



Report on MSE Transparent Recycling Bin Pilots

Prepared by Zero Waste SG
With inputs from MSE
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Background

1. Under the Singapore Green Plan 2030, Singapore has set targets to achieve a national recycling rate of 70% by 2030, which is supported by targets to increase the domestic recycling rate to 30% by 2030 and the non-domestic recycling rate to 81% by 2030.
2. Singapore's domestic recycling rate¹ currently stands at 13% (2021)². Recyclables collected under the National Recycling Programme are also subject to recycling bin contamination, which was found to be around 40%³ in 2019.
3. Based on one of the recommendations arising from #RecycleRight Citizens' Workgroup⁴ in 2019, MSE adapted and piloted new transparent recycling bin designs at selected blocks in Hong Kah North Single Member Constituency and East Coast Group Representative Constituency between 14 Nov 2021 to 9 Jan 2022. The pilots assess if adding a transparent feature or introducing segregation could encourage better recycling behaviour and reduce recycling bin contamination⁵.
4. Zero Waste SG partnered MSE for the management of these "Transparent Recycling Bin pilots". This report contains Zero Waste SG's analysis and recommendations on the pilots.

1 The domestic recycling rate comprises recyclables collected from the National Recycling Programme (NRP) and recyclables from the informal recycling sector (e.g. karang guni)

2 Waste Recycling Statistics and Overall Recycling, <https://www.nea.gov.sg/our-services/waste-management/waste-statistics-and-overall-recycling>

3 Three in Five Households Recycled Regularly In 2021, <https://www.nea.gov.sg/media/news/news/index/three-in-five-households-recycled-regularly-in-2021-singaporeans-are-encouraged-to-recycle-more-and-recycle-right>

4 In September 2019, MSE convened a #RecycleRight Citizens' Workgroup, where 48 Singaporeans met over four days to work together with MSE to co-create solutions to improve the way households recycle (i.e. to reduce contamination and encourage households to recycle more. One of the teams from the Workgroup came up with a proposal to improve the design of current recycling bins.

5 Transparent recycling bins pilot to nudge positive recycling behaviour, NEA, <https://www.mse.gov.sg/resource-room/category/2021-11-14-media-release-on-transparent-recycling-bins-pilot/>

Methodology

Pilot A

1. The objective of this pilot was to test if a retrofitted transparent feature on an existing recycling bin could reduce recycling contamination. The types of bins involved are shown in the pictures below. The pilot was conducted over eight weeks, with the first week used as a baseline.

CONTROL BINS



Regular Recycling Bin (Bin 4)
3 Bedok South Avenue 1



Mega Bin (Bin 5)
441C Bukit Batok Avenue 8

EXPERIMENT BIN



Retrofitted transparent feature



Retrofitted bin with transparent feature (Bin 2)
29 Upper Changi Road and 440B Bukit Batok West Avenue 8

Note: Only replaced Control Bins from week 2 onwards. The first week collection was used to establish a baseline for this pilot.

Pilot B

- The objective of this pilot was to test the effectiveness of having separate housing for glass, paper, metal, and plastic in reducing recycling contamination. Both control and experiment bins were transparent, and had an educational display on the top of the bins to show what could not be recycled.
- Pilot B's bins were placed near the Resident Committee (RC) Centres where there was more footfall. As the bins were smaller, they were meant to supplement (but not replace) the existing blue recycling bin of the block. The pilot was conducted over eight weeks. The types of bins involved are shown in the pictures below.

CONTROL BIN



Educational display on top of the bin

Newly fabricated comingled transparent bin (Bin 1)
369 Bukit Batok Street 31, 37 Bedok South Avenue 2

EXPERIMENT BIN



Educational display on top of the bin



Newly fabricated segregated transparent bins with four compartments for glass, paper, metal, and plastic (Bin 3)
343 Bukit Batok Street 34, 33 Bedok South Avenue 2

4. The findings contained in this report drew from two sources:

a. Contamination rates found in bins

MSE appointed Chye Thiam Maintenance, a company which provides recycling services, to:

- i. Collect items found in the bins – This was done three times a week for pilot A, and once a week for pilot B. Collection was done manually, without a recycling truck.
- ii. Sort items based on whether they were recyclable, and further by type of material (i.e., glass, metal, plastic, paper, others, electronics, reusables)
- iii. Weigh each category and establish a contamination rate. Recycling contamination rates were derived by dividing the weight of contaminants⁶ by the total weight of items collected.

b. Residents' survey

A survey was co-created by Zero Waste SG and MSE to obtain feedback on the bins from residents living in blocks where control or experiment bins were placed. Zero Waste SG recruited volunteers to conduct the household surveys over two weekends in January 2022.

Findings on contamination rate found in bins

1. The findings on recycling contamination rates were inconclusive. Both pilots, which were both done at two locations, saw differing trends in contamination rates at each location.

Contamination rates

2. For Pilot A, the retrofitted transparent bin at Bedok saw higher contamination rates than the Control bin (see figure 1). This was the opposite at Bukit Batok (see figure 2), where the contamination rates for the retrofitted transparent bin showed signs of tailing off towards the later weeks.

⁶ Contaminants refer to items which should not be placed in the blue recycling bins under the National Recycling Programme. Examples of this include food or liquids, bottles or containers with food or liquid remnants, diapers, laminated paper, textiles, electronic appliances, ceramics. Please see [Annex A](#) for pictures of some recycling contaminants found during the pilots.

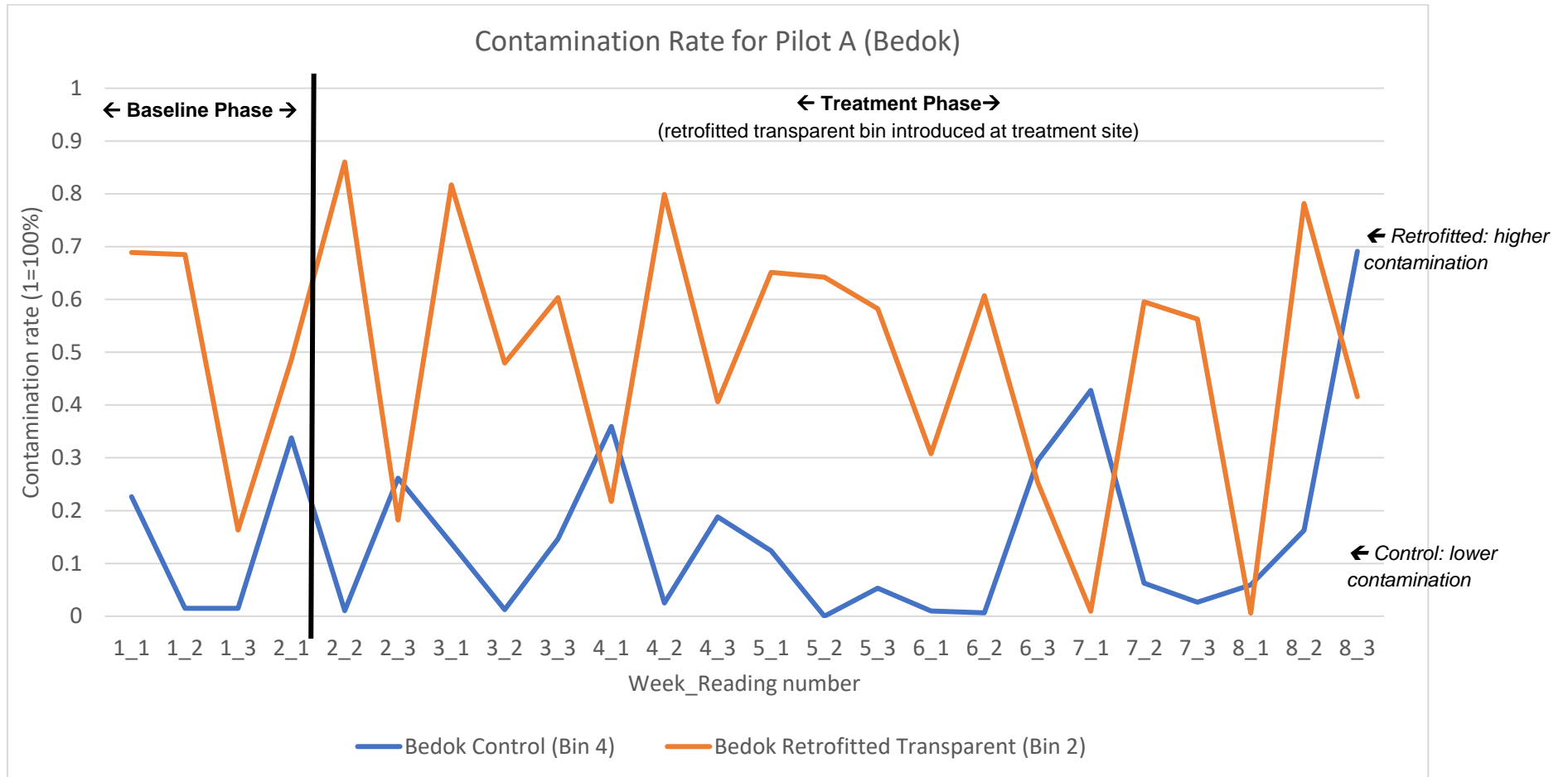


Figure 1. Recycling contamination rates for Pilot A, Bedok

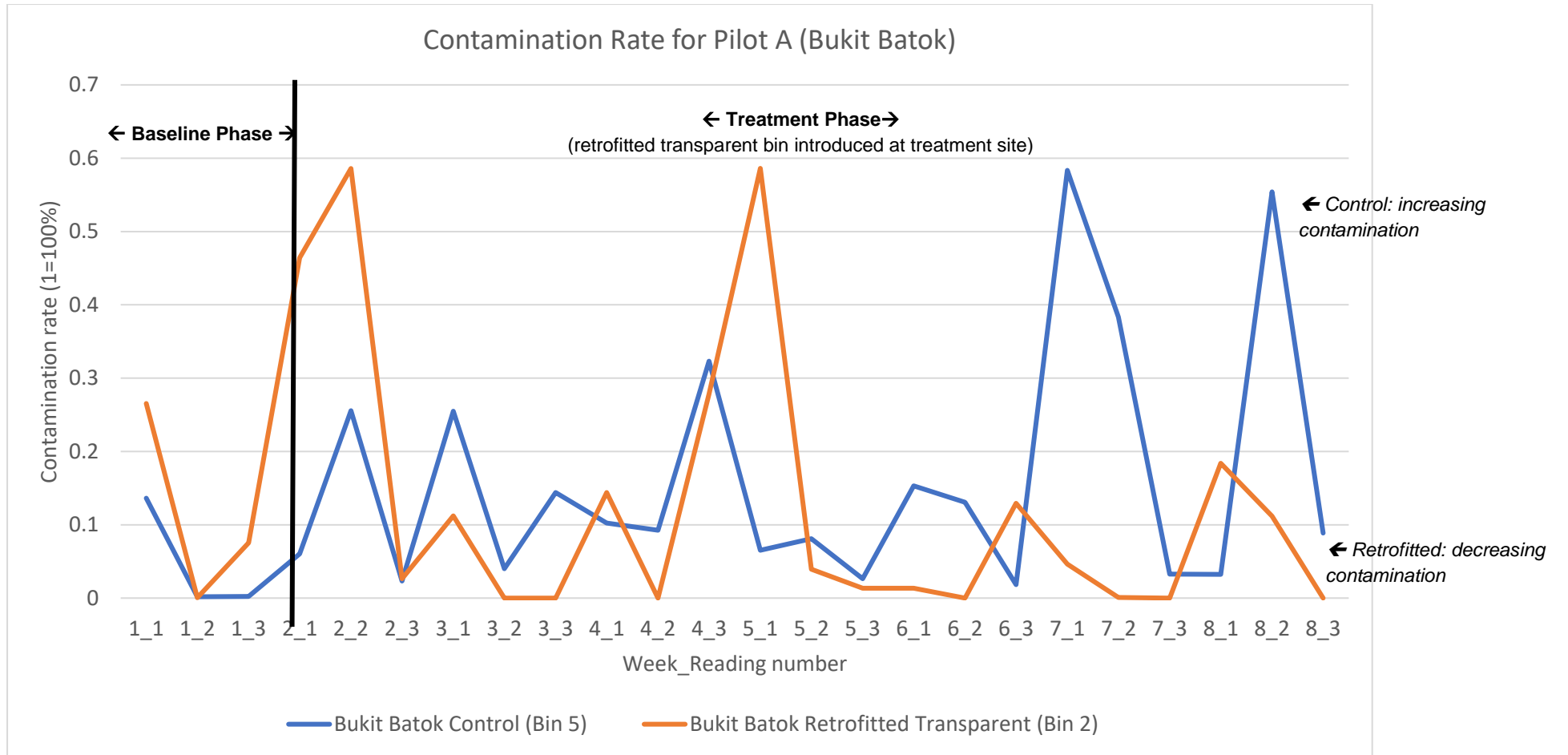


Figure 2. Recycling contamination rates for pilot A, Bukit Batok

3. The findings were also inconclusive for Pilot B. In Bedok, the segregated transparent bin had higher contamination rates than the comingled transparent bins (see figure 3). Whereas for Bukit Batok, the segregated transparent bin had lower contamination rates (see figure 4).

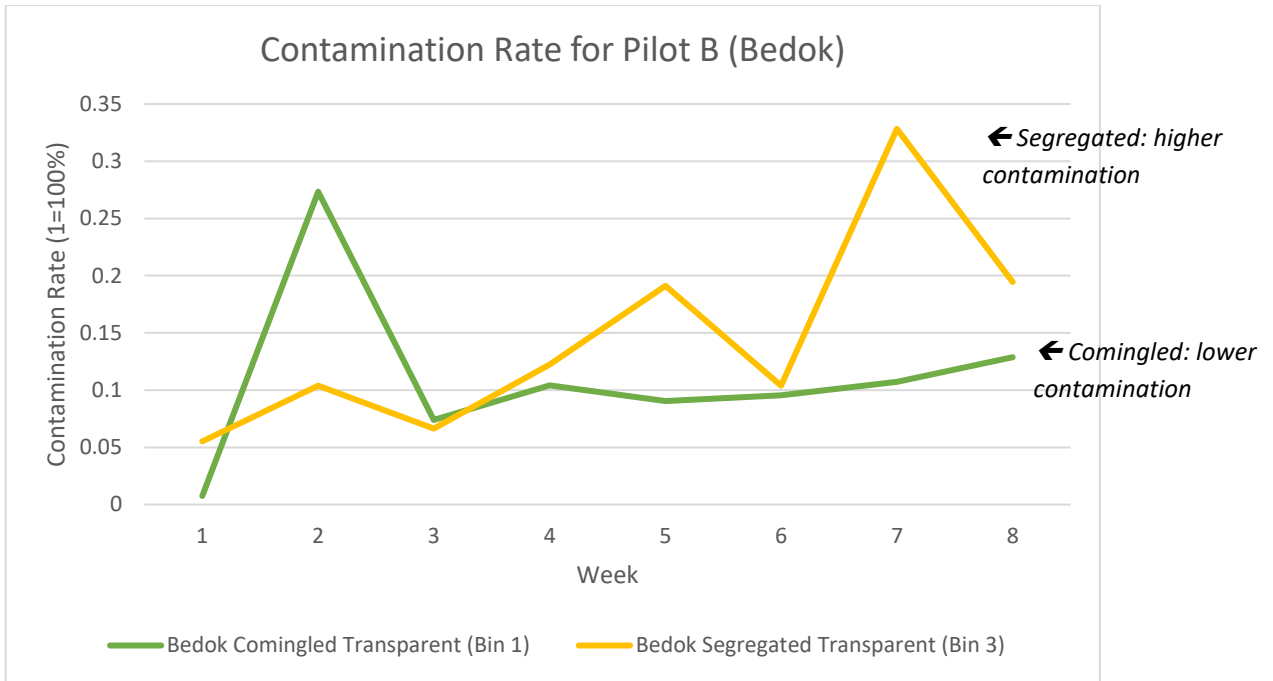


Figure 3. Recycling contamination rates for Pilot B, Bedok

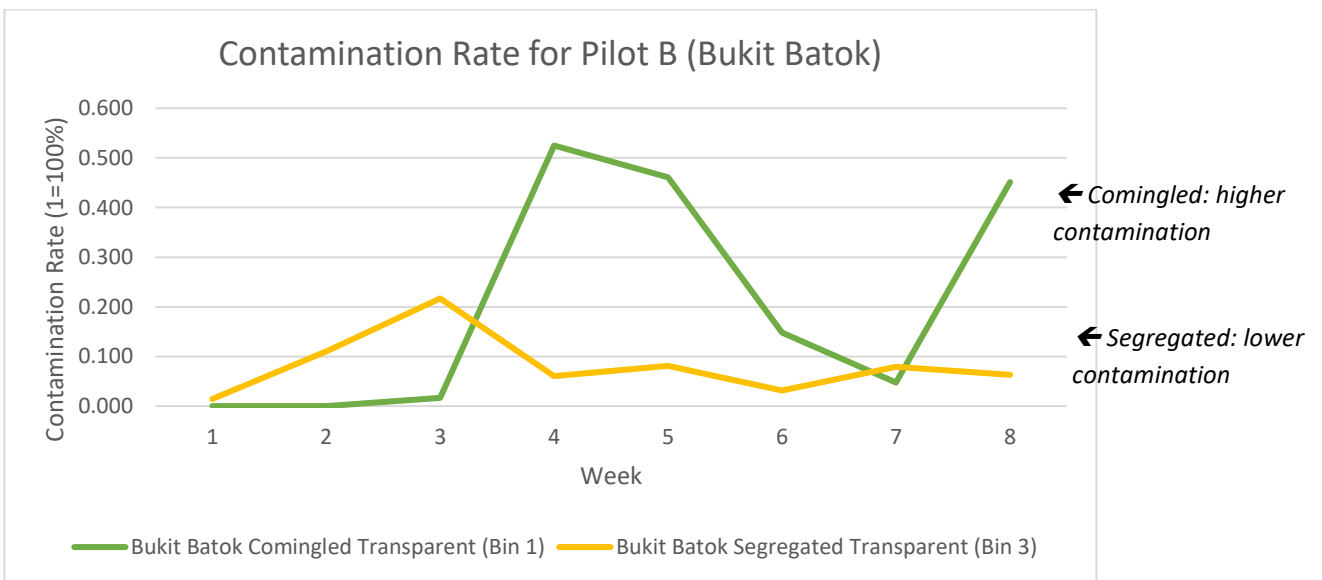


Figure 4. Recycling contamination rates for Pilot B, Bukit Batok

4. The summary of the average contamination rates is in table 1.

	PILOT A		PILOT B	
	Control Bin (Bin 4/5)	Retrofitted transparent bin (Bin 2)	Comingled transparent bin (Bin 1)	Segregated transparent bin (Bin 3)
Bedok	15.22%	48.89% ¹	11.01%	14.57%
Bukit Batok	14.94%	13.03%	16.05%	8.21%

Table 1. Average contamination per collection. For Bin 2, the average is over the last 7 weeks when bins were introduced.

Common contaminants

5. Across the bins², the most common contaminants (by weight) were:
 - a. Reusables (clothing, shoes, pillows, soft toys, toys etc),
 - b. Electrical appliances (household electrical appliances / electronics, computers and accessories, lamps, light bulbs, fluorescent tubes)
 - c. Others (disposable diapers, sanitary pads, tissue paper and mixed waste³)

6. However, this may not be indicative of whether they were most common in terms of quantity, as these categories of items are generally heavier when compared to lighter contaminants (such as a plastic or paper).

7. Please see [Annex B](#) for the breakdown of contaminants by category.

¹ This figure is an outlier compared to the other contamination rates. But even discounting this data point, the findings were deemed to be inconclusive based on the week-on-week data fluctuations in figure 1.

² There was one exception seen in Pilot A's control bins (regular recycling bins), where there was a significant amount of contaminated plastic was found in Week 4.

³ Mixed waste in this report's context refers to items made of several materials and are not easily separatable.

Findings from residents' survey

Residents' preference

1. Majority of residents⁴ (71%) surveyed said they preferred to use the segregated transparent bins, i.e., bin 3 (see figure 5). They appreciated the educational display and the ability to see what was inside the bins.

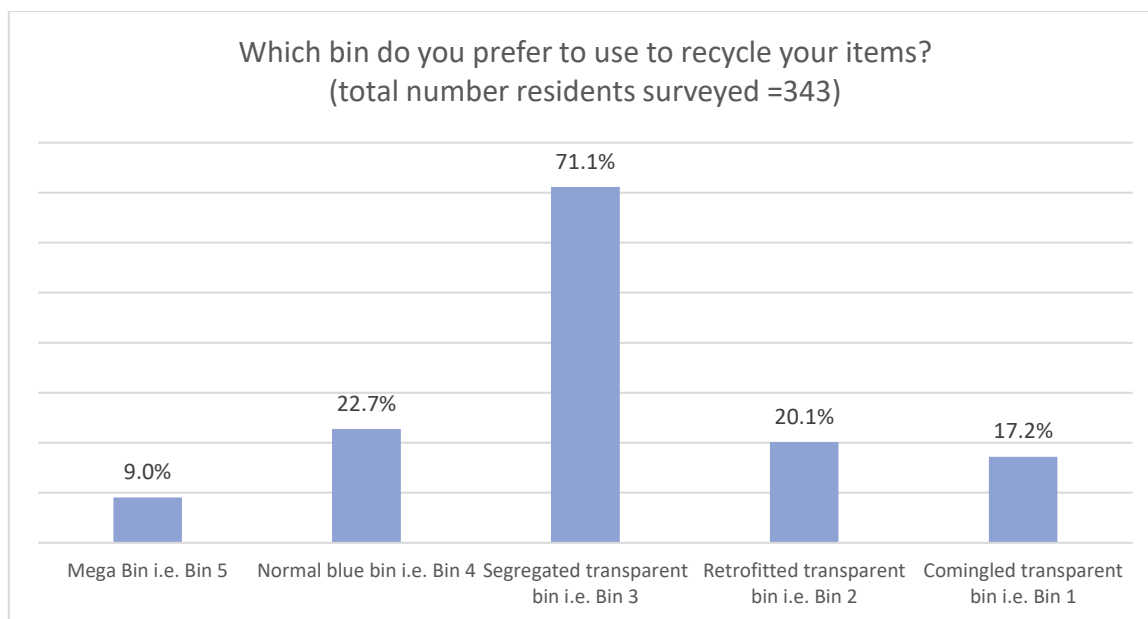


Figure 5. % Residents voting for each bin design. Residents were allowed more than 1 vote.

2. However, residents living in the blocks with the segregated transparent bin also raised some practical constraints of such a design – namely the smaller container size for each material type which would result in the bin filling up very quickly. Please see table 2 for overall verbatim feedback from residents on the bins.

Benefits of the on the segregated transparent bin (Bin 3)
<i>Good because it's easier to clearly see where people throw. More accountability. It's easy to correct people when they throw wrongly</i>
<i>I think it's better for the elderly, cos they cannot see cannot read. And sometimes in a hurry, pictures speaks louder than words</i>
<i>I think it's good. I am an environmental engineer anyway so for me it's good. We try to avoid plastic regardless of the bin. The old bins people didn't know what to dispose. This one is good because it displays what we can dispose and they can see through transparency. Pictures are better than words to say what can be recycled. The transparency and visuals are most important.</i>

⁴ Not all of those surveyed had used the bins. For those who did not use the bins, pictures of all bins were shown to aid them in answering the survey question.

<i>It's very good, clear on what can put inside or more. And the condition inside. I rarely use the blue bins because I don't what's inside.</i>
<i>Better than the original... Helps to separate everything in their own, people dont [sic] anyhow throw</i>
<i>Would prefer segregate to segregate the materials and its easier for the collectors as well</i>
<i>To me there's no difference. I think segregation helps, regarding what can be recycled and what's not. But it won't change the mindset much.</i>
<i>A bit small but transparent is good</i>

Practical constraints of the segregated transparent bin (Bin 3)
<i>Too small for household recycling. Passer by drinking a can drink ok la...</i>
<i>It has to be bigger. Too narrow. I prefer the usual recycling bins</i>
<i>Too small. Gets full easily and it is a deterrence for me to use it after that. Pls place more of this [sic] bins or make it better</i>
<i>...I've been recycling for 20 years but this bin is way too small. I collect items and recycle once a week. So the items is a large amount of items (2 bags). Can't put inside the new bins</i>
<i>Capacity is too small. Good to have different columns so that people know what can be recycled. There's not enough being done on what can be recycled and what can't.</i>

Table 2. Verbatim feedback from residents on recycling bin designs (transcribed by ZWSG team and volunteers administering the survey)

Resident's knowledge of common contaminants

3. When quizzed on what can be placed in the blue recycling bins, most residents were familiar with the four main categories of recyclables (i.e., paper, glass, metal plastic). However, a proportion of residents had wrongly categorised the following items as recyclable:
 - a. Textiles and clothing (35.40%)
 - b. Tissues (22.26%)
 - c. Styrofoam (18.61%)
 - d. Bulky items (10.95%)
 - e. Food-stained items (6.20%)
4. Please see [Annex C](#) for the breakdown of responses.

Recommendations

1. Based on the contamination rates, the findings on the effect of having transparent or segregated bins on recycling contamination were inconclusive as there were no consistent positive or negative trends.
2. If the pilot is to be revisited in the future, the design of the pilot and/or bin should explore or address the following:
 - a. Residents gave feedback that the bin was small and could become full too quickly (especially for Bin 3). Some possible solutions are to increase the bin's clearance frequency, or to make standalone larger bins for individual materials. However, these changes must be complemented with education to avoid a higher amount of contaminants being collected
 - b. The display feature used in pilot B was welcome by residents. There may be room to use this to address commonly mistaken items, e.g., clothing, toys, mugs.
 - c. The pilot could be run at more locations to allow a larger sample size, but each location's context (e.g. population) needs to be taken into consideration
3. We recommend that any island-wide change should consider the costs and benefits involved. For example:
 - a. Using the comingled, transparent bin (Bin 1) or the segregated transparent bin (Bin 3) would require manual collection, which takes more time. This may not be scalable.
 - b. Not all residents preferred the newer bins. About one-third of the residents surveyed indicated they preferred the existing bin designs (i.e., Mega bin or regular blue bins) – see figure 5.
4. We believe that the high recycling contamination rates in some of the readings and pilot locales could be due to misconceptions over what can be placed in the blue bins. Hence, more focus should be placed on effective and clear public education. For example, by:
 - a. Targeting specific items through public education efforts, i.e., educate public on commonly mistaken items such as textiles and clothing; tissue⁵; styrofoam; and bulky items.
 - b. Consider leveraging educational displays as it was well received by residents.

⁵ For tissue paper, there may be a need to emphasise that both clean and dirty tissues should not be put into the blue bins.

Annex A: Photos of common contaminants collected by Chye Thiam

Note: The list of photos shown here is not exhaustive.



Picture 1. Paper recyclables contaminated with food or liquids, 19 Nov 2021 at 3 Bedok South Ave 1.



Picture 2. Diapers, 29 Nov 2021 at 441C Bt Batok Ave 8.



Picture 3. Styrofoam, 6 Dec 2021 at 29 Upper Changi Rd.



Picture 4. Textiles, 29 Dec 2021 at 37 Bedok South Ave 2.



Picture 5. Mixed waste, 15 Dec 2021, 343 Bt Batok St 34.



Picture 6. Glass contaminated with food, 15 Dec 2021 at 369 Bt Batok St 31.



Picture 7. Ceramics, 8 Dec 2021, 33 Bedok South Ave 2.



Picture 8. Composite packaging, 13 Dec 2021, 440B Bt Batok West Ave 8.

Annex B: Analysis of recycling contaminants

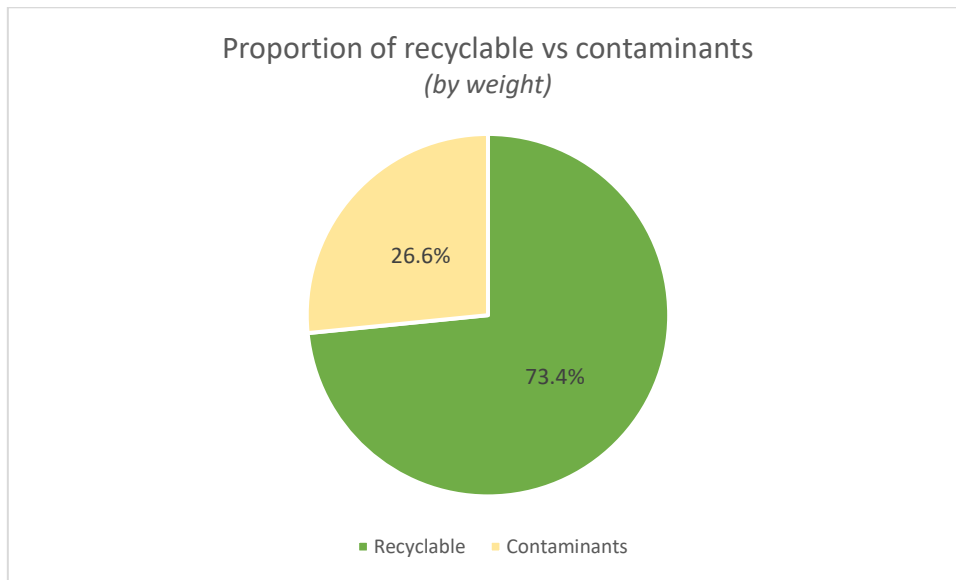


Figure 6. Proportion by weight of contaminants out of total deposits collected across all bins

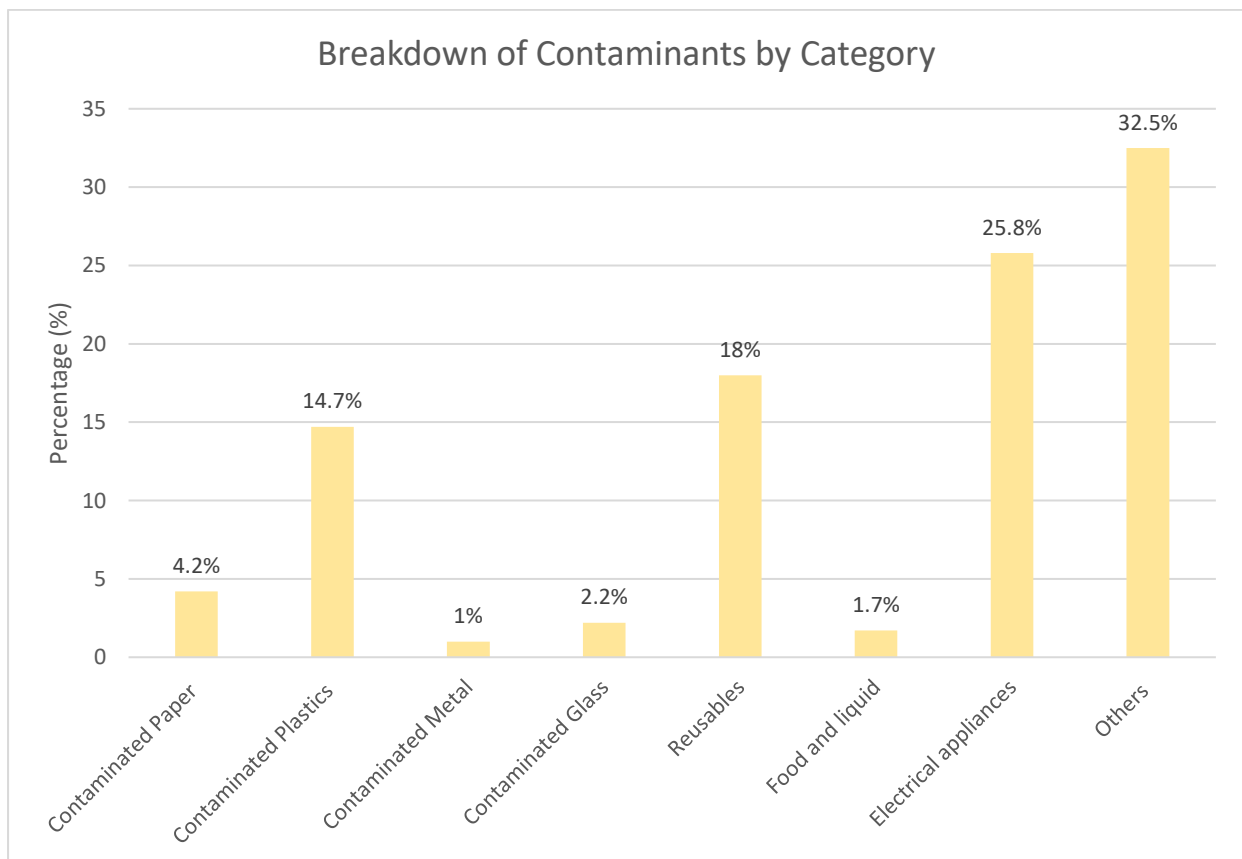


Figure 7. Breakdown of contaminants collected across all bins, by item type⁶

⁶ The 'others' category refers to items such as disposable diapers, sanitary pads, tissue paper and mixed waste. Mixed waste in this report's context refers to items made of several materials and are not easily separable.

Annex C: Analysis of residents familiarity with what can or cannot be recycled

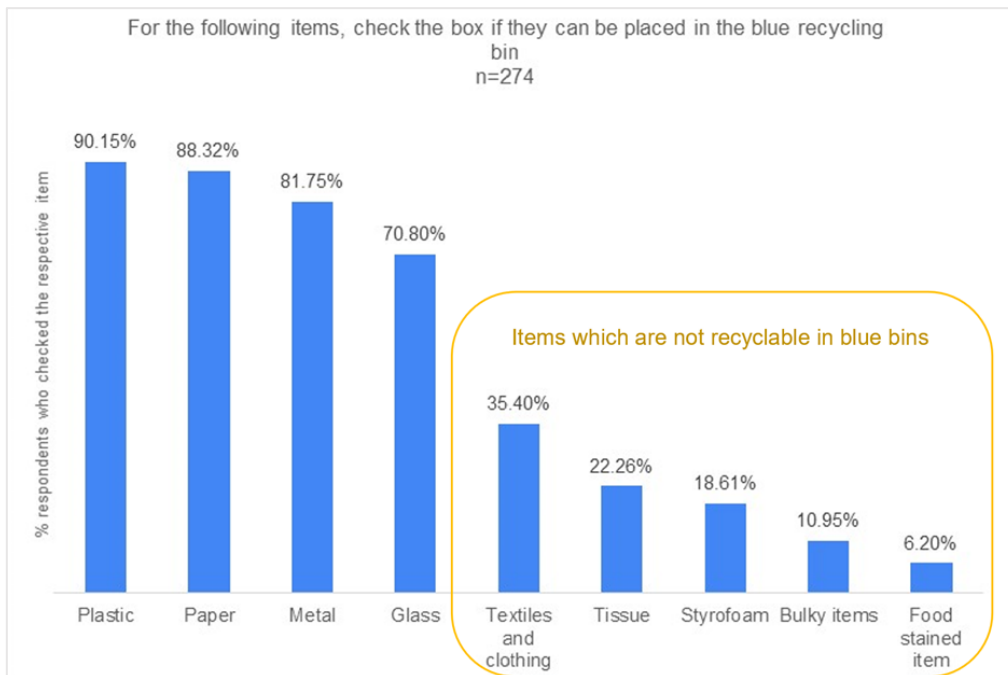


Figure 8. Responses from residents who use the bins / chute to recycle

Annex D: Caveats and Qualifications

1. We would like to note the following factors and observations which may have influenced the data collected and conclusions drawn in the previous segment:
 - a. Pilot A's Control bins for the two locations were different. Bedok had the regular 660L recycling bins (Bin 4), while Bukit Batok had Mega Bins (Bin 5).
 - b. Placement of bins under blocks differed based on the block's layout. For example, some of the 660L bins had to be placed near busy walkways.
 - c. MSE did not require Chye Thiam to submit data for items that were not placed inside the bin (i.e. placed adjacent to the bins).
 - d. In general, the age profile of Bukit Batok residents seemed to be younger than that in Bedok.



LEADING THE DRIVE TOWARDS ZERO WASTE

Prepared by Zero Waste SG
With inputs from MSE