MATERIAL RECOVERY FACILITY

FOR SAHIWAL CITY

DRAFT CONCEPT REPORT

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MATERIAL RECOVERY FACILITY FOR SAHIWAL CITY

1. GENERAL

Sahiwal town is situated at a distance of about 18 miles from the left bank of the river Ravi,187 Km west of Lahore and 200 km east of Multan. The Grand Trunk Road and the main railway line connecting Peshawar-Lahore with Karachi pass through the town. The Lower Bari Doab Canal separates the town into two parts.Its approximate height above sea level in 500 feet. Sahiwal lies 30°39'52.16" N latitude and 73°6’30.54"E longitude.Present population of Sahiwal is 406,681 and Estimated population is 482,775.

1.1 Existing Solid Waste Management System

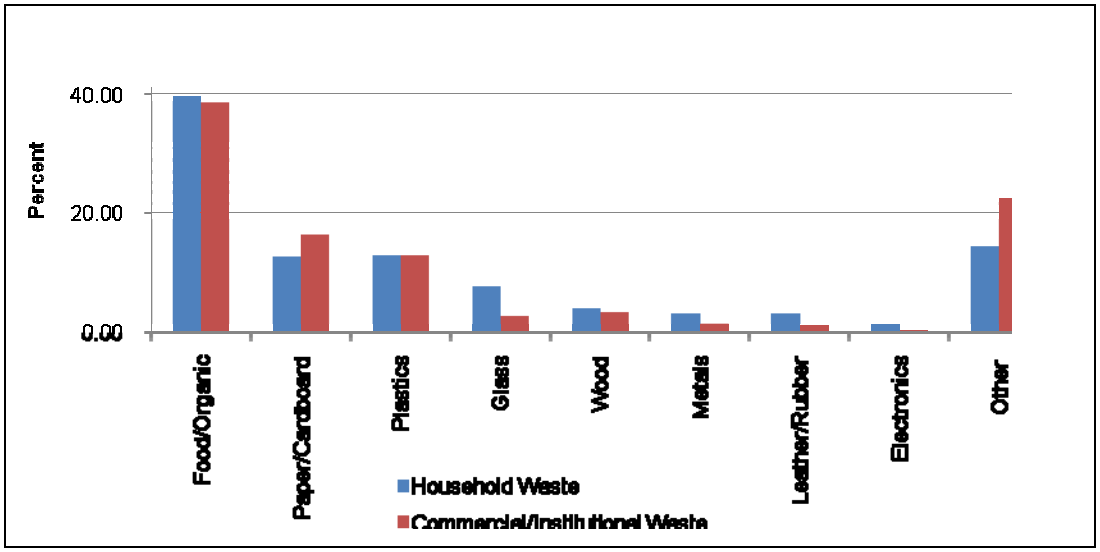
The existing solid waste management system of Sahiwal is being managed by the Tehsil Municipal Administration (TMA). Presently there is no proper disposal facility in Sahiwal. Waste generated is disposed off into the designated dump site at Ratti Tibbi without making any arrangements for environmental safeguards.

By adopting the 0.35 kg/person/day generation ate the present waste generated in Sahiwal comes out to be 140 tons/day which requires an area of approximately 28 Acres approximately for landfill facility. However, by installing a Material Recovery Facility, the landfill area will be decreased by 70 to 80%.

The waste composition adopted for Saihwal has been taken as same concluded by recent waste characterization survey carried out by GHK for Sialkot which are given below.

Table: Composition of MSW of Sialkot, Solid Waste Management Strategy and Action Plan **(PCIIP), 2010**

Component	
Glass	0.16
Metals	0.07
Paper/Cardboard	0.36
Plastics	0.33
Food/Organic	1.02
Wood	0.11
Leather/Rubber	0.10
Electronics	0.04
Other	0.27
Average (Per Household)	**2.46**
Average (Per Capita)	**0.35**



Municipal Waste Composition

Source: GHK Sialkot Waste Assessment Survey. 2010

2. RECOVERY OF MATERIAL FROM SOLID WASTE

There are three main methods that can be used to recover recyclable materials from Municipal Solid Waste (MSW):

i. Collection of source-separated recyclable materials by either the generator or the collector, with and without subsequent processing

ii. Commingled/Mixed recyclables collection with processing at centralized materials recovery facilities (MRFs)

iii. Mixed MSW collection with processing for recovery of the recyclable materials from the waste stream at (MRFs)

In Sahiwal city, mixed-waste collection is being practiced, that requires no extra effort by the generator and results in no incremental collection costs. Therefore, a much complex system is required for the processing and recovery of different materials from solid waste.

The different recyclable materials that will be recovered from the mixed MSW are as under:

- Bulky Items
- Cardboards

- Plastics (PETE, HDPE and other mixed plastic)
- Glass (clear and mixed)
- Aluminium cans, Tin cans
- Ferrous Materials
- Paper/Rags

By the recovery of the above recyclable materials, the mixed MSW eventually prepared, will be used as feedstock for composting.

3. TECHNICAL CONSIDERATIONS FOR PLANNING AND DESIGN OF MRF

For the planning and design of MRF, following technical considerations are followed:

- The coordination of the MRF with the integrated waste management plan for the community and clear explanation of the role and function of the MRF in achieving landfill waste diversion and recycling goals.

- What type of MRF should be built, which materials will be processed now and in the future, and what should be the design capacity of the MRF.

- While it has been possible to build and operate MRF in close proximity to both residential and industrial developments, extreme care is taken in their operation if they are to be environmentally and aesthetically acceptable. Ideally, to minimize the impact of the operation of MRF, it is sited in more remote location where adequate buffer zone surrounding the facility is maintained.

- In the design and selection of equipment for MRF, a materials balance analysis to determine the quantities of materials that can be recovered and the appropriate loading rates for the unit operations and processes used in the MRF is prepared.

- MRF layout will include: (1) sizing of the unloading areas for mixed MSW (2) sizing of presorting areas where oversized or undesirable materials are removed, (3) placement of conveyor lines, screens and other unit operations, (4) sizing of storage and outloading areas for recovered

materials, and (5) sizing and design of parking areas and traffic flow patterns in and out of the MRF.

- Staffing depending upon the degree of mechanization of MRF.

4. METHODOLOGY

4.1 Activities Of MRF

The different activities performed in an MRF depend upon the functions of MRF i.e (1) The role that the MRF is to serve in the waste management system (2) The types of material to be recovered (3) The form in which the materials to be recovered will be delivered to the MRF (4) The containerization and storage of processed materials for the buyer

In view of the above mentioned functions, the following processing and recovery activities are being formulated for the MRF receiving mixed MSW of Sahiwal City:

- Material Handling (Transport and transfer of solid waste)
- Size Separation (Separation of dust and Stones from the solid waste)
- Manual Sorting (Recovery of recyclable materials from solid waste)
- Size Reduction (Removal of bulky items)
- Densification (Compaction of recovered materials)

4.2 Methods and Equipment used for Processing and Recovery

Following are the general methods and equipments with respect to the activities of MRF defined in section 4.1:

Material Handling

Unit operations used for the transport and storage of MSW and recovered materials. Typical applications include: (1) conveyors for the transport of MSW and recovered materials, (2) storage bins for recovered materials, and (3) rolling stock such as fork lifts, front-end loaders, and various types of trucks for the movement of MSW and recovered materials.

Size Separation

Unit operation in which materials are separated by size and

shape characteristics, most commonly by the use of screens. Several types of screens are in common use including: (1) reciprocating screens for sizing shredded yard wastes, (2) trommel screens used for preparing commingled MSW prior to shredding, and (3) disc screens used for removing glass from shredded MSW.

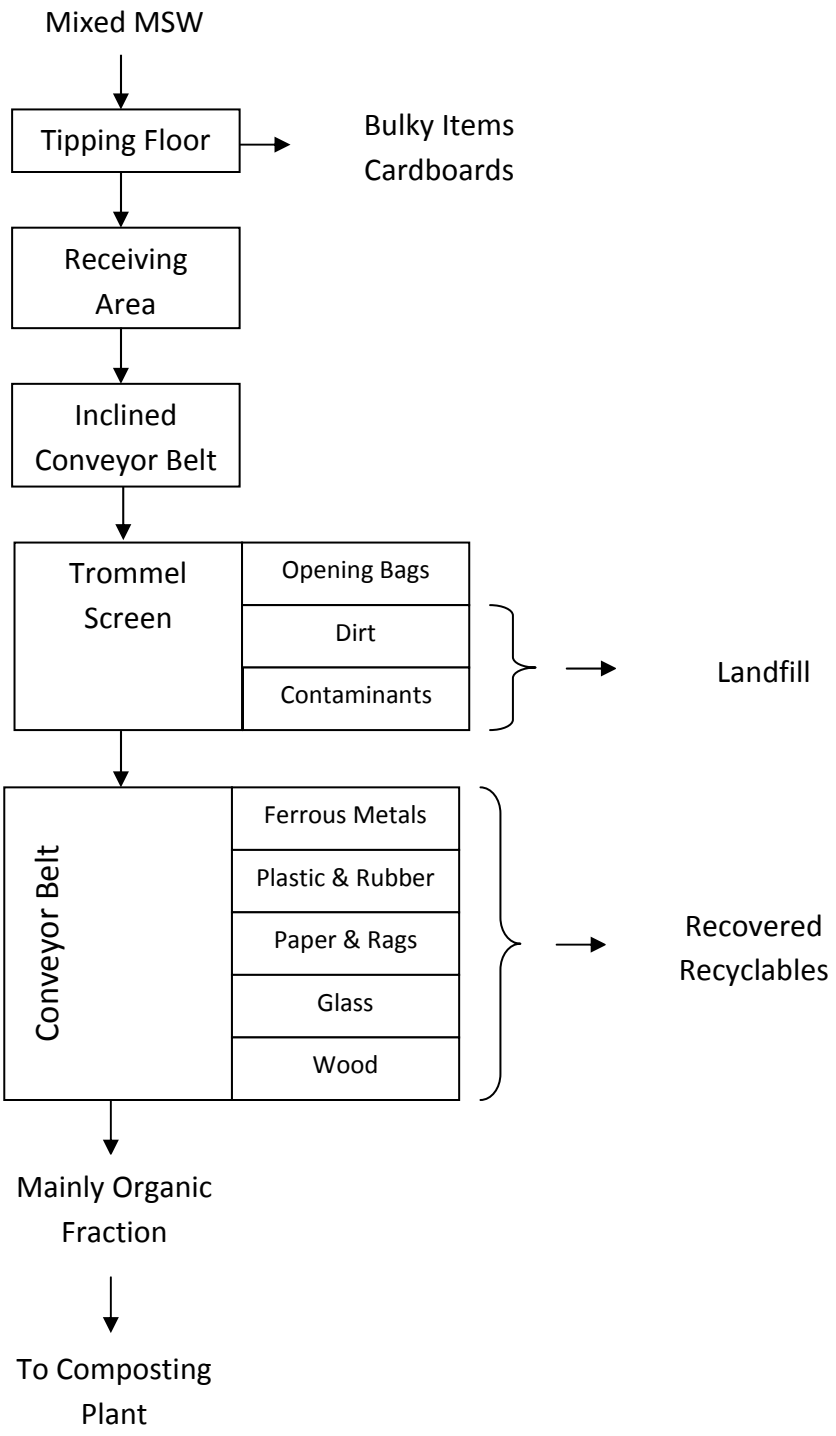
Manual Sorting

Unit operation in which personnel physically remove items from the waste stream.Typical examples include: (1) removal of bulky items that would interfere with other processes, and (2) sorting material off an elevated conveyor into large bins located below the conveyor.

4.3 Process Flow diagram

The different operations to be carried out in MRF are best described with the help of the following Process Flow Diagram.

Moreover, two schematic process diagrams i.e Fig. 2 & 3 are attached in annexure-1 that further elaborates the concept of process of MRF.


Mixed MSW
Tipping Floor
Bulky Items
Cardboards
Receiving Area
Inclined Conveyor Belt
Trommel Screen
Opening Bags
Dirt
Contaminants
Landfill
Conveyor Belt
Ferrous Metals
Plastic & Rubber
Paper & Rags
Glass
Wood
Recovered Recyclables
Mainly Organic Fraction
To Composting Plant

5. EQUIPMENT SELECTION AND CRITERIA

Following factors are kept in mind for the selection of equipment and physical facilities:

Capabilities
What will the device or mechanism do? Will its use be an improvement over conventional practices?

Reliability
Will the equipment perform its designated functions with little attention beyond preventive maintenance? Has the effectiveness of the equipment been demonstrated in use over a reasonable period of time or merely predicted?

Service
Will servicing capabilities beyond those of the local maintenance staff be required occasionally? Are properly trained service personnel available through the manufacturer or the local distributor?

Safety of operation
Is the proposed equipment reasonably foolproof so that it may be operated by personnel with limited mechanical knowledge or abilities? Does it have adequate safeguards to discourage careless use?

Efficiency
Does the equipment perform efficiently?

Environmental effect
Does the equipment pollute or contaminate the environment?

Health hazards
Does the device, mechanism, or equipment create or amplify health hazards?

Economics
What are the economics involved? Both first and annual costs must be considered. Full operation and maintenance costs must be assessed carefully. All factors being equal, equipment produced by well-established companies and having a proven history of satisfactory operation should be given appropriate consideration.

Following are the Equipments selected with respect to the activity to be performed for processing and recovery of materials from the mixed MSW of Sahiwal City.

5.1 Material Handling

Transport of waste materials between the various separation and processing operations requires a reliable and effective conveyor system. Conveyor systems include the horizontal and inclined belt.
Inclined belt conveyors will be used to transport waste from mixed waste hoppers or the tipping floor to elevated materials sorting lines. Materials will then be removed from the conveyor by manual or mechanical methods and deposited into their respective bins located below the conveyor. For manual separation processes, conveyors will be sized to enable sorters to comfortably reach items on the belt.

5.2 Manual Sorting

The most common system for the manual sorting of material is the elevated sorting belt with storage bins located beneath. Materials to be sorted are transported to the elevated sorting conveyor with an inclined conveyor. In this system, sorters will be located at stations on one or both sides of the elevated, moving conveyor.
Sorting stations are placed so that sorters are not interfering with other sorters. In other words, if sorting occurs only on one side of the conveyor, sufficient spacing is provided; if sorting occurs on both sides of a conveyor belt, the stations are staggered.

Typically, each sorter is responsible for a specific material, and controls are in place so that the conveyor speed can be adjusted or stopped. In some cases, reducing the speed of the conveyor may result in a higher-quality product and not significantly reduce overall processing rates. Other factors that affect the efficiency of sorting operations include the skill and training of the sorter, the presentation of the materials to be sorted (e.g., burden depth, time varying distribution of materials), and worker fatigue. Fatigue is reduced by adjustment of environmental variables such as temperature control, lighting, and ventilation.

Materials will be removed from the mixed-waste stream moving on the conveyor and pitched forward or pulled back and deposited into collection chutes. The collection chutes lead to bulk storage bins for the separated materials. Waste containers may also be present for the storage of contaminants.

Conveyor Belt
Design of Conveyor Belts for the above mentioned activities will be done according to the following design criteria:

Parameter	Unit	Value Range	Typical
Belt speed	ft/s	0–1.6	0.5
Belt width			
Stations on one side	in	30–42	36.5
Stations on both sides	in	48–72	60.5
Belt height	in	36–42	42.5
Material depth	in	0–6	4.5

5.3 Size Separation

The most common type of size separation process is screening, in which items are given the opportunity to pass through (underflow) a certain size opening.
The most common types of screens in recycling applications is the trommel screen which is adopted for the MRF of Sahiwal City.

Factors that are considered in the design of vibratory screen include the following:

- Particle size, particle size distribution, bulk density, moisture content, particle shape, and potential for the material to stick together or entangle
- Screen design characteristics, including materials of construction, size of screen openings, shape of screen openings, total surface screening area, rotational speed for rotary drum screens and length and diameter for rotary screens
- Separation efficiency and overall effectiveness
- Operational characteristics (e.g., energy requirements, routine maintenance, simplicity of operation, reliability, noise and vibration, potential for plugging)

Trommel Screen
Material to be separated will be fed into one end of a tubular, rotating screen with a downward slope (around 5°), so that the material will flow down the screen as it is dropped and tumbled. Lifters will be placed within the screen to increase the degree of lifting and dropping of material. Blades or prongs will be included on the inlet end to open bags.

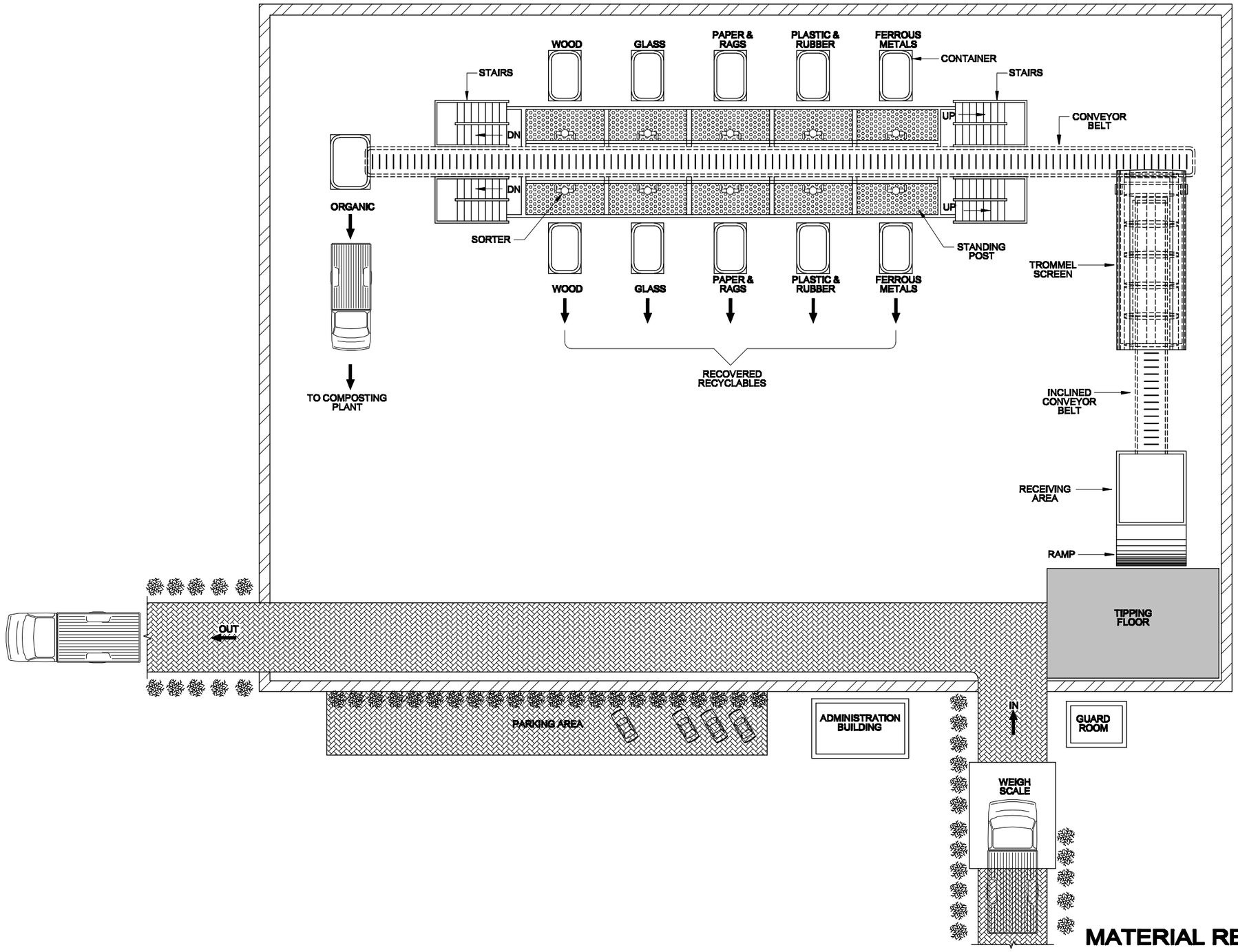
6. LAYOUT OF MRF

A schematic layout plan is attached in annexure-1 as Fig. 1, developed to highlight the following principle unit operations and equipment employed in processing materials at MRF:

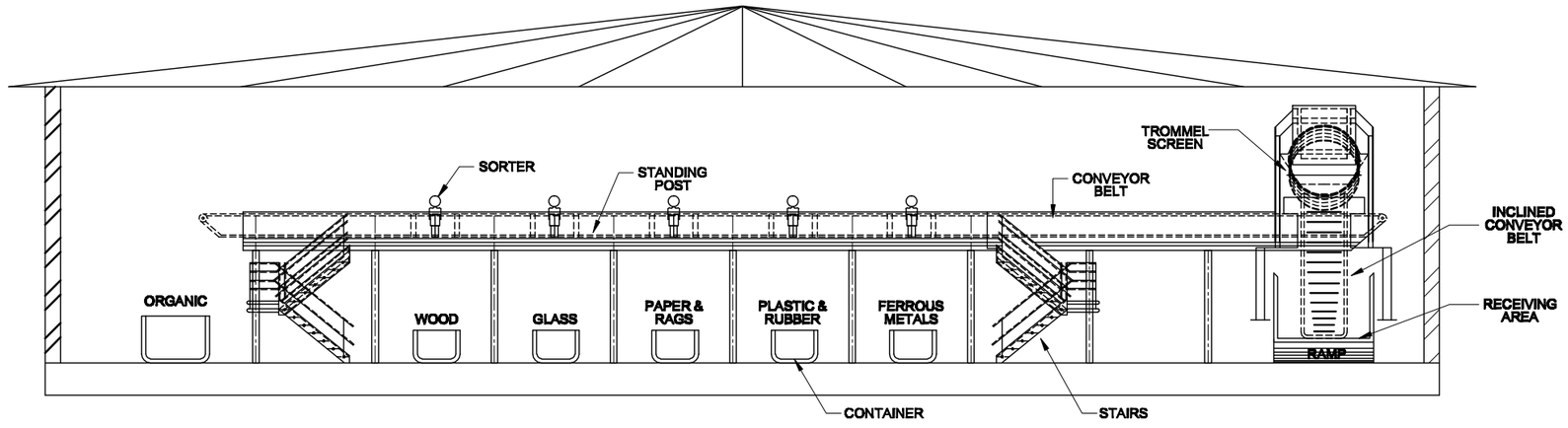
- Manual sorting facilities
- Equipment and facilities for materials transport
- Equipment for component separation
- Weighing facilities
- Movable equipment
- Storage facilities
- Administrative buildings

* The detailed layout of MRF will be designed on the basis of solid waste loading rate formulated according to the soild waste generation of Sahiwal city.

ANNEXURE-1
(Concept Design Figures)



MATERIAL RECOVERY FACILITY
LAYOUT PLAN
FIG. 1



MATERIAL RECOVERY FACILITY
SCHEMATIC PROCESS DIAGRAM
FIG. 2