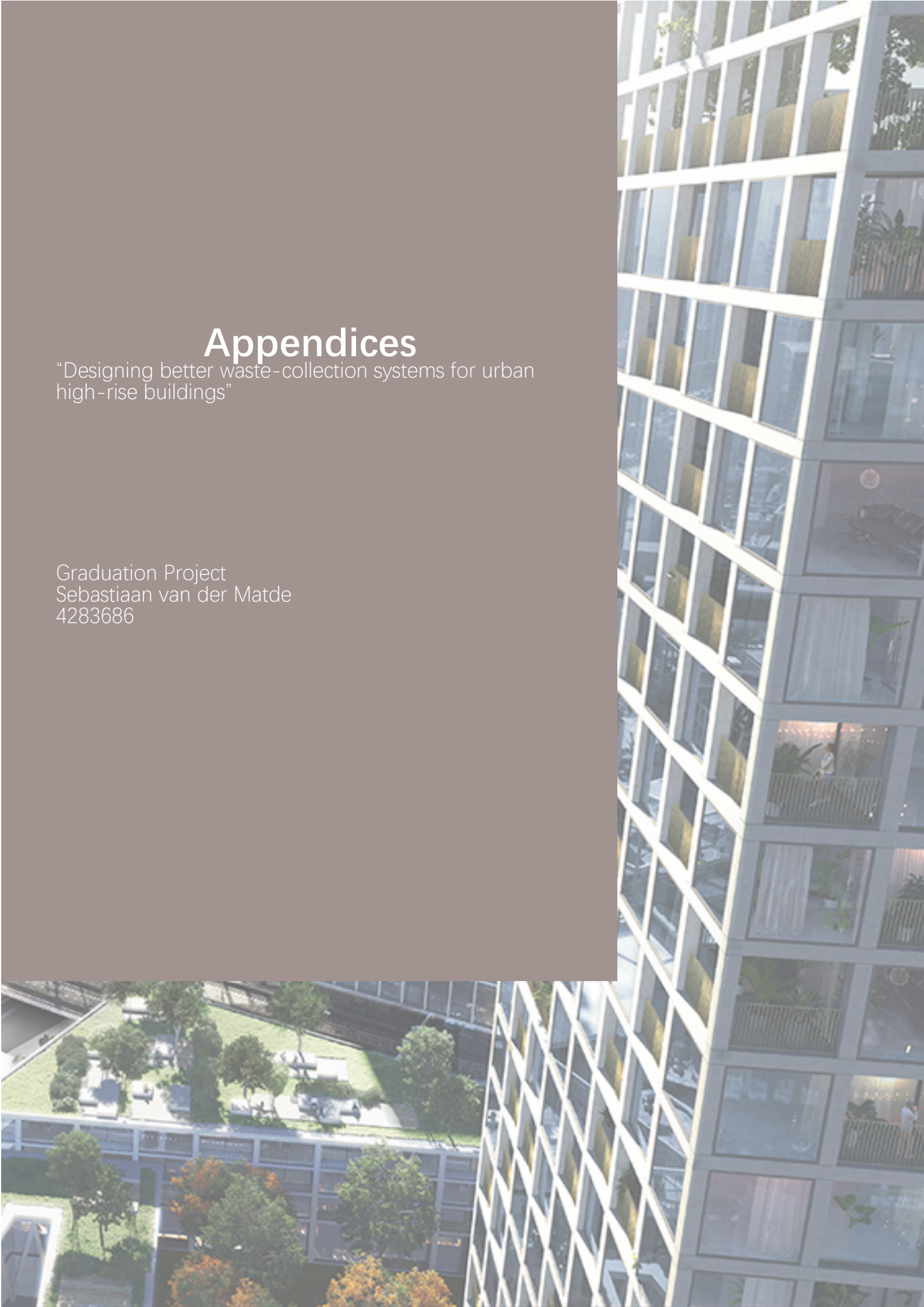


# Appendices

“Designing better waste-collection systems for urban high-rise buildings”

Graduation Project  
Sebastiaan van der Matde  
4283686



## Appendices

- A - Graduation Project Brief
- B - Conversion Table for Weight and Volume of Waste Fractions
- C - Programme of Requirements
- D - Data about MSW in Rotterdam
- E - Alternative Strategy for Improving the Collection Rate
- F - Concept Directions
- G - Previous Iteration of the Concept
- H - On the Shredding of PMD Waste
- I - Evaluation - Questionnaire and Results

## Appendix B: omrekeningstabel van m<sup>3</sup> naar ton



Component		Vermenigvuldigingfactor
<b>AEEA</b>		
– groot wit		1 stuk = 54.24 kg
– koel & vries		1 stuk = 48.26 kg
– overig AEEA		1 pallet = 334 kg (per stuk gem. 3.43kg)
– TV		1 pallet = 319kg (per stuk gem. 20 kg)
<b>Autobanden</b>		1 autoband = 7 kg 0,1
<b>Bouw- en sloopafval</b>		
– asbesthoudend materiaal (golfplaten, Eterniet, buizen, gevelplaten, vinylvloertegels, onderlaag, vloerbekleding, bloem- bakken, onderdakplaten, school- borden		600kg/m <sup>3</sup>
– bouw- en sloopafval		1,5
– gemengd bouwpuin(= niet steenachtig bouwpuin zoals ytongblokken, gips, kalk, pleister- werk, knauf, porcelein (WC- potten+ wasbakjes), wandtegels		300kg/m <sup>3</sup>
roofing		400kg/m <sup>3</sup>
<b>GFT</b>		1m <sup>3</sup> = 775 kg
<b>Glas</b>	wit	0,9
	gekleurd	0,9
	gemengd	0,9
<b>Groenafval</b>		
– bladeren		0,4
– boomstronken		1 stuk = 50 kg 1m <sup>3</sup> = ong. 600 kg
– gazonmaaisel		0,45
– gemengd tuinafval		0,35
– snoeihout	gestapeld	0,15

	versnipperd	0,4
<b>Grofvuil</b>		0,2
<b>Houtafval</b>		0,1
<b>Huisvuil</b>		0,5
<b>Isomo</b>		0,01
<b>KGA</b>		
– auto-accu's		1 stuk = 13 kg
– motorolie		1 l = 0,9 kg
– tl-lampen		3 stuks= 1kg
<b>Kroonkurken (450 kroonkurken =1 kg)</b>		1,1
<b>Kunststoffen</b>		
– bloempotjes		60kg/m <sup>3</sup>
– folie		30kg/m <sup>3</sup>
– kunststoffen gemengd		0,06
– landbouwfolies		0,5
– pvc		85kg/m <sup>3</sup>
<b>Luiers</b>		0,4
<b>Metalen gemengd</b>		1,1
<b>Papier en karton</b>		
– papier		0,4
– karton		0,2
– papier en karton gemengd		0,4
<b>Rioolkolkenslib</b>		1,2
<b>Textiel</b>		0,4
<b>Veegslib</b>		0,2
<b>Verpakkingen</b>		
– drankkartons		0,05
– kunststofflessen		0,023
– metalen verpakkingen		1,1

# Appendix C: Programme of Requirements

## Requirements

The design needs to...

### *Residents*

- Inform residents about the wanted behaviour in a clear way (what should they do)
- Make recycling easily understandable (how should they do it)
- Make recycling easy to do by:
  - Helping residents make optimal use of their space
  - Making the recycling process a small(er) time investment
  - Making the distance between the front door and the collection point as small as possible
  - Making starting out with recycling easy
  - Not requiring big investments by residents for bins or services
  - Being a clean and safe solution
- Be resistant to vandalism and improper use
- Prevent access to garbage by residents and other unauthorised persons
- Be usable by any independent person over 12 years old

### *Building owner / Developer*

- Have the claim on space be as small as possible
- Be similarly costly to current solutions or less so
- Be able to be cleaned / repaired easily

### *Municipality / Collection agents*

- Adhere to the laws and regulations on waste collection
- Make it possible to collect the waste with similar ease to the current situation.
- Make sure the waste is still suited to be collected with garbage trucks similar to those used currently

### *Processors.*

- Prevent contamination of the waste fractions by fluids and other waste

### *Product specifications*

- Deal with the collection residual and organic waste, and any waste used for packaging such as paper, glass, metals and plastics
- Have enough storage capacity for the average waste produced in the households of the intended users in 2 weeks
- Last for at least half of a building's average lifespan, around 30 years

## Opportunities

It would also be nice if...

- The amount & specifics of the waste streams could be changed (to help the city adapt to the developments in the waste processing)
- It can offer a reward for recycling
- It can track the amount of waste collected
- It can detect if the container should be emptied
- It gives feedback of the collected amounts to the users
- It will make recycling behaviour visible to set norms
- The way of collection makes post-sorting easier for current or future technologies
- The design makes it so that garbage trucks don't need to enter the neighbourhood

## Appendix D: Rotterdam Waste Data

The following data was found on <https://afvalmonitor.databank.nl/>

Ingezelde hoeveelheden en scheidingspercentages huishoudelijk afval 2017 - Rotterdam								
	Totaal aangeboden huishoudelijk afval [Kilo's per inwoner]	Hoeveelheid fijn huishoudelijk restafval [Kilo's per inwoner]	Gescheiden ingezameld gft [Kilo's per inwoner]	Gescheiden ingezameld papier [Kilo's per inwoner]	Gescheiden ingezameld glas [Kilo's per inwoner]	Gescheiden ingezameld textiel [Kilo's per inwoner]	Gescheiden ingezameld PMD (kunststof verpakkingen, blik en drankkartons) [Kilo's per inwoner]	Scheidingspercentage totaal huishoudelijk afval [Percentage]
Rotterdam	416	297	12	21	9	3,4	2,4	21

## Appendix E: Alternative strategy for increasing collection rates

In areas where the recycling rates are especially low, such as high rise neighbourhoods, a strategy for increased collections might be to reduce the amount of different waste streams.

This will make it easier for people to recycle: They will need less area for collecting the waste in their house, it is easier to know what should go where, and they have to make fewer trips to the collection area. Also, it will make collection more streamlined: fewer garbage trucks need to drive through the city to empty the different containers. This is especially advantageous for areas such as new Pompenburg, where cars are averted from the neighbourhood centre.

This practice has to be combined with new sorting facilities that can take the combined streams apart again. Deciding which streams to combine is difficult however. The combined streams shouldn't contaminate each other, and it should be possible to completely separate them from each other again. This means residual and organic waste should always have their own containers. Also, at this point it is very unadvisable to combine glass and paper waste in the same stream, since small particles of glass get stuck inside the paper fibres and cause all sorts of issues in existing single-stream recycling lines.

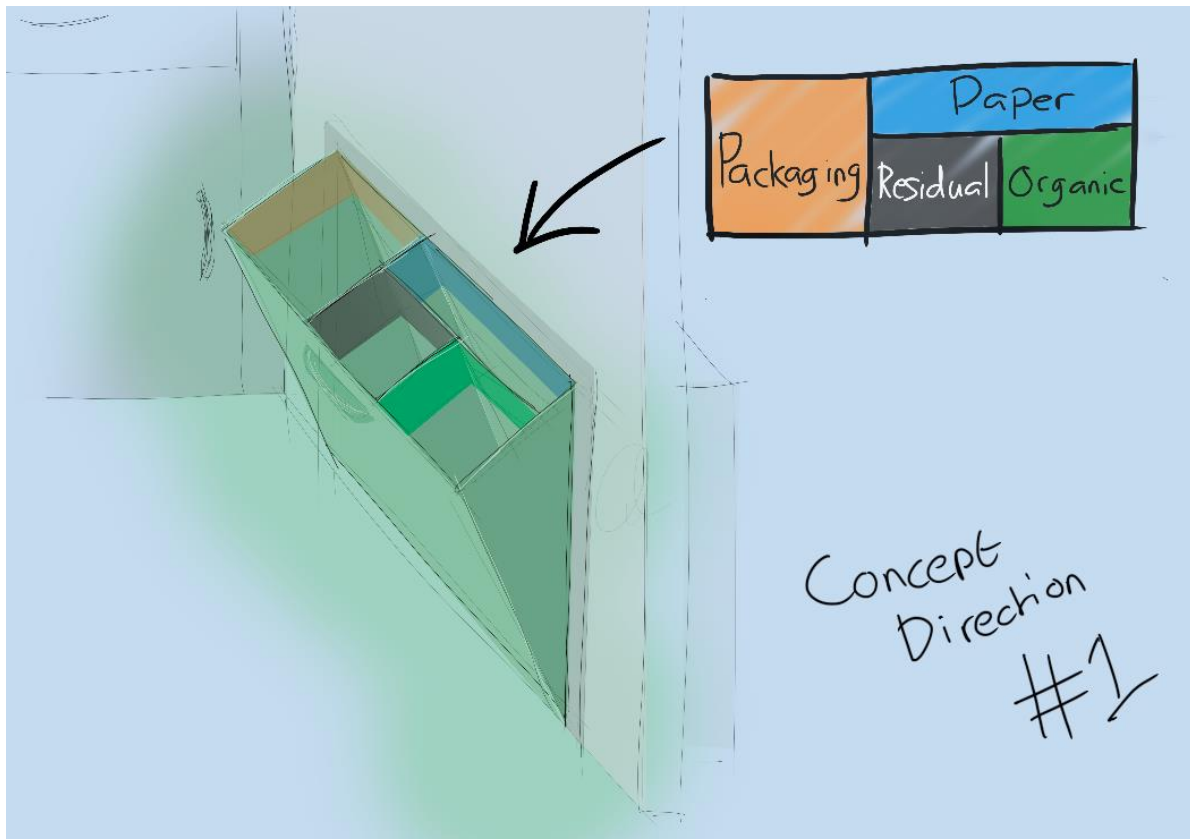
Something that is viable however, is to combine the current PMD fraction together with the glass fraction into a single 'Packaging' fraction. This new fraction will compose about 14% of the Rotterdam waste material, which is comparable to that of paper and cardboard. Having these streams combined will bring forth the above-mentioned advantages, and they are suitable for being post-separated from each other using sorting machines such as ballistic separators, air classifiers and optic sorters, making use of the difference in density and optical qualities for these materials.

Something to note is that single stream recycling is continually being developed in areas that use it, such as California. Californian environmental planning consultants have published a helpful guide for implementing a single stream collection system (Kinsella, Gertman, 2007) which outlines the main considerations that need to be made. It also discusses the common difficulties that single-stream sorting lines have to overcome, most importantly this contamination of paper by glass shards. It would be good to keep track of these developments and consider how they could help Rotterdam in achieving this development in their waste collection.

## Appendix F – Concept Directions in Detail

From the ideation, the ideas and findings were bundled in design directions in each of the steps found in the waste journey map. This step is a logical proceeding, since the ideation took place along the stretch of the waste journey, and different problems require different solutions.

### CD1 - In home solution



This concept direction deals with the problems of residents while setting up their recycling system. In order to be able to recycle effectively, people need a space in their homes assigned to collecting separate streams of material. However, in high rise buildings space is limited, and people have a hard time in figuring out how to (re-)arrange their space to do effectively separate their waste. Moreover, there might be costs involved in purchasing storage equipment.

This concept deals with these problems by providing the space needed to start recycling in a predetermined fashion. It is based on the premise that there are bins or space for bins directly built into the residence in a way that makes it unobtrusive but easy to collect waste inside. In addition, it is important that the design clearly communicates its purpose to the residents, as well as giving information about the requested recycling behaviour by for instance giving examples of the items that can be collected.



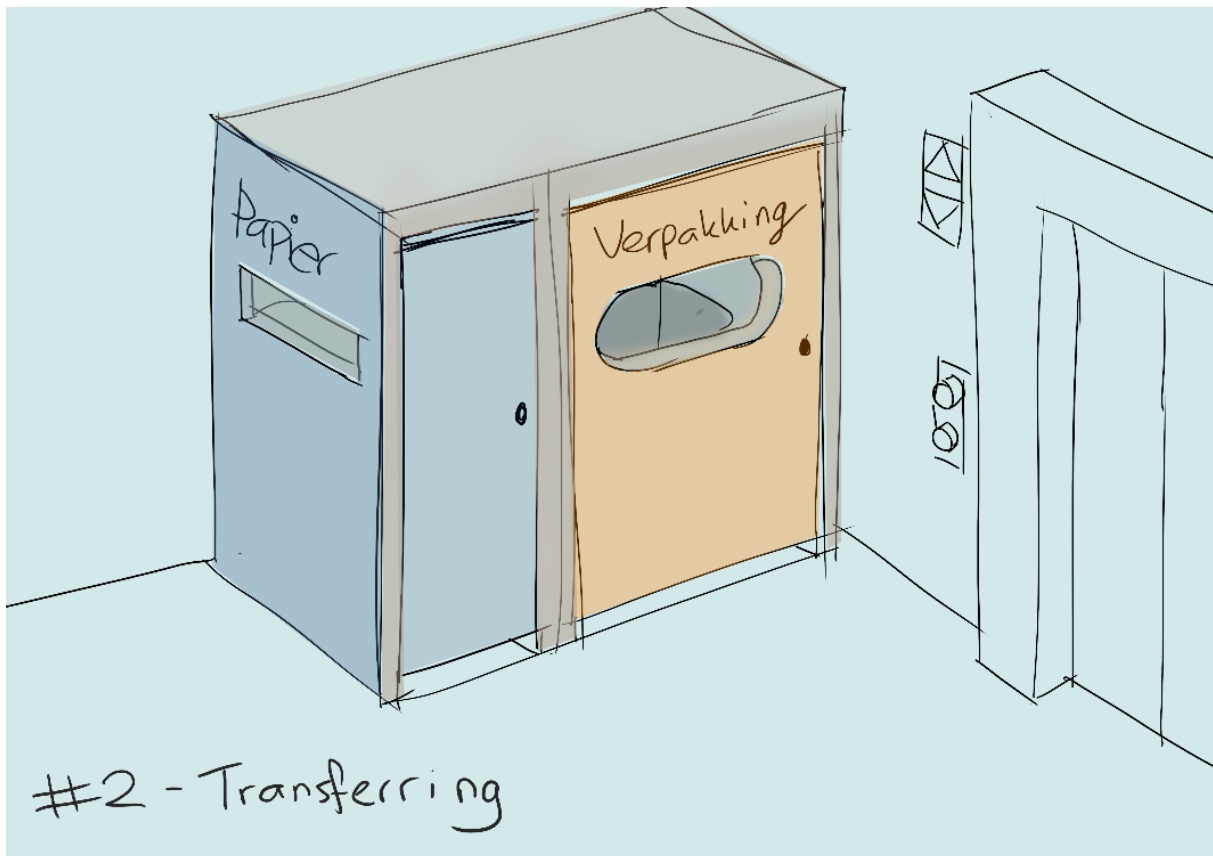
### Advantages

- It helps people with setting up recycling habits in their new environment by having an assigned space for collecting wastes
- People often have improvised systems for collecting recyclable waste, such as random bags hanging from door knobs. People that recycle will likely prefer to use a system that feels professional and unobtrusive.
- In chapter 4 it was discussed that reducing the size of the residual waste container will also push people to collect their other waste separately to stop it filling up too quickly. These kinds of considerations can be taken into account in this concept.

### Disadvantages

- By implementing a fixed system it is harder for residents to adjust it to their own needs. Different people have different buying habits, and therefore different space requirements for the different waste fractions. Especially people that already recycle might find the system they are used to conflicts with the solution offered.

### CD2 - Lift hall solution



This concept direction deals with the problem that residents have when having to transfer their stored waste to a collection point. Oftentimes people do not know where they are supposed to bring the waste to, or find that the collection point is too far away. They might decide that because the residual waste container is closer, it is more convenient to throw all their waste in there.

These problems are dealt with by providing a place to dispose of recyclables close to their front doors, such as in the space near the elevators or another central area of the floor they live on.

Because the residents will pass the containers every day, they will be reminded of the requested recycling behaviour, and it will make it easier for them to oblige. The main theory behind this concept is that when the largest recycling fractions are collected at a smaller distance than the residual waste, recycling these fractions will actually become easier than just collecting everything together.

The collection area needs to provide clear information about recycling, such as which kinds of waste are accepted and which are not. Additionally, the collection area should let the residents know where they can bring the waste fractions that are not collected at this location; informing them about the nearest 'milieustraat', or about what they should do with empty batteries or frying oils.

The waste fractions that can be collected per floor are limited by their tendency to start smelling. In Hong Kong there are several multi-story apartments that are equipped with a waste collection room on every floor, but they fell out of favour because the residents started to avoid them due to the hygiene issues connected with waste. (Yau, 2010)

The solution to this issue is to only collect dry recyclable materials such as paper, PMD, and glass in this way, and find another way to collect organic wastes.

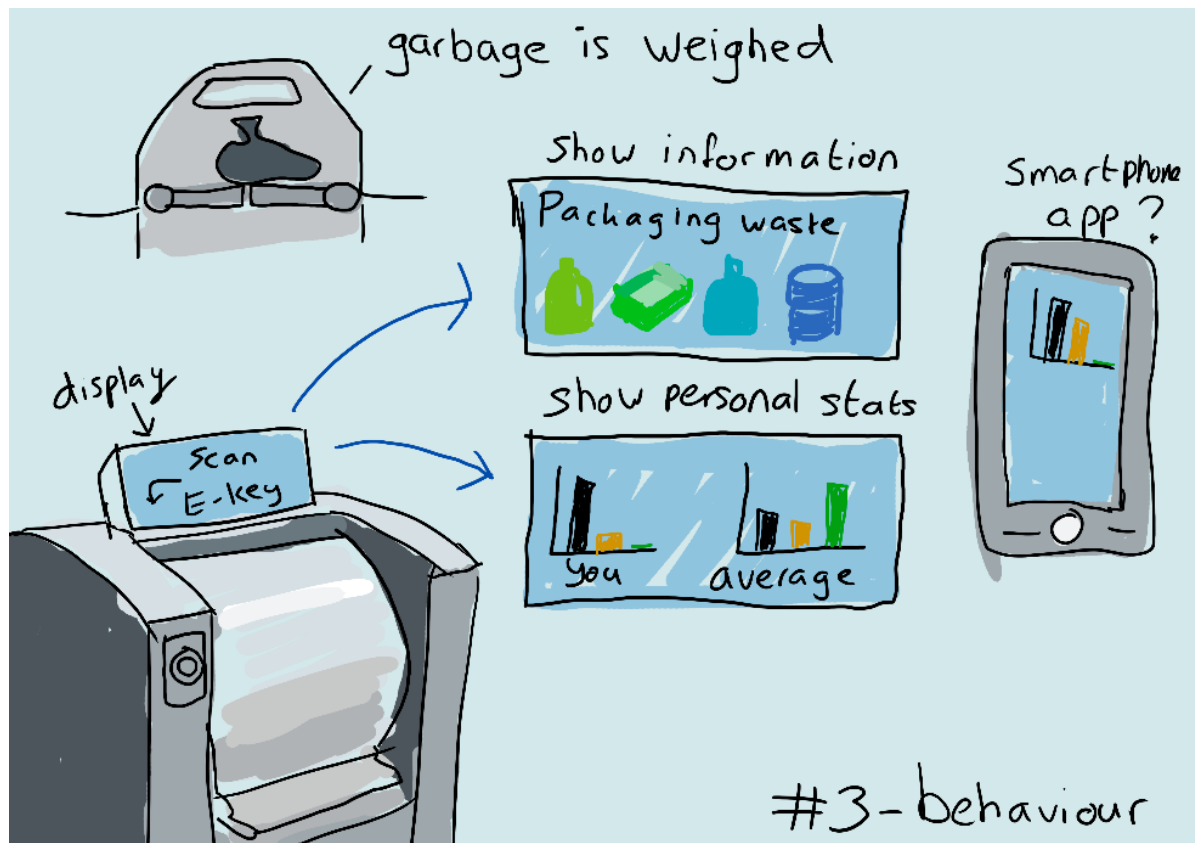
Another issue with this way of collection is the extra manpower that is needed to collect the waste from these points and move it downstairs for municipal collections. This work will need to be done by persons such as the cleaning crew that maintains the common areas of the building, but this will incur operating costs.

### **Advantages**

- Residents will know where they have to bring their different wastes.
- It will make recycling certain materials easier than throwing them with the residual waste
- Because of the reduced distance, more frequent drop-offs become viable. This reduces the space that people need at home to store the waste.
- Waste fractions such as paper and glass cannot be disposed of in bags. Therefore the vessel people use to bring it to the collection point has to be returned to the home making shortening the trip even more advantageous.

### **Disadvantages**

- This way of collecting waste will incur operating costs for the emptying and cleaning of the containers.
- This solution has a claim on space within the building. Floor space is an important factor especially in high-rise buildings.



This concept direction is about providing incentives and feedback to the people of Rotterdam about their recycling behaviour. Currently, there are no real incentives for the residents to recycle, other than the feeling that they are doing 'the right thing'. And when they do recycle, there is no way for them to know whether they actually did it correctly or not, and they have no indication of what happens to the waste other than it being taken away and supposedly made into new material.

This concept tries to make the recycling effort more tangible for the residents by measuring the weight of the collected materials, and then collect data about the amounts of waste for each household and make it available to them. This can be done by implementing a 'smart' system that reads an electronic tag (such as a SALTO - lock system) to associate the data to a specific household, then weighs the inserted waste before it is sent down to the container.

The data that is collected this way can be used in multiple ways: First of all, it will help the municipality get a very detailed view of the recycling behaviour of their residents, which will help them decide their further strategies in improving recycling rates even more.

Secondly, the data can be shown to the residents similarly to the way in which most energy companies let their customers see their energy usage over time. The information can be offered via an app or website, or via a display on the containers. It will help the residents become more aware of what they throw away, and the data could be accompanied by tips on how to improve their behaviour, perhaps specific to the situation.

Lastly, the data can be used to determine whether a household is doing well with recycling. This information can be used to give certain rewards or encouragement for the wanted behaviour.

These rewards do not have to be monetary per se, but can be in the form of a positive message, or a discount at certain stores in the area. The latter is being tried in Amsterdam with some success by Wastedlab (Wastedlab, n.d.)

Improving the feedback can also be done by connecting the amounts of waste collected with the result of the processing. The residents could be shown their contribution to paper recycling in the amount of paper that has been made in amounts of a4 sheets, or perhaps in the amounts of energy, water or trees that have been saved in the papermaking process because of their recycling. The energy saved might be expressed into cups of tea that can be heated with it, or into rounds of laundry or revolutions of a merry-go-round.

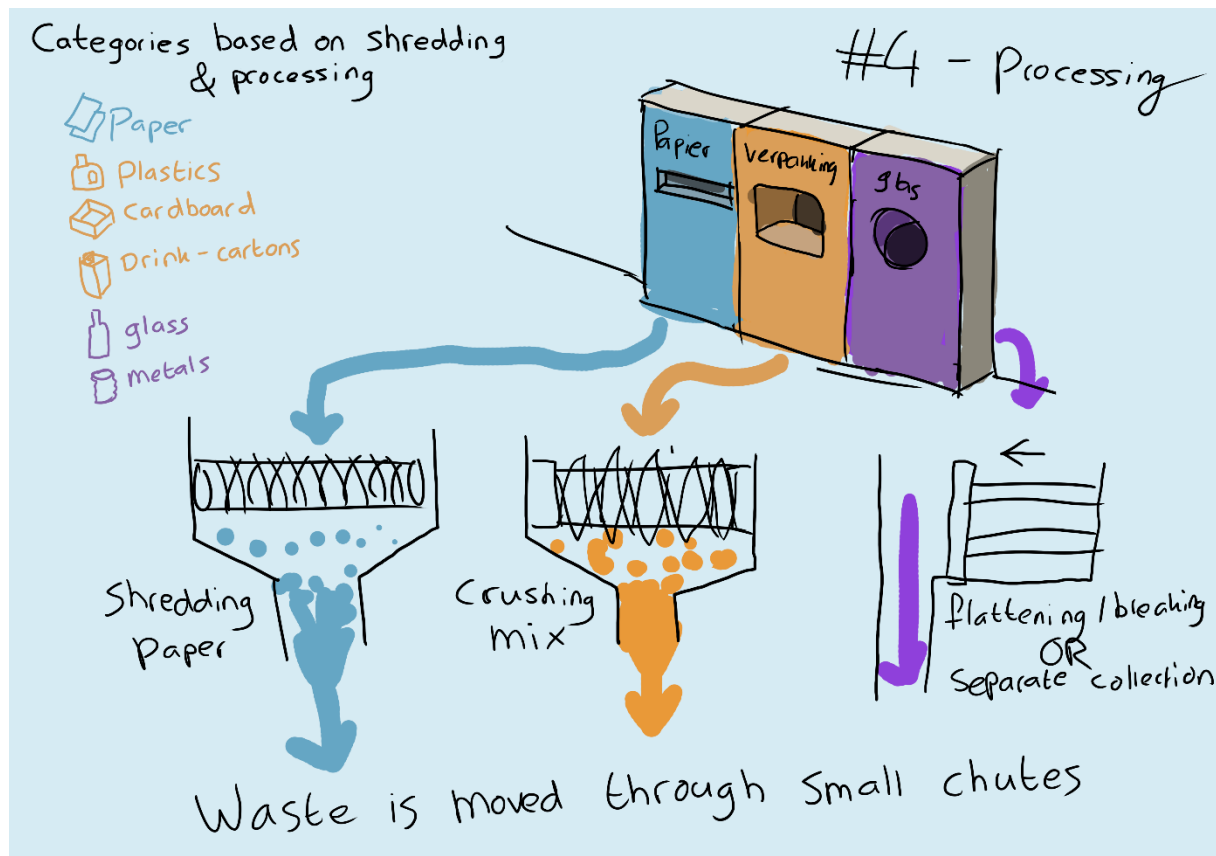
#### **Advantages**

- Data collection for multiple ends
- Creates feedback for recycling behaviour
- Creates an opportunity for offering incentives

#### **Disadvantages**

- Needs an extensive software side, hiring programmers, server maintenance costs
- Investment in designing and producing new data-gathering containers
- Containers have to be connected to the internet

#### CD4 - Pre-collection shredding of recyclable waste



This concept deals with the problems that are found on the back-end of the recycling process. In the research part of the main report it was found that the material quality of the collected items needs to be as high as possible in order to be able to reuse them in a circular fashion. This matter of quality is especially a problem for plastics: they are the most difficult to process because there are more than a dozen similar yet different categories of material that need to be separated from each other to form the pure, high quality fractions. Packaging commonly consists of multiple materials; for example, a bottle and its cap are made from different kinds of plastic. Furthermore, to save space in their homes, residents commonly insert material in the hollow shapes of other items. These issues make it impossible to separate the items for conventional methods. The solution is to grind the waste down into smaller pieces before it enters the sorting step.

There is another apparent factor influencing collections: the volume of the collected materials is significantly decreased. In turn, the decreased volume is beneficial to collections, as the bin will fill up more slowly and needs emptying less often. Collections vehicles for PMD waste do currently compress the waste, which has a similar effect on the volume as shredding does, which means that the amount of trips needed to collect stays the same. The length of the trips is shortened however, because the truck cannot compress shredded waste much further and will therefore fill up faster.

The way this concept could be implemented is by installing one or multiple shredders somewhere inside or near the building. After the waste is handed in by the residents, it moves to a shredding chamber that is out of reach of the user. After shredding, the waste would move down into a collection chamber, where it would wait to be collected for transport, separation, and processing.

The separating process can be done in a comparable way to how it is done now, only the focus will be less on size screens and more on the sorting by density and the optical sorting processes discussed in chapter 8. This scenario will likely require some small alterations to the sorting facility, but can mostly come down to fine-tuning the operational parameters such as lowering the belt speed or changing the position of the plate that divides the 2 streams in a separation process. (Wrap, 2010) Shredding the waste does however make it viable to use other kinds of sorting steps as well, such as the hydrocyclone separator. (Also see chapter 8)

### **Advantages**

- Volume reduction of material. In the case of PMD waste, the volume might be reduced by about 90%, which will make collections more efficient. It will also make alternative ways of transport more viable, for example by the use of garbage chutes with a small surface area.
- It will increase the quality of the separated fractions for packaging materials, allowing better processing and therefore re-use of material in a circular fashion.
- Plastic material has to be cleaned before processing; shredded material is easier to clean because there are no more hollow shapes or closed containers within the waste.
- Shredding the materials is also an important step in the processing of plastics. (Northern California Compactors Inc., 2019) It will still have to be shredded to a smaller, more homogenous size than pre-collection shredding will allow, but pre-shredding does save some amount of effort in this respect.

### **Disadvantages**

- The pre-shredding of waste will require shredding equipment to be able to be used by residents, and therefore there will be concerns for safety, as well as issues with fire-safety in the space where the shredder is placed.
- The shredder might be vulnerable to misuse; certain materials are not able to be shredded and will damage the machine when it comes in contact with them. Especially dangerous are items such as batteries, which might explode when put inside the shredder. For these reasons, the system would need some kind of screen that prevents these contaminants from entering.
- The device and receptacle for the shredder will occupy some amount of floor space within the building.
- The installation of the shredder and receptacle will incur relatively large installation costs. Running the shredder will also cost electricity and maintenance, and these running costs also need to be factored in.
- A shredder will produce some amount of noise, both by the machine itself and the motor that is driving it. This is undesirable in a living environment and needs to be mitigated.

## Appendix G – Previous Iteration of the Concept

The previous iteration of the concept was mainly based on the premise of concept direction 2, saying that waste should be collected on each floor. To make collecting the waste from this location easier, the idea was to use a shredder to reduce the volume of the waste, and afterwards move it down through a garbage chute of a reduced size. This would have the both the advantages mentioned in appendix F under concept direction 4 concerning increased quality for the processed PMD fraction, and the advantages for the residents concerning their convenience.

However, while working on this concept it was found that shredding would only be applicable for PMD waste. Organic waste would not reduce in volume that much, glass would have too much concerns about safety and noise, and shredding paper is detrimental to the quality of the recycled material. Together with other concerns about the implementation of a shredder on each floor, an alternative was made where only paper and PMD were moved downstairs, where the latter would be shredded. However, ultimately it was decided to change the whole premise of the concept to where instead of just one or two fractions, all of them should be collected with the same system.

The images below show this older iteration of the concept.

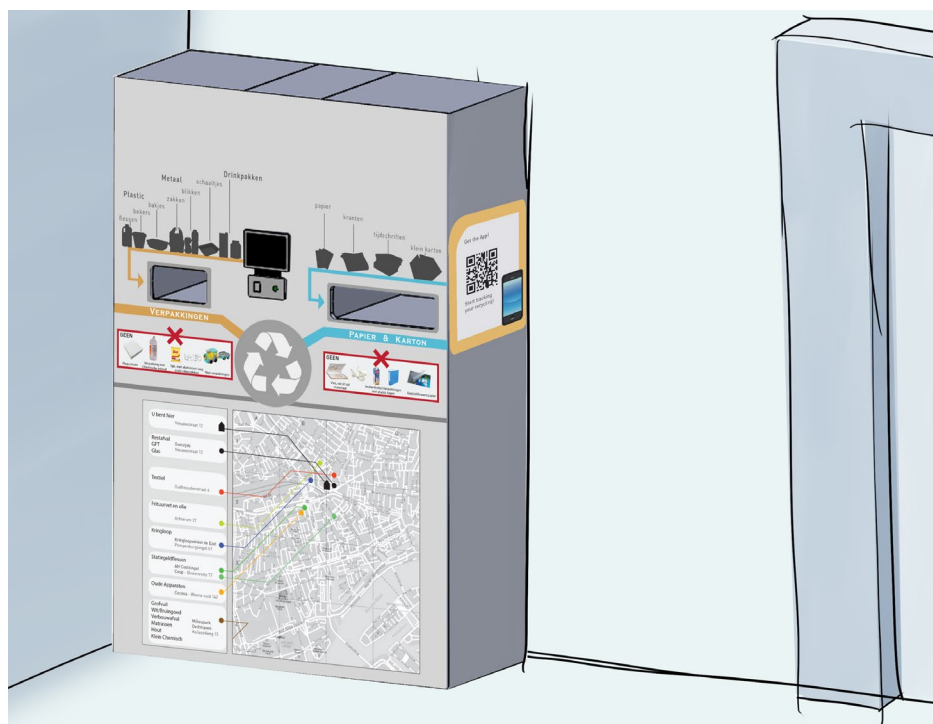


Figure G1 – The design of a receptacle taking only PMD and paper waste

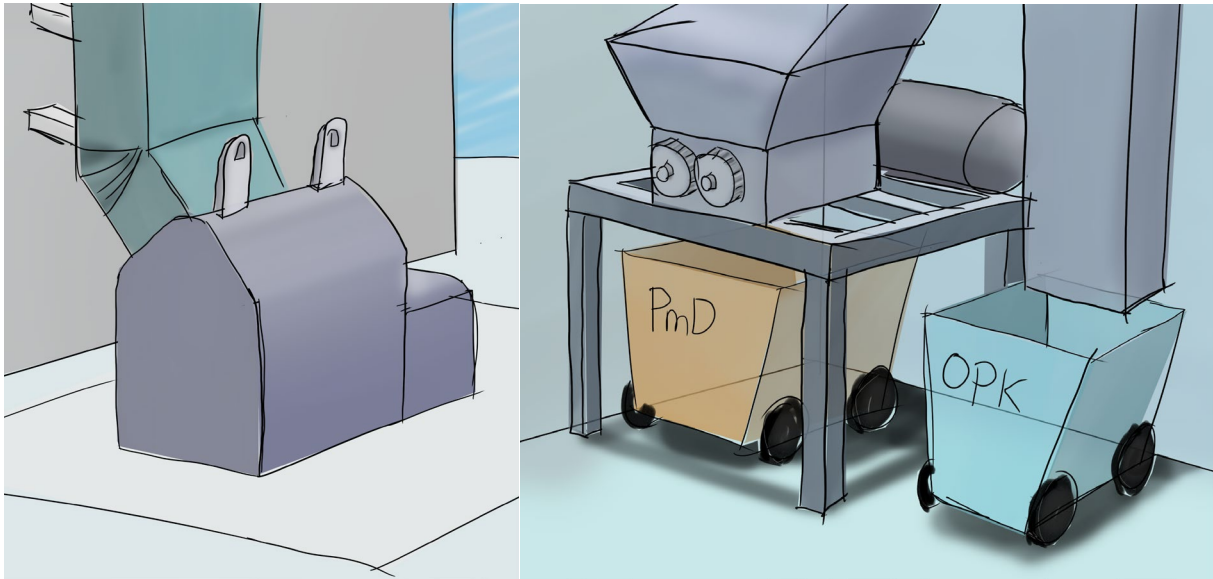


Figure G2 – Alternatives for collecting the waste downstairs, allowing for different ways of collection

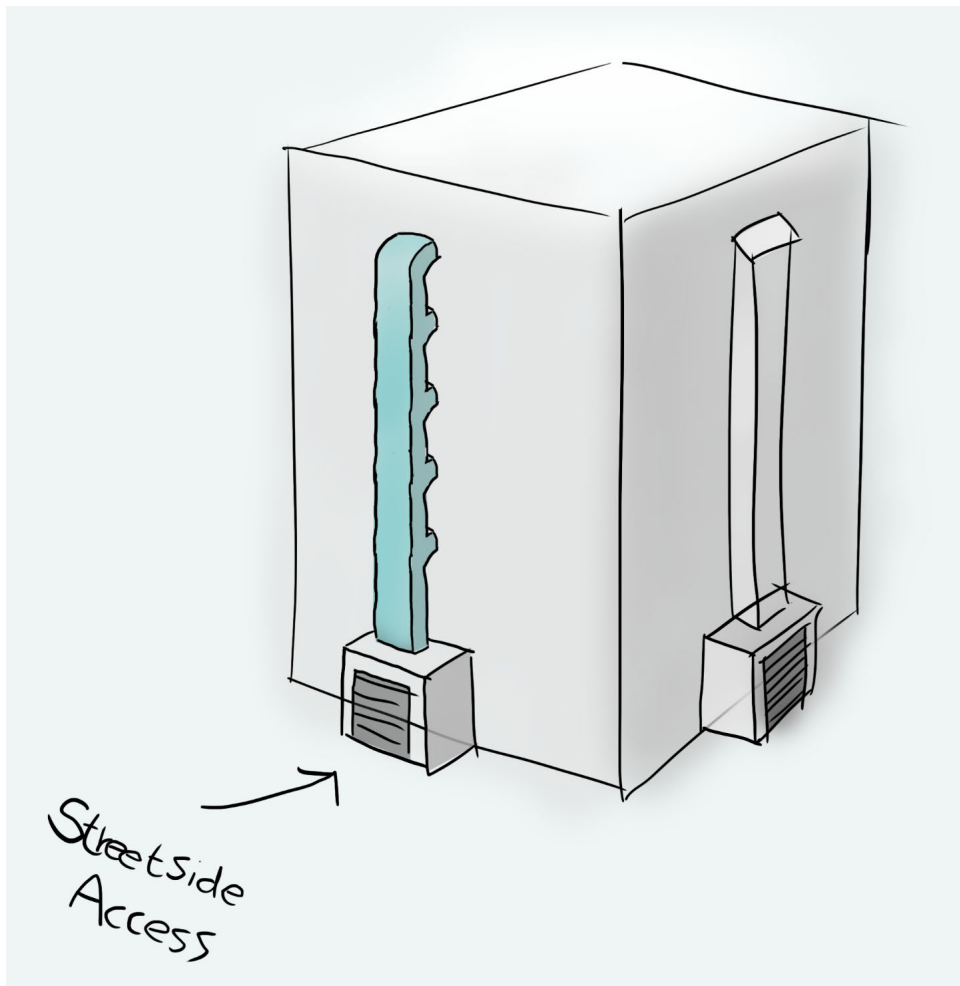


Figure G3 – Alternatives for moving the waste down the building. Having outside chutes would make the waste more accessible for collections, but they would have a big impact on the appearance of the building.



# Appendix H: Shredding PMD waste

There are many different kinds of shredders for all sorts of different purposes. For the application within this context there is one type that is most preferable, which is the rotary shear shredder. It works with either one or multiple instances of steel disks mounted on a rotating axle, that use shear-force to cut material into strips. The steel disks are lined with hooks that grab the material, to force it between the rotating blades.

The main advantages of this kind of shredding are the low horsepower that is needed, the low turning speed (which prevents material from launching out of the shredder) and the small space requirements. The main disadvantages are the low-throughput speeds and the limited size-control of the output, however these are not really an issue for this context.

(Robinson, W.D., 1986)



Figure H1 – Rotary Shear Shredder

The shredder can be installed at the ground floor of the building, in the pickup-point. A deflector will push the waste from the conveyor into a hopper on top of the shredding unit.

The system will detect the presence of material in the shredding chamber and start working. The shredded material will then drop inside the container that is placed underneath.

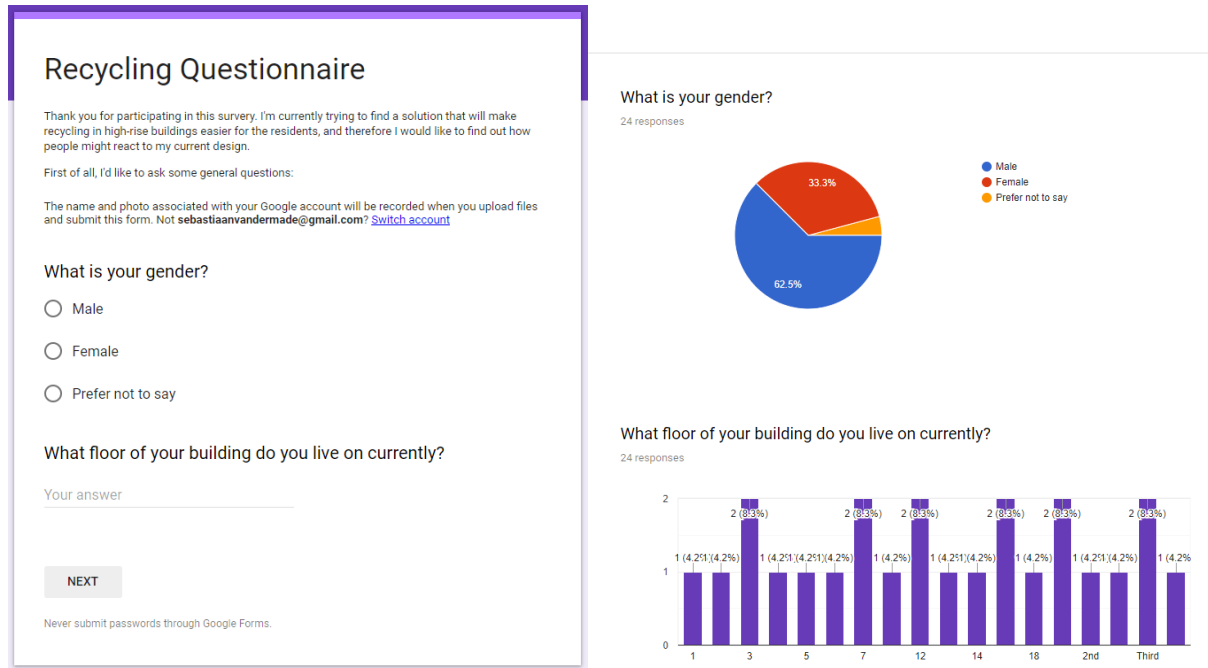
The shredder has to be powered by a hydraulic motor of around 7.5KW. This type of motor can detect the pressure on the shredding blades, and automatically reverse the rotation when it is in danger of getting stuck. Afterwards it can continue the shredding of the item from a different angle, which will usually get it through. A typical small-size shredding installation will be around 1500\*1000\*1900mm in dimensions, including the space for a container underneath.

(Primary double shaft shredder TB, n.d.)

The advantages of shredding PMD waste are found in appendix F.

# Appendix I – Evaluation Questionnaire and Results

## Introduction to the questionnaire



## 1 - Questions about personal recycling

### Questions about your recycling behaviour

Which of these kinds of waste do you collect separately? \*

- ☐ Residual waste (restafval)
- ☐ Organic waste (GFT)
- ☐ Paper/Cardboard
- ☐ Plastic, metals and drink cartons (PMD)
- ☐ Glass

If you selected more than 1 option, what is your reason for collecting them separately?

Your answer

About those kinds of waste you don't collect separately, what are the reasons you don't?

- ☐ I don't have much of this kind of waste
- ☐ I didn't know you could collect them separately
- ☐ I don't know where to bring them
- ☐ I do know where to bring them, but it is too far for me
- ☐ I don't know where in my apartment I should collect them
- ☐ I don't think recycling is important
- ☐ I do collect all of those 5 separately
- ☐ Other: \_\_\_\_\_

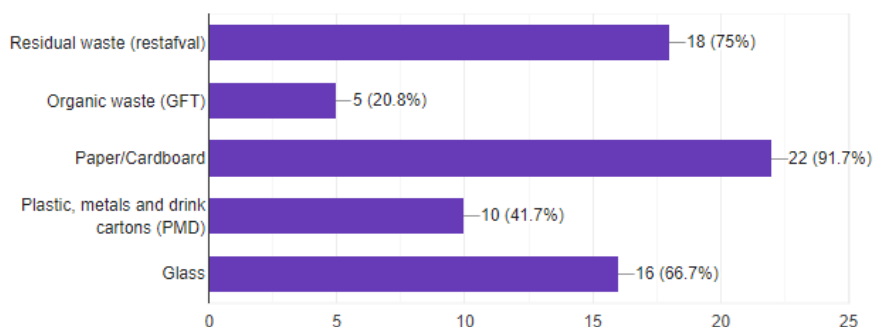
Are there other kinds of waste you hand in separately?

Your answer \_\_\_\_\_

1 - Answers:

Which of these kinds of waste do you collect separately?

24 responses



If you selected more than 1 option, what is your reason for collecting them separately? 22 responses

Goed voor het milieu en het is een kleine moeite

garbage disposal options within the building

Because these are the ones for which separate containers are available.

Because I know it improves the ability to recycle the materials used

So it can be recycled

There is a container in the building for residual waste and for paper. Glass is just a force of habit

I change the organig waste bin shopper more frequently than other materials bin.  
It's better for the environment to recycle stuff!

seperate dumpsters

Ease

The environment

Better for the environment

Environmental

Used to do it because my parents collect seperately

Better for recycling and in extension the environment

The flat only collects these two types.

The enviroment

I care about the environment and I feel bad when I throw something in the wrong bin

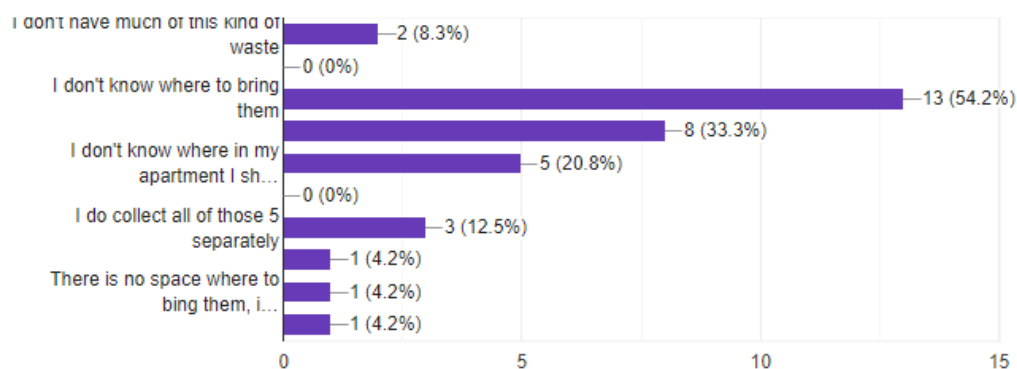
We got 2 different bins

Easy to collect seperstely

Around the corner of the building, there are large containers for paper, PMD and glass.

### About those kinds of waste you don't collect seperately, what are the reasons you don't?

24 responses



### Are there other kinds of waste you hand in separately? 16 responses

Textiel

no

Batteries,lamps

Batteries

I try to hand in clothes separately

big objects like chairs etc

Clothes

E-waste

Batteries, broken electronic products, lamps

Glass

Textiel and bateries

Batteries, textiles

No

Cloths

batteries, electronic waste (as much as possible)

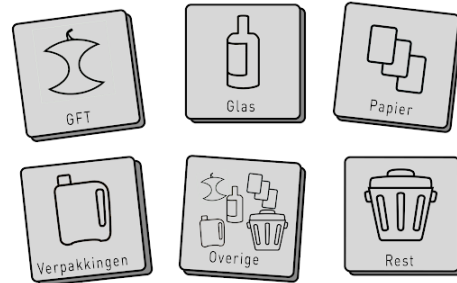
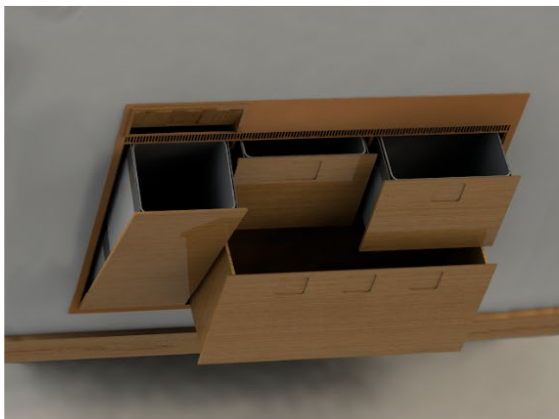
## 2 – Introducing the In-Home Buffer

This is a set of drawers that are built into the wall of your new kitchen. You can use it to store multiple different kinds of waste in your house. The left and upper drawers have removable bins inside allowing you to use bin liners inside them. The lower drawer offers space for a grocery bag or some small boxes to collect waste in. Inside one of the drawers you find these six tiles. They will fit into the indents in the drawers, allowing you to arrange for yourself the what kinds of waste should go into which bin.

### New scenario

Now I'd like to show you my design. Imagine you just moved to a new apartment. In the kitchen you find the following:

#### A waste-storage cabinet

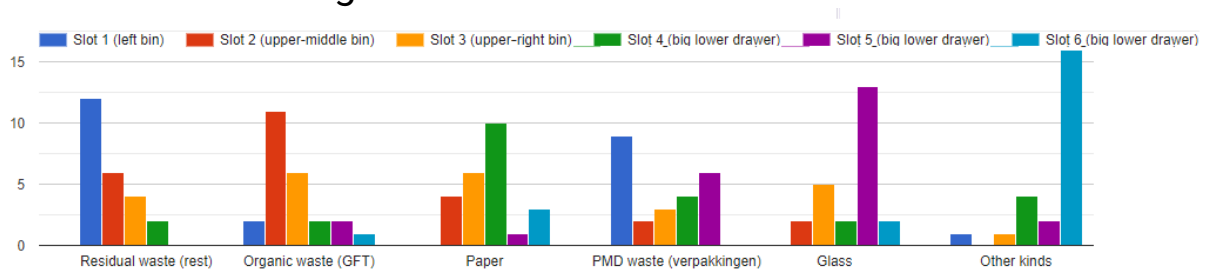


Please think about what kinds of waste you would collect in which bin, and match the tiles with your preferred slot according to the numbers in the image. \*

	Slot 1 (left bin)	Slot 2 (upper-middle bin)	Slot 3 (upper-right bin)	Slot 4 (big lower drawer)	Slot 5 (big lower drawer)	Slot 6 (big lower drawer)
Residual waste (rest)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Organic waste (GFT)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PMD waste (verpakkingen)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Glass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other kinds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 2 – Answer

Please think about what kinds of waste you would collect in which bin, and match the tiles with your preferred slot according to the numbers in the image.



### 3 – Questions about the In-Home Buffer

#### Questions about this part

You have just made your own division for collecting recyclable wastes. Next I'd like to understand how you would actually use this product.



How do you think having this in your home would affect your recycling habits?

- ☐ I would stop collecting certain kinds of waste
- ☐ It wouldn't change the way I collect waste
- ☐ I would start collecting more types of waste

If you want you can elaborate on your answer here. Which kinds would you start/stop collecting and why?

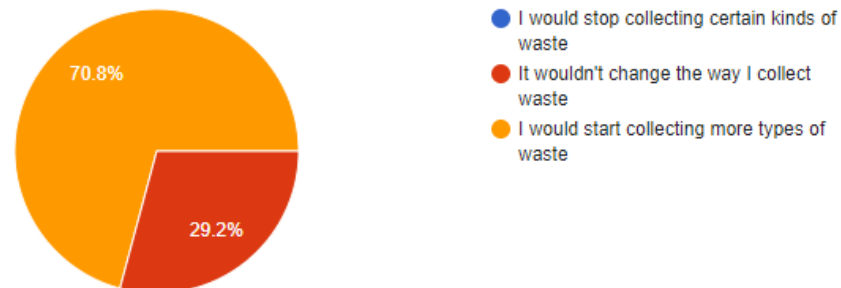
Your answer

---

### 3 – Answers

#### How do you think having this in your home would affect your recycling habits?

24 responses



If you want you can elaborate on your answer here. Which kinds would you start/stop collecting and why?

9 responses

Start met gft
I still don't know where I can recycle PMD...
It makes it easier so i would start separating everything
organic, because it's the biggest reason garbage smells
I like the design but for me to seperate waste is to have a collection point near me
The design is nice. I would like to collect GFT, but I currently don't do that because there is no place I can bring it. This would not change that. In fact, I think having good central waste collection is by far the most important thing to solve
Everything, if there is a place to bring them
start to separate GFT from residual waste. Because now there is a easy facility to do that.



## 4 – Questions about the Receptacle

### Taking out the trash

Next, you go out with the waste that you have collected. You go down the elevator, and in the entrance hall you find the following:



### A new waste receptacle

The building you just moved to has a new system, allowing you to enter multiple kinds of waste into the same receptacle. The system will make sure that the waste ends up in the correct bin, you just have to tell it what you are throwing in. It works like this: First you scan your electronic (salto) key. A menu comes up that lets you choose the type of waste.



Next, the receptacle will open automatically, and you will be able to throw in your waste.



How do you think that having this system in your building, together with the bins shown earlier, would affect your recycling behaviour?

- ☐ I would stop collecting certain kinds of waste
- ☐ It wouldn't change the types of waste I collect
- ☐ I would start collecting more types of waste

If you want you can elaborate: How would your behaviour change?

Your answer

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If this system was installed in your current building, and you had to collect the different wastes in your current home, would it change your answer?

- ☐ No, my answer would be the same
- ☐ Yes, I wouldn't be able to separate certain kinds of waste
- ☐ Yes, at my current home I'm better able to separate certain kinds of waste
- ☐ Other: \_\_\_\_\_

If you want you can elaborate here:

Your answer

---

Now imagine the receptacle was placed in the lift hall on the floor you live on. You don't have to take your trash down anymore. Would this change your answer?

- ☐ No, my answer would stay the same
- ☐ Yes, this would make me collect more kinds of waste separately
- ☐ Other: \_\_\_\_\_

If you want, you can elaborate here:

Your answer

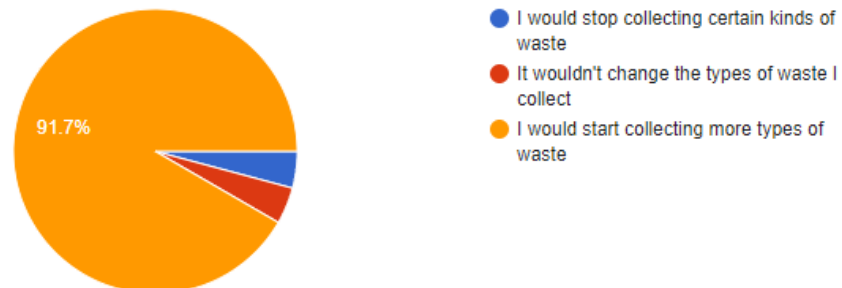
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## 4 – Answers

How do you think that having this system in your building, together with the bins shown earlier, would affect your recycling behaviour?

24 responses



If you want you can elaborate: How would your behaviour change?

10 responses

If all the waste types would be collected, of course this would improve things

Easy access, a low threshold to start

on the condition that u dont need to use the personal tag (privacy etc)

I would separate everything possible

Awesome. I would collect them all separately

Currently only 2 types of waste are collected in my building. I now bike to a separate location to throw away my other trash.

I would certainly perform more waste separation.

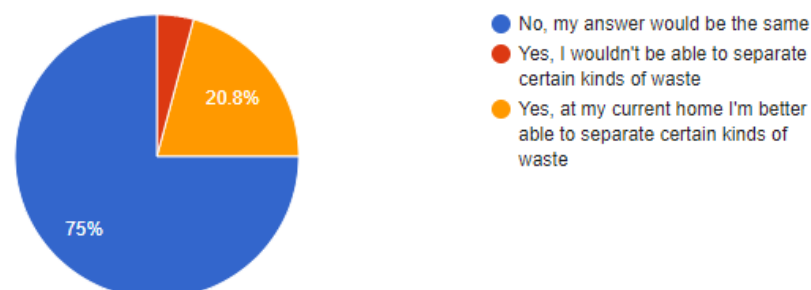
Probably takes to long

I would throw my waste more frequently

collecting every type of waste separately according to the system.

If this system was installed in your current building, and you had to collect the different wastes in your current home, would it change your answer?

24 responses



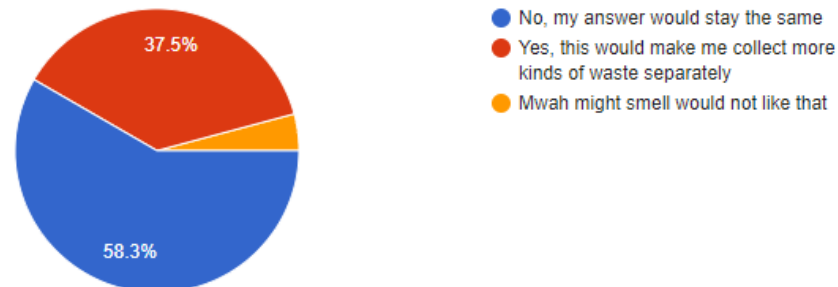
If you want you can elaborate here: 2 responses

The above question is confusing

I can't recycle other materials now

Now imagine the receptacle was placed in the lift hall on the floor you live on. You don't have to take your trash down anymore. Would this change your answer?

24 responses



If you want, you can elaborate here:

2 responses

This would be great. I think the trash-cabinet on a room is not a must, but at least one of this receptables would make an enourmous difference. You could also make PMD free, and ask a small fee for restafval, this could change the consumers mind.

Again, this question is confusing since you already ask exactly the same thing two questions back

## 5 – Final Questions

### Final questions

The system has one other feature. It weighs the trash you put in and collects data about your waste behaviour. Would you be interested to see statistics on how much you throw away and how well you recycle? Why?

Your answer

Do you have any comments about the in-home waste bins?

Your answer

Do you have any comments about the waste receptacle and the system around it?

Your answer

## 5 - Answers

The system has one other feature. It weighs the trash you put in and collects data about your waste behaviour. Would you be interested to see statistics on how much you throw away and how well you recycle? Why? 23 responses

No

no, privacy

Yes, would be interesting!

Yes, to be able to quantitatively assess my carbon footprint and to find ways to reduce it.

Yes, I think it would be usefull tot deze wat kind of waste I collect most, so I know what I could try to reduce

Yes, it would show which kind of waste is high in use in my home. If this kind is more harmful for the environment then i would reduce the amount of usage.

I might just look at the data once.

Yes, but in an environment that I can choose when I want to see it, so no monthly updates or something like that. I think it would help me be more conscious about how much waste I produce and it might motivate me to reduce that!

No, because in near future i am afraid they are going to charge you.

No. You people might think I'm an alcoholic.

Not really

No, but maybe general statistics would be nice.

Yeah definitely

Yes. Gives me a general idea about how much waste I actually produce whereas now I do not have a clue.

Yess

Yes! Important to know

Sure I like statistics, but wouldn't matter further

I would be very curious.

Yes because it could make me more conscious of how much plastic I use for example. I am currently looking to change that

Yes, it makes think about the amount i throw away

No, i'm not interested

no. if I can receive this data, others can also receive it, in theory. in the future, the government might find it a good idea to use this data to collect taxes. this is against privacy policy. therefore, if i really want to monitor my recylcle habit, i will find a way to do it myself, not with help of the system

## Do you have any comments about the in-home waste bins?

11 responses

No

They are rather big, and the fact they are build in the wall may be a downside for people wanting to buy it.

They should be VERY easily cleanable

Nice design

How easy can it be cleaned?

Not really

When can i buy them!! :D

Volume may not be enough, pmd takes a lot unless it gets compressed (depends on emptying rate too)

Do the Standard size bags fit in the system?

it would make it much easier for building livers to separate waste. especially for those who are not thinking of this themselves right away.

## Do you have any comments about the waste receptacle and the system around it?

10 responses

Het ziet er goed uit en ik zou het wel willen gebruiken.

How do you avoid misuse?

It looks like something that would work quite well. The only problem is that if it's measured then that data can be used to tax it and that would be a step to far.

Pseudonymization the data, so for instance people on the Nth floor deposit x kg of waste

The bins should be scaled to a one-person household and there should be fitting bags available

It seems more expensive than just 5 containers, don't really see the point

This would be AMAZING

I would love for this to be a thing

i guess no one has come up with the idea yet because it will cost a lot of money to realise the idea. but it should definitely be considered to implement the system, because this way, recycling will become much easier and less of a hassle. which is good for the environment!

