of households it is advisable to remove the concrete bins which act as a secondary choice for dumping of waste by households. The segregation of the waste is limited to only wet and dry rather than collecting e-waste separately. The norms for disposing off the sanitary napkins by the households in accordance with solid waste management rule 2016 is not done.

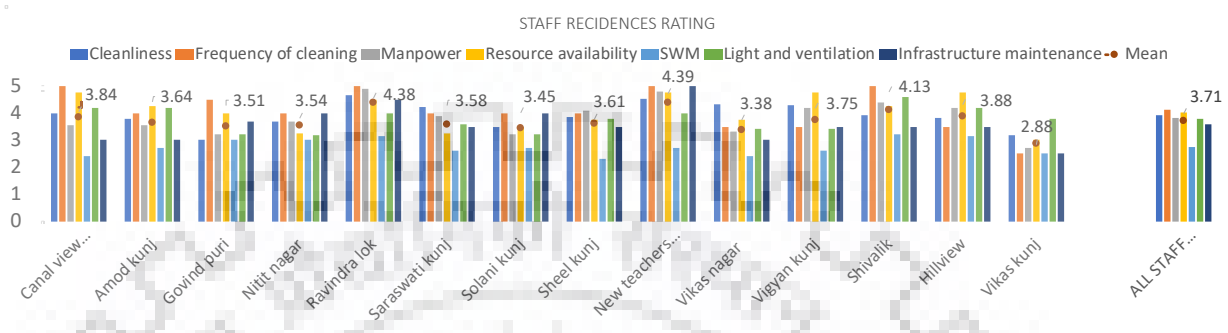


Fig 3.5 Rating of individual staff quarter

Thus Fig-18 shows the individual and overall rating of the staff quarters that is 3.71. It was repeatedly observed that the poor SWM practices and poor conditions of the toilets in D class staff quarter need immediate measures to augment the condition.

3.4Academic and Administrative Zones

The analysis results of individual academic and administrative blocks cleanliness on the basis of the developed parameters are given in table-3.3 and Fig-3.8. The findings have been discussed with respect to cleanliness of toilets and apartments, solid waste management, frequency of cleaning, manpower, available resources and light and ventilation subsequently.

Table 3.3 Rating of academic and administrative areas

ACADEMIC and ADMINISTRATIVE	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
James thomson building	4.32	4.6	4.8	4.5	2.68	3.8	4	*4.10*
DHRE	4.04	4	4.1	4.75	2.52	4	3.75	*3.88*
Architecture and planning	4.22	4.6	4	3.75	2.57	4	4.75	*3.98*
Biotechnology	4.3	4.6	3.88	4.25	2.63	3.8	4	*3.92*
Chemical engineering	3.75	5	4	4	2.73	3.8	3.25	*3.79*
Chemistry	3.76	5	3.77	4	3.05	3.8	3.75	*3.88*
Civil engineering	3.5	4.3	3.8	3.75	2.63	3.8	4.5	*3.75*
CS and electronics	4.25	4.3	3.88	4	2.52	4.2	4.5	*3.95*
Earthquake engineering	3.65	4.3	3.55	3.75	2.52	3.8	4.25	*3.69*
Earth sciences	4.22	4.6	4	3.75	2.57	4	4.75	*3.98*
Electrical engineering	3.47	4	3.55	3.75	2.42	3.2	3.25	*3.38*
Humanities and social sciences	3.62	4	3.55	4.25	2.1	3.8	4	*3.62*
Hydrology	3.44	4	3.55	4	2.36	3.6	3.5	*3.49*
Mathmatics and physics	3.67	4.6	3.77	4	2.42	4	4.25	*3.82*
Mechanical and industrial engineering	3.52	4.6	3.5	3.5	2.63	3.4	3.75	*3.56*
Management studies	4.4	5	5	4.5	3	4.6	5	*4.50*
Metalurgical and materials	3.57	4.3	4	3.75	2.57	4.75	3.75	*3.81*
COEDMM	4.89	5	4.3	5	3.3	4.2	5	*4.53*
CTRANS	4.9	5	4.3	5	3.05	3.8	5	*4.44*
CO Nanotechnology	4.6	5	4.5	4.5	2.52	4.8	5	*4.42*
WRD&M	3.95	5	4.4	4	2.47	4	4	*3.97*
Lecture complex	4.4	5	5	4.5	3	4.6	5	*4.50*
Step office	4.67	5	5	5	2.89	5	5	*4.65*
MG Library	4.72	5	5	5	2.68	5	5	*4.63*
Computer centre	3.82	5	3.8	4.25	2.73	4	3.5	*3.87*
IIC	3.68	5	3.7	4.25	2.68	4	3.75	*3.87*
Post office	3.6	4	3.66	5	1.89	4	3.75	*3.70*
SBI	4.13	4.6	3.44	5	2	5	5	*4.17*
PNB	4.16	4.8	3.66	5	2.3	5	5	*4.27*
TIDES	3.9	4	3.33	3.5	2	3.8	4.25	*3.54*
ACADEMIC AND ADMIN.	**4.04**	**4.61**	**4.03**	**4.28**	**2.58**	**4.12**	**4.28**	***3.99***

All the academic premises are cleaned timely. The infrastructure are well maintained except in some of the premises such as computer centre, architecture and planning, chemical engineering, metallurgical and materials engineering departments where the shortage of storage spaces were found which lead to accumulation of abandoned instruments and materials in lawns of the premises. That were simply resembling like dumping zones. Rest of the issues are discussed in subsequent sub headings.

3.4.1 Toilets

The total number of WC, wash basin, and urinal bowl in the academic buildings are not as per the NBC 2005. The gap in the no of toilets are given in Fig-3.7 and Fig-3.7 There are no proper legends that shows the location of the toilet within the premises. Most of the department does not provide the female toilet facilities on all the floor instead only on one floor which creates problem for female students. There is no proper provision for sanitary waste disposal in the toilets. Back water problem mainly during monsoon seasons have been also identified on ground floor toilets. The problem increases more during the monsoon period. Which indicates the the sewerage system has lost the capacity of collecting and discharging the waste water to main sewer lines. The walls of number of toilets has growth of algae that are clear sign of leakages of either water supply lines or grey water lines. The urinal bowl and wash basin of majorly all

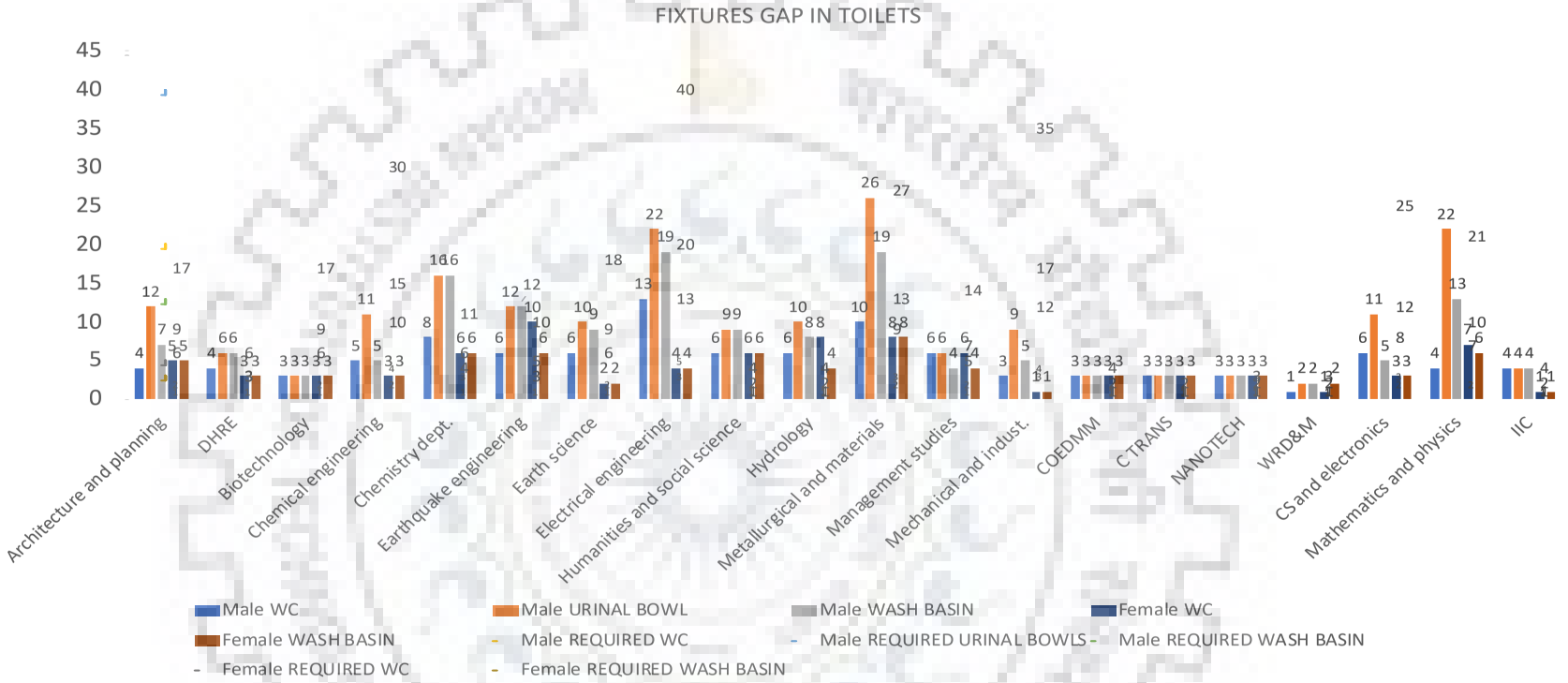


Fig -3.6 Graph showing gap in the fixtures of toilet.

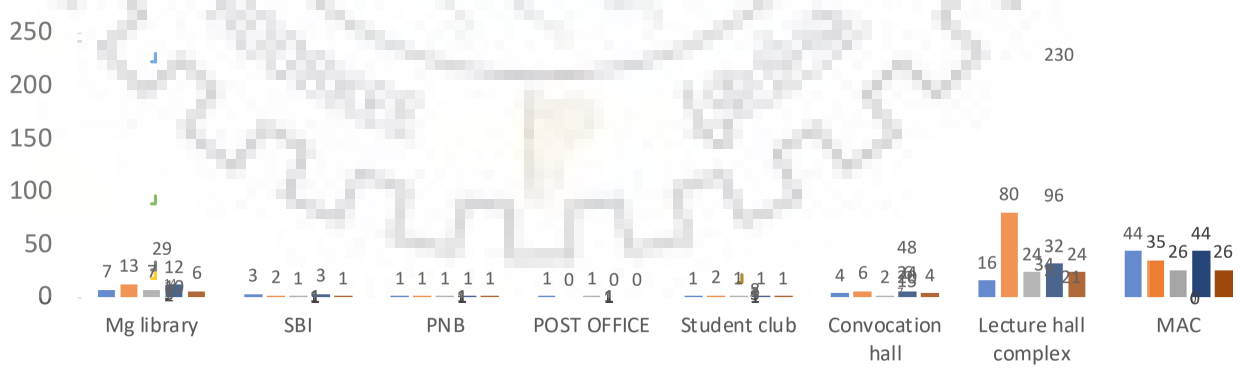


Fig -3.7 Graph showing gap in the fixtures of toilet.

department except humanities and social sciences and management studies department are not having bottle trap and are majorly using simply down pipe which results into lot of foul smell within the toilets. Proper gradient has been not provided within the toilets which result into stagnation of water. The toilets with western WC are not having hangers as such it make the use of the toilet not useful for some people. Very few no. of the toilets have been found free from leakages as such it creates unhygienic environment. Its advisable to have tiles on the walls of toilets or have cubicle units which are easy to operate and maintain.

3.4.2 Frequency of cleaning, manpower and resource availability

The corridors have been identified with cobwebs at certain location. The bird dropping has been majorly identified in the staircase well and open corridors. Other issues can be identified with help of the parameters individually for each department separately.

3.4.3 Solid waste management

As far as solid waste management and segregation at source is concern no twin dustbin provided for dry and wet waste in the department as such all the waste are being collected together and dumped at dumping zone provided for the department. Even the hazardous waste and e-waste are not disposed separately from the general waste. The doors in the dustbins are not locked properly as such waste are being scattered by the street dogs on the road.

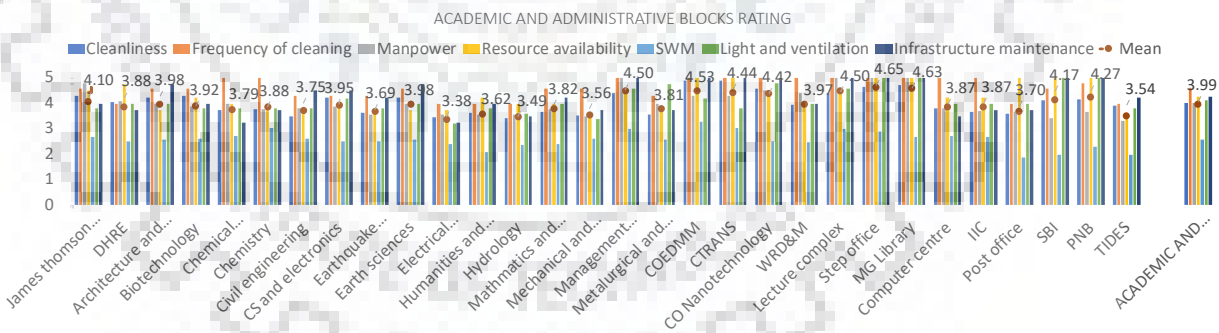


Fig 3.8 Rating of individual academic blocks

Thus Fig-3.8 shows the individual and overall rating of the academic and administrative buildings that is 3.99. The poor SWM practices, shortage, unhygienic condition of toilets and unavailability of the female toilets on each floor are major issues that need to be focused.

3.5 Recreational areas

The analysis result of the study sites are given in table-3.4 and Fig-3.9. It was found that recreational areas scores good in all categories , but the rating is badly effected due to poor SWM practices.

Table 3.4 Rating of recreational areas

RECREATIONAL AREAS	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
Engineering student club	3.69	3.66	3.66	4.75	2.6	4.6	4	*3.85*
Hobbies club	3.66	3.66	3.77	4	2.42	4.6	4	*3.73*
Convocation hall	4.7	4.66	4.55	5	2.52	4	3.25	*4.10*
Gymnasium	4.4	4	4.5	4	2.31	4	3.75	*3.85*
Swimming pool, OATand courts	3.59	4	4	4	2.2	5	3.5	*3.76*
MAC building	4.08	4.33	3.77	4.25	2.57	4.4	4	*3.91*
Community centre	3.61	4	3.1	3.5	2.52	4.8	4.7	*3.75*
SAC	4.8	5	4.5	5	2.52	5	5	*4.55*
RECREATIONAL AREAS	**4.07**	**4.16**	**3.98**	**4.31**	**2.46**	**4.55**	**4.03**	***3.94***

The no. of toilets were not sufficient in hobby club and at student club. There were no waste dumping dustbins were found in SAC building premises as such as such after any function a heap of garbage is collected behind the guard room. Which becomes source of foul smell and unhygienic environment. No. of times they are being scattered away by the street dogs.

No proper availability of kitchen area in mac building near auditorium as such during and after functions a large amount of plates, cups and other items are found scattering all around the mac. The toilets in the mac building lack proper gradient in the toilets because of which water are found most of the time floating on floor. The maintenance of toilets at the ground floor is poor.

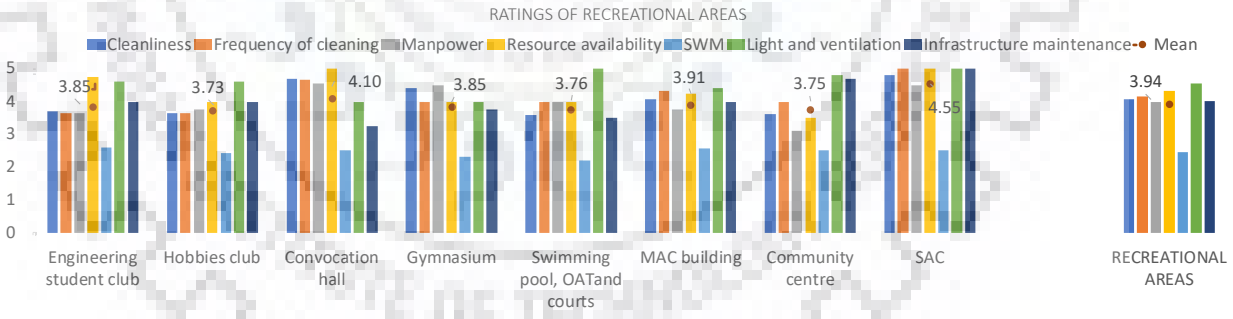


Fig 3.9 Rating of individual recreational areas

The overall rating of the recreational areas is 3.94 which is far better than other premises. But still improvement is required for the food waste generated during any occasion at SAC and MAC. More no. of toilet are required for both engineering student club and hobbies club. The condition of toilet at community centre is worst which requires immediate attention.

3.6 Hospital and School

Institute hospital: The institute has a 50 bedded hospital, with full facility. The analysed result are given in table 3.5 and Fig-12.

Table 3.5 Rating of school and hospital

HOSPITAL	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
Hospital	**3.95**	**4.00**	**3.90**	**3.50**	**3.00**	**3.40**	**3.50**	***3.61***
SCHOOL	**Cleanliness**	**Frequency of cleaning**	**Manpower**	**Resource availability**	**SWM**	**Light and ventilation**	**Infrastructure maintenance**	**Mean**
Abn school	3.23	4.3	3.3	3.75	1.9	4.2	3.5	*3.45*
Anusruti school	2.93	4.3	3.6	3.7	1.8	4	2.5	*3.26*
SCHOOL	**3.08**	**4.30**	**3.45**	**3.73**	**1.85**	**4.10**	**3.00**	***3.36***

As far as biomedical waste is concerned from the hospital which is generated during the process of diagnosis, treatment or immunization of human beings are infectious in nature and need special handling, storage, treatment and disposal mechanism. There was no centralized waste treatment facility for biomedical waste nor the incinerator provision are there. Few of them where having autoclaves and needle dispenser. Chemical disinfection is practiced to certain extent. But by and large the biomedical waste generated lacks proper disposal mechanism. It get mixed with the municipal solid waste as the waste from hospitals are carried along with other waste thus pose a big epidemic threat owing to their infectious nature and tendency to attract growth of pathogens. The Fig-3.11 shows the method adopted for the waste disposal but after the discussion with some of doctors it was found that no proper segregation is being done at the place.

Table 3.6 Type of container and treatment option during the colour code.(26)

Color of bag	Container Type	Treatment
Yellow	Plastic bag	Incineration and deep burial
Red	Disinfected container/plastic bag	Autoclaving , Microwaving, And Chemical Treatment
Blue and White	Plastic bag, puncture, proof And Container	Autoclaving, Microwaving, Chemical Treatment and Destruction and shredding
Black	Plastic bag	Disposal in secured landfill

Bio medical waste should not be mixed with any other type of municipal waste, and must be segregated at the source before storage and transport. Table-3.6 shows the type of container to be used as per the Bio Medical waste management rules 2016. Materials such as syringes, scalpels needles are shown in Fig-3.10. The autoclave technology and incineration can be used for disposal of bio medical waste.

Fig -3.10 Equipment

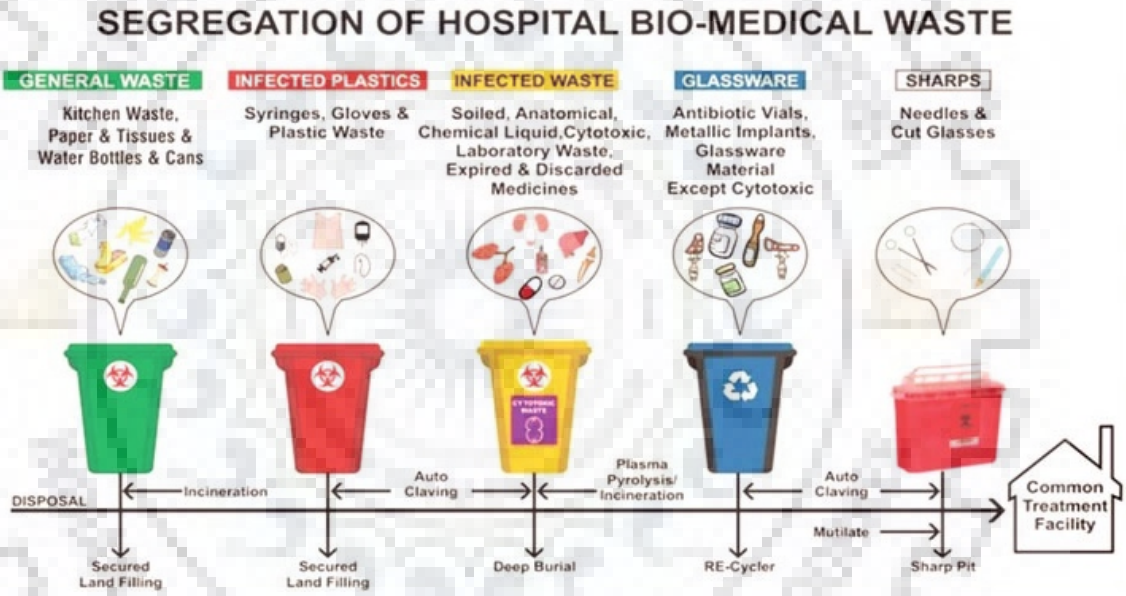


Fig -3.11 Container type for bio-medical waste (26)

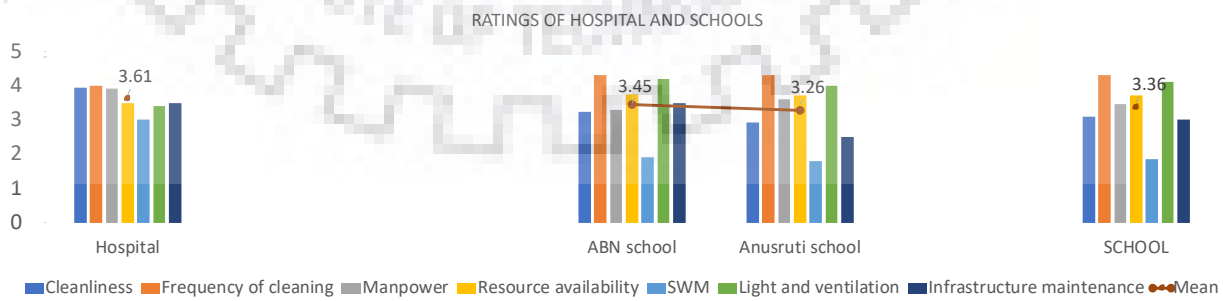


Fig 3.12 Rating of school and hospital

School: The rating of schools is 3.36 as shown in fig 3.12. In schools the no of toilets are far behind the prescribed standard both in primary and secondary blocks. Even after conversation

with students it was found that no of times situation occurs when there is no water in the tap. the girl toilet are sever foul smell. As exhaust were found not working. As far as waste management is concerned then more No. of twin dustbins should be installed as a part of IEC activities in children. Classrooms were poorly maintained because of cobwebs and dirt.

3.7 Green spaces, roads and religious building

The picturesque site and blossoming green environment makes the campus, free from pollution. The campus is spread over 358.5 acres of lush green land has more than 2,500 trees maintained by horticulture department. The campus is also having well maintained 16.81km of road network for connectivity. The analysed results are given in table-3.7 and Fig-3.13.

Table 3.7 Rating of roads, green spaces and religious buildings

PARKS/ GREEN SPACES	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM			Mean
PARKS/ GREEN SPACES	4.09	4.00	4.10	4.75	2.57			*3.90*
ROADS	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM			Mean
ROADS	3.60	5.00	4.20	4.25	2.92			*3.99*
RELLIGIOUS BUILDING	Cleanliness	Frequency of cleaning	Manpower	Resource availability	SWM	Light and ventilation	Infrastructure maintenance	Mean
Mosque	3.66	3.66	3.77	4	2.42	4.6	4	*3.73*
Saraswati building	4.7	4.66	4.55	5	2.52	4	3.25	*4.10*
St. johns church	4.8	5	4.5	5	2.52	5	5	*4.55*
RELLIGIOUS BUILDING	4.39	4.44	4.27	4.67	2.49	4.53	4.08	*4.12*

Sweeping is done once a day and garbage from the waste storage depots are being taken away on regular basis. It has been identified at various location the doors of concrete dustbins and the height are such that they are unable to restrict the entrance of dogs inside the chamber, as such the large amount of waste are being dragged outside the concrete bins on road. The issues is also with the open drain which are on either side of the road get choked because of the garbage and litters on account of runoff water and at certain points it was found that the sweeper purposely dump the dirt into drains moving along the road. Which decreases water taking capacity and also chokes the drain at some point.

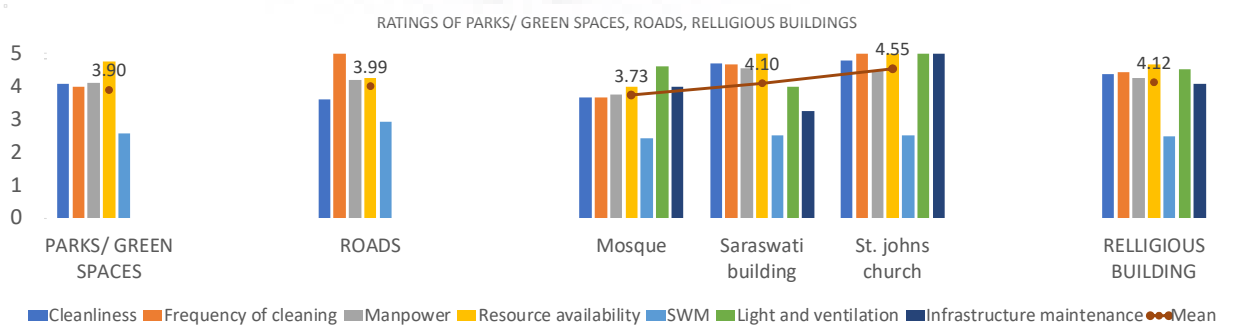
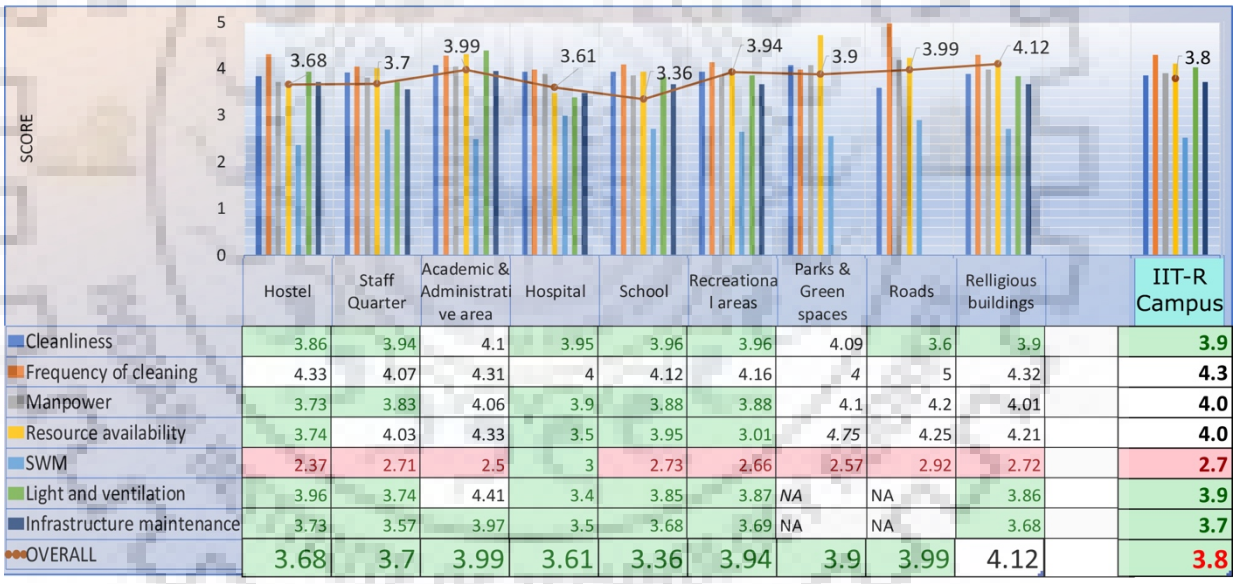


Fig 3.13 Rating of roads, religious building, parks and green spaces

The no of dustbins which are located are sufficient but at only 13 % location twin dustbins have been installed for segregation of waste at source. There are certain location identified which demands dustbins and has been shown in Fig -3.13. A poor habits of not putting the garbage within the waste storing bins have been found at certain location and specially near the new night canteens. Depots were found where the construction materials and heap of garbage is lying. Which overall reduces the rating of cleanliness for roads. As far as green spaces and lawns are concerned they are lacking the requisite no of dustbins as per the norms. sometimes the dustbins in this location are cleaned after every 3 days which result into foul smell in surroundings.

3.8 Overall rating:

Till now the individual rating of the premises on the line of developed parameters were discussed. In this heading the overall combined rating is analysed in Fig-3.14. It is clearly depicted from the Fig-3.14 that the overall rating 3.8 is majorly because of poor solid waste management up to large extent.



	Hostel	Staff Quarter	Academic & Administrative area	Hospital	School	Recreational areas	Parks & Green spaces	Roads	Relligious buildings	IIT-R Campus
Cleanliness	3.86	3.94	4.1	3.95	3.96	3.96	4.09	3.6	3.9	**3.9**
Frequency of cleaning	4.33	4.07	4.31	4	4.12	4.16	4	5	4.32	**4.3**
Manpower	3.73	3.83	4.06	3.9	3.88	3.88	4.1	4.2	4.01	**4.0**
Resource availability	3.74	4.03	4.33	3.5	3.95	3.01	4.75	4.25	4.21	**4.0**
SWM	2.37	2.71	2.5	3	2.73	2.66	2.57	2.92	2.72	**2.7**
Light and ventilation	3.96	3.74	4.41	3.4	3.85	3.87	NA	NA	3.86	**3.9**
Infrastructure maintenance	3.73	3.57	3.97	3.5	3.68	3.69	NA	NA	3.68	**3.7**
OVERALL	3.68	3.7	3.99	3.61	3.36	3.94	3.9	3.99	4.12	**3.8**

FIG-3.14 CAMPUS RATING

Though till now individual issues for various zones are discussed but here the major problem that restrict the campus from scoring high rating are discussed. The campus rating in fig-3.14 is 2.7 in SWM which is very poor and need immediate focus. The rating of frequency of cleaning is 4.3, resource availability is 4.0, manpower is 4.0 are good as compared to other areas that is cleanliness scoring 3.9 and infrastructure maintenance scoring 3.8 also require attention and need to be improved on priority basis.

3.8.1 Cleanliness of toilets and other spaces

The overall score is 3.9 which is good and according to cleanliness index performing well and requires less improvement, and with small effort the shortcomings can be removed away. Though the overall cleanliness rating of spaces which includes spaces like toilets, rooms, halls, kitchens/pantry, corridors are good but the toilets of the premises are poor to such an extent that they are largely responsible for restricting to score higher rating. It has been also observed that though the number of toilet are according to the NBC 2005 for various buildings but most of the toilets in poor condition due to growth of algae on the wall which is a sign of internal continuous leakages. Most of them have been not provided with the liquid soap, paper napkins and toilet paper. No incinerator was found in any of the female toilet anywhere. Even in some of the public toilets cistern are not in operational mode. These issues has to be resolved to made the toilets 100 percent functional and hygienic. Though the toilets in hostels and residential blocks is approximately near to standard norms in terms of number as compared to academic buildings which lag far behind the norms.

The condition of toilets are severely unhygienic in old hostels . The elements and techniques which are used for discharge of water such as down pipe, open drain, are too old. The issues of the back water need to be checked on priority basis. Existing condition of toilets are not good for example leakages in the walls, untiled wall leads to growth of algae, improper cross ventilation leads to lot of foul smell, sewerage network within premises are very old and not working efficiently. Even the soap dispensed are not filled on call basis. There is absence of incinerator for disposal of sanitary napkins in girls hostels and academic buildings. Negligible no. of toilets were found with the air freshener. Various toilets were even found filled with human excreta because of back water as such it leads to the spread of the disease. There is no availability of a cleaning personal outside the toilets for cleaning once its being used as per the government Swachh Office norms. Most of the toilets are required to be refurbished with the latest hardware that works more efficiently and effectively.

Rooms office and halls have been identified with such zones where lot of dust accumulation is there and mainly because most of the time its outside our vision area. Some windows and structural elements in staircase wells have been identified which are full of bird droppings. There cleanliness steps can be made because they are not approachable.

3.8.2 Solid waste management

The campus is performing very poorly in SWM practices that result into score of 2.7, campus generate near about 3000kg of waste daily. Thus being a bulk generator according to SWM Rules 2016, there is no plant to process the waste itself within the campus. In the present

study, various sources where identified at premises where prior segregation of waste is not done and they are being dumped by the contractor without prior treatment directly to municipal dump site. The auto tippers collect the dry waste and wet waste separately from the residential blocks of faculty, staff and married hostels but they are being dumped to municipal dumping site as there is no solid waste management practice being executed within the campus. All households don't put their dry and wet buckets timely outside their homes. The waste from the academic buildings, hostels and the canteens are being taken away by the lorries without prior segregation to municipal dumping sites as such the campus is being made clean but management part is being left with the municipal corporation.

It was also found that the norms for different colour dustbins for different types of waste at various places in the premises has not been made available. The number of small twin dustbins are negligible within the campus. The open storm water drains are found with lot of choked waste at some points. As such there collection all together, leaves the responsibility of segregation with the cleanliness worker, which shows the poor IEC and citizen awareness towards the waste management. Even there is no mechanism under which penalties can be imposed on citizen for enforcement of segregation and use of bins. Negligible amount of the waste is segregated into wet and dry. Biodegradable waste and recyclable waste such as paper, plastic, glass, rags etc are not separated at source. The collected waste are not transported to processing unit for disposal within the same day. Bulk garden waste and horticulture waste which have rich potential to be used as manure are kept mixed and composted at source.

The result of present study indicates that there is no mechanism to check the disposal of hazardous materials from various department separately, which results into pollution and leaching at the municipal dump yard. The dump yards for the waste which has been made and assigned for various premises at many locations have crossed there limit they and even the doors are not properly locked which results into overflow of waste from the structure outside on the road. The inoperable and open gates of concrete dustbins leads dispersion of waste by dogs.

3.8.3 Frequency of cleaning and manpower

The overall score is 4.3 and 4.0 for frequency of cleaning and manpower respectively. Frequency of cleaning and man power availability is good and requires less improvement as compared to other aspect. Though the cleanliness and maintenance staff are provided with the dress code and photo ID cards but they seldom wear it. There is no arrangement for the substitute staff by the bidder in the absence of staff as a result the part of his work is either left away of

shared by co- workers. There is no mechanism to ensure that the complaint has been completed on the same day. Poor training and supervising of staff wrt solid waste management.

3.8.4 Resource availability

The administration is procuring appropriate and necessary cleaning equipment as per requirements within time and timely maintenance of log book has results in scoring of 4.0, but there is no mechanism to ensure that the resources are being utilised for maintaining the proper cleanliness and solid waste management practices. The floor cleaning vehicles were found out of order for last 4 months. Number of households have not been issued dry and wet dustbins in M R Chopda hostel.

3.8.5 Light and ventilation, infrastructure maintenance

The overall rank is 3.9 for light and ventilation which is good. The provision of lights are sufficient but number of toilets found with full of odour because of poor cross ventilation, or ineffective exhaust. In addition some of the issues of leakages that leads to peeling of plaster from even the outside the buildings and giving a ugly looks were identified. Some of the classrooms found very dirty, having bad odour and inappropriate fixtures in metallurgy and chemical department.

Thus on combining the rating of all the premises and all the aspects cognate to cleanliness the overall ranking of the campus comes to be **3.8,** which is good but need improvement in all the identified issues to further improve the rating. This chapter identifies the individual rating and loopholes which are restricting the campus from securing the higher score on cleanliness index. The findings have been discussed with respect to cleanliness of toilets and other spaces, solid waste management, frequency of cleaning, manpower availability, available resources and light and ventilation. In upcoming chapter, measures are discussed that should be taken to improve the overall rating of campus along with estimation of financial requirement.

Chapter 4
Cost analysis

4 General

The campus spends major budget on SWM, sanitation facilities. Provisioning of universal access to toilet and sanitation facilities is a prime need under SBM to enhance the quality of life. On the basis of the deficiencies and gap found after conducting the structured survey throughout the campus on various attributes that concern the toilet, SWM and sanitation facilities following estimation of financial requirement has been made for filling up the gap and improving the ratings.

4.1 Total cost of toilets

It is found that there is need of providing some 80 more number of toilet seats and 205 more urinals on priority basis to remove the shortage of toilets specially in academic buildings. The cost estimate for toilets has been done with reference to Swachh Bharat Abhiyan guidelines on public toilets 2017.(27)

4.1.1 Capital cost for toilet construction

Table 4.1 cost estimation of toilets and urinals

Sr. No.	Description	Additional toilets	Cost per seat	Cost in lakh INR
1	Construction of toilets	80	75,000	60
2	Construction of urinals	205	25,000	51.25
	Total			**111.25**

4.1.2 O&M cost for toilets

Table 4.2 Maintenance cost of toilets and urinals

Sr. No.	Description	Cost per seat	No. of units/gap	Cost in lakh INR
1	Maintenance of toilet @1%	750	80	.60
2	Maintenance of urinals @1%	250	205	.512
	Total O&M cost annual	1000		
	Total O&M Cost in 5 years			5.562
	Total			**6.67**
	SUB TOTAL	**111.25 + 6.67 Lakh**		**117.92**

The total cost is INR 117.92 lakhs.

4.2 Storm water drainage

The cost estimates for upgradation of existing drains and creation of new drains in the campus is estimated by referring the CDP, authorities and DPR for storm water drainage of IIT Guwahati and is tabulated below.(28)

Table 4.3 Cost estimation of drainage system

Sr. No.	Description	Gap (Km)	Unit Cost INR in lakh	Cost in Lakh INR
1	Pucca open to puca closed	4	7	28
2	Const. of pucca closed	2.5	24	60
3	DPR preparation			
	Sub-total			88
	Annual O&M Cost		@ 2%	1.76
	O&M cost for 5 years			8.8
	Total project cost			**96.8**

4.3 Solid waste processing unit

The cost estimate for bio composting and verimi composting has been done with reference to Swachh Bharat Abhiyan guidelines on Advisory on On-Site and Decentralized Composting of Municipal Organic Waste. (5)

Table 4.4 Cost estimation of vermi-composting plant

Sr. No.	Description	Unit Cost in lakh INR	Gap in tonnes	Amount INR in lakhs
1	Vermi-composting plant for treating 2 tonnes of waste.	1.25	2	2.5
2	O&M cost per annum			16.8
3	O&M cost for 5 years			84
	Total project cost			**86.5**

The total cost is sum of capital cost and five-year O&M Cost for five years. It comes out to be INR 86.5 lakhs.

4.4 Bio- Medical waste disposal

The cost estimate for bio-medical waste disposal for 50 bedded hospital involves the cost of equipment and separate vehicle for disposal. (29)

Table 4.5 Cost estimation for treating bio-medical waste

Sr. No.	Description	Gap in tonnes	Unit Cost in lakh INR	Amount INR inlakhs
1	Incinerator	1	3.5	3.5
2	Autoclave	1	4	4
3	shredder	1	3.5	3.5
4	Small vehicles	1	16	16
5	Housing of equipment		12	12
	Sub-total			39
	centage@8%			3.12
	Total capital cost			42.12
	O&M cost per annum		@ 2%	.84
	O&M cost for 5 years			4.2
	Total project cost			**46.32**

4.5 Total overall cost involved for IITR campus

The total cost estimation for improving the rating by calculate the cost of all elements proposed above is 346.13 lakh provided in table-4.1.

Table 4.6 Total cost estimations

Sr. No.	Elements	Cost in INR Lakh
1	Total cost of toilets	117.92
2	Storm water drainage	96.5
3	Solid waste processing unit	86.5
4	Bio- Medical waste	46.32
Total cost		**347.24**

So by deploying total 347.24 lakh corpus of money, for removing various shortcomings and lacunas the rating of campus can be improved up to large extent. In addition, the other aspects discussed above the following are the suggestive measures to initiate and encourage general users to improve cleanliness.

4.6 Public awareness generation

The Information, education and communication (IEC) activity plays a crucial role in success of any mission. There is pressing need for IEC activities in the city as the stakeholders by and large lacks awareness regarding SWM, sanitation and hygiene. The IEC activities begins with identification of target user groups followed by education of the stakeholders regarding importance of solid waste management and corresponding benefits in terms of social, economical

and health benefits and finally the process of communicating the information in a way most suitable and convincing for each class of stakeholders.

Various activities that can be taken under IEC activities are given below:

- Student and college students- as awareness regarding hygiene will be useful life long.
- Women- they implement the good sanitation practices at the basic household level.
- Youth- they show enthusiastic participation in these activities and can also spread the message better .
- Sanitation workers involved in cleaning of the campus must be educated about various techniques and methods of cleaning, benefits of segregation of waste and regarding linkages between health and sanitation.
- The floating population within the campus should be made aware about hygiene and sanitation best practices so that they may not litter the campus and may take the same message forward to their community.
- Mess workers, canteen workers and workers of other shops establishment should also be educated about the segregation, reuse, and recycle approaches of the waste.

4.6.1 Proposed IEC and awareness generation strategy

The campus sanitation and waste management department should be the main facilitator of the IEC and awareness generation strategy. Some of the strategies that can be adopted and their approximate incurred cost is given in table-4.2 for imparting awareness within the users.

Table 4.7 Cost of IEC and awareness generation initiatives

Sr No.	Description	Total cost INR Lakh
1.	Print media (Pamphlets, cartoon in college brochure, advertisement in local journals etc, special featured articles), short films before starting of movies in convocation hall.	4
2.	Other printed material for publicity like- cups in canteens, local food packaging, stationary etc.	8
3.	Hoarding and posters at waste generator establishments like canteens, mess etc.	1
4.	Hosting of a separate section in the website of IIT-Roorkee that encourages hygiene practices	--
5.	Organizing part or whole of exhibitions, marathons, inter hostel competition, prize initiatives for the student in the hostel with cleanest room.	10
6.	Puppet shows, awareness generation activities like spot painting, poetry recitation, etc during the annual technical and cultural fest.	5

7.	Educating cleanliness workers.	2
	Total	30

4.6.2 Time frame for implementation

The entire process of stakeholder participation and awareness generation should be launched as a campaign for the initial one year and the activities that shows maximum effect should be carried on further to sustain the impact. The awareness generation need to be backed up with adequate resources, motivation and other sections of society to adopt the change in behavior, regulation to bring about change, in case of noncompliance by people and most importantly monitoring of the impact of the sanitation awareness generation campaign so that best practices can be encouraged and least effective practices can be eliminated.

Thus, by successful implementation of all these activities the cleanliness of the campus can be enhanced and rating of the campus can be improved.

Chapter 5
Conclusion and Recommendation

5.1 General

The sanitation, SWM and toilets are the three basic pillars of the Swachh Bharat Mission. The success of mission in campus will depend on the implementation of laid down procedures, regular monitoring of various aspect of cleanliness and taking requisite measures on the basis of it to improve the condition and mitigate the loopholes. In this study all the spaces and premises of campus were analysed on the basis of set of parameters, that were developed by referring literatures and government norms on cleanliness. The study concludes the following points from the analysis that need urgent focus to manage the solid waste, sanitation, and cleanliness of toilets and other spaces within the campus.

5.1.1 Cleanliness of Toilets and other spaces

- The overall score is 3.9 that shows the area is average rating and demands improvement for improving the rating. The rank is lower because of poor toilets scenario in campus as compared to other spaces which need to improve for the success of SBM.
- There is need of constructing more number of toilets as per the NBC 2005 norms, campus has a shortage of 80 WC and 205 urinals overall, which demands sum of 117.92 lakhs for construction.

Construction of new toilets and renovation of old toilets should be done with state-of-the-art technology from fixtures to construction materials, so that the working of the toilets can be improved.

Females toilets where missing at common places and on each floor of no. of academic department, need to be provided on priority basis. Incinerator should be provided in all the female toilet for the disposal of the sanitary napkins.

Sewage lines that have lost their capacity due to inner lining and resulting into backwater in most of the ground floor toilets need to be resolved on priority basis by laying new lines or renovating the older ones.

All other issues identified be resolved.

5.1.2 Solid waste management

- In SWM, campus has secured score of 2.7 which signifies that the solid waste management practices are poor and need to be improved on priority basis. This is largely

due to being a bulk generator under solid waste management rules 2016 there is complete absence of processing wet waste (Bio-degradable waste) to the extent possible in premises itself and develop a system of reuse by- products of processing, that is, compost or biogas etc. for horticulture.

- In campus only 60% of waste is segregated and the balance is directly dumped at Saliyar dumping site which defeats the purpose of SBM. *Thus there is need of adopting proper mechanism so that the segregation and utilisation of the waste can be assured at all level in three separate streams namely – (i) bio-degradable (wet waste); (ii) non-biodegradable (dry waste); and (iii) domestic hazardous wastes in suitable bins/containers.*
- Only 13% dustbins have provisions of dry and wet waste collection due to lack of awareness towards segregation of waste. *Thus twin dustbins should be provided at all the spots.*
- *Horticulture and garden waste generated from premises are not stored separately and directly dumped with all other waste at dumping site. It should be properly stored and composted in composting pits within the campus.*
- Biomedical waste are also not managed as per the Bio Medical waste management rules 2016. Thus posing a threat to spread the disease.

Absence of any pre-treatment plant for biodegradable waste results into unscientific dumping of waste at municipal dumping site. There is need of adopting decentralized methods for the disposal of waste. The administration requires to take initiative for creating awareness among citizens for adopting decentralized methods and reduce, reuse and recycling of waste. Existing Concrete bins have lost their capacity to handle waste at some points and are poorly maintained. Heap of garbage identified at some spot near bins. Their capacity should either be increased or more no of dustbins should be provided.

5.1.3 Storm water drainage

- Unavailability of drain at certain location lead to flooding of roads. Open drains were choked at many points. Thus open drain should be closed and new drain to be provided.
- Storm water can be stored and utilized for secondary purposes. Such an initiative should be adopted either at centralized or decentralized level.

5.1.4 Frequency of cleaning, manpower, resource availability

- The overall score is 4.1 that is good enough due to outsourcing of manpower from outside from three bidders (B Positive, cybex and Bharadwaj electricals). They are adequate to maintain the cleanliness within the campus. The resource allocation should be timely made available except where no maintenance issue is involved. The frequency of cleaning of toilets are once a day, that has to be at least twice and even sometime on call basis.

5.1.5 Lights and ventilation and infrastructure maintenance

- Number of toilets found with full of odour because of poor cross ventilation, or ineffective exhaust. In addition some of the issues of leakages that leads to peeling of plaster from even the outside the buildings and giving a ugly looks need to be checked.
- Some of the classrooms found very dirty, having bad odour and inappropriate fixtures need to be checked.

5.2 Recommendations

5.2.1 Toilets

It is suggested that the academic and administrative buildings, hostels, canteens, and common areas should provide toilets as per the government norms or as per the NBC 2005. The actual no of toilets and deficit have been accessed in this study which could be used by the institute construction and maintenance department for fulfilling the gap. The existing toilet complexes should be renovated at an immediate phase with respect to typical toilet details discuses in this study, so that we can go hand in hand with mission of clean India by 2nd October 2019.

It is suggested that a Detailer project report should be prepared for identification, both spatially and quantitively for the number of toilet seats required and number of toilets to be repaired with in the campus. The DPR should consider the following issues.

1. Assess the number of seats required and provision of female toilets at least 1 on each floor.
2. Identifying the existing toilets requiring repair and installation of proposed toilet complexes.
3. Gender sensitivity
4. Financial mechanism.
5. Feasibility study on the technological options, ease of maintenance, local know how and adaptability and the cost benefit analysis for the public toilet should be also done.

Once done it should be tendered and implemented for constructions and repairing of the toilets.

- Legends in each premises showing the location of various public facilities like toilets, water fountain should also be marked.
- The male and female toilets facilities should also be provided in girls and boys hostel canteens and common places.
- The person should be deployed at each toilet for cleanliness at regular interval in a day.

5.2.2 Storm water

The storm drains at some lengths are open resulting into the accumulation of the waste and blockage of drains so proper grating and covering should be provided to avoid deposition of garbage inside the drains.

5.2.3 Solid waste management

- The method should be adopted for segregation of the waste at hostel users level also. In order to encourage the practise of segregation of waste at source the concrete dustbins at the residential blocks should be removed to avoid the unnecessary dumping of waste thereby making the landscape dirty in the residential zones.
- The number of twin dustbins have to be increase within campus. Certain strict monitoring and punitive measures should be adopted for the violators.
- Setting up of centralized and decentralized treatment plants for biodegradable waste from mess, canteen and residential areas processes like bio composting, vermi-composting can be adopted at small scale. The solid waste generated in the premises should be managed as per the Solid Waste Management Rules, 2016

5.2.4 Bio-medical waste

Segregation of biomedical waste into container bags at the point of generation in accordance with schedule 2nd of biomedical waste management and handling rules 2001. Autoclaving should be adopted for highly infectious material. Final treatment methods like incineration, autoclaving, hydroclave or microwave be adopted.

Thus, last but not the least by surveying the campus time to time such issues can be identified and measures can be adopted to remove them. This kind of survey can also be conducted across other Central and state level institutes on the basis of annexures (developed parameters) to provide a comparative ranking and inculcate a sense of competition towards this aspect of cleanliness.

Paper writing

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Questionaries For Collection of Data

ACADEMIC AND ADMINISTRATIVE DEPARTMENT

Name of the department:

Predominant building use:

Department population:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	STUDENT	RATING
1	Water supply	45lt per head per day		
2	Male toilet seats	1 seat per 25 employees	1/40 student	
3	Female toilet seats	1 seat per 15 employees	1/15 student	
4	Ablution tap	1 water tap with ever toilet seat 1 tap per 50 employees in vicinity of toilet		
5	Urinals	Nil upto 6 person 1 for 7-20 person 2 for 21-45 person 3 for 46-70 person From 101- 200 person, add at the rate of 3 % For over 200 person add add at the rate of 2.5%		
6	Wash basin	1 per 25 employees	1/60(M) 1/40(F)	
7	Drinking water fountain	1 per 100 employees	1/50 Student	
8	Cleaner's sink	Minimum 1 per floor		
9	Dustbins	External area/ open spaces/ garden: 2/100m Office room: 1per desk Toilets: 1 per toilet Canteens: as per need but should have segregation. Conference rooms: 1 per room Visitors room: 1 per room Library: as per need		

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
1.	Foul odour within the toilet and surroundings.	
2.	Stains on the toilet seat/wash basins of sanitary area.	
3.	visible human faecal matter in the toilet.	

4.	Garbage/ litter strew in and around the toilet.	
5.	Stagnant of flowing water in and around the toilet.	
6.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	
7.	Water supply system.	
8.	Fixtures for adequate light and ventilation.	
9.	Operational locking system in door and Windows.	
10.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	
11.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
12.	Incinerator in toilet blocks for females wherever required.	
13.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
14.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
15.	Removal of waste from dustbin daily or call basis.	
16.	Housekeeping personnel available.	
17.	Algae growth on the wall and celling.	
18.	Check for Seepages in building.	
19.	Cleaning of Chrome fitting, glass frame, dispenser.	

(B) ROOMS, OFFICES HALLS:

SL NO.	PARAMETERS	RATING
1.	Foul odour within the room.	
2.	Fixtures for adequate light and ventilation.	
3.	Operation locking system in door and Windows.	
4.	Carpet/ floor should not have dirt litter spots and stains.	
5.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
6.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
7.	There should be no cowebs gives on wall ceiling fixture such as painting, clocks are behind under the furniture.	
8.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
9.	Room should be free of insects, pest, bird droppings and rats.	
10.	Cleaning of electrical fittings and AC vents.	
11.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
12.	Dustbin availability/ wastage removal.	
13.	Housekeeping personnel available.	
14.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
1.	Stains on the walls and ceiling.	
2.	Stains, garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
3.	Fixture for adequate light and ventilation.	
4.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
1.	The kitchen is smoke free and Fly- proofed.	
2.	Presence of cockroaches, flies, rats and other scavengers which are sure signs of unhealthy environment should not be there.	
3.	Employees and person who are working with food should look neat and clean	
4.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
5.	Food remains and dirt on the floor from previous guest are removed.	
6.	Water and food in the kitchen may not be present and effused on the floor.	
7.	Only healthy employees can work with food	
8.	Disinfection of tables and furnitures with disinfectant.	
9.	Place of trash (cans, container) should be with orderly stored waste.	
10.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
1.	Efficiency of redressal of complaint related to sanitation.	
2.	Cleaning of septic tank/pit.	
3.	Cleaning of overhead water tank/sump.	
4.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS, STILT, BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
1.	Check if grass moving and hedge clipping has been done.	
2.	Storm fallen trees have been removed.	
3.	All signage's have been cleaned.	
4.	Removal of All dry branches of Shrub plants.	
5.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, gates etc. should be clean.	

6.	Remove all dead trees.	
7.	Removing of grass and Hedges trimming same day.	
8.	Provisions for removal of storm water.	
9.	Driveway should free of any litter and fallen leaves.	
10.	Parking should be properly paved with proper gradient.	
11.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	
12.	Check whether mowing, has been done.	
13.	Potholes or spaces where stagnant water is collecting should not be present.	

2. Frequency of cleaning

SL NO.	PARAMETERS	RATING
1.	Housekeeping/ cleaning services should be done daily from Monday to Saturday. The working timings will be 8:30 am to 5:00pm daily & from 9.00 a.m. to 2.00 p.m. on Saturdays. [source: sop office. mohua]	
2.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	
3.	The cleaning in occupied area should be done, as and when, the halls/ rooms/ cabins are opened and in the presence of the officer concerned or and in the presence of his/her authorized representative twice in a day in addition on call basis.	

3. Availability of manpower

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
5.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
6.	Train, control and supervise staff under its establishment.	
7.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
8.	Cleaning schedules ensure that no area is missed from routine cleaning.	

9.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availability

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Is the segregation of wet and dry waste is done ?	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
7.	Biodegradable solid waste composted at site.	
8.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
9.	Percentage of wet waste Treated either by decentralized or centralised processing.	
10.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
11.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
12.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
13.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
14.	No visible solid waste in drains and water bodies.	

15.	Plastic should not be as seen plastic banned.	
16.	Scientific waste processing. Scientific landfilling and Construction and Demolition waste management.	
17.	Penalties on citizens for enforcement of segregation and use of bins	
18.	Cleaning of storm drain and surface of water bodies	
19.	Waste picker trained to collect dry and wet waste separately.	

6. Light and ventilation

SL NO.	PARAMETERS	RATING
1.	Sufficient amount of natural light within rooms, halls, corridors, staircase.	
2.	In absence of natural light there is provision for artificial lighting.	
3.	All the lighting fixtures are in working condition.	
4.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.	
5.	In absence of natural ventilation there is provision for mechanical ventilation.	

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING
1.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)	
2.	if it is then it should be removed away by the concerned agency on a weekly basis.	
3.	Seepages in building	

Questionaries For Collection of Data

RESIDENTIAL AREAS

Name of the building:

Predominant building use:

Population:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	RATING
1	Water supply	135lt per head per day	

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
1.	Foul odour within the toilet and surroundings.	
2.	Stains on the toilet seat/wash basins of sanitary area.	
3.	visible human faecal matter in the toilet.	
4.	Garbage/ litter strew in and around the toilet.	
5.	Stagnant of flowing water in and around the toilet.	
6.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	
7.	Water supply system.	
8.	Fixtures for adequate light and ventilation.	
9.	Operational locking system in door and Windows.	
10.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	
11.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
12.	Incinerator in toilet blocks for females wherever required.	
13.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
14.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
15.	Removal of waste from dustbin daily or call basis.	
16.	Housekeeping personnel available.	
17.	Cleaning of Chrome fitting glass frame dispenser so folder.	

(B) ROOMS, OFFICES, HALLS:

SL NO.	PARAMETERS	RATING
1.	Foul odour within the room.	
2.	Fixtures for adequate light and ventilation.	

3.	Operation locking system in door and Windows.	
4.	Carpet/ floor should not have dirt litter spots and stains.	
5.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
6.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
7.	There should be no cow gives on wall ceiling fixture such as printing clocks are behind under the furniture.	
8.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
9.	Room should be free of insects, pest, bird droppings and odour.	
10.	Cleaning of electrical fittings AC vents.	
11.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
12.	Dustbin availability/ wastage removal.	
13.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
1.	Stains on the walls and ceiling.	
2.	Stains garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
3.	Fixture for adequate light and ventilation.	
4.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
1.	The kitchen is smoke free and Fly- proofed.	
2.	Presence of cockroaches, flies rats and other scavengers are sure signs of unhealthy environment.	
3.	Employees and person who are working with food should look neat and clean	
4.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
5.	Food remains and dirt on the floor from previous guest.	
6.	Water and food in the kitchen may not be present and effused on the floor.	
7.	Only healthy employees can work with food	
8.	Disinfection of tables and furnitures with disinfectant.	
9.	Place of trash (cans, container) should be with orderly stored waste.	
10.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
1.	Efficiency of redressal of complaint related to sanitation.	
2.	Cleaning of septic tank/pit.	
3.	Cleaning of overhead water tank/sump.	
4.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS STILT BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
1.	Check if grass moving and hedge clipping has been done.	
2.	Storm fallen trees have been removed.	
3.	All signage's have been cleaned.	
4.	Removal of All dry branches of Shrub plants.	
5.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, signage's gates etc. should be clean.	
6.	Remove all dead trees in the park.	
7.	Removing of grass and Hedges trimming same day.	
8.	Provisions for removal of storm water.	
9.	Driveway should free of any litter and fallen leaves.	
10.	Parking should be properly paved with proper gradient.	
11.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	
12.	Check whether mowing, hedge clipping has been done.	
13.	Potholes or spaces where stagnant water is collecting.	

2. Frequency of cleaning

SL NO.	PARAMETERS	RATING
1.	Housekeeping/ cleaning services should be done dail. The working timings will be 8:30 am to 5:00pm daily. Are the staff also availed for the night duties.	
2.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	

3. Availability of manpower

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to	

	ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
5.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
6.	Train, control and supervise staff under its establishment.	
7.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
8.	Cleaning schedules ensure that no area is missed from routine cleaning.	
9.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availability

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
7.	Biodegradable solid waste composted at site.	
8.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and	

	mask) to all workers handling solid waste and the same are used by the workforce.	
9.	Percentage of wet waste Treated either by decentralized or centralised processing.	
10.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
11.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
12.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
13.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
14.	No visible solid waste in drains and water bodies.	
15.	Plastic should not be as seen plastic banned.	
16.	Scientific waste processing. Scientific landfilling and C and D waste management.	
17.	Penalties on citizens for enforcement of segregation and use of bins	
18.	Cleaning of storm drain and surface of water bodies	
19.	Waste picker trained to collect dry and wet waste separately.	

6. Light and ventilation

SL NO.	PARAMETERS	RATING
1.	Sufficient amount of natural light within rooms, halls, corridors, staircase.	
2.	In absence of natural light there is provision for artificial lighting.	
3.	All the lighting fixtures are in working condition.	
4.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.	
5.	In absence of natural ventilation there is provision for mechanical ventilation.	

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING
1.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)	
2.	if it is then it should be removed away by the concerned agency on a weekly basis.	

Questionaries For Collection of Data

HOSTELS
Name of the building:
Predominant building use:
Population:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	RATING
1	Water supply	135lt per head per day	
2	Male toilet seats	1 seat per 8 person	
4	Ablution tap	1 water tap with ever toilet seat 1 tap per 50 employees in vicinity of toilet	
5	Urinals	1 for 25 person	
6	Wash basin	1 for 8 person	
	Bath	1 for 8 person	
7	Drinking water fountain	1 per 100 students	
8	Cleaner's sink	Minimum 1 per floor	
9	Dustbins	External area/ open spaces/ garden: 2/100m Office room: 1per desk Toilets: 1 per toilet Canteens: as per need but should have segregation. Conference rooms: 1 per room Visitors room: 1 per room Meeting room: as per need	

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
1.	Foul odour within the toilet and surroundings.	
2.	Stains on the toilet seat/wash basins of sanitary area.	
3.	visible human faecal matter in the toilet.	
4.	Garbage/ litter strew in and around the toilet.	
5.	Stagnant of flowing water in and around the toilet.	
6.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	
7.	Water supply system.	
8.	Fixtures for adequate light and ventilation.	
9.	Operational locking system in door and Windows.	
10.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	

11.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
12.	Incinerator in toilet blocks for females wherever required.	
13.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
14.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
15.	Removal of waste from dustbin daily or call basis.	
16.	Housekeeping personnel available.	
18.	Cleaning of Chrome fitting glass frame dispenser so folder.	

(B) ROOMS, OFFICES, HALLS:

SL NO.	PARAMETERS	RATING
1.	Foul odour within the room.	
2.	Fixtures for adequate light and ventilation.	
3.	Operation locking system in door and Windows.	
4.	Carpet/ floor should not have dirt litter spots and stains.	
5.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
6.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
7.	There should be no cow gives on wall ceiling fixture such as printing clocks are behind under the furniture.	
8.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
9.	Room should be free of insects, pest, bird droppings and odour.	
10.	Cleaning of electrical fittings AC vents.	
11.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
12.	Dustbin availability/ wastage removal.	
13.	Pest control on regular interval.	
14.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
1.	Stains on the walls and ceiling.	
2.	Stains garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
3.	Fixture for adequate light and ventilation.	
4.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
1.	The kitchen is smoke free and Fly- proofed.	
2.	Presence of cockroaches, flies rats and other scavengers are sure signs of unhealthy environment.	
3.	Employees and person who are working with food should look neat and clean	
4.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
5.	Food remains and dirt on the floor from previous guest.	
6.	Water and food in the kitchen may not be present and effused on the floor.	
7.	Only healthy employees can work with food	
8.	Disinfection of tables and furnitures with disinfectant.	
9.	Place of trash (cans, container) should be with orderly stored waste.	
10.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
1.	Efficiency of redressal of complaint related to sanitation.	
2.	Cleaning of septic tank/pit.	
3.	Cleaning of overhead water tank/sump.	
4.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS STILT BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
1.	Check if grass moving and hedge clipping has been done.	
2.	Storm fallen trees have been removed.	
3.	All signage's have been cleaned.	
4.	Removal of All dry branches of Shrub plants.	
5.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, signage's gates etc. should be clean.	
6.	Remove all dead trees in the park.	
7.	Removing of grass and Hedges trimming same day.	
8.	Provisions for removal of storm water.	
9.	Driveway should free of any litter and fallen leaves.	
10.	Parking should be properly paved with proper gradient.	
11.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	

12.	Check whether mowing, hedge clipping has been done.	
13.	Potholes or spaces where stagnant water is collecting.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
1.	Housekeeping/ cleaning services should be done daily from Monday to Saturday. The working timings will be 8:30 am to 5:00pm daily & from 9.00 a.m. to 2.00 p.m. on Saturdays.	
2.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	
3.	The cleaning in occupied area should be done, as and when, the halls/ rooms/ cabins are opened and in the presence of the officer concerned or and in the presence of his/her authorized representative twice in a day in addition on call basis.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
5.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
6.	Train, control and supervise staff under its establishment.	
7.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
8.	Cleaning schedules ensure that no area is missed from routine cleaning.	
9.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
7.	Biodegradable solid waste composted at site.	
8.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
9.	Percentage of wet waste Treated either by decentralized or centralised processing.	
10.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
11.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
12.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
13.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
14.	No visible solid waste in drains and water bodies.	
15.	Plastic should not be as seen plastic banned.	
16.	Scientific waste processing. Scientific landfilling and C and D waste management.	

17.	Penalties on citizens for enforcement of segregation and use of bins				
18.	Cleaning of storm drain and surface of water bodies				
19.	Waste picker trained to collect dry and wet waste separately.				

6. Light and ventilation.

SL NO.	PARAMETERS	RATING			
1.	Sufficient amount of natural light within rooms, halls, corridors, staircase.				
2.	In absence of natural light there is provision for artificial lighting.				
3.	All the lighting fixtures are in working condition.				
4.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.				
5.	In absence of natural ventilation there is provision for mechanical ventilation.				

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING			
1.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)				
2.	if it is then it should be removed away by the concerned agency on a weekly basis.				
3.	Seepages in building				
4.	Paint work/ growth of algae.				

Questionaries For Collection of Data

GREEN SPACES AND PARKS

1. CLEANLINESS

SL NO.	PARAMETERS	RATING
1.	Check if all jogging tracks, walking lanes, lakes / ponds, fallen leaves and flowers have been cleaned / swept and waste removed appropriately.	
2.	Dustbins Colour segregated, Available within every 250 metres	
3.	Check if all Dustbins have been emptied and cleaned.	
4.	Benches / seats Available within every 500 metres.	
5.	Functional Toilet facilities Available within every 500 metres.	
6.	Toilet facilities available Separate facilities available for men and women, with at least one disabled friendly facility.	
7.	Check if cleaning and scrubbing of toilets, wash basins, sanitary fittings, glasses & mirrors and toilets floors has been done.	
8.	Check if grass mowing and hedge clipping has been done.	
9.	Check if toilets are clean and dry, and all fixtures (light bulbs, wash basin, exhaust fans) are functional	
10.	Check if cleaning and disinfecting all vitreous fixtures including toilet bowls, urinals, sinks, toilet seats, containers etc. has been done properly Check below water level and under rims including areas at hinges and cistern handles. Check if restock of toiletries, including Liquid hand soap, Toilet paper, air freshener, and Sanitary Cubes and Naphthalene balls in toilets has been done.	
11.	Check if one maintenance staff is present in front of every toilet.	
12.	Check if waste has been removed from park premises.	
13.	Check if storm fallen trees have been removed.	
14.	Check if all signage's have been cleaned.	
15.	Check and remove all dry branches of shrub plants	
16.	Repair all grills, walking paths, boundary walls, fitting and fixtures in toilets and other areas in the park, signage's, gates, etc.	
17.	Repair water body / sprinkler system, compost machine as required	
18.	Check and remove all dead trees in the park	
19.	Check all major infrastructural items and fittings to ensure they are in good condition.	
20.	Check roster/daily register of housekeeping staff to see that the deployment is adequate and timely.	
21.	Park ground lighting	
22.	Potholes or spaces where stagnant water is collecting.	
23.	Ensure proper disposal of good earth, manure, sand etc.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
1.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
5.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
6.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
7.	Train, control and supervise staff under its establishment.	
8.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
9.	Cleaning schedules ensure that no area is missed from routine cleaning.	
10.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
7.	Biodegradable solid waste composted at site.	
8.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
9.	Percentage of wet waste Treated either by decentralized or centralised processing.	
10.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
11.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
12.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
13.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
14.	No visible solid waste in drains and water bodies.	
15.	Plastic should not be as seen plastic banned.	
16.	Scientific waste processing. Scientific landfilling and C and D waste management.	
17.	Penalties on citizens for enforcement of segregation and use of bins	
18.	Cleaning of storm drain and surface of water bodies	
19.	Waste picker trained to collect dry and wet waste separately.	

Questionaries For Collection of Data

ROAD

1. CLEANLINESS

SL NO.	PARAMETERS	RATING
1.	Cleaning roadways: pathway and shoulders	
2.	Cleaning road dividers and footpath	
3.	Cleaning flyovers, foot over bridges, subways and guardrails etc.	
4.	Cleaning of waste storage depots	
5.	Transporting waste from waste storage depots for disposal/recycling	
6.	Cleaning of Toilets and washing areas (One Cleaning personnel should always be present in front of every toilet)	
7.	Cleaning of road direction signages, traffic signals and traffic signs	
8.	Cleaning of street lights	
9.	Painting of parking areas, street markings, zebra crossing, road dividers, speed breakers etc.	
10.	Cleaning of vehicular accident area (if any)	
11.	Cleaning of waste from roadside food vendor stalls	
12.	Maintaining plantation area. The maintenance shall include watering, manuring, fertilizing, plant protection for pests and diseases, sweeping, weeding, and disposal of garden refuse, cultivation and cutting of edges, pruning and clipping of hedges, etc.	
13.	Maintenance or prompt repairing of potholes, cracks, concrete joints and drains	
14.	Mopping of toilets	
15.	Street sweeping after melting of snow (in case of areas having snow fall)	
16.	Change/ check of toilets papers/ napkins	
17.	Removal of waste papers and any other garbage and blockage and choking from the entire area covered under the tender	
18.	Location of toilets have been marked.	
19.	Acid-cleaning and scrubbing of toilets, wash basins, sanitary fittings, and glasses & mirrors and toilets floors	
20.	Cleaning and disinfecting all vitreous fixtures including toilet bowls, urinals, sinks, toilet seats, containers etc. Brush thoroughly to include below water level and under rims including areas at hinges and cistern handles. Restock toiletries, which include liquid hand soap, toilet paper, air freshener, sanitary cubes and naphthalene balls in toilets after daily check-ups in the morning, afternoons and on call basis during daytime.	
21.	Check and remove dust, dirt or any such object from anywhere in area covered under the tender	

22.	Cleaning/maintenance of water drainage system to avoid collection of water on roads	
23.	Cleaning and repairing of fountains, aesthetic infrastructure (if any) on the road side	
24.	Water drainage system (with covered drains).	
25.	Street markings. Side guard rails. Road barriers.	
26.	Texture of the road.	
27.	Repairing any leakage from the water supply line, sewers or unfiltered water supply line.	
28.	Keeping the construction site /facilities in a clean, tidy and orderly condition, free of litter and debris and taking care of road furniture.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
1.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
3.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
4.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
5.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
6.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
7.	Train, control and supervise staff under its establishment.	
8.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	

9.	Cleaning schedules ensure that no area is missed from routine cleaning.	
10.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
7.	Percentage of wet waste Treated either by decentralized or centralised processing.	
8.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
9.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
10.	No visible solid waste in drains and water bodies.	
11.	Penalties on citizens for enforcement of segregation and use of bins	
12.	Cleaning of storm drain and surface of water bodies	
13.	Waste picker trained to collect dry and wet waste separately.	

Questionaries For Collection of Data

RECREATIONAL AREAS/ RELLIGIOUS BUILDINGS
Name of the building:
Predominant building use:
Expected population:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	RATING
1	Water supply	45lt per head per day	
2	Male toilet seats	Not less than 2 for every 50 person	
3	Female toilet seats	Not less than 2 for every 50 person	
4	Ablution tap	1 water tap with ever toilet seat 1 tap per 50 person in vicinity of toilet	
5	Urinals	Not less than 2 for every 50 person	
6	Wash basin	1 per 25	
7	Drinking water fountain	1 per 50 person	
8	Cleaner's sink	Minimum 1 per floor	
9	Dustbins	External area/ open spaces/ garden: 2/100m Office room: 1per desk Toilets: 1 per toilet Canteens: as per need but should have segregation. Conference rooms: 1 per room Visitors room: 1 per room Library: as per need	

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
1.	Foul odour within the toilet and surroundings.	
2.	Stains on the toilet seat/wash basins of sanitary area.	
3.	visible human faecal matter in the toilet.	
4.	Garbage/ litter strew in and around the toilet.	
5.	Stagnant of flowing water in and around the toilet.	

6.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	
7.	Water supply system.	
8.	Fixtures for adequate light and ventilation.	
9.	Operational locking system in door and Windows.	
10.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	
11.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
12.	Incinerator in toilet blocks for females wherever required.	
13.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
14.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
15.	Removal of waste from dustbin daily or call basis.	
16.	Housekeeping personnel available.	
17.	Cleaning of Chrome fitting glass frame dispenser so folder.	

(B) ROOMS, OFFICES HALLS:

SL NO.	PARAMETERS	RATING
1.	Foul odour within the room.	
2.	Fixtures for adequate light and ventilation.	
3.	Operation locking system in door and Windows.	
4.	Carpet/ floor should not have dirt litter spots and stains.	
5.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
6.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
7.	There should be no cow gives on wall ceiling fixture such as printing clocks are behind under the furniture.	
8.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
9.	Room should be free of insects, pest, bird droppings and odour.	
10.	Cleaning of electrical fittings AC vents.	
11.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
12.	Dustbin availability/ wastage removal.	
13.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
1.	Stains on the walls and ceiling.	

2.	Stains garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
3.	Fixture for adequate light and ventilation.	
4.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
1.	The kitchen is smoke free and Fly- proofed.	
2.	Presence of cockroaches, flies rats and other scavengers are sure signs of unhealthy environment.	
3.	Employees and person who are working with food should look neat and clean	
4.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
5.	Food remains and dirt on the floor from previous guest.	
6.	Water and food in the kitchen may not be present and effused on the floor.	
7.	Only healthy employees can work with food	
8.	Disinfection of tables and furnitures with disinfectant.	
9.	Place of trash (cans, container) should be with orderly stored waste.	
10.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
1.	Efficiency of redressal of complaint related to sanitation.	
2.	Cleaning of septic tank/pit.	
3.	Cleaning of overhead water tank/sump.	
4.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS STILT BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
1.	Check if grass moving and hedge clipping has been done.	
2.	Storm fallen trees have been removed.	
3.	All signage's have been cleaned.	
4.	Removal of All dry branches of Shrub plants.	
5.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, signage's gates etc. should be clean.	
6.	Remove all dead trees in the park.	
7.	Removing of grass and Hedges trimming same day.	

8.	Provisions for removal of storm water.	
9.	Driveway should free of any litter and fallen leaves.	
10.	Parking should be properly paved with proper gradient.	
11.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	
12.	Check whether mowing, hedge clipping has been done.	
13.	Potholes or spaces where stagnant water is collecting.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
1.	Housekeeping/ cleaning services should be done daily from Monday to Saturday. The working timings will be 8:30 am to 5:00pm daily & from 9.00 a.m. to 2.00 p.m. on Saturdays.	
2.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	
3.	The cleaning in occupied area should be done, as and when, the halls/ rooms/ cabins are opened and in the presence of the officer concerned or and in the presence of his/her authorized representative twice in a day in addition on call basis.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
5.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
6.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
7.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
8.	Train, control and supervise staff under its establishment.	
9.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and	

	when do they clean it).	
10.	Cleaning schedules ensure that no area is missed from routine cleaning.	
11.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Placement of bins or twin bins.	
6.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
7.	Biodegradable solid waste composted at site.	
8.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
9.	Percentage of wet waste Treated either by decentralized or centralised processing.	
10.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
11.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
12.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	

13.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
14.	No visible solid waste in drains and water bodies.	
15.	Plastic should not be as seen plastic banned.	
16.	Scientific waste processing. Scientific landfilling and C and D waste management.	
17.	Penalties on citizens for enforcement of segregation and use of bins	
18.	Cleaning of storm drain and surface of water bodies	
19.	Waste picker trained to collect dry and wet waste separately.	

6. Light and ventilation.

SL NO.	PARAMETERS	RATING
1.	Sufficient amount of natural light within rooms, halls, corridors, staircase.	
2.	In absence of natural light there is provision for artificial lighting.	
3.	All the lighting fixtures are in working condition.	
4.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.	
5.	In absence of natural ventilation there is provision for mechanical ventilation.	

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING
1.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)	
2.	if it is then it should be removed away by the concerned agency on a weekly basis.	

Questionaries For Collection of Data

HOSPITAL

Name of the hospital:

Predominant building use:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	RATING
1	Water supply	For a hospital with 25-100 beds: 350 litres of water per day per head For a hospital with 101-300 beds: 400 litres of water per day per head For a hospital with 301-750 beds: 450 litres of water per day per head	
	Indoor Patient Ward		
2	Water-closets	1 for every 8 beds or part thereof	
3	Ablution taps	1 in each water-closet plus one water tap with draining arrangements in	
4	Wash basins	the vicinity of water-closets and urinals for every 50 beds or part thereof	
5	Baths	2 up to 30 beds; add 1 for every additional 30 beds or part thereof	
6	Bed pan washing sinks	1 bath shower for every 8 beds or part thereof	
7	Cleaner's sinks	1 for each ward	
8	Kitchen sinks and dish washers (where kitchen is	1 for each ward	
	Outdoor Patient Wards and Visitors		
9	Water closets	1 for every 100 persons and part thereof (male) 2 for every 100 persons and part thereof (female)	
10	Ablution taps	1 in each water-closet	
11	Urinals	1 for every 50 persons and part thereof	
12	Wash basins	1 for every 100 persons and part thereof	
13	Drinking water fountain	1 for every 500 persons and part thereof	

14	Dustbins	Premises - Every 250 meters Toilets - 1 per toilet Kitchen - As per need Main hospital reception - 1 Bath Facility-1 Rooms/wards - 1 per room/ward Special care rooms (Operation theatres, Labor rooms. Laboratories, ICUS) - as per need, but should have color segregation OPD and visitor area - As per need	

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
1.	Toilets and baths with washbasins available for clinical and non clinical staff.	
2.	Toilet and bath facilities available for IPD patients.	
3.	Toilet facilities available for visitors and OPD patients.	
4.	Foul odour within the toilet and surroundings.	
5.	Stains on the toilet seat/wash basins of sanitary area.	
6.	visible human faecal matter in the toilet.	
7.	Garbage/ litter strew in and around the toilet.	
8.	Stagnant of flowing water in and around the toilet.	
9.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	
10.	Water supply system.	
11.	Fixtures for adequate light and ventilation.	
12.	Operational locking system in door and Windows.	
13.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	
14.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
15.	Incinerator in toilet blocks for females wherever required.	
16.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
17.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
18.	Removal of waste from dustbin daily or call basis.	
19.	Housekeeping personnel available.	
20.	Cleaning of Chrome fitting glass frame dispenser so folder.	

(B) ROOMS, OFFICES HALLS:

SL NO.	PARAMETERS	RATING
1.	Foul odour within the room.	
2.	Fixtures for adequate light and ventilation.	
3.	Operation locking system in door and Windows.	

4.	Carpet/ floor should not have dirt litter spots and stains.	
5.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
6.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
7.	There should be no cow gives on wall ceiling fixture such as printing clocks are behind under the furniture.	
8.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
9.	Room should be free of insects, pest, bird droppings and odour.	
10.	Cleaning of electrical fittings AC vents.	
11.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
12.	Dustbin availability/ wastage removal.	
13.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
1.	Stains on the walls and ceiling.	
2.	Stains garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
3.	Fixture for adequate light and ventilation.	
4.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
1.	The kitchen is smoke free and Fly- proofed.	
2.	Presence of cockroaches, flies rats and other scavengers are sure signs of unhealthy environment.	
3.	Employees and person who are working with food should look neat and clean	
4.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
5.	Food remains and dirt on the floor from previous guest.	
6.	Water and food in the kitchen may not be present and effused on the floor.	
7.	Only healthy employees can work with food	
8.	Disinfection of tables and furnitures with disinfectant.	
9.	Place of trash (cans, container) should be with orderly stored waste.	
10.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
1.	Efficiency of redressal of complaint related to sanitation.	
2.	Cleaning of septic tank/pit.	
3.	Maintained ambulance.	
4.	Sterilization facility.	
5.	Cleaning of overhead water tank/sump.	
6.	Covered sources of drinking water.	
7.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS STILT BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
1.	Check if grass moving and hedge clipping has been done.	
2.	Storm fallen trees have been removed.	
3.	All signage's have been cleaned.	
4.	Removal of All dry branches of Shrub plants.	
5.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, signage's gates etc. should be clean.	
6.	Remove all dead trees in the park.	
7.	Removing of grass and Hedges trimming same day.	
8.	Provisions for removal of storm water.	
9.	Driveway should free of any litter and fallen leaves.	
10.	Parking should be properly paved with proper gradient.	
11.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	
12.	Check whether mowing, hedge clipping has been done.	
13.	Potholes or spaces where stagnant water is collecting.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
1.	Housekeeping/ cleaning services should be done daily from Monday to Saturday. The working timings will be 8:30 am to 5:00pm daily & from 9.00 a.m. to 2.00 p.m. on Saturdays.	
2.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	
3.	The cleaning in occupied area should be done, as and when, the halls/ rooms/ cabins are opened and in the presence of the officer concerned or and in the presence of his/her authorized representative twice in a day in addition on call basis.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
1.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
2.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
3.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
4.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
5.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
6.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
7.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
8.	Train, control and supervise staff under its establishment.	
9.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
10.	Cleaning schedules ensure that no area is missed from routine cleaning.	
11.	Ensure safety and security of all staff under its department and to keep superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
1.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
2.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
3.	Control and issue of cleaning materials and equipment is met on regular basis.	
4.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
1.	Of the total waste generated what percentage is segregated into wet and dry.	
2.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
3.	Percentage of areas undertaking daily sweeping and cleaning.	
4.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
5.	Bio medical waste are collected and treated separately.	
6.	Placement of bins or twin bins.	
7.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
8.	Biodegradable solid waste composted at site.	
9.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
10.	Percentage of wet waste Treated either by decentralized or centralised processing.	
11.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
12.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
13.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
14.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
15.	No visible solid waste in drains and water bodies.	
16.	Plastic should not be as seen plastic banned.	
17.	Scientific waste processing. Scientific landfilling and C and D waste management.	
18.	Penalties on citizens for enforcement of segregation and use of bins	
19.	Cleaning of storm drain and surface of water bodies	
20.	Waste picker trained to collect dry and wet waste separately.	

6. Light and ventilation.

SL NO.	PARAMETERS	RATING
1.	Sufficient amount of natural light within rooms, halls, corridors, staircase.	
2.	In absence of natural light there is provision for artificial lighting.	

3.	All the lighting fixtures are in working condition.	
4.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.	
5.	In absence of natural ventilation there is provision for mechanical ventilation.	

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING
1.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)	
2.	if it is then it should be removed away by the concerned agency on a weekly basis.	

Questionaries For Collection of Data

SCHOOL

Name of the school:

Predominant building use:

School population:

1. CLEANLINESS

(A) TOILETS:

SL NO.	PARAMETERS	STANDARD	RATING
1	Water supply	45lt per head per day	
2	Male toilet seats	1 seat per 25 employees	
3	Female toilet seats	1 seat per 15 employees	
4	Ablution tap	1 water tap with ever toilet seat 1 tap per 50 employees in vicinity of toilet	
5	Urinals	Nil upto 6 person 1 for 7-20 person 2 for 21-45 person 3 for 46-70 person From 101- 200 person, add at the rate of 3 % For over 200 person add add at the rate of 2.5%	
6	Wash basin	1 per 25 employees	
7	Drinking water fountain	1 per 100 employees	
8	Cleaner's sink	Minimum 1 per floor	
9	Dustbins	External area/ open spaces/ garden: 2/100m Office room: 1per desk Toilets: 1 per toilet Canteens: as per need but should have segregation. Conference rooms: 1 per room Visitors room: 1 per room Library: as per need	

Source: NBC 2005(31)

SL NO.	PARAMETERS	RATING
18.	Foul odour within the toilet and surroundings.	
19.	Stains on the toilet seat/wash basins of sanitary area.	
20.	visible human faecal matter in the toilet.	
21.	Garbage/ litter strew in and around the toilet.	
22.	Stagnant of flowing water in and around the toilet.	
23.	adequate disposal mechanism for toilet blocks either through drainage connection or adequate soak pits.	

24.	Water supply system.	
25.	Fixtures for adequate light and ventilation.	
26.	Operational locking system in door and Windows.	
27.	Mirror disinfected liquid soap, paper napkins and dust bin placed close to the wash basin for disposing paper napkins.	
28.	Toilet blocks for females should have appropriate bins for disposal of sanitary napkins.	
29.	Incinerator in toilet blocks for females wherever required.	
30.	Cleaning sweeping and mopping of floors (daily/ call based) with disinfectant.	
31.	Dust free/ Satin free- electrical fittings, doors, windows, glass and grills, panes, furniture, fixture, venitian blind and window edges.	
32.	Removal of waste from dustbin daily or call basis.	
33.	Housekeeping personnel available.	
34.	Cleaning of Chrome fitting glass frame dispenser so folder.	

(B) ROOMS, OFFICES HALLS:

SL NO.	PARAMETERS	RATING
14.	Foul odour within the room.	
15.	Fixtures for adequate light and ventilation.	
16.	Operation locking system in door and Windows.	
17.	Carpet/ floor should not have dirt litter spots and stains.	
18.	Walls and switch board on them, doors and windows should be free of finger stains, pan/gutka spitting stains and dirt.	
19.	There should be no dust, litter or hair under the furniture like table, chairs, sofa and other furniture.	
20.	There should be no cow gives on wall ceiling fixture such as printing clocks are behind under the furniture.	
21.	Soft furniture (cusioned and with fabric covers), drapes and upholstery should not have dust in it. upon hitting it with hand no dust cloud should emerge.	
22.	Room should be free of insects, pest, bird droppings and odour.	
23.	Cleaning of electrical fittings AC vents.	
24.	There should be no the dust on calendar, poster other item hanging from the ceiling or on wall.	
25.	Dustbin availability/ wastage removal.	
26.	Sweeping, washing and mopping of floors with disinfectant.	

(C) CLEANLINESS OF CORRIDORS, STAIRCASES, TERRACES AND LIFT.

SL NO.	PARAMETERS	RATING
5.	Stains on the walls and ceiling.	
6.	Stains garbage or litter strewn cobwebs, bird droppings, insects, pest on wall and treads of staircase.	
7.	Fixture for adequate light and ventilation.	

8.	Operational locking system in doors and windows.	

(D) KITCHEN.PANTRIES, CANTEENS DINNING AREA:

SL NO.	PARAMETERS	RATING
11.	The kitchen is smoke free and Fly- proofed.	
12.	Presence of cockroaches, flies rats and other scavengers are sure signs of unhealthy environment.	
13.	Employees and person who are working with food should look neat and clean	
14.	Farrowed walls, floors as every object in canteen/ pantries need to be clean. In clean object there should not be even minimum of dust or grease which can be good environment for germs.	
15.	Food remains and dirt on the floor from previous guest.	
16.	Water and food in the kitchen may not be present and effused on the floor.	
17.	Only healthy employees can work with food	
18.	Disinfection of tables and furnitures with disinfectant.	
19.	Place of trash (cans, container) should be with orderly stored waste.	
20.	All equipment and surface that have direct contact with food must be cleaned and sanitize thoroughly.	

(E) MISCELLANEOUS AREA:

SL NO.	PARAMETERS	RATING
5.	Efficiency of redressal of complaint related to sanitation.	
6.	Cleaning of septic tank/pit.	
7.	Cleaning of overhead water tank/sump.	
8.	Cleanliness of drinking water cooler, water tank, water purifier.	

(E) OPEN LANDSCAPE AREAS STILT BASEMENT PARKING:

SL NO.	PARAMETERS	RATING
14.	Check if grass moving and hedge clipping has been done.	
15.	Storm fallen trees have been removed.	
16.	All signage's have been cleaned.	
17.	Removal of All dry branches of Shrub plants.	
18.	All grills, walking paths, boundary walls , fitting and fixtures in the lawn, signage's gates etc. should be clean.	
19.	Remove all dead trees in the park.	
20.	Removing of grass and Hedges trimming same day.	
21.	Provisions for removal of storm water.	
22.	Driveway should free of any litter and fallen leaves.	
23.	Parking should be properly paved with proper gradient.	

24.	There are no open sewers gutters damaged drain pipes, sewage blockage, and if they are address them immediately.	
25.	Check whether mowing, hedge clipping has been done.	
26.	Potholes or spaces where stagnant water is collecting.	

2. Frequency of cleaning.

SL NO.	PARAMETERS	RATING
4.	Housekeeping/ cleaning services should be done daily from Monday to Saturday. The working timings will be 8:30 am to 5:00pm daily & from 9.00 a.m. to 2.00 p.m. on Saturdays.	
5.	Are Various spaces in the premises are cleaned on daily or weekly basis as per the requirement.	
6.	The cleaning in occupied area should be done, as and when, the halls/ rooms/ cabins are opened and in the presence of the officer concerned or and in the presence of his/her authorized representative twice in a day in addition on call basis.	

3. Availability of manpower.

SL NO.	PARAMETERS	RATING
12.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
13.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
14.	The staff will immediately attend the complaint and complete the same on its receipt on the same day	
15.	Cleanliness and maintenance staff are regular. In case of absentee there is provision for substitute staff.	
16.	The supervisory staff should be available at site every day during office working hours. In case of emergency complaints, the Bidder is to ensure rectification of defects immediately	
17.	The staff will have to maintain all types of records for consumption and receipt of material as desired and instructions issued from time to time in this regard should be complied.	
18.	The staff deployed is well-dressed in neat and clean uniform and carrying photo identity cards displayed properly	
19.	Train, control and supervise staff under its establishment.	
20.	Cleaning standards, frequency and accountability for cleaning are clearly defined (i.e., who cleans, what and how do they clean and when do they clean it).	
21.	Cleaning schedules ensure that no area is missed from routine cleaning.	
22.	Ensure safety and security of all staff under its department and to keep	

	superior authorities informed about day to day activities	

4. Resource availiabilty.

SL NO.	PARAMETERS	RATING
5.	Is Administration/Contracting Agency is procuring appropriate and necessary cleaning equipment as per requirements within the time.	
6.	Brooms, Mops, Dusters, Staff Uniforms and Safety Equipment (Gloves, Masks, etc.)(1 per cleaning staff personnel)Vacuum Cleaners(2 per building/wing), Storage Units(2 per building/wing).	
7.	Control and issue of cleaning materials and equipment is met on regular basis.	
8.	Maintain official records on staffing, cleaning materials and equipment.	

5. Solid and waste water management

SL NO.	PARAMETERS	RATING
20.	Of the total waste generated what percentage is segregated into wet and dry.	
21.	What percentage of biodegradable waste and recycle waste such as paper, plastic, metal, glass, rags, etc. Are separated at source.	
22.	Percentage of areas undertaking daily sweeping and cleaning.	
23.	Percentage of collected waste transported to Processing Unit for disposal within the same day.	
24.	Placement of bins or twin bins.	
25.	Bulk Garden and horticulture waste shall be kept unmixed and composted at source.	
26.	Biodegradable solid waste composted at site.	
27.	Provisions of personal protection equipment (including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear and mask) to all workers handling solid waste and the same are used by the workforce.	
28.	Percentage of wet waste Treated either by decentralized or centralised processing.	
29.	Hazardous waste shall be scientifically disposed as per Municipal solid waste management norms.	
30.	All other non-biodegradable (dry) waste- both recyclable and non recyclable are being burn off at site or being taken by waste collection vehicle.	
31.	Burning of waste: disposal by burning of any type of solid waste is prohibited.	
32.	Waste such as used batteries, container for chemical and pesticides, discarded medicines and other toxic or hazardous household waste, (as under), if and when produced should be kept separately from the above stream of waste.	
33.	No visible solid waste in drains and water bodies.	

34.	Plastic should not be as seen plastic banned.	
35.	Scientific waste processing. Scientific landfilling and C and D waste management.	
36.	Penalties on citizens for enforcement of segregation and use of bins	
37.	Cleaning of storm drain and surface of water bodies	
38.	Waste picker trained to collect dry and wet waste separately.	

6. Light and ventilation.

SL NO.	PARAMETERS	RATING
6.	Sufficient amount of natural light within rooms, halls, corridors, staircase.	
7.	In absence of natural light there is provision for artificial lighting.	
8.	All the lighting fixtures are in working condition.	
9.	Sufficient amount of natural ventilation within rooms, halls, corridors, staircase.	
10.	In absence of natural ventilation there is provision for mechanical ventilation.	

7. Infrastructure maintenance

SL NO.	PARAMETERS	RATING
3.	infrastructure is well maintained (No major cracks, seepage, chipping plaster, chipped floors in building)	
4.	if it is then it should be removed away by the concerned agency on a weekly basis.	