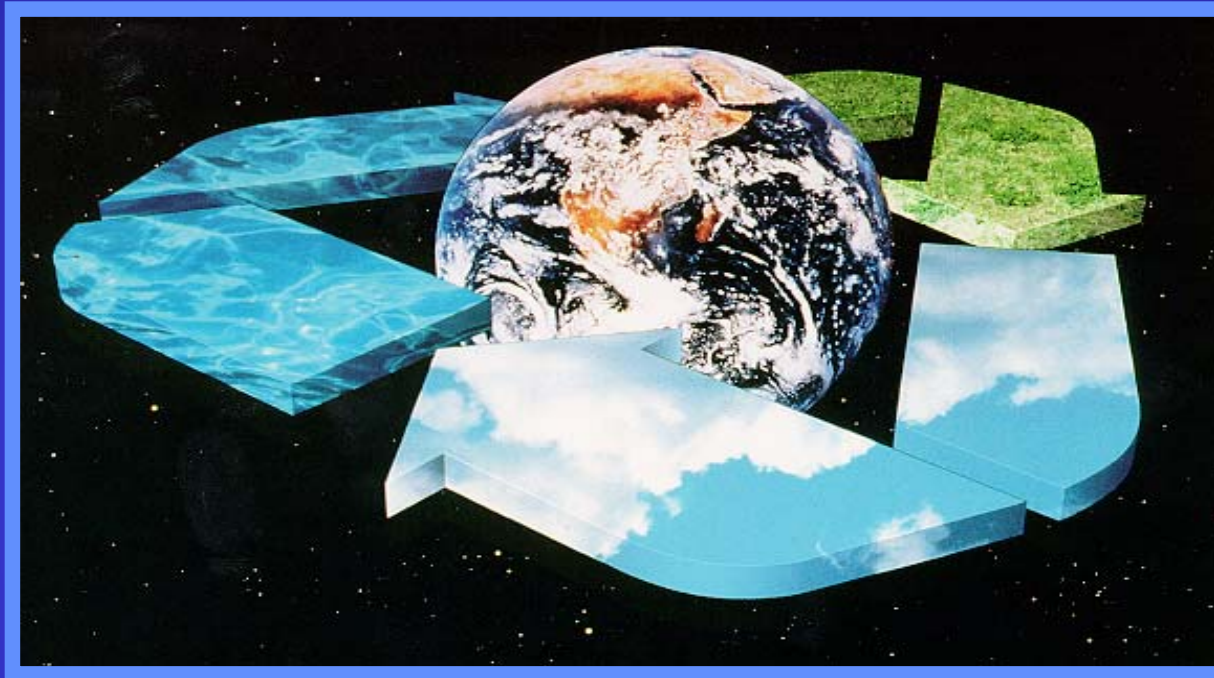


Glass Recovery at the MRF



Presented by
Nathiel Egosi, P.E.
November 8, 2016



RRT Design & Construction

Melville, NY- Milwaukee, WI- Baltimore, NY -Orlando, FL
Syracuse, NY- Vestal, NY- Philadelphia, PA
www.rrtenviro.com

Agenda

- The Issue
- Why
- Shift in thinking
- Solutions bring problems
- More solutions needed



RRT DESIGN & CONSTRUCTION

- **We build solid waste processing & recycling businesses**
- 27 years of over 400 successful plants including over 80 complete greenfield operations
- Experts in MRF plant operations, equipment, process engineering & construction



The Issue:

GLASS



Recycling glass cuts energy by 30%

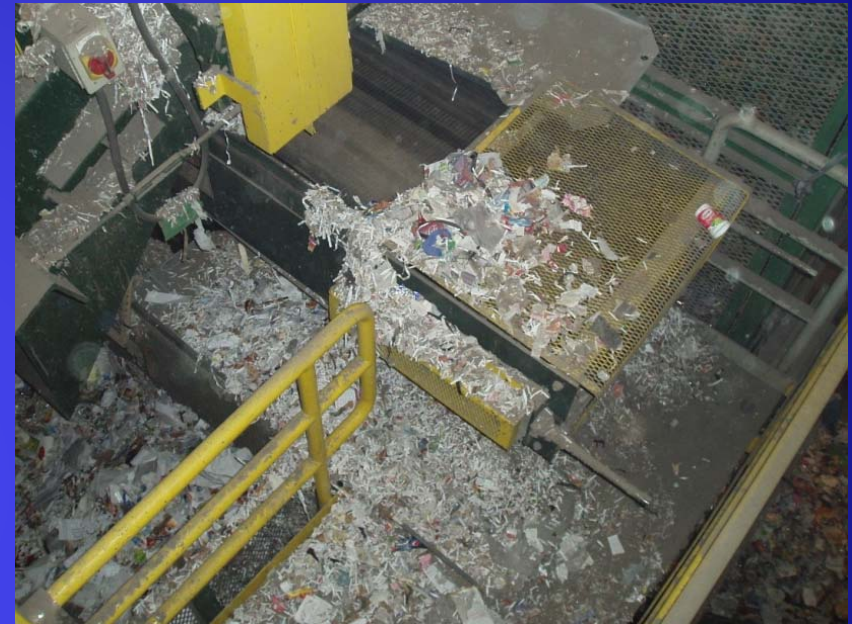


Producing glass from raw materials requires 30 percent more energy than producing from cullet (EPA)

The Issue-MRF Operator's View

We hate it...

- It goes everywhere
- Wears machinery
- Marketability difficult
- Much is lost to residue



....but we also like it...

- Keeps the recycling numbers up
- Fees are tonnage based

Composition

- Outbound
- Non-Bottle Bill
- Single Stream
- High Automation
- Well Run
- 50,000 TPY

Material Type	Composition
Newspaper / Mixed Paper	40.8%
Corrugated Cardboard	20.7%
Office Paper	1.3%
PET	4.2%
HDPE (N)	0.8%
HDPE (C)	1.2%
Mixed Plastics (#1 – 7)	0.7%
Rigid Plastic	0.2%
Ferrous Cans	1.8%
Aluminum / UBC	1.1%
Bulky/Scrap Metal	0.3%
Aseptic Containers	0.1%
Mixed Glass	15.6%
Residue/Trash	11.3%
TOTAL	100.0%

% of Glass in MRF Stream

MRF	Type of MRF	Glass % of Total Stream	Glass % of Containers	Year Data
Florida (South)	Dual Stream	14.8	49.5	2015
Florida (South)	Single Stream	21.0	53.2	2015
New Jersey (Central)	Single Stream	20.8	55.9	2016
New Jersey (Shore)	Single Stream	19.6	58.5	2013
Michigan (BB)	Single Stream	10.0	27.0	2015
Iowa (BB)	Dual Stream	5.1	30.9	2013
New York- Upstate (BB)	Single Stream	7.4	26.0	2012
New York-Bronx (BB)	Dual Stream	n/a	40.3	2013
New York-Brooklyn (BB)	Dual Stream	n/a	51.9	2013
New York-Manhattan (BB)	Dual Stream	n/a	56.1	2013
New York-Queens (BB)	Dual Stream	n/a	41.3	2013
California-Southern (BB)	Single Stream	17.0	79.8	2016



How our Thinking Started..years ago

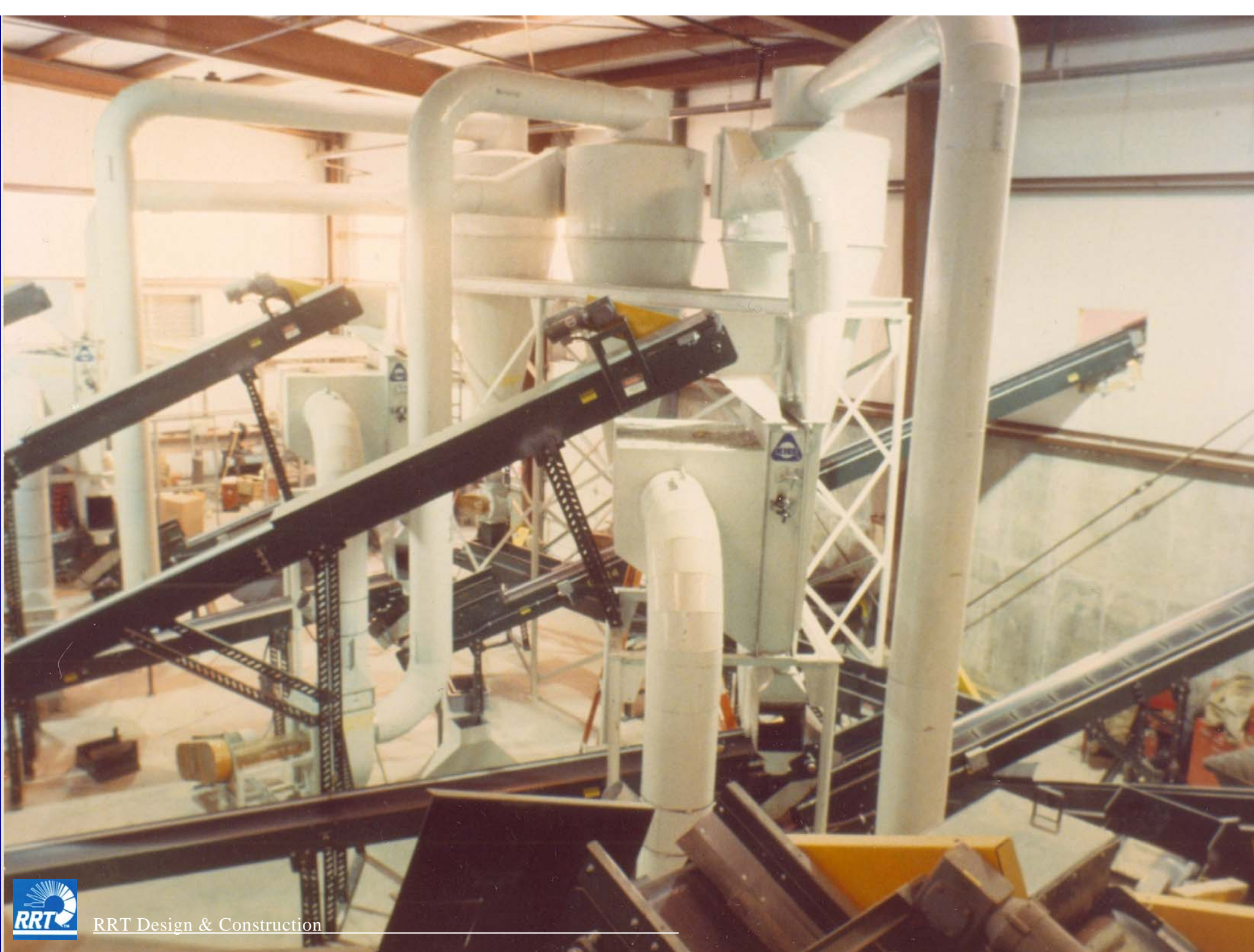
- Minimize breakage
- Sort by color
- Blue Bag cushions glass





RRT Design & Construction





Shift in Thinking

Improve Sorting

- Optical Sorting to Mill Specs
 - Westchester County
 - Rhode Island (RIRRC)
 - Boulder County, CO
 - Hartford, CT
- Co-Locate Processor
 - RRT Empire Returns (Syracuse)
 - FCR Stanley, NY (Ontario County)

Shift in Thinking

Single Stream Arrives

- All glass is broken
- Glass sorting stops
- Solutions...?
 - Convert all to aggregate; Marketing is difficult. Most all landfilled
 - Ship-out to processor
 - Processor deals with the glass
 - Yield
 - Minus ¼ inch out
 - Contaminants out
 - Green glass still difficult
 - Cost/Freight
 - Remove from Program



Shift in Thinking

Single Stream Plant Design

Early Plants

- Get paper out first
- Let glass travel to the end following the containers, sort what you can and let the rest go to residue

.....bad idea

Single Stream Plant Design



Modern Good Plants

- Get glass out first (pre-screen/glass breaker)
- Get the glass out again (another screen)
- Rest is in the paper or residue



Shift in Thinking

Single Stream Plant Design

Modern Best/Large Plants

- Get glass out first (pre-screen/glass breaker)
- Get more glass out again
- Screen container line negative sort (trash/residue)
- Screen paper line negative sort (news/mixed paper)

With the glass out, now what do we do with it and the fines?



Fines (aka Minus 2 inch)

MRF Location	% Glass	% Non-glass
MI	70	30
CT	80	20
NY	82	18
NJ	85	15

Source: RRT, above is minus 2 inch

Fines Breakdown

Material Type	Composition (%)
Mixed Broken Glass	70.00
Fines Glass (dirt)	1.19
Paper Shreds	25.35
Trash (non-glass, non-paper)	3.46
TOTAL	100.00

Source: RRT, above is minus 2 inch

Mixed Broken Glass Breakdown

Material Size	Composition (%)
3/8 inch plus	50.00
3/8 inch minus	50.00

Source: From two New England processors

Clean-Up Systems

Two Steps

- Screening- Remove fines
- Air Classification- Remove light contaminates

What you can get

- “Glass” Product for a 3rd party processor
- “Glass” Product for landfill use
- “Paper” Product for blending with mixed paper
- ...but not everyone creates the same quality, size & type of products.....

Different Approaches

	1 Nothing	2 Nothing	3 Air	4 Air	5 Air	6 Air, Screen	7 Air, Crush & Screen	8 Crush & Screen	9 Air, Screen & Crush	10 Air, Screen & Crush
Paper Product			✓				✓			✓
Aggregate Product					✓	✓	✓	✓	✓	✓
3 rd Party Processor		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓

.....glass and trash are driven by local markets & preferences.... 25

Techniques

- Vibratory Separator (RRT/Joest)
- Orka Air Separator (Binder)



Air Classification Techniques

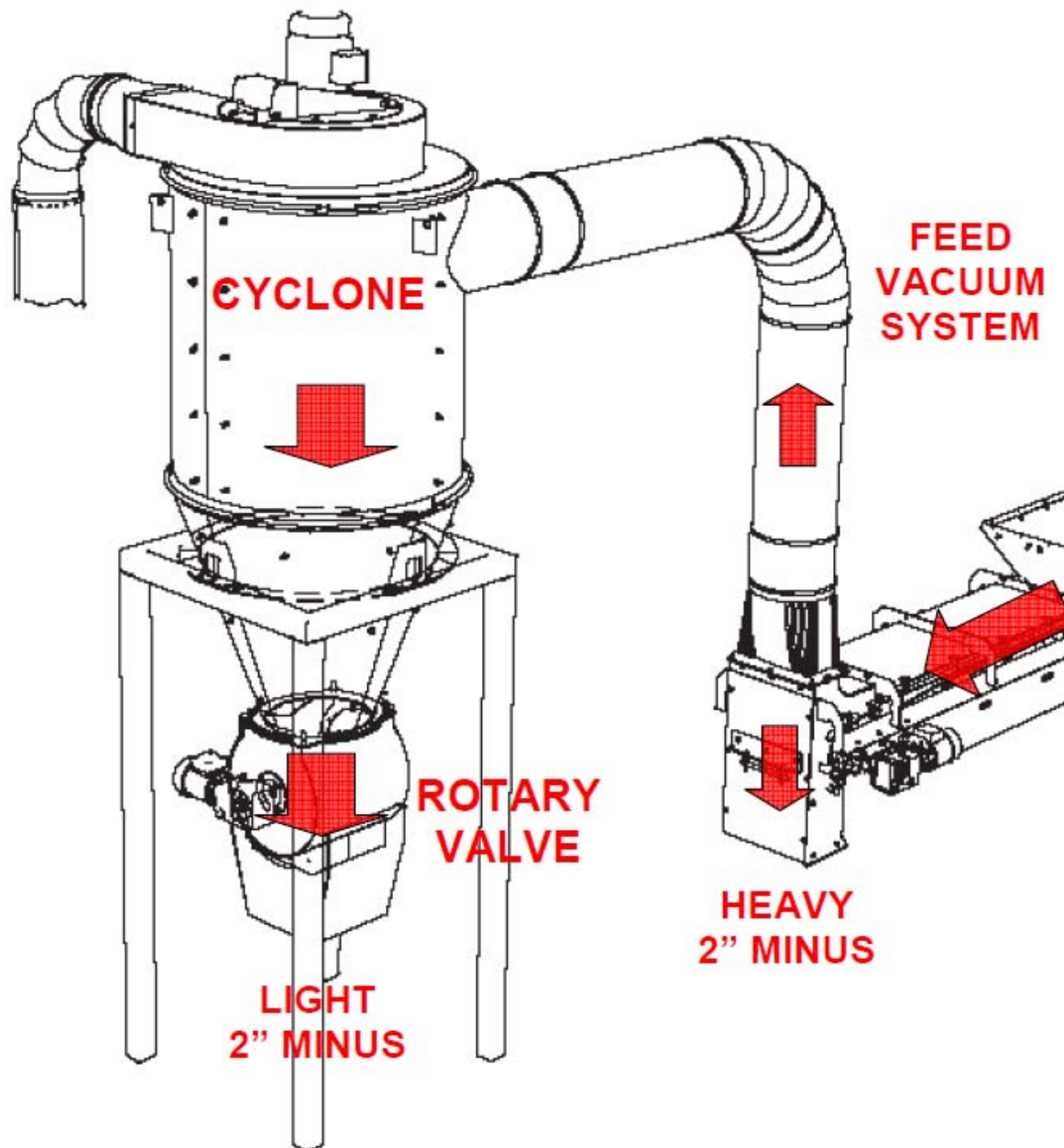
- Vibratory Screen/Feeder with air pickup at end
- Vibratory Feeder with combo drum separator & air pickup at end
- Belt Conveyor with air pickup at end
- Belt Conveyor with air pickup at end

+

- Air pickups at conveyor belt transfer chutes
- Air pickups at screen discharge chutes

+

- Cyclone
- Baghouse with Air lock
- Fan



Screening Techniques

- Vibratory Screens
- Trommel Screens







RRT Design & Construction







Minus 3/8 inch- Brand X

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓



Minus 3/8 inch- Brand Y

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓

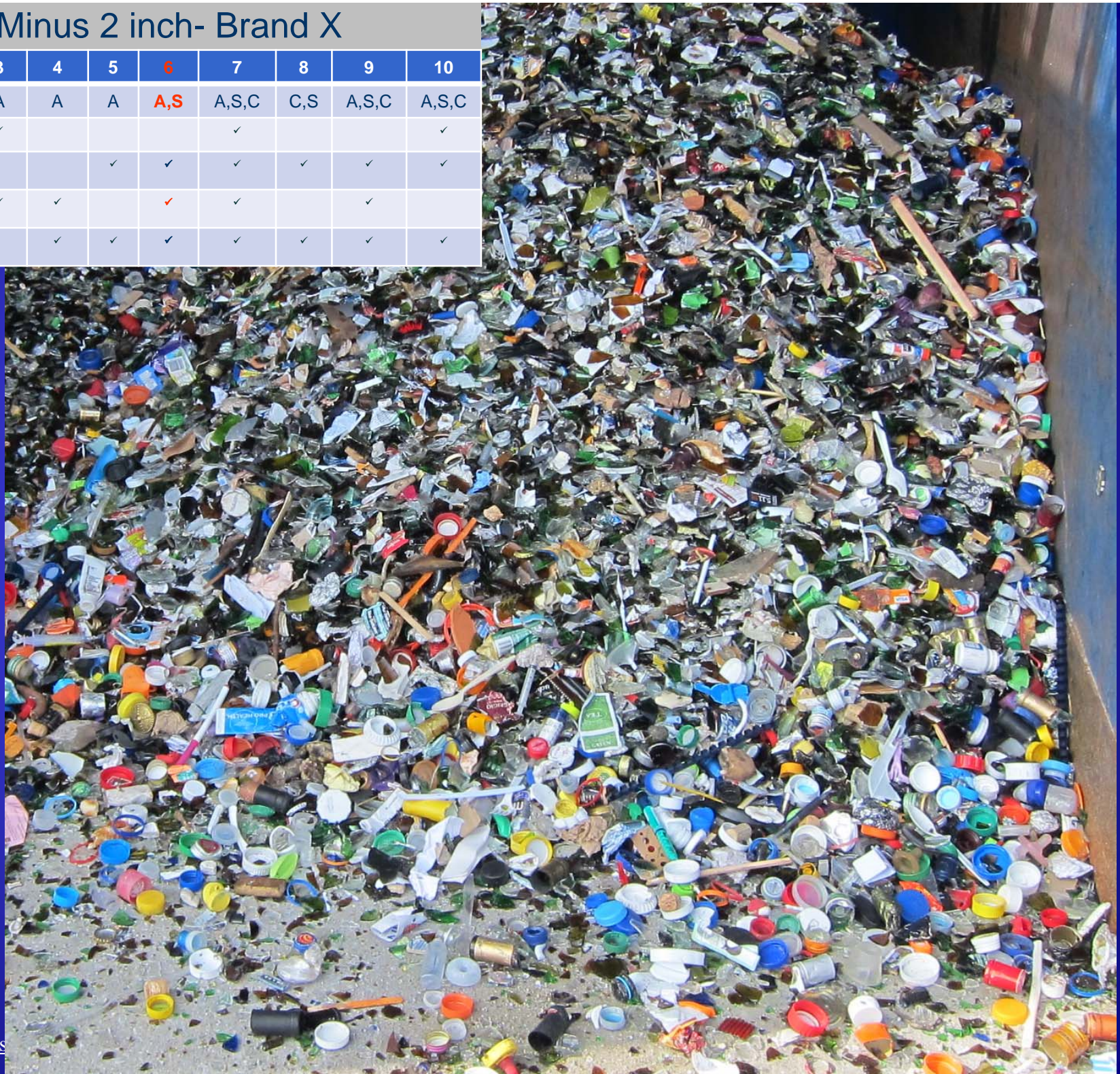


Plus 3/8, Minus 2 inch- Brand X

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓

Plus 3/8, Minus 2 inch- Brand X

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓



Minus 2 inch- Brand Z

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓



Minus 2 inch- Brand Z

	1	2	3	4	5	6	7	8	9	10
Approach	-	-	A	A	A	A,S	A,S,C	C,S	A,S,C	A,S,C
Paper			✓				✓			✓
Aggregate					✓	✓	✓	✓	✓	✓
3 rd Party		✓	✓	✓		✓	✓		✓	
Landfill	✓			✓	✓	✓	✓	✓	✓	✓



Opportunities

Sandblast media instead of ADC
Fine grind into a cement replacement in concrete
(pozzolan; a material when water is added will react with calcium hydroxide to form a cement like material)



