What happens to footwear that cannot be reused?

Each year in France 275 million pairs of shoes are marketed, i.e. 119K tons of pieces of leather, rubber, foam and other plastics that are glued/stitched together. Footwear represents 19% of Clothing, Linen and Footwear (CLF) tonnages introduced onto the market but only 6% of incoming CLF tonnages in sorting centres.

How can this difference be explained? Today, a large majority of consumers only dispose of footwear at the 45,000 collection points that is in "good condition"and that can be reused, and throw away footwear that is damaged. Indeed, today the reality of footwear recycling is rather stark: there are no (or few) recovery solutions unlike textiles for which tangible industrial projects are emerging.

HOW CAN THIS GAP BE EXPLAINED?

- Footwear items are comprised of an average of 5 different materials assembled together with glue/stitches making disassembly difficult.
- Once disassembled and sorted, these materials must be processed (shredded, melted, purified, etc.) so that they can be integrated into new applications. This involves many costly technical stages for a result which is unfortunately not as competitive as raw materials.

Working together, engaged together so that ALL footwear has a second life and can be recovered!

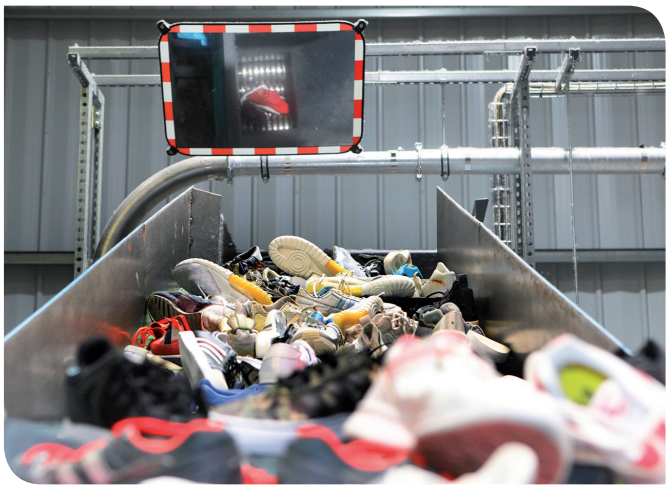
THE STAKES AND CHALLENGES ARE THEREFORE SIGNIFICANT in order to integrate this footwear sector into a circular economy:

- Generalise and deploy eco-design in order to increase the sustainability of products and improve their ability to be recycled (see p.22 for the opportunities that have been identified).
- Develop an efficient recycling industry (see the map on the next page showing the different solutions that already exist) that will enable the different materials in footwear to be characterised (material and colour) and separated.

***In brief*:**

In France, sneakers now represent 50% of the market (up to 80% for kids shoes)

**Sources : Insee, Fédération Française de la chaussure, CTC, Revue-Projet*



© SOEX

- Identify the sectors where materials resulting from the recycling of shoes can be integrated, mostly in an open loop; footwear is no longer produced in Europe (countries in Asia account for nearly 90% of world production in terms of volume).

Therefore, within the context of its mission to accompany the sector's players in optimising recycling, Eco TLC, participated in particular, in the funding of the only footwear recycling unit in Europe (call for R&D proposals 2012 and 2014). This is the pre-industrial SOEX unit, inaugurated in June 2018 (see article on p.28).

In keeping with its commitment, footwear will be at the heart of several projects implemented by Eco TLC during the 2019-2020 period:

- Updating the characterisation study on used CLF entering sorting centres (see 2014 report).
- Launch of an eco-design platform for entities introducing footwear onto the market.
- Development of a scale for the fees paid by entities introducing footwear onto the market (bonus/penalty system on footwear).
- Follow-up of footwear R&D projects in progress: Ector se recycle (Ector is recycling)/Insoft, Design for repair/Éram, Hodeï/Camy, Thermicuir/CTC.

This first footwear recycling map illustrates well the complexity of the challenges faced by this sector. If you know of other footwear sorting/recycling techniques, do not hesitate to send us the information. This map is regularly updated.

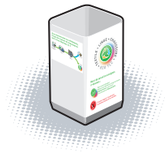
Mapping of footwear recycling

Footwear
introduced onto the market:

275,600,000 pairs/year

i.e. **119,000** tons/an
(19% of total weight of CLF)
FIGURES 2018

12% of those introduced onto the market are collected in collective points (14,000 tonnes)



85%
of footwear collected
can be reused

15%
of footwear collected cannot be reused and
must therefore be recycled

*In brief**:
On average each French citizen buys 5.4 pairs of shoes per year (7.5 pairs for children, 6 pairs for women and 3.5 pairs for men). On average men have 8 pairs and women 17 pairs.

Manual AND/OR automatical sorting
of non-reusable footwear
(2,100 tons)

Closed loop recycling

→ Single-material footwear (e.g. Okabashi - USA)

Industrial composting

→ Biodegradable materials which are transformed when composted (e.g. Puma InCycle)

Slicing of sports footwear:
separation of the shoe upper from the sole

Sorting then shredding into 3 types of granules:
RUBBER, FOAM AND FIBRES
→ Flooring surfaces, outsoles (e.g. Nike Grind)

SRF, Energy recovery or incineration/landfilling**

Models containing sorting disruptors:
- Toe caps (in metal or hard plastic) in safety footwear
- Heels in hard ABS plastic + shoe uppers in steel
- Parts which cannot be separated
- Electrical and/or electronic components

SHREDDING CHALLENGES:
- *Limit intra-material pollution,*
- *Reduce and homogenize particle size*

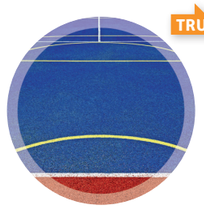
Complete shredding of footwear
Coarse shredding (about 2 cm²).
All types of footwear

FOOTWEAR RECYCLING PILOT LINE

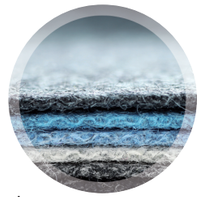
Delamination then densimetric separation of materials

RUBBERS
(NATURAL AND SYNTHETIC ELASTOMER),
FOAM, PVC, PU ETC.
FROM SOLES
→ Hard or rebounding coatings, thick mats, outsoles

TRUCS-TROUVAILLES



METALS
→ Existing metal recycling processes



TEXTILES
(NATURAL AND SYNTHETIC MATERIALS)
→ SRF**, Energy recovery
→ Integration into non-weaved items

REJECTS AND DUST PARTICLES
→ SRF**, Energy recovery

LEATHER / LEATHER LOOK
→ Mixed with PVC to serve as weighting
→ Mixed in with wood fibres to produce acoustic panels (e.g. Pavatex)
→ Integration into compressed wood panels (e.g. Taimee)
→ Thermal recovery

THERMICUIR

2,500 pairs...
foam inner soles allowing tennis courts to be built
rubber outer soles, 300m² of play areas for children

→ R&D projects at the industrial stage
→ R&D projects or trials in progress

PROJET
Projects supported by Eco TLC within the context of R&D projects

Focus on R&D projects supported by Eco TLC

Out of the 44 R&D projects supported by Eco TLC since 2010, only 8 are about footwear.

3 ECO-DESIGN PROJECTS:
DESIGN FOR REPAIR / ÉRAM, ECTOR / IN SOFT, HODEÏ / CAMY

4 MECHANICAL RECYCLING PROJECTS:
FOOTWEAR RECYCLING PROJECT / AGENCE AIR COOP (2 projects), ECTOR SE RECYCLE / IN SOFT, TRUCS-TROUVAILLES

1 THERMAL RECOVERY PROJECT:
THERMICUIR / CTC

**Sources : Insee, Fédération Française de la chaussure, CTC, Revue-Projet*

***SRF: Solid Recovered Fuel*

How to increase the sustainability of footwear and improve its capacity to be recycled

© ector

1. BY ECO-DESIGNING:

Simplify processes and components so that materials can be more easily sorted and recycled

© 3D Bonding - Simplicity Works

SUSTAINABLE STYLE:

Develop timeless, unisex, personalised models.

MATERIALS:

- Reduce the number of materials making up footwear thanks to new manufacturing processes (e.g. ME:sh by Salomon) or only use a single material (e.g. Méduse in PVC; Futurecraft loop by Adidas in TPU).

HODEÏ

- Select materials having a reduced environmental impact: bio-sourced materials (e.g. CWL by VEja; Cotton + Corn by Reebock), compostable materials (e.g. OAT shoes), recycled materials (e.g. Authentic Material) as well as materials that can be recycled.

ECTOR

- Choose leathers tanned without chrome (with plant substances).
- Support the implementation of detailed characterisation of materials (international pictograms) in order to guarantee traceability and material recognition during sorting.

MANUFACTURING AND DISASSEMBLY TECHNIQUES:

- Generalise the use of prototype design software enabling waste to be reduced: 3D printing and injection of polymer into a three-dimensional finish mould (e.g. 3D Bonding by Simplicity Works).
- Develop methods for "design with a view to disassembly" in order to make it easier to assemble and separate components at the end of their service life, carried out by the consumer (e.g. Comake Shoes) or the brand. DESIGN FOR REPAIR
- Assemble the upper and sole without glue or stitching (e.g. Loper by Proef designs; ACBC Shooz).
- Use sewing thread which dissolves under heat (e.g. Resortecs) or electromagnetic waves (e.g. wear2).
- Develop glues which make it easier to separate the shoe upper and sole.
- Manufacture soles and/or uppers using 3D printing (e.g. Feetz).
- Design models with repairable and/or replaceable soles.
- Industrialise RFID technology for identifying components during the sorting of end-of-life footwear.

*In brief**:

Average composition of footwear: 25% leather, 24% vinyl or polyvinyl, 23% natural or synthetic rubber, 17% polyurethane (foam).

© Futurecraft loop - Adidas

© Comake

© Angarde

© Loper - Proef designs

2. BY LENGTHENING SERVICE LIFE:

© Repair It Yourself - Eugenia Morpurgo

- Make it easier to reassemble, repair and renovation.
- Train consumers in footwear care.
- Develop reconditioning (e.g. sneakerdealers.net).
- Offer rental services (e.g. Atelier Bocage).
- For end of service life footwear, implement a deposit recovery service by the entity introducing it onto the market. (e.g. Angarde).

ECTOR SE RECYCLE

**Sources : Insee, Fédération Française de la chaussure, CTC, Revue-Projet*