

# JUNKLAND

## WASTE ARCHITECTURE

*how do we create space out of waste?*





Stacked washing machines awaiting disassembly at Road2Work, a recycling hub longer  
Source: Max Pinckers for The New York Times



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# WASTE ARCHITECTURE

## ABSTRACT

Waste, unethical construction and material sourcing, and unsustainable design. The construction industry is responsible for producing nearly 40% of all waste on the planet (Eurostat, 2022), and it is the role of designers and architects to address the waste problem and find solutions to design out of our mess. With circular economy principles being implemented and more practitioners exchanging design strategies, the industry is slowly moving towards a waste-free future. However, not enough buildings are maximizing the use of their own waste materials. This study seeks to understand the lifecycle processes of building materials, as well as explore new ways to circulate waste back into the design process. The research is centred around the question, how can we design space out of waste? In order to understand the full potential of waste

architecture, it will be assessed as a catalogue of parts and the building will be designed in layers<sup>(1)</sup>, each exploring the potential implementation of new waste materials. The methods of research include architecture case studies, material studies, interviews, data collection of BAMB – buildings as material banks, material passporting, demountable structures and value in waste materials. Junk can be acquired from various sources that do not need to be raw materials. The study also will look towards other design disciplines and industry waste flows to experiment with new ways to design out of waste. Junkland is an experimental exploration process seeking to identify creative solutions for reclaiming “unusable” waste materials back into the building.

**keywords:** *#junkland #wastearchitecture #wastematerials #materialexploration #circulardesign*

<sup>(1)</sup> Shearing Layers concept - Brand, S. (1994). How buildings learn: what happens after they're built. Viking Publishers.





Half of all waste in the Netherlands comes from construction and demolition  
Source: Max Pinckers for The New York Times





Wooden Nursery by Djuric Tardio Architectes is a nomadic object  
Source: Clément Guillaume for ArchDaily

# DEFINITIONS

## KEYWORDS AND ABBREVIATIONS

**BAMB:** buildings as material banks

**Building Layers:** reference to Shearing Layers system by Stewart Brand

**DFD:** design for disassembly

**LCA:** life cycle assessment of materials

**Junk:** second-hand waste materials deriving from former objects, products, and uses

**Junkland:** the design by research outcome of the experimental process of designing out of waste

**Waste architecture:** architecture designed out of waste

**Waste materials:** debris materials deriving from construction and building materials

# WHAT ABOUT WASTE?

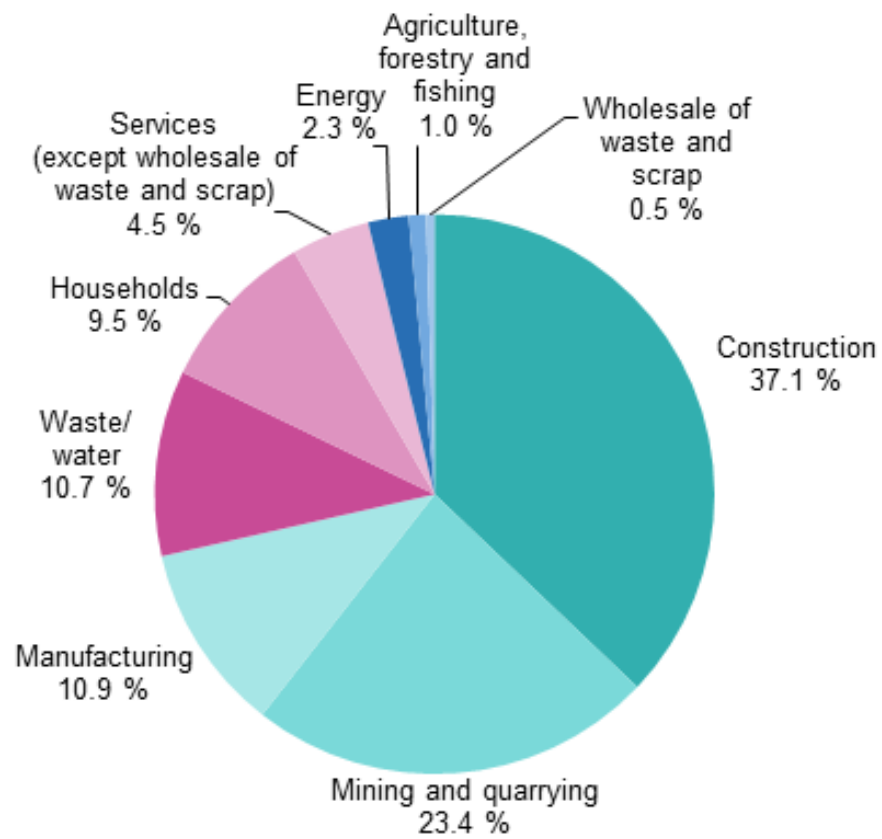
## PROBLEM STATEMENT

To put it frankly, we produce too much waste. The world is currently producing 2.01 billion tonnes of waste annually with the population only continuing to grow (World Bank, 2022). Where is all of this waste going? While we may think we live sustainably because we recycle our papers and our plastics, but this only equates to 13.5% of the overall global treatment and disposal of waste - most of our junk ends up in landfills (World Bank, 2022). Sure, we must all do our part and make better habits but how do we address the problem on a larger scale? What do we do with all of this junk?

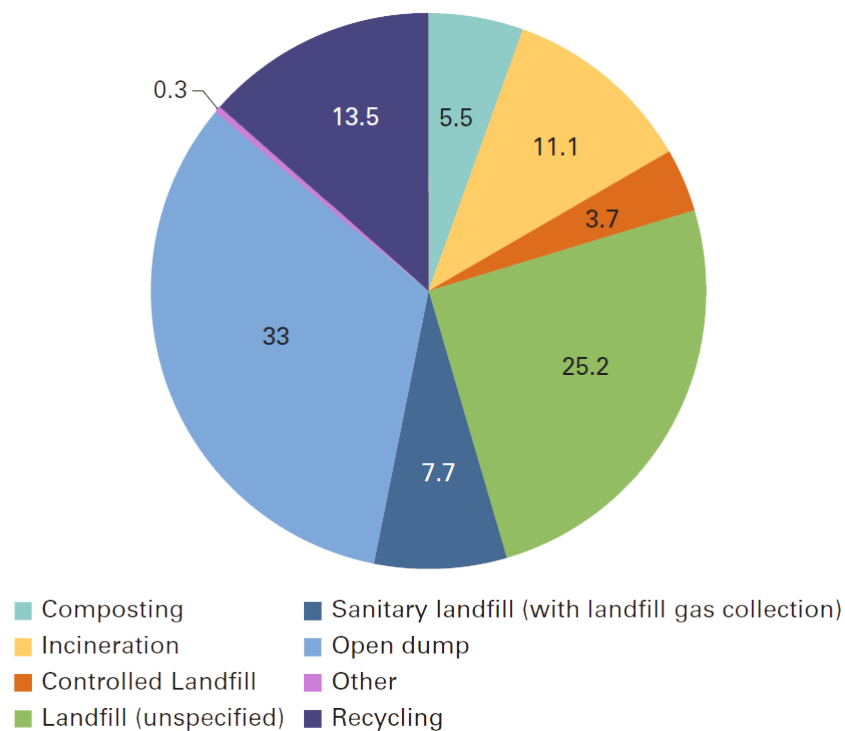
The Building and Construction Sector is responsible for the majority of waste generation within the EU at 37%. Following at 24%, is the Mining and Quarry Sector (Eurostat, 2022). This means that 60% of our overall waste comes from what materials we extract and what we build with them. The production of building industry materials such as concrete and steel produces 3.5 billion tonnes of CO2 emissions alone (EMF, 2020). Who takes on this role? If city planners are developing sustainability goals, and policymakers are implementing more circular business models, then is it not the responsibility of the architects and designers to problematize the construction process of this waste-less future?

There is a globally growing circular community, groups of leading organizations and platforms such as the Ellen MacArthur Foundation, that are connecting practitioners internationally to exchange knowledge and strategies that can shift the current linear industry towards a clean and circular one. Circular architecture focuses on material use and design for disassembly. Strategies include building with less materials, locally sourcing, material passporting, designing demountable elements, and replacing adhesives with screws and fasteners. The architecture becomes a kit of parts, that is easy to construct and loses minimum material value when it is required to be taken back apart. While these strategies have already begun to be implemented within the building industry, many projects compile of new and ready-to-use elements, and not enough waste elements being brought back to life. How do we re-add value into waste materials? And if we can, how can we design space out of waste?





Waste generation by economic activities and households, EU 2020 (% share of total waste)  
Source: Eurostat



Global Treatment and Disposal of Waste (% share of total waste)  
Source: World Bank





# HOW DO WE DESIGN SPACE OUT OF WASTE?

## METHODS

This research plan seeks investigate how to design architecture out of waste and explore the notion of a JUNKLAND space prototype architecture. Methods include critical architectural case studies on existing circular and waste architecture projects, and visual studies of products designed out of waste from other design disciplines. The intention of JUNKLAND is to be experimental and explore the opportunities of unconventional waste materials being adapted into the layers of architecture without losing too much of their material value. The research will include the data collection of existing material sourcing techniques and circular strategies within our current day architectural practice, as well as a thorough investigation in the research themes such as BAMB, material passporting, DFD and waste material values. The project will conduct a comparative study on existing building construction materials and new experimental waste materials. These waste materials will

derive from local industry waste disposals varying from building debris, textile and furniture waste, and junk from industrial objects, etc. and will be explored in the form of physical model studies and field sampling. Furthermore, interviews with circular initiatives as well as architectural practitioners will be performed to gain insight on their potentials and challenges with different junk materials. Through the process of accumulating the initial research and data, two Dutch architecture projects inspired new ideas for designing waste materials.

# CASE STUDY 01

## VILLA WELPELOO | SUPERUSE STUDIOS

Villa Welpeloo is a residential house intended to also be used as an exhibition space for contemporary art. It is also a circular house that is made up of 60% waste materials. Superuse Studio achieved this by developing what they called a harvest map. They collected material data around the area through Google Earth and site explorations, taking interest in the local waste flows and industrial zones (EMF, 2020). The architects set a goal to source all construction materials within a 15km radius of the site, and most of what they found was junk. The structure of the villa is composed of steel girders that previously made up a paternoster, sourced from the local textile industry. "One reclaimed machine was enough to build the entire villa with" (Superuse Studios, 2022). The building was insulated with polystyrene offcuts from neighbouring manufacturers, and the wood façade was made from 200 damaged cable reels. These damaged reels would typically be reduced to particleboard or burned however, in order to preserve the cable reel wood's material value Superuse found a treating method called Plato to strengthen the skin's durability against weathering. Without the use of chemicals, the wood was treated by different kinds of heat, provided by a local powerplant to treat. By maintaining as much

of the material value in the wood and steel, it was possible to achieve a 90% CO2 reduction in the construction of the building's structure and skin (Superuse Studios, 2022). On the interior level, the furniture elements are made up of previous billboard signs, the windows of waste glass from a local glass factory, and the bathroom tiles and surfaces are made up of recycled coffee cups (van Andel, 2018). The villa harvests as little materials as possible, and sources as much second-hand as possible. It results in a minimal, contemporary home/art gallery that does not look like a junk building. This project primarily designs out of waste for the shearing layers of structure, skin, space plan and stuff. It adapts local junk materials and reimagines their use into a house not only for living, but for art. Villa Welpeloo exemplifies how waste materials have the capacity to be repurposed into an architectural elements that are as beautiful as they are second-hand junk.





Villa Welpeloo front entrance  
Source: Frederique van Andel for DASH







# CASE STUDY 02

## ALLIANDER HQ | RAU ARCHITECTS

Alliander is the Dutch national energy grid company. When the company required more space, they hired RAU Architects to make their new headquarters the first ever BREEM sustainably certified building in the Netherlands. This is a net-positive energy efficient building, producing more energy than it consumed, and it distributes that surplus to its neighbouring context (RAU Architects, 2018). RAU achieved this by blanketing the 5 existing buildings on site under one undulating porous canopy roof to create one hyper-efficient building. Since the roof was a new addition and required new materials, RAU collaborated with a roller-coaster engineer to develop a lightweight undulating steel canopy structure that was designed for disassembly and reuse (Aguirre, 2022). This ensured minimization of the amount of raw materials required and all of which were documented in a "raw materials passport" for the project. The intention of the project is to preserve as much of the existing construction as possible and design out of the waste produced from what could not be preserved. 83% of the existing structure remains while the parking lots and small roads between the buildings are refurbished into the large naturally ventilated core atrium space (Aguilar, 2015). The facades of the existing buildings are maintained, and an extra skin is added to reduce heat loss. The interior facades

are clad with waste wood material, the toilets, doors, and ceiling plates are reused at full material value, and the concrete and asphalt from the previous parking lots around the site are recycled into flooring and furniture elements in the space plan. The services layer of the building is also circular, it features a rainwater collection system on the roof that is used in sinks, toilets and watering the plants and green walls in the HQ. The renovation also included the implementation of solar panels and an underground water thermal storage, making it a CO2 neutral building. The Alliander HQ maximizes the use of its existing site and construction while combining new building elements that are designed to be taken apart. It is not junk architecture per se however, it explores the possibilities of extracting portions of existing buildings and recycling them to other functions and products. The energy positive building demonstrates that waste materials are just as impactful as new construction methods when designing for a circular and carbon neutral architecture.

# JUNKLAND

## RELEVANCE AND PRELIMINARY CONCLUSIONS

Architectural case studies such as Villa Welpeloo and the Alliander HQ are relevant because they exemplify various ways methods at which waste materials can be circulated back into a design project, and at the different building layers. There is no single way to design a circular building, nor waste architecture. Therefore, an experimental research approach is most relevant to this type of project. By assessing the present strategies and construction techniques, I am able to understand the process of demounting architectural structures in such a way that maintains the highest possible value of its materials, as well as define the most plausible next stages of their life cycles. Through the education and reference of other design domains circular, I gain inspiration and ideas for methods of gaining aesthetic value in junk materials. This project seeks to create a playful architecture that draws a curiosity to its visitors as well as exemplifies the structural and functional capacities of waste architecture. By understanding material process and passporting, I will be able develop my own catalogue of waste materials that can circulate on the various layers of the building. While the exact materials I will explore are still to be determined, they will derive from what is available to be locally sourced. The goal is to learn the techniques of designing out of waste and applying them to my graduation project.

Junkland is an investigation on how we can design out of the already created waste of our industry and it falls under the umbrella of circular design research. However, the focus objective is to design with what we already have to produce a carbon neutral prototype project. Junkland holds the preliminary position that it is possible to design buildings without directing sourcing raw materials and that waste materials have the capacity to be as beautiful reclaimed architectural elements. By dissolving the stigma that junk holds no value, it opens up the door to a new type of circular design: playful, curious, waste architecture.





The Zero Waste Bistro made entirely from Recycled Materials  
Source: Nicholas Calcott for Visual Atelier 8





Waste Side Story Pavillion / Cloud-floor  
Source: Ketsiree Wongwan for ArchDaily



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An emerging group of architects believe in designing not just for the life of a building, but for its afterlife, too  
Source: Max Pinckers for The New York Times