

ReBox

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MEng 5

10 Page Summary



The Problem

Footwear is a huge industry all across the world, with 24.2 billion pairs of shoes produced in 2018 alone. Each and every pair come with their own cardboard box.

In 2020 the Global shoe packaging market was valued at \$4.3 billion and forecast to grow at a compound annual growth rate of 6.7% until 2027.

Currently the packaging system and infrastructure for footwear is a single use model. Shoes are boxed up to protect them then shipped or sold. Most shoes bought online are shipped in an outer box also.

When the shoes get to their final destination the box has done its job and is no longer required. They are most often binned or recycled, but with varying recycling rates across the world the system is not sustainable.

In addition to this, online shopping is becoming the dominant consumer pathway for buying.

Between 2021 and 2025 the packaging industry is expected to soar, with a compound annual growth rate of 4%.

This shows there is definitely a market for improved packaging of footwear.



Current solutions

The predominant solution to this problem on the market today is using recycled or FSC certified cardboard. This of course is more sustainable than virgin fibres but the material can only be recycled around 3 times before it loses its quality.

Some other alternative solutions are design based like Puma's clever little bag, shoe packaging designed with a further function and material minimising packages. Most of these seem to be drops in the water and don't last long for various reasons.

In other industries returnable packaging has become more popular, more so in industrial applications but we have begun to see a shift in consumer behaviours. Brands like LOOP and Boomerang offer packaging that can be sent back to the company for them to reuse.

There is a future in this as research suggests 60% of consumers in the UK said they try and limit their use of single use plastic, in addition 30% percent of Gen X shoppers in the UK said they would purchase more sustainable fashion products if they were widely available.



Hong Kong GDP

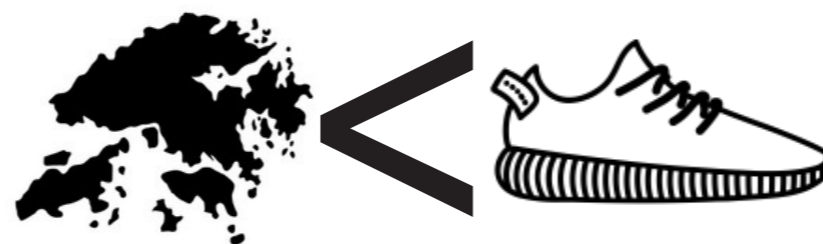
\$341

BILLION

Footwear market

\$352

BILLION



The Solution

A packaging product that maximises material life and reduces impact on the environment, while making each step of the process better for the users involved.

The carbon footprint of plastic is around 3 times that of paper, which means if the plastic product is used more than 3 times it proves better for the planet. This idea was the basis of the project and my starting point. Use materials that last longer and offer users an alternative to discarding packaging when they get their shoes.

Research methods

Various methods were used to gain all the knowledge needed for the project. Understanding the industry was vital. Interviews, task analysis, surveys and desk based research were the main methods.

Stakeholder Interviews

Interviews were key to understanding the seller's priorities and concerns, I interviewed one retail store worker who deals with shoes and sales every day and a footwear brand owner.



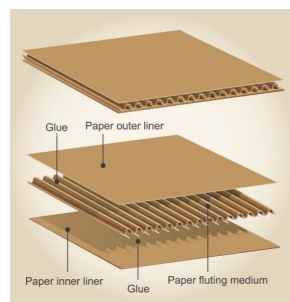
Jordan Anderson
Devana



Joe Cameron
Finnieston Clothing

Understanding the packaging journey

Using books and online resources provided valuable insight into the production of corrugated cardboard boxes. In addition to this I researched the shipping containers and infrastructure used in the industry and also 'last mile' delivery and brand partnerships.



Kite Packaging box flutes

E flute (1.6mm)
R flute (2.3mm)
B flute (3mm)
C flute (4mm)
A flute (5mm)
EB flute (4.6mm)
RB flute (5mm)
BC flute (5.7-6.5mm)
AC flute (9mm)

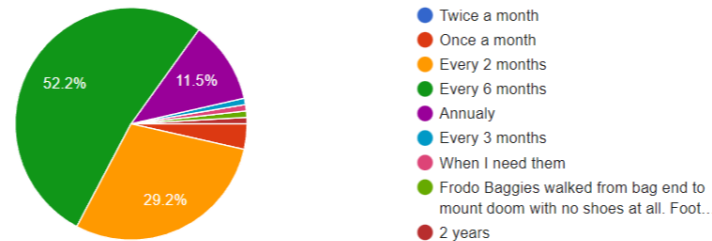


User Survey

Understanding the customer's behaviours and needs was important. A survey was conducted of over 100 people and provided valuable insight into peoples shopping behaviours and also their behaviours and interactions with regard to packaging.

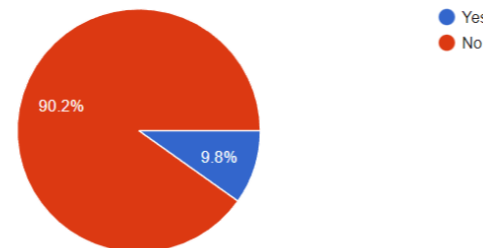
How often roughly do you buy shoes? (any type of footwear)

113 responses



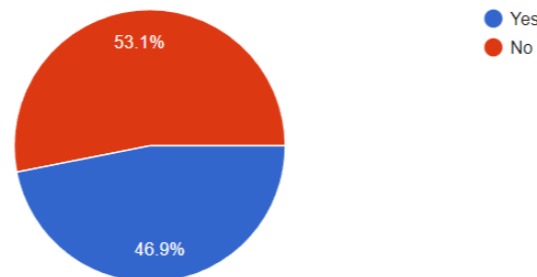
Do you consider packaging important when choosing a pair of shoes?

112 responses



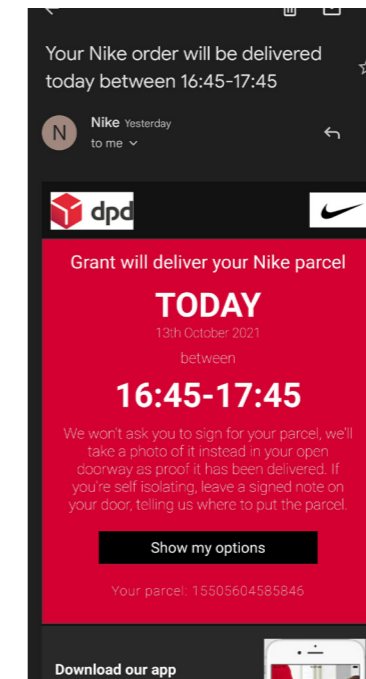
Do you keep shoeboxes?

113 responses



Observing user journey

Watching and recording peoples thoughts and interactions with shoe packaging was another research method and highlighted problems and areas of friction.



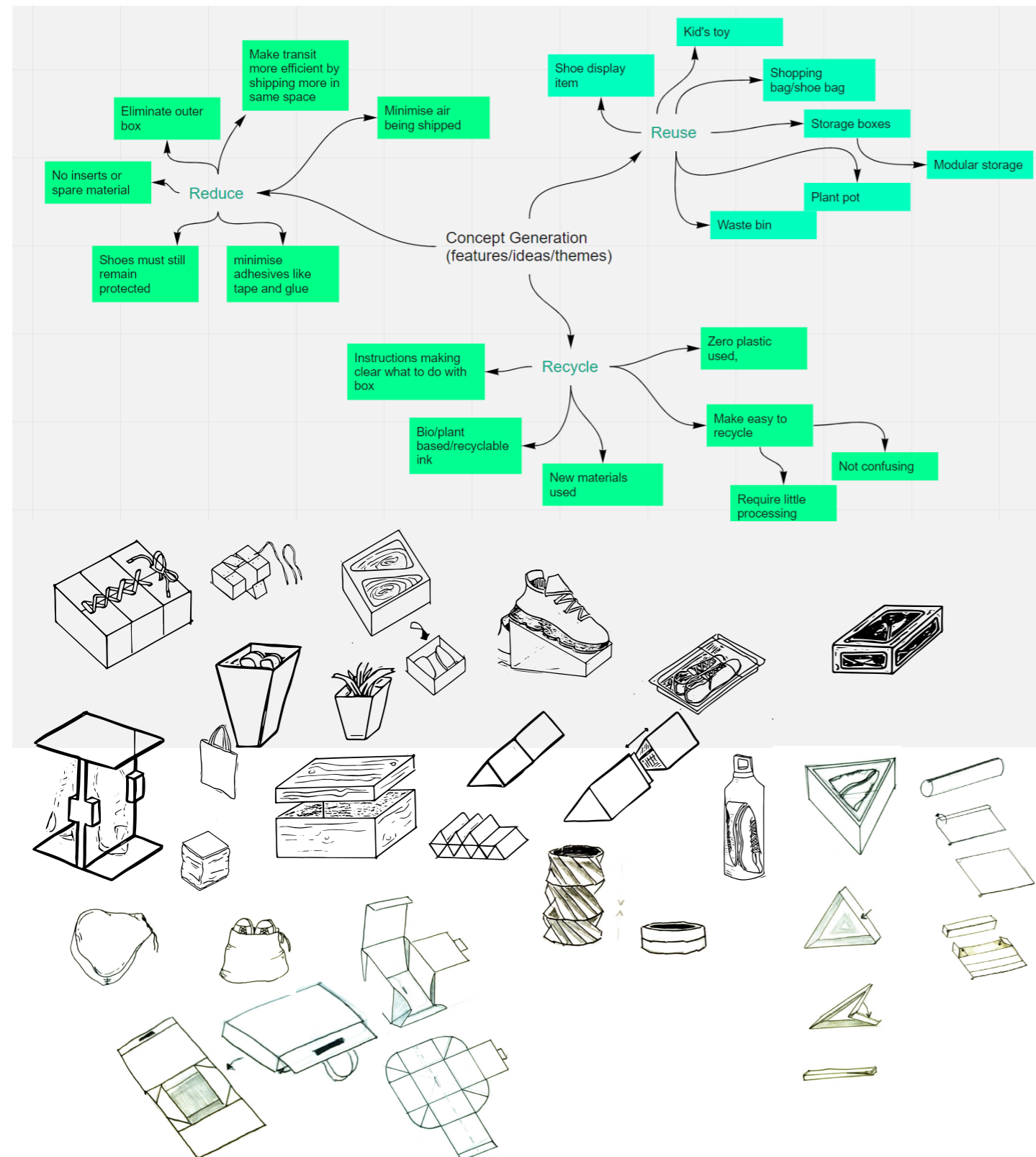
Insights

The key insights taken from the research were:

- People care about sustainable brands
- Packaging is not considered important when choosing footwear
- Delivery is a large part of the packaging journey
- Brands want to ensure their product is protected
- Not everyone interacts with their packaging the same way
- Boxes are awkward to carry home

Concepts and development

Initially sketching and mind maps were used to generate broad concepts and ideas. These were evaluated quickly against my insights and requirements to narrow down ideas. Initially I was focused on designing a package with another use, but soon realised if it was designed to ship shoes why cant the next use be to do this again! This led to develop returnable packaging that folded flat for shipping back to be reused.



The next stage was to prototype the ideas in paper and cardboard to explore them in 3D. A lot of inspiration was taken from origami designs at this stage. These were then evaluated using specific user and stakeholder requirements which were generated from analysing each type of user journey.

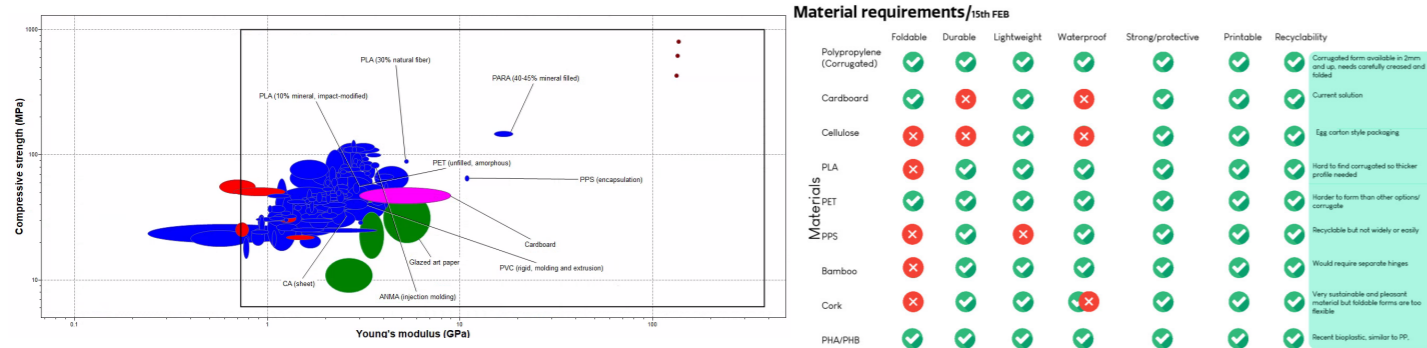


Development

The next stage of development was to develop my folding box further. Materials handles and closure all needed explored.

Materials

CES Edupack software was used to aid material selection from which it was clear a polymer was the most suitable material choice.

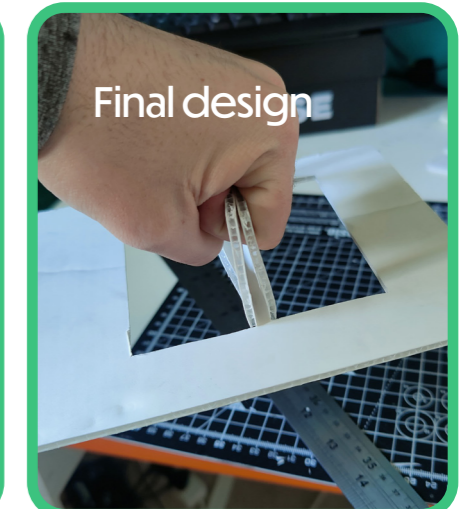
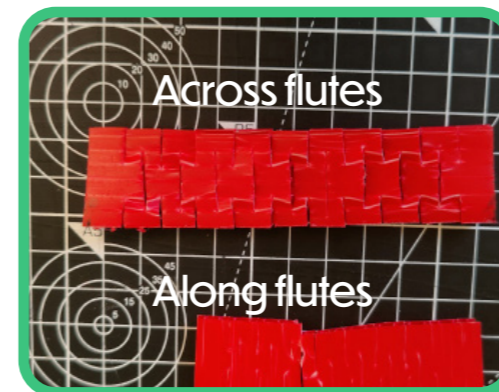
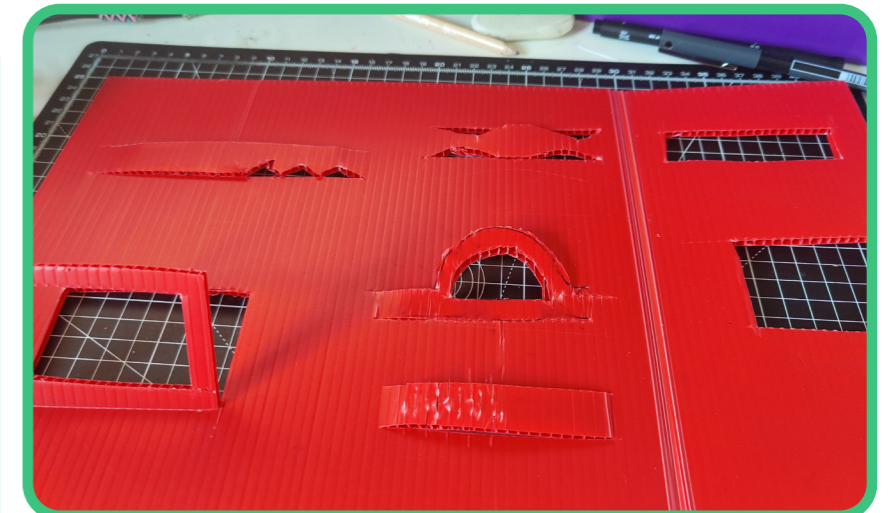


Prototyping using corrugated polypropylene and Rip-stop Nylon were tested after deciding on what properties were required. The corrugated polypropylene was nearly perfect however it tended to fail in one direction due to the fluting orientation. Using a bubble board style polypropylene allowed multi-directional rigidity making the product much more durable and the material could support 70kg.



Handle and Closure

The handle and closure were also extensively tested. It was vital the box was securely closed so the Velcro was chosen after user and environmental testing. Cut out and string handles were tested on the prototypes. The 'living hinge' style handle only worked for certain orientations of polypropylene so in the end a new fold out design was devised taking anthropometric data into consideration.



Final Product

Who

Everyone who buys shoes, sellers, delivery partners, the planet

What

ReBox is a polypropylene, fold flat shoebox which is returned after customers receive their shoes, so it can be reused for another pair

Where

For use in retail stores and e-commerce settings

When

Anytime a new pair of shoes is purchased

Why

To reduce single use packaging for a more sustainable future

ReBox



User Journey

The first step in the user journey is to select the ReBox option when shopping online

Next your order arrives to your door as normal but in the new ReBox packaging

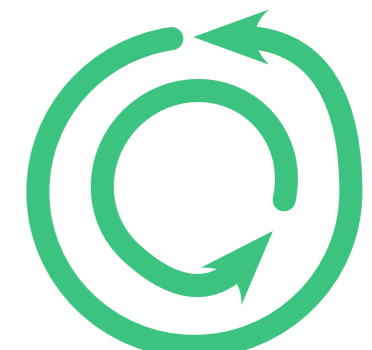
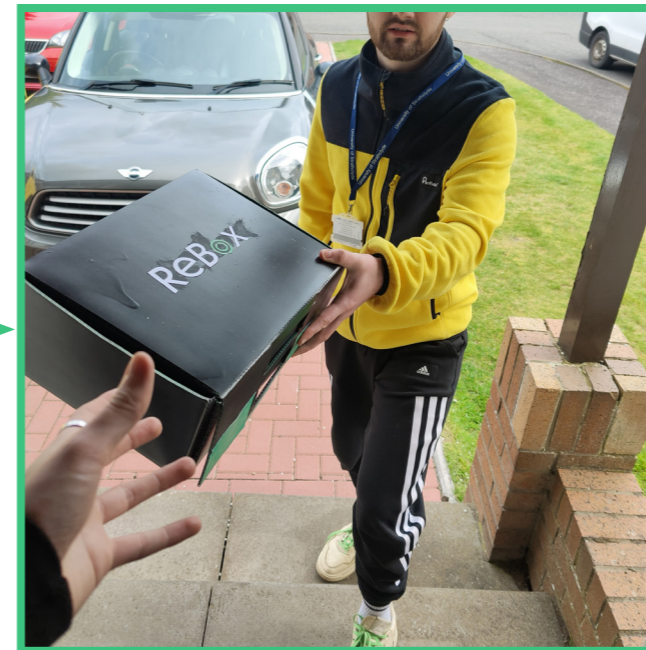
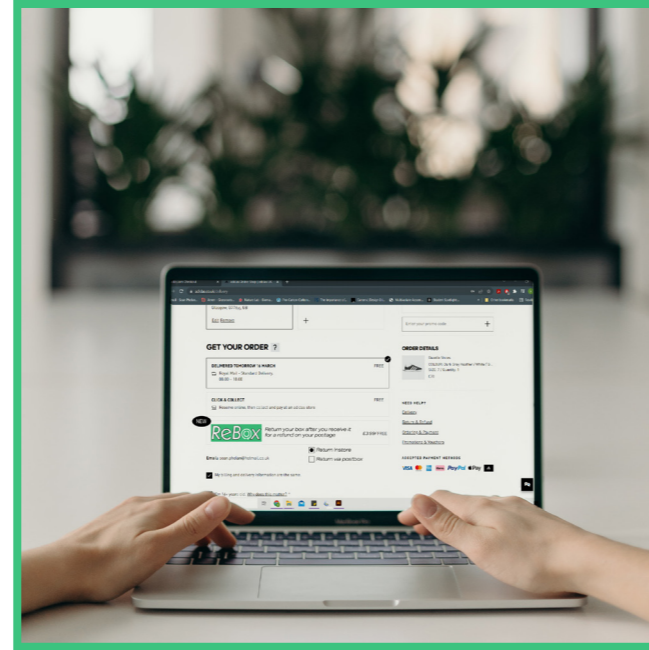
The customer unboxes their new shoes.

The box is then folded according to instructions

The box is returned at the nearest drop off location

Box is inspected and cleaned at HQ, ready to be sent out to footwear companies

The cycle begins again!



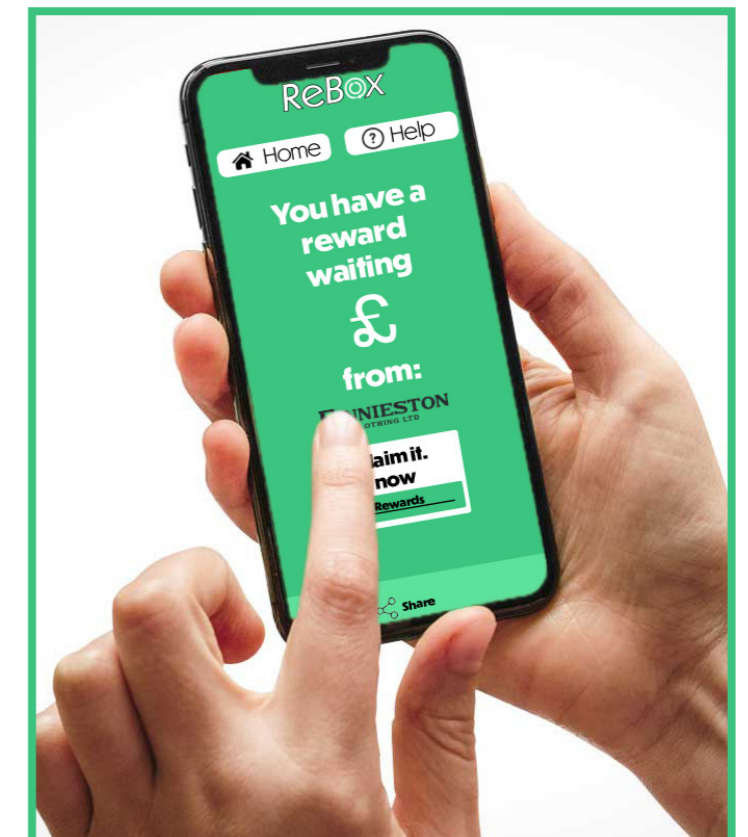
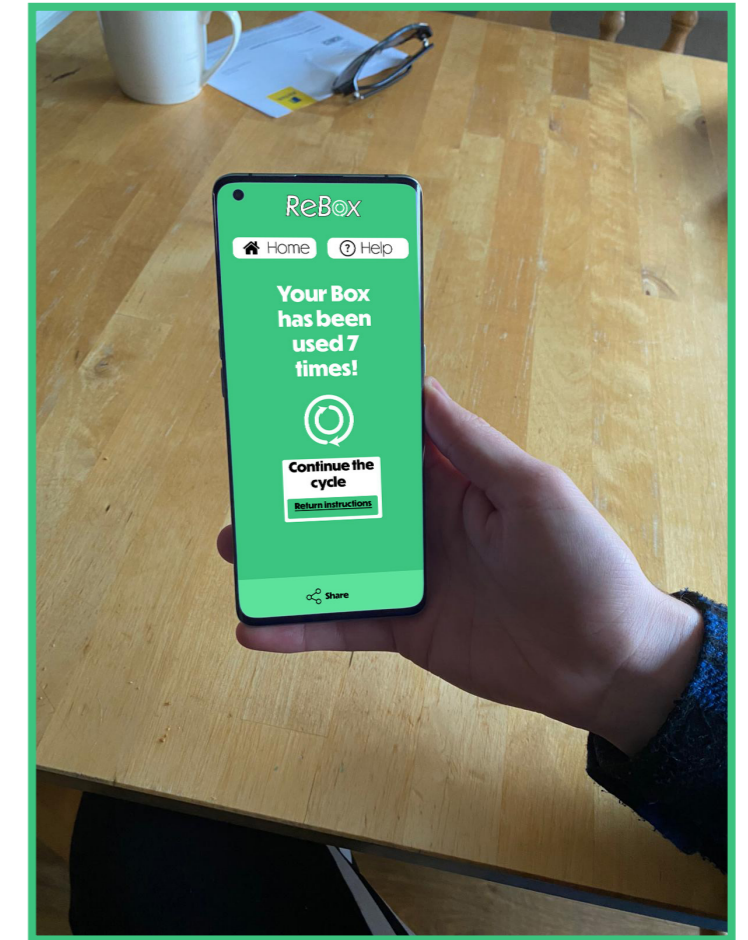
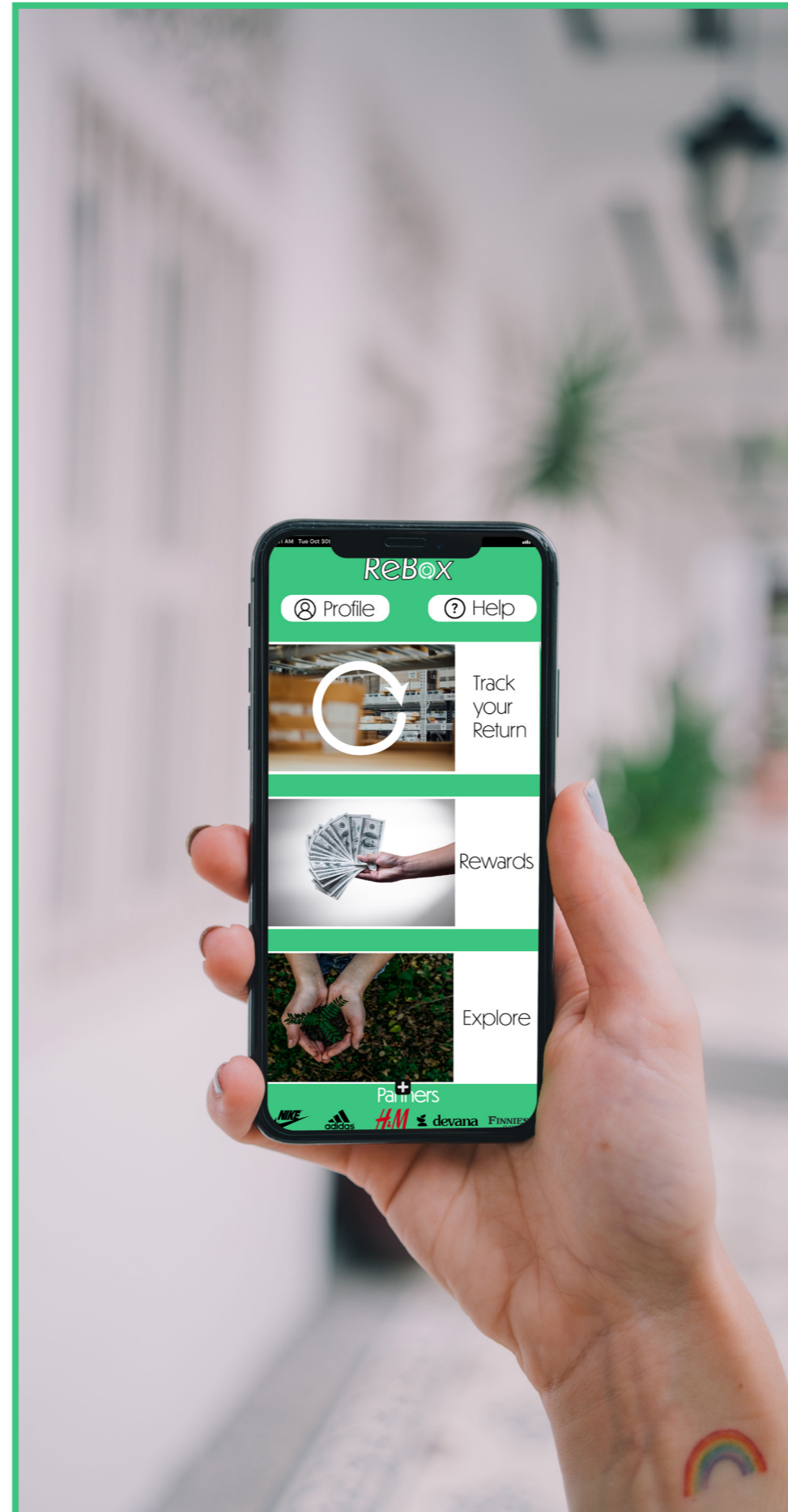
Cycle begins again for next shipment

App and system

In order to make customer interaction easier and a more seamless experience an app was developed in conjunction with the product system.

The app allows users to scan their ReBox and see how many times it has been used. Users can also track their rewards and returns from the app.

Other features include , sustainability information, return locations and also folding instructions.



Life Cycle Analysis

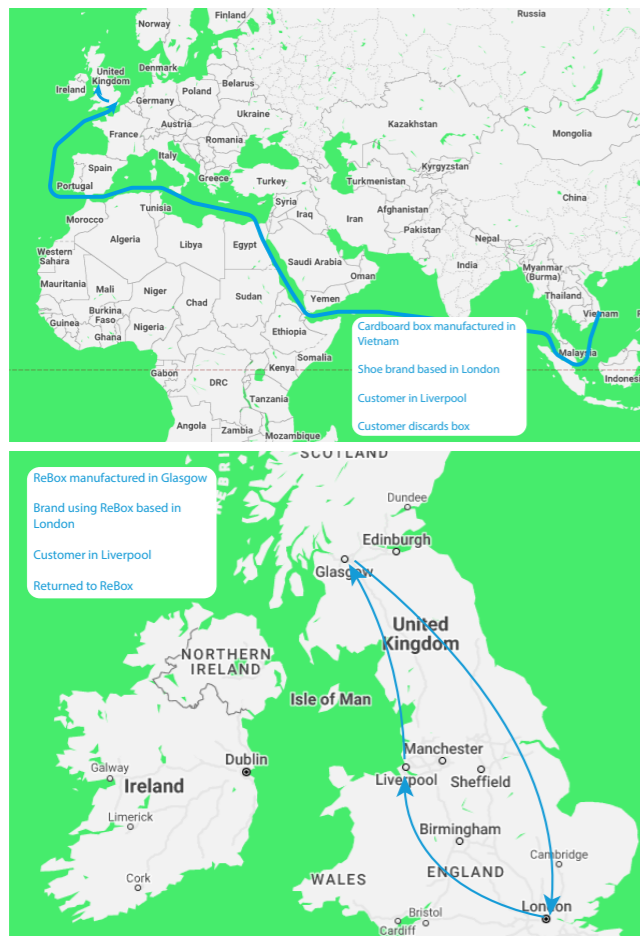
A full Life Cycle Analysis(LCA) of the ReBox product system was carried out to prove the environmental benefits. In addition a similar LCA was carried out for the current single use cardboard system for comparison.

Certain assumptions had to be made to determine the scope and boundaries of the analysis.

Assumptions

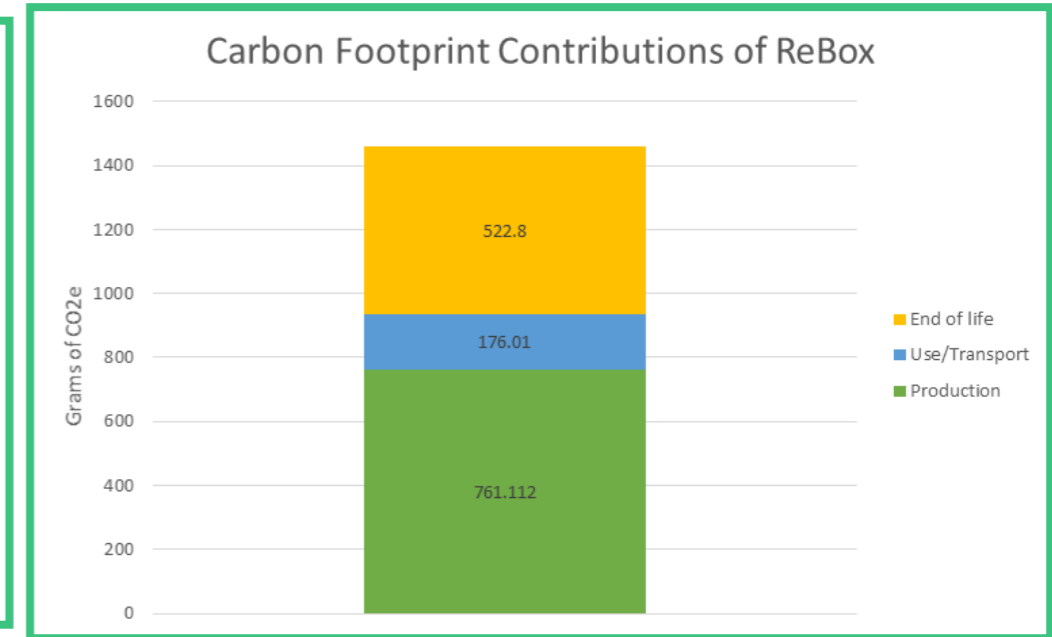
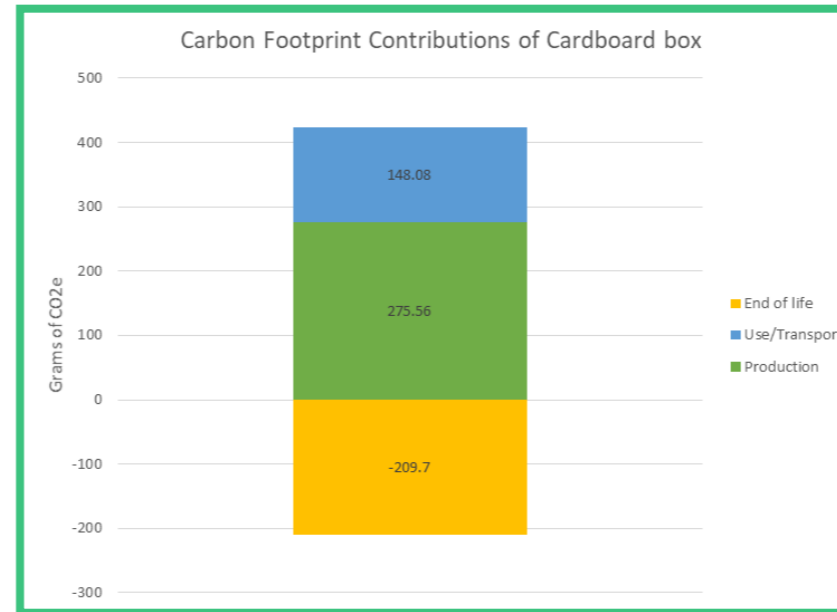
- The end customer is in Liverpool.
- The footwear brand/company is in London.
- The ReBox is manufactured in Glasgow.
- The cardboard boxes are manufactured in Vietnam (where Nike manufacture their boxes).
- Certain processes deemed not to have a significant effect on the life cycle were disregarded (cleaning, removal of Velcro at end of life).
- All ReBox products are returned.

The journeys for both the cardboard and ReBox(respectively) are shown from manufacture to end of life.

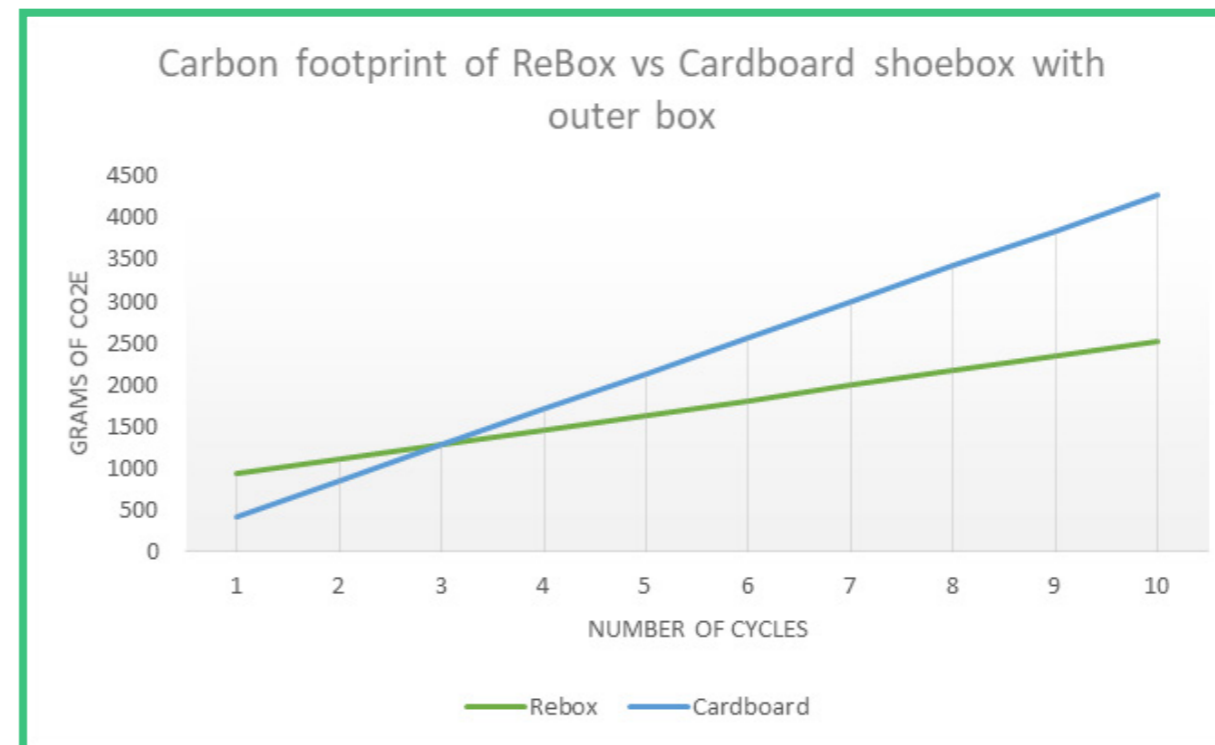


Results

The results were quantified and analysed to demonstrate the benefits of the ReBox system. Shown below are the CO2 equivalents (CO2e) contributions for each package. It is clear that the bulk of the carbon footprint for the ReBox is in the production stage.



It was proven through the LCA that over one complete cycle the cardboard system was better for the environment, however after just 6 reuses the ReBox system demonstrates an environmental advantage. This means the ReBox being sent back and reused only 6 times has a smaller carbon footprint than the current single use cardboard model.



After 6 uses the ReBox system saves 227.43g of CO2e. For the 24.2bn shoes sold each year this saves over 900 million kg of CO2e

Manufacture

The ReBox is made from only 2 materials, this was to keep the carbon footprint as low as possible:

The main polypropylene bubble board body and the Velcro closures.

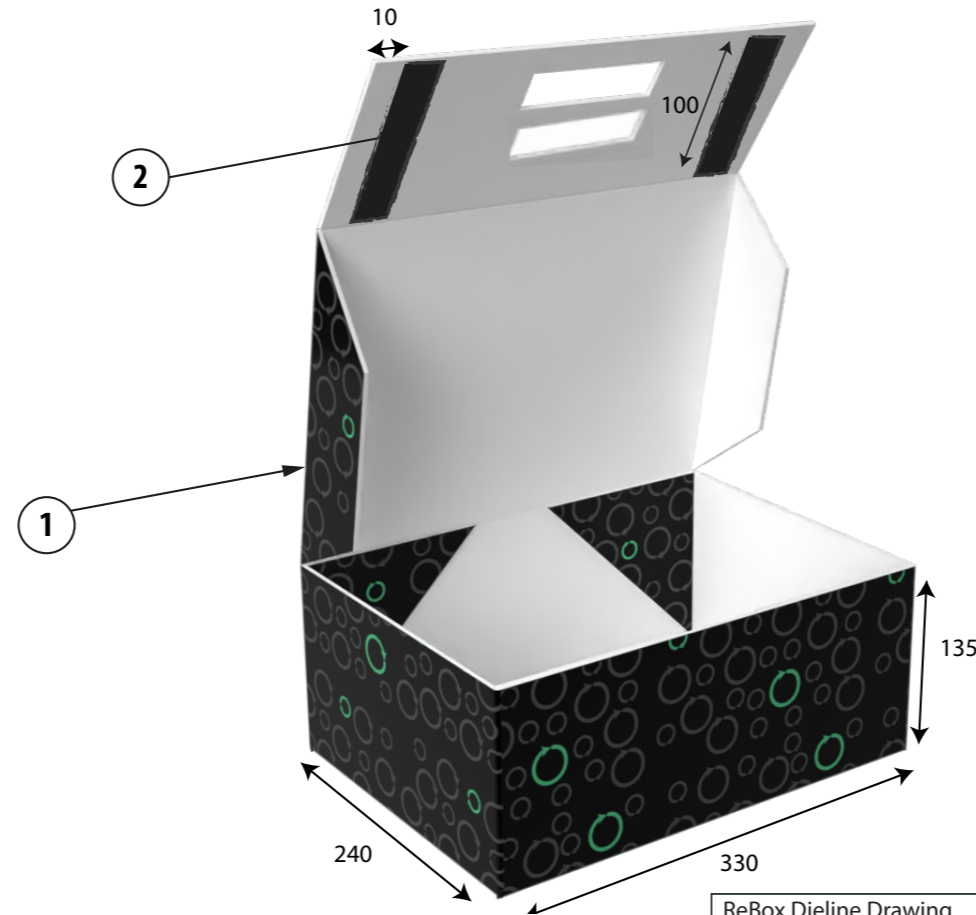
The first stage of the manufacture is production of the bubble board, this is co-extruded from polypropylene pellets (25% recycled).

Once the sheets have been formed they are die cut according to the die line drawing shown. The red lines indicate where the sheet is then given its creases using hot bending. This removes the need for scoring and keeps the internal structure undisturbed.

Following the die cutting and bending the graphics are applied to the inside and outside using flexographic printing, leaving a matte finish.

Once the box is printed 4 panels are ultrasonically welded to give the box its unique folding mechanism.

The final stage is application of the Velcro by hand using a methyl methacrylate adhesive which provides great adhesion to the polypropylene.



Part Number	Quantity	Part name
1	1	Polypropylene body
2	2	Velcro closure

Units: mm/g
Material thickness 3mm
Weight: 437g (432+5)

ReBox Dieline Drawing	
Material: 3mm Polypropylene bubble board	
Processes: Die cutting Hot bending Ultrasonic welding	
Units: mm, degrees	
Drawn: 30/3/22 Sean Phelan	
—	Cutting line
—	Crease/bend line
---	Bleed area
■	Welded area
Post cut processing:	
Creases, heat bending	
Ultrasonic welding (areas shown)	
Flexographic printing	

