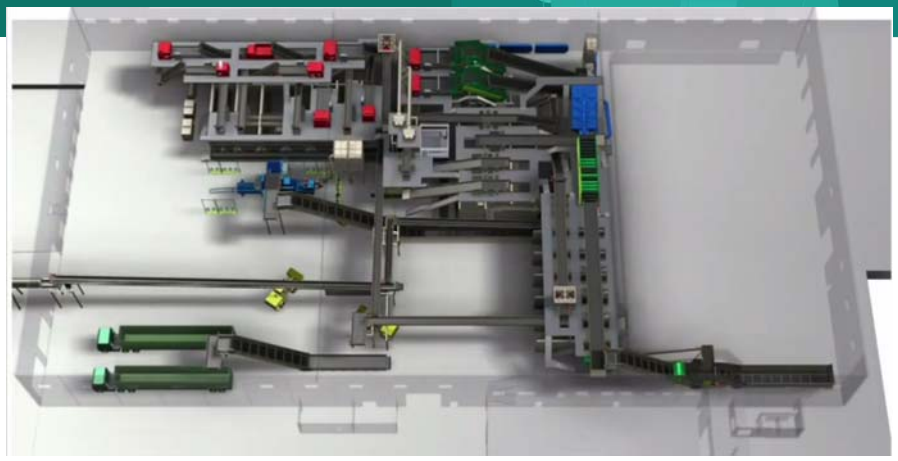
Processing Equipment and Recovery, from MRFs to MWPFs

September 2016

By
Bradley Kelley, Senior Project Engineer
Gershman, Brickner & Bratton, Inc.

GBB SOLID WASTE MANAGEMENT CONSULTANTS

Processing System



Source: BHS/Infinitus

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

10 Types of Major Processing Equipment

1. Conveyors (Metal and Rubber belt) including Sorting Conveyors
2. Bag Openers
3. Primary Shredders
4. Screens
5. Ferrous Magnets
6. Eddy Current Units
7. Air Separation Systems
8. Optical Sorting Systems
9. Secondary Shredders
10. Densification Systems

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Conveyors – Moving the Material

Source: BHS

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

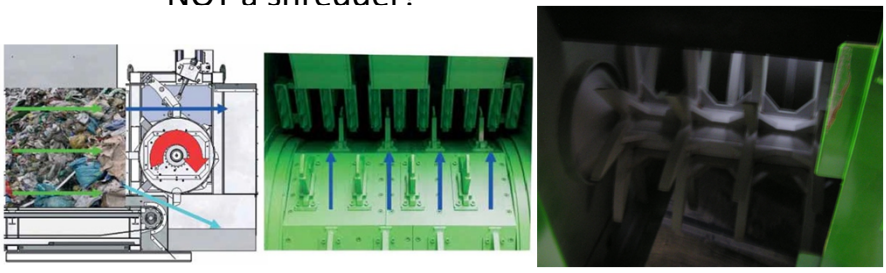
Conveyor Types in MRFs

- Slider Bed
  - Used as Sort Conveyors and general applications
- Idler Conveyor
  - Generally used for fines or abrasive materials
- Chainbelt Conveyor
  - Used for System Infeed, Baler Infeed or very steep applications

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Bag Breakers – Liberate the Material

- Open bags but not damage materials
- Offline or Inline
- NOT a shredder!



Source: Matthiassen, GBB Site Visit

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Primary Shredders – Resize the Material

- Open Bags
- Protect Downstream Equipment
- Size for Secondary Shredding

Source: SSI, Lindner

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Screens – Separate Material by Size

- Three main types of Screens
  - Trommel Screen, Disc Screen, Vibratory Screen

Source: www.ecocycle.org, Jost, BHS

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Fines Screening

- Generally removes 2”-3” and under- (referred to as 2” minus)
- To remove:
  - Fines such as dirt
  - Glass
  - Organics
  - Inerts such as Ceramics
- Trommel, Disk and Vibratory Screen can be used

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

OCC/Scalping Screening

- Separates large, flat, and relatively stiff items usually over 18”x18” in size
- To recover:
  - Cardboard
  - Bulky Plastics
- Disk Screen usually used but Trommel occasionally utilized

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

2D/3D Separators – Separate Fiber from

- Two types, Polishing Disk Screen and Ballistic Separator Screen
- Three Sorts – Flats over top, fines through middle, 3D objects off the back
- Items that behave as paper will also travel over the top
- Items that behave as containers will fall off the back

Powered by Waste 360 In Collaboration with National Waste & Recycling Association Penton GBB Solid Waste Management Consultants Waste 360 Recycling Summit

2D/3D Separators

Ballistic Screen

Source: Machinex

Polishing Disc Screen

Source: CP

Powered by Waste 360 In Collaboration with National Waste & Recycling Association Penton GBB Solid Waste Management Consultants Waste 360 Recycling Summit

Magnets – Recover Ferrous Steel

Belt Magnet

Source: Bunting Magnets

Drum Magnet

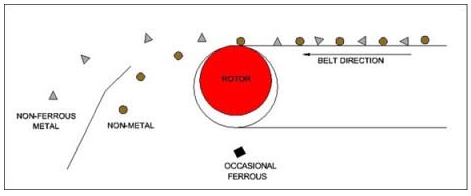
Source: Machinery.net

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Eddy Current Separators (ECS) – Recover Aluminum

- Recommend Eccentric rotors and Magnet before ECS
- Size dependent, usually <2” or between 2”-12” sizes
- Very effective on Al and some Copper, less so on Brass

Source: Steinert



Source: Magnapower

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

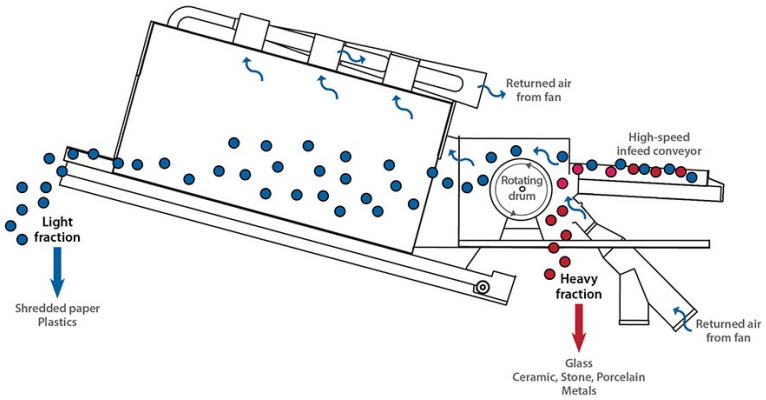
Air Classification – Separate by Density

Air Drum Separators and Aspirators

Source: BHS, Nihot

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Air Drum Separator



Source: Nihot

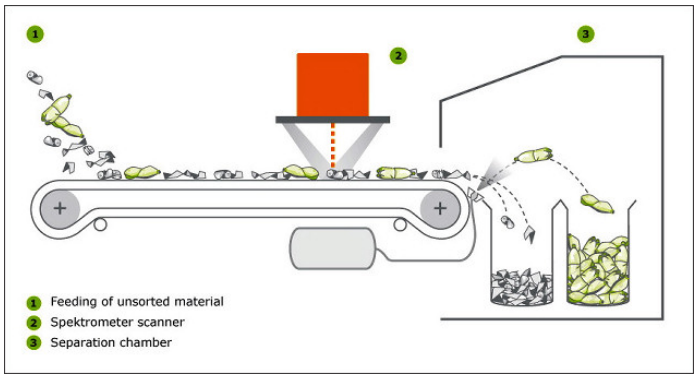
Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Container Optical Units – Separate by Resin Type

Source: GBB Site Visit

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Container Optical Units



Source: TiTech

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Densification: Bales and Pellets

- Primarily for Transportation

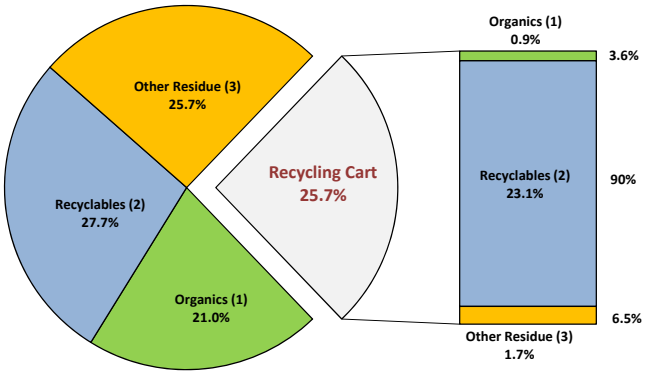
Source: GBB/Harris Baler, Warren and Baerg

Recovery Efficiency

- All methods of recovery, including manual, have a rate of efficiency of less that 100%
- Efficiency will vary based on material, type of automation, level of maintenance, and even weather
- In general, a MRF will be more efficient than MWPF due to nature of material

Powered by Waste 360
In Collaboration with National Waste & Recycling Association
Penton
GBB Solid Waste Management Consultants
Waste 360 Recycling Summit

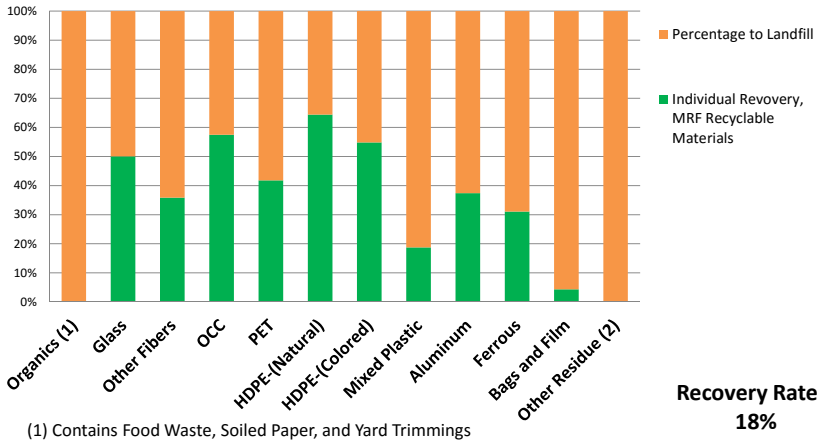
Fayetteville and Fort Worth Household Generation Total Material Composition



(1) Contains Food Waste, Soiled Paper, and Yard Trimmings
(2) Contains OCC, Other Fibers, PET, HDPE, Mixed Plastics, Al, Fe, Film and Glass
(3) Includes C&D, Diapers, Textiles, Electronics and Other Residue

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Estimated Recovery by Commodity - MRF Only

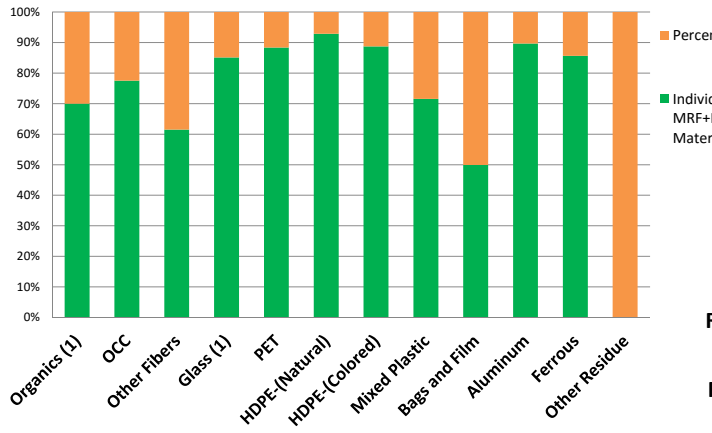


Recovery Rate – 18%

(1) Contains Food Waste, Soiled Paper, and Yard Trimmings
(2) Includes C&D, Diapers, Textiles, Electronics and Other Residue

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Estimated Recovery by Commodity - MRF and MWPF



Recovery Rate w/o Organics – 37%

Recovery Rate w/ Organics – 52%

(1) Organics and Glass recovery would require additional processing and facilities

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Conclusions

- Choices of equipment are highly dependent on goals and material characteristics
- Increased participation can increase non-program residue at MRF
- Economics must be sustainable and risks and rewards must be shared
- Landfill prices drive materials into the ground
- Can only recover what the material gives you!

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Additional Resources

American Chemistry Council Reports:

The Evolutions of Mixed Waste Processing Facilities – 1970 – Today

And

Supplemental Report: The Evolution of Mixed Waste Processing Facilities – Technology and Equipment Guide

Links found at www.gbbinc.com

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit

Thank you!

Bradley Kelley, BSME

bkelley@gbbinc.com
www.gbbinc.com
1-800-573-5801

Powered by Waste 360 | In Collaboration with National Waste & Recycling Association | Penton | GBB Solid Waste Management Consultants | Waste 360 Recycling Summit