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भारत सरकार
MINISTRY OF HOUSING AND
URBAN AFFAIRS
GOVERNMENT OF INDIA



MODEL DESIGN

For

10 TPD MATERIAL RECOVERY FACILITY

Swachh Bharat Mission - Urban 2.0

Central Public Health and Environmental
Engineering Organisation (CPHEEO)



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MINISTRY OF HOUSING AND URBAN AFFAIRS
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Abbreviations

AMC	Annual Maintenance Contract
ANSI	American National Standards Institute
BSI	Bureau of Indian Standards
BOQ	Bill of Quantities
CAPEX	Capital Expenses
CMC	Comprehensive Services Contract
CTE	Consent to Establish
CTO	Consent to Operate
DHW	Domestic Hazardous Waste
E & OE	Errors and Omissions Excepted
ELCB	Earth Leakage Circuit Breaker
EN	European Nation
EPA	Environment Protection Act, 1986
EU	European Union
GeM	Government Marketplace
GSM	Gramme per Square Metre
HDPE	High Density Poly Ethylene
HFL	High Flood Level
IEC	International Electro technical Commission
ID	Inner Diameter
ISO	International Standards Organization
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NITI	National Institution for Transforming India
OD	Outer Diameter
OPEX	Operational Expenses
PCC	Pollution Control Committee
PPE	Personal Protection Equipment
PVC	Poly Vinyl Chloride
RCCB	Residual Current Circuit Breaker
RDF	Refuse Derived Fuel
SOP	Standard Operating Procedure
SPCB	State Pollution Control Board
ULB	Urban Local Body

Executive Summary

With rapid urbanization and a growing population, Municipal Solid Waste Management (MSWM) in the country has become a daily challenge for Urban Local Bodies (ULBs). Nearly 55 million tonnes of Municipal Solid Waste (MSW) are generated annually by the 40 crore citizens residing in urban areas across the country. Mega, metro, large cities, and state capitals have initiated actions for the collection, transportation, processing, and disposal of treated solid waste. On the other hand, almost 4500 small cities and towns across the country, with a population of less than 1 lakh, need to take similar actions. The Central Government has decided to support these ULBs in implementing waste management action plans in mission mode for proper collection, sorting, transportation, processing, and safe disposal of municipal solid waste under its flagship program of SBM-U 2.0.

The Solid Waste Management (SWM) Rules, 2016, mandate the setting up of a Material Recovery Facility (MRF) for the secondary sorting of recyclable materials from the dry fraction of MSW, along with the formalization of informal waste pickers and waste collectors to segregate the recyclables from the waste. Thus, the MRF is an important value-adding waste handling plant that enhances Waste to Wealth intervention in dry MSW management by sorting proper recyclable materials for the recycling industry and eliminating the dumping of dry waste at landfills.

To assist the ULBs in planning, designing, and implementing material recovery from solid waste, this typical design for handling a 10-ton per day (TPD) Material Recovery Facility has been prepared. It provides details of essential machinery and their standard specifications. This facility is envisaged for dry waste handling only. As per SWM Rule 2016, the ULB has to collect dry and wet waste separately and transport only dry waste to the MRF, entailing the handling of wet waste separately.

This design has been developed in consultation with MRF operators, manufacturers, suppliers, vendors, user agencies, and learning from visits to some operating MRFs. This model document has been prepared with a view to providing general guidance and guidelines for the ULB. The document also provides an estimate of CAPEX, OPEX, SOPs, and safety procedures for the proper operations of the MRF. It is essential to recall that India is a vast and diverse country. Therefore, while planning and designing an MRF for a particular town, local and regional factors such as climate and topography along with characteristics of MSW need to be factored in before implementation.

It is expected that ULBs can develop their tenders and BOQs using this document as a reference.

Table A. Abstract of Normative CAPEX and OPEX Cost Estimate

Sr No	Description	As per detailed Estimates (Rs in Lakh)
A)	CAPEX	
	Civil Cost	252.55
	Electro-Mechanical Cost (with 18% GST)	46.45
	TOTAL	299
B)	OPEX (One year)	76.07
	Cost Recovery Potential - Recyclables per day 4.0 TPD - Annual Operating days 365 - Annual Recyclables 1,460 MT - Approx. Sale Price for recyclables(Rs) 6000 per MT - Annual Revenue from Sale (Rs) 87.60 lakh - Annual O&M Expenditure (Rs) 76.07 lakh The MRF with effective operation and maintenance is likely to generate adequate revenue to meet the day to day expenditure without having to spending from ULBs budget. However the ULB may consider levying user fees on households etc., which will further enhance revenue.	

Disclaimers:

- This Guideline has been prepared considering the best suited/appropriate material and capacities for ideal situation. However, guidelines may be modified/changed/replaced by the ULBs as per any available resources (already procured) and suitability as per soil, site and local conditions. ULB's must take prior approvals of the competent authority of ULB's / department concerned before implementing the MRF project.*
- This design can be suitable for plain areas. It can be used for hilly regions if adequate land is available.*
- The model design is subjected to continuous developments/improvements over time hence applicable revisions may be considered accordingly.*

1 Material Recovery Facility (MRF)

In India, material recovery starts at the primary level by households who segregate recyclables like newspapers, cardboard, plastics, bottles, etc. from waste to sell off such material to *kabadiwalas*, local recyclers and scrap dealers. Building on such behavior, the SWM Rules prescribe that waste should be segregated at source level as dry waste and wet waste separately. The collected dry waste can be further sorted in MRF as per market demand for resource recovery.

Dry non-biodegradable solid waste is brought at MRF from generators for sorting and recovery of recyclables. To bring rag pickers into mainstream, ULBs have to engage them as a work force for handling and sorting in MRF.

2 Need for MRF

SWM Rules mandate that only inert rejects (residue waste) from processing facilities, inert street sweepings, etc. can be landfilled. Therefore all options for minimizing waste residue should be utilized. To meet the aim to reduce the amount of waste being finally disposed and maximizing resource recovery and efficiency, MRFs are required to be established. MRF serves as an intermediate step between the collection of recyclable materials and handing over recyclable, non-recyclables and Refuse Derived Fuel (RDF) to the user agencies for further processing or reuse, as appropriate, as a step towards circular economy. After maximizing waste recovery in MRFs, minimum residual inert materials and rejects alone would go to landfill.

Thus setting up of MRF is an important initiative for resource recovery facilitating 'Circular Economy'.

3 Advantages of MRF

- ❁ The quantity and volume of waste dumped gets reduced resulting in cost savings in the disposal infrastructure;
- ❁ Generates livelihood opportunities for informal waste pickers, local vendors and recyclers;
- ❁ Enhances the availability of scarce resources as well as reducing environmental impacts;
- ❁ Reducing the burden of waste management costs on ULBs;
- ❁ On Establishment of the necessary market mechanisms, recycling generates revenue, contributing to the cost recovery in solid waste management leading to win-win situation;
- ❁ Increases the life span of landfills/reduced requirement of land, and
- ❁ Helps in facilitating Circular Economy.

4 MRF Process Description

Non-biodegradable components of municipal solid waste will be collected and transported to MRF facility in several kinds of vehicles suitable for the ULB. Upon reaching the MRF facility, vehicles will be weighed and recorded at the weighing bridge. The vehicles will then move to the tipping area for unloading of waste. From the tipping area, waste will be fed into the trommel through an infeed conveyor belt. The trommel will separate materials based on their size which will be further sorted manually and shall be collected in respective bins for different recyclable materials.

After completion of sorting, rejects/inert will be sent for landfilling and domestic hazardous waste will be handed over to respective common facility. Baling will be required for sorted fractions of paper/cardboard, metals, and plastics. The bales of different materials shall be kept in the storage area and will be handed over for further recycling. The glass fractions shall be stored separately for recycling. The general process flow diagram for a 10 TPD MRF facility is shown in Figure 1.

To get the maximum market price, the recyclable materials recovered at MRF must meet the needs of market. The recovered materials should be clean, same type/category, in bulk, uniformly compacted/baled etc. to facilitate and meet the market demand. Any poor quality of recovered recyclable materials would get lower prices or, rejection by recyclers.

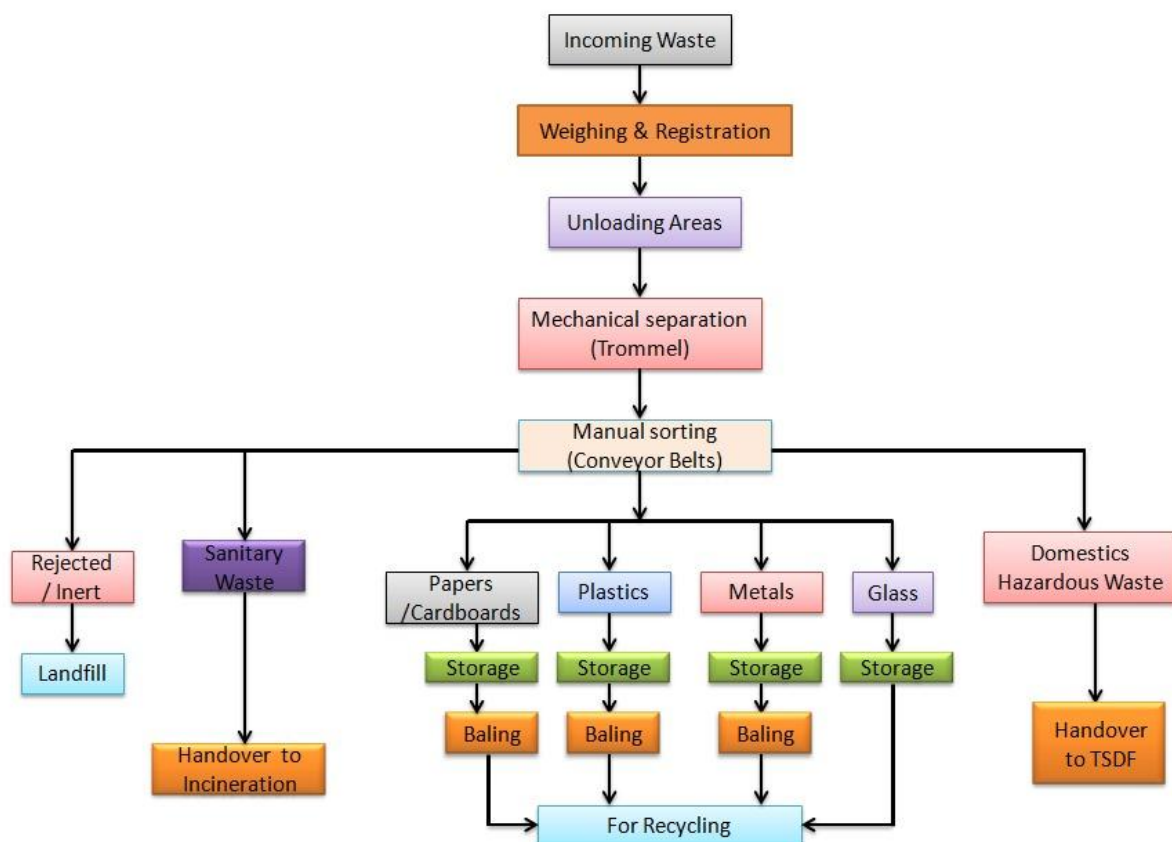


Figure 1: General MRF Process Flow Chart for Dry Waste

5 Minimum Requirement of Land, Manpower, Water Demand, Machinery

5.1 Land Requirement

Land is an important requirement for establishing MRF. About 1250 sq. m land is required for establishing a 10 TPD MRF facility to operate as the core activity area. The required land includes space for tipping, sorting, dispatching, storage, office space and changing rooms with locker facility, toilets and shower area. The area requirement for a typical MRF process plant is given in Table 1.

Table 1: Land Requirement

S. N.	Items	Numbers /Quantity	Area (m ²)
1	Tipping Area	1	123
2	Processing Area	1	380
3	Dispatch Area	1	118
4	Bale Storage	1	48
5	Storage for different materials	10	25
6	Changing Rooms	2	34
7	Office Area	1	40
8	Weigh Bridge cabin	1	8
9	Weigh Bridge	1	17
10	Security office	1	15
11	Toilets	2	14
Total Area ≈			1000 Sq.m
Total Area in Acre			0.25 Acre

5.2 Manpower Requirement

Functioning of MRF depends upon the deployment of sufficient labour at the sorting unit in respective sections. For calculating the number of sorting workers, yield of a worker is assumed as 1 – 1.5 tonne per eight hour operation. The labour requirement for a 10 TPD plant is envisaged as 19 labours per day for an 8 hour operational plant, in which 9 are for sorting, 3 for security, 1 electrician cum baler operator, weigh bridge operator and others. The manpower requirement with respective qualifications and responsibilities are given in Table 2.

Table 2: Manpower, Qualifications and Responsibility

S.N.	Manpower	Qualification	Number	Responsibility
1	In-charge / Supervisor (skilled)	Graduate Degree/Diploma (Environmental / Civil /Chemical/Mechanical) with minimum two year of	1	➊ Maintain all administrative and inventory records. ➋ Maintain Interactions with the ULB officials ➌ Maintain communications with local authorities like health departments, police, fire brigade

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S.N.	Manpower	Qualification	Number	Responsibility
		experience in Operations and Maintenances of plants for MSW processing/Used Water or Sewage treatment/Water treatment		etc. - Overseeing all the operational activities at MRF including daily/weekly checks, ensure defects and breakdowns are promptly attempted. - Ensure that machinery is maintained properly - Checking of incoming waste, reporting contamination or non-conforming wastes delivered to site. - Reviewing accidents, incidents, and near misses, environmental hazards, health & safety breaches. - Ensure appropriate safety equipment and PPEs used at all times. - Periodic checking at the MRF for red spots (Spiting spots) and cleanliness of the plant - Site Incident Controller during emergency at the MRF. - To perform other tasks including weekly/monthly reporting to ULB officials and/or supervisory duties.
2	Sorting workers (unskilled) #	Not Applicable	9	- Sort and separate recyclable materials based on type, such as paper, plastic, glass, or metal and keep the sorted waste in respective storage area/bins. - Inspect materials for contaminants, such as non-recyclable items or domestic hazardous substances, and store them separately to maintain the quality of waste. - Maintain cleanliness and orderliness in the recycling facility by regularly cleaning work areas. - In any case, assist with the maintenance and repair of equipment to ensure proper

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S.N.	Manpower	Qualification	Number	Responsibility
				functioning and minimize downtime.
3	Electrician cum baling operator (skilled)	ITI Electrician with 1 year of experience	1	➤ Operate and maintain the baler machine to compress and bind the sorted waste. ➤ Notify maintenance requirements with the Manager. ➤ Troubleshooting electrical issues in the plant like reversal of polarity, checking the continuity of the earthing etc. ➤ Ensure all the electrical equipments/machinery are switched off before leaving the plant ➤ Keep equipment in a clean and orderly condition and maintain the work area. ➤ Run the day to day activities of the plant in the absence of Plant In charge
4	Person at tipping area (unskilled)	Not Applicable	2	➤ Tearing of dumpster bags and feeding the segregated waste into hopper. ➤ Identify and remove the domestic hazardous waste, discarded blankets, furniture and empty cans from dry waste. ➤ Keep tipping area clean. ➤ Should engage in the sorting activity on clearing the receiving area
5	Weigh Bridge operator (Skilled)	12 th class with 1 year operating experience of weigh bridge	1	➤ Weighing of in and out vehicles carrying segregated waste. ➤ Preparing daily/ weekly/monthly reports and record keeping. ➤ Submitting reports to plant incharge
6	Safai Mitra (Unskilled)	Not Applicable	1	➤ Cleaning wash room/toilets and keeping all emergency exits and walkways clear from obstructions. ➤ Reporting at MRF two hours before commencement of operations and keeping working area neat and tidy



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S.N.	Manpower	Qualification	Number	Responsibility
				➤ Maintain and water the garden around the MRF ➤ Switch on the fans half an hour before the commencement of MRF operations ➤ Should engage in the sorting activity as and when required
7	Office Staff (skilled)	12 th class	1	➤ Keeping records of materials received, processed, and dispatched from the MRF ➤ Keeping records of attendance, visitors, feedbacks, and complaints received.
8	Security (Unskilled)	10 th class, physically fit with one year of experience as a security staff.	3	➤ Protect the MRF from intruders. ➤ Control facility access for employees, visitors, vendors, and contractors (have visitors sign in/out, issue and collect visitor badges, occasionally escort visitors from one area to another, etc). ➤ Periodically conduct security checks (surveillance) of specified areas. ➤ Maintain a security log register and write reports on what was observed while on duty. ➤ Patrolling the MRF(Inside and outside), thrice in a shift
Total			19	

*# Possibility of integration of informal sector may also be explored by ULBs at MRF Plant
Wages of staff are indicative. Wages shall be paid as per the norms of concern State Government.*

5.3 Water requirement

Minimum water supply has been calculated as per NBC guidelines for a factory building with bathroom facility. It requires 45 litre/day/head for staff of which the domestic requirement is 30 litre/day/head and flushing requirement is 15 litre/day/head. It is 15 litre/day/head for visitors. The details are given in Table 3.

Table 3: Tentative Water Demand

S. N.	Labour Details	Number of workers (Nos.)	Per capita demand (L)	Total Requirement (L)
1	Manpower	19	45	855
2	Visitors to the facility	10	15	150



S. N.	Labour Details	Number of workers (Nos.)	Per capita demand (L)	Total Requirement (L)
3	Water for cleaning			1500
	Total water requirement per day in Litres			2505 say 2500

5.4 Wastewater generation (Used Water)

The wastewater generation from an MRF facility is considered as 80% of water consumption at the plant. Hence the wastewater quantity is estimated as 1932 litre/day. The recommended treatment is a septic tank and a soak pit for 50 users. For the construction of septic tank, IS: 2470 (Parts 1&2)-1985 shall be adhered to. In case sewerage is available, the wastewater flow shall be connected to it.

5.5 Indicative Machinery Requirement

The minimum and essential machinery for 10 TPD MRF is given in Table 4.

Table 4: List of Indicative Machineries

S. N.	Name of Machinery/Equipment	Description	Quantity (Nos.)
1	Weigh Bridge	10 Tonne capacity	01
2	Trommel	03 TPH	01
3	Conveyor Belts	Flat roller Conveyor belt	06
4	Magnetic Separator	Separate ferrous materials using electromagnetic field	01
5	Hydraulic baling Machine	25 Tonne (Jack Force)	01
6	Wheelbarrow (Two-wheel types as per IS:4184)	Volume: 140 litre	04
7	HDPE Container bins	1100 litre	10

Disclaimer: These are Indicative machineries ULBs may choose alternate or similar machinery depending upon availability and suitability as per their own site conditions.

6 Technical Specifications of Machinery

Technical specifications for the machineries required in the MRF are briefly given in the following tables along with their pictures/sketches.

6.1 Weigh Bridge

Table 5: Technical Specification of Weigh Bridge

Parameter	Specifications
Weigh Bridge Type	Electronic Pitless Type
Platform material & Size	1. High Tensile Structural Steel as per IS:2062:2011 2. Should be anti-skid type. 3. Thickness of platform plate not less than 10 mm 4. Size 6.6 metre and 2.5 metre (length X width)
Weighing Capacity	10 Tonne
Load cell	4 Load cell
UPS	30 minute backup

Parameter	Specifications
Printer	Laser Printer
Display modes	a) Indicate weight b) Indicate calibration-Auto zero tracking c) Calibration to be checked automatically every 5 minutes
Readability	2 Kg
Type/capacity of load cell	Digital Double Ended Shear Beam load cells, pre-calibrated load cells – 5000/kg (04 No.) with mounting kits
Accessories of Junction Box (01 Set)	Cables: Home run cable 20 metre & inter connections cable between load cell and junction box & weighing electronics.
Electric supply	3 Phase (440 V 50Hz)
Surface finish on metal parts	Powder coating/ paint
Weightment printouts	Attached as Annexure 2 (A)
User Manual	Yes, shall be provided
Installation, Demonstration and Training	Yes, shall be provided



Figure 2: Representative picture for general assembly of Weigh Bridge

6.2 Trommel

It is a mechanical screening machine used to separate materials in solid waste processing. It consists of a large perforated cylindrical drum that is usually elevated at an angle at the feed end. The trommel should have a self-cleaning mechanism for sieves. Technical specifications are mentioned in Table 6.

Table 6: Technical Specification for Trommel

Parameter	Specifications
Capacity	3 TPH
Material	Mild Steel confirming to IS:2062
Minimum length	8000 mm
Shell Outer Diameter	1800 mm
Ring Diameter	1500 mm



Parameter	Specifications
Hole Size	60 mm and 250 mm (minimum 90 holes of 60 mm and 10 holes of 250 mm per m ² of screen)
Shell Thickness	10 mm
Screen Thickness	8 mm
Screen type	Bolted & Replaceable (if damage during operation)
Inclination	5-7 degree
RPM	8-10 (variable through Variable Frequency Drive)
Knives	Should be effective in tearing bags, installed inside the trommel screen in the first 3 (three) metres after the material feeding point. Mild steel knives to be easily replaceable. Bolted design is preferred. Different configurations (positions) of knives inside the trommel to be possible
Power supply	3 phase (440 V, 50 Hz)
Motor (2 no.)	3.7 kW (5HP) 4-pole, 1420 rpm, AC Induction motor with copper winding
Surface Finish	Epoxy Paint Coated
Stand / Legs & material	6 in number, Mild Steel
Warranty	1 year minimum and extendable
User Manual	Yes, shall be provided
Installation, Demonstration & Training	Yes, shall be provided



Figure 3: Representative picture of Trommel

6.3 Flat Conveyor Belt for Sorting

The Flat sort conveyor belt with built-in guard rails and adjustable MS Floor support is ideal for conveying loose materials such as dry municipal waste. Each conveyor belt shall be fitted with VFD (Variable Frequency Drive). Specification for Conveyor belts are detailed in Table 7.

Table 7: Technical Specifications for Flat Sorting Conveyor Belt

Parameter	Specifications
Conveyor Belt no. 1 (Infeed line)	
Type	Flat roller type belt conveyor
Motor	3.75 kW (5HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire, conforming to IS: 13730, 3- phase, 4- pole
Inclination	20° Inclined flat
Length of Conveyor	Approx. 9.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt no.2 (Fines)	
Type	Flat roller type belt conveyor
Motor	3.75 kW (5 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 7 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt no. 3 (Mid Size incline)	
Type	Flat roller type belt conveyor
Motor	2.25 kW (3 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	10°
Length of Conveyor	Approx. 3 m from End to End of Conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt no. 4 (Mid size)	
Type	Flat roller type belt conveyor
Motor	3.75 kW (5HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 6 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt no. 5 (Over size)	
Type	Flat roller type belt conveyor
Motor	3.75 kW (5 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 9 m from End to End of Conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt no.6 (Trommel out)	
Type	Flat roller type belt conveyor
Motor	2.25 kW (3HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	20°
Length of Conveyor	Approx. 2.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Other details (Common for above conveyor belts from 1 to 6)	

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Belt Specification	Plain rubber belt, 3 ply, 3 mm top, 1.5 mm bottom rubber covering, total belt thickness 10 mm, nylon cord conforming to M 24 grade
Side Guard	2 mm thick MS sheet with supporting structure
Side guard skirting	2 mm thick rubber belt
Conveyor body	Framing structure of square pipe with ISI mark (IS 4923:1997) standard 49.5 x 49.5 x 4.5 mm & 75 x 75 x 4.9 mm sections
Drive pulley for conveyor	Ø 290 mm OD with crowning surface with 70 mm shaft with rubber coating and hearing bone design
Rear pulley for conveyor	Ø 290 mm OD with crowning surface with 70 mm shaft with rubber coating and hearing bone design
Rear pulley cover	2 mm thick MS sheet
Bearing for roller	6205 2RS type
Shaft	Precise Machined from EN-8 Shaft Material
Guide rollers	Ø 50 mm pipe with bright bar spindle and sealed with single roll anti friction deep grooved ball bearing
Carrying & return roller	76.1 mm inch ID ERW pipe with CI housing, bright bar spindle and sealed with single roll anti friction deep grooved ball bearing
Bearing	Angular contact type with fitted in split housing
Idler Spacing confirming to IS 9295-1983	Carrying Idler – 800 mm, Impact Idler - 400 mm, Return Idler - 1500 mm
Belt joint	Endless type belt
Scrappers	Driver side: Flat Scraper Rear Pulley: V plough type
Take up	Screw type take up design
Gear Box	Worm type, 20:1 ratio, Hollow input & output
Belt speed	1.2 m/sec
Pulley RPM	72 RPM
Conveyor direction	Uni- direction (One side)
VFD specification	VFD suitable for speed control of conveyor belt motor ranging from 5% to 100% of rated speed
Speed Control	0.3 to 1.2 m/sec (using gear & VFD)

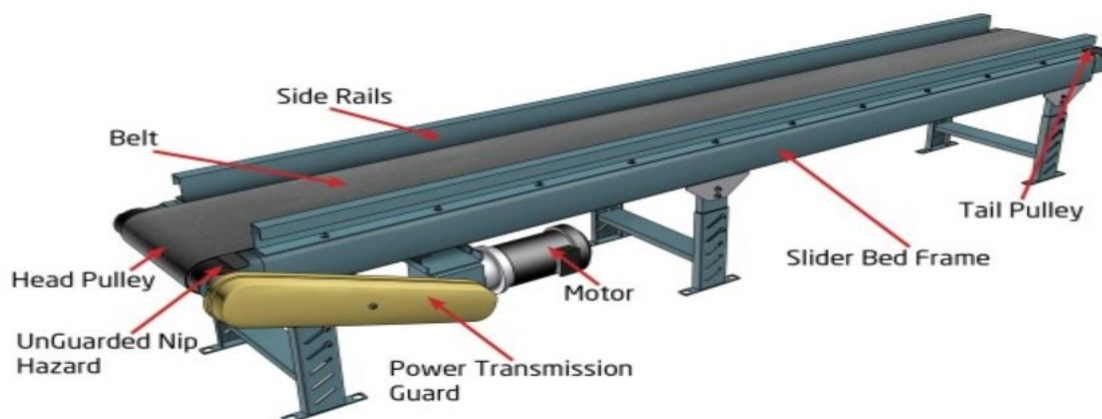


Figure 4: Representative picture of Flat Conveyor Belt for Sorting

6.4 Magnetic Separators

Magnetic separators are used to separate materials having magnetic constituent from a moving stream of particles when passed through an electromagnetic field. It is important that the materials should be put through it as a thin spread in order that all the particles are subjected to a field of same intensity and so that the free movement of individual particles is not impeded. The technical specification for a magnetic separator is given below:

Table 8: Magnetic Separator

Parameters	Specifications
Type	Automatic Cross Belt Overhead Magnetic Separator
Application	Separation of ferrous material from Municipal Solid Waste
Magnet Unit	Permanent Magnet of High Intensity Strontium Ferrite Magnets without power requirement
Magnetic Poles	Covered with non-magnetic stainless steel plates confirming to IS : 10632
Bottom plate	Heavy, wear resistant manganese steel confirming to IS:276
Suspension	Four point suspension
Construction	Two U section pieces fixed on magnet with fastening ears supporting bearing drums
Bearing Drums	With shaft mounted on removable hubs
Belt driven	Reduction gear coupled to electric motor
Working distance (mm)	300 - 390
Belt width – Across (mm)	1200
Motor kW	3.0
Belt type	Belt with 35 mm high studs
Length of magnet (mm)	1100
Width of magnet (mm)	1520
Depth of magnet (mm)	250

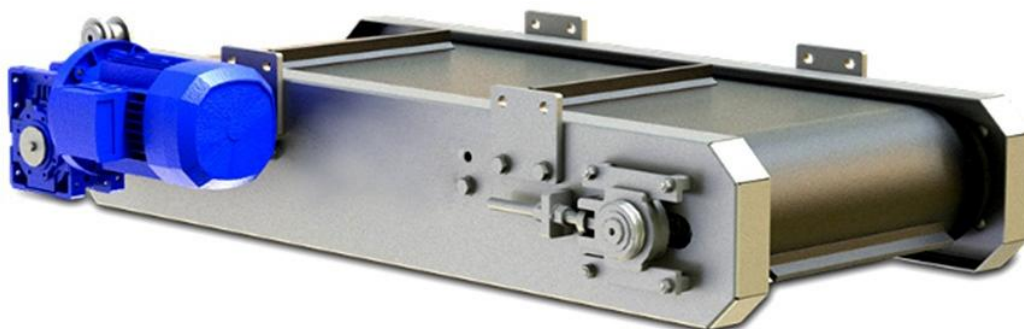


Figure 5: Representative picture of Magnetic Separator

6.5 Vertical Hydraulic Baling Machine (Single Cylinder- Double Chamber)

The Hydraulic Baling machine is used for compressing material such as plastic bottles, aluminum cans, disposal plastic and cardboards etc. into a compact bale for storage and transportation. It shall be vertical single cylinder with double chamber. Detailed specifications are given in the Table 9.

Table 9: Vertical Hydraulic Baling Machine

Parameter	Specifications
Length x Width x Height	540 X 680 X 2600 (mm x mm x mm)
Machine material	Mild Steel (Confirming to IS: 2062)
Type	Vertical Single Cylinder Double Chamber
Capacity of Machine	25 Tonne (Jack force)
Chamber size	540mm x 450mm x 1200mm
Day light gap	1050 mm
Weight of Bale (kg)	50kg -100kg (depending on material feeding & its density)
Cycle time per bale	10min – 12min
Number of Cylinder	1
Stroke length	1100 mm
Platform size	540 x 450 mm
Bale size	540mm x 450mm x 450mm
Machine powder coated	Yes
Cylinder size	65 mm
Operation	Hand Lever Operation System
Motor	5.22 kW (7 HP) copper winding, AC inducting motor, 3-phase, (440 V 50Hz)
Thickness of body plate	8mm
Number of doors	4 nos
Thickness of Clamping plate	30 mm
Accessories & parts	Confirming to BIS Standards
Bale Ejection	By side door
Hydraulic oil tank capacity	120 litre
Drainage system for residue fluid/liquid	Yes
Number of Rope ties	2 nos

Parameter	Specifications
Approx weight of machine	850 kg
Manual	Yes, shall be provided

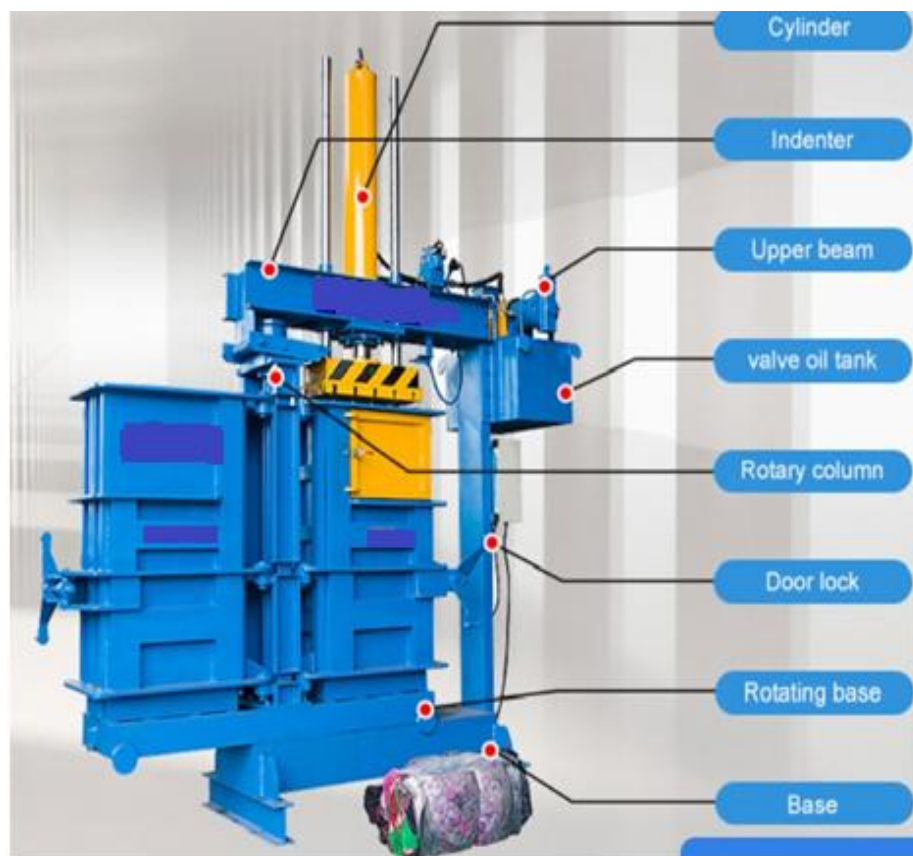


Figure 6: Representative picture of Vertical Hydraulic Baling Machine

6.6 Wheel Barrow

A wheel barrow is a small hand-driven vehicle with two wheels designed to be pushed and guided by a single person using two handles given at the rear. The main usage of wheel barrow at MRF is to move baled materials or any other materials between the designated places. The detailed specifications of wheel barrow are given in Table 10.

Table 10: Technical Specification for Double Wheel Barrow

Parameter	Specifications
Capacity of Wheel barrow	140 litre
Load carrying capacity	450 kg
Sheet Material	Steel sheets confirming to IS:2062
Sheet thickness	1.8 mm
Wheel material	Mild Steel with Solid or Cushioned rubber tyre
Type of bearing / bush	Cast iron bearing
Steel tube	not be drilled, light tubes confirming to IS:1239
Grey Iron Castings	Conform to IS:210
Finish of Metal parts	Two coats of black bituminous paint

Parameter	Specifications
Diameter of the Wheel	500 mm
Nominal width of tyre	50 mm
Hand Grips	Yes
Leg support	Yes
GeM portal ID	5116877-24324484266



Figure 7: Representative picture of Wheel Barrow

6.7 HDPE wheeled Container Bin

These container bins are required to temporarily store the sorted materials at MRF. Dedicated bins will be placed near conveyor belts for sorted materials. The detailed specifications for HDPE wheeled storage bin are given in Table 11.

Table 11: Technical Specification for HDPE Wheeled Container Bin

Parameter	Specifications
Capacity	1100 litre
Size of Container (A x B x C)	1354 x 1373 x 1073 mm ('A' Height x 'B' Width x 'C' Depth)
Upper edge comb (D)	1206 mm
Wheel base width (E)	750 mm
Wheel base depth (F)	880 mm
Wheel base Diameter (G)	200 mm
Material	High Density Polyethylene (HDPE)
Type	Material Injection molded
High resistance to	Heat, chemicals and radiation
Dead weight	50 kg
Pay load	440 kg
Confirming Standards	EN 840-1: 2020
Legs support	4 nos
Hand Grips	Yes

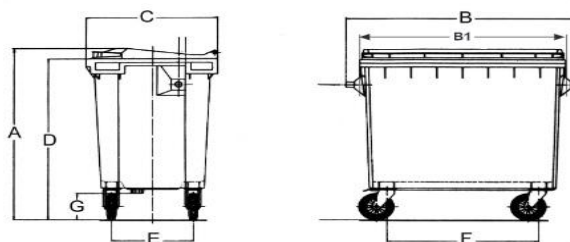


Figure 8: Representative of HDPE Wheeled Container Bin

7 Power Consumption

Monthly power consumption cost, by considering Rs 10 per unit (including fixed cost, cess, etc), is estimated as Rs 62,302 (7.48 Lakh annual). The details of appliances with their power rating are given in Table 12.

Table 12: Estimated Power Consumption

S.N.	Appliance details	Power Rating (W)	Duration of Operation (Hr)	Quantity (Nos.)	Per day Power consumption with usage factor (W)
1	Trommel- Motors	3750	5	2	37500
2	Conveyor Belt motors	19500*	5	1	97500
3	Magnetic Separator	2250	5	1	11250
4	Baler Machine	5220	4	1	20880
5	Weighing Bridge	500	5	1	2500
6	Desktop PC	200	8	2	3200
7	LED Street Light	250	12	3	9000
8	LED Light	100	4	20	8000
9	LED Tub Lights	24	8	15	2880
10	Wall mounted Fan	180	8	5	7200
11	Ceiling Fan	75	5	8	3000
12	Exhaust Fan	60	8	2	960
13	Others load	100	4	1	400
	Expected power consumption in W/day				204270
	Expected power consumption in kWh (units)				204.27
	Expected power consumption per month (units)				6230.24
	Expected annual power consumption in kWh(units)				74762.82

*- Considered as cumulative rating & inclusive of all the belt conveyors

8 Earth Leakage Circuit Breaker (ELCB)

Earth Leakage Circuit Breakers detect and interrupt ground faults. They would protect people, equipment and property from dangerous line-to-ground and shock hazard currents. Applications include ground fault protection of equipment (GFPE), especially when high

distributed capacitance or other leakages cause excessive nuisance trips at lower fault currents. The detailed specification of ELCB is given in Table 13.

Table 13: Specification of Earth Leakage Circuit Breaker

Particulars	Motor	
	3 HP	5 HP
Compliance to ISO certification	ISO 9001	ISO 9001
Conformity to Standard	IEC 61008 – 1	NA
Certification	CE	NA
Electricity	3 phase	
Leakage Action Current, mA	100	30
Nominal Frequency	50 Hz	50 Hz
Pole	2	4
Voltage (AC)	220 V	460 V
Tripping Curve	C type	C type
Protection Degree	IP20	IP20
Current Rating, Ampere	25	63
Rated Sensitivity, mA	100	50
Breaking capacity (kA)	125	60
Leakage Action Time (max)	0.1 second	0.1 second
Rated Impulse Withstand Voltage U _{imp} (kV)	4 kV	4 kV



Figure 9: Pictorial view of ELCB

9 Personal Protective Equipment (PPE)

The PPE are mandatory requirement for the safety and hygiene purpose for workers at the MRF. Table 14 provides the detailed specifications, GeM portal IDs along with applicable codes of practice.

Table 14: Specifications for PPE

Name of PPE	Image/Picture	Specification	Standards
Nose Mask (Surgical)		- Size (L x W) 5.5" x 3.5" - Blue Colour - Plain Cloth Fabric	IS: 9473-2002
(GeM portal ID : 5116877-		- Cotton (10% Poplin) cloth - Non-irritant, anti-allergenic	IS:15323-2003

Name of PPE	Image/Picture	Specification	Standards
63996078307)		- and Skin friendly - Breathable without restriction and environment friendly 50 to 150 GSM of Fabric - Soft stretch elastic ear loops - Foldable	
Safety goggles (GeM product ID 5116877-86122185840_1)		- Polycarbonate lens with soft PVC frame & body. - Fully adjustable headband attached to fit most users. - Light, resilient, durable & over the glass protective eyewear for all day wears. - Anti-fog lens coating 4-point venting system that circulates air yet prevents dust, splashes. - Scratch resistant lens - Lens provides medium velocity impact & splash protection around the eyes. - Universal fit soft nose bridge conforms to facial contours to ensure a comfortable fit.	EU 86/686/EFC , EN166/200 2 and ANSI/SEA Z87.1-2010 or equivalent
Chemical resistant gloves, multi-use		- CE Marked fully nitrile rubber hand gloves (In pair) shall have inside soft cotton flocked lining. - It shall be able to resist acid, alkali & solvent while providing solid protection against snags, abrasion, puncture & cuts. - Nitrile rubber hand glove should meet requirement of the overall length of the gloves shall not be less than 12 Inches (from middle finger to end of the sleeve).	IS: 4770-1991 EN-388 & EN-374 (2016)
Safety (High visibility/ warning) Jacket		100% mesh polyester - Reflective Tape: High gloss - Tape Width: 2 inches	IS: 15809 - 2017

Model Design & Estimates for 10 TPD MRF with Specifications

Name of PPE	Image/Picture	Specification	Standards
Bouffant Caps		- Bouffant caps are lightweight. - Water repellent - Help protect the user against germs and bacteria.	IS: 2925-1984 CE-EN-397 ANSI Z891-2003
Safety shoes		- Safety footwear must be as per ISO. - The standard outlines the minimum and optional requirements for safety footwear. - A protective toecap that can withstand a 200-joule impact. - Antistatic protection, midsole penetration protection, energy absorption, water resistance insulation against cold and heat.	IS: 5852-2004 IS: 15298 (Part 2)-2011
Ear Plugs		- Ear plug for protection against noise (NRR to be minimum 29db) - Made of soft sponge material or silicone - Polyurethane, non-allergic, smooth, comfortable, tapered shape to fit into the ear canal closely, longer length to facilitate fitting. - Removable point, attached with nylon thread packed in good quality self-sealing plastic pouch.	IS: 6229-1980
Hand Sanitizers (GeM portal Product ID 5116877-89293994232)		- Ethanol+Chlorhexidine, isopropanol 20% - Shelf life 36 month from date of manufacturing	IS: 4117-2008

Name of PPE	Image/Picture	Specification	Standards
Apron		- Apron to be used in by personnel performing works procedures with high risk of contamination. - Thickness: 150-300 microns.	IS: 4501-1981

Note: If apron having reflective stripe are available in market that will be preferable, instead of separate Apron & Safety jacket

10 Standard Operating Procedures (SOP) of MRF

Collected dry waste from the sources will be received through an auto tipper/other vehicles, which will be weighed on the weigh bridge. Vehicles will be unloaded at the tipping area. The dumpster bags, gathari etc will be unbundled and oversized materials will be taken out physically for further handling and disposal. The remaining waste will be scooped and placed on infeed Conveyor belt to the trommel. Waste materials will be sorted/seived in fine size less than 60 mm, mid size (60-250 mm) and oversize (above 250 mm) in the Trommel. Fine fraction would generally contain inert, multi layered, plastics etc. Mid-size (60 -250mm) recyclable materials and oversize (>250mm) particle materials contain multi-layer package materials, paper and cardboards etc. Workers would physically sort this waste on sorting belts. Non-recyclable components and inert will be sent to sanitary landfill. Potential hazardous, such as batteries, aerosol cans, etc would also be removed physically. Other Domestic Hazardous Waste (DHW), such as empty paint cans, empty vials of injections, discarded/expired medicines, etc. are segregated. DHW would be sent to common facilities for hazardous wastes and bio-medical wastes, as relevant. Checklist and formats are attached at **Annexure 2**.

MRF is designed with the assumption that only dry waste shall be received at the receiving area. In case of mixed waste/domestic hazardous waste/sanitary waste are arriving at the receipt area a checklist need to be filled by the weigh bridge operator. The checklist is attached as **Annexure 2(B)**. The mixed waste/domestic hazardous waste/sanitary waste should to be channelized separately at the receiving area and the segregated materials shall be deposited in the bins. SOP for all the activities with do's and don'ts are described in the following sections.

10.1 Morning Protocol/Starting Protocol- Incharge/Workers-each category

While starting operations in the morning, MRF in-charge or, his/her assistant may take a round of facility apart from a roll call. Information may be noted as per **Annexure 2 (C)**.

- Swachhata Mitra will wear the uniform and put on the required PPE.
- The premises of the facility shall be cleaned.
- Waste receiving and transfer points shall be kept clear.
- Switch on the fans for proper ventilation half an hour before the operation

- ❶ Maintaining and watering the garden around the MRF

10.2 Receiving Waste

Each consignment of segregated dry waste would be weighed. Segregated dry waste shall be brought to “Tipping area”. Sample format for the Receipt of Material/waste is provided at **Annexure 2 (D)**.

10.3 Sorting of Waste

Some waste materials will be sorted out at tipping area and then in a trommel. The materials such as valuable recyclables, paper, empty cans, metal scrap, plastics (polyethylene terephthalate and polypropylene) and glass will be sorted.

- ❶ Segregated solid waste would be fed in the trommel for size separation. The qualified materials (undersize product) are discharged at the end of conveyor belt. While oversize materials are discharged at the rear end to the oversize conveyor belt.
- ❷ The 9 workers (preferably trained rag pickers) should be employed for three conveyor belts for material sorting. One 1100 litre HDPE bin will be placed between two workers.
- ❸ Workers should sort the material as per the waste category and deposit in the designated bins.
- ❹ All material except glass, glass bottles and E-waste shall be separately baled in the baling machine.

10.4 Evening Protocol/Closing Protocol

- ❶ All workers shall change their uniform to personal dress and keep PPE in locker at MRF before leaving the plant. **Annexure 2 (I)** may be followed.
- ❷ All workers must wash their hands and face before leaving the plant.
- ❸ Ensure all the machinery/ equipments(fan/lights) are switched off before leaving the MRF

10.5 Storage

- ❶ It should be ensured that sorted items are stored in designated compartments.
- ❷ Fragile material shall be heaped in low height heap.
- ❸ Individual recyclable materials shall not be evacuated before occupy it occupies 90% storage capacity.
- ❹ Compartments are to be thoroughly cleaned at least once in a month, at a set date of calendar month.
- ❺ Rodent control measures shall be adopted at least once in a month. Intense control measures shall be adopted if rat infestation noticed (visibility of rats and rat litter)



Sorted & stored plastic bottles



Bales of plastic bottles



Sorted & stored cardboard papers



Bales cardboard papers



Sorted & stored Aluminum cans



Bales Aluminum cans

Figure 10: Examples of good practices for the storage of sorted waste

10.6 Dispatch and Sales

Materials must be dispatched at regular frequency to the authorized recyclers. More dispatch procedures shall also be initiated if the allotted space for a particular material is occupied by 90%. During dispatch, outgoing materials shall be weighed and be recorded by

authorized by MRF in-charge. Sale proceeds received in cash shall be registered. Formats for material dispatch and sale is provided at **Annexure 2 (E) and (F)**.

10.7 Record Keeping (Documentation)

- ❶ Receipt & Dispatch details including photographs shall be documented for monthly reporting by the MRF in charge at **Annexure 2 (G)**
- ❷ Monthly wages shall be processed based on attendance register.
- ❸ A suggestion and feedback register shall be maintained at the facility.
- ❹ Information to be displayed as per **Annexure 2(H)**

11 Maintenance

A maintenance schedule is required for the smooth, uninterrupted operations of the MRF. Preventive and breakdown maintenance are the two major parts. For breakdown maintenance follow LOTO checklist **Annexure 2 (J)**. Preventive maintenance is required at MRF may be on daily, weekly, and monthly basis. Maintenance schedule may be drawn in consultation with the equipment supplier(s) and should be adhered to. Some of the major points are given below.

- ❶ A preventive maintenance checklist /record book / card shall be maintained.
- ❷ All bearing, roller and rotating machine parts shall be cleaned and greased every week (Say Friday).
- ❸ The functioning of all utilities like drinking water, toilet facilities, electrical fittings, rainwater harvesting system (if any), and solar panel & inverter (if any) shall be checked for complaints & problems by the incharge every week (Say Thursday).
- ❹ All firefighting equipment and accessories are regularly checked and ensured in place (every Wednesday).

Onsite maintenance should be recorded.

12 Annual Maintenance Contract (AMC)

Various machines such as trommel, conveyor belts, weigh bridge, Hydraulic baling machine, desktop computer, fans, etc would be installed at MRF. Each machine has a warranty associated with fresh procurement. On expiry of warranty period, maintenance contract would be necessary.

An Annual Maintenance Contract (AMC) to cover basic service on products or a Comprehensive Services Contract (CMC) covering additional spare parts, labour, travel cost of technician, etc may be entered into. It may be appropriate that AMC/CMC is done with the contractor, who has supplied and commissioned MRF, for a period of three years after the initial warranty period of 1 year.

13 Display of Information Under The Factories Act, 1948

- ❶ Working hours shall be displayed outside the facility.

- ❶ The facility shall also display “OPEN” and “CLOSED” signboards during and after working hours respectively.
- ❷ Bilingual signboard mentioning “Child labour Prohibited” shall be permanently displayed at main gate of facility.
- ❸ Campaign posters on the following topics like segregation, recyclability, and hazards of burning mixed waste/incineration shall be displayed.
- ❹ The contact number of the MRF-in-charge, helpline numbers, nearest physician, hospital, area fire station and police station shall be prominently displayed.

14 Safety and Hygiene Practices

On commissioning of MRF and during handing over to ULB or, operated on behalf of ULB, following table shall be referred and safety practices should be adopted as per checklists for Electric safety, Mechanical safety and Fire prevention & protection. Check list for machine safety and format for electrical safety is attached at **Annexure 2 (K) and (L)**.

Table 15: Hazardous Activities and Safety Practices

S. N.	Hazard	Precaution	Cure
1	Cuts and injuries due to presence of broken glass, sharps, needles which may lead to septic wounds and tetanus	Use of Safety Gloves	Medical help be sought immediately in case of injury
2	Contact with dirt and domestic hazardous waste	Along with wearing gloves, sanitizers always be carried and used	---
3	Contact with used sanitary napkin, and soiled diapers	Gloves should be worn and direct contact with any such waste be avoided. Handle with tools and store & forward to BMW facilities.	---
4	Callosities on the fingers observed	---	Should immediately contact a doctor
5	Exposure to fumes causing irritation of nose, throat and lungs	Suitable masks be used by the <i>Safai Mitra</i> while working	Medical help for severe cases to be sought immediately

14.1 Hygiene Practices

It is mandatory to provide a safe working environment for workers at the MRF. The following points shall be considered for hygiene practices.

- ❶ Always keep the MRF dry & clean.
- ❷ Keep sorting & storage area dry and free from pests & flies.
- ❸ Regularly spray disinfection agent as a prevention practice.

- All working personnel at the MRF must wear uniform and PPEs while at MRF plant.
- Hands should be washed with soap before leaving/eating at the MRF.
- Monthly cleaning and “Pest-Control Treatment” routine has to be fixed at MRF and should be strictly followed.
- Rodent control measures shall be in place.

15 Safety Trainings

15.1 Refresher Training

The training may be conducted on a quarterly basis to ensure that all workers are updated with safety requirements on site as per work requirements.

15.2 Toolbox Talk

At least one toolbox talk should be organized once a month. These talks will be designed to highlight relevant safety and industrial health issues to the workforce on a regular basis to raise their level of awareness in local language. A safety pledge will be developed and it should be a part of toolbox talks.

16 Fire Prevention and Protection

The following are some of the fire prevention measures that shall be adopted.

- Store flammable liquids in approved containers, cabinets, and designated areas and follow the standard procedures.
- Never pour flammable liquids into sewer or drains.
- Ensure fire extinguishers are placed at strategic locations and should be always in working condition.

17 Emergency Response Plan

An emergency plan must be played at each MRF by engaging a certified individual safety professional. The major steps for developing the Emergency Response Plan must include the following:

- Review hazard or threat scenarios identified during the risk assessment.
- Assess the availability and capabilities of resources for incident control & stabilization including people, systems, and equipment available within MRF and from external sources.
- In-charge will contact public emergency services (e.g., fire, police and emergency medical services) to determine their response time for reaching the MRF, knowledge about facility and associated hazards and their capabilities to stabilize an emergency at MRF.
- Develop protective actions for life safety (evacuation, shelter, shelter-in-place, lockdown).
- Develop hazard and threat-specific emergency procedures using the Emergency Response Plan.

- ❶ Train personnel so they can fulfill their roles and responsibilities.
- ❷ Facilitate exercise/drills to practice the plan.
- ❸ Observe Fire Safety drills and conduct fire safety week.
- ❹ Conduct mock drills at least once in six months.

The emergency contact numbers are given in Table 16.

Table 16: Emergency Contact Numbers

Sr No	Particulars	Contact Number
1	In-charge	-
2	On duty Supervisor	-
3	Disaster Helpline	1077
4	Women Helpline	1091
5	Police	100
6	Fire & Rescue	101
7	Ambulance	102, 108
8	Nearest Govt. Hospital	-
9	Disaster Management	-
10	Nearest De-poisoning Centre	-

17.1 First Aid Box

It is important to have a well-stocked first aid box at MRF to deal with minor accidents and injuries. It should be accessible all the time. A basic first aid box should contain,

- ❶ Antiseptic liquid/cream
- ❷ Bandages of different sizes
- ❸ Small, medium and large sterile gauze dressings
- ❹ A box of adhesive bandages
- ❺ Crepe rolled bandages
- ❻ Safety pins
- ❼ Disposable sterile gloves
- ❽ Tweezers, scissors
- ❾ Micro-porous, sticky tape
- ❿ Thermometer
- ⓫ Cream or spray to relieve insect bites and stings.
- ⓬ Painkiller cream/spray



18 Other Guidelines

- ❶ The entrance and exit of MRF plant should always be kept clear.
- ❷ A minimum safe distance/clearance between two machines as advised by the manufacturer and in case of doing maintenance or, futuristic replacement.

- ❖ Facility should be certified by a structural engineer/local ULB engineer and the fire department as per rules.
- ❖ Emergency numbers can be displayed at prominent locations.
- ❖ Regular checking of PPEs and maintain PPE replacement records.
- ❖ Fitness certification of machines/equipment, frequency of certification need to be recorded in a file.
- ❖ Regular inspection, medical fitness record of personals and workmen, tied up with the nearby hospitals.
- ❖ Emergency stop switches on conveyer belts and various electrical machines, ensuring adequate earthing and regular maintenance of earth pits with display of earth resistance value.
- ❖ Different type of mock-drills to check the effectiveness of the system.
- ❖ CCTV installation at various locations within MRF.

19 Important points in Civil Works

Sequence of civil works for MRF construction

- ❖ Clearing out the site (Drawings as per design should be ready)
- ❖ Setting out the MRF building
- ❖ Excavations for isolated footing and flooring
- ❖ Construction of isolated footing and column upto the plinth beam level- All works
- ❖ Leveling and compacting of the earth upto the GSB layer following the IRC guidelines
- ❖ Vibratory rollers of 8 - 10 capacity should be engaged for compacting the soil and sub base layers
 1. Granular Sub Base (GSB) layer
 2. Wet Mix Macadam (WMM) layer
- ❖ Laying and compacting of GSB/WMM layers to the recommended thickness
- ❖ Laying of Cement Concrete layer 1:2:4 over the WMM layer, duly vibrated
- ❖ Construction of plinth beam and superstructure including columns, brick walls etc. say to a height 1 m above the plinth level
- ❖ Laying of flooring using vibrated M30 grade concrete. Care should be given for preventing cracks on the floor by providing expansion joints at a recommended size of 3 X 4 m as per design
- ❖ The concreting of floors should be done in staggered bays, laying diagonally

Best practices to be adopted

- ❖ The State Government/State Mission Director should develop a technical team for implementing MRFs across the State including quality control of civil works in all ULBs
- ❖ Ensure proper construction & expansion joints for the building where concrete flooring and concrete road works are required.

- Tendering of works may be done at the State level - ULB wise and agreements for finalized bids may be executed by the ULB and Contractor and monitored
- ULBs may take support of State PWD for implementing civil works for proper setting out and quality control.

20 Statutory Requirement

Various applicable clearances under different rules and acts need to be obtained by the ULB prior to the commencement of work or operation of the plant. A generic requirement of clearances is described in Table 17.

Table 17: Statutory Clearances

S. No.	Clearance Requirement	Regulatory Authority	Remarks
1	Consent to Establish (CTE)	State Pollution Control Board/PCC for UTs	To be obtained by the ULB/Contractor under Water Act 1974 and Air Act 1981 through online application at the respective SPCB/PCC with necessary supporting documents like layout plan, key plan, project report and consent fee at least 30 days prior to the commencement of works at site
2	Consent to Operate (CTO)	State Pollution Control Board/PCC for UT	To be obtained by the ULB/Contractor/Occupier under Water Act 1974 & Air Act 1981 through online application at the respective SPCB/PCC with necessary supporting documents like Key plan, actual layout plan, project report and consent fee at least 30 days prior to the commencement of operation of plant
3	Building permit/building number	Concerned Urban Local Body	Buildings permit/building number to be issued to the MRF.
4	LT power connections	Electricity Supply Company	The ULB/operator/occupier need to submit an application with necessary fees at the concerned electricity company along with documents as per checklist including test report from competent electrical contractor, layout plan, authority letter in favor of applicant official, and clear title of facility should be submitted prior to the commencement of operation of the plant.
5	Water Connection	Water Supply and Sewerage Department/ULBs	The applicant should submit an application of water connection with necessary fees and supporting documents to the concerned water supply and sewage department prior to the commencement of operation of the unit.
6	Sewer	Water Supply and	The applicant should submit a new application

S. No.	Clearance Requirement	Regulatory Authority	Remarks
	Connection	Sewerage Department	for connecting the sewage outlet with the sewerage network system with necessary fees and supporting documents to the concerned Water Supply and Sewage Department prior to the commencement of operation of the unit.
7	NOC/Clearance from Fire Department	Fire Department	The respective ULB shall obtain NoC/Clearance from respective fire department prior to the operation of the plant after the issue of building number.

21 Suggestions for Siting of MRF

Accessibility and land use may be important for MRF siting. MRF facility shall be located close to the source of the MSW generation or Waste to Energy plant or landfill for minimization of travel distances and cost optimization. Centralized/decentralized MRF can be developed as per site suitability. In order to locate a MRF near residential areas, the facility must be environmentally and aesthetically acceptable. The plantation of trees/shrubs in the buffer zone of MRF will improve aesthetics and decrease noise pollution. Some of the suggestions for siting of MRF are given below:

- Located close to existing roads, but traffic resulting from the movement of waste collection trucks should be accounted for.
- Near or within municipal limits that generate the dry waste to be processed for recyclables.
- Should be sited in flat or, gently sloping stable area to reduce excavation/construction cost and avoid problems of slope in stability
- Flood-prone areas should be avoided. If there is no alternative site, its plinth level may be 1.0 metre above the high flood level (HFL) mark.
- Apart from above, every State Pollution Control Board/ Pollution Control Committee has their own siting guidelines which shall be adhered to siting MRF.

22 Lightning Protection System

A lightning arrestor confirming to IS -2309:1989 may be provided to protect the shed and machinery/equipment.



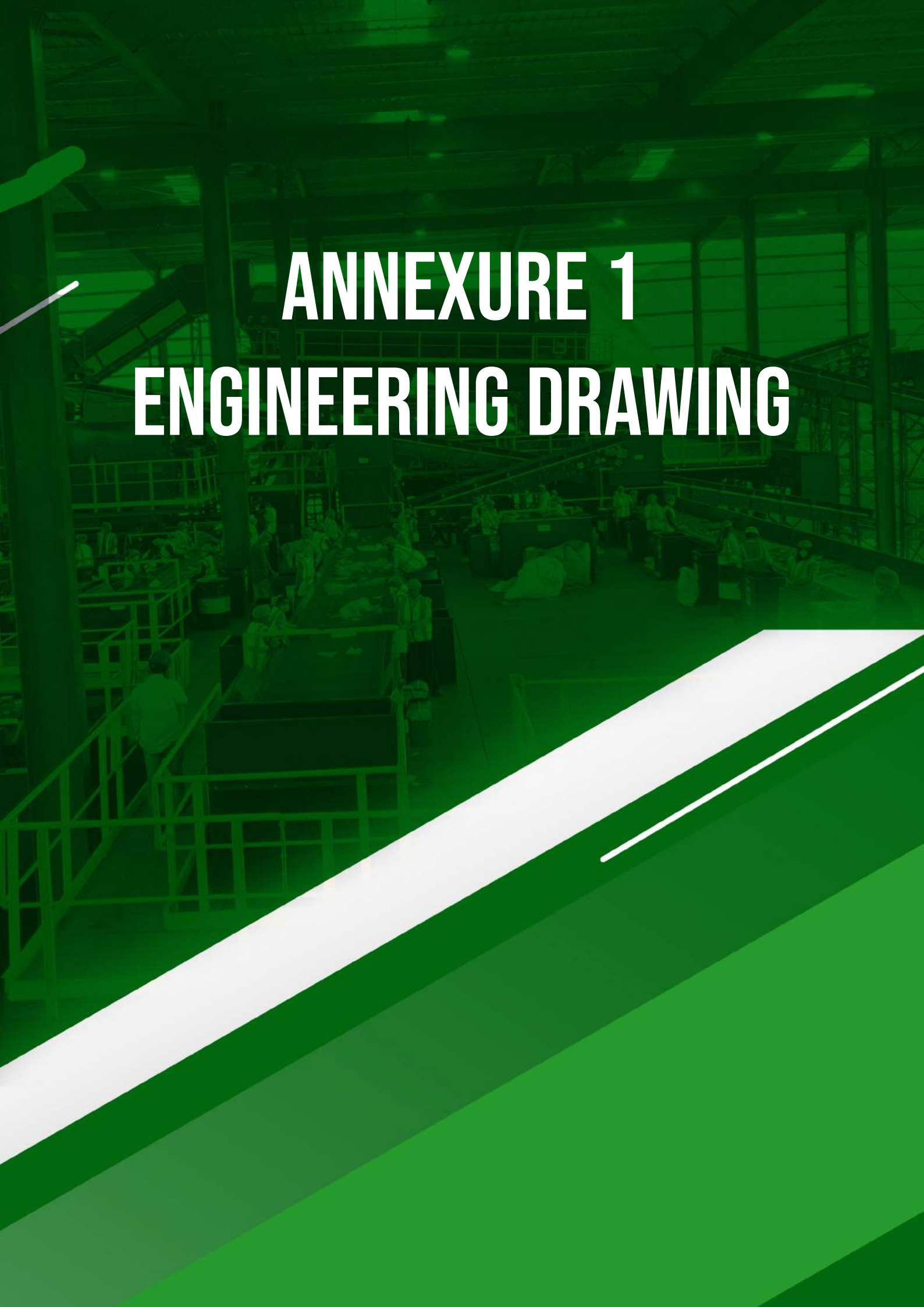
Reference

- ♻️ Advisory on Material Recovery Facility (MRF) for Municipal Solid Waste by Central Public Health and Environmental Engineering Organization(CPHEEO)
- ♻️ Municipal Solid Waste Management Manual, Part 2 & 3, 2016 by Central Public Health and Environmental Engineering Organization(CPHEEO)
- ♻️ The Solid Waste Management Rules, 2016
- ♻️ The Plastic Waste Management Rules, 2016
- ♻️ Guidelines for Disposal of Plastic Waste, Central Pollution Control Board, 2017
- ♻️ National Building Code of India 2016 Volume 1 & 2
- ♻️ Delhi Schedule of Rates Volume 1 & 2, 2023.



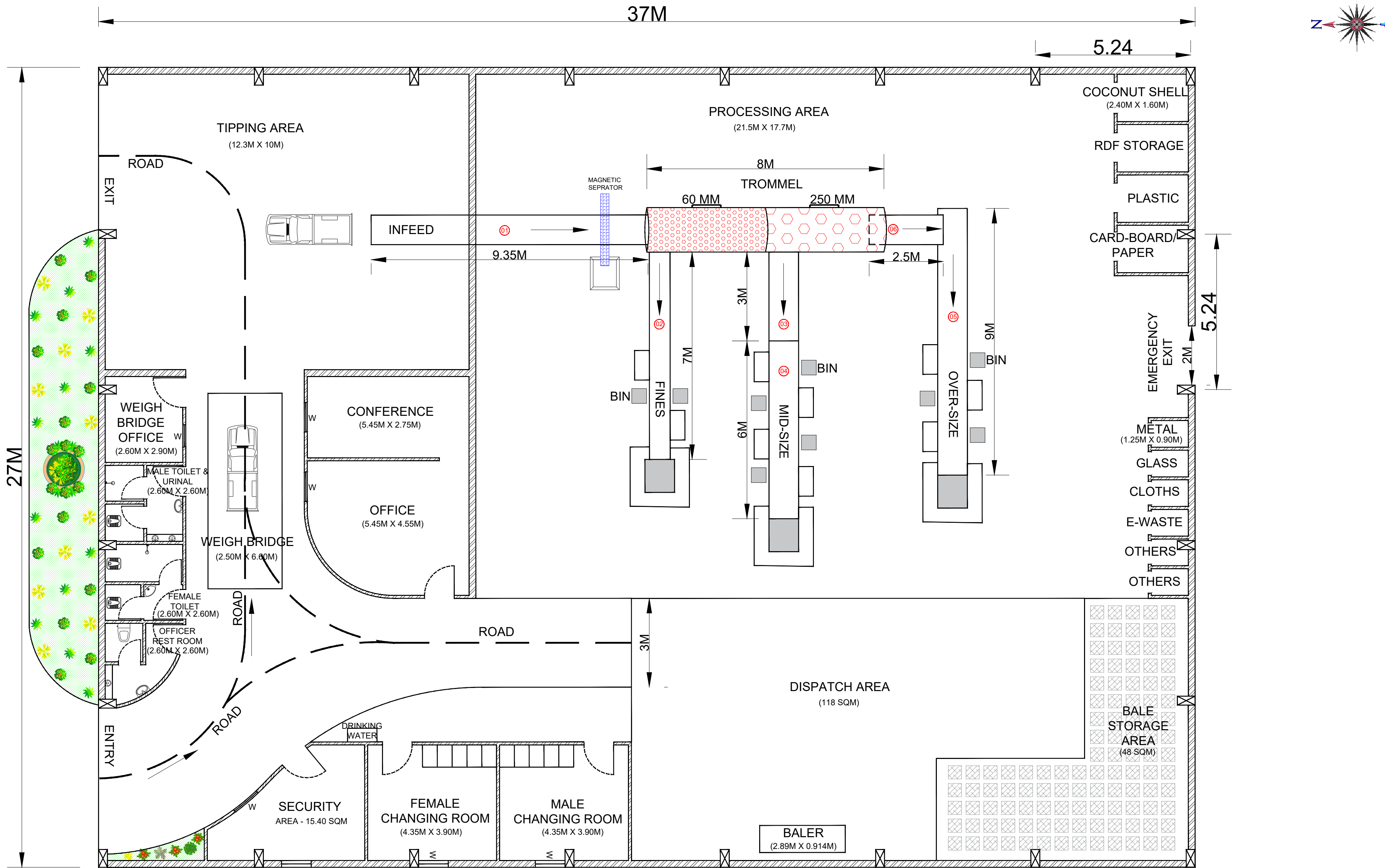
ANNEXURE

The background of the page is a photograph of a large industrial facility, likely a textile mill or garment factory, with multiple levels, conveyor belts, and workers. The entire image is overlaid with a semi-transparent green filter. In the bottom right corner, there is a large, abstract geometric design consisting of several overlapping triangles in different shades of green and white, creating a modern, dynamic look.

The background is a photograph of a large industrial factory interior, featuring high ceilings, steel beams, and various pieces of machinery. The entire image is overlaid with a semi-transparent green filter. In the bottom right corner, there are several overlapping geometric shapes in different shades of green, along with a few thin white diagonal lines.

ANNEXURE 1

ENGINEERING DRAWING

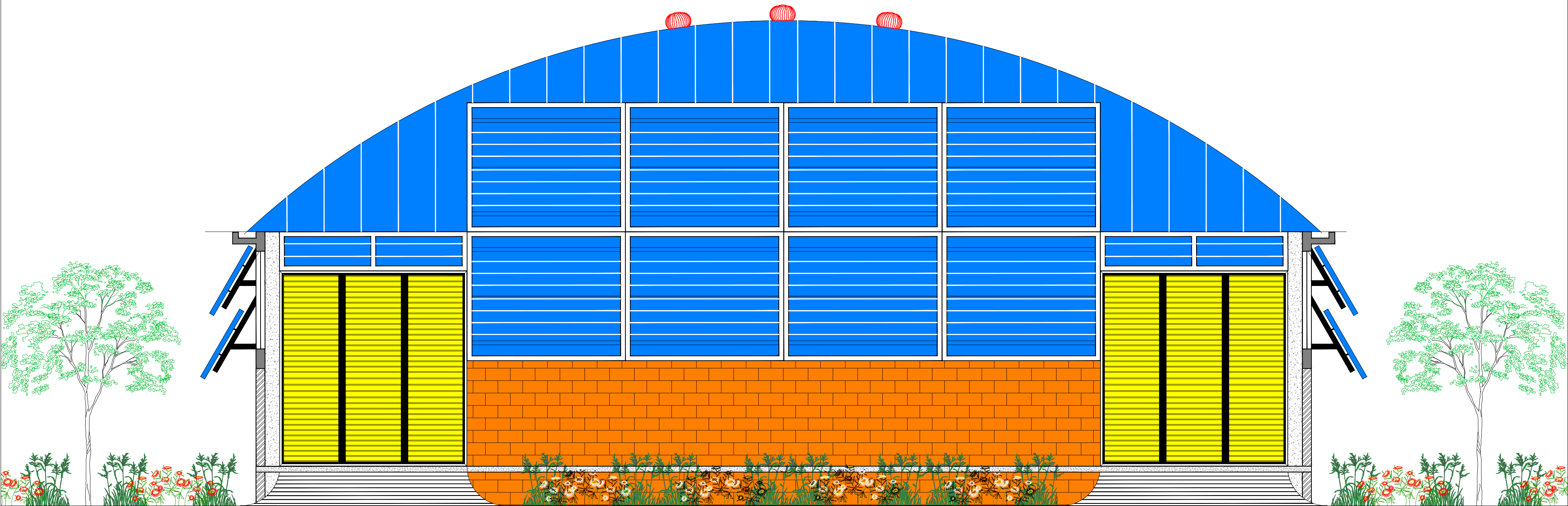


DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

SR. NO.	EQUIPMENTS	QUANTITY(NO.)	DIMENSIONS(M)	Client:		Project:		DESIGNED BY :		
01	WEIGH BRIDGE	1	2.5 X 6.6	 Ministry of Housing and Urban Affairs Government of India		MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0		DRAWN BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
02	TROMMEL	1	1.0 X 8.0						RAHUL ARYA	
03	CONVEYOR BELTS	6	TOTAL LENGTH : 37M	 RITES Ltd. (A Government of India Enterprise)		TITLE: TYPICAL LAYOUT FOR 10 TPD MRF PLANT		CHECKED BY :	SANJAY RAUT	
04	BALER	1	2.89 X 0.914					REVIEWED BY :	CPHEEO,MoHUA	
05	MAGNETIC SEPRATOR	1							DATE : FEB. 2024	



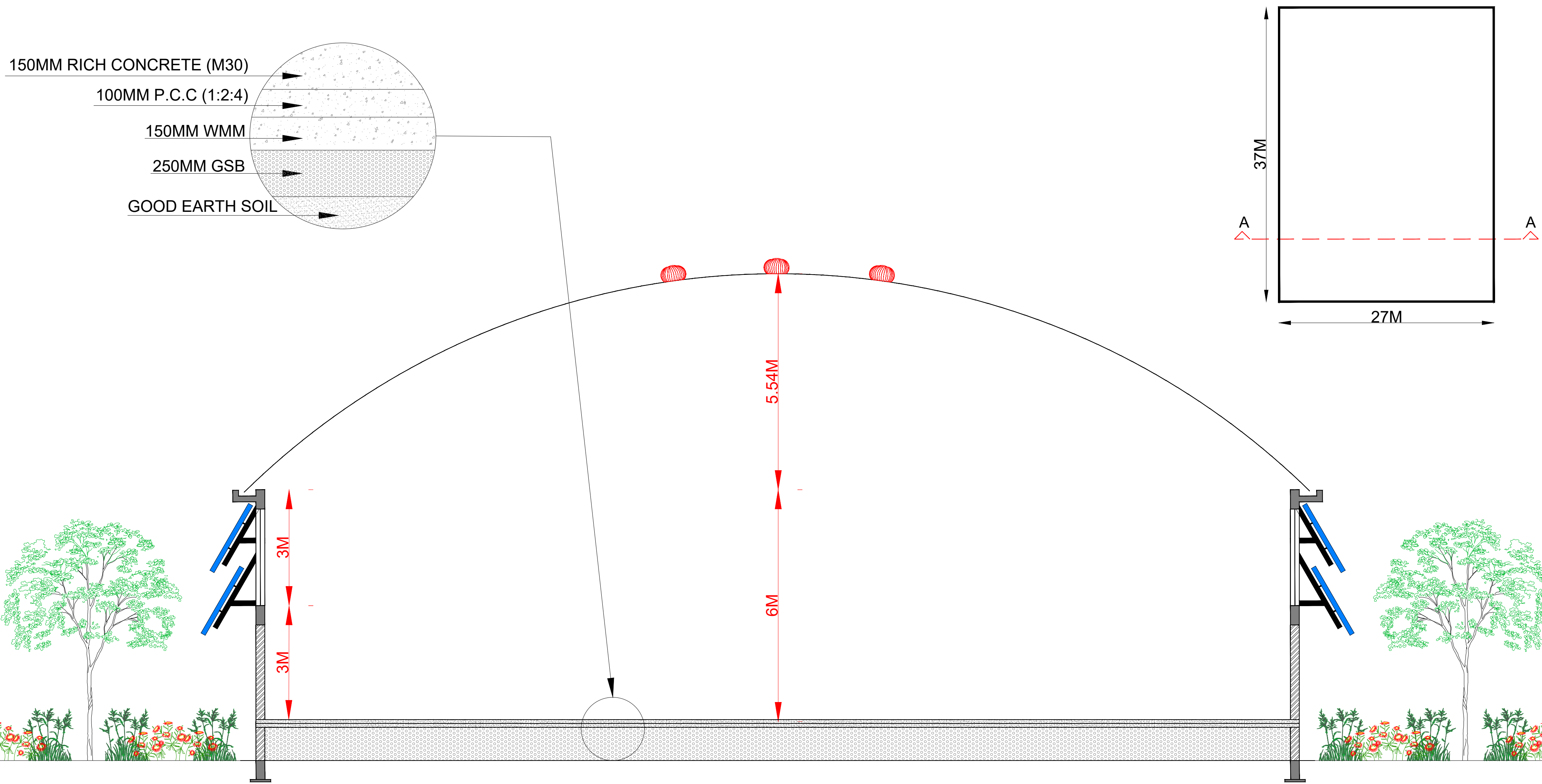
FRONT ELEVATION

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NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant:  RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
			DRAWN BY :	RAHUL ARYA	
		TITLE: TYPICAL ELEVATION OF 10 TPD MRF	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024



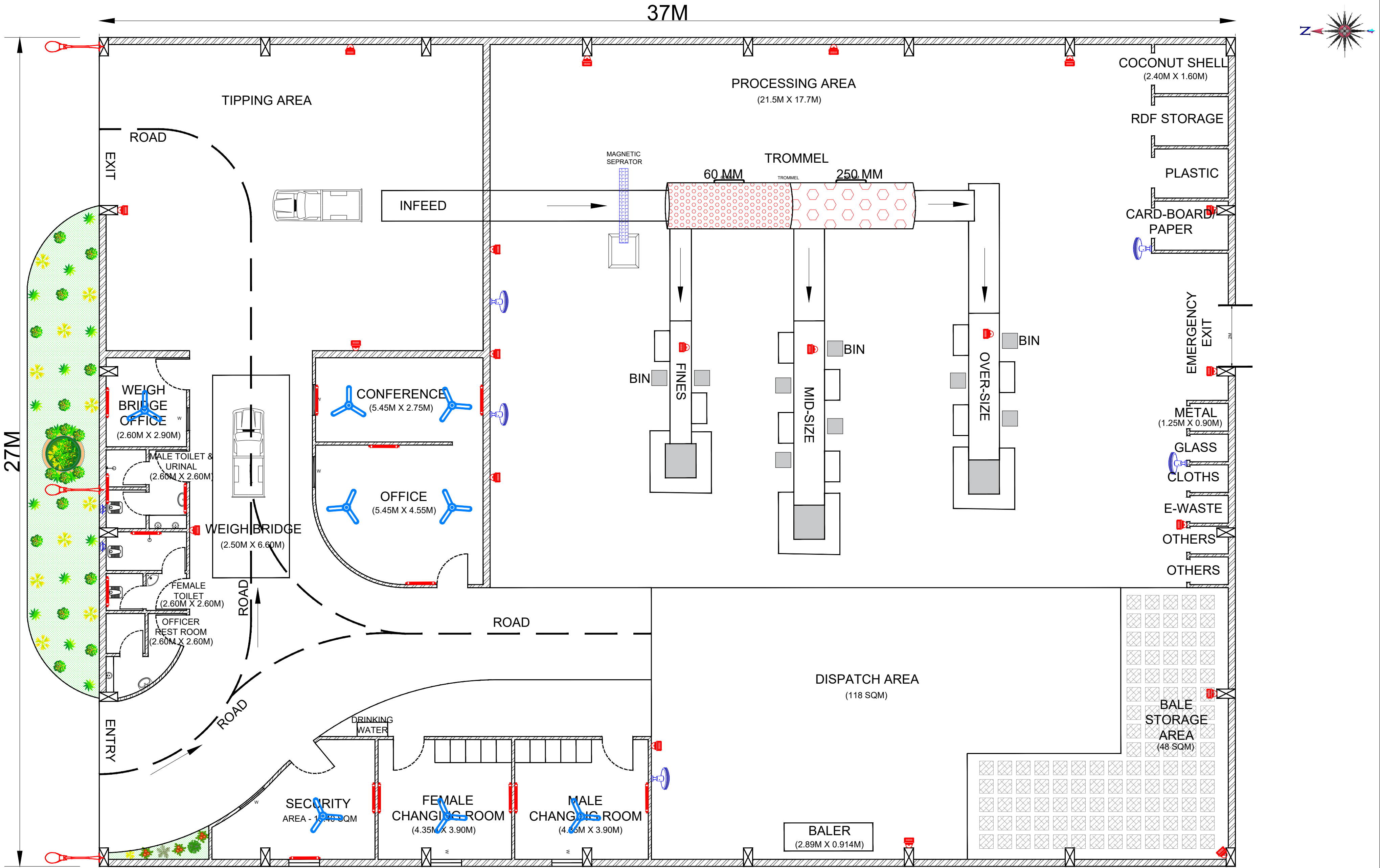
DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant:  RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY : CHETAN A. PATIL & DR. ANAND SONAWANE		
			DRAWN BY : RAHUL ARYA		
		TITLE: TYPICAL CROSS SECTION 10 TPD MRF	CHECKED BY : SANJAY RAUT		
			REVIEWED BY : CPHEEO,MoHUA	DATE : FEB. 2024	

DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

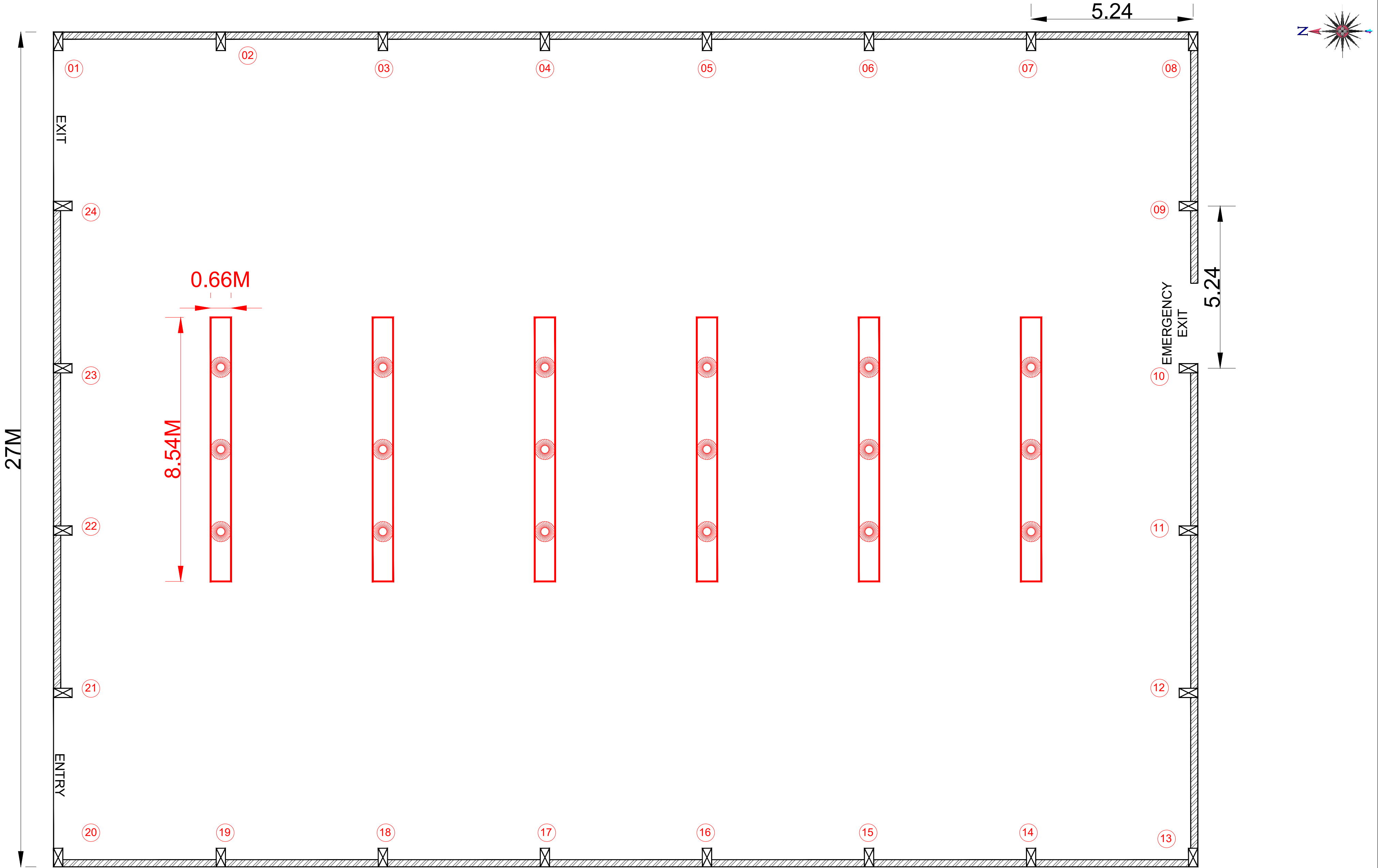


ELECTRICAL LAYOUT

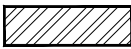
NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

SR. NO.	ITEMS	QUANTITY(NO.)	SYMBOL	Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS Consultant:  THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0 TITLE: TYPICAL ELECTRICAL LAYOUT FOR 10 TPD MRF PLANT	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
01	STREET LIGHT (250W)	03				DRAWN BY :	RAHUL ARYA	
02	LED LIGHT (100W)	20				CHECKED BY :	SANJAY RAUT	
03	LED TUBE (24W)	15						
04	WALL MOUNTED FAN (180W)	05						
05	CELLING FAN (75W)	08				REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024
06	TOILET EXHAUST FAN (60W)	02						

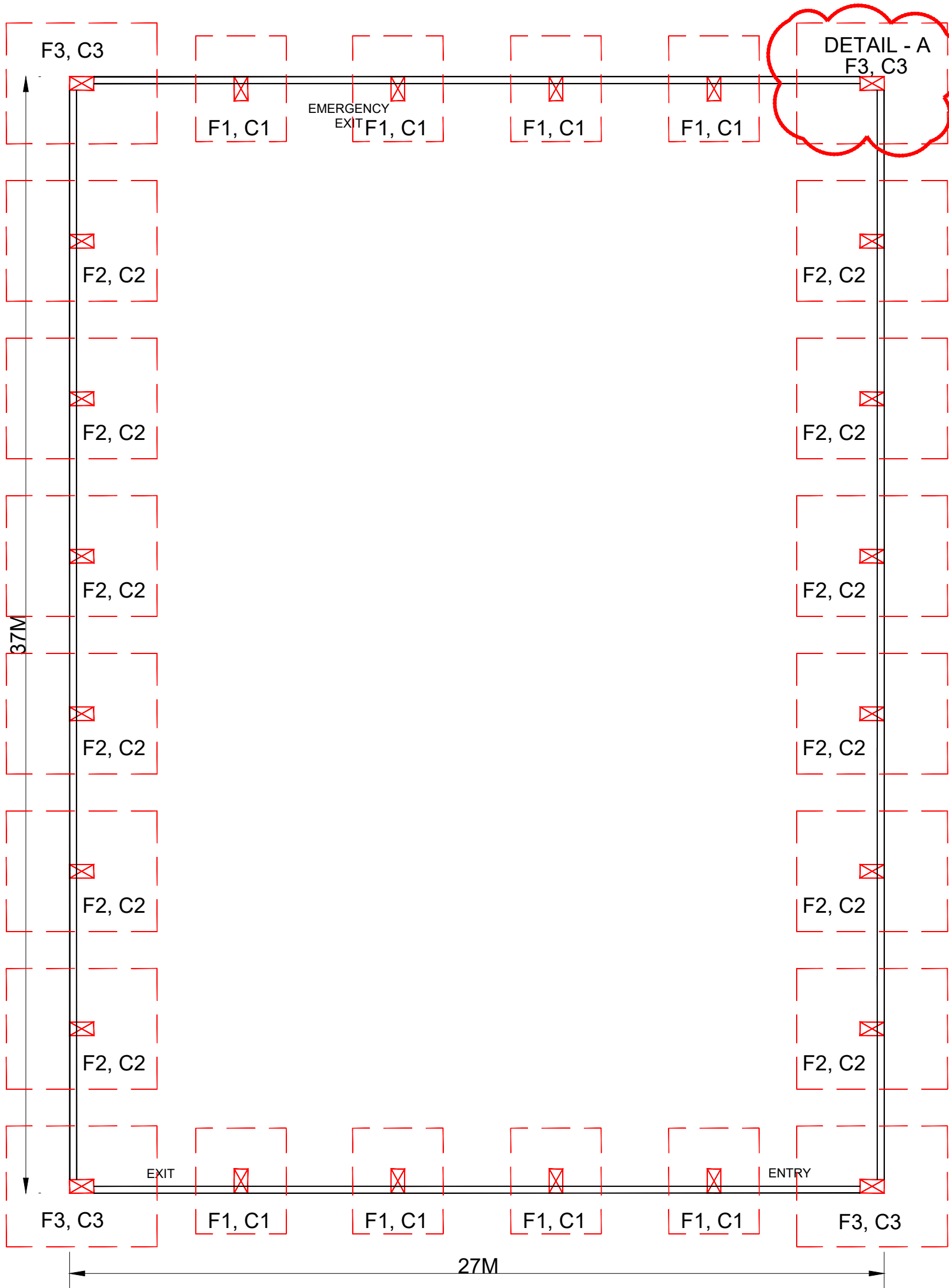
DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED



NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

SR. NO.	ITEMS	SYMBOLS	Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS Consultant:  THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0 TITLE: TYPICAL LAYOUT OF SKYLIGHT ROOF & VENTILATORS EXHAUST FAN	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
01	COLUMN (HT - 6M) DIMENSION : 300 X 600 MM				DRAWN BY :	RAHUL ARYA	
02	BRICK WORK (230 MM THICK) 3M HT				CHECKED BY :	SANJAY RAUT	
03	ROOF EXHAUST FAN				REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024
04	SKYLIGHT SHEET (8.54 X 0.66M)						

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COLUMN & FOOTING PLAN

NOTES:- NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

1. SBC assumed for design of foundation is 10ton/m2 at 2m below the natural ground level.
2. Building is assumed to be situated in Seismic Zone IV.
3. Grade of concrete as M30.
4. Reinforcement bars shall be TMT Fe-500D grade conforming to IS:1786 of 2006 reinforcement shall be clean and free from oil, mill scale etc, and shall be bent cold to the shapes and dimensions indicated and shall be placed exactly as shown.
5. Wind load at top of the RCC frame and wind pressure applicable on the RCC frame is taken as per profflex loading provided.
6. The walls are assumed to be made up of block work (200mm thick) having a density of 11kN/m3.
7. All RCC works to be done as per IS 456-2000.
8. All reinforcement work to conform to IS-456-2000 & IS-13920-2003.
9. All intersections of bars shall be securely bound with n0.18 gauge pliable wire.
10. The lap length shall not be less than 50Ø and anchorage length of bars shall not be less than 52Ø. not more than 50% of bars shall be lapped at same location . lap shall be staggered as per Clause 7.2.1 of IS 13920-1993.

Client:



Ministry of Housing
and Urban Affairs
Government of India

MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:



RITES
THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

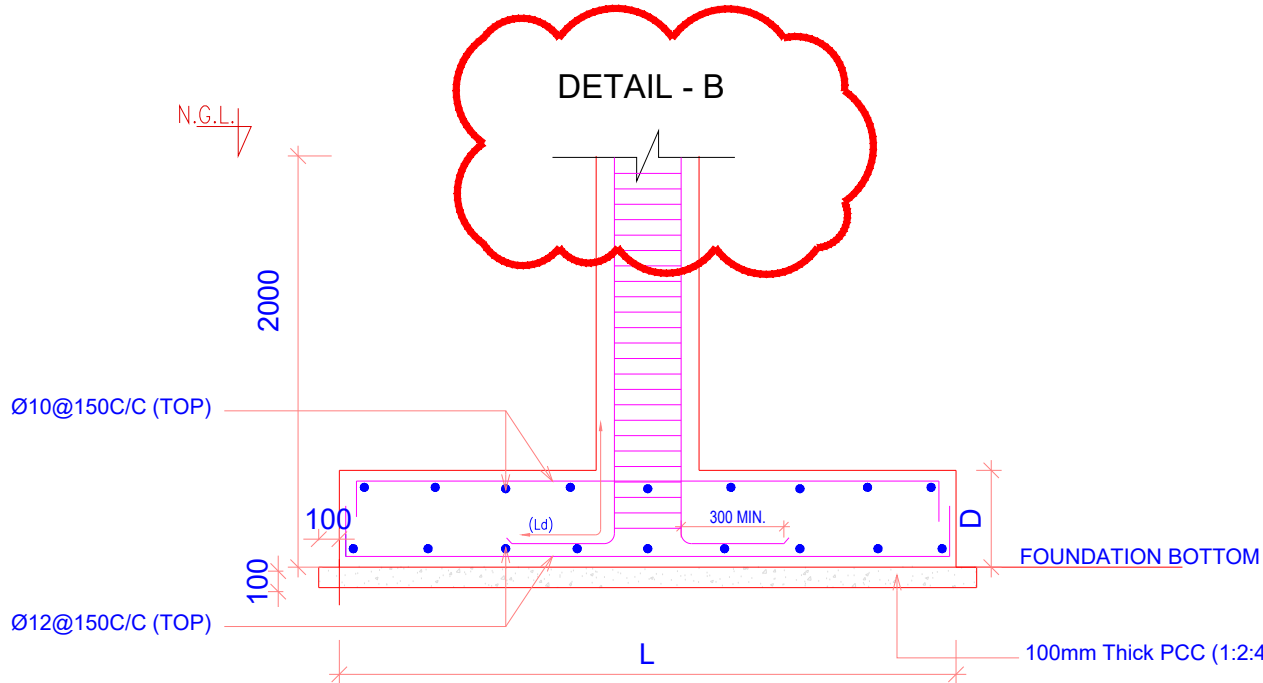
Project:

MODEL DESIGN FOR 10 TPD MATERIAL
RECOVERY FACILITY UNDER SBM-U 2.0

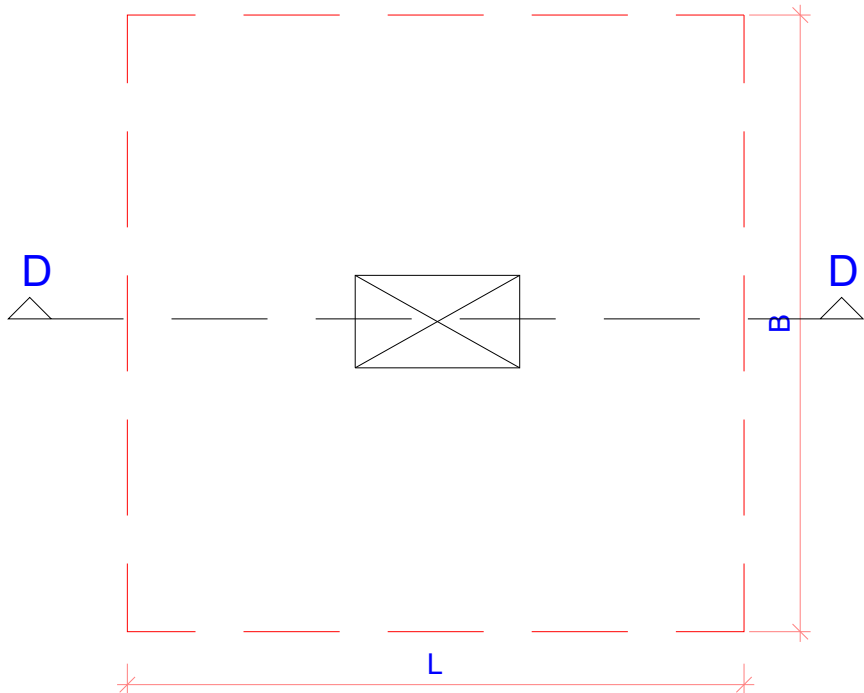
Title: TYPICAL LAYOUT FOR FOUNDATION &
REINFORCEMENT DETAILS FOR
STRUCTURAL MEMBER FOR
10 TPD MRF PLANT

DRAWN BY :	RAHUL ARYA	
CHECKED BY :	CHETAN A. PATIL & ANTONY JOSE	
APPROVED BY :	SANJAY RAUT	
REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024

PLINTH BEAM REINFORCEMENT



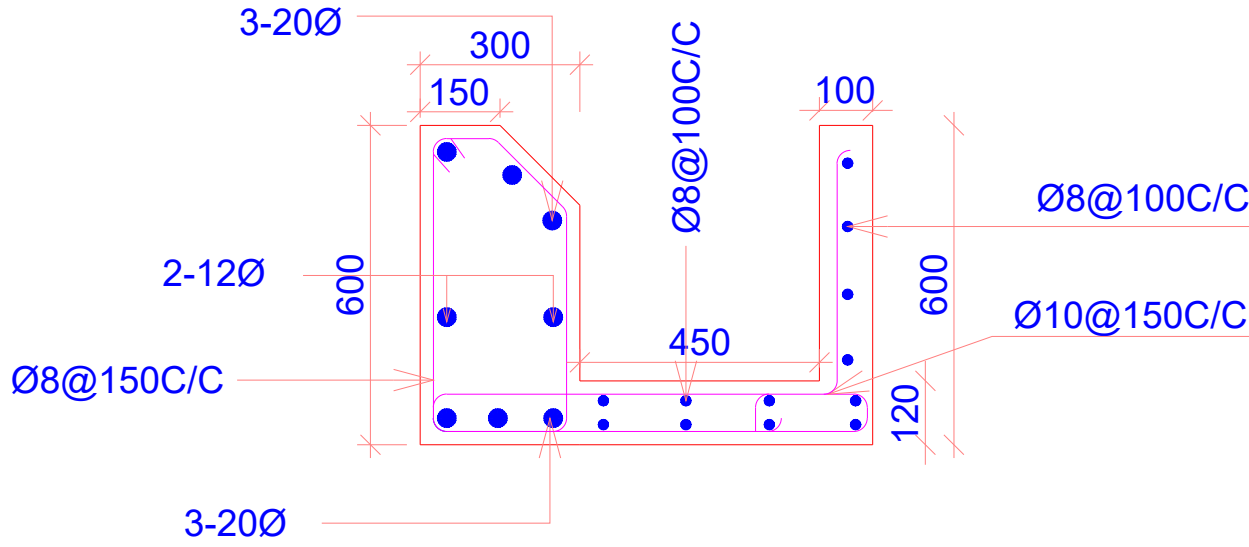
SECTION D-D



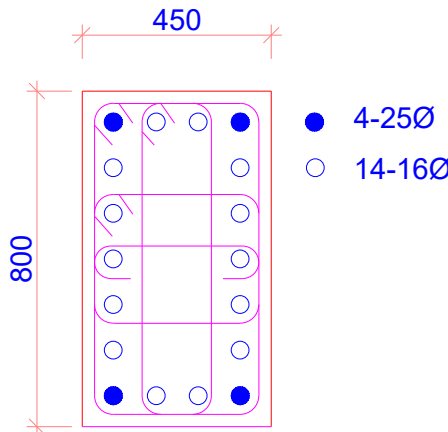
DETAIL - A
FOUNDATION DETAILS

STRUCTURAL MEMBER	DIMENSIONS (m)			NO.
	L	B	D	
FOUNDATION -1 (F1)	3	2.5	0.6	8
FOUNDATION -2 (F2)	3	4	0.6	12
FOUNDATION -3 (F3)	3	4	0.6	4

MIDDLE BEAM REINFORCEMENT



TERRACE BEAM+GUTTER REINFORCEMENT

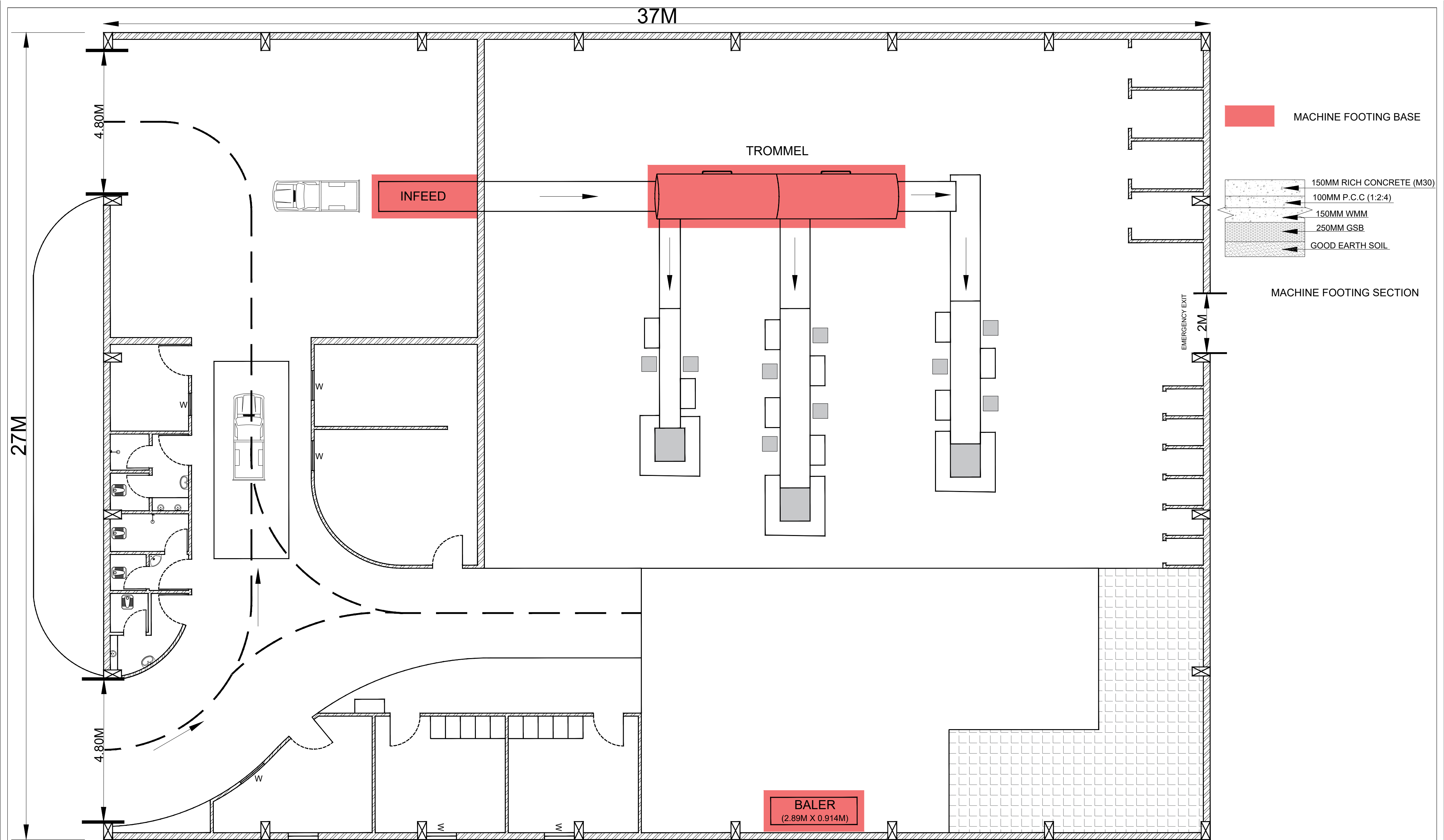


ALL STIRRUP Ø8@150C/C
COLUMN REINFORCEMENT

DETAIL - B

COLUMN DETAILS

STRUCTURAL MEMBER	DIMENSIONS (m)		NO.
	L	B	
COLUMN -1 (C1)	0.45	0.8	8
COLUMN -2 (C2)	0.45	0.8	12
COLUMN -3 (C3)	0.45	0.8	4



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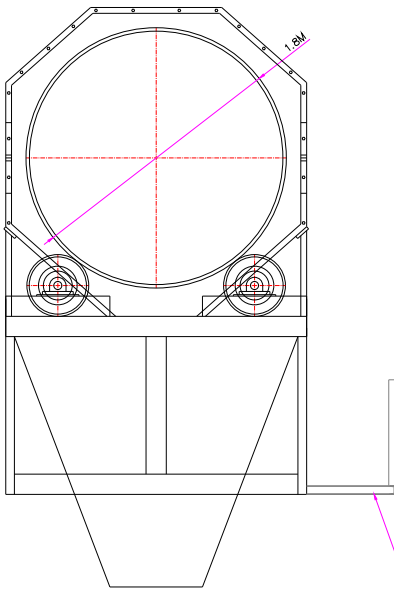
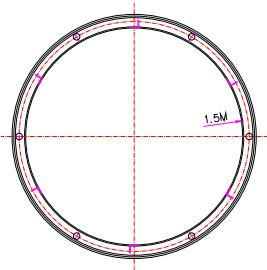
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

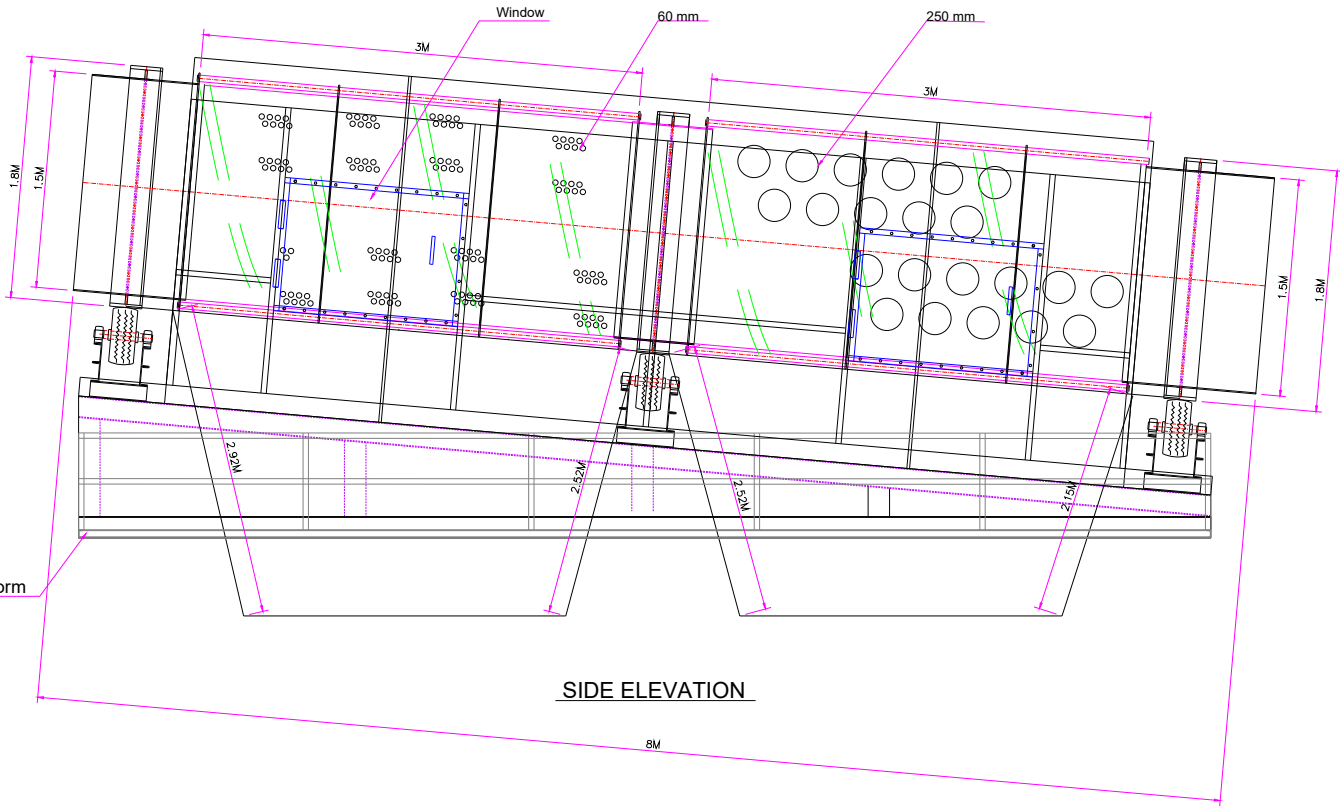
Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant:  THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	Project:	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
		MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DRAWN BY :	RAHUL ARYA	
		TITLE:	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024
		TYPICAL MACHINE FOOTING PLAN			

DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
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SR. NO.	EQUIPMENTS	QUANTITY(NO.)	DIMENSIONS(M)
01	TROMMEL	1	1.0 X 8.0



FRONT ELEVATION



SIDE ELEVATION

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:



MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:



RITES Ltd. (A Government of India Enterprise)

Project:

MODEL DESIGN FOR 10 TPD MATERIAL
RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

TROMMEL DETAILS

DRAWN BY :

RAHUL ARYA

CHECKED BY :

CHETAN A. PATIL & DR. ANAND SONAWANE

APPROVED BY :

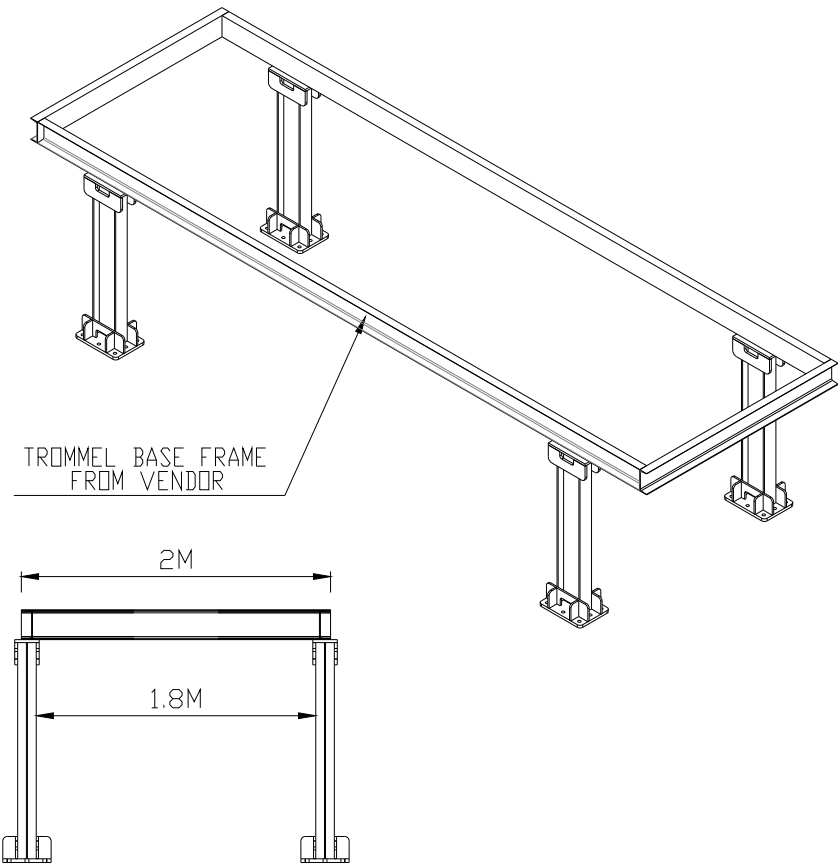
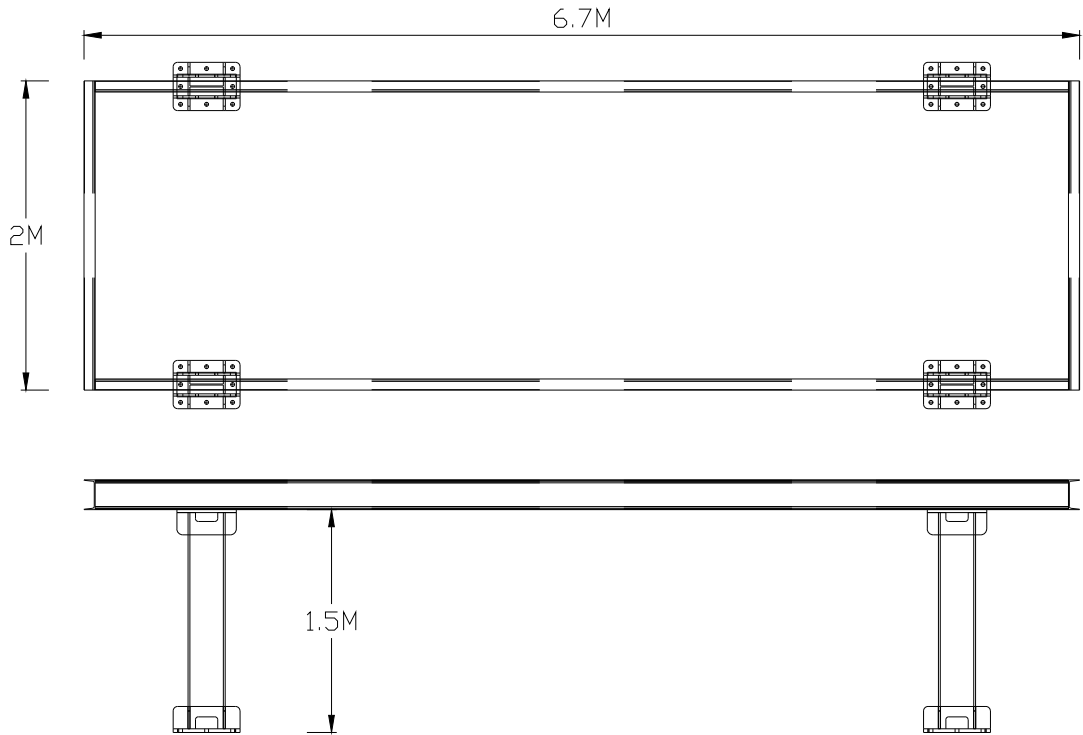
SANJAY RAUT

REVIEWED BY :

CPHEEO, MoHUA

DATE : FEB. 2024

DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
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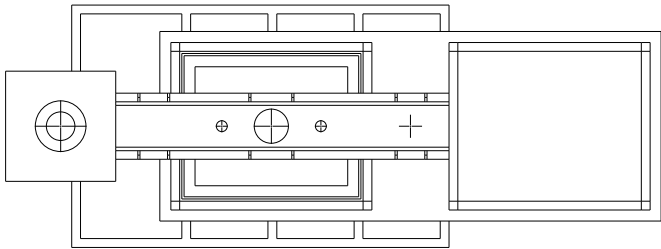
NOTE :
1. FOOTING TO BE DESIGN AS PER LOCAL SITE CONDITION, BEARING CAPACITY OF SOIL ETC.

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

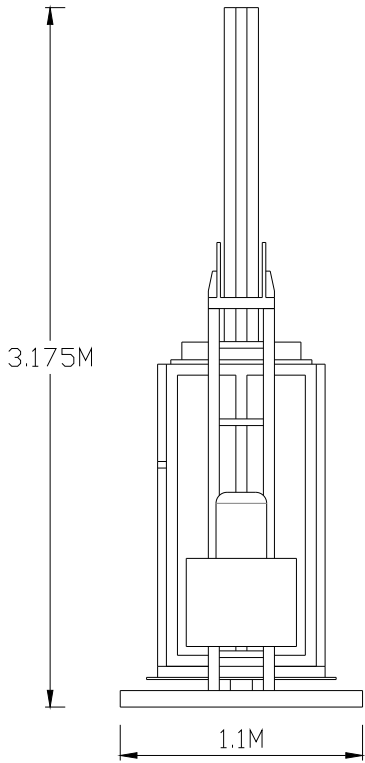
Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant:  RITES THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	Project:	DRAWN BY :	RAHUL ARYA	
		MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	CHECKED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
		TITLE: TROMMEL FOOT DETAILS	APPROVED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024

DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
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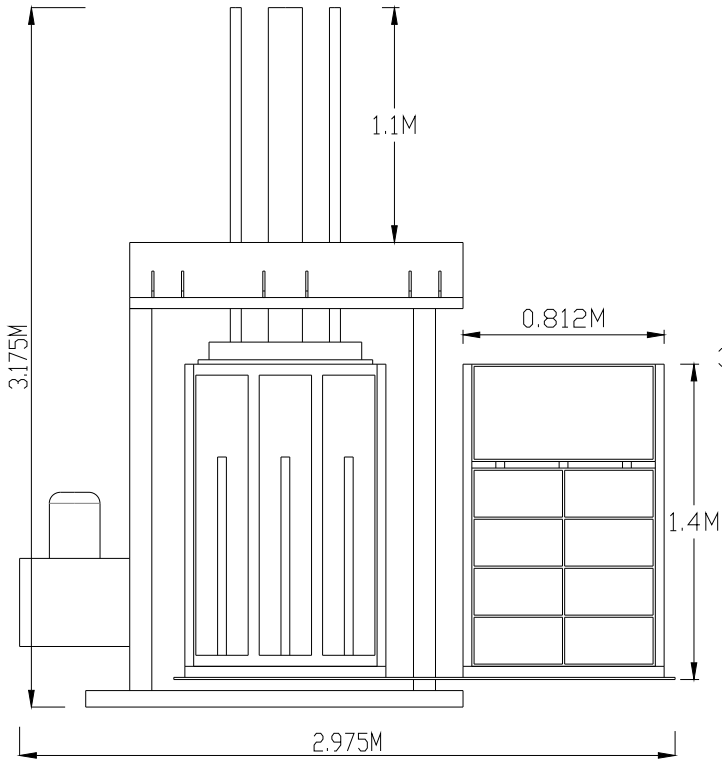
DOUBLE BUCKET
SINGLE CYLINDER
BALER MACHINE



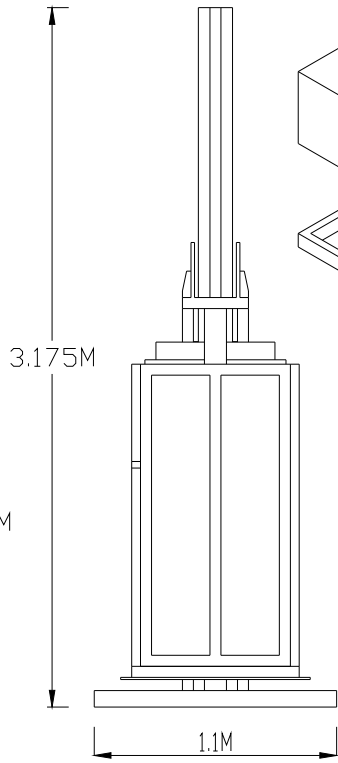
TOP VIEW



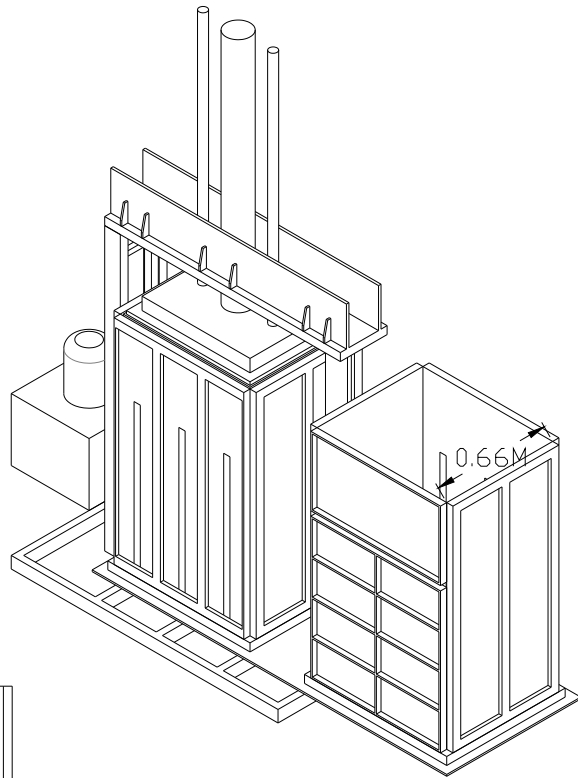
SIDE VIEW



FRONT VIEW



SIDE VIEW



NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:



**Ministry of Housing
and Urban Affairs**
Government of India

MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:



RITES
THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

Project:

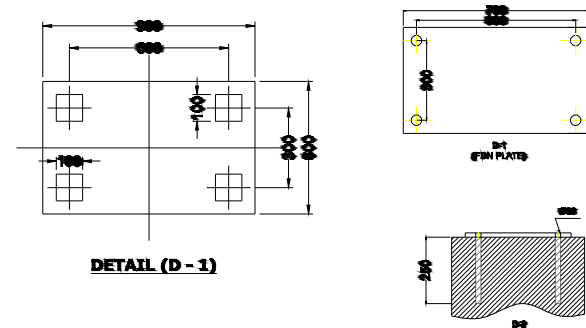
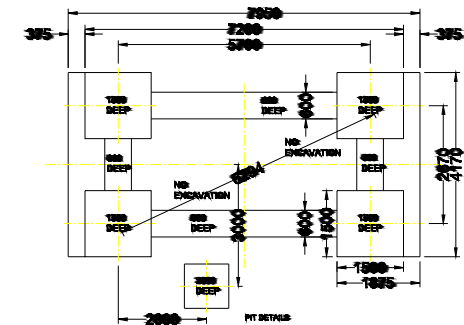
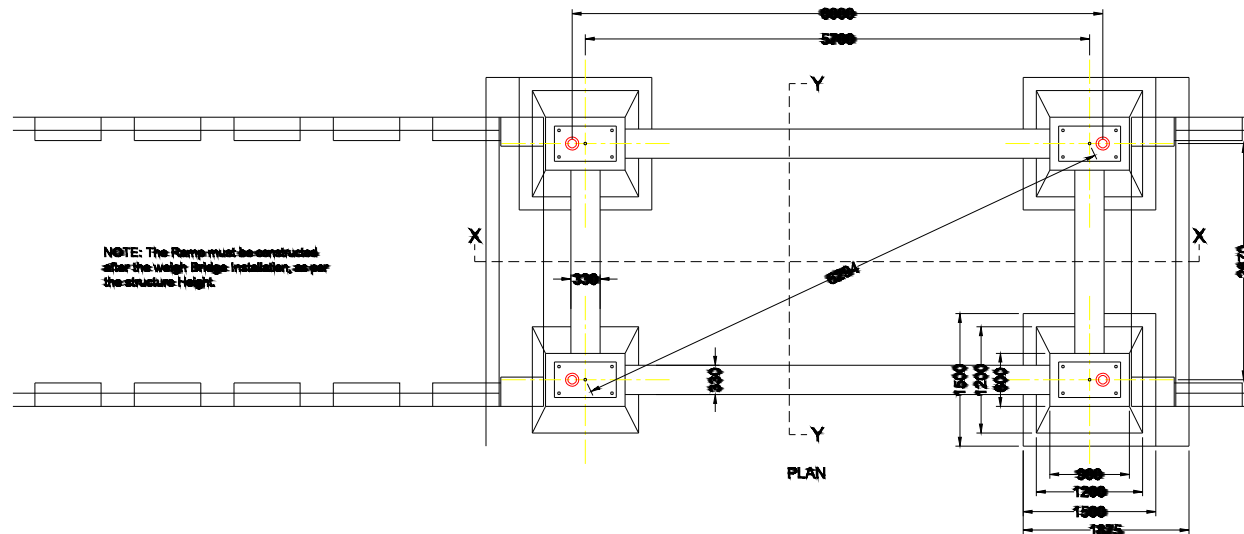
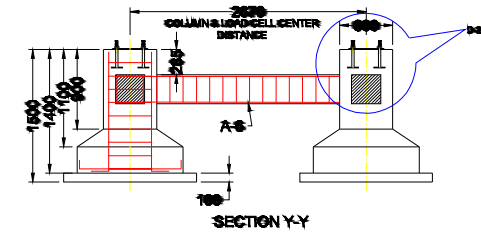
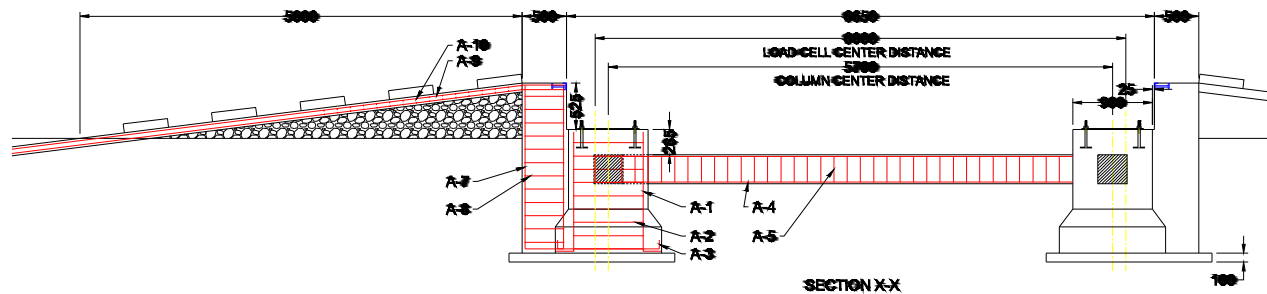
MODEL DESIGN FOR 10 TPD MATERIAL
RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

BALER DETAILS

DRAWN BY :	RAHUL ARYA	
CHECKED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
APPROVED BY :	SANJAY RAUT	
REVIEWED BY :	CPHEEO,MoHUA	DATE : FEB. 2024

DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL
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- A. REFERENCE STANDARDS :-**
- | | |
|-----------------------------------|-----------|
| 1. CONCRETE AND ITS CONSTRUCTION | IS : 546 |
| 2. CEMENT | IS : 269 |
| 3. AGGREGATES | IS : 383 |
| 4. REINFORCEMENT BARS | IS : 1786 |
| 5. ASSEMBLY OF REINFORCEMENT BARS | IS : 3992 |
| 6. SKIRTING ANGLES | IS : 308 |
| 7. CONDUIT PIPES | IS : 1787 |
- B. NOTES :-**
- ALL DIMENSIONS ARE IN MM. AND LEVELS ARE METERS.
 - EL. 0000 DENOTES FINISHED ROAD LEVEL (S.L. REFERENCE LEVEL).
 - SOIL BEARING CAPACITY OF 10 TONS/SQ.M ASSUMED AT FOUNDATION LEVEL.
 - GROUND-WATER TABLE IS ASSUMED TO BE BELOW FOUNDATION LEVEL.
 - ADEQUATE RUBBLE SOLING TO BE DONE BELOW P.C.C. SKIRTINGS AS REQUIRED.
 - MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT TO BE AS FOLLOWS: RAFTS - 35MM, WALLS - 35MM, COLUMNS - 45MM.
 - ADEQUATE CONCRETE TEST CUBES TO BE TAKEN AND TESTED FOR STRENGTH.
 - REINFORCEMENT BARS NOT TO BE WELDED TO EACH OTHER FOR RETAINING PURPOSES, BUT TO BE TIED TOGETHER ONLY. LAP LENGTH = 30D (D = DIA OF BAR TO BE LAPPED).
 - NON SHRINKING GROUTING MATERIAL SUCH AS SHRINOOM - H FROM ADD TO BE USED FOR GROUTING.
 - SOIL IS CONSIDERED AS NORMAL.
 - THE REINFORCEMENT BARS SHALL NOT COME ON THE POCKET LOCATION.

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:



MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:



RITES Ltd. (A Government of India Enterprise)

Project:

MODEL DESIGN FOR 10 TPD MATERIAL
RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

WEIGH BRIDGE DETAILS
(10 TON)

DRAWN BY :

RAHUL ARYA

CHECKED BY :

CHETAN A. PATIL & DR. ANAND SONAWANE

APPROVED BY :

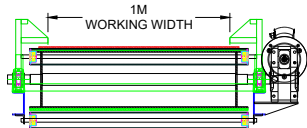
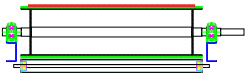
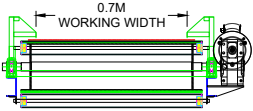
SANJAY RAUT

REVIEWED BY :

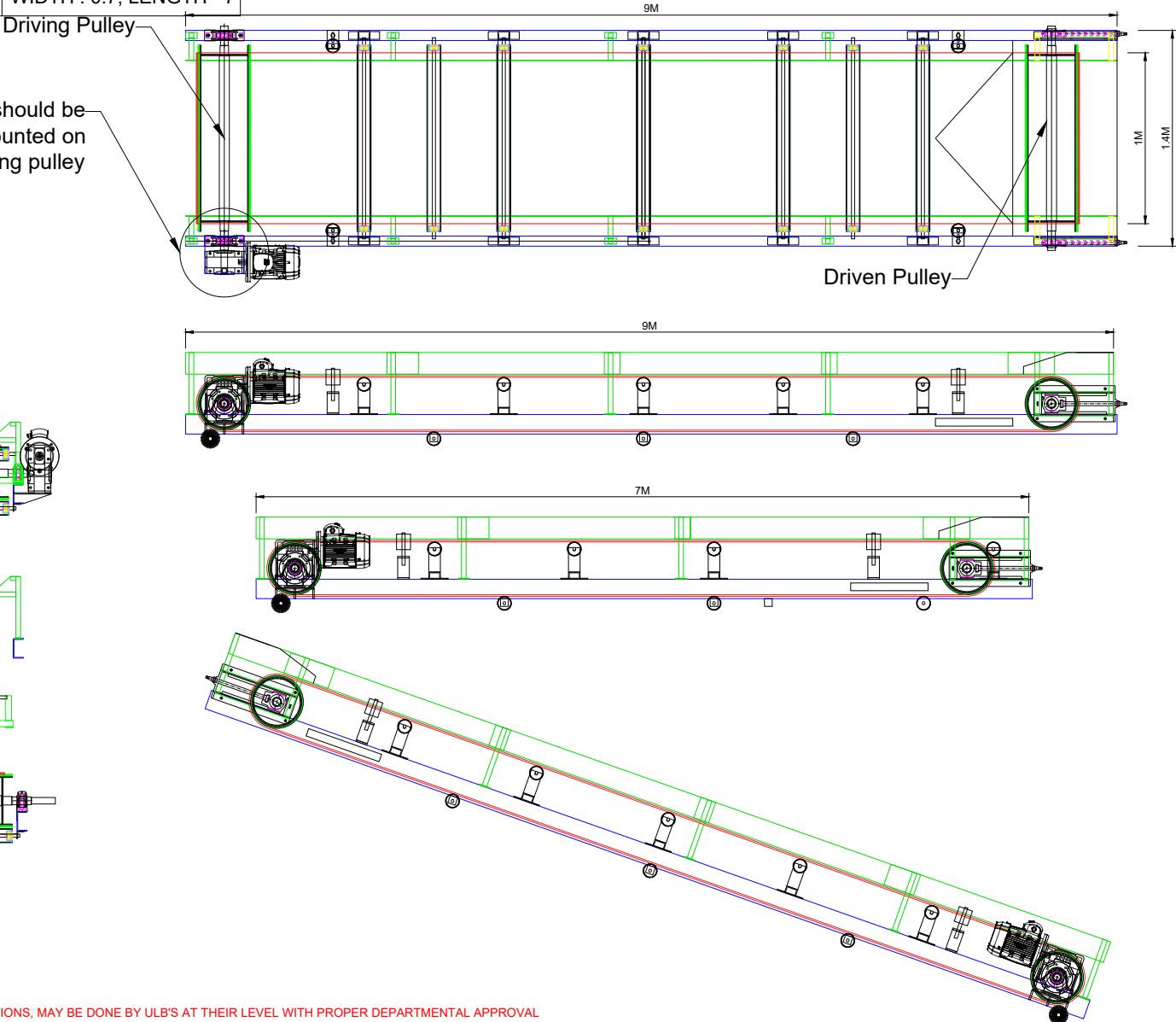
CPHEEO, MoHUA

DATE : FEB. 2024

SR. NO.	EQUIPMENTS	QUANTITY(NO.)	DIMENSIONS(M)
01	CONVER BELTS	3	WIDTH : 1, LENGTH - 9
01	CONVER BELTS	1	WIDTH : 0.7, LENGTH - 7



Gear Motor should be directly mounted on shaft of driving pulley



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NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:  Ministry of Housing and Urban Affairs Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant:  RITES THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 10 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DRAWN BY : RAHUL ARYA	
			CHECKED BY : CHETAN A. PATIL & DR. ANAND SONAWANE	
		TITLE: PLAN & SECTION FOR CONVEYOR BELT	APPROVED BY : SANJAY RAUT	
			REVIEWED BY : CPHEEO,MoHUA	DATE : FEB. 2024

The background of the slide is a photograph of a large industrial factory interior, featuring high ceilings, steel beams, and various pieces of machinery. The entire image is overlaid with a semi-transparent green filter. In the bottom right corner, there are several overlapping geometric shapes: a white triangle pointing upwards, a dark green triangle pointing downwards, and a medium green triangle pointing to the right. The text is centered in the upper half of the slide.

ANNEXURE 2

CHECKLIST AND FORMAT

Model Design & Estimates for 10 TPD MRF with Specifications

A. Weighing Bridge demo slip

Demo Company 1

[DUPLICATE-PRINT]

Add1

Add2

Print Date: 30/08/2018 12:55:11

Ticket No :	11	Supplier_Name :	Supplier - 1
Party_Name :	Customer -1	Order_No :	User Define Field - 5
Vehicle_No :	GJ 1020	Field05_Name :	User Define Field - 6
Item_Name :	Product - 1	Field06_Name :	User Define Field - 7
Field01_Name :	User Define Field - 1	Charges :	100
Field02_Name :	User Define Field - 2	Pcs :	User define Field - 4
Fiedl03_Name :	User Define Field - 3	User Name :	1st-Admin 2nd-

Gross Weight :	25000	Kg	30/08/2018	12:53:00
Tare Weight :	15000	Kg	30/08/2018	12:53:00
Net Weight :	10000	Kg		

OPERATOR'S SIGNATURE

B. Pre-assessment checklist for waste received at MRF plant

Vehicle No :

Location name & Ward No :

Driver Name :

Date :

Time :

Vehicle code:

Sl. No.	Particulars	Whether acceptable		Remarks
		Yes	No	
1.	Whether mixed waste (dry waste with significant quantity of wet waste) is received at the MRF?			
2.	Whether the received waste contains a higher fraction of C&D waste/silt/inert?			
3.	Whether the received waste contains a higher/substantial fraction of hazardous waste?			
4.	Whether the received waste contains a higher/substantial fraction of sanitary?			

Note: Weighbridge operator should be responsible to fill the checklist during the receipt of waste at the plant with the help of security guards.

In the above checklist if any of the answer is yes the same should be reported to the plant manager/Plant in Charge to take further decision on the acceptance of the material.

WASTE ISN'T WASTE
UNTIL WE WASTE



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C. Morning/Starting Protocol

Date:

Location:

Part -A

Sl. No.	Procedural Steps	Nos.	Remarks
1.	Total number workers (All Category)		
2.	Workers present		
3.	Workers absent		
4.	No. of workers with PPE		
5.	Any worker running fever, coughing or infectious diseases		

Part-B

Sl.No.	Procedural Steps	Yes	No	Comments
1.	Any abnormal odour experienced			
2.	Any sign of smoke or fire			
3.	Any sign of oil spillage on floor			
4.	If trommel screen choked			
5.	a. Spilled solid waste lying below belt conveyors or on floor			
	b. If spilled solid waste causing obstacle in movement of vehicles, wheel barrow etc.			
6.	Any spark observed while switching on fan, lights or machines			
7.	Any abnormal sound from moving parts /machine of plant (Motor, Bearing, trommel, belt conveyor, baler etc.)			
8.	Are belt conveyor clear of spilled solid waste			

D. Material Receipt

Sl. No	Name & Address (of Depositor)/ULB	Name of Driver & Vehicle number	Date	Time		Material Weight (Kilogram)	Signature	Remarks
				In	Out			

E. Material Dispatch

Sl. No	Name & Address (of Receiver))/ULB	Name of Driver & Vehicle number	Date	Time		Material Weight (Kilogram)	Signature	Remarks
				In	Out			

F. Material Sale

Sl. No	Name & Address (of Receiver))/ULB	Date	Material	Material Weight (Kilogram)	Unit Rate	Billing Amount	Out Time	Signature	Remarks

WASTE ISN'T WASTE
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G. Monthly Report

Sl. No	Name & Address (ULB)	Month	Material	Material		In Stock (in kg)	Sale processed (Rs.)	Signature	Remarks
				Segregated (Kg)	Dispatched (Kg)				

H. Information Display

Local Body Name:	Date:	MRF Incharge Name & number:
Location of MRF Plant	Operating Time: -- AM to -- PM	Operating Firm & contact person name & number:
Material Accepted		
Total Plastic Bottles (PET)		
Total Cardboard (Paper)		
Total Glass bottles (Glass) etc		

I. Evening Protocol/Closing Protocol

Part A				
S.N.	Procedural Steps	Nos	Remarks	
1.	Total Strength of workers			
2.	Worker presence			
3.	Worker left during half day			
4.	Any health issue reported by workers			
5.	Whether workers changed their dress before leaving and kept PPE in respective lockers allotted to them			
Part B				
S.N.	Procedural Steps	Yes	No	Remarks
1.	Proper shutdown of machines done			
2.	All fans & Lights Switched off			
3.	Spilled solid waste removed from belt conveyor pits			
4.	If solid waste is strewn here and there on floors- Clean up			
5.	If any materials left in trommel/belt conveyor /baler to be cleaned			
6.	Any spark observed during shunting switching off machines, fans and light			

Checked by:

Supervisor



Model Design & Estimates for 10 TPD MRF with Specifications

J. Maintenance/Lock out Tag (LOTO Checklist)

Lockout/Tag out (LOTO)

INSPECTION CHECKLIST FOR CONTROL OF HAZARD ASSOCIATED WITH POWER SUPPLY

Employee Name:			
Equipment:	Date:		
Procedure:	Location:		

Hazards Involved:

- a) Electrical Voltage: ____ b) Pressure (pneumatic/hydraulic) ____ c) Spark ____
- d) Signify smoke: ____ e) Feasibility of doing ____ f) Mechanical ____

TO LOCK OUT THE EQUIPMENT

S.N.	Procedural Steps	Yes	No	Comments
1.	Whether affected workers & employees are notified?			
2.	Whether all the power disconnect points were identified?			
3.	Whether equipments are switched off?			
4.	Whether all the equipments/machines connected to the same source were listed and isolated?			
5.	Whether LOTO tag attached for locking the machine?			
6.	Whether the machinery re-start/re-energize attempted through normal position (Off position)?			
7.	Whether test equipment/meters were identified?			
TO RE-ENERGIZE THE EQUIPMENT/MACHINES				
1.	Whether all guard and safety controls are checked and properly replaced?			
2.	Whether all locks and tags from energy control points are removed?			
3.	Whether personnel are cleared from the affected of the machine?			
4.	Whether the equipment is restart/re-energize?			
5.	Whether the affected employees are notified on completion of LOTO?			

K. Check list for Machine Safety

Sl. No	Equipment Safeguarding (in proper working condition)`	Yes/No	Remarks
A	General		
1.	Whether machine guards are in place and functional to prevent contact with moving parts?		
B	Tools		
1.	Whether all tools and equipment are formally inspected on a quarterly basis and tagged properly?		



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2.	Whether all tools are visually inspected prior to use and defective one tagged properly?		
Remarks if any:			
Name, Signature and Date of Checking Officials			

L. Format for Electrical Safety Checklist (weekly basis)

Sl. No.	Checklist for Electrical Safety	Yes/ No	Remarks
1.	Whether all plugs, sockets and electrical fittings sufficiently robust for use?		
2.	Whether all electrical fuse/junction boxes in the factory securely fixed, closed and undamaged?		
3.	Whether fuses, circuit breakers and other electrical devices correctly rated for the circuit they protect?		
4.	Main switches readily accessible and clearly identified, with all workers know use them in an emergency.		
5.	All electrical installations checked periodically, and repairs carried out by a competent electrician.		
6.	There are any cables or wires without proper casing, found in the area.		
7.	Any electrical wires improperly spliced or taped.		
8.	Electrical equipment properly grounded to prevent electrocution or fire.		
9.	Any electrical wires found in damp areas or standing water.		
10.	Any electrical wires obstructing aisles or passageways.		
11.	All visible electrical wires securely fixed.		
12.	Electrical fittings and installations checked once in month.		
Remarks if any:			
Name, Signature and Date of Checking Officials			

** format for daily electrical safety checking and keeping signed copy in office records.



The background of the slide is a photograph of a large industrial facility, likely a steel mill or manufacturing plant, with high ceilings, structural beams, and various pieces of equipment. The entire image is overlaid with a semi-transparent green filter. In the bottom right corner, there are several overlapping geometric shapes: a white triangle pointing upwards, a dark green triangle pointing downwards, and a lighter green trapezoid. The text is centered in the upper half of the slide.

ANNEXURE 3

COST ESTIMATE AND

BILL OF QUANTITY

Model Design & Estimates for 10 TPD MRF with Specifications

A) Machinery Cost

S.N.	Particulars	Quantity	Approx Amount (Rs. In Lakh)	Rate on GEM Portal Rate
1	Weigh Bridge	01	4	
2	Trommel	01	11	Custom made design
3	Magnetic Separator	01	2.5	
4	Flat Conveyor Belt :	03	9.75	
	a) Flat Conveyor Belt (9 m length, 1m width thickness 10 mm, 3 ply)			
	b) Flat Conveyor Belt (7m length, 0.7m width thickness 10mm, 3 ply)	01	2.25	
5	Baler Machine (Single cylinder double chamber)	01	4.5	
6	Double wheel Barrow (GeM product ID 5116877-243244 84266)	04	0.15	Available on GeM portal at Rs.3750/- per unit
7	HDPE wheel Container Bin	10	2.60	
Total		21	32.25	
Considering 18% GST,			38.06	
For transportation and installation 10% extra			41.86	

Disclaimers: Cost of Machinery is indicative while transportation, installation and GST charges will be extra "as applicable".

Rates from GeM portal are average price, which may change depending upon product and vendor availability. Wherever applicable approved make for civil construction materials, mechanical equipment and electrical equipment notified by concerned departments/authorities of the Government of State/UT must be followed to maintain assured quality

B) PPE Cost

S.N.	PPE-Items	Annual Required Items	GeM Portal Rates	Annual Total Amount (Rs.)
1	Nose Mask (Surgical)	365	10	3650
2	Safety Goggles	4	229	916
3	Hand gloves	24	125	3000
4	High-Visibility Jacket	2	50	100
5	Bouffant Caps	365	1	365
6	Safety shoes	2	400	800
7	Ear Plugs	12	50	600
8	Apron	04	200	800
9	Hand Sanitizer (500 ml per month)	06	60	360
Annual cost (per person)				10,591
Annual cost (for 19 person) (GST Extra)				1,80,047



Model Design & Estimates for 10 TPD MRF with Specifications

Note: Apron having reflective stripe are available will be preferable, instead of going for both (Apron & Safety jacket)

Cost of PPEs is indicative as ascertained in Oct. 2023; it may change, depending upon product and vendor availability.

Rates from GeM portal are average price, which may change depending upon product and vendor availability

C) Manpower Cost

S.N.	Staff	No.	Wages (Rs.)- per day	Cost per month (Rs.)
1	Supervisor (skilled)	1	1150	35075
2	Segregation labor (unskilled) #	9	736	202032
3	Electrician cum baler operator (skilled)	1	973	29676.5
4	Person at tipping area (unskilled)	2	736	44896
5	Weigh Bridge operator (skilled)	1	897	27358.5
6	Premises & Toilet bath Cleaner (Unskilled)	1	736	22448
7	Multi-Tasking Staff (MTS) (skilled)	1	897	27358.5
8	Security Guard (Unskilled)	3	897	27358.5
Total		19	15440	4,70,920
Annual Cost (Rs.)				56,51,040

Disclaimers: Wages of Staff are indicative. Wages shall be paid as per the norms of concern State Government.

#Possibility of integration of informal sector may also be explored by ULBs at MRF plant.

D) Operation and Maintenance Cost (Tentative)

S.N.	Components of O & M	Rate	Quantity	Expected Expenditures (Rs)	
				Monthly	Annually
1	Water Consumption	@ Rs. 117.13/ KLD for consumption b/w 50-100 KL (72.6KL/Month) and service charges @ Rs.800/monthly	2.42 KL/day i.e. 72.6 KL/month	10,000	1,20,000
2	Sewerage charges	60% of water consumption charges	--	6,000	72,000
3	Civil Maintenance	@ Rs. 10/ Sq. m. including toilets	Area 1000 Sq. m.	10,000	1,20,000
4	Electrical+ Mechanical Maintenance Equipment	10% of cost of equipment per annum	Rs. 41,86,050	34,884	4,18,605
5	Firefighting Equipment	5% of cost of equipment per annum	Rs.41,86,050	17,442	2,09,303
6	Electricity Consumption	@Rs. 7.75/KWH + @Rs.2.30/- other charges = @Rs. 10- per KWH Approx	237 kW for 08 hr per day	55,980	6,71,760
	Total Cost (Rs.)			1,34,306	16,11,668

Note: Cost of Operation and Maintenance is indicative, as ascertain in Oct 2023, it may change.



The background is a photograph of a large industrial facility, likely a steel mill or manufacturing plant, with high ceilings, structural beams, and various pieces of machinery. The entire image is overlaid with a semi-transparent green filter. In the bottom right corner, there are several overlapping geometric shapes: a white triangle pointing upwards, a dark green triangle pointing downwards, and a medium green triangle pointing to the right. The text "BILL OF QUANTITY" is centered in the upper half of the image.

BILL OF QUANTITY

BOQ for 10 TPD MRF

(Delhi Schedule of Rates - 2023 and Quotation & Market Rate)

Disclaimer: Modifications based on the suitability as per soil, site and local conditions, shall be carried out by ULBs with proper departmental approval. Wherever applicable approved make for civil construction materials, mechanical equipment and electrical equipment notified by the concerned department/authority of the state government should be followed to maintain assured quality.

Note: It must vetted for individual project by the competent engineer / authorities of the ULBs / Department concerned.

DSR Item No.	Description	Unit	Qty.	Rate	Amount
(1)	SITE CLEANING				
2.31	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.	sqm	999.00	17.60	17582.40
(2)	EXCAVATION				
2.6	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth with lead upto 50 m and for all lift, as directed by Engineer-in-charge.				
2.6.1	Ordinary Soil	cum	531.36	177.50	94316.40
2.7	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth with lead upto 50 m and lift upto 1.50 m, as directed by Engineer-in-charge.				
2.7.1	Ordinary Rock	cum	177.12	498.90	88365.17
(3)	CEMENT CONCRETE				
4.1.4	1:2:4 (1 Cement : 2 coarse sand (zone-III) derived from natural sources : 4 graded stone aggregate 40 mm nominal size derived from natural sources)	cum	138.11	7780.30	1074513.89
4.10	Providing and laying damp-proof course 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand (zone-III) derived from natural sources : 4 graded stone aggregate 12.5 mm nominal size derived from natural sources)	sqm	27.65	410.85	11358.36
(4)	BACK FILLING & PLINTH FILLING				
2.25	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and for all lift.	cum	517.80	196.00	101488.80
2.25(a)	Excavating, supplying and filling of local earth (including royalty) by mechanical transport upto a lead of 5km	cum	399.60	700.50	279919.80

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	also including ramming and watering of the earth in layers not exceeding 20 cm in trenches, plinth, sides of foundation etc. complete.				
16.78	Construction of granular sub-base by providing close graded Material conforming to specifications, mixing in a mechanical mix plant at OMC, carriage of mixed material by tippers to work site, for all leads & lifts, spreading in uniform layers of specified thickness with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per specifications and directions of Engineerin- Charge.				
16.78.1	With material conforming to Grade-I (size range 75 mm to 0.075 mm) having CBR Value-30	cum	249.75	2784.00	695304.00
16.79	Providing, laying, spreading and compacting graded stone aggregate (size range 53 mm to 0.075 mm) to wet mix macadam (WMM) specification including premixing the material with water at OMC in for all leads & lifts, laying in uniform layers with mechanical paver finisher in sub- base / base course on well prepared surface and compacting with vibratory roller of 8 to 10 tonne capacity to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.	cum	149.85	2914.30	436707.86
(5)	REINFORCED CEMENT CONCRETE				
5.33 A	Providing and laying in position ready mixed or site batched design mix cement concrete for reinforced cement concrete work; using coarse aggregate and fine aggregate derived from natural sources and using recycled concrete aggregate (RCA) as coarse aggregate and fine aggregate within permissible utilization of 20% each, Portland Pozzolana [Ordinary Portland/Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the engineer-in-charge; for the following grades of concrete. Note: Extra cement up to 10% of the minimum specified cement content in design mix shall be payable separately. In case the cement content in design mix is more than 110% of the specified minimum cement content, the contractor shall have discretion to either re-design the mix or bear the cost of extra cement.				
5.33A.1	All works upto plinth level				
5.33A.1.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	cum	339.97	9333.95	3173225.65
5.33A.2	All works above plinth level up to floor V level				
5.33A.2.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	cum	110.13	9689.60	1067151.11
5.35	Add for using extra cement in the items of design mix over and above the specified cement content therein.	cum	67.99	733.50	49873.01
5.35	Add for using extra cement in the items of design mix over and above the specified cement content therein.	cum	22.03	733.50	16156.61

DSR Item No.	Description	Unit	Qty.	Rate	Amount
(6)	CENTERING AND SHUTTERING				
5.9	Centering and shuttering including strutting, propping etc. and removal of form for				
5.9.1	Foundations , footings, bases of columns, etc. for mass concrete	sqm	187.20	392.15	73410.48
5.9.2	Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.	sqm	98.51	842.50	82996.36
5.9.3	Suspended floors, roofs , landings, balconies and access platform	sqm	13.52	927.25	12536.42
5.9.5	Lintels, beams , plinth beams, girders, bressumers and cantilevers	sqm	468.78	736.40	345209.59
5.9.6	Columns , Pillars, Piers, Abutments, Posts and Struts	sqm	240.00	961.30	230712.00
(7)	STEEL REINFORCEMENT				
5.22	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
5.22.6	Thermo-Mechanically Treated bars of grade Fe-500D or more.	kg	27197.28	107.85	2933226.65
5.22A.6	Thermo-Mechanically Treated bars of grade Fe-500D or more.	Kg	8082.91	107.85	871742.06
(8)	BRICK WORK				
6.1	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 , In foundation and plinth in				
6.1.1	Cement mortar 1:4 (1 cement : 4 coarse sand)	cum	4.15	7370.65	30565.35
6.4	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in				
6.4.1	Cement mortar 1:6 (1 cement : 6 coarse sand)	cum	109.59	9105.95	997958.76
(9)	CLADDING, WOOD AND STEEL WORK				
8.27	Providing and fixing specified wood frame work consisting of battens 50x25 mm fixed with rawl plug and drilling necessary holes for rawl plug etc. including priming coat complete.				
8.27.1	Kiln seasoned and chemically treated hollock wood	cum	0.57	187227.65	107244.93
9.21	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters:				
9.21.1	35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	sqm	29.68	2392.65	71012.46
10.31	Providing and fixing angle iron frames for doors , windows and ventilators of mild steel Angle sections of size 35x35x5 mm , joints mitred and welded by angle iron 35x35x5 mm or 35x 5 mm flat pieces to the existing T-iron frame or to the wall with dash fastener, including fixing of necessary butt hinges and screws and applying a priming coat of approved steel primer, all complete as per the direction of Engineer-In-charge.	kg	75.87	130.50	9900.77

DSR Item No.	Description	Unit	Qty.	Rate	Amount
(10)	CEMENT PLASTER				
13.1	12 mm cement plaster of mix:				
13.1.1	1:4 (1 cement: 4 fine sand)	sqm	920.46	347.05	319445.64
13.2	15 mm cement plaster on the rough side of single or half brick wall of mix:				
13.2.1	1:4 (1 cement: 4 fine sand)	sqm	512.00	399.45	204518.40
13.16	6 mm cement plaster of mix:				
13.16.1	1:3 (1 cement : 3 fine sand)	sqm	691.36	300.45	207720.31
(11)	SELF-SUPPORTED MECHANICALLY SEAMED ROOFING				
Quotation	Providing and fixing of self-supported mechanically seamed roofing system such as proflex, green curve, Kialash roofing or equivalent made of high strength quality steel, having 340 MPA yield strength, pre coated galvalume sheet as per ASTM A792 M of base metal thickness 1.4 mm (Tolerance +/- 0.02 mm). high grade steel sheet should have 55% aluminium and 45% Zinc coating by hot dip process of minimum 25 micron on top side and 12 micron on back side with epoxy primer and polyester wash -coat as per AZM 150. Roofing should be designed as per ASCE 7-20 international building code 2002. The analysis should carried out for span and centre arch -rise considering the required live load, wind load, dead load and seismic factor. The analysis should also determine the thickness of steel and the end reaction at the beam level. Shop drawing of roofing system shall be submitted by contractor through consultant and same shall be checked and approved by the department. The roof panel formation shall be done as per the required length and curvature using hydraulic profile machine to give it the trapezoidal shape in required curvature. In this process the width of sheet the width of sheet reduces from 0.914 meter to 0.61 meter (tolerance +/- 0.02 mm). The roof panel shall be lifted using a suitable crane and using a spreader bar and a sling evenly placed to ensure no distortion of panel till the alignment is done and completed using plumb and a water tube and bolted into beam. These curved panels have interlocking formation and are crimped together using mechanical seaming machine with imposed a load of approximately five tonnes to ensure the seaming of required rigidity. After seaming a clear epoxy lacquer is applied on the inner side of panel and concrete beam. Theses panel are installed over water proof concrete gutter - beams having bevelled edge to receive (support) curved panels. Beam shall be designed for arch reaction and vertical loads. Plaster shall not be applied on the beam. Schmitt hammer test of concrete should be carried out before erection to ensure that the anchor bolt can be securely fixed on the support. In case of steel structure a steel runner plate of 6 mm thickness and GI sheet gutter of suitable size shall be provided for installation of panels, G.I. anchor bolt of required sizes and type with G.I. washer and neoprene washer shall be as design. After installation of panels, trapezoidal voids are created	sqm	1881.66	2773.00	5217829.32

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	between gutter-beam and panels which should be covered by a flashing fabricated or brick masonry which is to be paid separately. Area of this roof shall be measured along the periphery on hem-top between end to end panels. Ridge and valley shall not taken in to consideration for measuring length transverse to periphery. The rate includes supplying, fixing, loading unloading, hire charges of all plants machineries, anchors, fasteners, washers, bolt, epoxy, paint and all wastage etc. complete. Accessories and fixtures like hangers /clamp for installation of lighting/ fixtures /utility/duct as per requirement and ventilators, skylight can also be provided at crown/ridge by making cuts into the panels which is to be paid separately. This item shall be executed only by the agency which has all required manufacturing machineries and necessary expertise.				
Quotation	Triple Turbo Ventilators with Skylights with complete Fitting Accessories. Side Sky Light sheets (2 feet x 28 feet).	each	6.00	41300.00	247800.00
(12)	FLOORING BASE CONCRETE				
26.83	Applying stamping finish to the top surface of freshly laid plain/reinforced cement concrete of specified grade in porticos, sidewalks, driveways, pool decks and open yards as per direction of the Engineer-in-Charge. The process shall include the following:- - The concrete shall be placed and screened to the finished grade, and floated to a uniform surface by using standard finishing techniques. The approved color hardener @ 2.7 kg/sqm shall be applied evenly to the surface of the fresh concrete by the dry shake method by sprinkling in two or more shakes, floated after each shake and trowelled only after the final floating. The approved release agent @ 0.113 kg/sqm shall be applied evenly to the trowelled surface before stamping or the said release agent can be applied to the flexible polyurethane stamp moulds of approved design and in required sizes to achieve final stamped pattern. These stampings shall be placed on the surface of concrete in three to four pieces at a time and tapped gently with rammers of sufficient size & weight to leave proper stamp marks and the process repeated for the remaining concrete surface till the whole surface to be stamped is completed within the time while concrete is in plastic stage of setting. - After stamping, the curing shall be done as per manufactures specifications. After initial curing the imprinted joints shall be grouted using cement slurry mixed with color hardener as per the requirement. The surface shall be sealed by applying acrylic based sealer not less than 0.167 litre/ sqm. on finished surface. - The construction joints shall be provided by groove cutting of size 4 mm x 20 mm in panel size 3m x 3 m or lesser as per the site conditions and filling the same with 10 mm baker rod and providing and laying (PU) Polyurethane based joint sealer of approved make as per manufacturer's specifications and finished	sqm	999.00	762.75	761987.25

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	by applying Polyurethane resin based top protective clear coat of minimum 80 micron applied with rollers on properly cured and dry clean surface.				
(13)	WATER PROOFING FOR WC etc.				
22.3	Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C., kitchen and the like consisting of: (i) Ist course of applying cement slurry @ 4.4 kg/sqm mixed with water proofing compound conforming to IS : 2645 in recommended proportions including rounding off junction of vertical and horizontal surface. (ii) IInd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound in recommended proportion including rounding off junction of vertical and horizontal surface. (iii) IIIrd course of applying blown or residual bitumen applied hot at 1.7 kg. per sqm of area. (iv) IVth course of 400 micron thick PVC sheet. (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sqm).	sqm	20.28	769.60	15607.49
22.7	Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc consisting of following operations: a) Applying a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls upto 300 mm height including cleaning the surface before treatment. b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs. c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge. d) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 (1 cement :4 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep. e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	and for final test. "All above operations to be done in order and as directed and specified by the Engineer-in-Charge":				
22.7.1	With average thickness of 120 mm and minimum thickness at khurra as 65 mm.	sqm	2.54	1684.60	4270.46
(14)	PAINT				
13.41	Distempering with 1st quality acrylic distemper (ready mixed) having VOC content less than 50 gram/litre, of approved manufacturer and of required shade and colour all complete to achieve even shade and colour.				
13.41.1	New work (two or more coats) over and including water thinnable priming coat with cement primer having VOC content less than 50 gram/litre	sqm	4630.50	185.65	859652.33
13.46	Finishing walls with Acrylic Smooth exterior paint of required shade				
13.46.1	New work (Two or more coat applied @ 1.67 ltr/10 sqm over and including priming coat of exterior primer applied @ 0.90 litre/10 sqm)	sqm	553.15	160.60	88836.21
13.48.3	Painting Steel work with Deluxe Multi Surface Paint to give an even shade. Two or more coat applied @ 0.90 ltr/10 sqm over an under coat of primer applied @ 0.80 ltr/10 sqm of approved brand and manufacture	sqm	34.80	170.70	5940.36
13.50.3	Applying priming coat: With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	sqm	234.43	67.40	15800.72
13.62.1	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade : Two or more coats on new work over an under coat of suitable shade with ordinary paint of approved brand and manufacture	sqm	234.43	226.25	53040.24
13.80	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	sqm	4630.50	156.05	722589.53
(15)	TOP LAYER OF FLOWERING (TILES)				
8.31	Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	sqm	43.50	1267.95	55155.83
11.41	Providing and laying vitified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20 mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments etc., complete.				

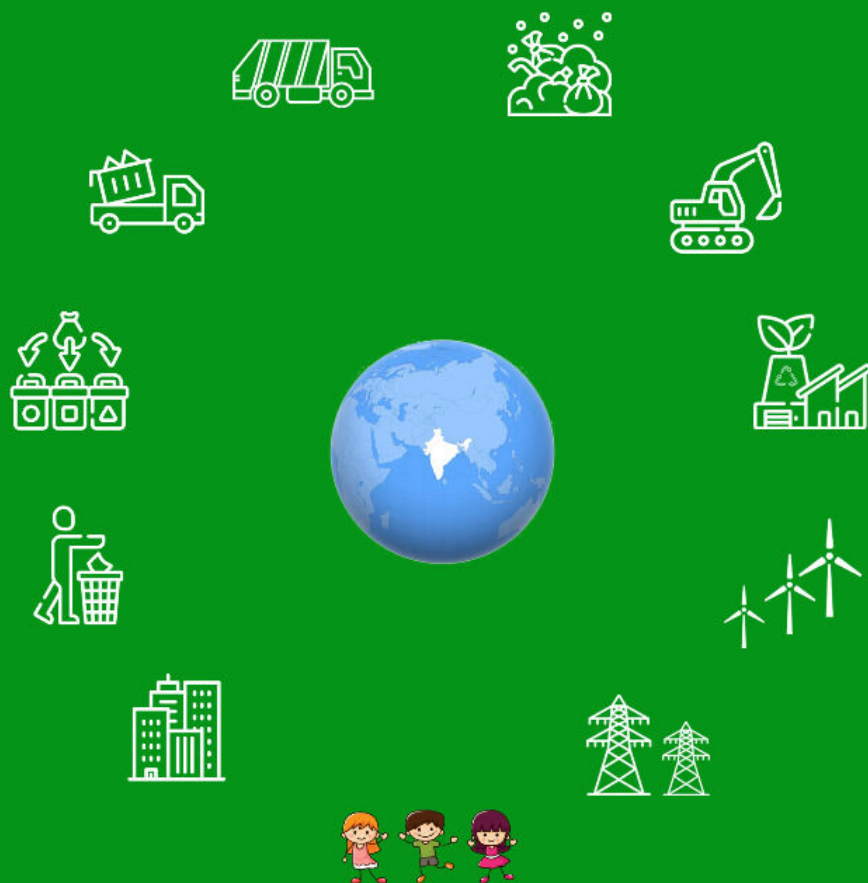
DSR Item No.	Description	Unit	Qty.	Rate	Amount
11.41.2	Size of Tile 600x600 mm	sqm	96.66	1553.45	150148.71
11.41A	Providing and laying Vitrified tiles in floor in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS:15622, of approved brand & manufacturer, in all colours and shade, laid on 20 mm thick cement mortar 1:4 (1 cement: 4 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with white cement and matching pigments etc. The tiles must be cut with the zero chipping diamond cutter only . Laying of tiles will be done with the notch trowel, plier, wedge, clips of required thickness, leveling system and rubber mallet for placing the tiles gently and easily.				
11.41A.3.1	Glazed Vitrified tiles Matt/ Antiskid finish of size Size of Tile 600 x 600 mm	sqm	20.28	1464.85	29707.16
(16)	STEEL WORK				
10.6	Supplying and fixing rolling shutters of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters.				
10.6.1	80x1.25 mm M.S. laths with 1.25 mm thick top cover	sqm	54.00	3653.20	197272.80
10.7	Providing and fixing ball bearing for rolling shutters.	each	9.00	492.35	4431.15
10.8	Extra for providing mechanical device chain and crank operation for operating rolling shutters.				
10.8.1	Exceeding 10.00 sqm and upto 16.80 sqm in the area	sqm	6.00	1281.35	7688.10
10.8.2	Exceeding 16.80 sqm in area	sqm	48.00	1181.80	56726.40
10.9	Extra for providing grilled rolling shutters manufactured out of 8 mm dia M.S. bar instead of laths as per design approved by Engineer-in- charge,	sqm	5.80	768.25	4455.85
10.15	Providing and fixing M.S. Tubular frames for doors, windows, ventilators and cupboard with rectangular/ L-Type sections , made of 1.60 mm thick M.S. Sheet, joints mitred, welded and grinded finish, with profiles of required size, including fixing of necessary butt hinges and screws and applying a priming coat of approved steel primer.				
10.15.2	Fixing with carbon steel galvanised dash fastener of required dia and size (to be paid for separately)	Kg	2367.76	181.25	429157.08
10.25	Steel work welded in built up sections/ framed work , including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.				
10.25.2	In gratings, frames, guard bar, ladder, railings , brackets, gates and similar works	Kg	1445.81	172.60	249546.46

DSR Item No.	Description	Unit	Qty.	Rate	Amount
10.29	Providing & fixing fly proof wire gauze to windows , clerestory windows & doors with M.S. Flat 15x3 mm and nuts & bolts complete.				
10.29.2	Stainless steel (grade 304) wire gauze of 0.5 mm dia wire and 1.4 mm aperture on both sides	sqm	255.74	1133.55	289898.61
(17)	ALUMINIUM WORK				
21.1	Providing and fixing aluminium work for doors , windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / panelling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) :				
21.1.1.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)	Kg	185.60	295.50	54844.80
21.1.2	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately)				
21.1.2.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)	Kg	116.00	598.60	69437.60
21.3	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge. (Cost of aluminium snap beading shall be paid in basic item):				
21.3.2	With float glass panes of 5 mm thickness (weight not less than 12.50 kg/sqm)	sqm	23.20	1505.25	34921.80
(18)	SANITARY INSTALLATIONS				
14.80	Providing & fixing White vitreous china water closet squatting pan (Indian type) along with "S" or "P" trap including dismantling of old WC seat and "S" or "P" trap at site complete with all operations including all necessary materials, labour and disposal of dismantled material including malba, all complete as per the direction of Engineer-in charge.				
14.80.2	Orissa pattern W.C Pan of size 580x440 mm	each	3.00	4478.75	13436.25

DSR Item No.	Description	Unit	Qty.	Rate	Amount
17.2	Providing and fixing white vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever), conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required :				
17.2.1	W.C. pan with ISI marked white solid plastic seat and lid	each	1.00	6515.55	6515.55
17.7	Providing and fixing wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever require:				
17.7.2	White Vitreous China Wash basin size 630x450 mm with a single 15 mm C.P. brass pillar tap	each	3.00	2226.35	6679.05
18.48	Providing and placing on terrace (at all floor levels) polyethylene water storage tank, IS : 12701 marked, with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank.	per lit	3000.00	11.00	33000.00
Quotation	RCC SEPTIC TANK 1200 MM, 3000 liters capacity for 25 users, with two outlets.	each	1.00	30385.00	30385.00
(19)	ELECTRIC FIXTURES				
Quotation	Internal Illumination & Fan				
	Street Light (250 W)	each	3.00	4613.00	13839.00
	Led Light (100 W)	each	20.00	3119.00	62380.00
	Led Tube (25 W)	each	15.00	260.00	3900.00
	Wall Mounted Fan (180 W)	each	5.00	13194.00	65970.00
	Celling Fan (75W)	each	8.00	2360.00	18880.00
	Toilet Exhaust Fan (60 W)	each	2.00	1818.00	3636.00
Lump Sum	Internal Plumbing and Electric Work				1000000.00
Lump Sum	Illuminated Signage				30000.00
	Sub Total Rs				24519530.33
	Contingency			3%	735585.91
	Total Cost in Rs				25255116.24
	Total Cost in Rs Lakh				252.55



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