आवासन और शहरी कार्य मंत्रालय
भारत सरकार
MINISTRY OF HOUSING AND URBAN AFFAIRS
GOVERNMENT OF INDIA

स्वच्छ भारत
एक कदम स्वच्छता की ओर

MODEL DESIGN

For

100 TPD MATERIAL RECOVERY FACILITY

Swachh Bharat Mission - Urban 2.0

Central Public Health and Environmental Engineering Organisation (CPHEEO)

February 2024

MINISTRY OF HOUSING AND URBAN AFFAIRS
GOVERNMENT OF INDIA

Table of Contents

List of Table

List of Figure

Annexure

Annexure 1: Engineering Drawings

1. Typical Layout
2. Typical Elevation
3. Typical Cross Section
4. Typical Foundation and Reinforcement details for Structural Member
5. Typical Foundation & Reinforcement details for Structural Member
6. Typical Machine Footing Plan
7. Typical Electrical Layout
8. Fire Fighting System
9. Typical Layout of Solar Panel, Skylight Roof & Ventilator Exhaust Fan
10. Typical Trommel Details
11. Typical Trommel Footing Details
12. Typical Plan and Section of Conveyor Belt
13. Typical Conveyor Footing Details
14. Typical Shredder Details
15. Typical Air Classifier Details
16. Typical Baler Details
17. Typical Weigh Bridge Details

Annexure 2: Checklists and Formats

1. Weighing Bridge (Demo slip)
2. Pre-assessment checklist for waste received
3. Morning Protocol
4. Material Receipt
5. Material Dispatch
6. Material Sale
7. Evening Protocol
8. Monthly Report
9. Maintenance/Lock Out Tag out (LOTO Checklist)
10. Checklist for Machine Safety
11. Format for Electrical Safety Checklist (Weekly Basis)
12. Information Display

Annexure 3: Bill of Quantities and Cost Estimates

A. CAPEX

   i. Process Equipment
   ii. Electrical Equipment
   iii. Fire Fighting Equipment

B. OPEX

   1. PPE Cost
   2. Manpower Cost
   3. Operational & Maintenance Cost

C. BILL OF QUANTITIES

Abbreviations

ABS	:	Acrylonitrile Butadiene Styrene
AMC	:	Annual Maintenance Contract
BOQ	:	Bill of Quantity
CCTV	:	Closed-Circuit Television
CFM	:	Cubic Feet per Minute
CMC	:	Comprehensive Service Contract
CPCB	:	Central Pollution Control Board
CPHEEO	:	Central Public Health & Environmental Engineering Organisation
CTE	:	Consent to Establish
DJB	:	Delhi Jal Board
ELCB	:	Earth Leakage Circuit Breaker
ERT	:	Emergency Response Team
ERW	:	Electric Resistance Weld
EVA	:	Ethylene Vinyl Acetate
GI	:	Galvanized Iron
GSM	:	Gramme per Square Metre
HFL	:	Highest Flood Level
HP	:	Horse Power
HSE	:	Health, Safety and Environment
ID	:	Inner Diameter
IP	:	Ingress Protection
ISI	:	Indian Standards Institute
ISO	:	International Organization for Standardization
ISWM	:	Integrated Solid Waste Management
ITI	:	Industrial Training Institute
KL	:	Kilo Litre
KLD	:	Kilo Litre per Day
kW	:	Kilo Watts
LED	:	Light Emitting Diode
LPM	:	Litre Per Minute
LT	:	Low Tension
MLP	:	Multi Layered Plastic
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MoHUA	:	Ministry of Housing and Urban Affairs
MRF	:	Material Recovery Facility
MS	:	Mild Steel
MSW	:	Municipal Solid Waste
MT	:	Metric Tonne
NBC	:	National Building Code
NCR	:	National Capital Region
NFPA	:	National Fire Prevention Association
NOC	:	No Objection Certificate
NRR	:	Noise Reduction Rating
O&M	:	Operation and Maintenance
OD	:	Outer Diameter
On-SEMP	:	On-Site Emergency Management Plan

PCC	:	Pollution Control Committee
PET	:	Polyethylene Terephthalate
PLC	:	Programmable Logic Controller
PPE	:	Personal Protective Equipment
PVC	:	Polyvinyl Chloride
RDF	:	Refuse Derived Fuel
RPM	:	Revolution Per Minute
RTO	:	Regional Transport Office
SBM	:	Swachh Bharat Mission
SLF	:	Sanitary Landfill
SOP	:	Standard Operating Procedure
SPCB	:	State Pollution Control Board
SS	:	Stainless Steel
SUP	:	Single-Use Plastic
SWM	:	Solid Waste Management
TPD	:	Tonnes Per Day
TPH	:	Tonnes Per Hour
TSDF	:	Treatment, Storage, and Disposal Facility
ULB	:	Urban Local Body
UPS	:	Uninterrupted Power Supply
UV	:	Ultraviolet
VFD	:	Variable Frequency Drive

Executive Summary

The country is grappling with a significant waste management challenge due to rapid urbanization and changing lifestyles. Solid Waste Management (SWM) is a crucial service provided by Urban Local Bodies (ULBs) to maintain cleanliness in urban areas. Unfortunately, many ULBs have been facing challenges due to the absence of properly designed MRF.

Government of India, through the Ministry of Housing and Urban Affairs (MoHUA), has taken several steps to address the issue of scientific SWM. One major initiative is the Swachh Bharat Mission (SBM), launched on October 2, 2014, to realize the vision of a 'Cleaner Bharat.' SBM-Urban aims to make urban India clean with 100% scientific management of Municipal Solid Waste (MSW) in 4800+ statutory towns across the country. On October 1, 2021, the Hon'ble Prime Minister launched the continuing mission of SBM-Urban 2.0 with a mission to make all Indian cities 'Garbage Free.'

SBM-U 2.0 seeks to address the gaps in MSW management. An essential intervention is the establishment of Material Recovery Facilities (MRFs) to recover commercially valuable materials like plastics, paper, metals, glass, e-waste, etc., from dry (non-biodegradable) waste for recycling. SWM Rules 2016 prescribe the duties and responsibilities of ULBs to set up MRFs or secondary storage facilities, with sufficient space for sorting materials. There is a target to set up at least one MRF in every city/town.

Depending on the ULB's population, MRF requirements may vary in capacity and process. This model document address the needs of a ULBs with a population in the range of 500,001 to 700,000. The approximate waste generation for such a population is between 200 - 300 TPD, with about 30% - 35% being dry waste, while the rest comprises wet waste and inerts.

The document provides a brief on the process requirements, area requirements, infrastructure requirements, and essential equipment/instruments, etc. It also covers manpower requirements, water demand, power consumption, and personal protective equipment. Other important points covered like SOP, Record Keeping, Annual Maintenance Contract, Emergency Response Plan, Statutory Requirements, layout and engineering drawings, and siting Requirements for a MRF.

The document also provides economic aspects of MRF like CAPEX and OPEX. It is expected that ULBs can develop their tender document and BoQ using this document as a reference. The brief summary of CAPEX, OPEX & Sustainability is as follows:

Table A. Abstract of cost estimate including O&M and Sustainability

Sl. No	Description	As per detailed Estimates (Rs in Lakhs)
A	**CAPEX**	
	Civil Cost	**1260.19**
	Electro-mechanical & firefighting equipment cost	**256.39**
	Total	**1516.58**
B	**OPEX (Yearly)**	**279.94**
	O&M Sustainability Details ➢ **Recyclables** — **40 TPD** ➢ **Annual Operation** — **365 days** ➢ **Annual Recyclables** — **14600 MT** ➢ **Approx. Sale Price for recyclables** — **Rs. 6000 per** ➢ **Annual revenue** — **Rs. 876.00 lakh** ➢ **Annual Expenditure** — **Rs. 279.94 lakh** The effective operation and maintenance of MRF is likely to generate revenue to meet the day to day expenditure without having burden on municipality's kitty. However the ULB may consider levying some uses fees on households etc., which will further enhance revenue.	

Disclaimers:

1. *This Guideline has been prepared considering the best suited/appropriate material and capacities for ideal situation. However, it 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.*
2. *This model design can be adopted in plain areas. However it may be suitable for hilly regions if adequate land is available.*
3. *The model design is subjected to continuous developments/improvements over time hence applicable revisions may be considered accordingly.*

1. Introduction

Municipal Solid Waste Management (MSWM) is a major environmental challenge all over the world and India is not an exception to it. Growing population and expanding urban agglomeration across the country contributes to an increase in waste generation. As per the annual report of CPCB for the year 2020-21, a total quantity of 1,50,847 TPD solid waste is generated in the country of which 1,46,053 TPD is collected.

The Swachh Bharat Mission (SBM), Swachh Bharat Abhiyan or Clean India Mission is a country wide campaign initiated by the Government of India in 2nd October, 2014 to eliminate open defecation and improve solid waste management. Further on 1st October 2021, the Hon'ble Prime Minister launched SBM- Urban 2.0 with a mission to make all Indian cities 'Garbage Free.' The Ministry of Housing and Urban Affairs (MoHUA) is steering the mission and is entrusted with role of providing technical guidelines and project finances for the mission.

2. Need of MRF

MSW generated in India consist of biodegradable and non biodegradable fractions of waste. Among the non biodegradable fraction, materials like plastic, metals, glass, textile, paper & cardboards having a recycling value should be retrieved from the waste streams. MRF where non-biodegradable fraction of solid waste can be temporarily stored by the local body to facilitate sorting and recovery of recyclables from the waste fractions. The needs for an MRF are as listed below:

- MRF reduce the amount of waste being disposed/dumped and maximize resource recovery promoting circular economy.
- MRF serve as an intermediate processing step between the collection of recyclable materials from waste generators and the sale of recyclable and RDF to the recycling market and for other processes and industries
- Generate the revenues from the waste and to maximize the reuse of segregated fractions in different processes/industries.

3. Advantage of MRF

The advantages of having MRF in the municipal solid waste services of ULBs are:

- MRF help the ULBs in reducing the waste volumes.
- Sorting and salvaging of recycling waste materials prevents a significant fraction of municipal waste from being dumped or disposed in landfills.
- MRF ensures longer life span for landfills/reduced requirement of land and subsequent environmental management efforts.
- Recovery of recyclables generate revenue and help in cost recovery
- Help in generating livelihood opportunities for informal workers, local vendors/recyclers and promote in circular economy.
- Help in reducing environmental impacts and the burden of waste management on public authorities.

- Cost savings in the collection, transportation and disposal infrastructure.

4. Design Factors

Adopting suitable configuration of MRF for sorting dry waste depends upon the quantity and composition of MSW generated at a particular locality. The quantity and composition of MSW are dependent on population, demographic details, principal activities in the city or town, income level and lifestyle of the community. Hence ULB may conduct necessary quantification and composition studies for fixing the capacity and technologies for MRF. The following sections discussed about population and waste composition for designing MRF.

4.1. Design Population

A 100 TPD MRF is most suitable for serving population ranging between 5,00,001 to 7,00,000 or for ULBs with a population above 10 lakhs having clusters of population between 5 lakhs to 7 lakhs in an identified catchment/cluster area. This facility is proposed for each municipal zone of the city having waste generation more than 250 TPD to optimize sorting, transportation cost and sustainability. Semi automated MRF are proposed as a sustainable solution for the particular capacity of MRF's.

4.2. Waste characterization

MSW composition and characteristics vary considerably across the country. The heterogeneous nature of MSW necessitates the requirement of characterization prior to the design of MRF. Waste characterization shall be done as per the Municipal Solid Waste Management Manual of Central Public Health and Environmental Engineering Organisation (CPHEEO), MoHUA.

5. Equipment for MRF

MRF consist of permutation and combination of processing units in varying degree of mechanization. The common processing units adopted include pre-sorting, mechanical sorting, size reduction and baling. Mechanical sorting typically employs the following processes like screening, ferrous metal separation, air classification, non-ferrous metal separation, and optical system. The equipment used for particular processing is described in **Table 1**.

Table 1: Intended Use of Equipment

Sl. No.	Processing units	Equipment used	Remarks
A.	Pre-sorting	Manual sorting at receiving area, conveyors with hopper	To separate out bulky/large pieces of waste/ gathari /dumpster bags
B.	Mechanical Sorting	Conveyors	Requires specialized equipment for Sorting of commingled municipal waste

Sl. No.	Processing units	Equipment used	Remarks
1.	Screening	Disc screens/ trommels/ Vibratory screens	For separation of wastes into two or more size distributions
2.	Ferrous metal separation	Magnetic separators	Electromagnets are used for separating ferrous metal from mixed waste
3.	Air classification	Air classifiers	Separation of lighter materials from heavy material, specifically for separating out lightweight plastics and paper from the mixed stream
4.	Non-ferrous metal separation	Eddy current separators	Separate non-ferrous metal based on their electrical conductivity
5.	Optical system (sensor based)	Optical sensors	To separate various grades of paper, plastics and glass which are not sorted out in the air classifier
C.	Size reduction	Shredder	To reduce too large sorted materials to smaller sizes
D.	Baling	Baler	Compaction and binding of recyclables
E.	Weighing	Weighbridge and weighing scale	Weighing of large and small quantities of incoming and outgoing materials from the site
F.	Loading and Unloading	Loaders and forklifts	For loading of waste to process lines and movement of stored materials

6. Process Description

Dry fraction of municipal solid waste received from door to door collection will be gathered and transported to MRF. Upon reaching the MRF, vehicles will be weighed and recorded at the weighing bridge. The vehicles will then move to unloading area and empty vehicles will be weighed again to determine the quantity of waste delivered.

Gathari and dumpster bags shall be unbundled at receiving area. Discarded furniture, blankets, empty tins, etc. shall be physically removed. From receiving area, dry waste will be fed onto a slow-moving conveyor belt for screening through trommel. Items not suitable for trommel, such as glass bottles, metal containers, paint containers, etc. will taken out by hand and will be placed in appropriate bins.

Magnetic separator is fixed at the end of conveyor belt before trommel to segregate waste materials having magnetic constituents at in-feed conveyor belt. The depth of

moving waste layer on conveyor belt leading to disc screens should be maintained less than 10 cm. Materials separated using magnetic separator shall be stored and send to the recyclers.

The disc screens and trommel will separate materials based on their size which will be further sorted manually at the tail end conveyor lines. The fraction that is separated from the disc screens shall be stored and send for disposal. Leftover waste shall be segregated as recyclable, sanitary waste, coconut shell, hazardous waste into vats or large containers.

After sorting, rejects/inert will be sent for land filling while domestic hazardous waste and sanitary waste will be handed over to respective common facilities. Baling will be required for sorted fractions of cardboard, metal cans, and plastics. The bales of different materials shall be kept in the designated storage area to be handed over for further recycling. The glass fractions shall be stored separately for recycling. The general process flow diagram is shown in Figure 1.

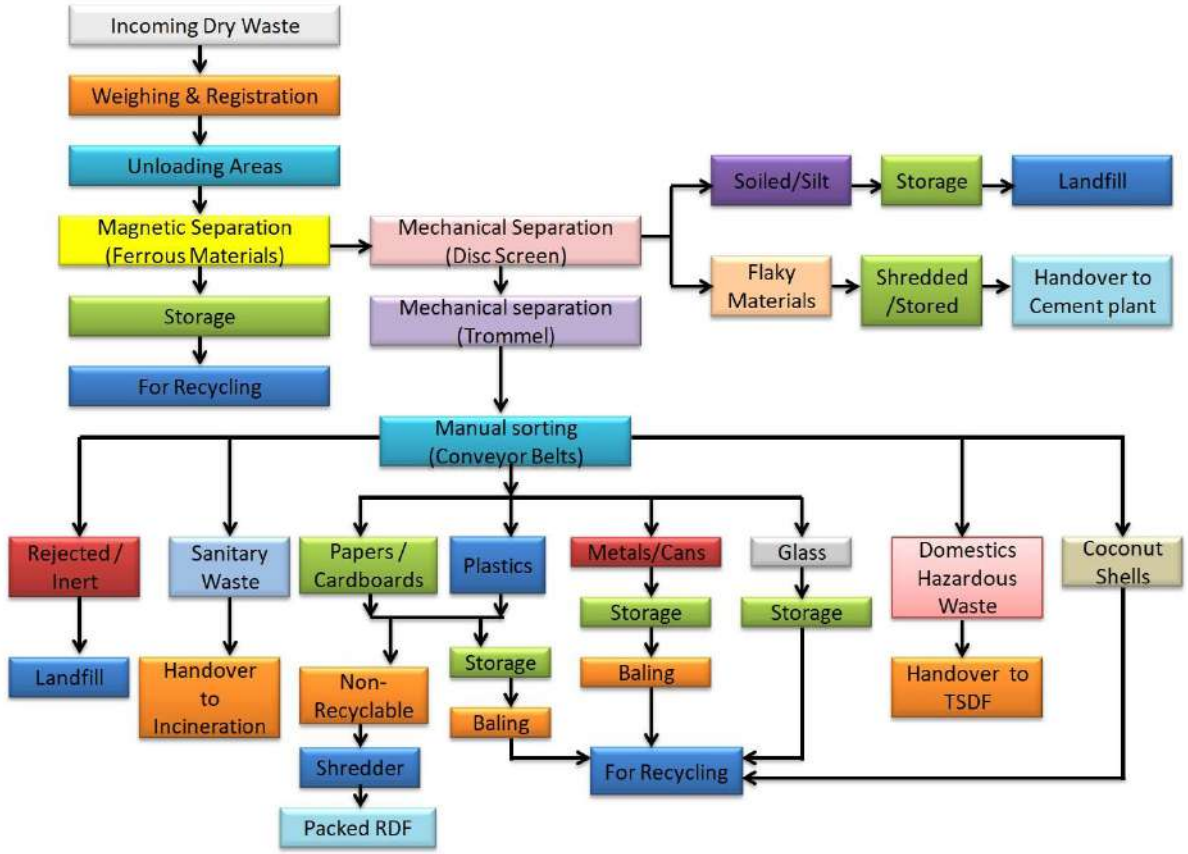


Figure 1: Process Flow Diagram

To get the maximum price, recyclable materials recovered at MRF must meet the need of market. The recovered materials should be clean, adhering to quality parameter acceptable to market, in bulk package, uniformly compacted/baled etc. to facilitate and meet the market demand. If not, the materials will get lower prices or rejection by recyclers.

7. Infrastructure

The plot area requirement for this typical 100 TPD MRF is 10640 sqm say 10700 sqm (2.65 acres approx.) with plot size of 95 m x 112 m including green belt, parking etc. The space required for establishing a processing and storage warehouse building is about 4500 sq. metre. The supporting infrastructure includes access roads, utility area, office space and parking area. Depending on the actual plot size and dimensions, the general arrangement/layout can be changed to suit the land available.

Essential facilities should include adequate space for receiving & unloading, sorting & processing, storage space for recyclables, equipment area, space for office/admin/record room, space for loading of residual and processed recyclables, wash room, changing room, parking and utility areas. The engineering drawing for the facility is attached at Annexure 1. The area statement as per the typical layout plan is given in the Table 2.

Table 2: Area Statement

Sl. No	Description	Area in sq. metre	Remarks
I	Processing, storage and equipment area		
a.	Processing & circulation area	770	Processing area includes sorting area, conveyor systems, trommels, and passages for vehicular and material/personnel movement
b.	Receiving area + Organic Waste Processing	1500	Includes area for receiving waste from the tippers/collection vehicles, space for operation of handling units, Organic waste processing unit, maturation trays and storage space for broken furniture.
c.	Storage for recyclables	110	15 store room considered for sorted recyclable material
d.	Baler machine	28	-
e.	Shredder machine	25	Area is inclusive of circulation space and
f.	Shredded Material storage area	100	Area for keeping shredded materials
g.	Bales storage area	450	Area for keeping the bales before sending over to recyclers.
II	Office area		

Sl. No	Description	Area in sq. metre	Remarks
1	Office space	266.2	Includes space for reception, project manager cabin, pantry, meeting room, toilet, conference and workshop
2	Changing Room + Toilets block (Male & Female)	223	Space with locker facility including changing space for workers and toilets for workers as per the Factory Act
3	Parking area	968	Space allotted for four wheeler and two wheeler parking
III	Utility Spaces		
1	Pump house	12	For fire pumps as per NBC guidelines
2	Water tank	32	Water tanks to meet the fire demand per NBC guidelines for a Category H building
3	Transformer	15	Transformer of connected load 191.2 kW to transfer the power required by the plant
4	Security room	16	Space for security staff
5	Weigh bridge & Weighbridge cabin	65	Space for weigh bridge operator & records
	Total	**10640**	**≈10700 Sqm**

8. Equipment

The overall quality of segregated materials depends on the configuration of MRF processing line. The configuration of line depends on several factors including the quality and quantity of incoming waste, land availability and required specifications for the end products. Every ULB have to adopt the type of MRF as per their specific requirements, which fulfill the actual site conditions.

Equipment required for day to day operations of MRF are divided into three heads namely process, electrical and firefighting equipment. Following sections described the tentative specifications for equipment considered.

8.1. Process Equipment

The process equipment/machinery and their technical specifications are detailed below:

8.1.1. Weighbridge

Weighbridges are machinery to determine the weight of vehicle and its contents by performing quick and continuous measurement of vehicles and recording these metrics. Vehicles shall be weighed while loaded and when emptied to calculate the quantity of waste carried by the vehicle. The specification of a weighbridge is as given below

Table 3: Weigh Bridge

Parameters	Specifications
Weigh Bridge Type	Surface mounted Electronic Weigh Bridge
Platform material	Mild Steel meeting requirements under IS 2062 Should be anti-skid type (chequered). Thickness of platform plate not less than 10 mm (7.5 m long and 3 m width) with proper MS beams
Weighing Capacity	40 Tonne
Load cell	4 Load cell with Nickel plated alloy steel body
UPS	½ hour backup.
Printer	Laser
Weighment & printouts	Attached as **Annexure 2 (1)**
Display modes	a) Indicate weight b)Indicate calibration-Auto zero tracking and calibration to be checked automatically every 5 minutes
Indicator Units	Kg
Type/capacity of load cell	Digital Double Ended Shear Beam load cells, pre-calibrated load cells – 10000kg (04 No.) with mounting kits
ABS Junction Box : 01 Set with IP 65 protection class for connection	Cables : Home run cable 12 m & inter connections cable between load cell and junction box & weighing electronics 02 m
Least count	2 Kg
Acceptable error	± 1Kg
Electric supply	3 Phase (440 V 50Hz)
The Machine metal part	powder /paint
Installation & Demonstration	Yes

Figure 2: Representative picture of Weighbridge

8.1.2. Conveyor Belt System

Belt conveyor systems are the most versatile and simplest material handling systems used at MRF's for enhancing the efficiency of material handling. It is designed for manual sorting and to transport or move materials from one point to another using belts. 15 conveyor belts are used to configure a single process line and **Table 4** gives the specification of conveyor lines used to configure the process lines.

Table 4: Conveyor Belt Systems

Parameter	Specifications
Conveyor Belt 1- Hopper to Disc Screen	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	5.63 kW (7.5HP), 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. 8.5 m from End to End of conveyor
Size of belt	1200 mm wide (working width 1000 mm)
Conveyor Belt 2- Disc Screen to Trommel	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	2.3 kW (3HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 2.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)

Parameter	Specifications
Conveyor Belt 3- Below Disc Screen	
Type	Flat roller type belt conveyor
Quantity	2 nos
Motor	2.3 kW (3HP), 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. 3.0 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 4- For > 60 mm particles	
Type	Flat roller type belt conveyor
Quantity	1 nos
Motor	2.3 kW (3HP), 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. 4.6 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 5- Below Trommel	
Type	Flat roller type belt conveyor
Quantity	1 no
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. 5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 6- Trommel to Sorting Belt	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	2.3 kW (3HP), 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. 3.8 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 7- Trommel to Sorting Belt 09	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	2.3 kW (3HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole

Parameter	Specifications
Inclination	20° Inclined flat
Length of Conveyor	Approx. 3.4 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 8- Sorting Conveyor Belt no. 1	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	7.5 kW (10 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3-phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 14.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 9- Sorting Conveyor Belt no. 2	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	7.5 kW (10 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3-phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 14.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 10- Sorting Conveyor Belt no. 3	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	7.5 kW (10 HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3-phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 14.5 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 11- Conveyor Belt for heavy fraction	
Type	Flat roller type belt conveyor
Quantity	1 no
Motor	5.63 kW (7.5HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3-phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 11 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 12- Conveyor belt for heavy fraction to Sorting Table no. 1	
Type	Flat roller type belt conveyor
Quantity	1 no

Parameter	Specifications
Motor	2.3 kW (3HP), 1440 RPM, TEFC (Totally Enclosed Fan Cooled) copper wire conforming to IS: 13730, 3- phase, 4- pole
Inclination	0°
Length of Conveyor	Approx. 4 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 13- Conveyor Belt for >200 mm particles	
Type	Flat roller type belt conveyor
Quantity	1 no
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. 7.7 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Conveyor Belt 14- Conveyor Belt for Sorting Table No. 3	
Type	Flat roller type belt conveyor
Quantity	1 no
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. 6.7 m from End to End of conveyor
Size of belt	1000 mm wide (working width 800 mm)
Other details	
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) 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 ID ERW pipe with CI housing, bright bar spindle and sealed with single roll anti friction deep

Parameter	Specifications
	grooved ball bearing
Bearing	Angular contact type with fitted in split housing
Idler Spacing	Carrying Idler – 800 mm, Impact Idler - 400 mm, Return Idler - 1500 mm
Belt joint	Endless type belt
Scrappers	Driver side: Flat Scrapper 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 3: Representative picture of Flat Conveyor Belt System

8.1.3. Magnetic Separator

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 supplied as a thin sheet 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 5: 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 4: Representative picture of Magnetic Separator

8.1.4. Disc Screen

Disc screens are flat screens that consist of an array of disks that spin on shafts. It consist of rotating discs to separate waste through the clearance between the discs depending upon the size and the weight of the waste.

Disc screens move the materials across the screen by means of the disc rotation, which allows materials to be fed directly onto the screen. Disc screens are capable of separating combustible and non-combustible waste. Disc screens are proposed prior to

the trommel to separate out the smaller fractions from the waste. The specification for a disc screen separator is given in the table below:

Table 6: Disc Screen Separator

Parameter	Specification
Capacity	100 TPD
Screening length	5 m
Screening width	1 m
Perforation	25 mm
Drive	Electrical driven with VFD
Motor	10 HP

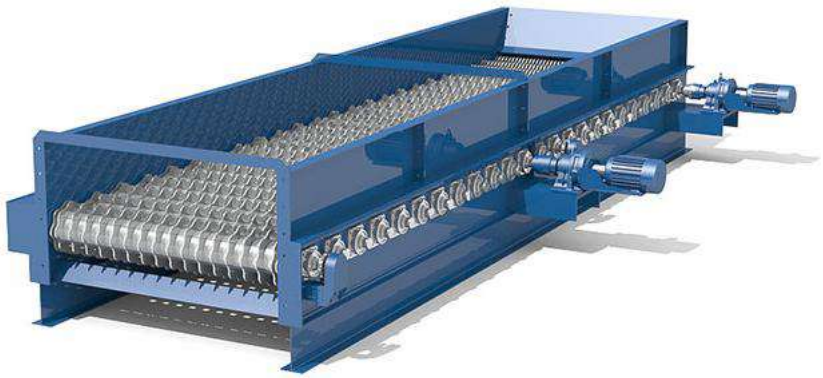


Figure 5: Representative picture of Disc Screen Separator

8.1.5. Trommel

Trommel is a type of screen used at MRF to separate materials of different sizes into two or more size distributions. They are rotating cylindrical screen inclined downward with an angle to the horizontal. Materials feed at the elevated end and separation occurs while material moves down the drum. Length, diameter, angle of the drum and speed of rotation are important parameters for configuring the trommel. The specification of trommel is given in **Table 7**.

Table 7: Trommel

Parameter	Specification
Capacity	20 TPH
Material	Mild Steel (confirming to IS:2062)
Size length (mm)	10000
Shell Diameter (mm)	2500
Ring Diameter (mm)	2700
Hole Size (mm)	250 (minimum 10 hole of 250 mm in per m^2 of screen) Anti wrapping 3D hole,
Shell Thickness 10 mm	MS confirming to IS: 2062

Parameter	Specification
Screen Thickness 08 mm	MS confirming to IS: 2062
Screen type	Bolted & Replaceable (if damage during operations)
Side covers	Fully covered with windows for inspection and maintenance
Inclination	4-5°
RPM	8-11 (variable through Variable Frequency Drive)
Knives	Should be effective in tearing bags, installed inside the trommel screen in the first 3 (three) m after the material feeding point. high carbon steel Knives may be easily replaceable. Bolted design is preferred. Different configurations (positions) of knives inside the trommel are possible as per requirement.
Vibrations	No vibration are allowed
Drive	Friction drive with solid poly urethane tyres
Tyre	Specially made, heavy duty, Solid poly Urethane tyres
Power supply	Electric (3 phase) 440V, 50 Hz, 4-pole
Motor(02 numbers)	7.5 kW (5HP), 1440 RPM, copper winding, 3 phase, 4 poles
Special feature	All screens are bolted with the trommel frame for easy maintenance. Inbuilt blades and knives for bag opening
Surface Finish	Epoxy Paint Coated
Walkway	On three sides with railing for maintenance
Trommel lifting arrangement	Hydraulic jack for easy maintenance & tyre replacement
Front Door with Ramp	Lever operated ramp to enter inside trommel to be provided for easy accessibility
Maintenance/Safety	Should have features like railing like railings, door, platform on both sides for maintenance and safety. Back door limit switch to ensure trommel screen to be included (for Maintenance tasks)


Figure 6: Representative picture of Trommel with Screens

8.1.6. Shredder

Shredder machine are used to cut waste materials into smaller. The shaft and blades are the critical components in shredder machine that determines its performance. Plastic sheets, flexible, SUP and MLP can be shredded based on the requirements. **Table 8** gives the specification for a heavy duty twin shaft shredder.

Table 8: Heavy Duty Twin Shaft Shredder

Parameter	Specification
Type of Shredder	Twin Shaft
Shape of Shaft	Horizontal Hexagonal Shaped
Material of Housing Enclosure	Mild Steel (confirming to IS:2062)
Capacity in TPH	2TPH
Motor Power (kW)	44.7kW (66HP), copper wiring, 4 pole, 3 phase
Hopper	Mild Steel (confirming to IS: 2062)
Base Frame	Mild Steel wide-flange beam of welded construction
Material of Construction of Mulcher	Shredder blades of tool steel having high wearing resistance and shock proof
Mulcher Cleaner	Made of alloy steel to clean the shredder knives.
Painting	Primer Coated with gloss finishing
Housing	Outdoor weather protection metal sheet Housing c/w double layer panel's door.
Inside dimensions of shredder chamber in mm x mm with tolerance ±10 mm (W x H)	1218 x 250
Opening of loading hooper in mm x mm with tolerance ±10 mm	600 x 800
Material of Shaft	Mild Steel confirming to IS: 3688-2004 (1990)
Rotation Speed (Max)	200 RPM

Parameter	Specification
Over all Dimensions of shredding machine in LxWxH in mm	3757 x 1050 x 2054
Advanced Control Panel	Includes slow start VFD control, full function control panel, run/trip indicating light, start/stop push button, emergency push button stop, yellow light indicator on reverse motion, optical indicator to show operation, main switch, auto-reverse and stop in case of overfeeding, low power consumption on no feeding, control panel to fix problem without entering the shredding machine, manual push button to reverse and forward motions, low power consumption yet high output, robust construction and easy maintenance design, minimum cutting knife wear, operator friendly, etc.

Figure 7: Representative picture of Shredder

8.1.7. Baling Machine

A baling machine is a device used to compress materials into bale for ease of storage and transportation or handling. Baling helps to save expensive storage space. Hydraulic scrap baling presses are used to compress different types of scraps into bale forms using hydraulic power. High degree of compaction reduces the volume and increases the density of bales. Horizontal balers are suitable for handling higher volume of materials. The specification of a fully automatic horizontal baler machine is given in the table below:

Table 9: Fully Automatic Horizontal Baler Machine

Parameter	Specification
Baling chamber size	2100 X 940 X 835 (mm x mm x mm)

Parameter	Specification
Bale size L x W (mm)	2000 X 940 X 835 (mm x mm x mm)
Feed opening (L X W)	1500 X 940 (mm x mm)
Motor	50HP, 3 Phase, 4-pole, copper winding
Electric supply	3 Phase (440 V 50Hz)
Number of belts	3
Body	Fabricated
Weight of Bale (kg)	500 - 750
Cycle time per bale (minute)	5 – 8 Min/Bale
Number of Cylinder	4
Hydraulic Oil tank capacity (L)	1200
Hydraulic Pressure	3045 PSI
Oil drive	Double Vane Pump
Working fluid	Hydro Enclo 68
Operation	PLC operated
Output	4 - 6 Tonne per Hour
Main Cylinder (Bore x Rod)	Ø200 mm x Ø150 mm
Oil cooling system	2 Ton A.C with Oil Chiller
Conveyor	W (1 x 10) m
Bale Ejection	By Hydraulic Cylinder
Material for pressing/compressing	Plastic bottles, aluminum cans, disposal plastic and cardboards

Figure 8: Representative picture of Fully Automatic Horizontal Baler Machine

8.1.8. Air Blower

Air blower is used to separate the jumbled materials from a mixed waste using a forced channel of air. It also helps to remove the dust and moisture from the waste. Air blowers

installed in the conveyor lines will separate lighter materials from heavier materials. The technical specification for an air blower is given in **Table 10**.

Table 10: Air Blower

Parameter	Specification
Capacity	1500 CFM
Working temperature	30° C
Pressure	750 mm WC
Drive	Direct foot mounted fan
Recommended motor power	11 kW or 15 HP, 3 phase, 4-pole, copper winding, confirming to IS 12615:2011
Blower RPM	2900
MoC of Casing	3 mm MS fabricated
MoC of Impeller	MS fabricated
Balancing	As per IS 1940, grade 6.3
Standard accessories	Set of both ends companion matching flanges, Duly painted with epoxy primer and synthetic paint / HR paint.
Power Supply	200-440 V, 50 Hz
Electric Motor	Standard IE2 rating ABB or BBL or CG make or equivalent

Figure 9: Representative picture of Air Blower

8.1.9. Tractor with Loader

Tractors with front-mounted wide bucket (loader) connected to the end of two booms are used to scoop up or load loose materials from the ground. It will be used to load the waste into hopper of the conveyor belt from receipt area/tipping area. The specification for a tractor with loader is given in **Table 11**.

Table 11: Tractor with Loader

Parameter	Specification
Description	Self-propelled wheeled machine which has front-mounted equipment primarily designed for multi utility operation
Type of loader	Tractor with loader
Engine	40 HP (3 cyclinder)
Engine Capacity	2400 CC
Engine rated RPM	2599 RPM
PTO HP	34 HP
PTO type	6 Spline
PTO RPM	540
PTO Power	34 HP
Wheel drive	2 wheel
Forward Gears	8
Reverse Gears	2
Brake type	Multi disc oil Immensed
Turning radius with brake	2850 - 3100
Number of cylinder	3 nos
Air filter	3 steps oil bath type with pre cleaner
Clutch type	Dual
Transmission type	Partial Constant Mesh
Steering type	Power steering
Hydraulic controls	Draft, position and response
Bucket Capacity	0.3 cubic metre
Dump angle	45°
Dump height	2252 mm
Max Operating weight	3000 kg
Lifting capacity	500 kg
Horse Power	45 HP

Figure 10: Representative picture of Tractor with Loader

8.1.10. Electric Forklift

Electric forklift is important machinery at MRF used to lift and move materials over short distances. They are mainly used to shift, stack and load bales. The technical specification for an electrically operated forklift is given in **Table 12**.

Table 12: Electrical Forklift

Parameter	Specification
Power	Battery Power (Electric)
Load Capacity	1500 kg
Load Centre	500 mm
Tilt Angle	6° - 12°
Travel Speed (laden/Unladen)	10/12 kmph
Lifting Speed (laden/Unladen)	300/430 mm
Gradeability	16 %
Drive Motor	8 kW
Hydraulic Motor	10 kW
Battery Rating	48/440 V/Ah
Lifting Height (Std)	3000 mm
Fork length	920 mm
Fork width	100 mm
Fork thickness	40 mm
Operating Weight (Max)	2950 kg
Standard requirements	Wide view mast, load backrest, standard forks, power steering, retaining rollers, overhead guard, standard seat, return hydraulic filter, battery discharge indicators, discharge lift cutoff, turn

Parameter	Specification
	indicator lights, hour meter, halogen head lights, rear combination lights, rear view mirrors, reverse buzzer, electric horn, rubber floor mat, safe load indicator, biometric access system and tool kit

Figure 11: Representative picture of Electric Forklift

8.1.11. Storage Bins

Storage bins are proposed at the waste receipt area and besides the conveyor belts where manual sorting will be done. Storage bins are used for the temporary storage of sorted waste as recyclables. These sorted recyclables would be shifted to the storage sheds for their recycling/reuse. The table below describes typical technical specification for a storage bin.

Table 13: Storage Bin

Parameter	Specification
Capacity	1000 L
Material	GI/Metal
Wheel locking device	Yes
Frontal & ventral grip	Yes
Lid	Yes
Container dimension and making	As per IS 12402
Class conforming to IS 12402	Class B – Normal Type

8.1.12. Wheel Barrow

Wheel barrows are small hand-propelled load bearing vehicle used for transporting materials within the MRF. They are used for shifting of sorted materials from storage bins to storage sheds. The specification for a wheelbarrow is given in the table below.

Table 14: Wheel Barrow

Parameter	Specification
Capacity	140 L
Load carrying capacity	450 kg
Sheet Material	Steel sheets confirming to IS: 2062
Sheet thickness	1.8 mm
Wheel material	MS with solid/cushioned rubber tyre
Type of bearing/bush	CI bearing
Hand grips	Yes
Leg Support	Yes
Steel tube	Light tube confirming to IS:1239
Grey Iron Castings	Conform to IS: 210
Metal part finish	Two coats of black bituminous paint
Wheel diameter	500 mm
Tyre width	50 mm
GeM Product ID	5116877-24324484266

8.2. Electrical Equipment

The electrical equipment considered for solar power plant, lighting and ventilation are described briefly in the following sections.

8.2.1. Solar Power Plant

Solar power plant is sustainable solution for reducing electricity consumption and increase the competitiveness of MRF. It helps to reduce the negative impact on environment and dependency on other electricity suppliers. **ULB's must utilize the available schemes by Government of India for the purposes to promote such renewable energy source.**

The arrangements of solar panels are proposed on the roof top of MRF. The arrangements of solar panels on roof top are depicted in layout at **Annexure 1**. The technical specification of a solar panel confirming to IS 14286-1&2 is given in the table below.

Table 15: Solar Power Plant

Parameter	Specification
Cell Type	Polycrystalline
Rated Power	315 W
Max Power Voltage	36.92 V
Max Power Current	8.55 A
Open circuit voltage	46.15 V
Short circuit current	8.91 A
Minimum Module efficiency	16.26%
Number of cells	6 x 12
Module dimension	1956 mm x 990 mm
Module thickness	35 mm

Parameter	Specification
Junction Box	IP 67
Frame	Silver Anodized Aluminum Alloy
Encapsulation	Ethylene Vinyl Acetate film (EVA)
PV connectors	MC4 compatible
Front Cover	3.2 mm thick low iron, high transmission tempered glass
Ambient operating temperature	-40°C to +85°C
Maximum surface load capacity	5400 Pascals
Maximum relative humidity	85%
Temp. Co-efficient of voltage	-0.30%/°C
Temp. Co-efficient of current	0.05%/°C
Temp. Co-efficient of power	-0.40%/°C
Output cable CSA/length	4 mm^2/1000 mm

Figure 12: Representative picture of Solar Panels

8.2.2. Lighting and Ventilation Equipment

Ample lighting and ventilation are essential for healthy and safe working environment.. Adequate natural/ artificial lighting and ventilation has been provided by proper designing the MRF. Latout showing the lighting and ventilations are given at **Annexure 1**. Artificial lighting are proposed to have 200 lux inside the plant during operations and street lights are considered for illuminating service roads. The equipment & items proposed are LED lights, LED tube lights, wall mounted fans, ceiling fan and exhaust fans. The number of unit required and technical specification of the equipment are given in table below.

Table 16: Lighting and Ventilation Equipment

Sl. No	Equipment	Specifications	No of Unit
1.	LED Street light	Rectangular LED lights with luminaire system wattage of 250 W confirming to IS 10322 (Part 5): 2012, with	27

Sl. No	Equipment	Specifications	No of Unit
		lumen output greater than 120 lumen/watt. UV stabilized polycarbonate optic lens and with IK07 impact resistance, mounting shall be of metallic adjustable bracket (SS) with eye bolt and fitted with 3 core connecting cable of ISI mark including necessary accessories.	
2.	LED light	Round LED light with luminaire system wattage of 100 W confirming to IS 16103-2: 2012, with lumen output greater than 120 lumen/watt, UV stabilized polycarbonate optic lens and with IK07 impact resistance. Mounting shall be of metallic adjustable bracket (SS) with eye bolt and fitted with 3 core connecting cable of ISI mark including necessary accessories.	18
3.	LED Tube Light	T-5 LED tube light of 1200 mm length and 22 W power rating confirming to IS 16103-2: 2012. With minimum lamp efficiency of 100 lumen/W and shell material made of polycarbonate lamp. Tube light should be of inbuilt driver type.	40
4.	Wall Mounted Fan	Heavy duty AC wall fan of 0.6 m made of aluminium with a rated power of 180 W for operating at 230 V AC single phase supply confirming to IS 2997(B)-1964. Wall fan shall be of single speed setting with 3 blades and an air delivery of 270 m^3/min. Operating frequency as 50 Hz and sweep of 600 mm	20
5.	Ceiling Fan	Three blade ceiling fan with a rated power of 75 W and operating at a maximum speed of 380 RPM confirming to IS 374: 2019. Sweep size as 1200 mm.	16
6.	Exhaust Fan	Five (plastic) blade exhaust fan with a rated power of 60 W and single speed control. Exhaust fan shall be with a speed in the range of 2200 – 2400 RPM and with a size of 250mm confirming to IS 12080: 1987	10

8.2.3. Earth Leakage Circuit Breaker (ELCB)

ELCB's are safety devices used in electrical installations with high earth impedance to prevent shock. It detects small stray voltages on the metal enclosures of electrical equipment and interrupts the circuit if a danger is detected. The technical specifications of earth leakage circuit breakers confirming to IS/IEC 60947-2 are given in the table below:

Table 17: Earth Leakage Circuit Breaker

Parameter	Specification	
	For 3 HP Motor	For 5 HP Motor
Compliance to ISO certification	ISO 9001	ISO 9001
Conformity to Standards	IEC 61008-1	NA
Certification	CE	NA
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	IP 20	IP 20
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
Electricity	3 phase	3 phase

Figure 13: Representative picture of Earth Leakage Circuit Breaker

8.3. Fire Fighting System

All buildings depending upon the occupancy use and height shall be protected against fire using fire extinguishers, hose reels, hydrants, automatic sprinkler etc, in accordance with the provisions given in Table 7 of Part 4 of NBC of India. The MRF is designed with the consideration of a storage type building with height less than 15 m and covered area more than 250 m^2.

8.3.1. Fire fighting equipment

The essential components of fire fighting system are electrical fire pump, diesel fire pump, jockey pump and a control panel. Components selection for firefighting system has been done as per NBC guidelines. The duty conditions for the pumps are derived from the tentative drawings prepared for 100 TPD MRF and from NBC requirements. The technical specification for firefighting equipment is given in the table below.

Table 18: Fire Fighting

Parameter	Specification
Motor- 22kW/30 HP	
Power Source	Electric
Pump Type	Non self priming, single stage, centrifugal volute pump with axial suction port, radial discharge port and horizontal shaft
Flow rate	1620 LPM
Head	50 m
Rated Speed	2900 RPM
Material of Construction of Pump Casing	Cast Iron
Material of Construction of Shaft	SS 410 conforming to ISO: 15510
Material of Construction of Impeller	Bronze –LTB 2
Sealing method	Mechanical Seal
Protection	IP 55
Motor type	3 phase squirrel cage induction motor
Voltage	415+/- 10%
Frequency	50 Hz +/- 5%
Starter	DOL starter
Motor- 3.7 kW/5 HP	
Power Source	Electric
Pump Type	Non self priming, single stage, centrifugal volute pump with axial suction port, radial discharge port and horizontal shaft
Flow rate	180 LPM
Head	50 m
Rated Speed	2900 RPM
Material of Construction of Pump Casing	Cast Iron
Material of Construction of Shaft	SS 410 confirming to ISO: 15510
Material of Construction of Impeller	Bronze –LTB 2
Sealing method	Mechanical Seal
Protection	IP 55
Motor type	3 phase squirrel cage induction motor
Voltage	415+/- 10%
Frequency	50 Hz +/- 5%
Starter	DOL starter
D.G. Engine- 36 HP (Confirming to MoEF&CC emission standards and CPCB type approval)	
Power Source	Diesel
Pump type	Non self priming, single stage, centrifugal volute pump with axial suction port, radial discharge port and horizontal shaft
Flow rate	1620 LPM
Head	50 m
Rated Speed	2100 RPM
MoC of Pump Casing	Cast Iron
MoC of Shaft	SS 410 confirming to ISO:15510

Parameter	Specification
MoC of Impeller	Bronze -LTB 2
Sealing method	Mechanical Seal

Figure 14: Representative picture of Fire Fighting System

8.3.2. Fire Alarm System

Fire alarm system is designed to detect and alert occupants for the presence of smoke, fire, carbon monoxide or other fire prone emergencies within MRF. The system includes smoke detectors, heat detectors and manual fire alarm activation devices connected to a fire alarm control panel. Only smoke detectors are proposed for MRF. The technical specification for a fire alarm system is given in the table below:

Table 19: Fire Alarm System

Parameter	Specifications
Feature	Programmable logic Controller (PLC) shall be located inside a control panel made of mild steel of suitable thickness and shall be powder coated
Power Source	Electric
Detector	Smoke detector confirming to IS 11360:1985
User programmable	Front key pad
Desktop HMI monitoring system with monitor size	24 inch LED
ISO certification	ISO 9001: 2015

Parameter	Specifications
Air pressure differential (inches of water)	1
Air velocity rating (ft/min)	2000
Material	ABS
Nominal sound output	90 dBA at 10 feet (3m)
Sound/noise level (min)	92 dB and multiple frequencies
Frequency	400 Hertz
Indicator	LED
Electronic hooter	24 V DC nominal
For Loop/Speaker	PVC covered armored cable. Approximate length- 10000m
Power	PVC covers armored cable. Approximate length – 200m
Product Id:	5116877- 77151804545

8.3.3. Fire Extinguisher

Fire extinguisher is an external fire safety device useful to extinguish or control minor fires, in emergency cases. Fire extinguishers are not for use in out-of-control fire incidents. It consists of a hand-held cylindrical pressure vessel carrying an agent which discharges to extinguish the fire. For MRF, two classes of fire extinguishers are proposed namely ABC class and CO_2 class. The location of fire extinguishers within the MRF is depicted at the fire fighting layout at **Annexure 1**. The technical specifications for fire extinguishers are given in the table below.

Table 20: Fire Extinguisher

Parameter	Specification
ABC based Extinguisher	
Capacity	6 Kg
Extinguisher Media	Powder Based (as per IS 4308)
Extinguisher Class	ABC
Gross weight of the unit without bracket	8.7 Kg
Operating Temperature	-10°C to +60°C
Minimum efficient discharge time	8 second
Type of extinguisher	Low pressure extinguisher
Expellant medium	N2 based (Stored pressure)
Max. travel distance	22.86 m (NFPA 10 Section- 2018)
MoC of body for Low Pressure Extinguisher	Welded low carbon cylinder (as per clause 9.2.5 of IS 15683)
Additional features	With carrying handle, safety devices, suitable for recharge and with hose assemblies
Applications	For use in ordinary combustibles like wood, vegetable, fibers, rubber, plastics,

Parameter	Specification
	papers etc.
Product Id	5116877- 90932096240
CO_2 based Extinguisher	
Quantity of condensed aerosol	6.5 Kg
Type	Hot
Gross Weight of the unit without bracket	10.33 Kg
Extinguishing Media	Powder based (as per IS 4308)
Operating Temperature	-10°C to +60°C
Minimum efficient discharge time	8 second
Type of Extinguisher	Low Pressure Extinguisher
Class of fire for which is suitable	Electrical
Expellant medium	CO_2 Based
MoC of body for Low Pressure Extinguisher	Welded low carbon cylinder (as per clause 9.2.5 of IS 15683)
Effective space volume covered	7.47 m^3
Material of aerosols housing	Mild steel
Additional features	With carrying handle, safety devices, suitable for recharge and with hose assemblies
Product Id at GeM Portal	5116877-32421068855

Figure 15: Representative picture of Fire Extinguisher

8.3.4. Fire Bucket

The buckets filled with water and sand which used to prevent or extinguish fires. They are used to control a small fire which is low technology method of fire fighting. Sixteen fire buckets are proposed for the MRF and the locations of fire buckets are depicted at the fire fighting layout attached at **Annexure 1**. The technical specifications for fire buckets are given in the **Table 21**.

Table 21: Fire Bucket

Parameter	Specification
Nominal Capacity	7 litre
Shape and essential dimensions	Yes, as per clause 3.1 of IS 2546
Anti corrosive treatment	Zinc coating of 0.06 mm minimum
Top Handle	MS rod 10 mm diameter
Outside paint	Fire red
Top rim	MS wire conforming to IS 280
Top and bottom handles	MS rod conforming to IS 226
Material of Construction of buckets	MS black sheets conforming to Grade St 34 or Grade St 42 of IS : 2062
Body	Two halves joined together by butt welding, top rim wired and uniformly beaded fully formed without gaps. Thickness of body shall be 1 mm and diameter of beading wire of 3.55 mm
Bottom	Dished bottom joined to the body by butt welding without raw edge or crevice inside the bucket. The thickness of sheet as 1 mm
Ears	MS sheet fitted to the body by welding with flat head on the side. The thickness of sheet as 2.8 mm

Figure 16: Representative picture of Fire Bucket

8.3.5. Fire hydrant pipes

A pipe with control valve through which water flows from a water main in order to put out fire. They are designed to provide the water required by firefighters instantly to fight and extinguish a fire. The specification for a fire hydrant pipe is given in the table below:

Table 22: Fire Hydrant Pipe

Parameter	Specification
Thickness	4.85 mm
Diameter	25 mm – 150 mm
Material	Mild Steel
Pressure rating	15 kg/cm^2
Grade	C grade
Colour	Red
Certificate	ISI
Usage/Application	Fire fighting

9. Power Requirement

The per day power consumption for the MRF is 987 kWh. Annexure 3 gives an indicative expenditure for annual power consumption. Annual expenditure on power consumption charges came to Rs. 36.14 lakh/annum. Table 23 details the estimated power consumption of various equipment and machineries installed at the MRF.

Table 23: Estimated Power Consumption

Sl. No.	Equipment Details	Power Rating (W)	Duration of operation (Hr)	Quantity (Nos)	Critical power load (W)	Per day Power consumption (W)
1	Weighbridge	500	5	2	1000	4000
2	Conveyor belt system	61110*	5.5	1	61110	488880
3	Magnetic Separator	2250	5.5	1	2250	18000
4	Disc Screen Separator	7500	5.5	1	7500	60000
5	Trommel	11250	5.5	1	11250	90000
6	Twin Shaft Shredder	44700	3	1	-	268200
7	Baler machine	37500	3	1	-	300000
8	Air Blower	11190	5.5	2	22380	179040
9	Electric forklift machine	18000	1	1	-	18000
10	Fire pump-2 no.	25700	0.03	1	-	771
11	LED street light	250	12	27	-	31725
12	LED light	100	4	18	1800	6480
13	LED tube lights	24	8	40	960	7680
14	Wall mounted fan	180	8	20	3600	14400
15	Ceiling fan	75	5	16	1200	4800
16	Exhaust fan	60	8	10	600	1200
17	Desktop PC	250	8	2	500	4000
18	Water cooler	300	4	2	600	2400
	Other load	100	4	1	-	800
					Critical power load in W	114750

Sl. No.	Equipment Details	Power Rating (W)	Duration of operation (Hr)	Quantity (Nos)	Critical power load (W)	Per day Power consumption (W)
	Expected power consumption in W/day					987346
	Expected power consumption per day in kWh (units)					987.35
	Expected power consumption per month kWh (Units)					30114
	Expected annual power consumption in kWh (Units)					361368

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

10. Manpower Requirement

Efficient functioning of MRF depends upon the deployment of number of qualified & experienced staffs/workers as required. The manpower requirement is envisaged as 70 staff per day for an eight hour operational shift. For calculating the number of sorting workers, yield of a worker is assumed as 1 – 1.5 tonne per eight hour operation. The annual expense including wages for staff/worker is calculated as 1.99 Cr per annum are presented at Annexure 3. The qualification and responsibilities of staffs/workers is given in the table below.

Table 24: Manpower, Qualification and Responsibility

Sl. No.	Manpower	Qualification	Number	Responsibility
1.	Manager In-charge (Skilled)	Engineering Degree/Diploma (Environmental / Civil /Chemical/Mechanical) with minimum five years of experience in Operations and Maintenances of plants for MSW processing/Used Water or Sewage treatment/Water treatment	1	♻ Maintain all administrative and inventory records. ♻ Maintain Interactions with the ULB officials ♻ Maintain communications with local authorities like health departments, police, fire brigade 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

Sl. No.	Manpower	Qualification	Number	Responsibility
				delivered to site. ♻ Site Incident Controller during emergency at the MRF. ♻ To perform other tasks including weekly/monthly reporting to ULB officials and/or supervisory duties.
2.	Safety Supervisor	12th class with Diploma in Industrial safety course and minimum five years of experience in Environmental Health and Safety	2	♻ Ensure the safety of worker and staff in the plant ♻ Ensure appropriate safety equipment and PPEs used at all times ♻ Reviewing accidents, incidents, and near misses, environmental hazards, health & safety breaches. ♻ Conduct training and mock drills for worker and staff. ♻ Periodic checking at the MRF for red spots(Spiting spots) and cleanliness of the plant
3.	Weigh bridge operator	12th class with 2 year operating experience of weigh bridge	2	♻ Operate and maintain the weigh bridge. ♻ Notify maintenance and calibration requirements with the MRF in charge. ♻ Prepare records of materials received and dispatched from the MRF ♻ Ensure weigh bridge is clean after days operation.
4.	Electrician cum baler operator (skilled)	ITI Electrician with 3 years of experience	1	♻ Operate and maintain the baler machine to compress and bind the sorted waste. ♻ Notify maintenance requirements with the MRF in charge. ♻ Troubleshooting

Sl. No.	Manpower	Qualification	Number	Responsibility
				electrical issues in the plant. ♻ Ensure all the electrical equipment/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
5.	Electrician cum Shredder operator (skilled)	ITI Electrician with 3 years of experience	1	♻ Operate and maintain the shredder machine. ♻ 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 equipment/machinery are switched off before leaving the plant ♻ Keep equipment in a clean and orderly condition and maintain the work area.
6.	Office Staff (skilled)	12th class	2	♻ Keeping records of materials received, sorted, and dispatched from the MRF ♻ Keeping records of attendance, visitors, feedbacks, and complaints received.
7.	Electric Fork lift operator (Skilled)	10th class with the applicable driving license and with two	1	♻ Operate and maintain the forklift for shifting of materials.

Sl. No.	Manpower	Qualification	Number	Responsibility
		year experience of such equipments.		♻ Check tyre conditions and oil leakage on a daily basis ♻ Keep the forklift clean after the day's operation ♻ Notify maintenance requirements with the Manager ♻ Ensure the forklift are put in charging after the day's operation
8.	Skip loader operator (Skilled)	10th class with the applicable driving license and with two year experience of such equipments.	2	♻ Operate and maintain the loader machine to feed the hopper of infeed conveyor. ♻ Check the tyre pressure and oil leakage on a daily basis ♻ Keep the loader clean after the day's operation ♻ Notify maintenance requirements with the Manager
9.	Security# (unskilled)	10th class, physically fit with five years of experience as a security staff.	3	♻ Regular patrolling (thrice in a shift) and 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.
10.	Safai mitra Cleaner#	Not applicable	4	♻ Cleaning wash room/toilets and keeping

Sl. No.	Manpower	Qualification	Number	Responsibility
	(unskilled)			all emergency exits and walkways clear from obstructions. ♻ Reporting at MRF two hours before commencement of operations and keeping working area neat and tidy ♻ Maintain and water the garden around the MRF daily ♻ Switch on the fans half an hour before the commencement of MRF operations ♻ Should engage in the sorting activity as and when required
11.	Person at tipping area (unskilled)	Not applicable	3	♻ 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
12.	Sorting workers# (women's) (unskilled)	Not applicable	48	♻ 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. ♻ Maintain cleanliness and orderliness in the recycling facility by regularly cleaning work areas.
Total			70	

** 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

11. Water Demand

Water is essential for day to day operations to meet the drinking and non drinking requirements of staff and visitors arriving at the MRF. Water is also required for the cleaning of floor, equipments and machineries. The per capita water demand 45 Litres per day/head has been taken from Table 1 of IS 1172: 1993 to calculate the total water demand. The details is furnished in the **Table 25**.

Table 25: Water Requirement

Sl. No.	Details	Number of workers (No)	Per capita demand (L)	Total requirement (L)
1	Manpower	70	45	3150
2	Visitors to the facility	120	15	1800
3	Water for cleaning requirement			4600
	Total water requirement per day			9550
	Say			10000
	Water for firefighting as reserves			50000
	Minimum total storage required in the sump tanks			60000

The daily water demand is calculated as 10 KL and monthly as 305 KL. Water tariff for calculating operational cost is arrived from the Delhi Jal Board (DJB) rates. As per DJB, volumetric charges for industrial use exceeding 100 KL is Rs. 146.4/KL and the rates may vary from state to state. The annual water charges came to Rs. 5.52 L/annum and the calculation is given in O&M cost table at Annexure 3.

12. Wastewater Generation

Wastewater generation is estimated as 80 % of the water consumption per day and is calculated as 7640 litres per day. Wastewater should be discharges to public sewers if sewers are available within a distance of 100 metre from the MRF or on-site sanitation measures should be adopted. A septic tank with soak pit is a recommended as on-site sanitation measure which can be adopted based on the site conditions.

DJB rates are used for calculating the sewer charges and equals to 60% of volumetric charges of water consumption. The annual charges come to Rs. 3.31 L/annum and are presented at Annexure 3.

13. Personal Protective Equipment

Personal Protective Equipment are used for ensuring the safety and hygiene of workers engaged at the MRF. The PPE's include nose mask, safety goggles, chemical resistant gloves, safety jackets, bouffant caps, safety shoes, ear plugs and aprons. Table 26 gives the annual requirement of various PPE's for the MRF.

Table 26: Specification for various PPEs

Name of PPE	Specification	Annual requirement (no)
Nose Mask (Surgical)	Size (L x W) 5.5" x 3.5" , plain cloth fabric, cotton (10% Poplin). As per standards: IS 9473-2002, IS 15323-2003	32850
Safety goggles	Polycarbonate lens with soft PVC frame & body, fully adjustable headband, light, resilient & durable, anti-fog lens coating etc. As per standards: EU 86/686/EFC, EN166/2002 and ANSI/SEA Z87.1-2010 or equivalent	150
Chemical resistant gloves, multi-use	CE Marked fully nitrile rubber hand gloves (In pair) with inside soft cotton flocked lining, overall length not be less than 12 inches. Confirming to IS: 4770- 1991, EN-388 & EN-374 (2016)	225
Safety (High visibility/ warning) Jacket	100% mesh polyester, high gloss reflective tape, Confirming to IS: 15809 -2017	150
Bouffant Caps	Lightweight, water repellent and confirming to IS: 2925-1984, CE-EN-397, ANSI Z891-2003	32850
Safety shoes	A protective toecap that can withstand a 200-joule impact 12 with antistatic protection, etc. confirming to IS: 5852-2004, IS 15298 (Part 2)-2011	75
Ear Plugs / Canal caps	Ear plug for protection against noise (NRR to be minimum 29db), made of soft sponge material or silicone, polyurethane confirming to IS: 6229- 1980	150
Apron	Width of 80cm (+/-10cm), thickness: 150-300 microns confirming to as per standards: IS: 4501- 1981	75

Note:
Apron having reflective stripe both (apron & safety jacket) may be preferred instead of having separately
Annual requirement is based on considered manpower in this guideline

14. Standard Operating Procedure (SOP)

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 at **Annexure 2(2).** Such 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 presented in the following sections.

14.1. Morning Protocol

While starting operation in the morning, plant 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 (3).**

- Swachhata Mitras will wear the uniform and put on the required PPE.
- The premises of the facility shall be cleaned before starting the operations.
- Waste receiving and transfer points shall be kept clear.
- Switch on the fans for proper ventilation half an hour before the operations start
- Maintaining and watering the garden around the MRF

14.2. Receipt of waste

- Dry waste after weighment shall be unloaded in the waste receipt area at MRF
- After unloading the waste, empty vehicles shall be weighed again.
- Dumpster bags and gathari should be unbundled and oversized materials like blankets furniture, empty tins etc. shall be taken out physically by dedicated deployed staff for further process
- Sample format for the Receipt of Material/waste is provided at **Annexure 2 (4).**

Items like glass bottles, metal containers and hazardous materials like containers of paints should be removed from the waste at the receipt area itself.

14.3. Waste Feeding

- Once dry waste is received in receiving area then the waste is feed on the *infeed conveyor belt* nos. 1 for feeding into the disc screen

a) Waste Loader

- Loader shall drive/push the unload waste to the Infeed conveyor belts using the clamshell bucket
- Loader shall clear the receiving area before arrival of next vehicle
- In case of any breakdown waste shall be heaped to accommodate new consignment

Check the coolant, fuel level, engine oil, tyre pressure and hydraulic oil levels before starting the loader.
Make sure loader is operated by authorized personnel only.
Make sure all persons and vehicles are clear of the danger zone before operating the loader.
Operator shall communicate with workers deployed at receiving area to ensure safe, efficient and easy loading into the conveyor belts.
Ensure proper lighting at the operational area.

b) Conveyor belts

- Be operated at an average speed of 5 m/min to ensure proper Sorting of waste.
- Waste be spread to a thickness less than 10 cm on the conveyor belts for sorting of waste.

Check for rotation and unusual sounds of the conveyor system.
Ensure each belts are clean and no waste is blocking the rotation of the belt before each operation.
Ensure uniform loading on the conveyor belts.

14.4. Screening

- Received dry waste will be screened on the basis of their size
- Materials having magnetic constituents will be separated through magnetic separators

Don't keep bundle of bags in waste.

a) Magnetic Separator

- Materials having magnetic constituents will be separated through magnetic separators

Materials should be supplied in thin layers so that all the particles are subjected to a field of same intensity.

b) Disc Screening

- Waste is separated on the basis of their shape and size. Bottles (3D) materials tumble back and cardboards, paper (2D) materials will climb over. Fine will fall through the screen.

Don't keep bundle of bags in waste.

c) Trommel

- Dry waste received from infeed conveyor belt shall move through the trommel
- Waste materials be segregated in the trommel as fine (below 60mm), mid (above 60 mm and below 250mm) and oversized (more than 250mm) fractions.
- Fine fraction of the waste be collected at conveyor belt nos. 4 in the form of inert, earth mixed with flaky material like paper, plastic and MLP
- Mid-sized materials consisting of recyclables and shall be collected through belts no 5 and 13.
- Oversized materials suitable for RDF consisting of bulk packing material, MLP and SUP shall be collected

Check of the rotation and unusual sounds from the trommel or motors before each operation commence.
Ensure that entire trommel is clean and no waste is left or stuck in screen before each operation.
After each operation, operator should ensure to switch off power buttons and clean the trommel and sieve holes.

through conveyor belt no 11
- Each trommel should be operated to a maximum of 4 hr/day.

d) Air blower

- Air blower be placed at conveyor belt no. 3 and 04
- Flaky materials of paper, plastic, MLP and SUP shall be blown out of the conveyor belts using the 'Air Blower' at conveyor belts 9, 10 and 14.
- The blown out materials shall be shifted to the storage unit or shredded in the shredding machine

Switch on the air blower for checking the unusual sounds before the commencement of every operation.
Workers working near the air blower must wear dust mask and goggles while the blower in operation.

14.5. Sorting and Storage

- Workers are engaged at conveyor belt nos. 6, 7 & 8 for manual sorting into allotted bins.
- Recyclable sorted materials are stored in temporary storage area/compartment.
- Material be shredded/baled regularly when the storage compartments are full.
- Domestic hazardous and sanitary waste be stored and handed over to common hazardous waste management facility and Bio-medical waste facility respectively
- Rejects/inert be stored and send to sanitary landfill facilities.
- Plastic/cardboards be baled and handed over to recyclers.
- Metals/glass be stored and handed over to recyclers.
- Plastic/paper be shredded and stored for handing over to recyclers.
- Aluminum metals cans be baled and stored for handing over to recyclers.

Keep sorting and storage area dry and free from pest and files.
Regularly spray disinfection liquid as better prevention practices.
Ensure that compartments are not stored beyond their capacity.
Don't stack glass material at height.

14.6. Post Processing Unit

a) Shredder

- The materials for shredding be shifted near shredder from the recyclable storage area one by one
- Materials to be shredded shall be

Switch on the shredder and check for any abnormal noise during operation and stop the machine if necessary.
The blockage if any in the shredder

loaded from the top of the shredder
- Ensure positioning of empty container/jumbo bags to capture the shredded material
- Container/jumbo bags should be shifted shredded RDF storage area using forklift
- Shredder be operated as per instruction manuals.

unit shall be cleared after disconnecting the power supply.
The machine shall be disconnected from the power supply at the end of operations of the day.
Clean the shredder surface using brush after every use.

b) Baler

- Operate the baler as per Manual

Check the bale chamber is clean and lay a flat piece of cardboard at the bottom of the bale chamber over top of the ejector straps or chain if cardboards are to be baled.
Close and latch the bale chamber door.
Special care be taken of safety lock on doors.
If safety lock is broken/jam, baler not to be operated.

14.7. Dispatch and Sales

- Materials must be dispatched at regular frequency.
- 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 along with signature of plant in charge.
- Formats for material dispatch and sale is provided at **Annexure 2 (5) & Annexure 2 (6).**
- Bales of paper, pet bottles and metal cans shall be handed over to recyclers after weighment.
- RDF shall be transferred to cement plants, thermal power plants once truck load is available.
- Sorted cloths would be handed over to recycler.
- Tender coconut shell would be handed over for coco pith manufacturers, waste to energy plant as per available options.
- Rejects and inert shall be collected and taken to landfill for disposal

Do's

- Compulsory use of personal protective equipment/gears by the workers
- Ensure provision of suitable exhausts/vents/scrubbers etc.
- Ensure adequate fire protection

Don'ts

- No littering in the premises.
- Do not fuel/oil change of any engine while the engine is switched on.
- Wearing loose clothes near the machineries.

measures
- Regular inspection of fire extinguishers and equipment setup
- Follow good hygiene and sanitation practices including safe drinking water at MRF
- Check for any leakage of oil from the motor or gears
- Check for loose nuts, bolts and screws before each operation of the unit
- Check for lubrication of moving parts
- MRF should be kept clean and tidy all the time. Internal and external sweeping to be done thrice minimum (Morning, before lunch break and before closing)
- Keep the detailed logbook of MRF
- Good housekeeping and cleaning all machinery after use
- Ensure proper stock of first aid medicines
- Electrical equipment should be connected through ELCB's
- Ensure earthing of all electrical equipment
- Flywheel and belt of motors should be covered with guards
- Periodic meetings of workers for mock drills, training etc
- Compartments are to be cleaned once in a month and after the dispatch of material to resource recovery centre or identified recycler
- Electrical device shall be unplugged after completing the every time work
- Before changing a light LED/tubelight/bulb, switch off the connections
- Don't put hands on moving parts of machineries.
- No child labor (below 18 years of age).
- No smoking.
- Do not burn any waste.
- Pregnant women should be avoided from operating machinery
- Never use a defective electrical device or switches etc.
- No inflammable objects permitted in the premise.
- No explosives or firearms inside MRF.
- No animals inside the plant.
- Do not dispose waste inside or near storm water drains, drainage, ditches of any other location where they can damage the environment, cleanliness and aesthetics of the premises.
- Avoid wastage of water and electricity.
- Never use a damaged plug/extension cord.

14.8. Documentation and Reporting

- Receipt & Dispatch details including photographs shall be documented digitally. In case of manual entry, MRF in charge /weighbridge operator should sign the receipt in the format given at **Annexure 2(4) & (5)**.

- Officer in Charge shall maintain a soft copy of the consolidated figures of receipt and dispatch of materials at the MRF.
- A complaint, suggestion and feedback register shall be maintained at the MRF.
- Attendance of staff shall be reported bi-weekly to the Officer in Charge.
- Quantity of materials received or sorted or baled shall be reported category wise to Officer in Charge monthly as per **Annexure 2(7)**. The date of submission of details shall be decided by Officer in Charge as per his peer review schedule.
- Attendance & visitor log details shall be maintained at the MRF and monthly wages should be processed based attendance register.
- The total number of visitors shall be reported to Officer in Charge once in a month for review.
- Feedback on quality of waste material received shall be shared with the Officer in Charge

14.9. Evening Protocol

- All workers shall change their uniform and keep PPE in locker at MRF before leaving. **Annexure 2(8)** may be followed.
- All workers must wash their hands and face before leaving. They may take a bath as well, if required.
- Ensure all the machinery/equipment (fans/light etc.) are switched off before leaving the MRF

15. Maintenance

Format of maintenance checklists are given at **Annexure 2(9)**

- Storage compartments shall be cleaned after the dispatch of materials.
- The structural soundness of the compartment shall be checked and the necessary requests shall be forwarded to officer in charge for carrying out repair work
- All equipment shall be cleaned and greased as required. Lubrication of equipment shall be carried out after the shutdown only.
- The functioning of all utilities like drinking water, toilet facilities, electrical fittings, and solar panel shall be checked for faults. Necessary requests shall be submitted to officer in charge for required repairs

16. Annual Maintenance Contracts (AMC)

Various machines such as trommel, conveyor belts, weigh bridge, baling machine, desktop, printer, fans etc would be installed at MRF. Each machine has a warranty associated with its fresh procurement. On expiry of warranty period, maintenance contract would be a necessity. The officer in charge shall maintain a warranty register of equipment and thereafter AMC for the same equipment.

An Annual Maintenance Contract (AMC) to cover basic service on products or a Comprehensive Service Contract (CMC) covering additional spare parts, labour, travel

cost of technician etc. need to be maintained with the contractor who supplied and commissioned MRF for a further period of three years after warranty period.

17. Safety and Hygiene Practices

Safety practices should be adopted as per checklists for electric & mechanical safety and fire prevention & protection. Check list for machine safety and format for electrical safety is attached at Annexure 2(10 &11)

Table 27: Hazardous, Unhygienic Events and Safety Practices

Sl. No.	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	Use of first aid kit, medical help be sought immediately in case of injury
2	Direct contact with sanitary waste and domestic hazardous waste	Along with wearing gloves, sanitizers shall be used	Seek physicians advice in case of allergy
3	Direct contact with used sanitary napkins and soiled diapers	Gloves should be worn and avoid direct contact with any waste. Handle with tools and store & forward to BMW facilities.	Seek physicians advice in case of emergency
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 Safai Mitra while working	Medical help to be sought immediately

17.1. Display of Information under The Factories Act, 1948

Format of display of information under The Factories Act is presented at **Annexure 2(12)**

- Working hours shall be displayed at main gate of the MRF
- Display "OPEN" and "CLOSED" signboards during and after working hours respectively
- Display bilingual signboard mentioning "Child Labour Prohibited" at main gate
- Display campaign posters on segregation, recyclability, composting, and hazards of burning mixed waste/incineration
- Display the contact number of the Plant-in-Charge, police, fire department and other public authorities at the entrance.

17.2. Hygiene Practices

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

- Medical examination shall be done for all staff/workers (for Hepatitis B, AIDS)
- Keep sorting & storage area dry and free from pests and flies
- Regularly spray disinfection liquid as better prevention practices
- All working personnel at the MRF must wear uniform and PPEs while at work in
- Hands should be washed with soap before entering/leaving/eating
- Monthly cleaning and "pest-control treatment" routine has to be fixed and should be strictly followed
- Rodent control measures shall be in place.

18. Safety Training

18.1. Refresher Training

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

18.2. Toolbox Talk

At least one toolbox talk should be organized once in a week. 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 vernacular language. A safety pledge will be developed and it should be a part of toolbox talks.

19. Emergency Response Plan

An emergency response plan is for the effective management of an accident to minimize the losses to the people and property. On-site Emergency Management Plan (On-SEMP) described how major accidents will be dealt with and responsibilities for taking actions in accordance with the plan. Since fire is a manmade hazard with the highest probability of occurrence during operations of MRF is considered for establishing a response action plan. Depending upon the seriousness and response requirements during emergencies, they are classified into two levels and are listed as below:

- Level 1: Emergencies that can be effectively and safely managed and contained within the site, location or installation by the available resources. These incidents have no impacts outside the site, location or installation site of the machineries.
- Level 2: Emergencies that cannot be effectively and safely managed or contained at the location or installation by available resource and additional supports is alerted or required. These incidents have an effect beyond the site, location or installation and where external support of district authorities may be involved.

The level 2 incidents may be danger to life, environment or to industrial assets or reputation.

ULB's shall make an up to date on site emergency plan according to their manpower allocations. For level 2 emergencies, the on-site emergency plan shall work in coordination with nearest fire brigades and medical services. The schematic representation of onsite emergency management plan upto level 2 emergency is presented in the figure given below:

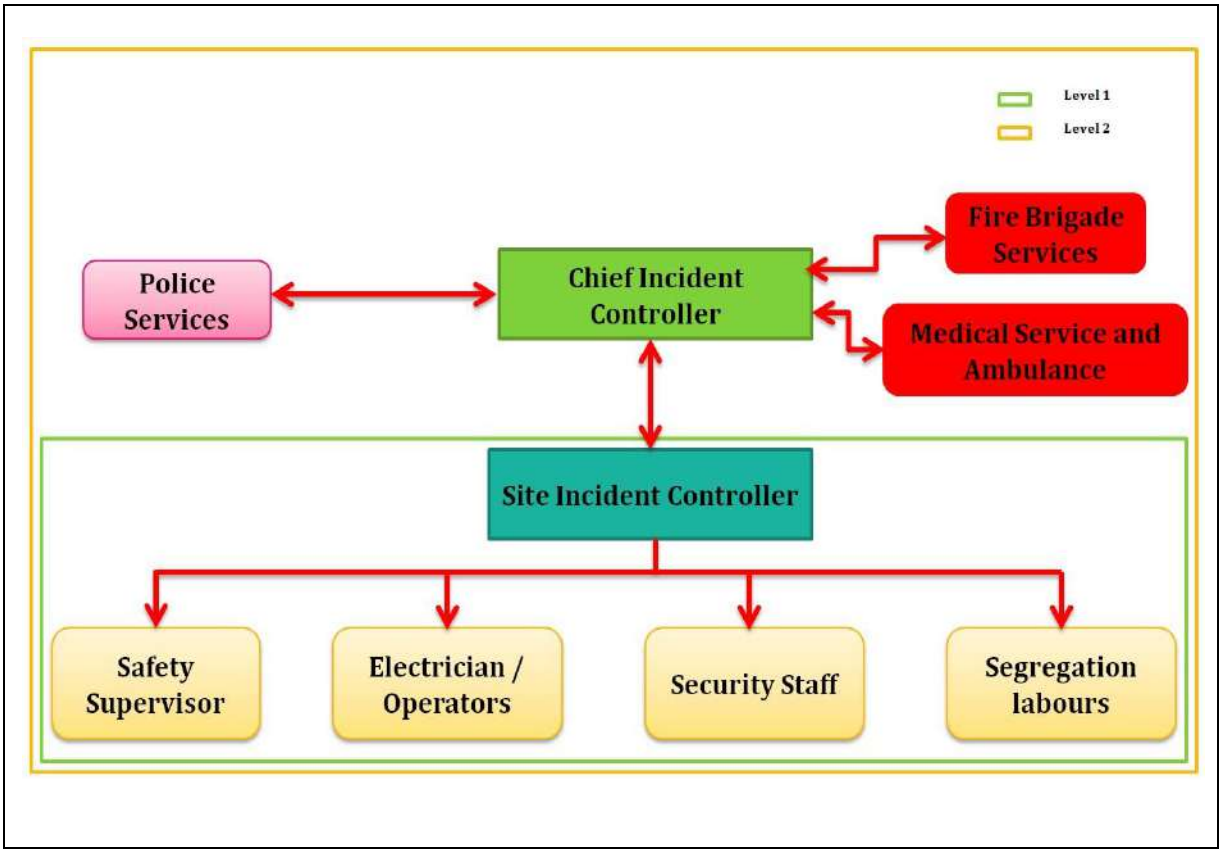


Figure 17: Emergency Response Plan

19.1. Roles and Responsibilities of Emergency Response Team

The roles and responsibility of concerned staff during a Level 1 fire incident are described below:

Table 28: Roles and Responsibility of Emergency Response Team

Sl. No.	Position Held	Staff Deployed	Responsibility
1.	Chief Incident Controller	Health Supervisor/Sanitation Officer of ULB	♻ Act as the coordinating point for transfer of information between District administration and SIC ♻ Extend all the supports to SIC through external

Sl. No.	Position Held	Staff Deployed	Responsibility
			assistance regarding technical resources/equipment/medical supports as deemed necessary ♻ Ensure round the clock operation, with shift personal being prepared to take charge of emergency control function, emergency shutdown of system if needed
2.	Site Incident Controller	Manager In Charge	♻ Ensure essential HSE equipment are availed with ERT ♻ Lead response team and start response activities without any delay ♻ Take quick decisions on priority of operation – life saving requirements/ response requirements ♻ Ensure that medical aid has been made available as early as possible ♻ Updating CIC about the incident and supporting him for taking decisions
3.	Safety Supervisor	Safety Supervisor	♻ Responsible for monitoring and assessing hazardous, unsafe act and conditions ♻ Conduct safety training program for works and arrange mock drills as a preparedness for handling emergency situations ♻ Watches out for the safety of all workers and protect them from entering hazardous situations
4.	Electrician/Operators	Electricians and operators	♻ Ensure power supply in the plant

Sl. No.	Position Held	Staff Deployed	Responsibility
			♻ Take orders from SIC regarding the evacuation of forklift and wheeled skid loader ♻ Switch off the machines as per directions from SIC
5.	Security staff	Security staff	♻ Controls and directs traffic in the Plant ♻ Shall supervise evacuation of personnel from the scene
6.	Sorting labours	Sorting labours	♻ Will take orders from the site incident controllers ♻ Will respond to the incident with

19.2. Emergency Contact Numbers

The major essential emergency contact numbers are given in Table 29

Table 29: Emergency Contact Numbers

Sl. No.	Particulars	Contact Numbers
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 snake bite antivenam	-

20. First Aid Box

It is important to have a well-stocked first aid kit at MRF to deal with minor accidents and injuries. It should be accessible all the time. A basic first aid kit should contain bandages of different sizes, small, medium and large sterile gauze dressings, adhesive bandages, crepe bandages, safety pins, disposable sterile gloves, tweezers, scissors, micro-porous, sticky tape, thermometer, cream or spray to receive insect bites and stings, antiseptic cream, antiseptic liquid, painkiller sprays and creams etc.

21. Signages

Signage is proposed at the workplaces for accident prevention, fire protection, health hazard information and emergency evacuation. Safety signage are prepared by using the appropriate safety colour, contrast colour and geometric shapes as per IS 9457:2005. Table below describes the different signage that can be adopted for MRF plants across the country.

Table 30: Signage for MRF

SL. No	Geometric shape and description		Signage purpose	Practical applications at MRF
1.		Circle with Diagonal Bars	Prohibition	No Smoking No Unauthorized Vehicles Do not Drink No entry Do not touch Do not litter
2.		Circle	Mandatory Action	Wear Eye Protection Wear Personal Protective Equipment Switch off mobile Use Forklift Wash your hands Keep clean Switch off light
3.		Equilateral Triangle	Warning	Danger High Voltage Conveyor may start without warning Don't block door Forklift in Use Hazardous material storage area Rotating parts
4.	 	Square/Rectangle	Safe condition, Means of Escape Safety Equipment	First Aid Room Fire Exit Fire Assembly Point Emergency exit
5.	 	Square/Rectangle	Fire safety	Fire alarm Fire Alarm Call Point Fire Fighting Equipment Fire Extinguisher Fire hydrant & hose reel Fire Phone

22. Other Important Guidelines

- The minimum safe distance/clearance between two machines as advised by the manufacturer and in case of doing maintenance or future replacements

- MRF should be certified by a structural engineer/local ULB engineer and the fire department as per rules
- Emergency numbers should be displayed at prominent locations
- Regular checking of PPEs and maintained replacement records
- Fitness certification of machines/equipment, frequency of certification need to be recorded in 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

23. Important points in Civil Works

Sequence of civil works for MRF construction

- Clearing out the site (as per layout and drawings)
- 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. about to 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 MRF 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.

24. Statutory Requirements

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 MRF. A generic requirement of clearances is described in Table 31.

Table 31: Statutory Requirement

Sl. No.	Statutory Requirement	Regulatory Authority	Responsibilities	Remarks
1	Consent to Establish (CTE)	Concerned State/ Union territory Pollution Control Board	ULB/Contractor/ Occupier	To be obtained under The Water Act 1974 and The Air Act 1981 through online application at the respective SPCB/PCC with necessary supporting documents like layout plan, key plan, project report and project fee before the commencement of works at site
2	Consent to Operate	Concerned State/ Union territory Pollution Control Board	ULB/Contractor/ Occupier	To be obtained under The Water Act 1974 & The 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 before the commencement of operation of plant
3	Building permit/building number	Concerned Urban Local Body	ULB/Contractor/ Occupier	Building number may be obtained.
4	LT power connections	Concerned State Electricity Board/Electrical Company	ULB/Contractor/ Occupier	Occupier may submit an application with necessary fees at the concerned electricity board/company along with documents as per

Sl. No.	Statutory Requirement	Regulatory Authority	Responsibilities	Remarks
				checklist including test report from competent electrical contractor, layout plan, authority letter in favor of applicant official and clear title of should be submitted prior to the commencement of operation of the plant.
5	Water Connection	Concerned State Water Supply and Sewerage Department	ULB/Contractor/ Occupier	Occupier may submit a new application for 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 Connection	Concerned State Water Supply and Sewerage Department	ULB/Contractor/ Occupier	A new application for connecting the outlet lines 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	Concerned State Fire Department	ULB/Contractor/ Occupier	NoC/Clearance from respective fire department may be obtained prior to operation of the plant

25. Siting of MRF

Accessibility, land use and geology need to be considered when siting MRFs. MRF shall be located close to the source of the MSW generation for minimization of travel distances for cost effectiveness. 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 periphery of MRF will improve aesthetics and decrease odour and noise pollution. Some of the suggestions for siting of MRF are given below.

- MRF needs to be located close to existing roads, but traffic resulting from the movement of waste collection trucks should be considered. These facilities must be near or within urban areas that generate the inputs to be processed for recyclables
- A minimum buffer zone of 100 meters is used for sensitive receptors such as schools, hospitals, parks and residential areas. If the area is zoned, MRFs are preferably located in an industrial zone or close to a sanitary landfill to facilitate efficient movement of waste from various generators and disposal of residual or biodegradable materials
- MRF should be sited in flat or gently sloping, stable areas to reduce excavation cost and avoid problems of slope stability.
- The plinth level of MRF may be kept 1.0 metre above HFL

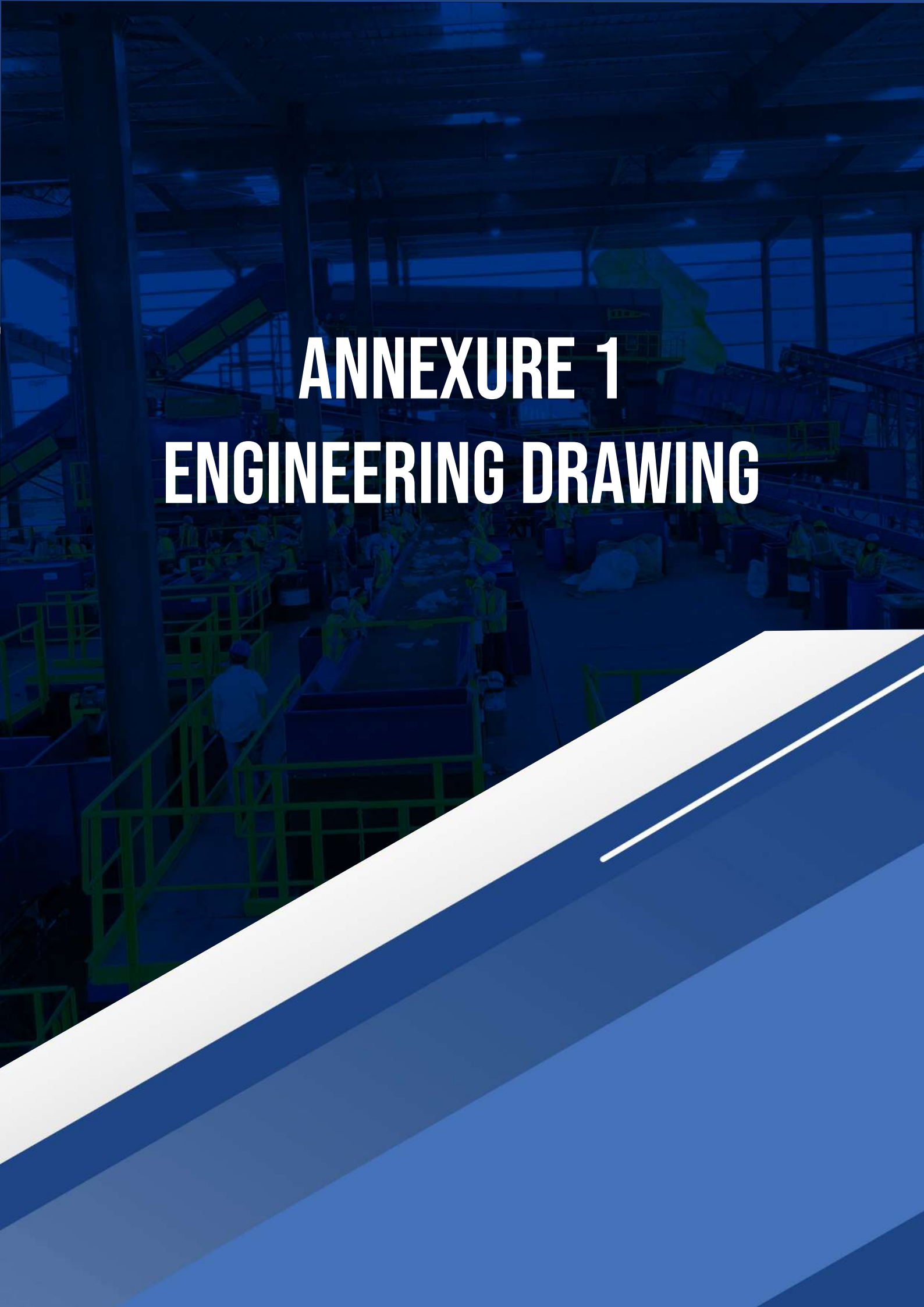
26. Lightning Protection System

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

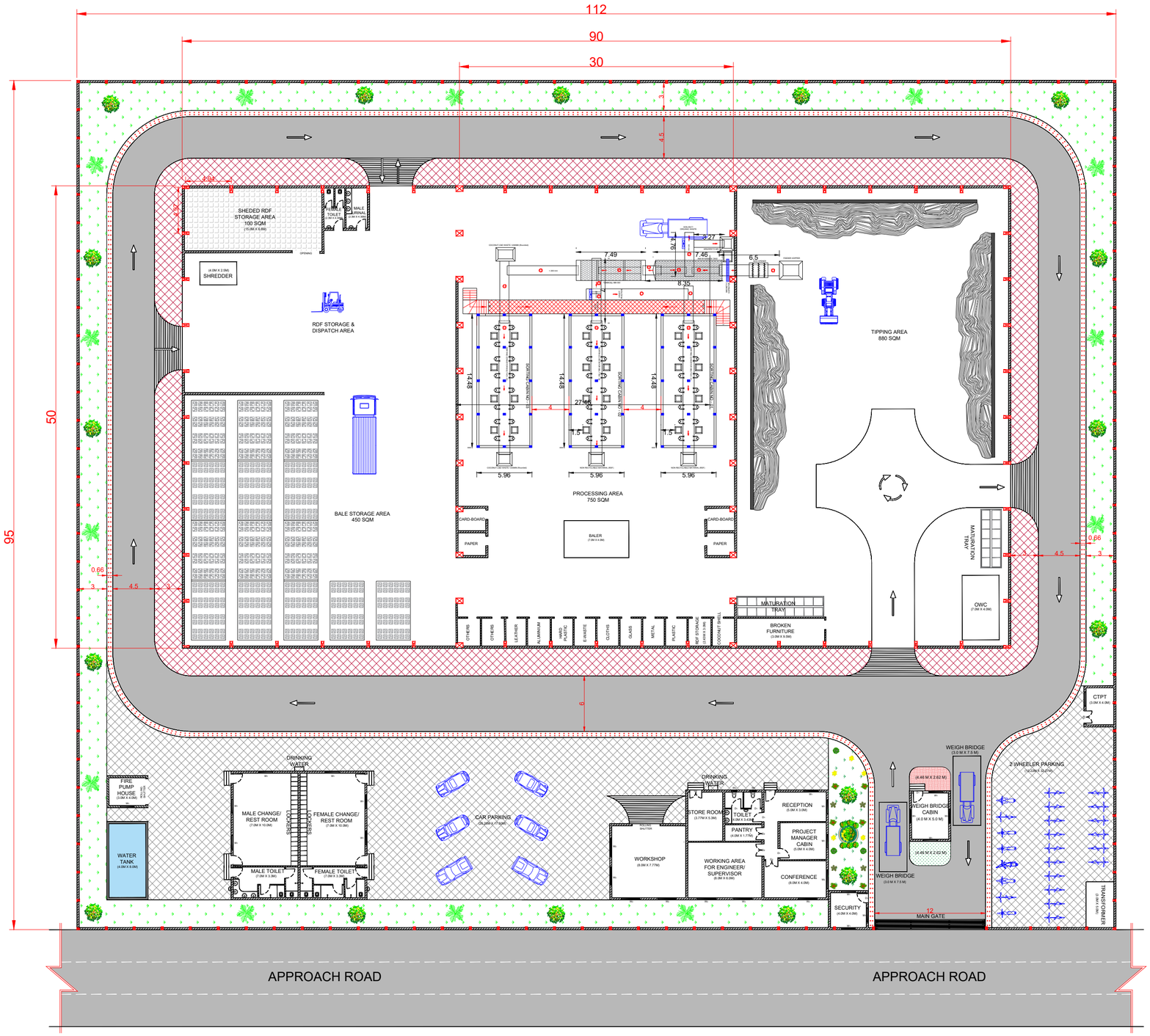
Reference

- "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)
- "Guidelines for Disposal of Plastic Waste", Central Pollution Control Board, 2017
- The Municipal Solid Waste Management Rule, 2016
- The Plastic Waste Management Rules, 2016
- National Building Code of India 2016 Volume 1 & 2
- Delhi Schedule of Rates Volume 1 & 2, 2021
- Safety colours and safety signs- Code of practice(first revision)- IS 9457: 2005

ANNEXURE



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.)
01	WEIGH BRIDGE	2
02	TROMMEL	1
03	DISC SCREEN	2
04	CONVEYOR BELTS	15
05	BALER	1
06	SHREDDER	1
07	MAGNETIC SEPRATOR	1

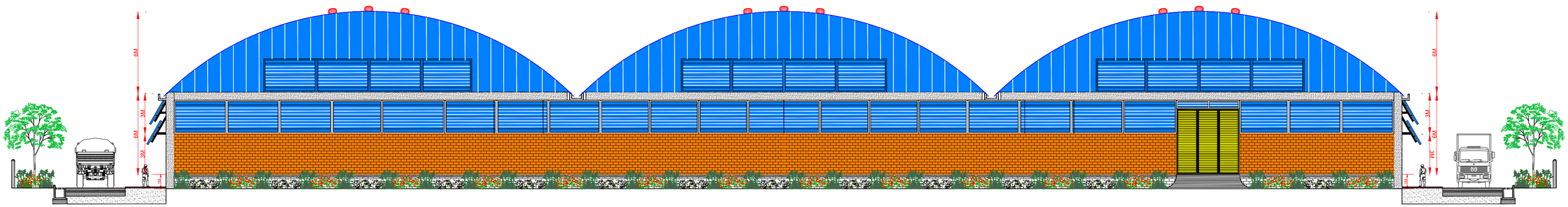
Client:
Ministry of Housing and Urban Affairs
Government of India
MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:
RITES
THE INFRASTRUCTURE PEOPLE
RITES Ltd. (A Government of India Enterprise)

Project:
MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:
TYPICAL LAYOUT FOR 100 TPD MRF PLANT

DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
DRAWN BY :	RAHUL ARYA	
CHECKED BY :	SANJAY RAUT	
REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024



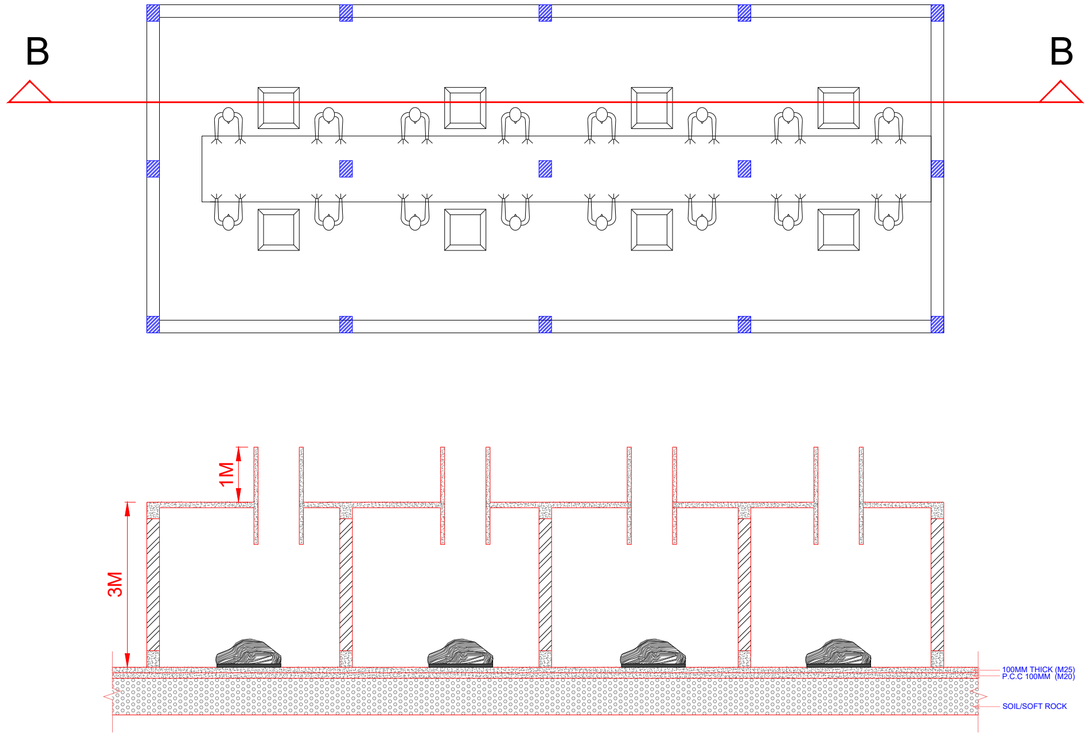
ELEVATION

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

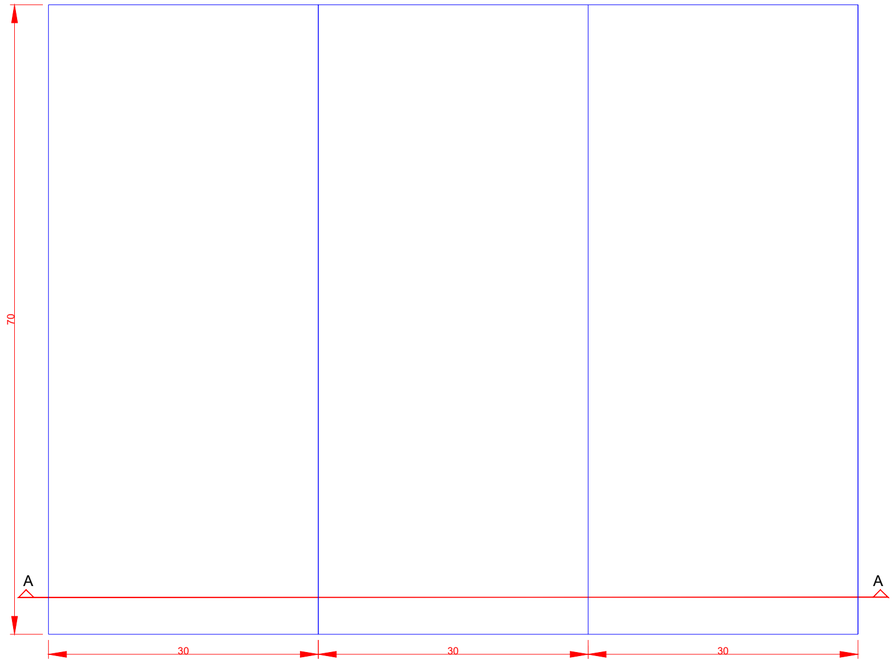
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

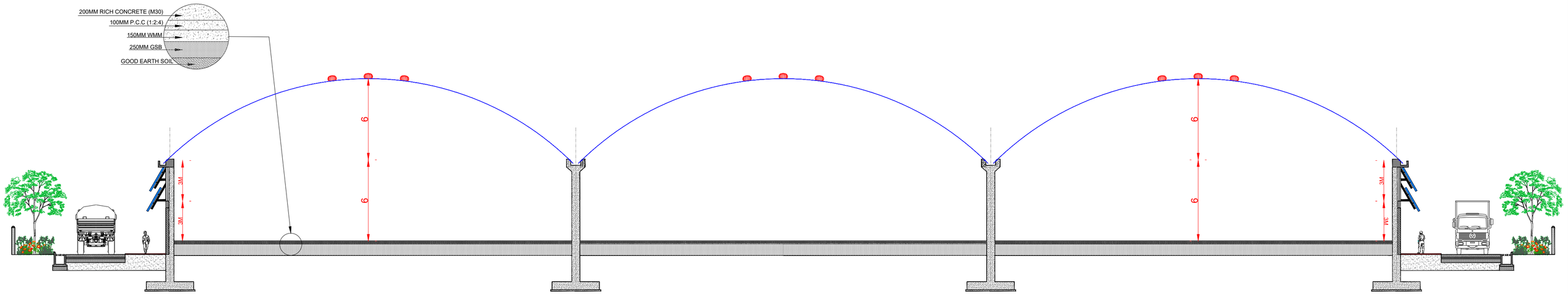
NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client: Ministry of Housing and Urban Affairs, Government of India — MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant: RITES THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 100 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 100 TPD MRF	CHECKED BY :	SANJAY RAUT
			REVIEWED BY :	CPHEEO,MoHUA
			Date :	1st Mar. 2024



SECTION B-B





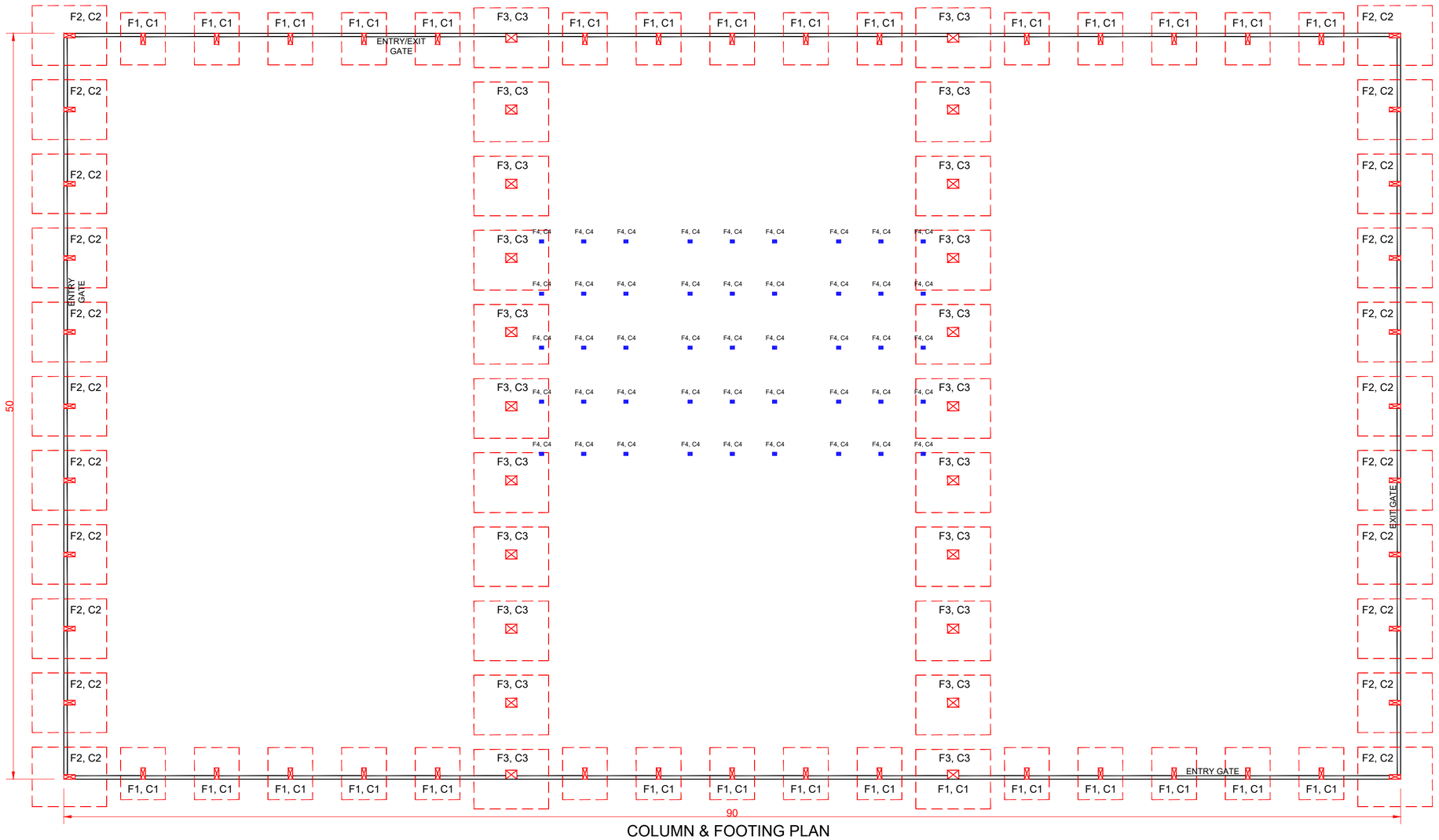
SECTION A-A

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 — THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 100 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 FOR 100 TPD MRF	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024



COLUMN & 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

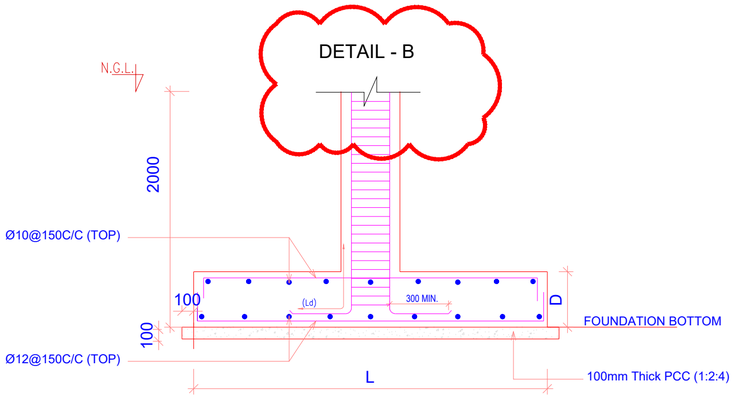
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTES:-

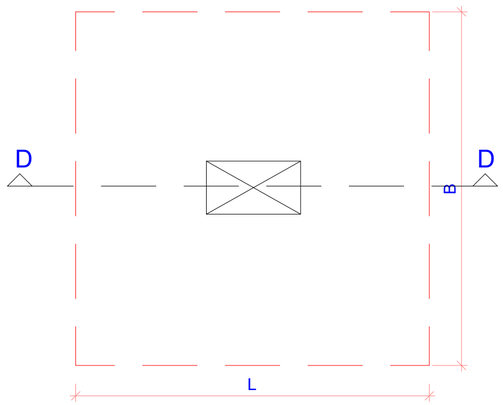
NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

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 proflex 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.

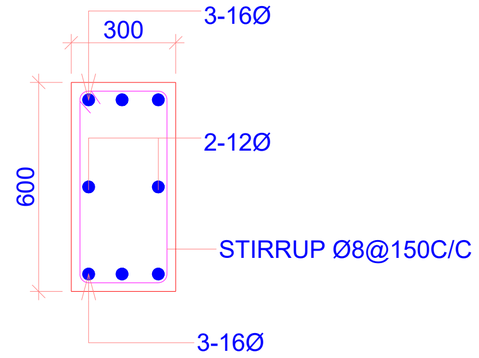
Client: Ministry of Housing and Urban Affairs, Government of India — MINISTRY OF HOUSING AND URBAN AFFAIRS	Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DRAWN BY :	RAHUL ARYA
		CHECKED BY :	CHETAN A. PATIL & ANTONY JOSE
Consultant: RITES THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	TITLE: TYPICAL FOUNDATION & REINFORCEMENT DETAILS FOR STRUCTURAL MEMBER FOR 100 TPD MRF PLANT	APPROVED BY :	SANJAY RAUT
		REVIEWED BY :	CPHEEO,MoHUA
		Date :	1st Mar. 2024



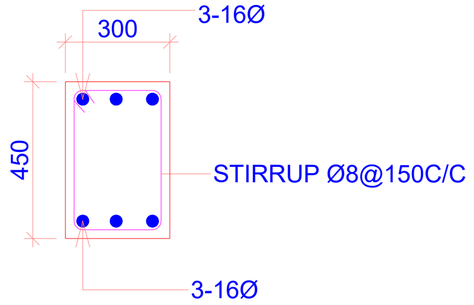
SECTION D-D



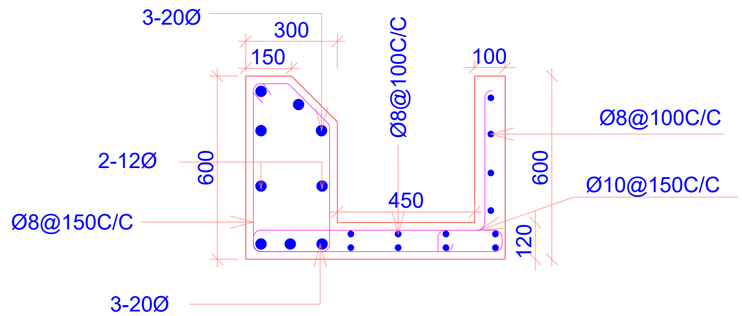
DETAIL - A



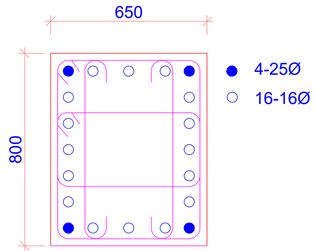
PLINTH BEAM REINFORCEMENT



MIDDLE BEAM REINFORCEMENT



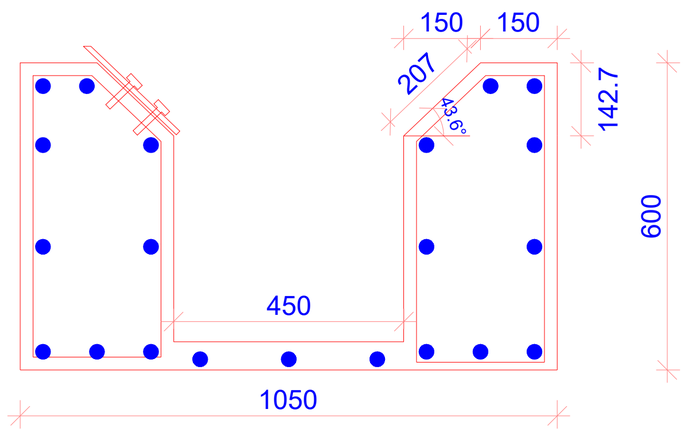
TERRACE BEAM+GUTTER REINFORCEMENT



ALL STIRRUP Ø8@150C/C

COLUMN REINFORCEMENT

DETAIL - B



STRUCTURAL MEMBER	DIMENSIONS (m)			NO.
	L	B	D	
FOUNDATION -1 (F1)	3	2.5	0.6	30
FOUNDATION -2 (F2)	3	4	0.6	30
FOUNDATION -3 (F3)	3.5	4	0.6	30

STRUCTURAL MEMBER	DIMENSIONS (m)		NO.
	L	B	
COLUMN -1 (C1)	0.45	0.8	30
COLUMN -2 (C2)	0.45	0.8	30
COLUMN -3 (C3)	0.65	0.8	30

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

NOTES:-

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 proflex 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)

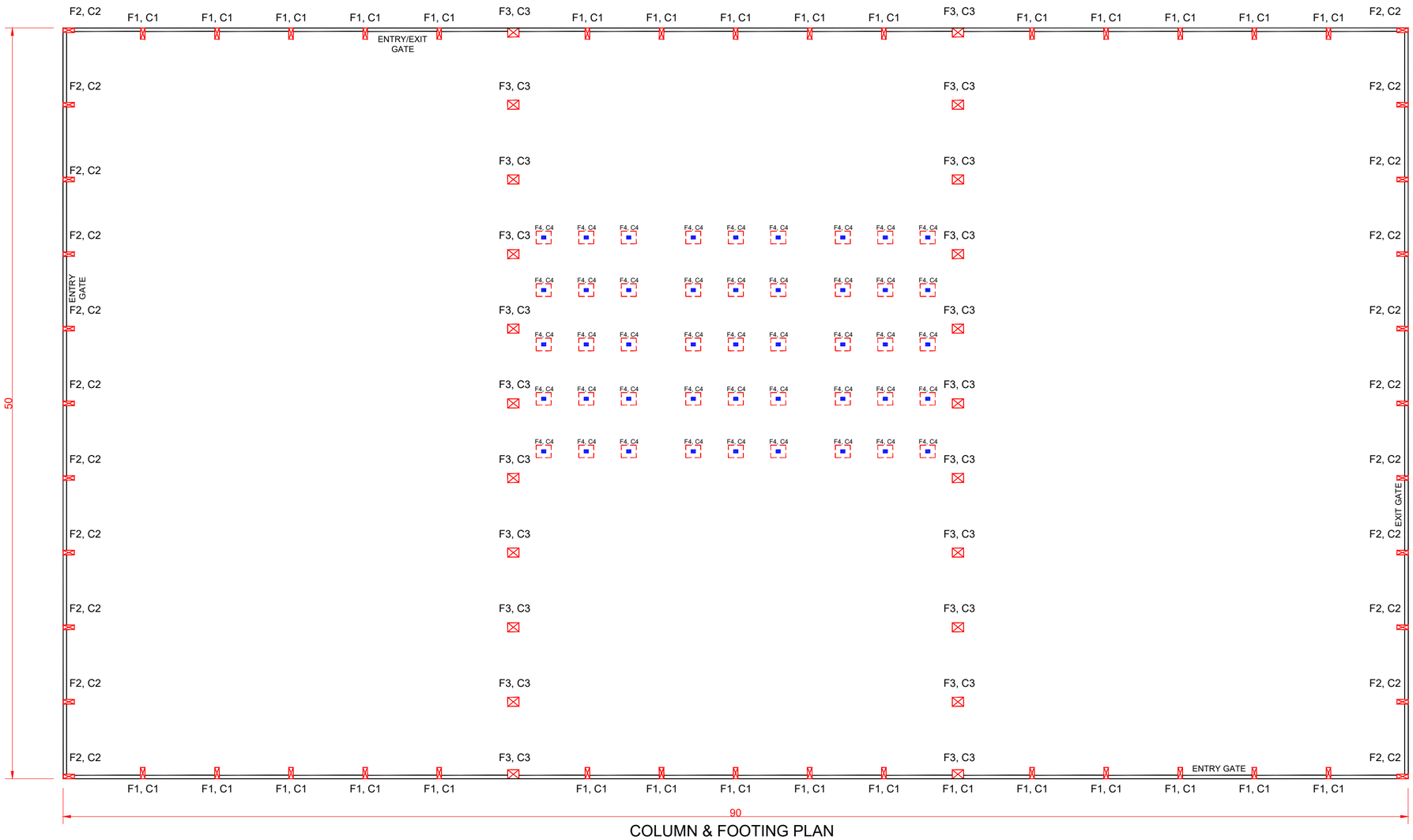
Project:

MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

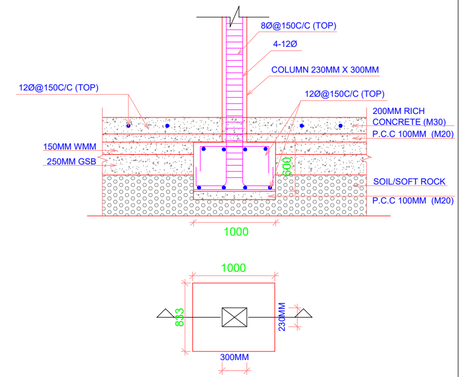
TITLE:

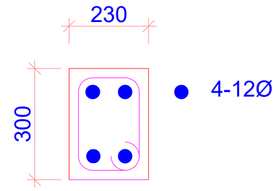
TYPICAL FOUNDATION & REINFORCEMENT DETAILS FOR STRUCTURAL MEMBER FOR 100 TPD MRF PLANT

DRAWN BY :	**RAHUL ARYA**	
CHECKED BY :	**CHETAN A. PATIL & ANTONY JOSE**	
APPROVED BY :	**SANJAY RAUT**	
REVIEWED BY :	**CPHEEO,MoHUA**	**Date : 01st Mar. 2024**



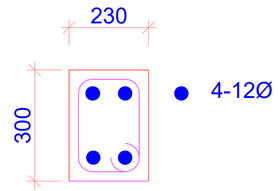
COLUMN & FOOTING PLAN





ALL STIRRUP Ø8@150C/C

COLUMN REINFORCEMENT



ALL STIRRUP Ø8@150C/C

BEAM REINFORCEMENT

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

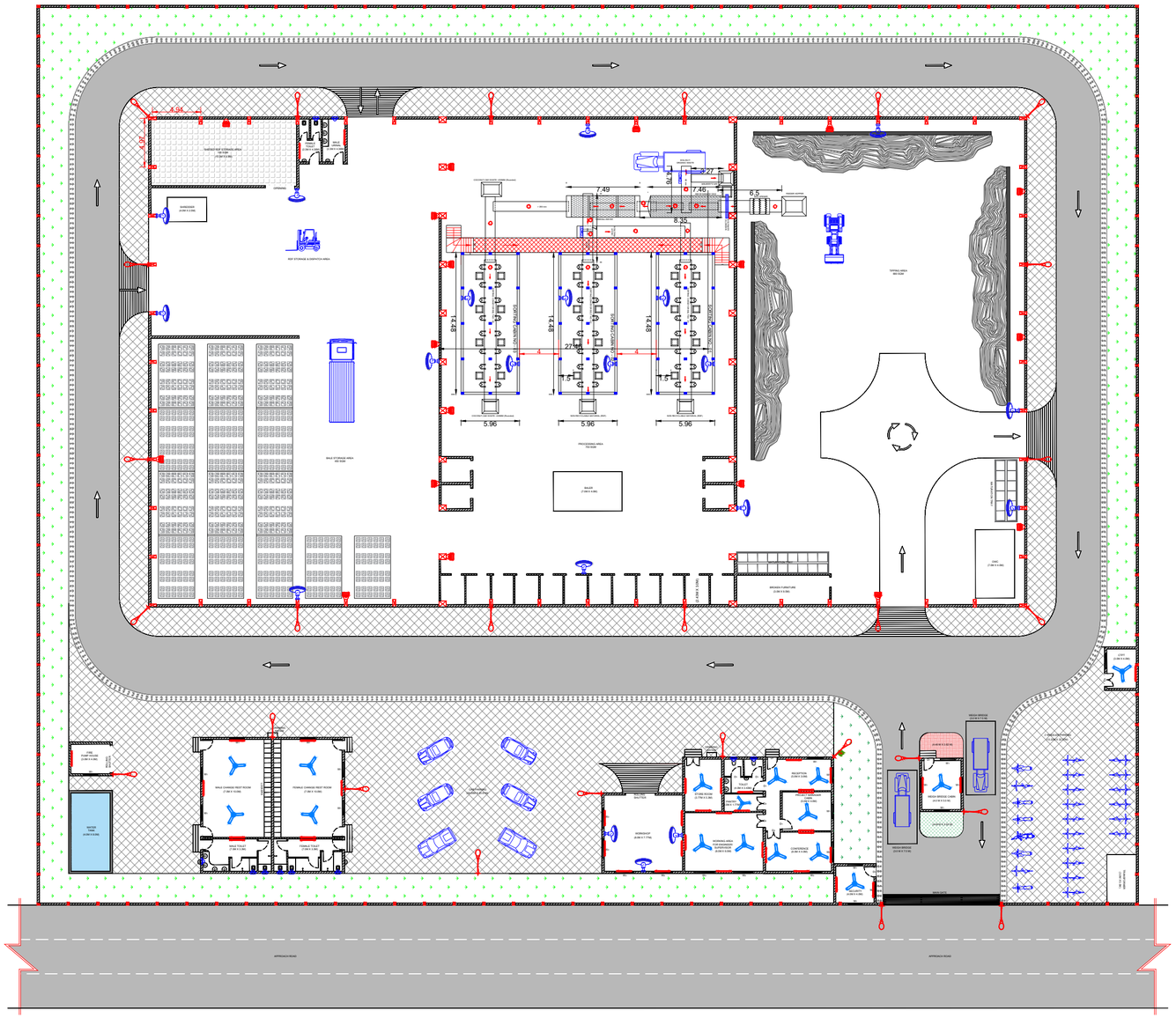
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

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 proflex 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	Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DRAWN BY :	RAHUL ARYA	
		CHECKED BY :	CHETAN A. PATIL & ANTONY JOSE	
Consultant: RITES Ltd. (A Government of India Enterprise)	TITLE: TYPICAL FOUNDATION & REINFORCEMENT DETAILS FOR STRUCTURAL MEMBER FOR 100 TPD MRF PLANT	APPROVED BY :	SANJAY RAUT	
		REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 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

SR. NO.	ITEMS	QUANTITY(NO.)	SYMBOL
01	STREET LIGHT (250W)	27	
02	LED LIGHT (100W)	18	
03	LED TUBE (24W)	40	
04	WALL MOUNTED FAN (180W)	20	
05	CELLING FAN (75W)	16	
06	TOILET EXHAUST FAN (60W)	10	

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)

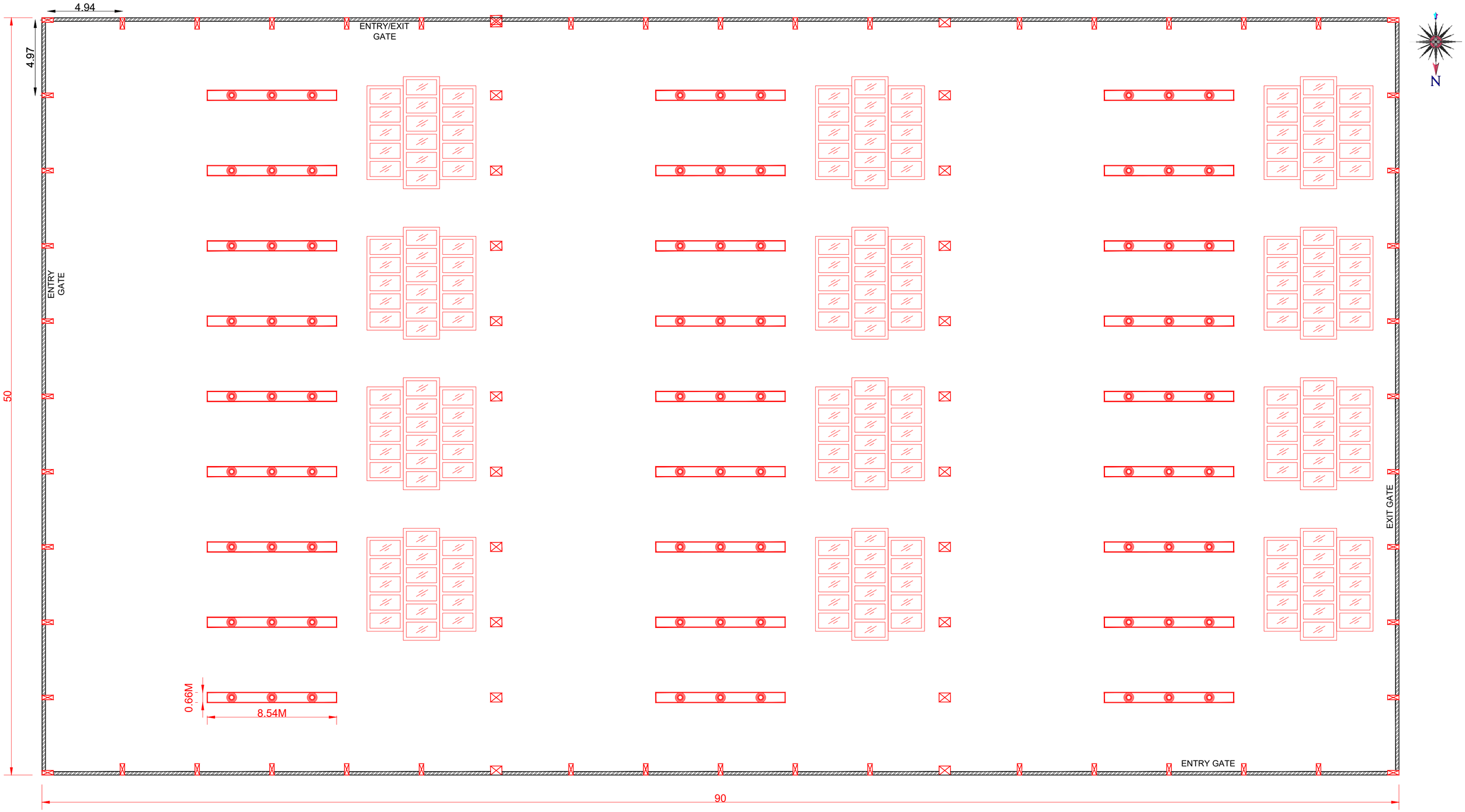
Project:

MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

TYPICAL ELECTRICAL LAYOUT FOR 100 TPD MRF PLANT

DESIGNED BY :	**CHETAN A. PATIL & DHARMBER PRAJAPAT**	
DRAWN BY :	**RAHUL ARYA**	
CHECKED BY :	**SANJAY RAUT**	
REVIEWED BY :	**CPHEEO,MoHUA**	**Date : 1st Mar. 2024**



DISCLAIMER I : 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

DISCLAIMER II : DRAWINGS FOR THE INSTALLATION OF SOLAR PANELS NEED TO BE CHECKED AND APPROVED BY CONCERNED EXPERTS BEFORE INDIVIDUAL PROJECT TO GET THE ACTUAL NUMBER OF PANELS AS PER THE AVAILABILITY OF SUNLIGHT IN THAT AREA

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
01	COLUMN (HT - 6M) DIMENSION : 300 X 750 MM, 600 x 750 MM	
02	BRICK WORK (230 MM THICK) 3M HT	
03	SOLAR PANEL (16 x 18 = 288 Nos.)	
04	SKYLIGHT SHEET WITH ROOF EXHAUST FAN (8.54 X 0.66M)	

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)

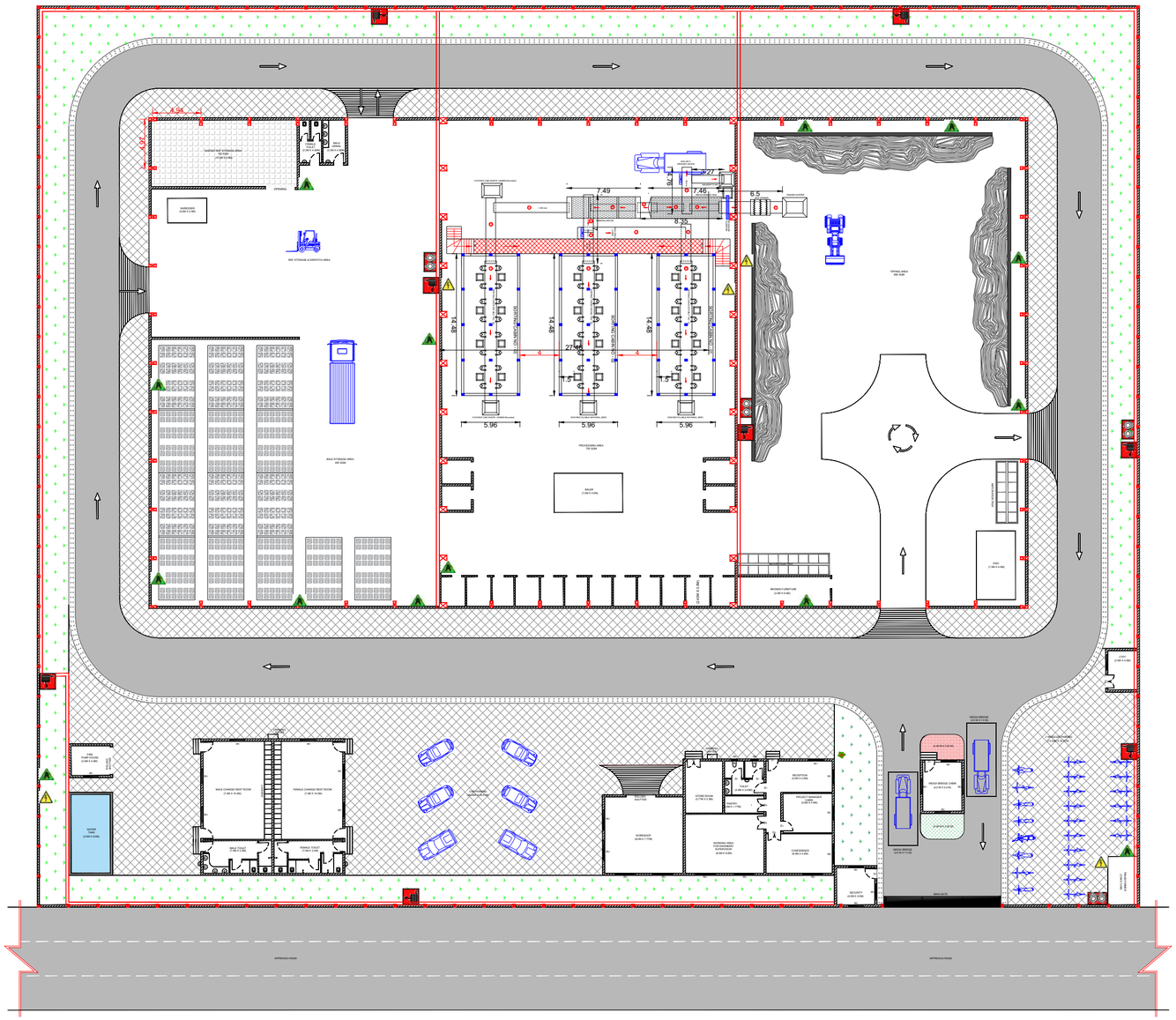
Project:

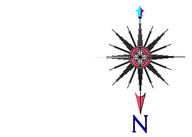
MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

TYPICAL LAYOUT OF SOLAR PANEL, SKYLIGHT ROOF & VENTILATORS EXHAUST FAN

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





FIRE BUCKETS

CO-2 TYPES

ABC FIRE EXTINGUISHER

FIRE FIGHTING HYDRANT BOX

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	QUANTITY(NO.)	SYMBOL
01	ABC FIRE EXTINGUISHER	16	
02	CO-2 TYPES	05	
03	FIRE FIGHTING BOXES	08	
04	FIRE SAND BUCKETS	04	

Client: Ministry of Housing and Urban Affairs, Government of India

MINISTRY OF HOUSING AND URBAN AFFAIRS

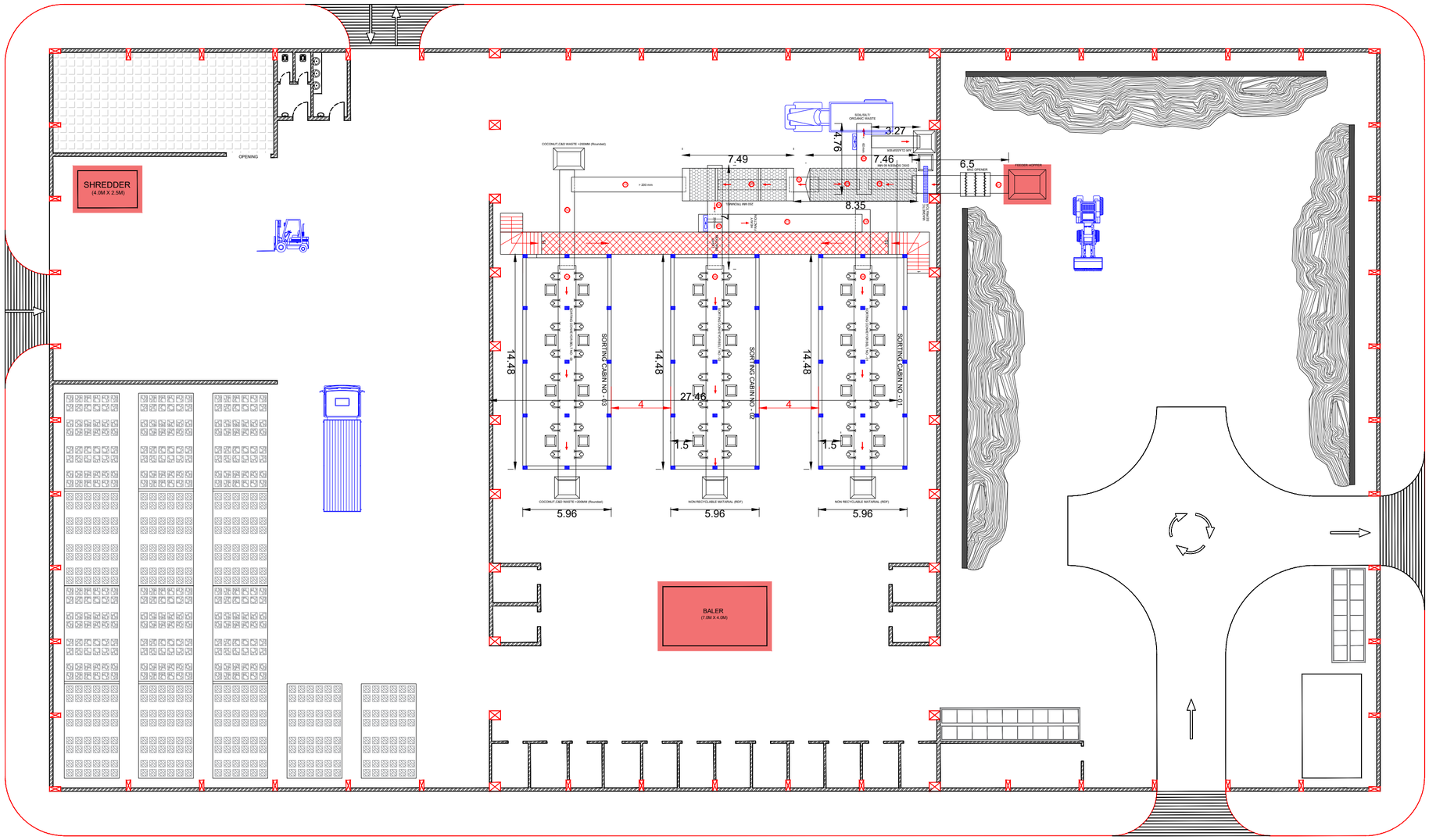
Consultant: RITES THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

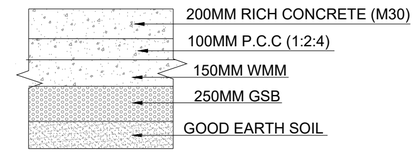
Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

TITLE: TYPICAL FIRE FIGHTING LAYOUT FOR 100 TPD MRF PLANT

DESIGNED BY :	**CHETAN A. PATIL & DHARMBER PRAJAPAT**	
DRAWN BY :	**RAHUL ARYA**	
CHECKED BY :	**SANJAY RAUT**	
REVIEWED BY :	**CPHEEO,MoHUA**	**Date : 1st Mar. 2024**



MACHINE FOOTING BASE



MACHINE FOOTING SECTION

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
सत्यमेव जयते

MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:

RITES
THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

Project:

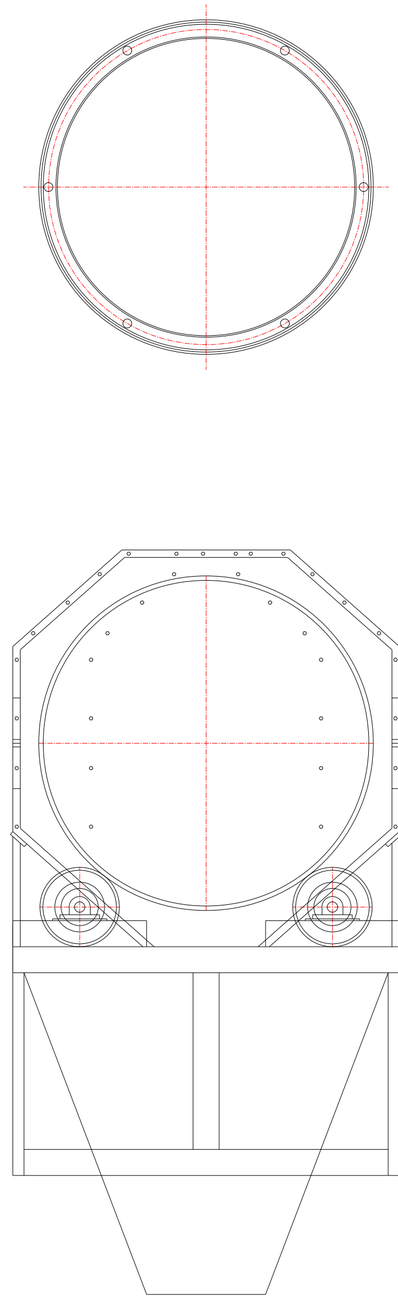
MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

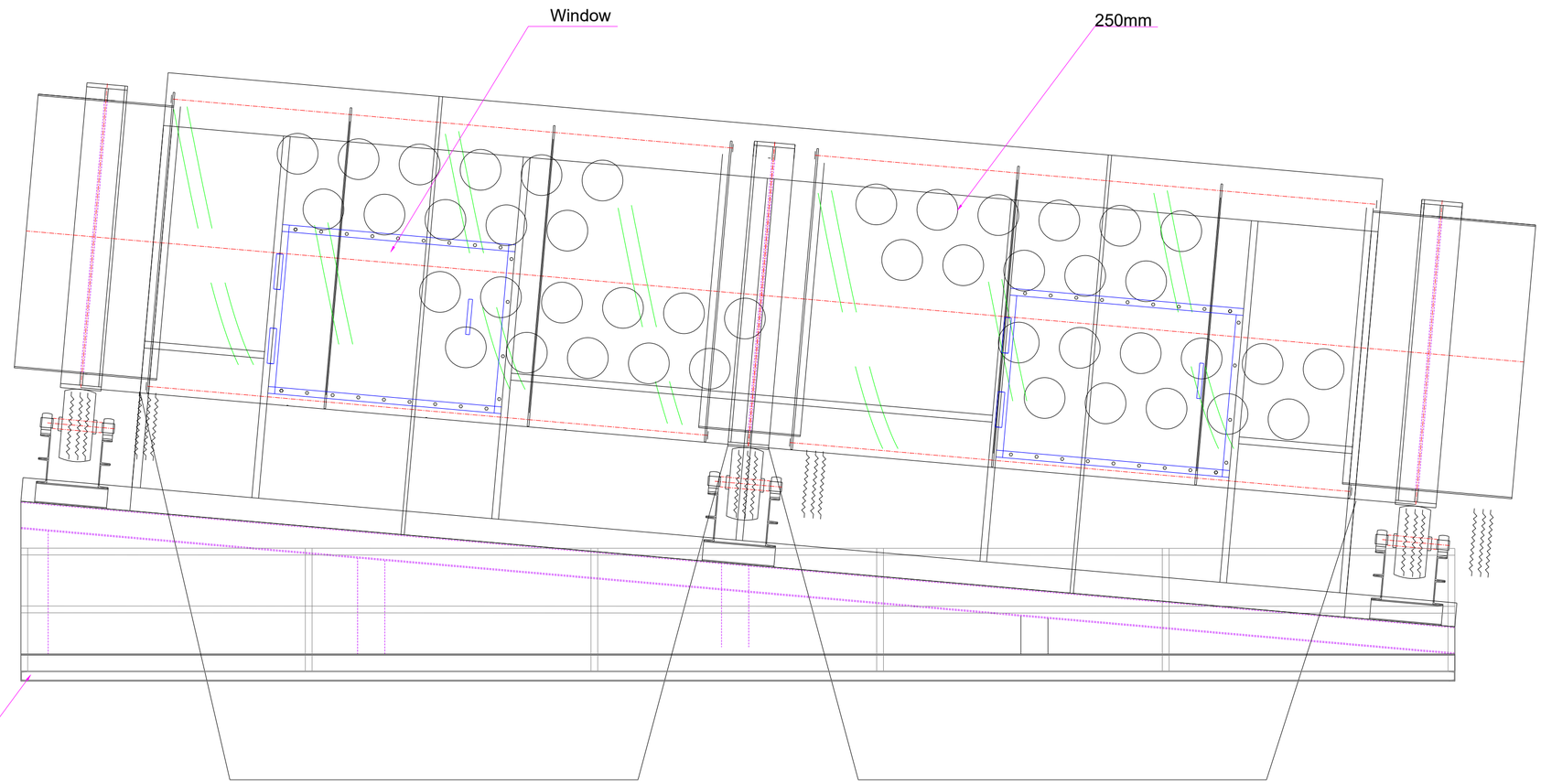
TITLE:

TYPICAL MACHINE FOOTING PLAN

DESIGNED BY :	**CHETAN A. PATIL & DR. ANAND SONAWANE**	
DRAWN BY :	**RAHUL ARYA**	
CHECKED BY :	**SANJAY RAUT**	
REVIEWED BY :	**CPHEEO,MoHUA**	**Date : 1st Mar. 2024**

S.NO.	EQUIPMENTS	QUANTITY (NO.)	DIMENSIONS(M)
1	TROMMEL	1	1.0 X 8.0





FRONT ELEVATION

SIDE ELEVATION

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
सत्यमेव जयते

MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:

RITES
THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

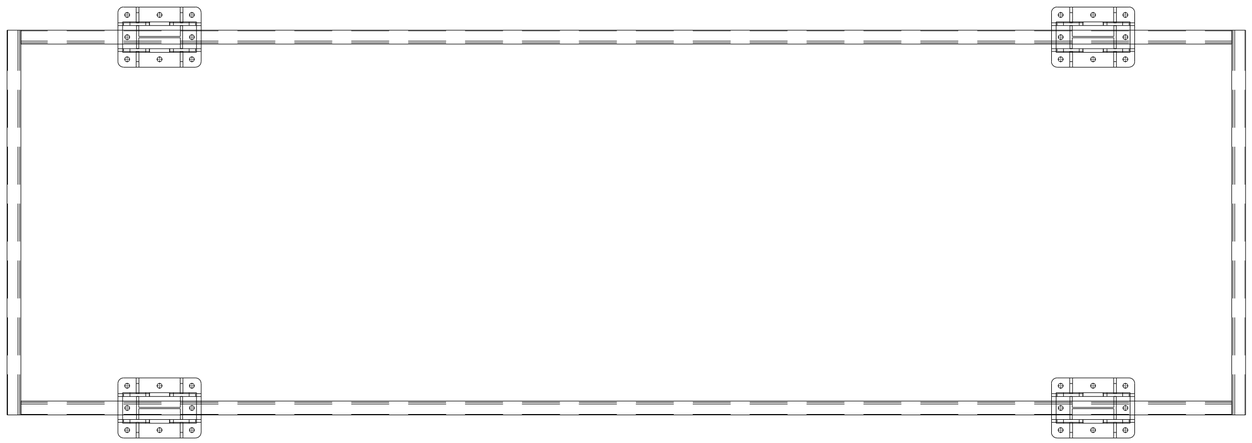
Project:

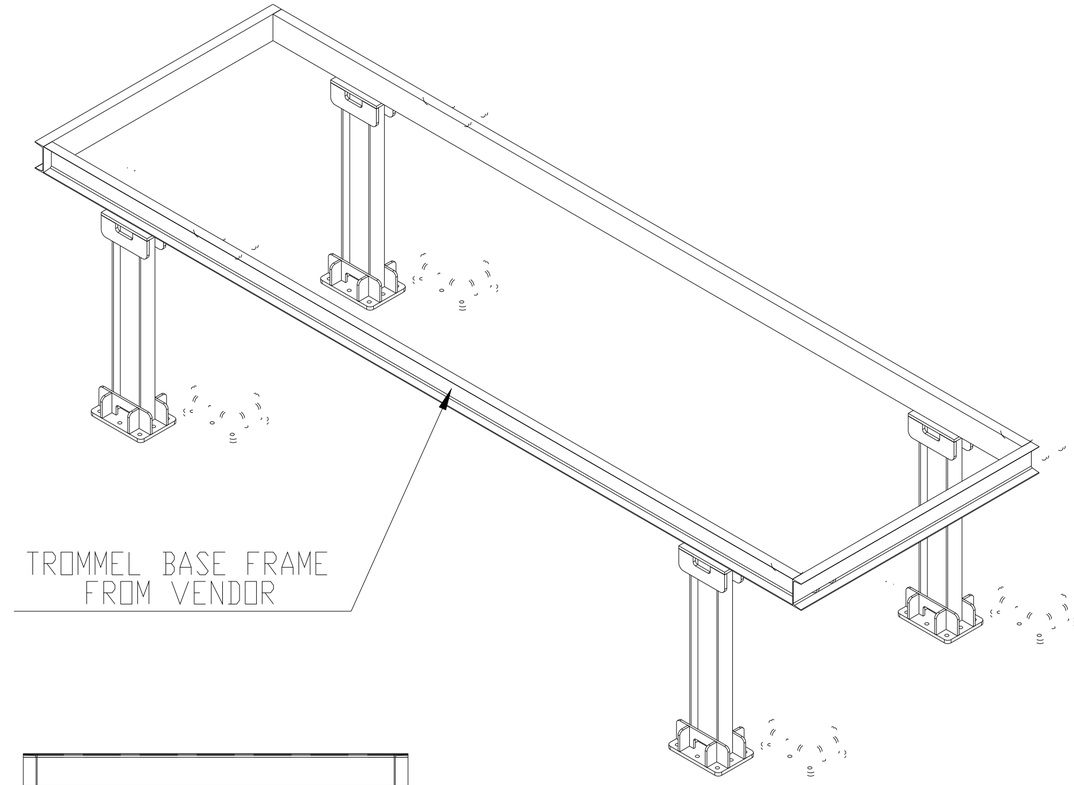
MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

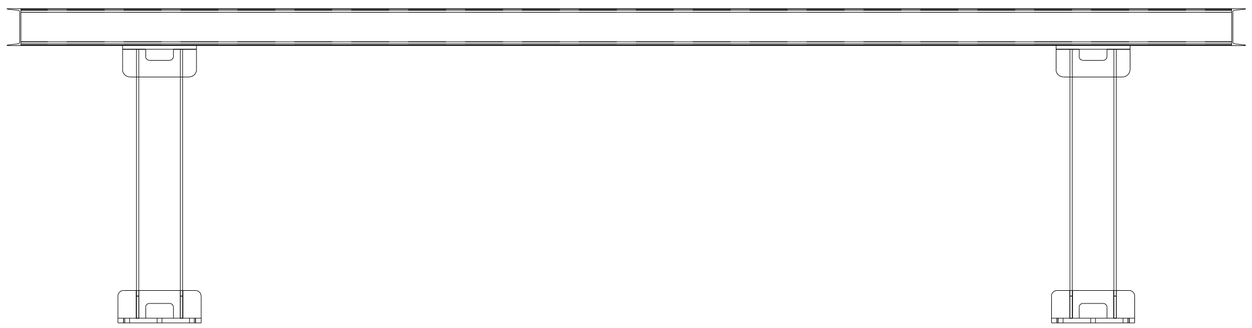
TITLE:

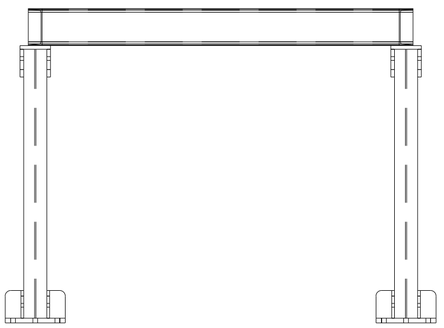
TYPICAL TROMMEL DETAILS

DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
DRAWN BY :	RAHUL ARYA	
CHECKED BY :	SANJAY RAUT	
REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024







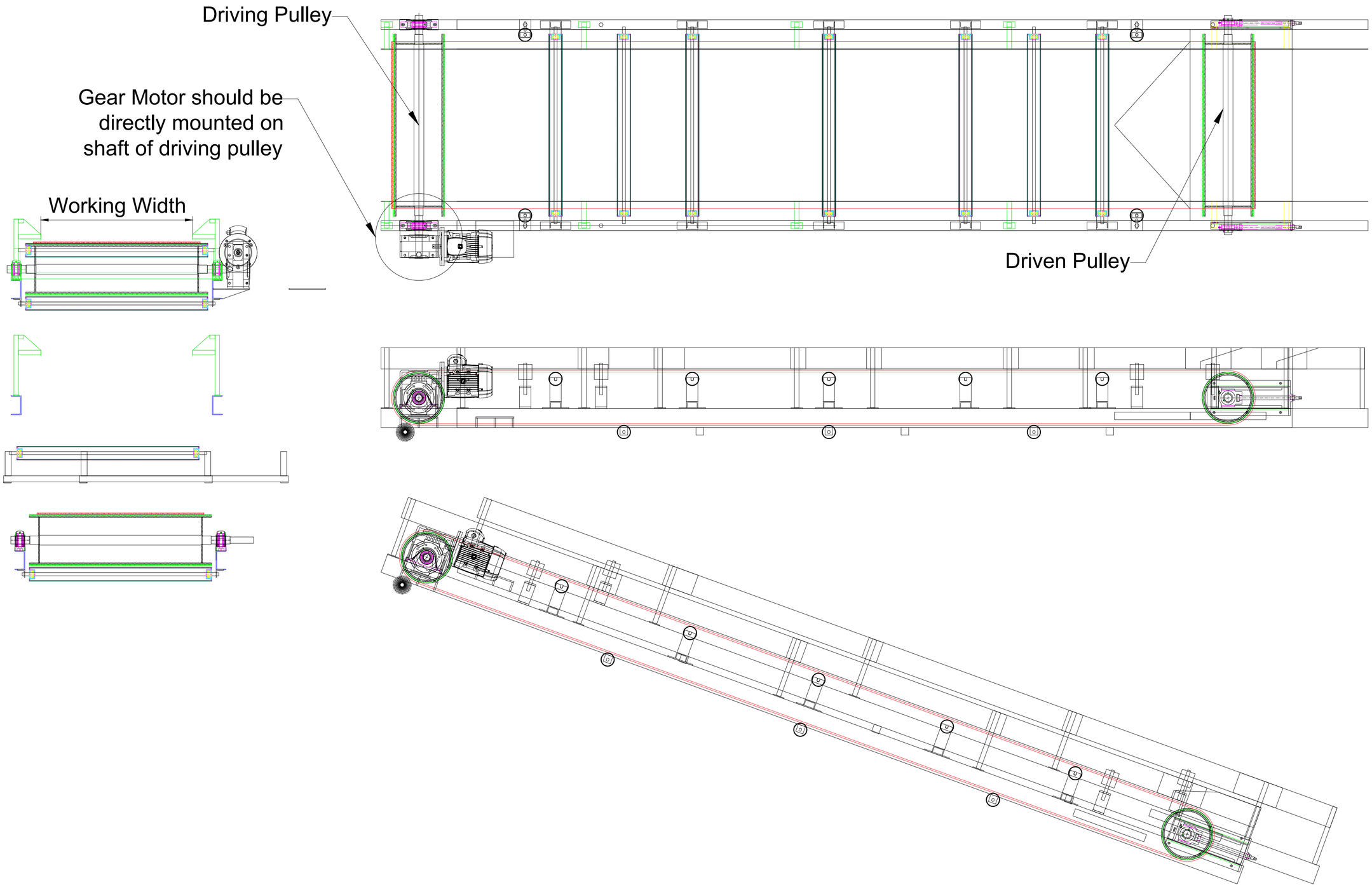


DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

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 — THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	**DESIGNED BY :** CHETAN A. PATIL & DR. ANAND SONAWANE
			DRAWN BY : RAHUL ARYA
		TITLE: TYPICAL TROMMEL FOOT DETAILS	**CHECKED BY :** SANJAY RAUT
			REVIEWED BY : CPHEEO,MoHUA — **Date :** 1st Mar. 2024

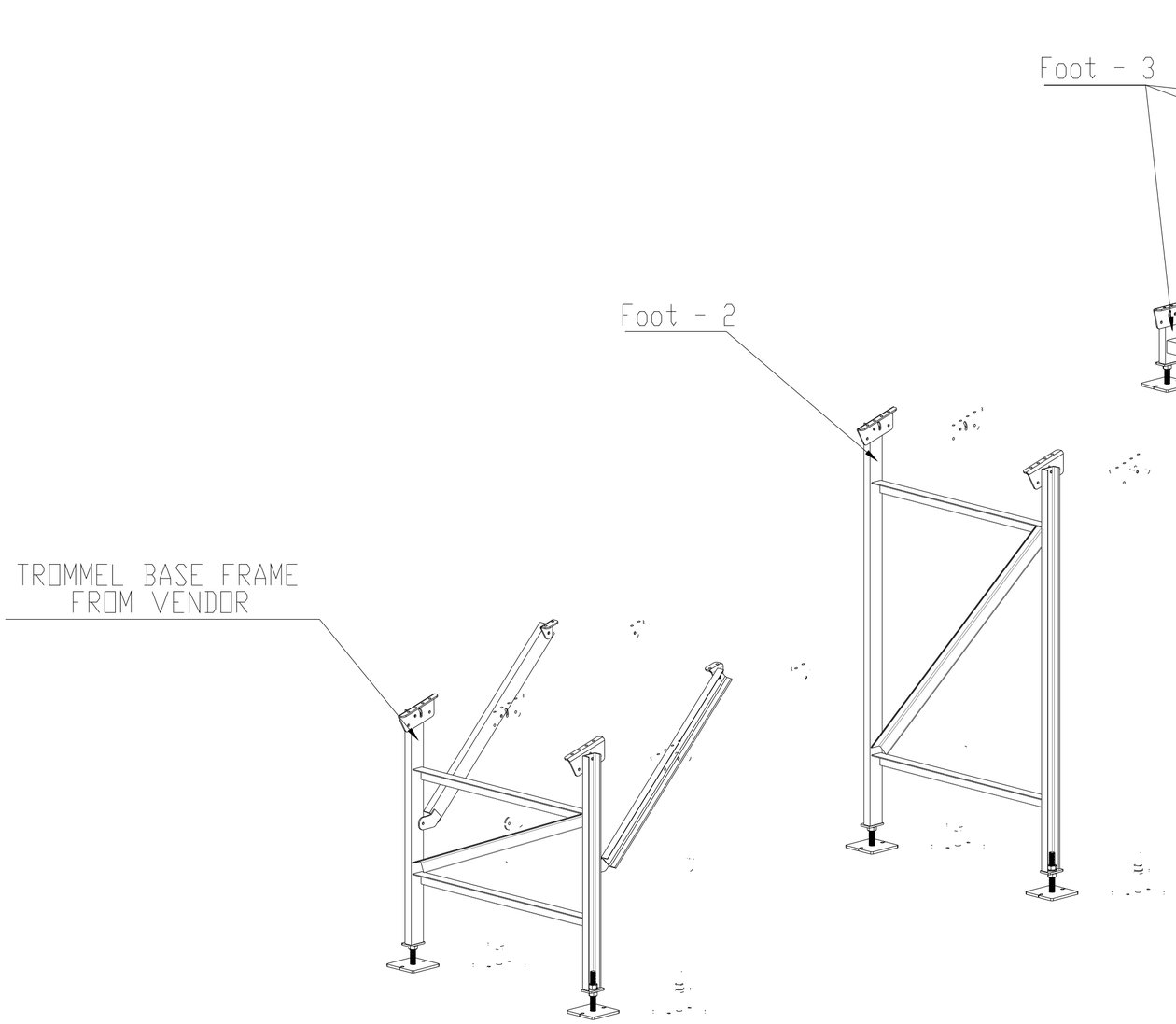


DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

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 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
			DRAWN BY :	RAHUL ARYA	
		TITLE: TYPICAL PLAN & SECTION CONVEYOR BELT FOR 100 TPD MRF	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024

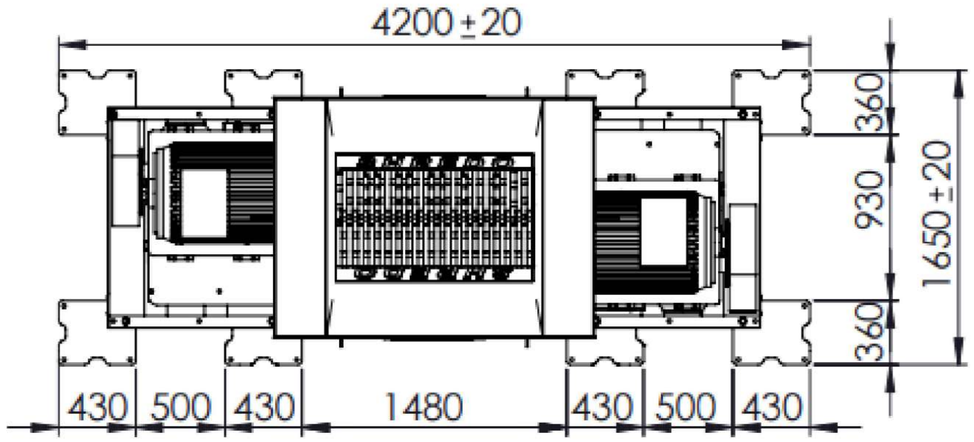


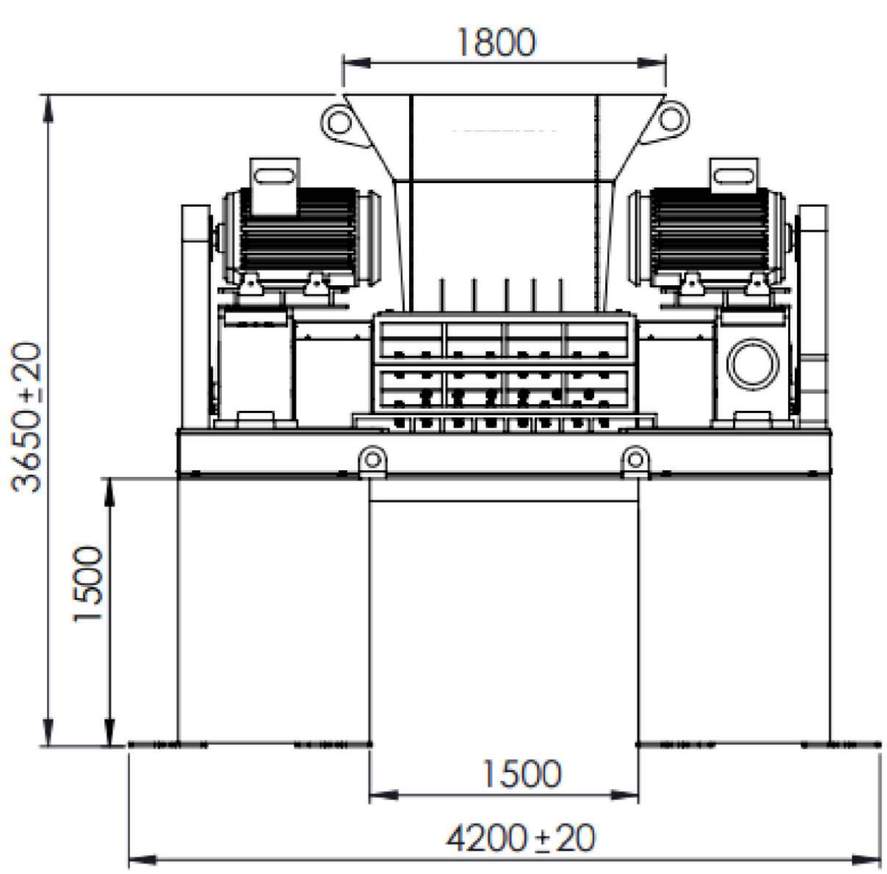
DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

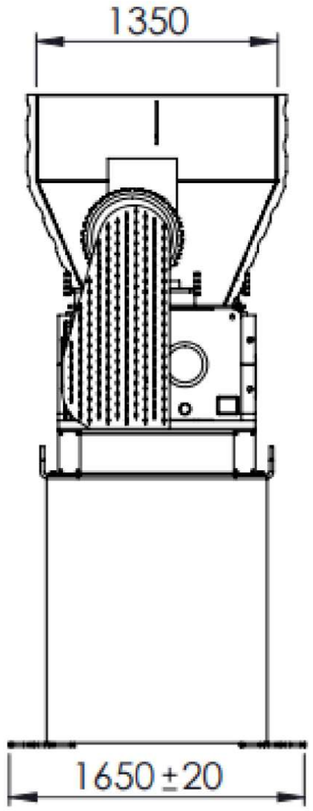
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

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 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
			DRAWN BY :	RAHUL ARYA	
		TITLE: TYPICAL CONVEYOR FOOT DETAILS	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024







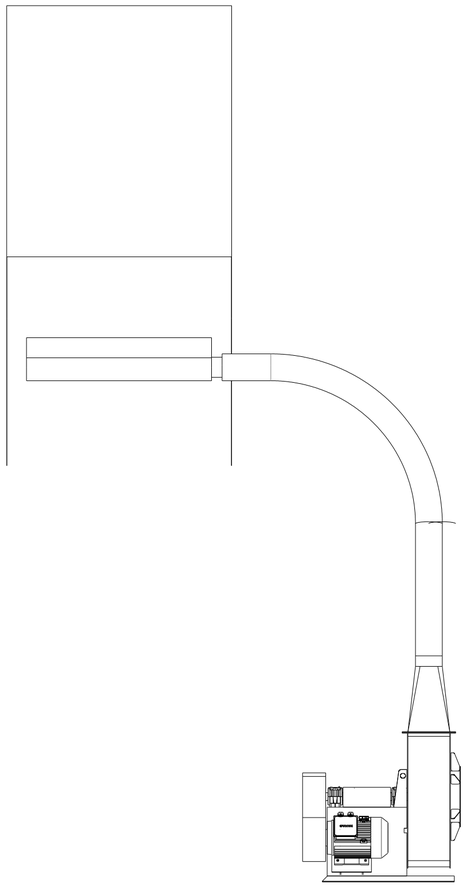
Note:-
1. All dimensions are in mm.

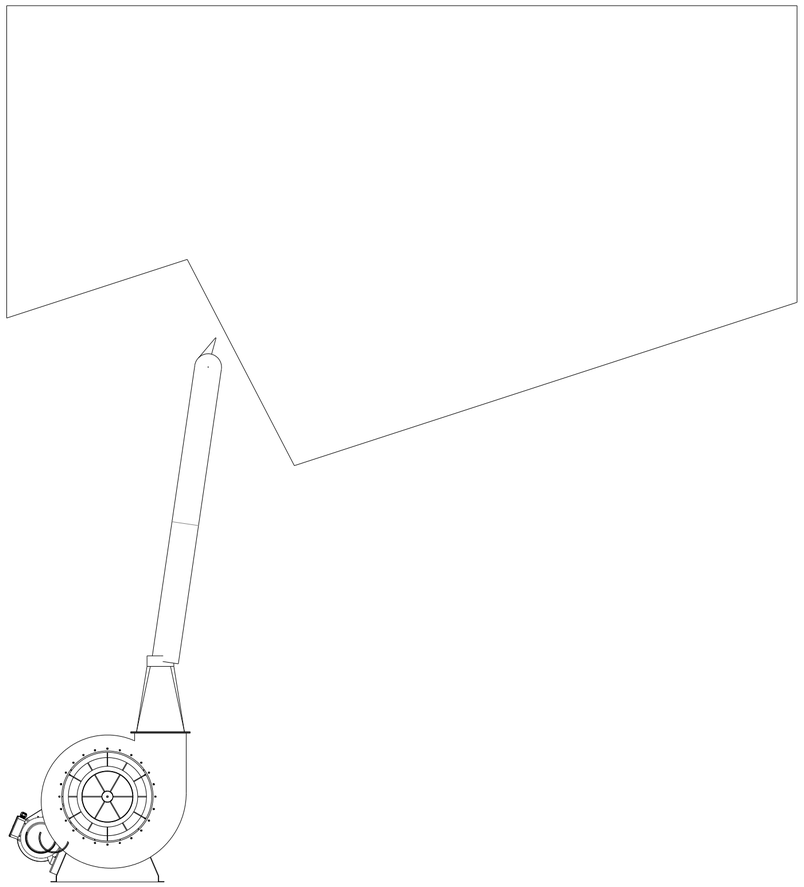
DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

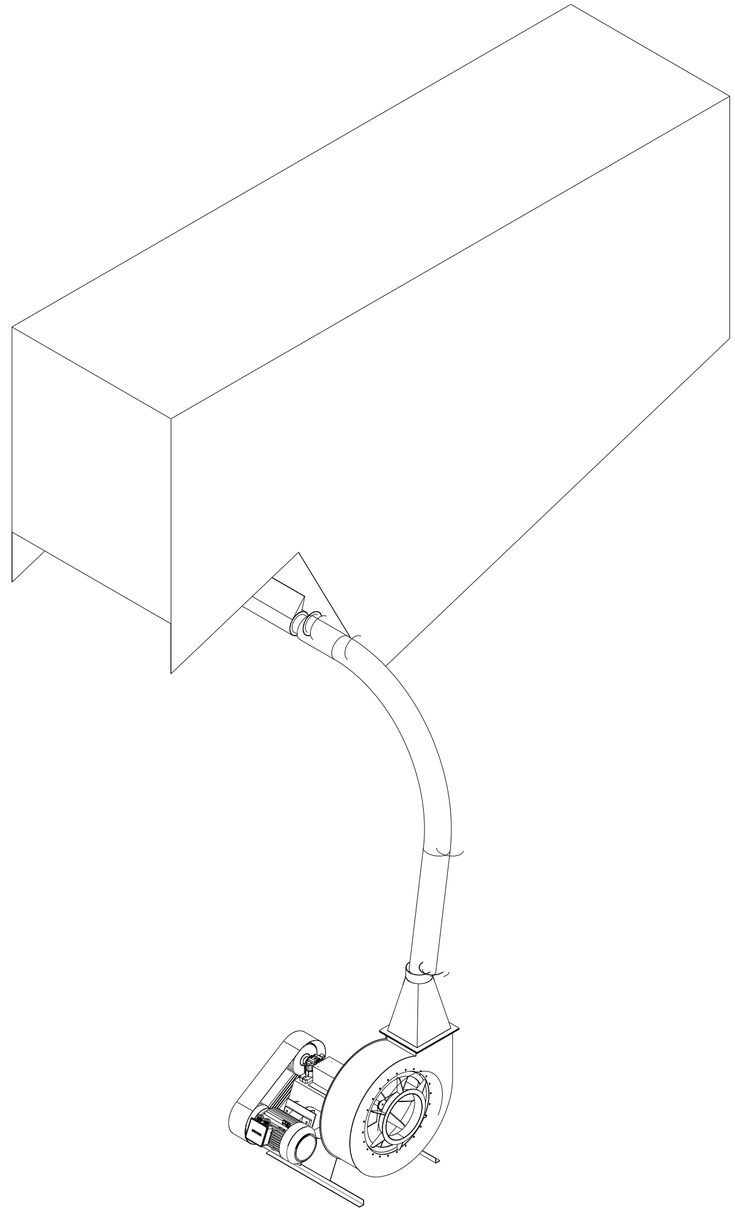
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

Client:	Consultant:	Project:			
Ministry of Housing and Urban Affairs, Government of India MINISTRY OF HOUSING AND URBAN AFFAIRS	RITES THE INFRASTRUCTURE PEOPLE RITES Ltd. (A Government of India Enterprise)	MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
			DRAWN BY :	RAHUL ARYA	
		TITLE: TYPICAL SHREDDER DETAILS	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024





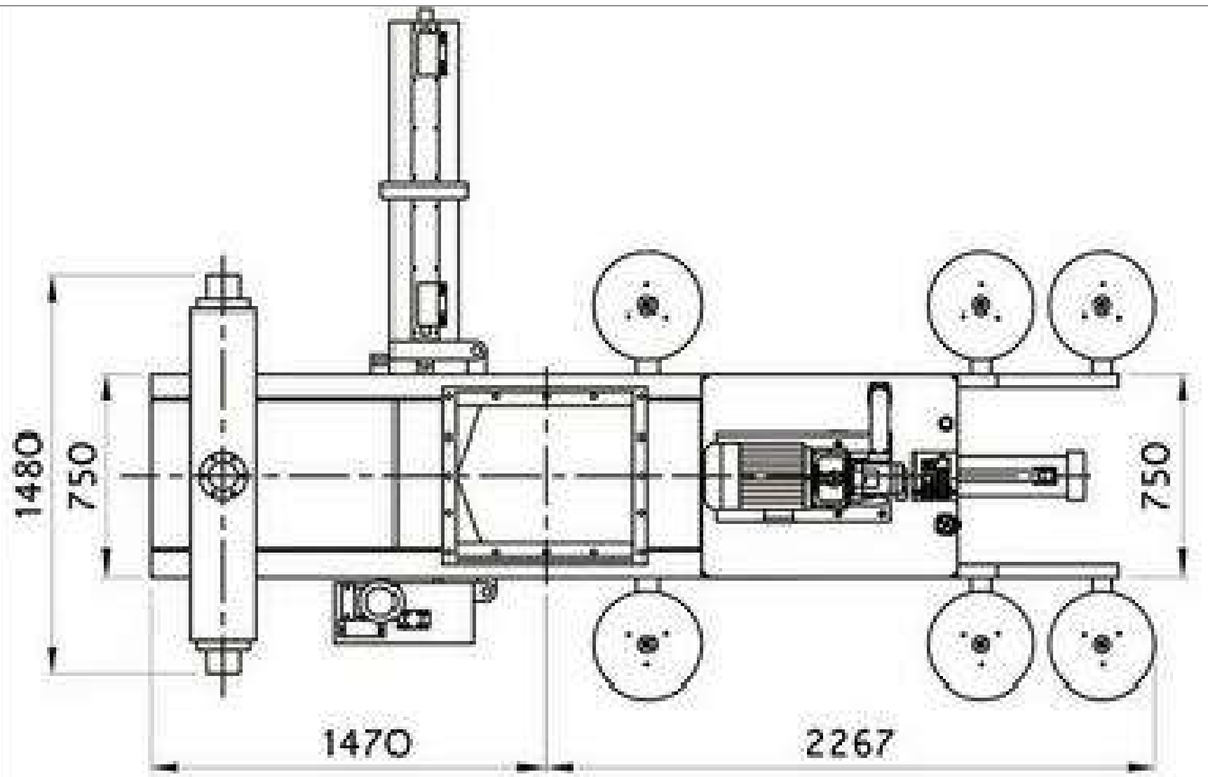


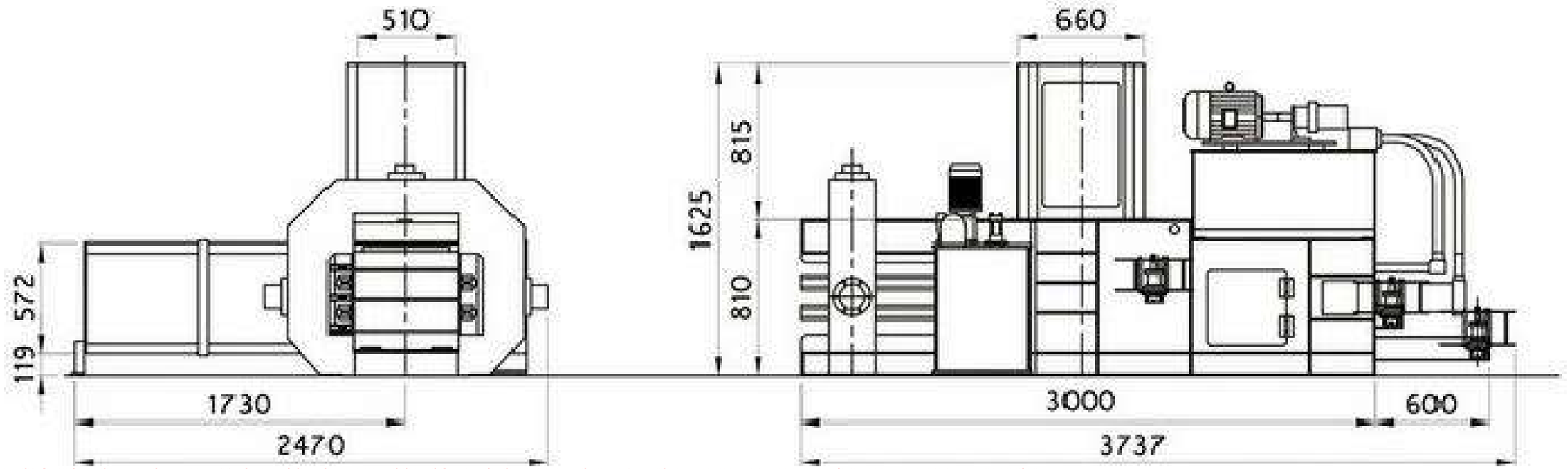
DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

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 — THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
			DRAWN BY :	RAHUL ARYA	
		TITLE: TYPICAL AIR CLASSIFIER DETAILS	CHECKED BY :	SANJAY RAUT	
			REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024



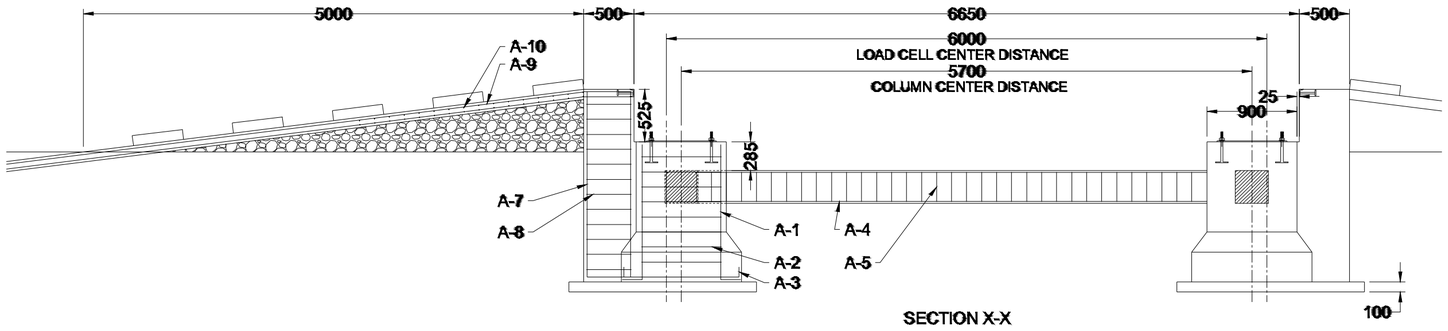


DISCLAIMER : MODIFICATIONS BASED ON THE SUITABILITY AS PER SOIL, SITE AND LOCAL CONDITIONS, MAY BE DONE BY ULB'S AT THEIR LEVEL WITH PROPER DEPARTMENTAL APPROVAL

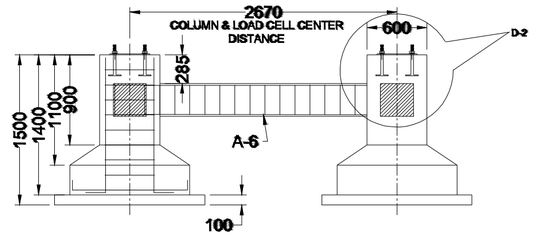
NOTE : IT MUST BE VETTED FOR INDIVIDUAL PROJECT BY THE COMPETENT ENGINEER/AUTHORITIES OF THE ULB'S/DEPARTMENT CONCERNED

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

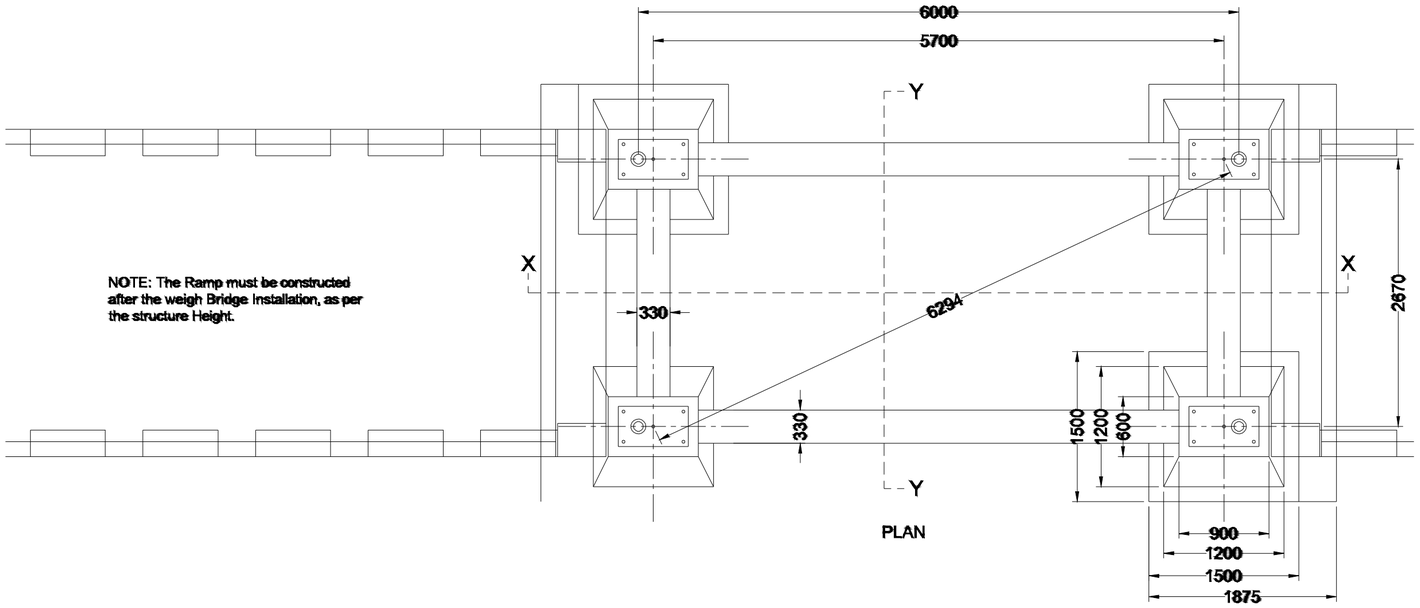
Client: Ministry of Housing and Urban Affairs, Government of India — MINISTRY OF HOUSING AND URBAN AFFAIRS	Consultant: RITES — THE INFRASTRUCTURE PEOPLE — RITES Ltd. (A Government of India Enterprise)	Project: MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0	DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE
			DRAWN BY :	RAHUL ARYA
		TITLE: TYPICAL BALER DETAILS	CHECKED BY :	SANJAY RAUT
			REVIEWED BY :	CPHEEO,MoHUA — Date : 1st Mar. 2024



SECTION X-X

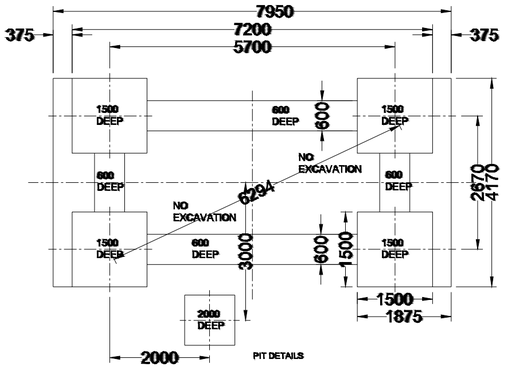


SECTION Y-Y

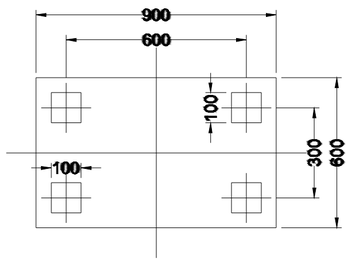


PLAN

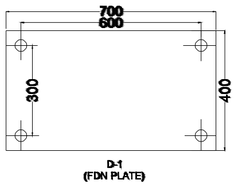
NOTE: The Ramp must be constructed after the weigh Bridge Installation, as per the structure Height.



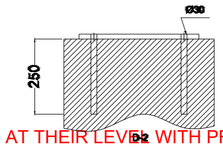
PIT DETAILS



DETAIL (D - 1)



D-1
(FDN PLATE)



D-2

A. REFERENCE STANDARDS :-

1.	CONCRETE AND ITS CONSTRUCTION	IS : 546
2.	CEMENT	IS : 269
3.	AGREGATES	IS : 383
4.	REINFORCEMENT BARS	IS : 1786
5.	ASSEMBLY OF REINFORCEMENT BARS	IS : 2502
6.	SKIRTING ANGLES	IS : 808
7.	CONDUIT PIPES	IS : 1161

B. NOTES :-

8. ALL DIMENSIONS ARE IN mm. AND LEVELS ARE METERS.
9. EL 0.000 DENOTES FINISHED ROAD LEVEL/G.L. (REFERENCE LEVEL).
10. SOIL BEARING CAPACITY OF 10 TONS/SQ.M ASSUMED AT FOUNDATION LEVEL.
11. GROUND WATER TABLE IS ASSUMED TO BE BELOW FOUNDATION LEVEL.
12. ADEQUATE RUBBLE SOLING TO BE DONE BELOW P.C.C. SKIRITNGS AS REQUIRED.
13. MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT TO BE AS FOLLOWSRAFTS - 25MM, WALLS - 25MM, COLUMNS - 40MM.
14. ADEQUATE CONCRETE TEST CUBES TO BE TAKEN AND TESTED FOR STRENGTH.
15. REINFORCEMENT BARS NOT TO BE WELDED TO EACH OTHER FOR RETANING PURPOSES, BUT TO BE TIED TOGETHER ONLY. LAP LENGTH = 500 (D = DIA OF BAR TO BE LAPPED.)
16. NON SHRINKING GROUTING MATERIAL (SUCH AS SHRINCOM - H FROM ACC) TO BE USED FOR GROUTING.
17. SOIL IS CONSIDERED AS NORMAL.
18. THE REINFORCEMENT BARS SHALL NOT COME ON THE POCKET LOCATION.

NOTE : ALL DIMENSIONS IN METER OTHERWISE MENTION

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

Client:

Ministry of Housing and Urban Affairs
Government of India
सत्यमेव जयते

MINISTRY OF HOUSING AND URBAN AFFAIRS

Consultant:

RITES
THE INFRASTRUCTURE PEOPLE

RITES Ltd. (A Government of India Enterprise)

Project:

MODEL DESIGN FOR 100 TPD MATERIAL RECOVERY FACILITY UNDER SBM-U 2.0

TITLE:

TYPICAL WEIGH BRIDGE DETAILS

DESIGNED BY :	CHETAN A. PATIL & DR. ANAND SONAWANE	
DRAWN BY :	RAHUL ARYA	
CHECKED BY :	SANJAY RAUT	
REVIEWED BY :	CPHEEO,MoHUA	Date : 1st Mar. 2024

ANNEXURE 2
CHECKLIST AND FORMAT

1. 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

2. Pre-assessment checklist for waste received

Vehicle No : Date :
Location name & Ward No : Time :
Driver Name : 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.

3. Morning Protocol

Date: **Location:**

Part -A

Sl. No.	Procedural Steps	Nos.	Remarks
1.	Total strength of 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 chocked			
5.	a. Spilled solid waste 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.	Is belt conveyor are clear of spilled solid waste			

4. Material Receipt

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

5. Material Dispatch

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

6. Material Sale

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

7. Monthly Report

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

8. Evening Protocol

Part A			
	Procedural Steps	**Nos.**	**Remarks**
i.	Total Strength of workers		
ii.	Worker presence		
iii.	Worker left during half day		
iv.	Any health issue reported by workers		
v.	Whether workers changed their dress before leaving and kept PPE in respective lockers allotted to them		

Part B				
S.N.	**Procedural Steps**	**Yes**	**No**	**Comments**
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 strewed 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

9. 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 equipment are switched off?			
4.	Whether all the equipment/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?			

10. Checklist 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?		
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			

11. Format for Electrical Safety Checklist (weekly basis)

Sl. No.	Checklist for Electrical Safety	Yes/ No Action, If no proposed
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.

12. Information Display

Local Body Name: **Location of MRF Plant**	**Date:**	**MRF Incharge Name & number:**
	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		

ANNEXURE 3
COST ESTIMATE AND BILL OF QUANTITY

A. CAPEX

I. Process Equipment

Sl. No.	Equipment	No. of Units	Unit rate Rs. (lakh)	Total cost of equipment (lakh)
1	Weigh Bridge	2	6.50	13.00
2	Conveyor belts system	1	43.55	43.55
3	Magnetic Separator	1	2.50	2.50
4	Trommel	1	47.00	47.00
5	Air blower	2	0.76	1.52
6	Baler Machine	1	40.00	40.00
7	Shredder	1	30.00	30.00
8	Tractor with loader	1	8.75	8.75
9	Electric Fork lift	1	8.00	8.00
10	Storage bins	30	0.30	9.00
11	Wheel barrows	4	0.037	0.15
	Total			203.47
	Transportation and Installation charges extra (10%)			20.35
	Total Cost			**223.82**

Disclaimers: *Cost of machinery is indicative; also their transportation, installation and GST charges may be "as applicable"*

Rates from GeM portal is average price, it 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

II. Electrical Equipment

Sl. No	Equipment/Instrument	No of units	Unit rate (Rs.)	Cost of equipment (Rs.)
1	Solar Panels	192ø	7796	1496832×
2	Lighting and Ventilation equipment	1	458123*	458123
3	Desktop PC	2	33436	66872
4	Water cooler	2	36400	36400
	Total			2058227.00
	Transportation and installation charges (10%)			205823.00
	Total cost in Lakh			**22.64**

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

* Considered the cumulative price of all the lighting and ventilation equipments

ø Drawings for the installation of solar panels need to be checked and approved by concerned experts before individual project to get the actual number of panels as per the availability of sunlight in that area

× ULB's must utilize the available schemes by Government of India for the purposes to promote such renewable energy source.

III. Fire Fighting Equipment

Sl. No.	Equipment/Instrument	No. of Units	Unit Rate (Rs.)	Cost of equipment (Rs.)
1	Fire fighting pump	1	500000*	500000
2	Jockey Pump	1		
3	Diesel fire fighting pump	1		
4	Fire Extinguisher	20	16992*	16992
5	Fire Bucket	16	272	4352
6	Fire hydrant system & pipes	1	210000	210000
7	Fire Hose-30 m	5	7830	39150
8	Fire alarm system	8	16500	132000
	Total cost of fire fighting equipment			902494
	Transportation and installation charges extra (10%)			90249
	Total cost in Lakh			**9.93**

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

* Considered the cumulative price of all the fire fighting pumps and fire extinguishers

B. OPEX

1. PPE Cost

Sl. No.	Name of PPE	Annual requirement (no)	Unit rate (Rs.)	Amount (Rs.)
1	Nose Mask (Surgical)	32850	10	328500
2	Safety goggles	150	250	37500
3	Chemical resistant gloves, multi-use	225	125	28125
4	Safety (High visibility/ warning) Jacket	150	50	7500
5	Bouffant Caps	32850	1	32850
6	Safety shoes	75	400	30000
7	Ear Plugs / Canal caps	150	50	7500
8	Apron	75	200	15000
	Annual Cost (for 70 person) (GST Extra)			**4,86,975**

Note: Cost of PPEs is tentative 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

2. Manpower Cost

Sl. No.	Manpower	Number	Wages* (Rs.)/day	Total Cost (Rs.)
1.	Manager In-charge (Skilled)	1	1150	1150
2.	Safety Supervisor	2	973	1946
3.	Weigh bridge operator	2	897	1794
4.	Electrician cum baler operator (Skilled)	1	973	973
5.	Electrician cum Shredder operator (skilled)	1	973	973
6.	Multi-Tasking Staff (MTS) (skilled)	2	897	1794
7.	Electric Fork lift operator (Skilled)	1	897	897
8.	Skip loader operator (Skilled)	2	897	1794
9.	Security# (unskilled)	3	897	2691
10.	Safai mitra Cleaner# (unskilled)	4	736	2944
11.	Person at tipping area (unskilled)	3	736	2208
12.	Sorting workers# (women's) (unskilled)	48	736	35328
			Total wages per day	54,492/-
			Monthly wages	16,62,006/-
			Annual wages	**1,99,44,072/-**

Disclaimers: *Wages of staff is 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.

3. Indicative Operation and Maintenance Cost

Sl. No.	Components of O & M	Rate	Quantity	Expected Expenditures (Rs)	
				Monthly	Annually
1.	Water Consumption	@ Rs. 146.4/ KLD for consumption exceeding 100 KL (305 KL/Month) and service charges @ Rs. 1317.69/monthly	10 KL/day i.e. 305 KL/month	45,970	5,51,640
2.	Sewerage charges	60% of water consumption charges	--	27,582	3,30,984
3.	Civil Maintenance	@ Rs. 10/ Sq. m. including toilets	Area 4600 Sq. m.	46,000	5,52,000
4.	Electrical Mechanical Maintenance Equipment	10% of cost of equipment per annum	Rs. 24,64,596	2,05,383	24,64,596
5.	Firefighting Equipment	5% of cost of equipment per annum	Rs. 49,637	4,136	49,637
6.	Electricity Consumption	@Rs. 7.75/kWh + @Rs. 2.30/-other charges = @Rs. 10-per kWh Approx	987.35 kWh for 08 hr per day	3,01,140	36,13,680
			Total Cost	**6,30,211**	**75,62,537**

Note: C*ost of Operation and Maintenance is indicative, as ascertain in March 2024, it may change*

BILL OF QUANTITY

BOQ for 100 TPD MRF Shed

(Delhi Schedule Rates (2023), 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.*

Note: *It must vetted for individual project by the competent engineer / authorities of the ULB's / 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	10640.00	17.60	187264.00
(2)	**EXCAVATION**				
2.6	**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 lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in charge.				
2.6.1	Ordinary Soil	cum	3883.97	177.50	689404.24
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 sgm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.				
2.7.1	Ordinary Rock	cum	1468.17	498.90	732467.64
(3)	**CEMENT CONCRETE**				
4.1.4	**1:2:4** (1 Cement : 2 coarse sand (zone-lll) derived from natural sources : 4 graded stone aggregate 40 mm nominal size derived from natural sources)	cum	676.61	7780.30	5264215.63
4.10	Providing and laying **damp-proof course** 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand (zone-lll) derived from natural sources : 4 graded stone aggregate 12.5 mm nominal size derived from natural sources)	sqm	205.67	410.85	84497.86
(4)	**BACK 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	3131.64	196.00	613801.45
2.25(a)	Excavating, **supplying** and filling of **local earth** (including royalty) by mechanical transport upto a lead of 5km also including ramming and watering of the earth in layers not exceeding 20 cm in trenches, plinth, sides of foundation etc. complete.	cum	1177.12	700.50	824569.65
(5)	**REINFORCED CEMENT CONCRETE**				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
5.33A.1	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	1781.78	9333.95	16631036.56
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	653.93	9689.60	6336279.09
5.35	Add for using **extra cement** in the items of design mix over and above the specified cement content therein.	cum	712.71	733.50	522773.97
5.35	Add for using **extra cement** in the items of design mix over and above the specified cement content therein.	cum	261.57	733.50	191861.82
(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	803.00	392.15	314898.02
5.9.2	**Walls** (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	sqm	601.15	842.50	506470.56
5.9.3	Suspended floors, **roofs**, landings, balconies and access platform	sqm	895.83	927.25	830660.13
5.9.5	Lintels, **beams**, plinth beams, girders, bressumers and cantilevers	sqm	2446.40	736.40	1801527.49
5.9.6	**Columns**, Pillars, Piers, Abutments, Posts and Struts	sqm	2468.56	961.30	2373025.38
5.9.16	**Edges of slabs** and breaks in floors and walls				
5.9.16.1	Under 20 cm wide	meter	1659.34	208.55	346056.02
(7)	**STEEL REINFORCEMENT**				
5.22	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	and binding all complete upto plinth level.				
5.22.6	Thermo-Mechanically Treated bars of grade Fe-500D or more.	kg	150477.38	107.85	16228985.17
5.22A.6	Thermo-Mechanically Treated bars of grade Fe-500D or more.	kg	52314.06	107.85	5642071.50
(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	7.57	7370.65	55772.35
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	567.43	9105.95	5166996.53
(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	3.98	187227.65	746004.83
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	117.20	2392.65	280416.19
(10)	**CEMENT PLASTER**				
13.1	**12 mm** cement plaster of mix:				
13.1.1	1:4 (1 cement: 4 fine sand)	sqm	4311.63	347.05	1496350.84
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	2798.98	399.45	1118053.36
13.16	**6 mm** cement plaster of mix:				
13.16.1	1:3 (1 cement : 3 fine sand)	sqm	3240.24	300.45	973531.40
(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	sqm	6753.60	2773.00	18727732.80

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	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 which 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 designed for arch reaction and vertical loads. Plaster shall not be applied on the beam. Schmitt hammer test of concrete should be carried 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 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	27.00	41300.00	1115100.00

DSR Item No.	Description	Unit	Qty.	Rate	Amount
(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 by applying Polyurethane resin based top protective clear coat of minimum 80 micron applied with rollers on properly cured and dry clean surface.	sqm	4500.00	762.75	3432375.00
(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.	sqm	420.70	769.60	323769.03

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	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).				
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 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	528.97	1684.60	891100.17
(14)	**PAINT**				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
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	5207.46	185.65	966765.12
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	1556.98	160.60	250051.31
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 (For Window Grills)	sqm	725.11	67.40	48872.68
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	725.11	226.25	164057.04
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	5207.46	156.05	812624.27
Market Rate	Applying priming coat: With ready mixed **red oxide** zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	meter	4325.52	27.00	116789.04
Market Rate	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	meter	4325.52	91.00	393622.32
(15)	**TOP LAYER OF FLOWERING (TILES)**				
8.31	Providing and fixing Ist 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	347.36	1267.95	440438.54
11.41	Providing and laying **vitrified 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				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	cement and matching pigments etc., complete.				
11.41.2	Size of Tile 600x600 mm	sqm	325.99	1553.45	506411.81
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 size of tile 600 x 600 mm	sqm	21.37	1464.85	31305.31
(16)	**STEEL WORK**				
10.6.1	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	110.60	3653.20	404043.92
10.7	Providing and fixing ball bearing for rolling shutters.	each	18.00	492.35	8862.30
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	17.40	1281.35	22295.49
10.8.2	Exceeding 16.80 sqm in area	sqm	93.20	1181.80	110143.76
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	12.22	768.25	9388.02
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	6085.39	181.25	1102977.19
10.25	**Steel work** welded in built up sections/ framed work, including cutting, hoisting, fixing in position				

DSR Item No.	Description	Unit	Qty.	Rate	Amount
	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	7872.45	172.60	1358784.25
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	681.62	1133.55	772645.82
(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	520.06	295.50	153677.14
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	297.18	598.60	177889.55
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	74.29	1505.25	111831.04
(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	14.00	4478.75	62702.50

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	2.00	6515.55	13031.10
17.23	Providing and fixing white vitreous china flat back or wall corner type lipped front **urinal basin** of 430x260x350 mm or 340x410x265 mm sizes respectively.	each	14.00	1648.95	23085.30
17.7.2	White Vitreous China **Wash basin** size 630x450 mm with a single 15 mm C.P. brass pillar tap	each	10.00	2226.35	22263.50
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	6000.00	11.00	66000.00
Market Rate	**RCC SEPTIC TANK** 1200 MM, 3000 liters capacity for 25 users, with two outlets.	each	3.00	30385.00	91155.00
(19)	**ROAD WORK**				
16.75	Providing and laying **C.C. pavement** of mix M-25 with ready mixed concrete from batching plant. The ready mixed concrete shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Engineer-in-charge.	cum	349.76	9823.80	3435923.17
	(Note:- Cement content considered in this item is @ 330 kg/cum. Excess/ less cement used as per design mix is payable/ recoverable separately).	cum	69.95	9823.80	687184.63
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 Engineer-in- Charge.				
16.78.1	With material conforming to Grade-I (size range 75 mm to 0.075 mm) having CBR Value-30	cum	1263.56	2784.00	3517745.26
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	758.13	2914.30	2209432.12

DSR Item No.	Description	Unit	Qty.	Rate	Amount
16.8	Construction of **dry lean cement concrete** sub base over a prepared subgrade with coarse and fine aggregate conforming to IS:383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per specifications, cement content not to be less than 150 Kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, for all leads & lifts, laid with a mechanical paver, compacting with 8-10 tonne vibratory roller, finishing and curing etc. complete as per direction of Engineer-in- charge.	cum	437.19	4148.65	1813763.85
16.91	Providing and laying factory made chamfered edge Cement Concrete **paver blocks** in footpath, parks, lawns, drive ways or light traffic parking etc, of required strength, thickness & size/ shape, made by table vibratory method using PU mould, laid in required colour & pattern over 50 mm thick compacted bed of sand, compacting and proper embedding/laying of inter locking paver blocks into the sand bedding layer through vibratory compaction by using plate vibrator, filling the joints with sand and cutting of paver blocks as per required size and pattern, finishing and sweeping extra sand. complete all as per direction of Engineer-in-Charge.				
16.91.1	60 mm thick cement concrete paver block of M-35 grade with approved colour, design & pattern.	cqm	1860.25	1045.65	1945170.41
Market Rate	Providing and Placing in position suitable **125 micron PVC** water stops conforming for construction/ expansion joints	kg	222.97	122.36	27282.46
(20)	**GREEN BELT**				
DSR- 2022-23: Gov. Maharashtra PWD Park, Garden , Pune Region	Preparation of Shrub garden with suppling fersh soil 30 cm deep with decomposed farmyard manure for excavation area 30 cm deep. Providing varity of shrubs 30 cm c/c, (free from weeds and diesease etc.) size 7" x 8" . Excavation for planting shrubs bed in earth, soil of all types, soft murum, including removing the excavated material up to a distance of 50 mtrs. for a depth of 30 cms. Filling fresh garden soil / silt & manure in excavated area of depth 30cms. Mixing garden soil/silt & manure thoroughly well, watering previous night. Planting reqired plant species, lawn grass as directed etc. complete for required depth 30 cms. for planting lawn/ shrub/ flower bed/ hedges/ edges/ canna bed/ ground cover. Maintenance of Newly Developed Shrubs Area. For First 30 days Only.	sqm	1114.00	789.00	878946.00
DSR- 2022-23: Gov. Maharashtra PWD Park,	Plantation of trees with supplying on site fersh for excavated pit size area of 0.60 x 0.60 x 0.60m, Supplying on site well decomposed Farm Yard Manure FYM for excavated pit size area of 0.60 x 0.60 x 0.60m. Providing on site required variety of Tree (free from weeds /diesease etc.) 30 cms. apart c/c.Name:- Bahava;Bag Size 13 x13'', ht 6-8'. Excavation pit size 0.60 x 0.60 x 0.60 m for	each	184.00	719.00	132296.00

DSR Item No.	Description	Unit	Qty.	Rate	Amount
Garden , Pune Region	planting small & medium ornamental plants/ large flowering/ shady trees (plant height 1 to 2 mtr.) in earth, soil of all types, soft murum, including removing the excavated & unwanted material up to a required distance of 50 mtrs. Filling fresh garden soil / silt & manure in excavated pit size area of 0.60 x 0.60 x 0.60m. Mixing garden soil/silt & manure thoroughly well, watering previous night. Planting required plant species as directed etc. complete for required pit size 0.60 x 0.60 x 0.60m. Maintenance of Newly Planted tree varieties having height 1mtr. - 2mtr. For First 30 days Only				
(21)	**EXTRA CIVIL ITEM**				
Market Rate	Rubble Soling	cum	147.68	2400.00	354432.00
(22)	**ELECTRIC FIXTURES**				
Market Rate	Internal Illumination & Fan				
	Street Light (250 W)	each	27.00	4613.00	124551.00
	Led Light (100 W)	each	18.00	2779.00	50022.00
	Led Tube (25 W)	each	39.00	260.00	10140.00
	Wall Mounted Fan (180 W)	each	20.00	11206.00	224120.00
	Celling Fan (75W)	each	16.00	2360.00	37760.00
	Toilet Exhaust Fan (60 W)	each	10.00	1127.00	11270.00
(23)	**OTHERS**				
Lump Sum	Main Gate	each	1.00	200000.00	200000.00
Lump Sum	Metal Steps upto Plinth	each	5.00	15000.00	75000.00
Lump Sum	Gritting Platform with Relling and ladder with Relling	each	1.00	350000.00	350000.00
Lump Sum	Cowcatcher	each	1.00	200000.00	200000.00
Lump Sum	Illuminated Signage				30000.00
Lump Sum	Internal Plumbing and Electric Work (Termite treatment etc.)				3000000.00
			Sub Total Rs		122348872.61
			Contingency	**3%**	3670466.18
			Total		**126019338.79**
			Total Rs In Lakhs		**1260.19**

Disclaimer Where ever 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

Ministry of Housing and Urban Affairs
Government of India

Prepared by

RITES
THE INFRASTRUCTURE PEOPLE

Swachh Bharat Mission - Urban 2.0

www.sbmurban.org

@SwachhBharatGov | @SwachhBharatUrban | @sbmurbangov | @swachhbharaturban