



Redesigning Adria Caravans for a Circular Economy

Graduation Thesis for Master Integrated Product Design | Faculty of IDE

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Summary

This project started with the following assignment: redesign the Adria Action caravan to fit in a circular economy and to have less CO₂ emissions. However, the outcome of this project is not a redesign of a caravan but a framework for Adria to work towards (partial) circular economy. As an example of the functioning of this framework, a redesign of the bathroom floor was done.

To get to know the particular caravan and the caravan industry an analysis of the context was conducted. An eco-analysis on material basis of the Action caravan was done and visits to experts in the industry, repairmen and a caravan recycling company, were made. The main conclusions from the analysis were that the structural body has the most value, both economically as environmentally, and therefore needs to be used for a longer time. There already is an effort made but it is complicated due to components that are hard to repair and due to a lack of support and instructions and availability of spare parts. In the caravan industry and this company there is also little standardization which means there are a lot of unique parts. This makes it hard to find fitting components and to reuse perfectly good components in other vehicles. The successful business of repair and recycling companies shows that there is value after the sale of the caravan but it is made unnecessary complex to retain this value by the organization of the caravan companies.

The framework shows that designing caravans for a circular economy involves more aspects than just redesigning the individual parts for reuse, repair and recycling possibilities. There are different levels on which actions can take place and to become completely circular, these levels must work together. First, analytical capabilities, such as LCA and hot spot mapping, are needed to assess the current condition of the caravans and evaluate improvements. To do this, a different way of documenting will be required within Adria. Next, with this objective way of assessing the caravan, focus points can be found and components can be redesigned using the circular economy ideals. Those adjustments can then again be evaluated.

One of the focus points found is the bathroom floor. It is a critical part because it protects the frame from moisture, the bathroom is not functional without the floor and it is very difficult to disassemble and reassemble the floor. At the moment, the floor is being repaired with polyurethane, which restores the value of the caravan at that time, but the repair makes the component non-recyclable and therefore no longer part of the circular economy. It is more sustainable to replace the tray as a whole. So when redesigning the tray, it was looked at how this can be done easier. It requires minor adjustments to the part and larger adjustments at a company level. On a company level, some variables should be agreed on as a fixed standard. This makes future designs backward compatible and therefore makes it easy and cost-efficient to produce an extra part when a customer orders it, enabling the replacement of the tray.

1

CARAVAN LEVEL

IDENTIFY CRITICAL PARTS

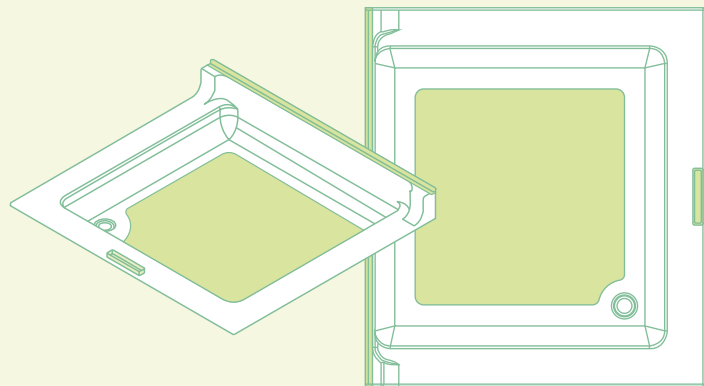
A fast-track LCA showed that the most valuable materials are in the structural body. Caravans are discarded due to inside components that are hard to repair. These repairs are difficult due to lack of instructions, unavailability of parts after many years and no standardization in the industry. A good example of a hard to repair a critical component is the bathroom floor. It is a critical part because it protects the frame from moisture, the bathroom is not functional without the floor and it is very difficult to disassemble and reassemble the floor.

2

PART LEVEL

DOES IT FIT WITHIN THE CIRCULAR ECONOMY?

Bathroom floors crack because the plasticizers leave the material, making the plastic floor brittle. Current repair methods, such as filling the floor with the resin polyurethane, make the floor non-recyclable. It would be better to replace the floors to make sure they stay in the circular economy. This is currently hard to do due to the order of assembly, having to take out a lot of furniture before reaching the floor.



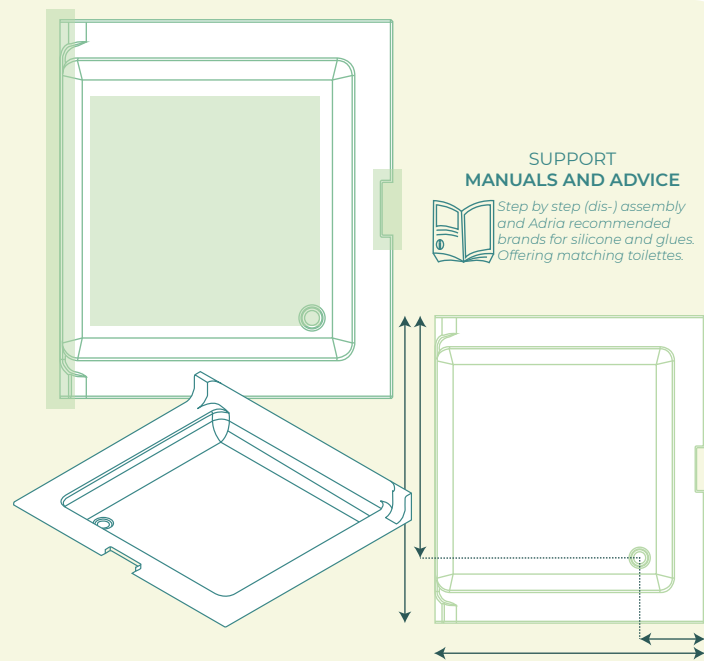
3

ALL LEVELS

SOLUTION

Improving the floor goes beyond adjusting the design features. To solve the problem in the long run, there needs to be a standardization movement. Creating back-ward compatible components and limiting the number of unique parts in the company.

- PART LEVEL
INCREASE REPAIRABILITY, DESIGN FOR REPLACEMENT
- CARAVAN LEVEL
EVALUATE SURROUNDING FURNITURE
- ADRIA LEVEL
STANDARDIZE DIMENSIONS AND PLACEMENTS



SUPPORT MANUALS AND ADVICE

Step by step (dis-) assembly and Adria recommended brands for silicone and glues. Offering matching toilettes.



Introduction

Problem definition

Adria is a leisure vehicle company and produces caravans, motorhomes and campervans. Sustainability within this industry mostly consists of comparing caravanning to hotel rooms and long flight destinations, and concludes in how much better it is to go camping. This comparison to these other forms of holidays sets the industry in a good lighting but does not say anything about the differences between the options of different brands, sizes and shapes within the caravan industry. This is because there currently are no more sustainable alternatives, there are no designs that are advertised with recyclable materials or with more aerodynamic shapes.

Based on the desires of customers and European legislation a larger trend is visible which asks for more circular products. Currently, Adria does not have caravans designed for the circular economy. The caravans are mainly designed to be as light as possible, are very durable and cost efficient. In light of new trends and upcoming rules it is logical for Adria to make a sustainable step forward and review her own products. Doing this with the circular economy in mind complies with legislation and sustainability trends. There are obvious aspects that are non recyclable but since, no analysis has been done, it is unknown what are the focus points and high contributing components.

Project

This project started with the idea to redesign one model in the Adria portfolio: the Action caravan. It became clear that this would not be an option since not all needed data is present, there is no support system in place for repairs, refurbishing or remanufacturing and local recycling programs are not ready. This led to more insights on how the total context surrounding the caravan can be used for circularity where Adria can participate in.

A framework (Chapter 7) with steps is created for Adria for Adria to work on creating circular components instead of focusing on one particular caravan. This starts with filling in the knowledge gaps,

reviewing the data and redesigning valuable, impactful components first. To explore how component redesigns could be done in practice, one critical component is redesigned (Chapter 8). The redesigning of the bathroom floor shows that designing components for a circular economy can be simple, it might only demand small adjustments per part, but there is a larger organisational change needed. For this particular critical component, companywide standardization is needed to eliminate excessive growth of unique trays. Since there are a lot of model unique components, it can be assumed this will be needed for more parts.

In the future, Adria can expand their business with other business elements, such as selling components, leasing caravans, creating workshops or recycling their own caravans. These will generate profit by adding value to the products and will be easier if there is more standardisation between editions, models and layouts.

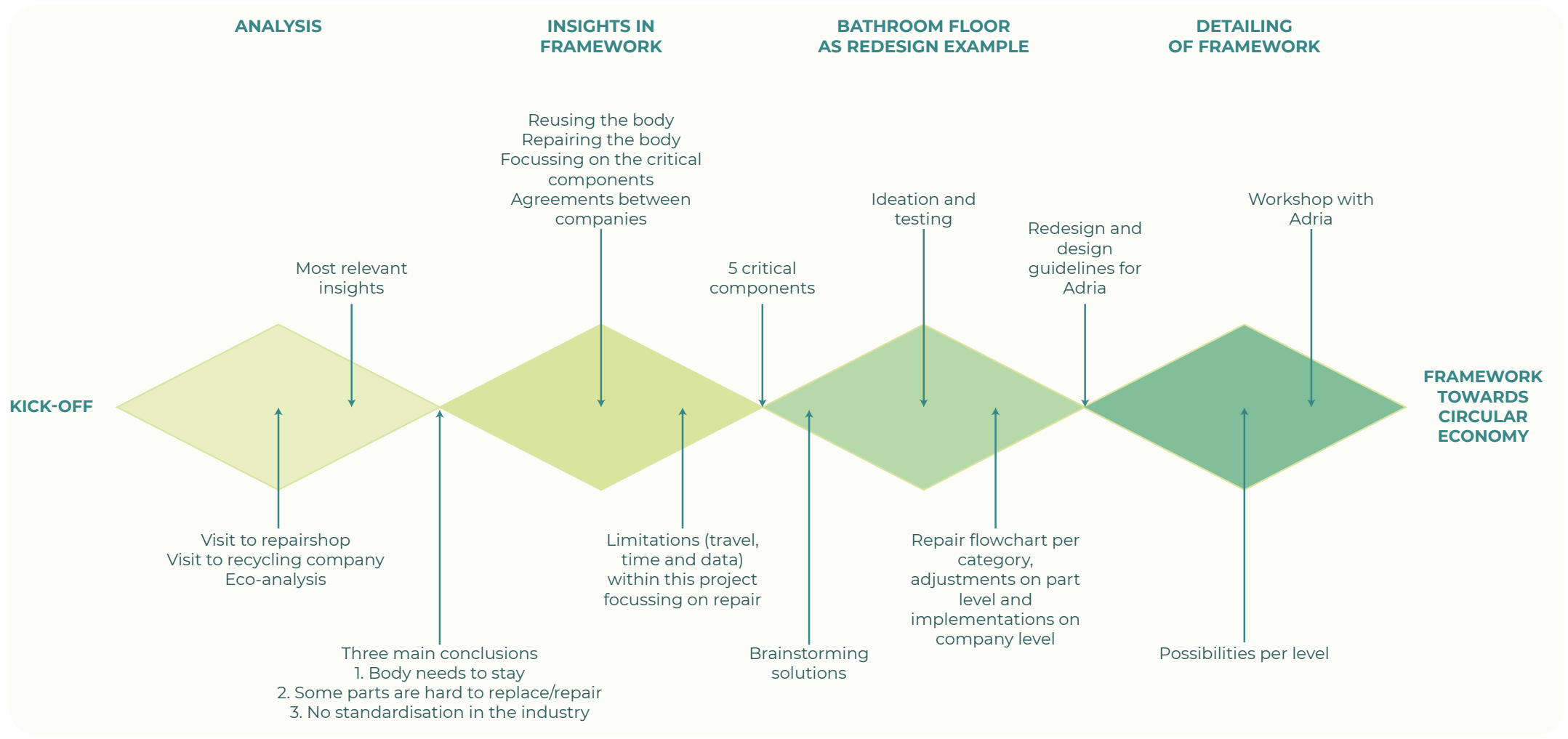


Figure 1 Overview of the project



IA



ADRIA

ADRIA

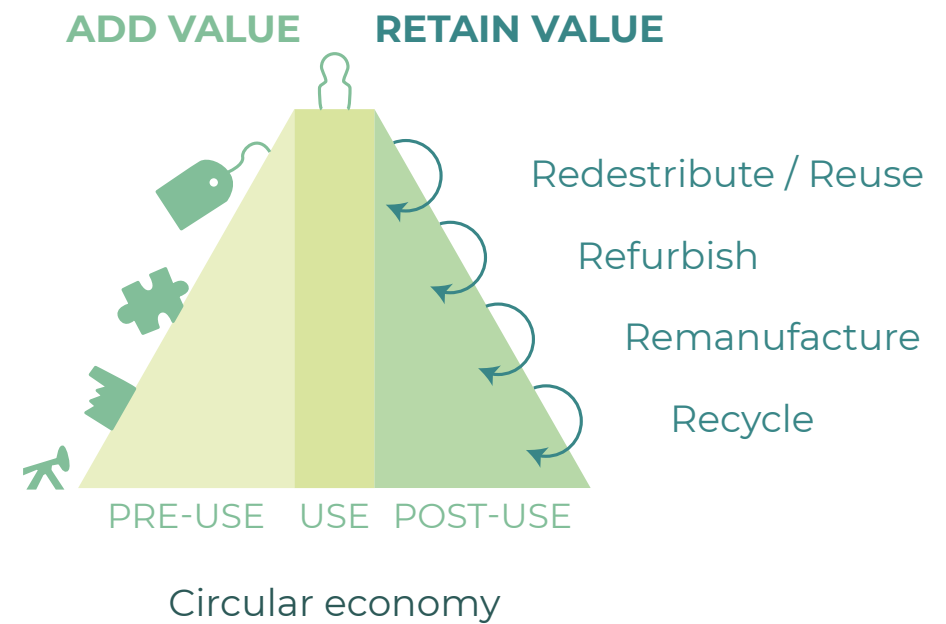
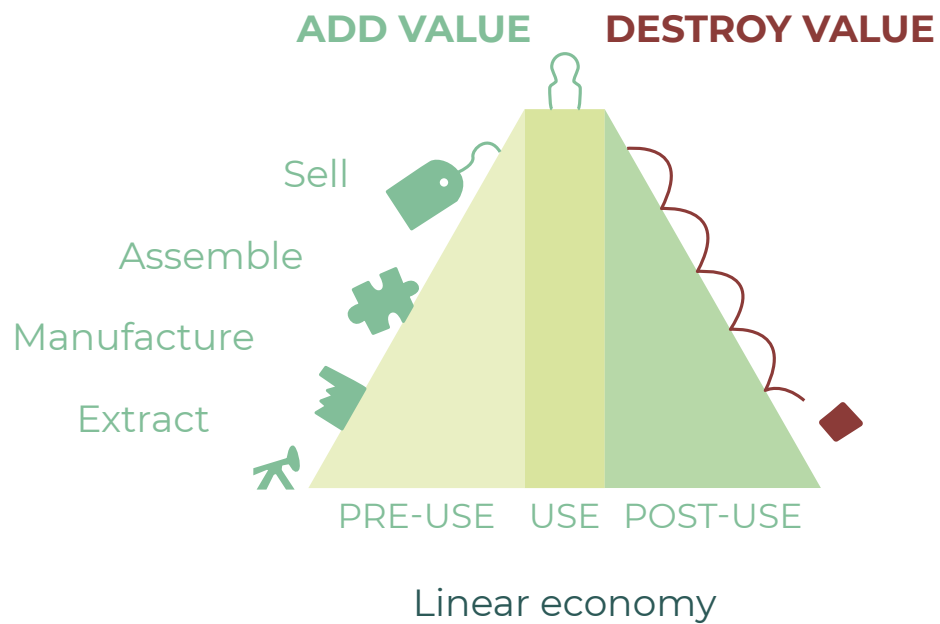
Büros





CONTEXT

Introducing the reader to the circular economy methodology, Adria Mobil and caravan industry.



“A circular economy describes an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.” (Julian Kirchherr, 2017)

1. Introduction to the Circular Economy

Within the idea of a circular economy, there are different levels, all with different product integrities are needs for resources. It would be ideal to keep a product within reuse as long as possible: elongating total lifespan and repair components that are broken during use and preventing failure by maintaining critical elements. In this way, we hold the initial value for as long as possible. But even in the last step: recycling still has value. We put less time, money, and energy into obtaining materials or we sell these materials to other manufacturers. More reading about the circular economy method can be done in *Products That Last* from Conny Bakker.

1.1 Circular activities in the leisure vehicle industry

At the moment, the makers of leisure vehicles are not yet pushing for a shift to a circular world. However, third parties are already busy picking up the lost profit. This becomes painfully obvious when the owner of the scrap yard drives a Ferrari. Somewhere companies like Adria are losing their profit because they are making their products linear.

1.2 Design strategies

There are several methods of designing for a circular economy (Conny Bakker, 2014). It is possible to design in such a way that people value their properties very much, these products last a long time and thus the consumer is willing to take good care of these products. By then offering upgrades, expansion packs, and repair kits, people continue to buy elements from the company. These aspects are easy to organize within a company when different variables are standardized within a company and an industry. To recycle materials at the end of the life of an element or a complete product, it is important that disassembly is taken into account during assembly and that it is clear to the consumer where the materials should be sent. This can also mean that companies take back their products, they are familiar with the materials and in this way can sell the same materials a second time.

1.3 Trends

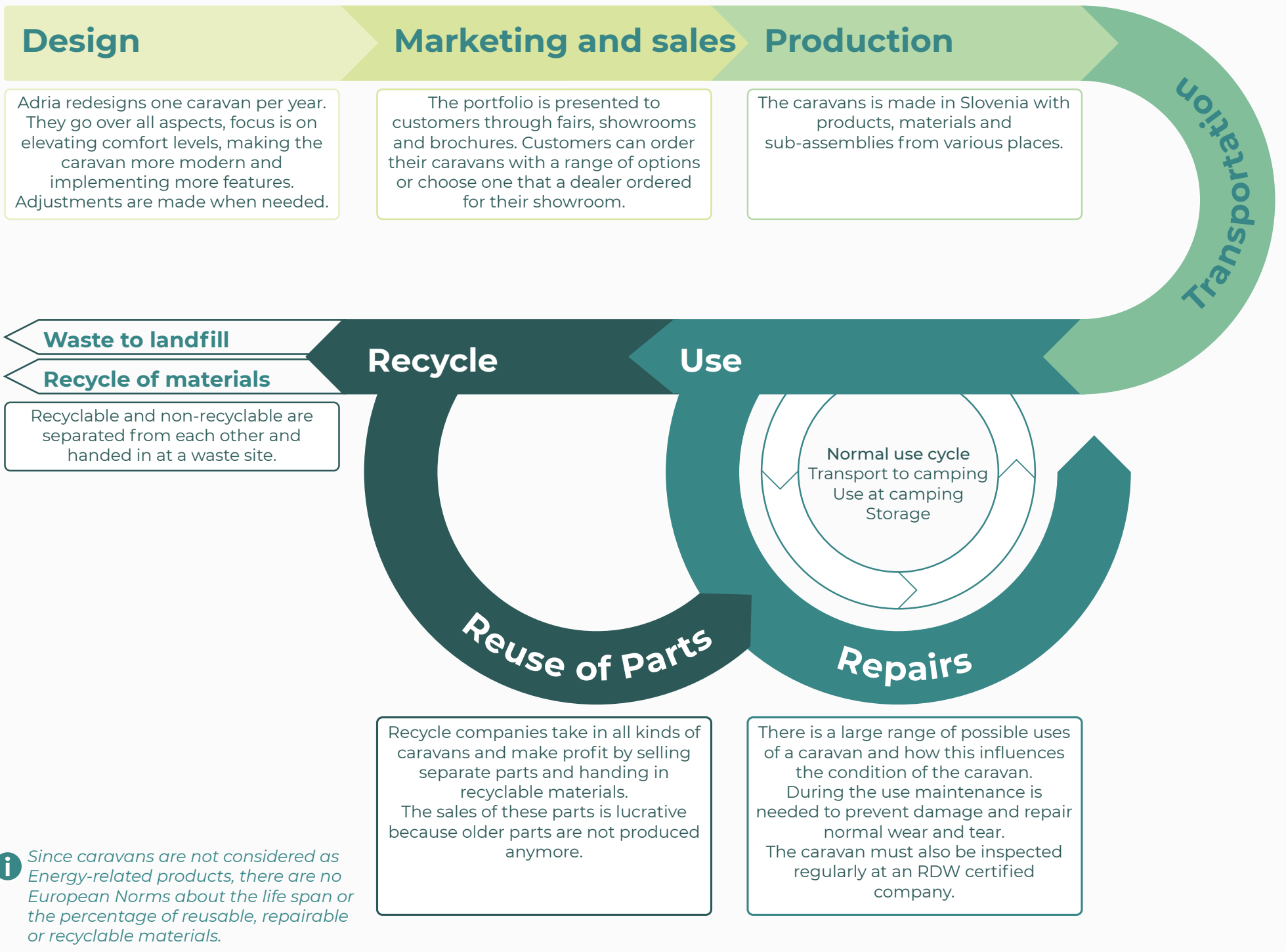
In addition to upcoming regulations from the EU, the so-called action plan, consumers and companies are increasingly aware of the products they buy and produce. BMW only wants reusable parts by 2025 (De Telegraaf, 2021), IKEA will take back its furniture (Taylor, 2020) and Auping is transparent about the suppliers and materials (Auping, 2020). The overall trend is clear and consumers are demanding that companies offer options to buy and repair products, for example with the right to repair initiative (Right to repair, 2021), that last a long time.

1.4 LCA

Life cycle assessment (LCA) is a method of quantifying the environmental impacts associated with a given product. In LCA, researchers create an inventory of resources used and pollutants generated in product production and use. From this, an impact assessment estimates the product's ultimate effects on human health, ecosystem function, and natural resource depletion (Levin, 2013). A LCA can be done in more or less detail, the eco-analysis in Chapter 4 is an example of a fast track LCA purely based on the embedded CO₂ in the materials. This can pinpoint focus points very quickly. Including more elements, such as fuel consumption during use, it might show that the initial material contribution is not the place to focus on when trying to lower the CO₂ outputs. This is something that can be analyzed when Adria has more data available.

Differences between the LCA method and the circular economy method are that the circular economy does not calculate or care for the CO₂ impact of a product but focuses on the economical value of waste. While, for example, incineration lowers the CO₂ impact when using the LCA method. In this project, the fast track LCA is used to show valuable and impactful components as a starting point for implementing a circular economy.

More reading about LCA can be done in *LCA* by Joost G. Vogtländer, ISO norms 14040 and 14044, and there are companies who conduct certified LCAs.



i Since caravans are not considered as Energy-related products, there are no European Norms about the life span or the percentage of reusable, repairable or recyclable materials.

Figure 2.1 Current product journey

2. Current Product Journey

The product journey for the current Adria Action caravan consists of various stages (Figure 2.1).

2.1 Design

Just as the rest of the caravan market (Appendix C: Market analysis), Adria re-launches one caravan model per year and makes adjustments during manufacturing if needed. With the caravan being a complex product, one year is a short time but this timeframe fits with the customers' desire to being able to buy the newest product at yearly fairs.

2.2 Marketing and sales

Sales go through Adria dealers. Dealers often represent multiple brands and order a couple of caravans for their showroom which they also can sell as-is. Customers are only able to see the complete range of models at fairs. Caravans are often marketed as luxury items. The action caravan is aimed at a more active owner, within this segment, there are some similarly marketed caravans (Appendix C: Market analysis).

2.3 Production

The caravans are made in Slovenia at the Adria factory and use a large variety of manufacturers from different countries. An overview of the materials and production methods can be found in the Confidential Appendix B.

2.4 Transportation

From Slovenia, the caravans are transported throughout Europe to all dealers where the owners can pick up their order.

2.5 Use

Owners all use their caravan in different ways, for different lengths, and during different seasons. During use, the caravan is mostly transported behind a car to warmer destinations and used at a camping site. Due to the heating element and good insulation, the caravan can also be used during colder months. All together the caravan is designed to withstand a wide range of environmental influences such as vibrations, hot and cold temperatures, and rain. During the operational time of the caravan, there should be regular maintenance and specific repairs due to wear and tear, road safety examinations, or accidents people have had.

2.6 Recycle

When the caravan is written off, recycling companies will disassemble the caravan to sell the parts and valuable materials and will bring the rest in as residual waste for landfill. These companies are profitable because they will pick up your caravan for free and sell the parts for cash. These parts are wanted since they are no longer being produced or it is cheaper to use second-hand.



The Netherlands

Slovenia

Figure 3.1 Impression of the company (Adria, 2021)

3. Adria

3.1 Company profile

Adria is a company from Novo Mesto- Slovenia, founded in 1965. They have a rich history that can be read in a magazine released in honor of their 50th anniversary.

Adria is one of the larger leisure vehicle companies in Europe. They had a 6.2% market share in 2014 (Adria, 2015), more information about the market can be found in Appendix C: Market analysis. They produce vans, motorhomes, and caravans and sell them through dealers in different countries (Figure 3.1). There are 33 points of sale in the Benelux.

3.2 Adria Action

“ The Action, the original iconic, light-weight, and stylish caravan for active holidays, in three sporty colours. A caravan which always puts a smile on your face and delivers on space, features and comfort. Contemporary interior with smart kitchen, ergo bathroom and comfortable sleeping.” (Adria, 2021)

Place in Adria portfolio

The Action Caravan is a bit of an outlier in the Adria portfolio, this is concerning the outside appearance and since it is a small and light caravan (Figure 3.2). The interior is very similar to the other Adria caravans (Appendix B: Adria Action). It is one of the cheapest caravans starting at around 18.000 Euros. Competitive caravans from other brands can be found in Appendix C: Market analysis.

Production and materials can be found in the Confidential Appendix B, C, and D.



The Action speaks a new design language that still thrills our customers and excites them with a primal passion for travel.

Figure 3.2 Adria Action (Adria, 2021)

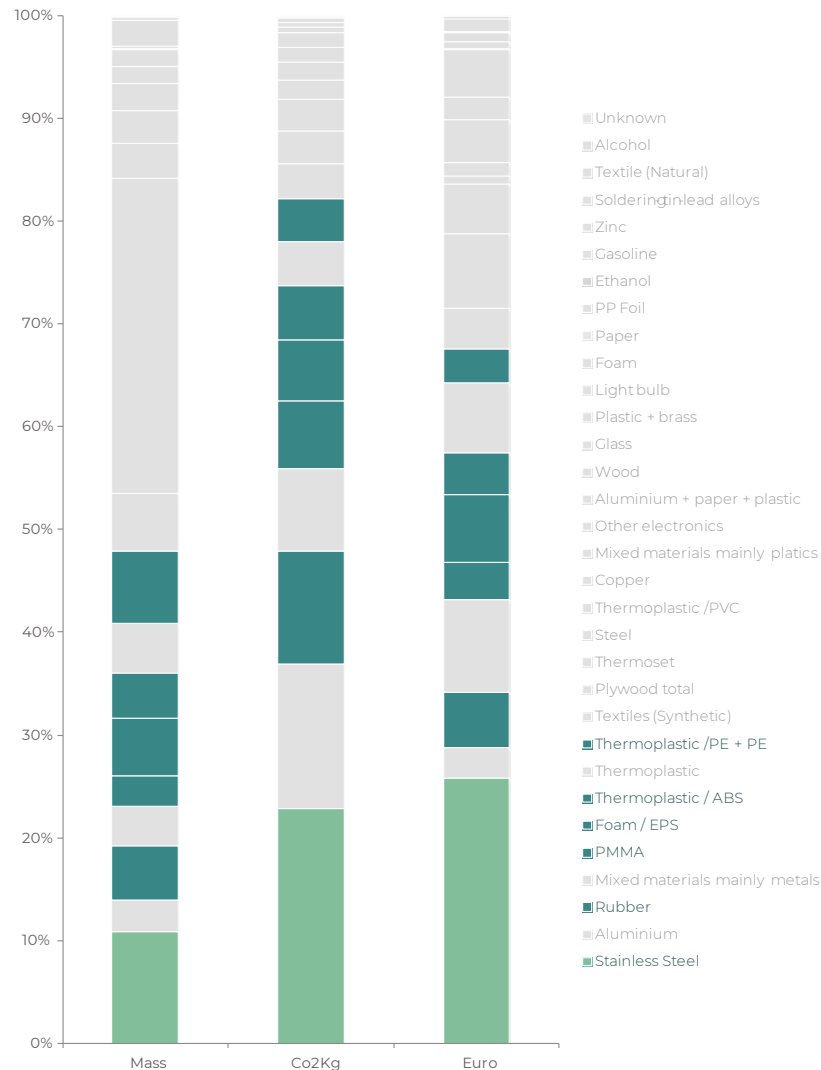




ANALYSIS

By means of visits to third parties and a theoretical analysis of the caravan, it can be concluded that the overall body should last longer, not all parts are easily repairable and there is no standardization within the company and the industry.

Materials that are solely or mainly used in **the body** (the walls, ceiling, floor and chassis) have the biggest impact. These material groups form 40% of the mass while being responsible of 55% of CO₂ impact and 51% of the price.



The fridge and the oven (mixed materials mainly metals) contribute **7.5% of the total CO₂ impact** and should therefore be reusable, repairable, replaceable, and recyclable.

All **57 parts** made of **aluminium** contribute **13.2% of the CO₂ impact**. It is important to retrieve these parts for reuse or recycling.

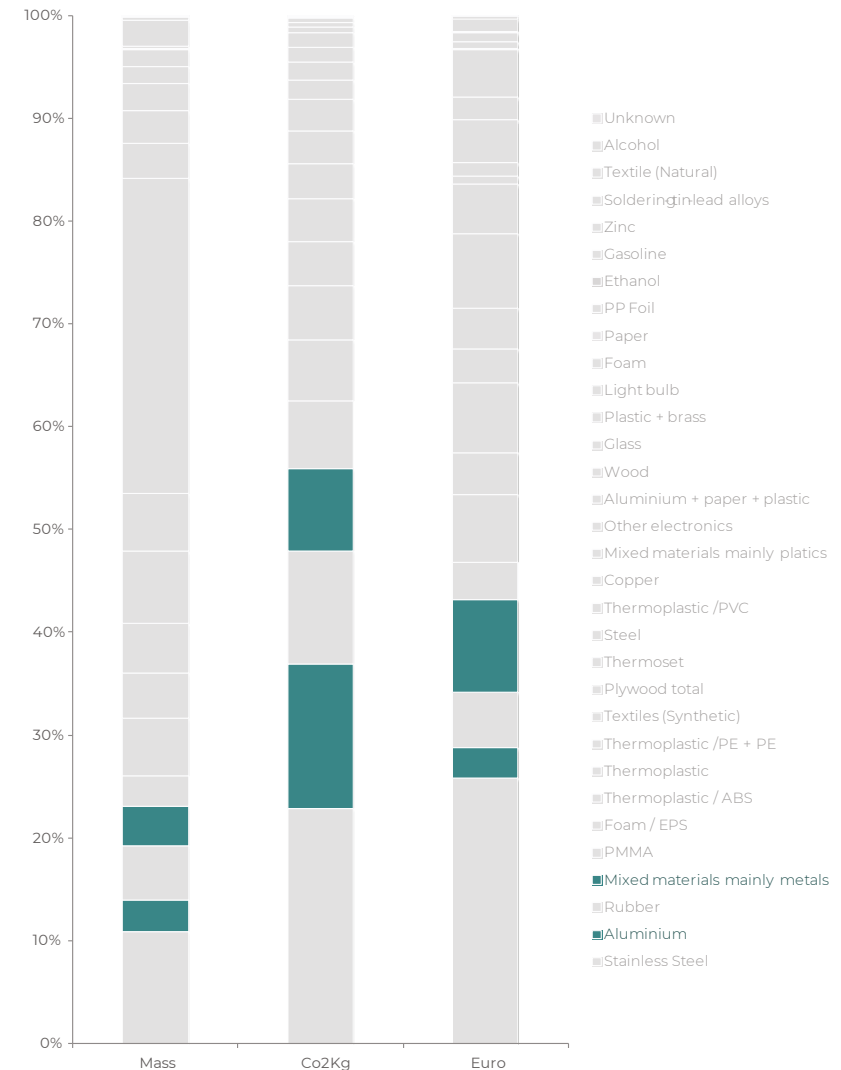


Figure 4.1 Conclusions Eco analysis

4. Eco-analysis

A theoretical approach to find the most influential elements within a caravan: the body, aluminium parts, and all appliances. These parts have a large contribution to the overall CO₂ impact (Figure 4.1) of the caravan and are therefore the best starting points of a positive change.

Important insights

- Materials that are solely or mainly used in the body (the walls, ceiling, floor and chassis) have the biggest impact. These material groups form 40% of the mass while being responsible of 55% of CO₂ impact and 51% of the price.
- The fridge and the oven (mixed materials, mainly metals) contribute 7.5% of the total CO₂ impact and should therefore be reusable, repairable, replaceable, and recyclable.
- All 57 parts made of aluminium contribute 13.2% of the CO₂ impact. It is important to retrieve these parts for reuse or recycling.
- For a more accurate in-depth picture, the materials should be further specified and sub-assemblies will have to be disassembled to avoid a mix of materials, this is a good next step for Adria to take.

4.1 Method and materials

On a component basis, all weights are multiplied by a factor for CO₂ impact and a factor for economic value. This concludes results by part, material and subassembly.

4.1.1 Materials

Bill of materials

The Bill of Materials (BOM) consists of all 970 components in the Adria action caravan. These components can be sub-assemblies (e.g. toilette) as well as loose parts (e.g. screws). Most components are described comprehensively and make clear which function they have, what material they are made of, and how much they weigh. On the other hand: some components are only described with a product number and leave knowledge gaps about material and weight.

All incomplete components information is completed with a weight and a material. This is done based on the CAD model, photos of the production process, general other information in the BOM and a meeting with designers from Adria. All remarks about adjustments are shown in the complete overview of the BOM and results in the Confidential Appendix F.

Materials are based on the description of the element and based on the knowledge of the designers from Adria. Not all materials are specified in detail because this was not known and the choice was made to continue with the project with this model for now. The BOM was delivered in Slovenian, English translations must be approached with caution about their veracity.

Materials

All materials used, have a CO₂ and a economic influence coming from the Idemat database or Granta Edupack 2020. A complete overview is shown in table 4.1 on pages 22 and 23.

4.1.2 Method

The CO₂ impact and costs per part are determined by means of the factors per material and the mass of the part. Subsequently, the proportions per material, interior, the general construction (body) and other subcategories were examined. No account has been taken here of the CO₂ impact or the costs from possible transport, production, finishing or packaging (Figure 4.2).

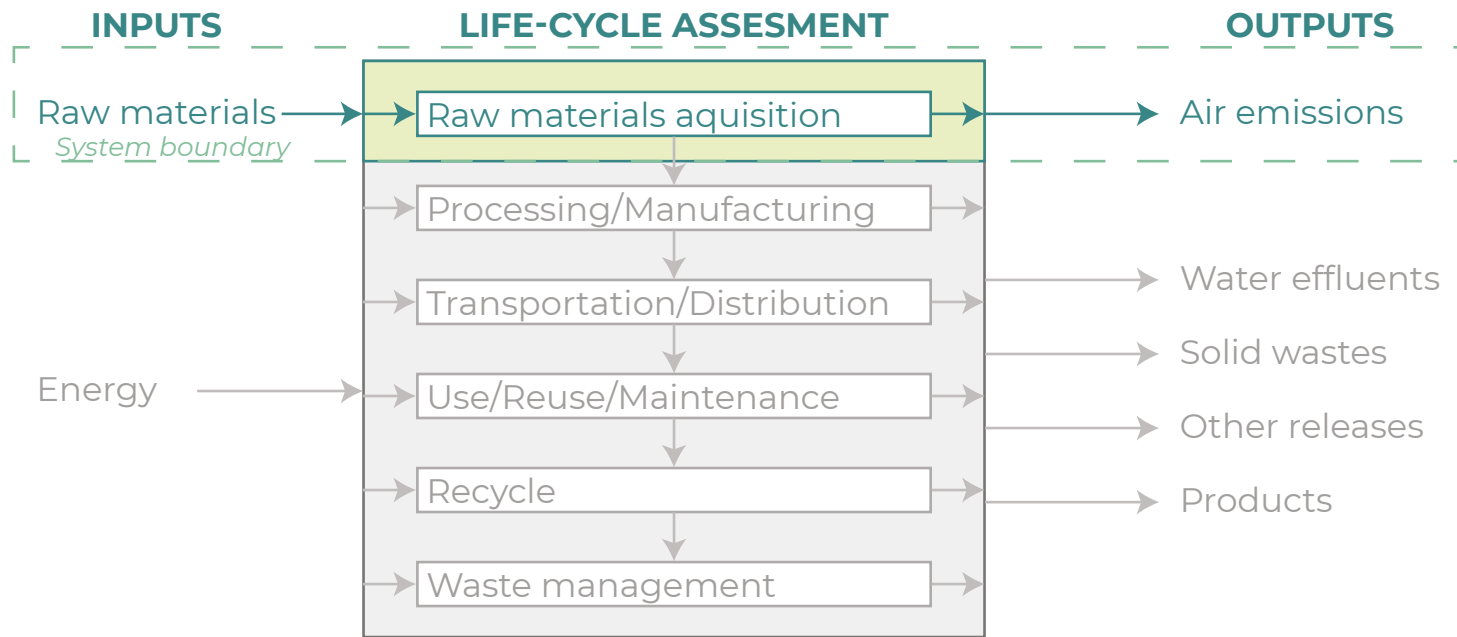


Figure 4.2 Eco analysis scope

Looking at the categories Adria maintains in their BOM, all exterior components, which could be classified as body, are responsible for 77% of the total CO₂ impact and 64% of the economic value on a material basis with **670 separate parts** of the total 970 parts (**70% of all parts**). This includes elements that might be more likely to be considered furniture by outsiders, such as luggage space, more generic elements and parts that do not contribute to the overall construction. Thus, this graph **may bias the impact of the body** because viewers may have a different idea when the construction or body is mentioned. Namely, only those materials mentioned in the concluding chart.

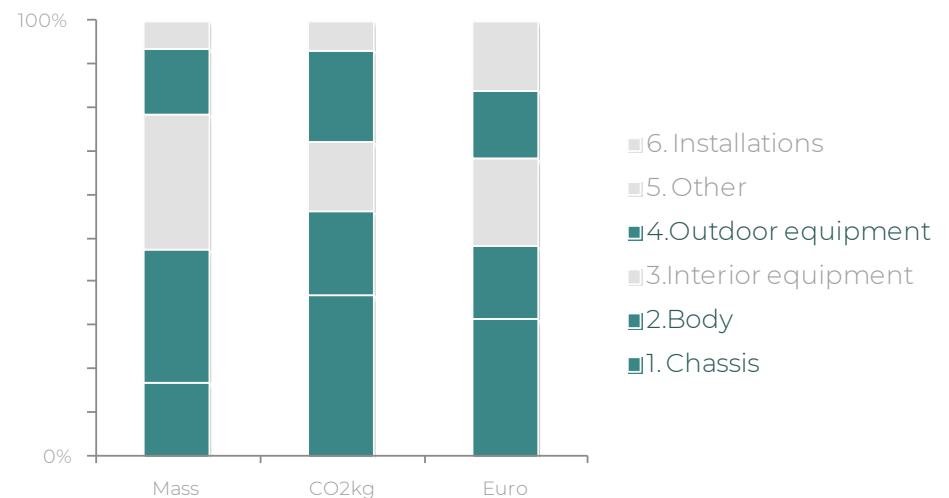


Figure 4.3 Conclusions Eco analysis

4.2 Results

All results are in Confidential Appendix F (separate Excel sheet). This table can be sorted in the same way as the BOM was provided, so people who normally work with the BOM can recognize parts. Table 4.1 contains an overview per material with the source material and the absolute values, Table 4.2 contains a categorized overview with the relative contributions.

4.3 Discussion

4.3.1 Subassemblies

On this bill of materials, the subassemblies are not always detailed enough to allocate one material. In this way, for example, the furnace or the wheels ended up very high in CO₂. It would be good to do further research into whether this is correct for these critical parts.

4.3.2 Materials

Only pure materials have been assigned and no account has been taken of additives or contamination from adhesives. This gives a distorted picture of how easily recyclable the caravan is. The values could also shift because of this.

4.3.3 Weights

No weights were known for various components and these are approximated. It is not certain that these are very inaccurate, but, certainly, they are not based on actual numbers.

4.4 Conclusions

4.4.1 Body

The body, as used in this project, consists of all elements contributing to the function of making the outside and making the caravan functional (Figure 4.1). This includes chassis, wheels, walls, insulation, windows, outside bumpers. Does not include any attachment methods or adhesives. The body consists of 46 unique elements and 118 parts. See Confidential Appendix C Body components, for the overview of all parts included.

Looking at the categories Adria maintains in their BOM, all exterior components, which could be classified as body, are responsible for

77% of the total CO₂ impact and 64% of the economic value on a material basis with 670 separate parts (Figure 4.3).

This includes elements that might be more likely to be considered furniture by outsiders, such as luggage space, and that do not contribute to the overall construction.

These are not included in the concluding graph because they are elements that are easier to replace, could break more quickly and ensure that 'the body' will consist of many components while the lampshades on the outside are not the low-hanging fruit within this calculation.

It is in this stage more important to focus on less components that make up for a relatively large percentage of the impact. Which are the elements constructing the body, those are contributing 46% of the CO₂ impact and 44% of the price of the caravan (less than the graphs in Figure 4.1, those graphs are solely based on the materials and less compared to predetermined categories).

Elongating the lifespan of these parts and making them recyclable in the end will create a big impact as a whole.

4.4.2 Aluminum

There are 57 aluminum parts which together contribute 14% of the total CO₂ impact. Currently, these are not separated to be recycled; partially because it is unknown which parts are from aluminum and because the weight is low.

4.4.3 Appliances

Mixed materials mainly metals are only two parts: the fridge and the oven and those contribute 7.5% of the CO₂ impact. Even if this percentage is not completely accurate, it is known that the fridge and the oven will need replacing. The CO₂ is an additional reason why this has high priority when redesigning the caravan.

Material	Source	CO ₂ kg/ kg	ScCO ₂	Mat. price/ kg	ScEuro	Total mass (kg)	#parts	Total CO ₂ kg	Total Euro
Alcohol		0.00	0.00	0.00	0.00	0.16	3	0.00	0.00
Aluminium	Level 0 Aluminium	13.15	15.00	1.74	2.00	32.62	57	489.31	65.24
Aluminium + paper + plastic	Level 0 Aluminium *0.75	9.86	11.25	1.31	1.50	1.43	3	16.06	2.14
Copper	Idematapp2020 Copper wire, plate, pipe, trade mix (56% prim 44% sec) + Granta Edupack 2020 Copper	3.00	3.00	5.38	5.38	12.12	35	36.35	65.19
Dubbelsided Tape	Level 0 Rubber	6.58	7.00	1.74	2.00	3.98	13	27.84	7.95
Ethanol	Idematapp2020 Ethanol, bio-based from agricultural waste + Global petrol prices	1.27	1.27	0.68	0.68	0.10	1	0.13	0.07
Foam	Level 0 Foam	3.17	3.00	13.50	15.00	0.43	4	1.29	6.46
Foam / EPS	Idematapp2020 PS (EPS, expandable polystyrene) + Granta Edupack 202 Expanded PS foam	3.56	2.04	2.49	2.99	112.68	6	229.88	336.93
Gasoline	Idematapp2020 Benzene + Global petrol prices	1.40	1.40	1.25	1.25	0.02	3	0.03	0.02
Glass	Level 0 Glass + Granta Edupack2020 Laminated Glass	1.74	1.50	6.50	6.50	3.05	2	4.57	19.82
Glue tape	Level 0 Mixed materials mainly plastics		3.00		3.00	0.03	1	0.08	0.08
Half plastic/half textile Probably PVC	Idematapp2020 PVC (Polyvinylchloride, market mix) + Granta Edupack 2020 PVC (rigid, modling and extrusion)	2.10	2.10	1.00	1.00	0.35	3	0.73	0.35
Laminated plywood + bit of plastic	Idematapp2020 Plywood, indoor use (softwood 600 kg/m ³) + Granta Edupack 2020 Plywood (5ply, bleach)	0.35	0.35	0.50	0.50	191.53	143	67.04	95.77
Light bulb	Idematapp2020 LED light bulb 8 watt. + Granta Edupack 2020 Diodes and LEDS	8.26	8.26	142.00	142.00	0.19	5	1.59	27.36
Metal	Level 0 Mixed materials mainly metals		7.00		5.00	2.37	2	16.59	11.85
Metal + plastic	Level 0 Mixed materials mainly metals		7.00		5.00	29.62	2	207.34	148.10
Mixed materials mainly metals	Level 0 Mixed materials mainly metals		7.00		5.00	5.86	10	41.04	29.32
Other electronics	Level 0 Other electronics	10.00	10.00	148.20	52.00	1.97	4	19.72	102.54
Painters tape	Level 0 Paper	1.17	1.00	0.93	1.00	0.28	12	0.28	0.28
PVC	Idematapp2020 PVC (Polyvinylchloride, market mix) + Granta Edupack 2020 PVC (rigid, modling and extrusion)	2.10	2.10	1.00	1.00	28.12	30	59.05	28.12

PE	Idematapp2020 PE (HDPE, High density Polyethylene) + Granta Edupack 2020 PE-HD (general purpose, molding and extrusion)	2.00	2.00	1.00	1.00	0.04	2	0.07	0.04
Plastic	Level 0 Thermoplastic	3.03	3.00	2.76	3.00	2.25	27	6.75	6.75
Plastic + brass	Idematapp2020 CuZn40Pb (Brass, alpha-beta, machinable) + Granta Edupack 2020 Brass	2.87	2.87	5.00	5.00	0.63	2	1.81	3.15
Plastic + Foam + metal	Level 0 Mixed materials mainly plastics		3.00		3.00	13.00	1	39.00	39.00
Plastic + motor + wires	Level 0 Mixed materials mainly metals		7.00		5.00	1.39	2	9.73	6.95
Plywood	Idematapp2020 Plywood, indoor use (softwood 600 kg/m3) + Granta Edupack 2020 Plywood (5ply, bleech)	0.35	0.35	0.50	0.50	101.30	18	35.45	50.65
Plywood + plastic HPL	Idematapp2020 Plywood, indoor use (softwood 600 kg/m3) + Granta Edupack 2020 Plywood (5ply, bleech)	0.35	0.35	0.50	0.50	13.11	3	4.59	6.56
Protective foil	Level 0 Thermoplastic	3.03	3.00	2.76	3.00	0.08	1	0.24	0.24
Rope	Level 0 Mixed materials mainly plastics		3.00		3.00	0.00	1	0.01	0.01
Rubber	Level 0 Rubber	6.58	7.00	1.74	2.00	6.53	14	45.73	13.07
Rubber + Metal	Level 0 Rubber	6.58	7.00	1.74	3.50	7.23	4	50.64	25.32
Sanding Paper	Level 0 Paper	1.17	1.00	0.93	1.00	0.00	3	0.00	0.00
Soldering - tin-lead alloys	Idematapp2020 solder Lead Tin/Lead 60/40 (normal) + Granta Edupack 2020 Solder (Lead based)	10.82	10.82	13.00	13.00	0.00	4	0.00	0.00
Stainless Steel	Level 0 Stainless Steel	7.26	7.00	4.92	5.00	114.20	7	799.40	571.00
Steel	Level 0 Steel	2.38	2.00	0.60	0.50	30.75	176	61.50	15.37
Steel + Copper	Level 0 Steel	2.38	2.00	0.60	0.50	1.35	1	2.70	0.68
Steel + Plastic	Level 0 Steel	2.38	2.00	0.60	0.50	0.46	4	0.92	0.23
Steel + Rubber	Level 0 Rubber	6.58	7.00	1.74	2.00	36.00	1	252.00	72.00
Textile (Natural)	Level 0 Textile (Natural)	3.00	3.00	0.21	0.50	0.00	1	0.00	0.00
Textiles (Synthetic)	Level 0 Textiles (Synthetic)	1.86	2.00	1.39	1.50	44.84	6	89.67	67.25
Textiles (Synthetic) + Plastic	Level 0 Textiles (Synthetic)	1.86	2.00	1.39	1.50	13.86	5	27.71	20.79
Thermoplastic	Level 0 Thermoplastic	3.03	3.00	2.76	3.00	47.08	135	141.25	141.25
Thermoplastic / ABS	Idematapp2020 ABS (Acrylonitrile butadiene styrene) + Granta Edupack 2020 ABS (Extrusion)	3.96	3.96	1.95	1.95	46.35	27	183.56	90.39
Thermoplastic / PE	Idematapp2020 PE (HDPE, High density Polyethylene) + Granta Edupack 2020 PE-HD (general purpose, molding and extrusion)	2.00	2.00	1.00	1.00	73.25	8	146.51	73.25

Table 4.1 Materials and corresponding sources, factors, weights and outcomes

Thermoplastic + Copper	Idematapp2020 Copper wire, plate, pipe, trade mix (56% prim 44% sec) + Granta Edupack 2020 Copper	3.00	3.00	5.38	5.38	5.02	47	15.06	27.01
Thermoplastic + metal	Level 0 Mixed materials mainly plastics		3.00		3.00	0.33	4	0.98	0.98
Thermoplastic + rubber	Level 0 Rubber	6.58	7.00	1.74	2.00	0.89	13	6.24	1.78
Thermoplastic + steel (spring and shaft)	Level 0 Mixed materials mainly metals		7.00		5.00	0.42	6	2.97	2.12
Thermoset	Level 0 Thermoset	3.00	3.00	3.40	3.00	35.51	66	106.52	106.52
Wood	Level 0 Wood	0.60	0.50	0.58	0.50	27.13	22	13.56	13.56
Wood + Plastic	Idematapp2020 Plywood, indoor use (softwood 600 kg/m3) + Granta Edupack 2020 Plywood (5ply, bleech)	0.35	0.35	0.50	0.50	13.60	1	4.76	6.80
Zinc	Idematapp2020 Zinc Oxide + Granta Edupack 2020 Zinc Oxide	2.78	2.78	2.35	2.35	0.01	3	0.01	0.01
PMMA	Idematapp2020 PMMA (Polymethyl methacrylate) + Granta Edupack 2020 PMMA (Cast sheet)	7.32	7.32	2.56	2.56	31.30	4	228.96	80.13
Mixed materials mainly platics	Level 0 Mixed materials mainly plastics		3.00		3.00	2.81	4	8.44	8.44
PP Foil	Idematapp2020 PP (Polypropylene) + Granta Edupack 2020 PP (Random copolymer, high flow)	2.04	2.04	1.20	1.20	0.11	4	0.23	0.14
Unknown						0.10	4	0.00	0.00
	Totals:					1097.85 kg	970 parts	3505.92 kg	2399.03 Euro

Material	Mass	CO ₂ Kg	Euro
Stainless Steel	10.95%	22.95%	25.87%
Aluminium	3.13%	14.05%	2.96%
Rubber	5.24%	10.98%	5.44%
Mixed materials mainly metals	3.80%	7.97%	8.99%
PMMA	3.00%	6.57%	3.63%
Foam / EPS	5.57%	5.93%	6.55%
Thermoplastic / ABS	4.44%	5.27%	4.10%
Thermoplastic	4.74%	4.26%	6.72%
Thermoplastic /PE + PE	7.03%	4.21%	3.32%
Textiles (Synthetic)	5.63%	3.37%	3.99%
Plywood total	30.63%	3.21%	7.24%
Thermoset	3.40%	3.06%	4.83%
Steel	3.12%	1.87%	0.74%
Thermoplastic /PVC	2.73%	1.72%	1.29%
Copper	1.64%	1.48%	4.18%
Mixed materials mainly platics	1.56%	1.40%	2.22%
Other electronics	0.19%	0.57%	4.65%
Aluminium + paper + plastic	0.14%	0.46%	0.10%
Wood	2.60%	0.39%	0.61%
Rest	0.46%	0.29%	2.60%
Totals	100%	100%	100%

Table 4.2 Materials and their relative contributions

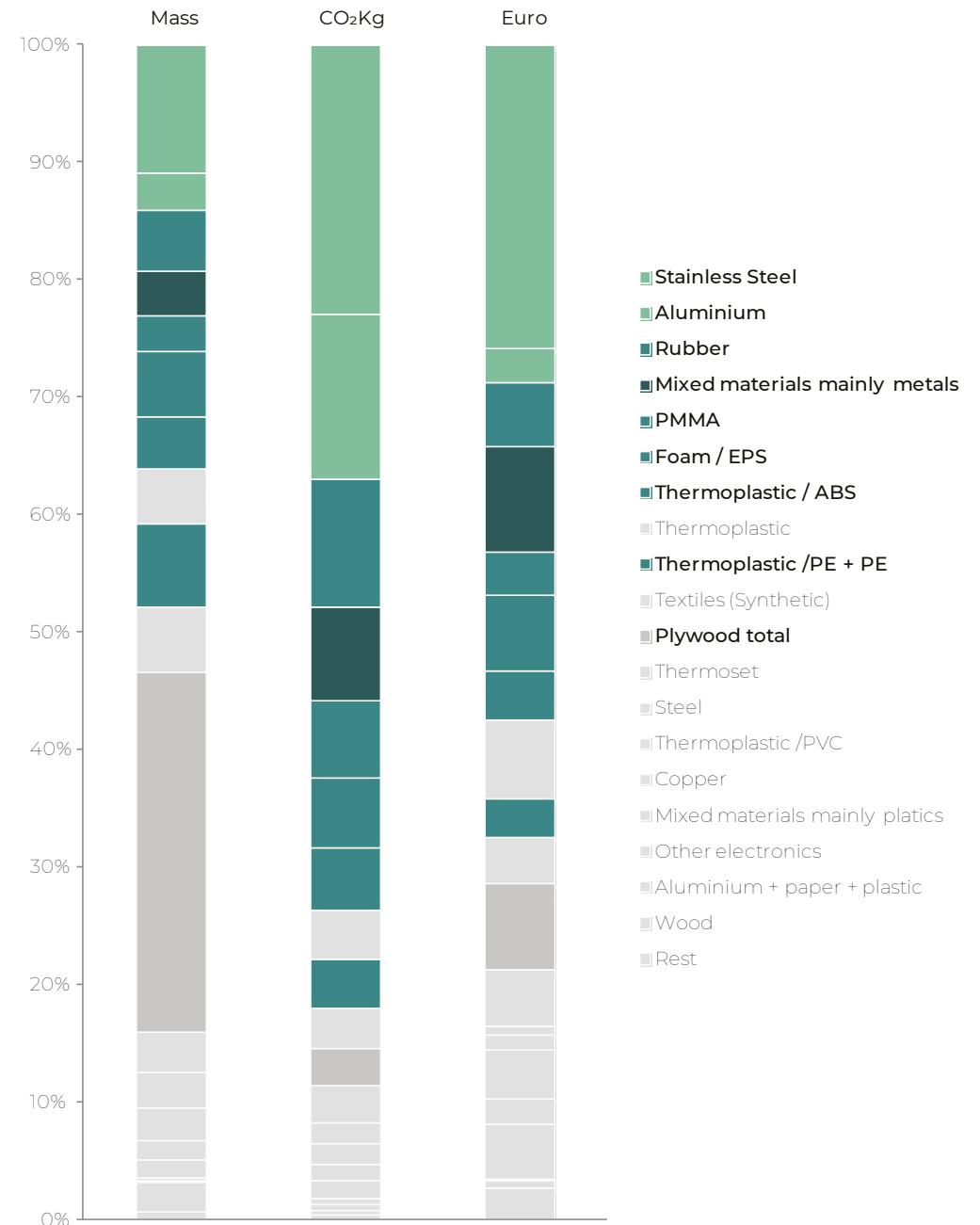
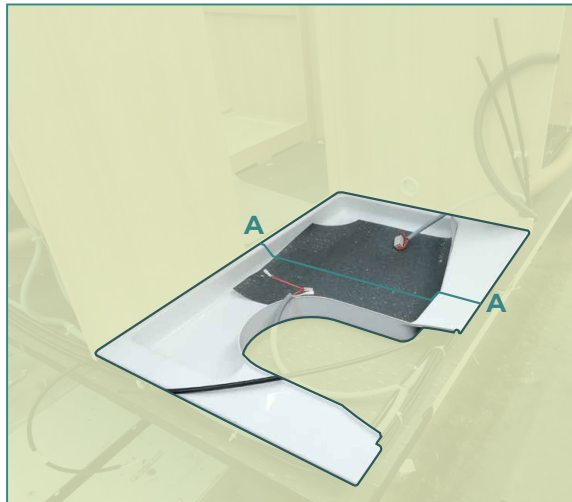


Figure 4.4 Overview relative contributions



Construction of Avia caravan (Štiglic, 2020)



Bathroom Action caravan



Table in living area of the Action caravan

Intersection of bathroom floor (A-A) :

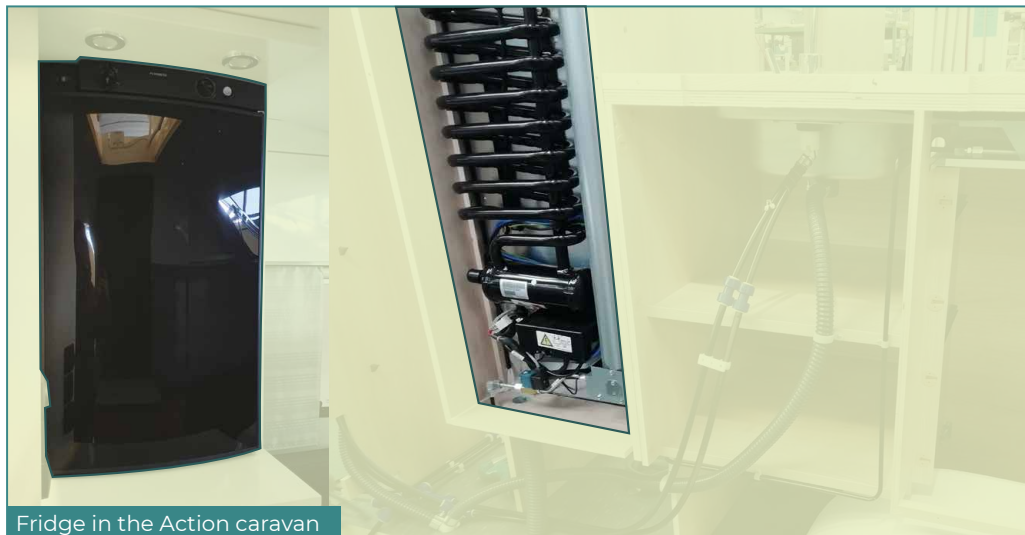


Fragile and vulnerable points

Sideview of the tabletop



Creating dents and imperfections



Fridge in the Action caravan

Does not last the full lifetime of the caravan.

Figure 5.1 Critical components from a repairmen's perspective

5. Repair Company

This chapter contains the conclusion from the interview conducted at CamperService Delft, a repair shop, on the 17th of November 2020. The transcriptions can be found in Appendix M.

Important insights:

- Replacement parts cannot always be ordered, but delivery times are long and prices high. This means that people have now developed their own methods to deliver faster to their customers. This is visible in the repairs of the bathroom floor.
- Electronics are difficult to repair. Often the wiring is hidden and it is difficult to find out exactly how everything works. Sometimes there are also updates that customers cannot install themselves.
- Appliances, such as refrigerators, must be replaced during the lifespan of a motor home or caravan. This is not always easy due to the mounting method and the size of the refrigerator in relation to the door. It also happens that it is no longer possible to order the same sizes.
- There is a big difference between the car technical support and from companies that are responsible for the living area of the camper. This ensures that employees have to find out about the construction method for each make and model, which takes a lot of time and therefore a lot of money for the customer.
- Some parts are very difficult to reach for maintenance. Think of the wooden structure in the walls and floor.

5.1 Introducing CamperService Delft

CamperService Delft is a company that maintains and sells motorhomes. Here they do maintenance on the automotive part as well as the living area on the inside and outside. Hans Koonincks, the interviewee, owns this company with his brother and has worked in the automotive industry for years. There are differences between campers and caravans, for this study, it is assumed that the core of the design, construction method, and maintenance is similar.

5.2 Reasons for repairs

Regular maintenance

- The general condition of kits, waterproofness, breaks, and other elements.
- Moisture check
- RDW compulsory checks

Repairing or replacing broken parts due to normal use

- Bathroom floor
- Top surfaces e.g. tabletops
- Appliances

Refurbish for sale or new users

- Mattress change
- Upholstery change

Repairs after car accidents, fires, or natural disasters

- These are mainly very costly and differ per case

Repairs due to lack of regular maintenance

- Moisture damage

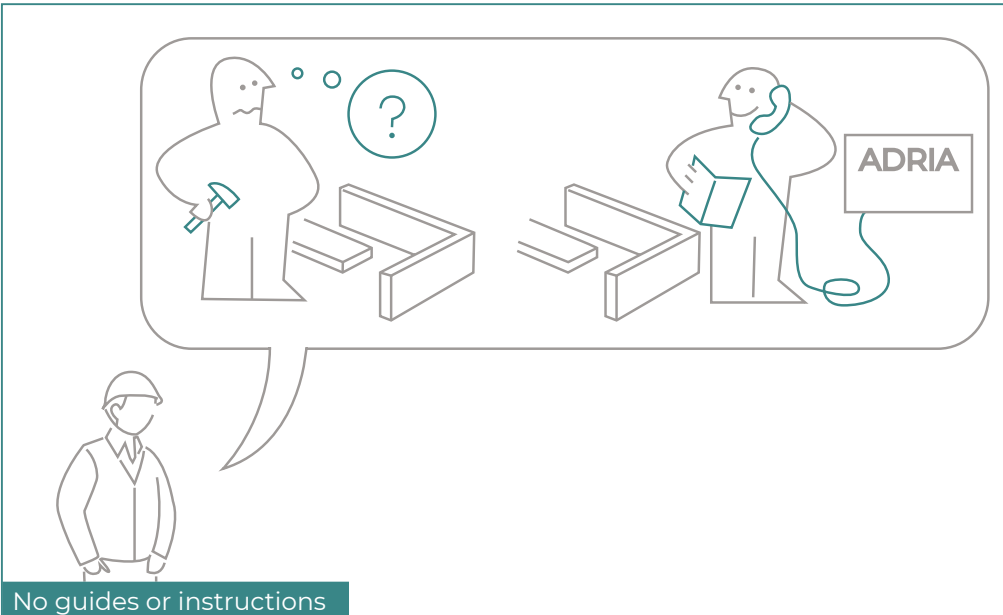
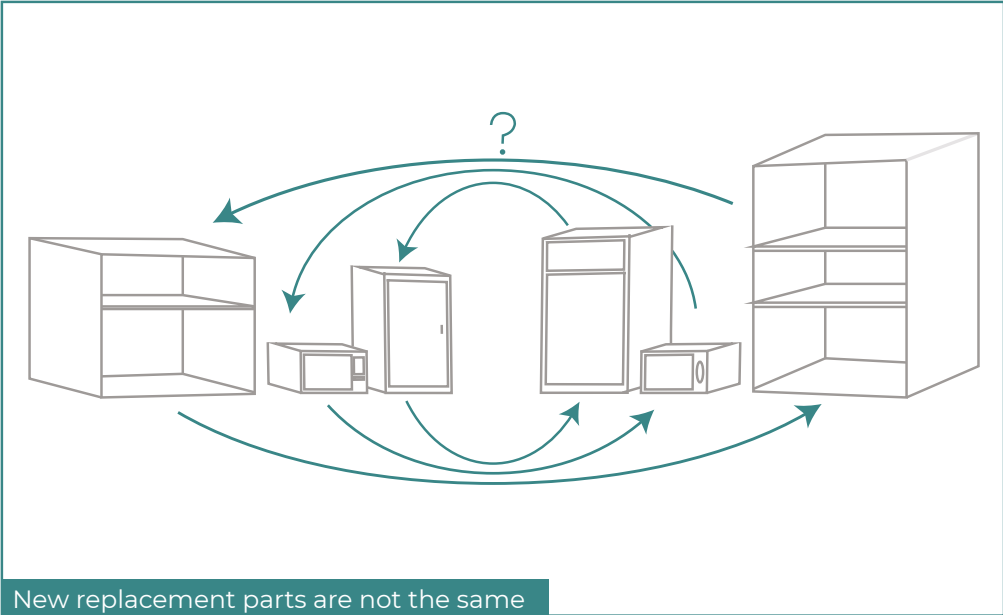
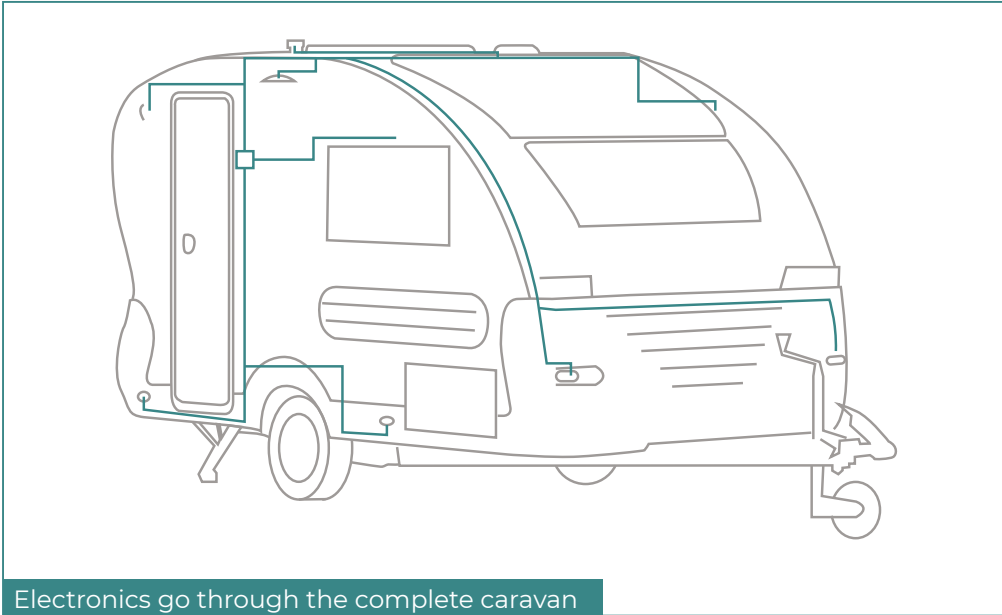


Figure 5.2 Aspects that make repairs difficult

5.3 Common repairs

Bathroom floor

The bathroom floor is an element that is very hard to take out due to the building order. It goes in first and all other bathroom elements go in after, in some cases even the walls surrounding the bathroom stand on the sides of the tub. Hans has the experience that the plastics of the bathroom floors get brittle over time combining with how some bathroom floor tubs are designed they cannot handle the weight of the users anymore.

Surfaces

Surfaces as table tops and countertops are vulnerable to things falling out of cabinets above causing dents. A dent in the protecting layer over the plywood is leaving the wood underneath vulnerable to moisture and dirt. Understandably, owners want to have this fixed. Replacing these parts is often difficult due to the delivery time of parts from companies, which means that repair garages often come up with solutions for these types of problems themselves. As a result, the costs of labour are often high.

Appliances

Fridges are not designed per se to last as long as the rest of the vehicle. Replacing these appliances is often complicated by insufficient knowledge of how the appliance is connected or because the new generation of, for example, the refrigerator has slightly different dimensions.

5.4 Other comments from Hans

Maintenance on the walls and flooring

Is very labour intensive, especially when there is rotting woodwork. This all due to the fact it is not accessible at all.

Communication between companies

All companies are very closed about their information, keeping their cards close to their chest. This makes that innovation hard. There is a big difference between the leisure vehicle industry and the car industry.



Figure 6.1 Impression of the demolition site

6. Recycling Company

This chapter contains the research conducted about the recycling of caravans in The Netherlands. Transcriptions of the interviews are in Appendix N.

Important insights:

- Everything comes down to costs, workers are expensive and therefore everything that takes too long to disassemble without adding value is not being done.
- There is a large secondhand market for caravan parts, ranging from bathroom elements to window hinges. A major problem with disassembling the different parts is that it is not always clear how they are attached and therefore break.
- If the company gets money to hand in materials separately, it will take extra steps to do so. Not all materials are separated due to not knowing what it is made of.

6.1 Recycling companies

Looking for a company that wants to accept your old caravan, you come across several offers (Figure 6.2). Many of these companies collect these old caravans for free and sell them again at a profit without having changed anything. There are only three or four companies in the Netherlands that disassemble caravans for landfill or recycling. The largest of these companies is WW-Trading. At the time of the interview, October 23, 2020, they had about 50 caravans on their dismantling site ready for demolition.

6.2 Collection

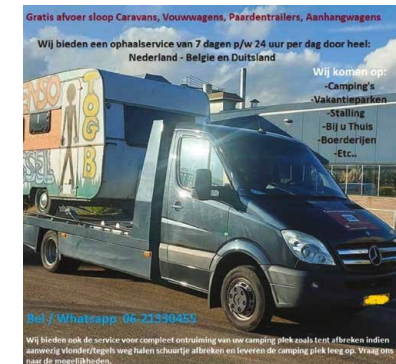
Owners of old caravans themselves call a company such as WW trading to make an appointment for collection. The owners are asked to describe the state of the caravan to judge if the company can make a profit from it. If it is, the owner can receive a fee or the pick-up is free or when the state is not good, the owner has to pay for the pick-up (fixed amount: 150 Euros).

Factors taken into consideration

- The vehicle is roadworthy
- There is a license plate
- There are no obvious defects (such as broken windows, flat tires, or loose walls)
- The caravan is in storage or next to the house indicates a better condition. Caravans that are left at a campsite are mostly ready for demolition.



Wij zijn een van de weinige gespecialiseerde caravansloperijen uit Nederland. U kunt door ons uw oude caravan GRATIS en door heel Nederland laten ophalen. Ook voor het ophalen van uw oude vouwwagen kunt u bij ons terecht.



Beschrijving

Wij zoeken het hele jaar door chalets, sta caravans en tourcaravans.

Opknip caravan, sloop caravan, inruil caravan, export caravan, tour caravan met of zonder kenteken, woonwagens, tiny house, woonunits, container, chalets jong en oud. Alles is welkom!

Tegen meerprijs kunnen we eventueel uw gehele kavel ontruimen.

Wij beschikken over een eigen ophaaldienst. Heeft u een caravan waar u vanaf wilt? Dan kunt u het volgende doen:

Wat te doen bij de verkoop van uw chalet, stacaravan of tourcaravan. Het werkt voor u en ons het best als u een email naar ons stuurt met de volgende gegevens:

1. Uw naam en adres en zeker uw (mobiele) telefoonnummer.
2. U maakt foto's van de buitenkant van de caravan, vooraanzicht, achteraanzicht en zijkant.
3. U maakt een aantal foto's van de binnenkant, zodat wij een duidelijk overzicht hebben van de staat waarin de caravan zich bevindt.
4. Vermeld erbij waar uw caravan staat.

E-mailen naar info@caravanhandelvandervekken.nl

gezocht / gevraagd alle merken caravans loop of sloop

26262 x gezien 99 x bewaard sinds 08 jan '16, 21:11

[Bewaar](#)



N.o.t.k.

[Grote foto's](#)

Deel via [WhatsApp](#) [Facebook](#) [Twitter](#) [LinkedIn](#) <https://link.marktplaats.nl/m100> [Bewaar](#)

Beschrijving

WIJ VRAGEN DOORLOPEND CARAVANS VAN IEDER TYPE, MERK EN SOORT EN VAN ALLE BOUWJAREN !!

EIGEN GRATIS OPHALDIENST OP IEDERE LOCATIE: CAMPING, STALLING OF BIJ U THUIS DOOR HEEL NEDERLAND EN OMLIGGENDE LANDEN.

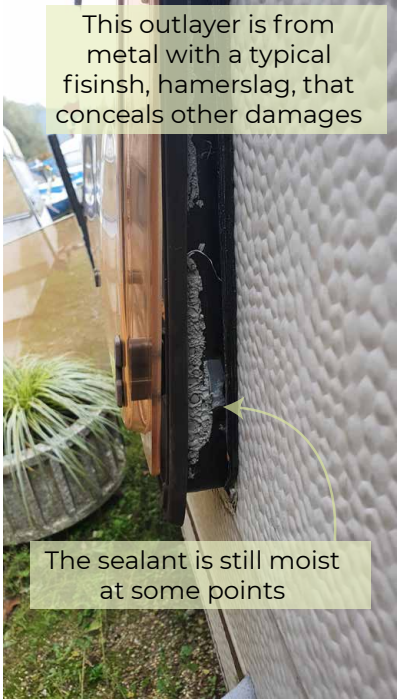
CORRECTE, SNELLE EN PRETTIGE AFWIKKELING, GEEN GEZEUR AAN DE DEUR, WIJ KOMEN DE DOOR ONS GEMAAKTE AFSPRAKEN NA!

TREKVOERDEN: FENDT/ HOBBY/ KNAUS/ BEVERLAND/ ADRIA/ HOME CAR/ CHATEAU/ CARAVELAIR/ LMC/ BURSTNER/ DETHLEFFS

Figure 6.2 Examples of companies collecting old caravans for free

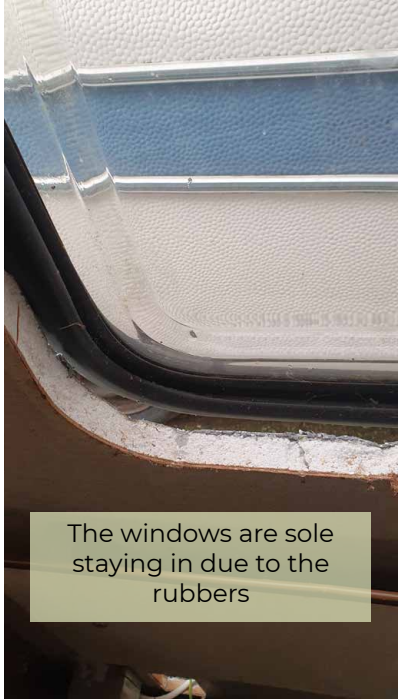


Taking the windows out by sticking a screwdriver between the rubber and the walls



This outlayer is from metal with a typical fisinsh, hamerslag, that conceals other damages

The sealant is still moist at some points



The windows are sole staying in due to the rubbers

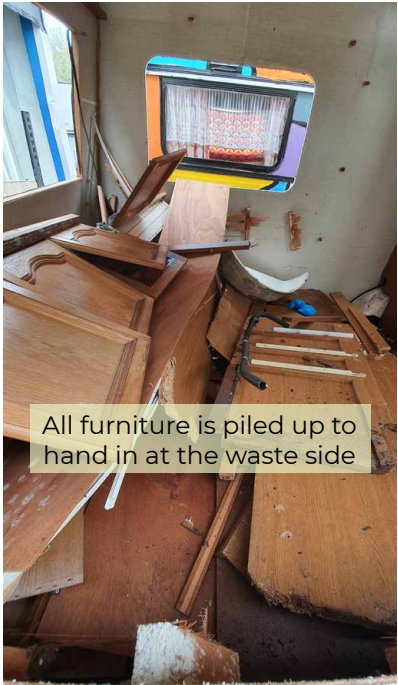


The bathroom was still intact but could not be saved because most elements were nailed to the wall



Nails
Ceiling covering
Insulation material

The upper cabinets were nailed outside in and could not be removed without removing a part of the roof



All furniture is piled up to hand in at the waste side



There was no glue between the insulation and the outer panelling

Wood construction
Insulation material
Outside panelling



Work in progress



The main reason this caravan was written off was water damage and mold. Below the bed there was proof the owners tried to safe the caravan

Figure 6.3 Photos of the demolition process

6.3 Disassembly and demolition of the caravan

The order of steps is mainly based on valuable materials and how easy it is to break them in the process.

- **Cushions, seating and mattresses**
These must be delivered separately to the recycling station. They can often still be sold to people who are renovating their camper.
- **Windows**
Windows are difficult to replace as they are only made for a short period. When you own an older caravan that needs a new window, the only option that remains is to check with these types of companies to see if they happen to have that make and model. Because they are such unique elements, and because people find it difficult to get them, they are sold for a lot of money. If the windows are broken, the mounting elements are also kept separate, these are also unique for each caravan.
- **Doors**
Exterior doors are often broken by burglaries and are therefore a much sought after item that makes them worth saving.
- **Kitchen**
The sink, faucet, and cookers can mostly be reinstalled for other uses. Those are therefore being saved. Kitchen cabinets are destroyed during the dismantling process because it takes too much time to take them out in any other way and this is often not possible without breaking part of the cabinets.
- **Wiring, pipes, fuse box electrical components**
Lead, copper, and wiring are being separated from the waste, and fuse boxes are sold.
- **Cabinets**
All cabinets and furniture that are not demolished in the process are torn down to make room for other disassemblies. Hinges, handles, and other metal attributes are not separated due to time.
- **Bathroom**
Bathrooms that are complete are removed as a whole but mostly break during this process since a lot of these elements are nailed or glued to the walls.



Figure 6.4 Getting ready to go to the waste site

6.4 Caravan at the waste site

The caravan is loaded onto a truck and taken to the waste site. There is a special agreement with the waste site, private individuals can't bring a caravan themselves.

First, the waste (e.g. all wooden furniture) is dumped at the designated location, and thereafter the rest of the caravan is loaded off with a forklift truck.

6.5 Costs and profits

Costs	Profit
Fuel/transportation	Pick-up fee from owners
Worker at demolition site	Handing in Chassis
Handing in wood	Parts

The specific costs vary per caravan. For most caravans it comes down to the sales of parts if it was profitable.

The figure shows two receipts from the waste site, both issued by Van Gerrevink. The top receipt is for wood, and the bottom receipt is for metal. Both receipts include the company name, logo, and contact information: WW Trading, Molenmakershoek 2, 7328 JK APELDOORN, NLR 4313085502. The BTW-nr is NL205720006B01 for both. The top receipt shows a total amount of -16,20 Euro for 90 kg of wood, with a specific amount of -0,180 Euro/kg. The bottom receipt shows a total amount of 27,00 Euro for 450 kg of metal, with a specific amount of 0,060 Euro/kg.

Receipt 1: Wood			
Kasbon nr.	12004547		
Weegbon nr	564881		
Datum	23-10-2020		
WW Trading Molenmakershoek 2 7328 JK APELDOORN NLR 4313085502			
BTW-nr:	NL205720006B01		
Bedrag:	-16,20	Totaal incl.BTW:	-16,20
BTW:	0,00	Tekst	
<u>Specificatie bedrag:</u>			
Verwerking grof vuil	90 kg	-0,180	-16,20

			-16,20

Receipt 2: Metal			
Kasbon nr.	12004548		
Weegbon nr	564882		
Datum	23-10-2020		
WW Trading Molenmakershoek 2 7328 JK APELDOORN NLR 4313085502			
BTW-nr:	NL205720006B01		
Bedrag:	27,00	Totaal incl.BTW:	27,00
BTW:	0,00	Tekst	
<u>Specificatie bedrag:</u>			
Gruis	450 kg	0,060	27,00

			27,00

Figure 6.5

Receipts from the waste site.
Landfill (such as wood) costs 0.180 Euro/kg
Metal gives you 0.060 Euro/kg

ADRIA

ADRIA

Willkommen
bei Adria Saison 202

ADRIA

Willkommen auf unserem Stand



Wohnmobile

Modell	Wohnfläche	Preis	Wohnfläche	Preis	
590C	40m²	19.900,-	590A	40m²	19.900,-
590B	40m²	19.900,-	590D	40m²	19.900,-
590E	40m²	19.900,-	590F	40m²	19.900,-



FRAMEWORK

This section describes the actions for Adria to go to a circular caravan and business, some elements are more specified than others and more details will emerge with every step closer to the end goal.



11 Organise logistics for recycling with third parties

12 Leasing caravans, buying caravans from other brands for remanufacturing, opening Adria branded repair shops

10 Evaluate, document and compare to other brands

13 Evaluating current circularity program and research new sustainability trends

14 Evaluating the caravans on new sustainability aspects

15 Adjusts designs with new parameters

FUTURE VISION

Just like CO₂ impact and the circular economy today, there may be other sustainability topics that are important in the future. Perhaps by then the electricity aspect will have been resolved and products will mainly be assessed on water use or transport costs. By properly documenting everything over the years, when the time comes, it is not only possible to calculate new methods but also to make an estimate for caravans from the past.

In addition, Adria's core business may have shifted and other aspects have become more important as a result.

EXAMPLE OF GOING THROUGH THE FRAMEWORK IN THIS PROJECT

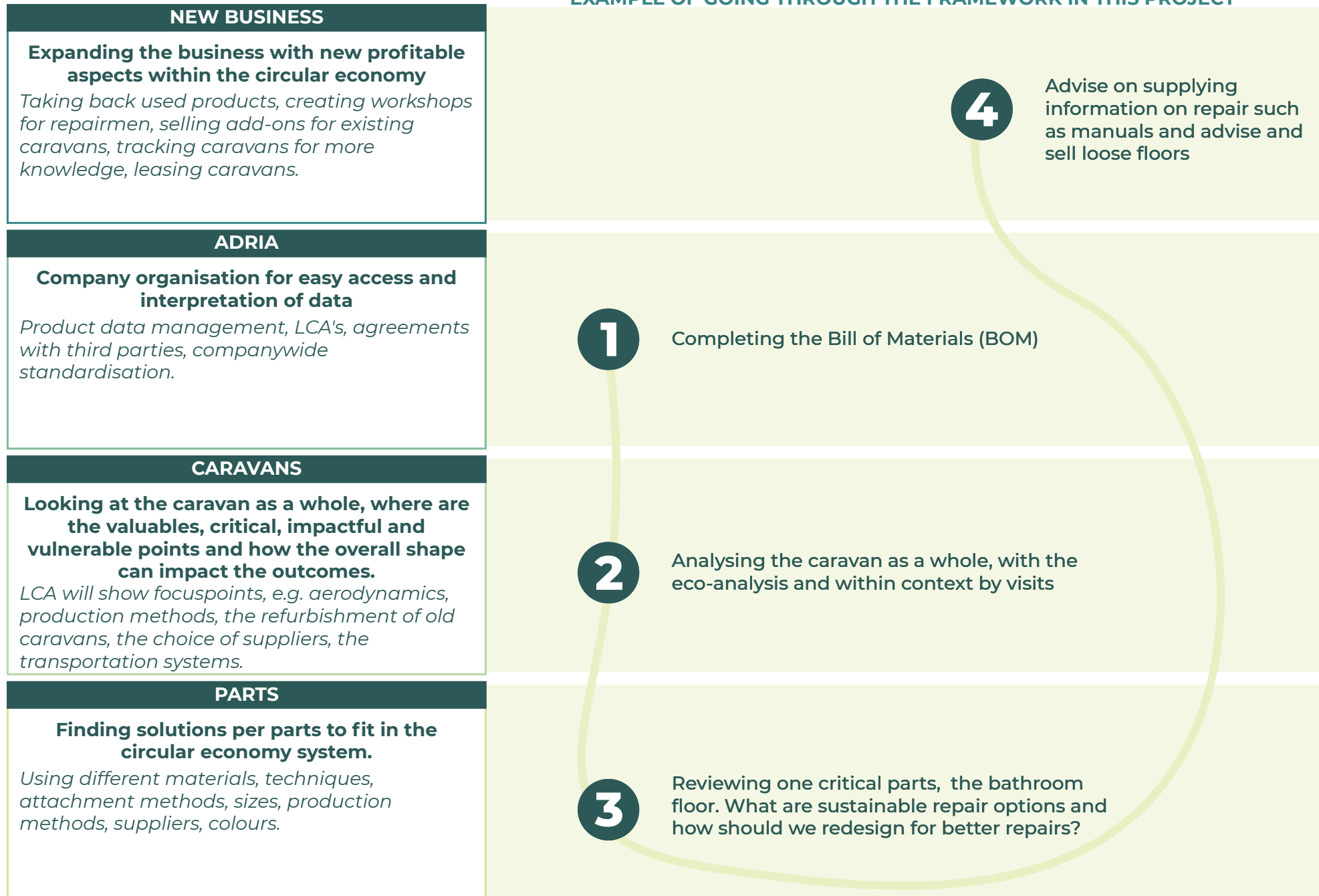


Figure 7.2 Framework of this project

7. Design Framework

There are multiple steps to take for Adria at various levels as shown in Figure 7.1. These vary from product data management to set goals for the future to reviewing single parts on their reparability. This chapter describes all aspects that should change on the different levels.

7.1 Overview Framework

There are four levels where change can happen, there can arise new business, changes in Adria as a company, on a caravan level, and part level (Figure 7.2). As shown on the previous pages (Figure 7.1), there is logical order to come to the first step of circularity. It all starts with managing all information in a way it can be used for analysis and comparing new design choices to old ones. This way the abstract idea of sustainability can become a measurable result through methods as life cycle assessments (LCA) and focus points can be chosen. The principles of circular economy can help to find solutions for reuse, repairs, and recycling. Most of the time these aspects have a positive effect on the outcome of the LCA or are ways to generate more profit.

This project can be viewed as a 'light' version of the first four steps: completing data, analyzing the data on caravan level, redesigning on part level, and giving recommendations at company level (Figure 7.2).

In the rest of this chapter the changes on all levels are further explained.

7.2 Getting in a circular mindset: organizing Adria

7.2.1 Product data management

To achieve circularity, even if it is only for one caravan, there must be a mindset within the company that focuses on this. It must be clear what is happening right now, what should be happening in the future, and how Adria wants to achieve her goals. This mindset starts with completing and organizing all materials and documents and no knowledge is dependent on specific persons. This way everyone can work with them individually and all employees can see how well products are scoring. Third parties can be held accountable for their contributions and being involved in the design cycle to improve. The

design cycle can rely on data and can focus on the actual critical and valuable components. There are existing product data management (PDM) systems available to use that will track and document the components and design choices.

7.2.2 Working together

Experts from outside Adria can also work on projects, such as this graduation project. This can include but is not limited to, new projects with the TU Delft after this project. Organizing the data will also clarify how many variables are dependent on third-party products. Third parties have their own BOM and redesign their products as and when they see fit, currently without much input from their customer. Working with the suppliers of the heating system, toilette, and fridge on standardization and material usage to find common ground will help both parties in the long run. It may be wise to hire someone for this who will organize it within the company. This is easier than having colleagues convince each other to move away from ways that have been the same for years, it already showed with this project that a fresh set of eyes can help focus on other parts.

7.2.3 Reasons for organizing

During this project, it became clear that not all documentation is ready for analysis and that additional information is not easily accessible. First, the bill of materials (BOM) that is used for the eco-analysis was not complete, materials and masses were missing and the descriptions were inconclusive. It was created to use during design and assembly instead of conducting sustainability analysis. Without all data, it is impossible to do a life cycle analysis (LCA) and evaluate the environmental impact of the current and future products.

Secondly, when trying to complete the BOM to a level that would be useful during this project, it was not possible for Vid to look it up and therefore another colleague had to come in. Ideally, employees such as Vid should be able to find all information because it means they can design or engineer based on all information.

Level in circular economy

What to do

Motivation for Adria

REDUCE

Reduce the material use

Less material is often less CO₂, Adria already focusses on this aspect within the caravan design but with a lot of unique parts there is a lot of material not used to its full potential.

Reduce the CO₂ impact

Choosing alternative materials or manufacture and production methods.

REFURBISH & REMANUFACTURE

Design for disassembly

If components can be removed and installed again, it elongates the lifespan of both the body as well as single components

Design for standardization

When it is possible to use components in different vehicles, the possibilities of reuse expand (for both the caravan as the component). It is also possible to replace critical elements such as refrigerators between different brands.

Design for accessibility

At the moment in today's caravans, many repairs are made more difficult because the components are not accessible. This makes it very expensive to replace parts and sometimes impossible to repair parts. If this becomes easier in a new caravan, more people will use the options for repair.

Design for upgradability

When caravans last a long time, 30 years or more, there comes a time when they are no longer up to date with the wishes of the consumer. For example, because of the possibilities for entertainment, electronics or upholstery. If it is possible to make adjustments at a later stage, consumers can maintain the value of the vehicle.

Design for durability

When elements last a long time, such as the body, it is possible to reuse parts such as the chassis.

RECYCLE

Material choice

Material choice can be based on whether it is recyclable or compostable. When this is both possible and it is clear that it is possible, it will be easier in the future to take the step towards actual recycling.

Taking back own components

When taking back components, it is clear which material it is and it is possible to reprocess it in a part.

Figure 7.3 All actions during design in circular caravan

7.3 Caravans and Parts

If Adria is focused on the circular economy and knows everything about the caravans, it will be possible to design a circular caravan. We can follow the steps of the circular economy: reduce, refurbish, remanufacture and recycle. All aspects have their strategies within the design (Figure 7.3).

7.3.1 Reduce

Reducing the CO₂ impact and the waste generated at all stages of production and use will have sustainability benefits. These are elements that become more clear once engineers can see what changes in the design have which effects on the outcome of the LCA. Reducing cost, impact, weight, and waste and their trade-off can then be evaluated objectively. Currently, there is no system to rate materials which means the focus can be on small elements or in a less effective direction.

7.3.2 Refurbish & remanufacture

During designing, it should be a priority to make critical components better accessible. This way it is easier and cheaper to maintain the caravan and therefore helps the main goal: keeping valuable components in use longer. Currently, some items are almost impossible to repair due to their accessibility, such as the bathroom floor.

All items should be evaluated to see if they are necessary for the functionalities (doors) and safety (brakes and lights), items that do not have a long-expected lifespan (fridges), or are trend sensitive (entertainment systems, upholstery). These items should be removable within, for instance, 6 steps to create a lucrative replacement. These are also items that should be standardized since it is known they need replacements. Standard items are more easy and affordable to produce.

Critical parts

Various critical parts are critical for different reasons. Here, the critical parts are divided into four groups. Examples of these groups are shown in Figure 7.4.

- **Critical for overall stability and safety**

Some components are critical for the functioning or safety of

the caravan on the road, those are checked compulsory every two years. This includes gas lines, brakes, lights, and visible damages on the outside and structure (RDW, 2020). These items are often accessible due to the outside placement and therefore easy to repair (Koonincks, 2020). The repair shops are also very informed about these repairs since they do a lot of them due to the regulations surrounding them. What is also important during regular checks are the windows and rubbers due to possible moisture in the body structure. It is easy to replace a window as long as a replacement window is available to the repairman. This is an organizational challenge for Adria to produce these windows for a longer time and ship them to the right places, more on this at the next section Spare parts. These components rely most on information and the availability of replacement parts.

- **Critical for functioning and moist**

Some components are critical since they are not easy to repair while limiting the functioning of the caravan or posing threats to other components. A broken bathroom floor is not only keeping the user from taking a shower but is also a spot where water has access to floor paneling. Moisture in the floor panels reduces the overall stability. The same goes for the flooring, inside paneling on the walls, and the sinks in the kitchen and bathroom. Components such as the bathroom floor do not need repairs often during the lifespan of one caravan but when they do there is less logistical support for these parts, they are uniquely designed for a specific caravan with a specific layout and are therefore hard to reproduce after twenty years. It is needed to look per part what is the best solution to repair them now or in the future. As an example, the bathroom floor is analyzed and redesigned in Chapter 8.

- **Critical for the comfort levels**

The fridges are not made to last the complete lifespan of the caravan. This means the need of replacement is clear at the moment of designing. While Adria is designing the space and surrounding dimensions in a way that it is possible to replace the fridge (Murn, 2020) it is still not always possible to find the product with the same dimensions and the instructions on how to do the actual replacement (Koonincks, 2020). For third-party

CRITICAL FOR OVERALL STABILITY AND SAFETY

CRITICAL FOR FUNCTIONING AND MOIST

CRITICAL FOR COMFORT LEVELS

CRITICAL TO KEEP VALUE AFTER YEARS



products it will be needed to come to a standard, in terms of placement of outlets, dimensions, and maximum weight. This way it will be possible for the repairmen to order the replacement products at the third parties and fit them into the same placement as originally designed.

Other examples of products within this category: heaters, cookers, tents, kitchen appliances.

- **Critical to keep value after years**

Trends and fashion changes and therefore the requirements of a caravan increase with the wishes of the customer. To keep the caravan up-to-date some items need upgrading throughout the lifespan. These are mainly electronic-based equipment (such as more sockets, USB charging points, or coffee machines), clean mattresses when buying second hand and outdated or dirty upholstery. This is mainly made easier for the owners by giving information on where to open up the walls and sizing and patterns of the interior.

Spare parts

Elongating the lifespan of already sold caravans is desired because these caravans consist of more non-recyclable materials than the circular redesigns of the future. Keeping these caravans around longer will show good moral and ethics which is appreciated by the public (Forrester, 2021). The production of spare parts of these caravans is hard because there are a lot of unique parts made over the years and as stated before, the organization was not focused on this line of business when designing them. It might be worthwhile to use the dimensions of past products as standard and increase the number of products that are backward compatible by decreasing the number of unique parts.

Selling spare parts is something Adria is doing for several components. Widening this range can be a new way of generating profit for Adria. Rather than selling a caravan to consumers once, these same people continue to buy replacement parts to repair, modernize or upgrade their caravan. The range can be made very broad, namely all parts in the caravan, but can start with parts that

are replaced more often. The margin on these sales is larger if more parts are standard throughout the company.

Informing users

Informing customers about their possibilities for repair and reuse will lead to them using all options within the range of the caravan. Redesigning caravans to elongate their lifespan is not only about design, it is also about making it easy for the user to use and act as intended and repair the products. When Adria makes the change between design for assembly and design for disassembly, it will be possible to replace parts. But it is not only usable for the new range of caravans because there are already a lot of parts that are probably better repairable if Adria informs their partners. Many of these aspects are already existing for other industries, such as manuals for cars (Handleiding Kwijt, 2021). This has come about through laws and regulations, but it now shows that people are also bound to the brand. If it is possible to repair something by buying an addition from the same brand, people are less tempted to look at other companies and possibly switch between brands.

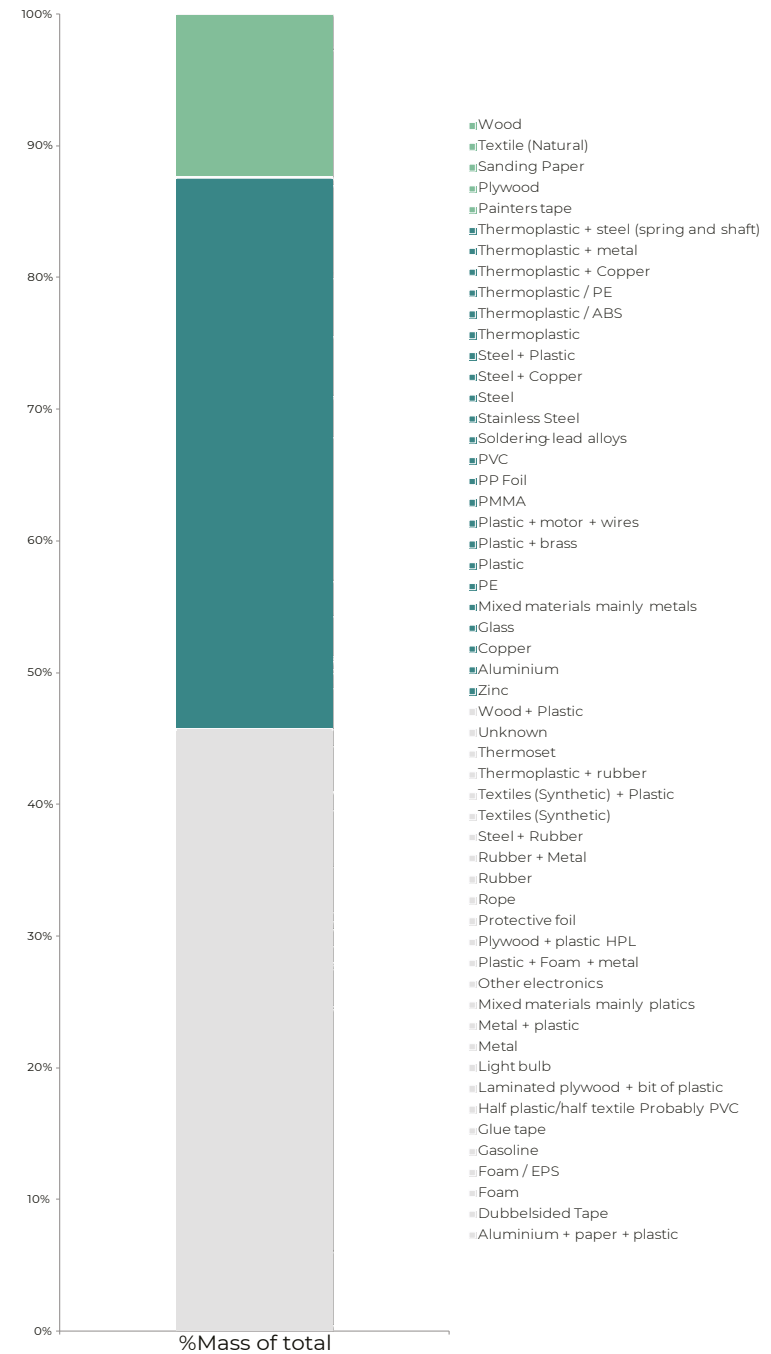
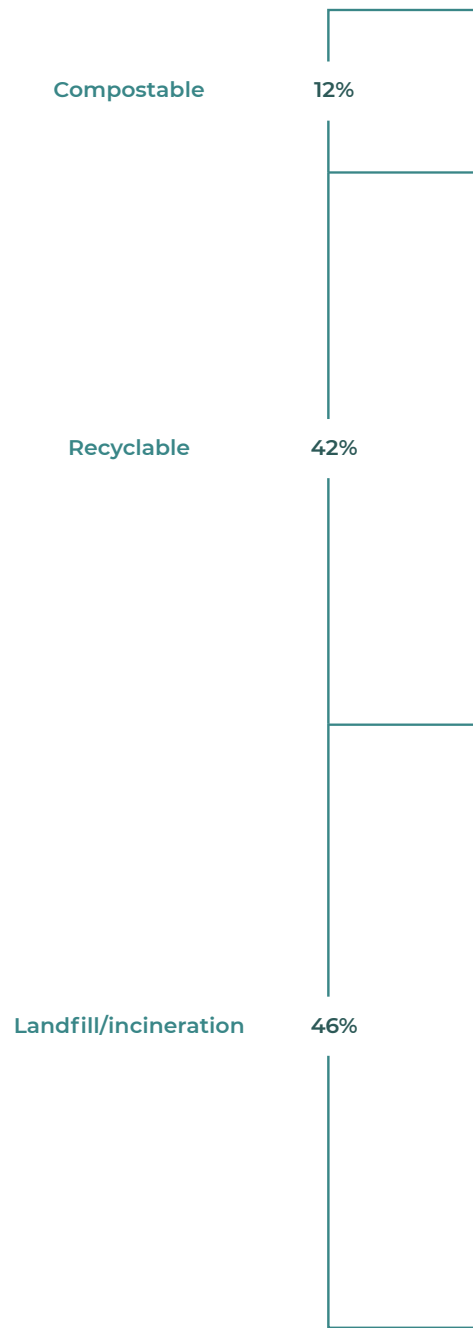


Figure 7.5 Recyclability of the caravan

7.3.4 Recycle

Figure 7.5 is a graph made of Table I.1 in Appendix I, it shows all materials used in the eco-analysis. These are a level 0 or level 1 (GRANTA Edupack, 2018), which means they are very basic and not specified to the actual material. All values are averages for the overall material, where in reality there are many forms, additions, and applications possible. Things like plasticizers for plastics, recycled content for metal, or variations in alloys for aluminum. Stating if materials are recyclable is therefore possible, but not realistic. The graphs shows if in general, these materials are recyclable if they are not contaminated, with for instance glass fiber, non-water-soluble glue, or other materials that are attached to them (Cotrep, 2016), at the end of a regular sorting process.

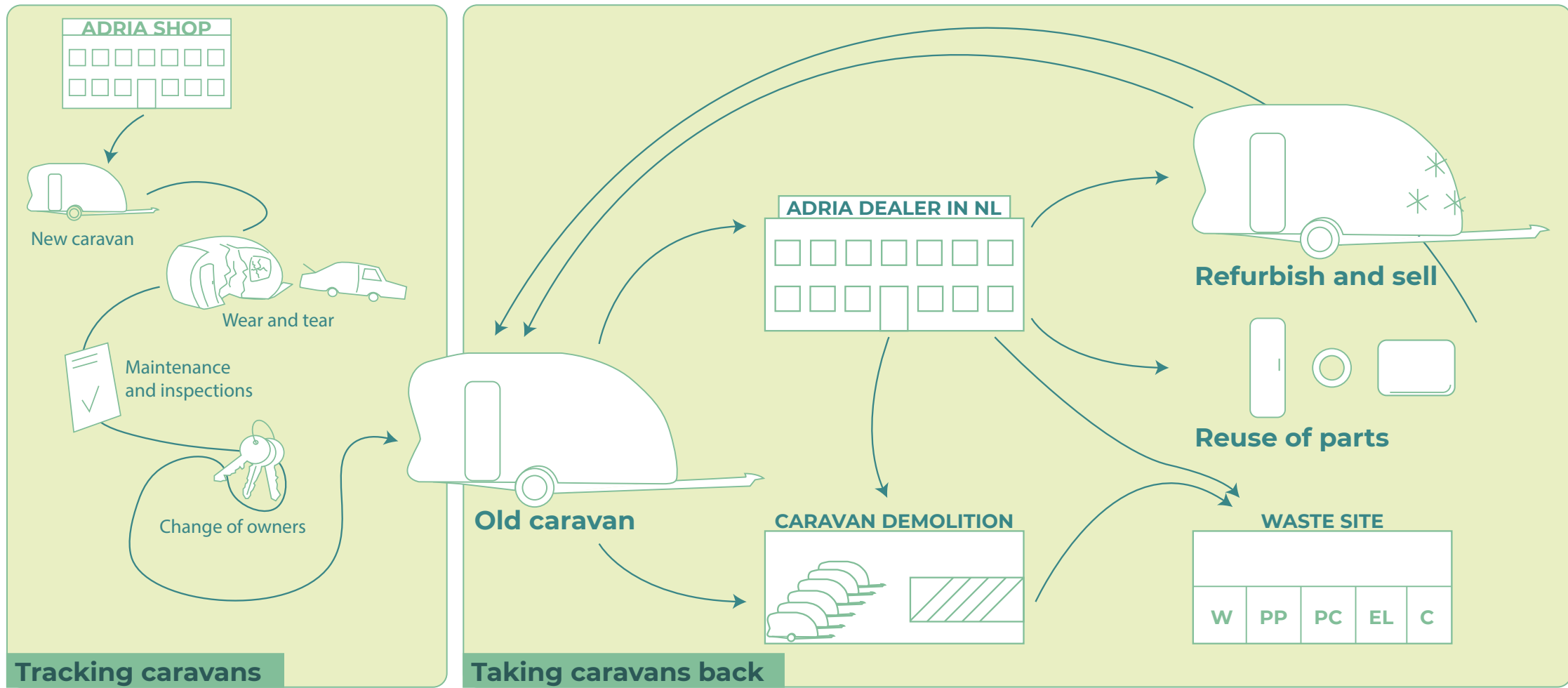
However, this graph does show how much of the overall caravan could be recyclable if recycling would be taken into account during designing, if it would be clear to the person handling the elements at end-of-life and if countries would be handling their waste responsively. Some items are most certainly being recycled, metal components are most often removed from the scrap with large magnets due to their value. Plastic that is not used as packaging (60% of all plastic waste) is incinerated in the Netherlands (Straver, 2019). Half of all the plastic used as packaging, for example for packing vegetables, toys, or furniture, is recycled. There are regulations for the car industry that 95% must be recyclable but it is estimated that 98% of cars are recycled (ARN, 2021). There are separate logistics for the recycling of cars.

Off all European countries, the Netherlands does the best in the circular material use rate (Eurostat, 2020). This means that in other European countries where Adria sells caravans the recycling is worse. In short, it can be assumed that the plastic components of caravans are not being recycled during end-of-life unless the company takes them back and recycles their components themselves. The only way these parts will be recycled is if the waste management in the countries is going to focus on product-plastics which is currently not being done.

For taking back your materials it is important that the materials can

be separated, that there is a logistical plan, and that you have the intention of your materials to be used again. If all three are in place it adds value to all components and generates profit by eliminating costs of new material.

To indicate more accurately which materials must be replaced, the BOM must first be supplemented with more detailed knowledge of materials and non-recyclable materials could be replaced with alternatives. Appendix H shows how new materials for the body could be explored. Since most materials are chosen for their durability, it would be logical to focus on repairing and disassembly first.

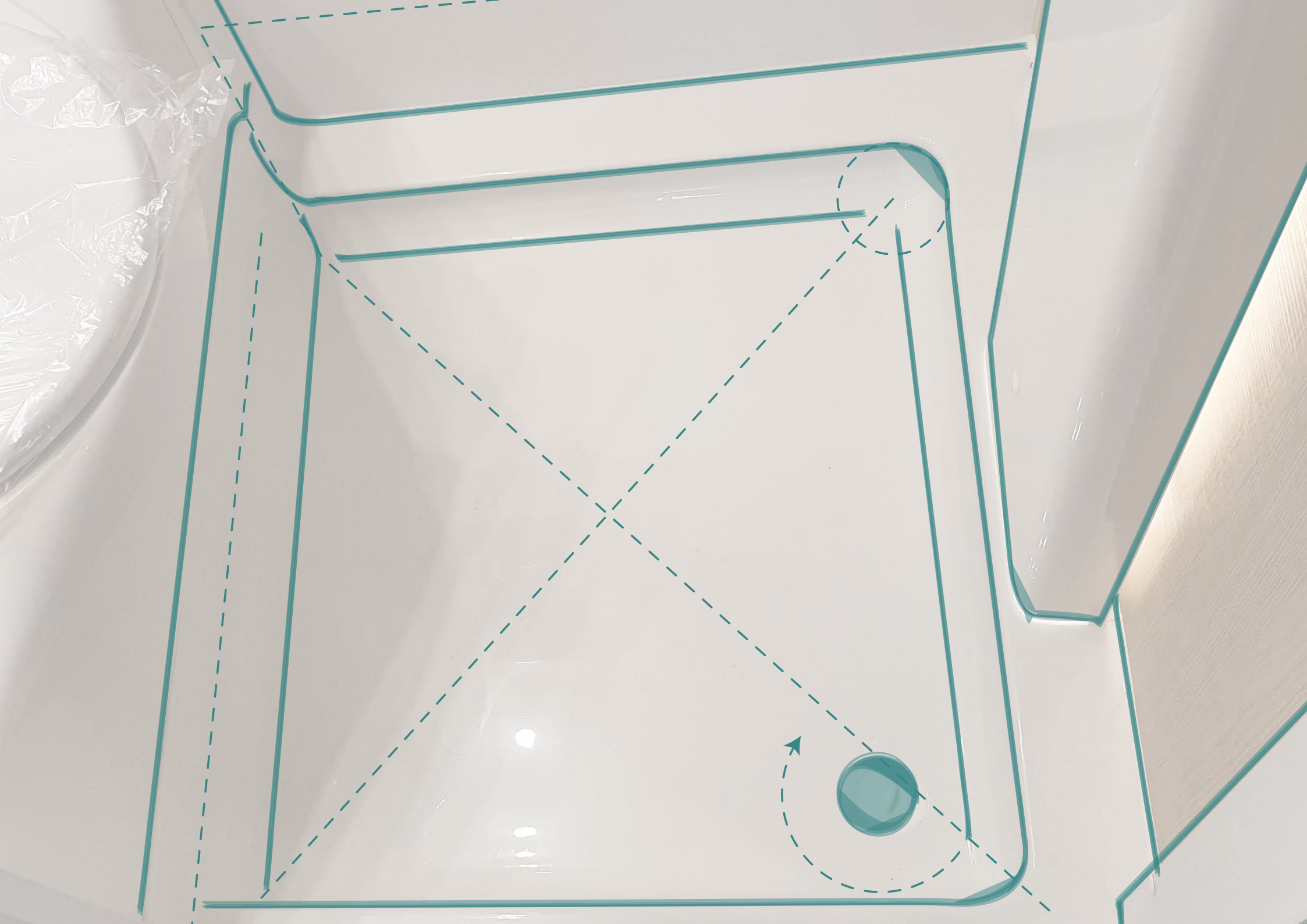


7.4 Closing the loop

Complete circularity is achieved when it is also ensured that the caravans are recycled and the materials can be reused. As stated before, this is currently not the case for a large part of the materials (Straver, 2019). The EU is trying to improve these numbers (Neri, 2021). Real circularity is created when Adria takes back her products and recycles them into new components for new caravans (Figure 7.6). When Adria maintains used caravans itself or with partners, it is possible to earn money by selling parts within the same country. This prevents extra transport costs and emissions from Slovenia.

It is also interesting to track the caravans during their life cycle. In this way, it is clear how people use their products, what value parts have afterward, where the caravans are, how much maintenance is done, and which parts are critical. Adria will know to improve the parts that matter during the use. This certainly becomes important when regulations ensure that companies are responsible for their products during end-of-life.

Tracking the caravan can also gain insights into the CO₂ impact during use. The possibilities of tracking the fuel consumption of the car should be explored, how much extra weight the users are adding when traveling and how much gas and electricity is needed. Comparing these results will not only be a reality check of the theoretical results but also make future analyses more accurate. Ultimately, an accurate LCA will be useful to convince people of the added value of a camping holiday compared to a hotel or flying holiday.





REDESIGN BATHROOM FLOOR

This section explores the possibilities of repairs and redesign of one critical component: the bathroom floor. It can be concluded that this part is not stand-alone and the real redesign is based on choices of standardization. This section finishes with design guides for this specific part and others.

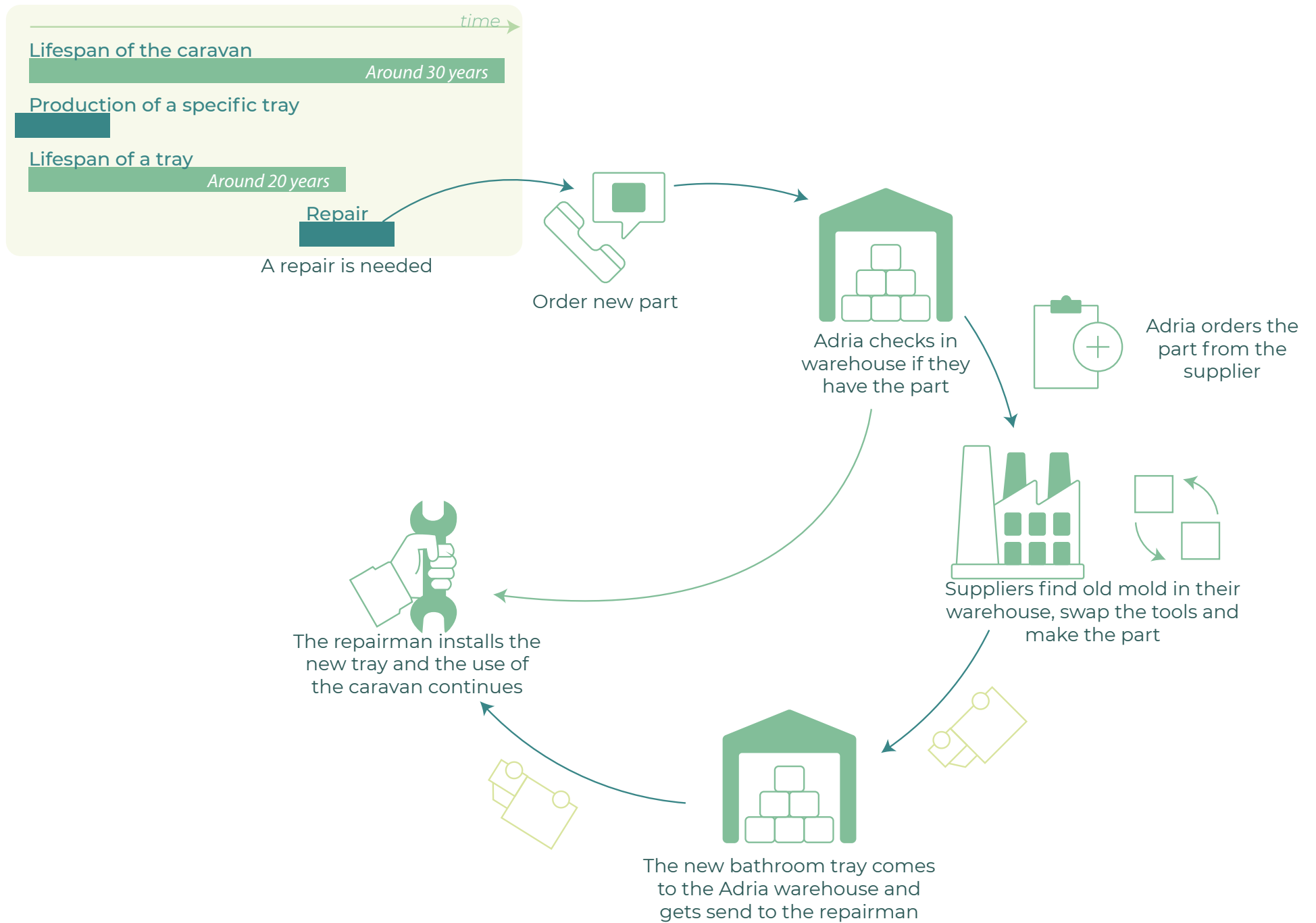


Figure 8.1 Schematic timeline and critical components

8. Redesign Bathroom Floor

In this chapter, the design process of redesigning the repairs of the bathroom floor and the requirements, limitations, and options arising from that are discussed and in the end a redesign is proposed. The bathroom floor is a wide term for what can also be called a shower tray, a bathroom tub, the toilet floor, or else.

8.1 Introduction

8.1.1 Why the bathroom floor?

There are a lot of different elements in one caravan, in the Adria Action there are 970 parts. The analysis has shown that based on value, experience, and material, there are four groups of critical parts as described in Chapter 7 Framework. Critical for safety, functioning, comfort, or staying up-to-date. For some of those, there are solutions such as informing the customer, creating ways to order spare parts easier, agreements with third parties, or new business ideas with add-ons to upgrade the caravan. Other components are harder to repair or replace due to the uniqueness of the part and the placement within the caravan but are also necessary to replace due to the moisture damage that can happen in their absence. One prime example of this group of components is the bathroom floor. The bathroom floor is a suitable part to set as a design example due to the complexity of the problem and the many requirements for the result.

8.2 Design questions:

1. How can we repair current floors more sustainably?
2. How to redesign the bathroom floor to better enable repairs and circular end-of-life?

From the analysis, it became clear it is needed to repair critical parts to elongate the lifespan of the body of the caravan (Figure 8.1). One way to achieve this is to make sure the interior has the same lifespan as the body. Currently, the bathroom floor does not have the same lifespan due to material and construction choices. It is needed to create possibilities for repairs on this part for the floors produced in the past, present, and future.

If the bathroom floor does not get repaired, moisture can get into

the construction of the caravan which leads to structural damage, the total value of the caravan lowers, it is not possible to use the caravan to its full potential and the complete caravan could be written off.

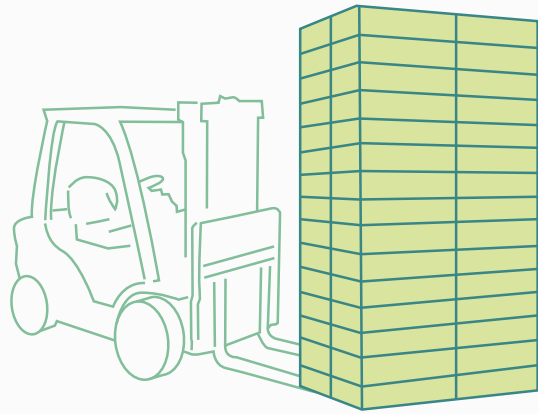
In theory, it is possible to order a new identical bathroom floor, the tools and machines still exist, but it is very expensive because the bathroom floor factory needs to swap the machines, create one floor, send it to Adria for inspection, Adria sends it to the local repair shop and they charge labor costs to install it. The installation of a replacement floor is very time-intensive due to the amount of furniture constructed on top of this bathroom floor and creates situations for more elements to potentially break.

The current method for repair, pouring thermosetting resin onto the floor, is not compatible with a circular economy because it is creating a hybrid component where the materials cannot be separated from the recyclable ABS/PMMA floor. It would be better if Adria recommends repair methods to garage owners on sustainable durable repairs and their impact on the environment and the longevity of the caravan.

8.3 Current design of bathroom floors Adria Action

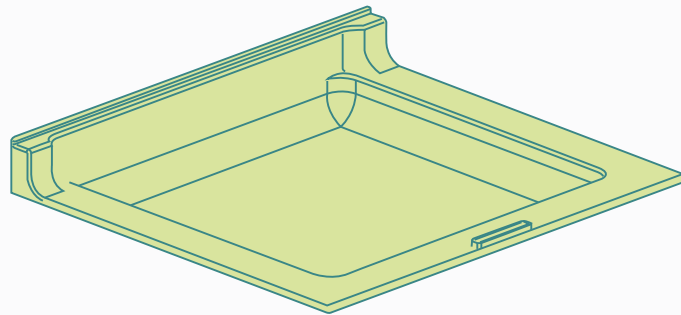
The bathroom floor is currently made for an ABS/PMMA mixture, the information sheet can be found in Confidential Appendix D. The materials are made in one factory and transported as sheets to the thermoforming company (Figure 8.2). Due to the minimum order, 3000 kg, most floors used at Adria are made from the same material. The sheets need to be used within 6 months because with unprotected edges moisture has an entry and can damage the material. Wooden molds are used for prototypes, it is possible to create around 20 trays with one wooden mold. For final designs, aluminum molds are used. They cost around 5.000 Euros. The largest portion of the cost of the mold is in the labor making them.

In general, the trays are designed to look like showers people have at home. The trend in home bathrooms is more and more minimalistic so the bathrooms in leisure vehicles follow this movement.



Manufacturer of sheet material

- Minimum order is 3.000 kg
- ABS + PMMA
- Different layers (UV protection, Shine coating, Structure, ABS and Recycled content)



Manufacturer of trays

- Creates shower trays ready for installation.
- The forming needs to be done within 6 months because the edges of the sheets are not protected from moist and can damage.
- Due to this time line and the minimum amount the order, all trays are made from the same material.
- Most floors are white, this way the stretch in the material is less noticeable
- Aluminium mold (~5.000 euro / between 3.000 and 10.000)

8.4 Thinking of solutions

To find answers to the design questions conversations and brainstorming with multiple experts were conducted. Richard Oosting, an adhesives expert, had advice on how to proceed with sprays that are currently being used for example roofs of campers. The main disadvantage of these kinds of solutions is that they can be slippery when wet. The workers at the practical labs at the faculty were more focused on separating the polyurethane from the shower tray at end of life. Finally, the repairmen at CamperService Delft explained the methods they currently are using. Most of the time they fill the tray with polyurethane, sometimes they buy the tray from the suppliers and they have experimented with creating a mold to recreate (part of) the tray. The easiest and most cost-effective way to repair a broken tray is to fill it up, this can be done with a two-component resin that costs 25 Euros and is delivered the next day.

With these insights and some inspiration from other contexts, I have brainstormed on other solutions (Appendix K). On the next pages, there is a summary of solutions with explanations as to why it would or wouldn't work in this situation. Due to the ease, costs, and effectiveness of polyurethane it is hard to beat this method. The main downside of this method is that the tray is taken out of the circular economy. Repairing it makes the tray unsuitable for recycling. For future trays, the ease of replacing must be easier to keep the value of the tray.

8.4.1 Current methods

Currently, most repairmen use polyurethane to fill the shower tray. These materials do not adhere well to smooth surfaces, to improve this the surface is sanded before applying the resin. Polyurethane is chosen over polyester (shrinkage) and epoxy (lack of flexibility). The main problem with this method is the creation of a hybrid monster. Hybrid monsters are created when two materials are combined to be never separated again but can as a combination not be reused or recycled. In this case, the ABS/PMMA mixture can be recycled but when adding the thermoset material it creates something that no longer has value or future potential, thereby named a monster. What makes replacing the floor more difficult is that it is not possible or desirable to remove the floor from the caravan. This

would mean that many other components have to be removed from the caravan, which increases labor costs and which can cause more elements to break. In more recent produced trays these steps are minimized to disconnecting all cables and drain systems, lifting the toilette, and removing silicone sealants. In older trays, there are constructions where the walls of the bathroom are standing on the edges of the trays.

A replacement tray of older models costs between 200 and 800 Euros (Koonincks, 2020). The polyurethane costs 25 Euros. Labor costs are lower with the filling of polyurethane but are case dependant.

8.4.2 Reasons for breaks

1. The plasticizers get out of the plastic over time making the plastic more brittle and therefore more vulnerable for forces
2. The floor is not supported well or the materials that are used to support the tray become less flexible. Sometimes in older caravans, some kind of foam is used to support the tray which deflates over time and cannot perform as expected.
3. The caravan was in an accident. This can lead to all kinds of damages.

Most important for regular repairs is the lack of plasticizers, this happens in most cases and is hard to prevent by the owner or by regular maintenance.

8.4.3 Requirements for repair

- Wear-resistant, people stand on it with various footwear and might use the shower as a storage facility while traveling.
- The material should have some flexibility just like the rest of the caravan and can handle the vibrations during traveling.
- Anti-slip with and without water, and in combination with the normal use of toiletries to ensure safe use of the bathroom.
- Water-resistant and waterproof, the new material should not absorb moisture or let the water go through to the structure.
- Functional in a range of temperatures (as ABS), caravans are stored over winter where temperatures can drop well below 0 °C and are used in warmer countries where an enclosed vehicle can

heat up to 45°C.

- The solution must be safe to use in a repair shop for the repairmen and the surrounding environment.
- Materials that are used must be able to be separated to be recycled, to comply with the circular economy.
- One solution applicable on the wide range of bathroom tray designs up until 30 years ago.

8.4.4 Wishes

- The solution should be price competitive with the current method of polyurethane
- The bathroom should end up looking aesthetically pleasing, if not, people are less inclined to use the solution. This means it should be able to use some form of finishing and color choices fitting to general bathroom furniture.
- Ideally, the repair lasts for the rest of the lifespan of the caravan.
- The number of steps should be as low as possible
- It must be clear to the person repairing the tray how it was designed
- Private individuals should be able to order the materials to repair their own caravan.
- Locally used resources are preferable due to transportation costs and impact

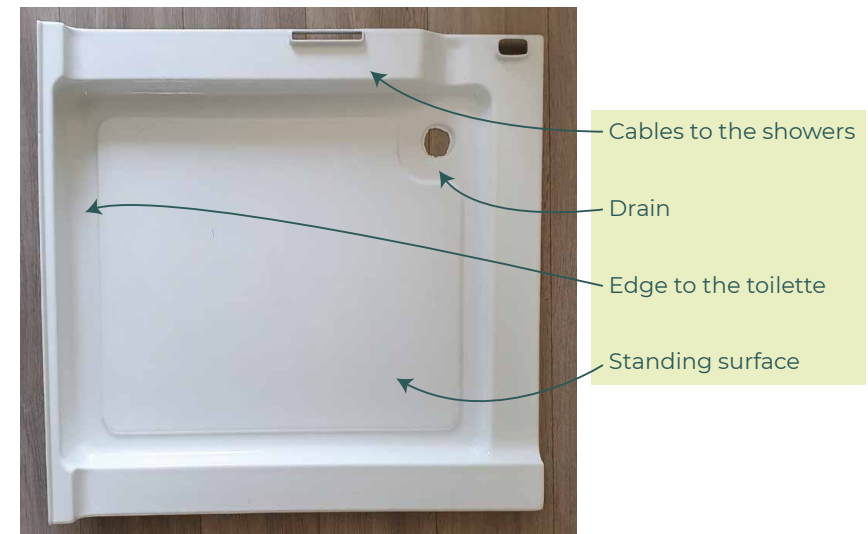


Figure 8.3 Photograph of showertray

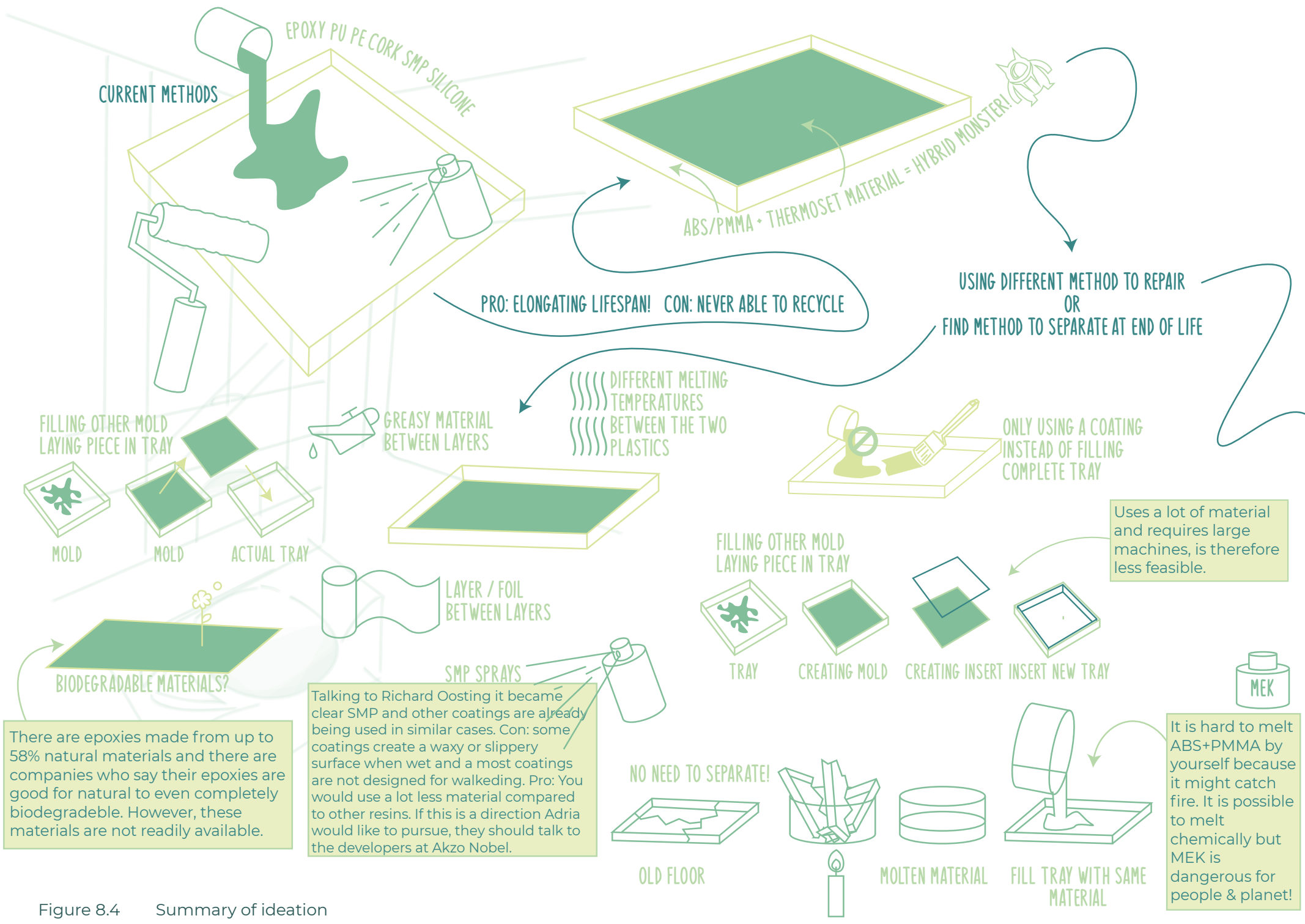
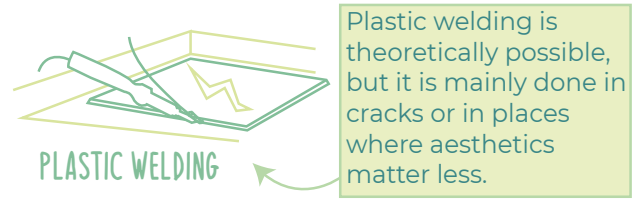
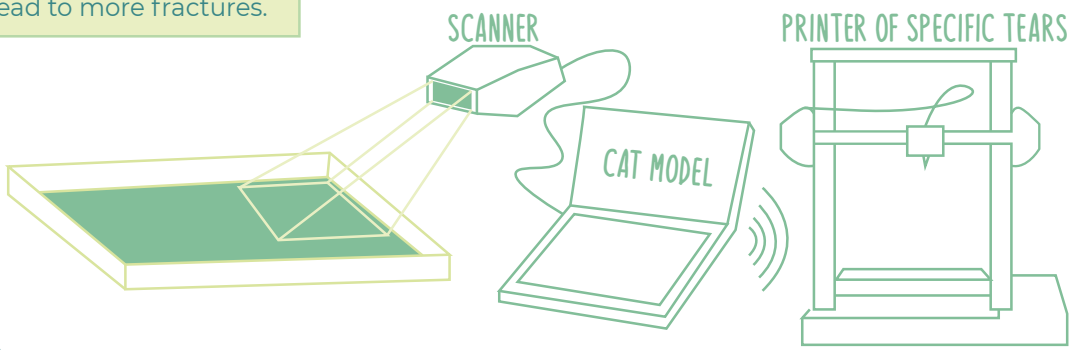
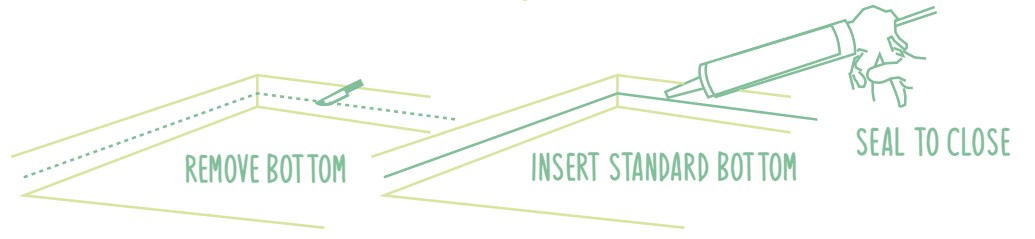
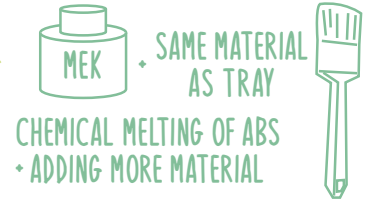


Figure 8.4 Summary of ideation

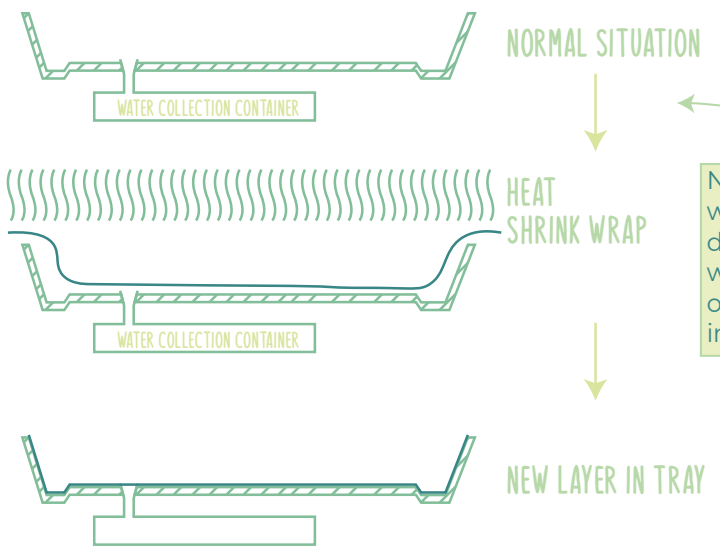
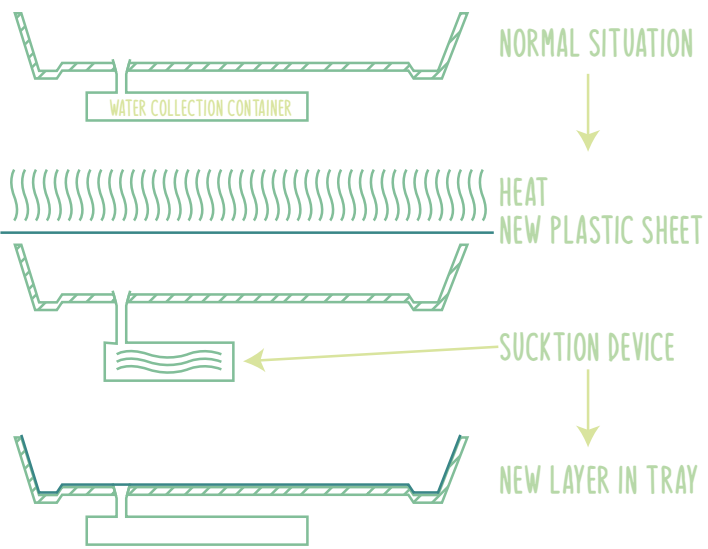


The glue will be much harder than the material around it. If the tray is already brittle, this method will lead to more fractures.



Plastic welding is theoretically possible, but it is mainly done in cracks or in places where aesthetics matter less.

In addition to problems with accessibility to equipment and suction for even distribution, the total surface area of the new plastic will have to be larger than the current tray viewed in 2D. Since the tray is surrounded by walls, it is not possible to let the plastic protrude. That makes this direction of solutions very difficult.



Normal shrink wrap is not designed for walking and other forms of impact.

Before adding the polyurethane

With liquid polyurethane that is still spreading over the tray.

The polyurethane is cured



8.5 Testing separating materials

8.5.1 Introduction

From all discussed and brainstormed suggestions, a barrier between a thermosetting resin and the bathroom tray could be a viable solution to save the recyclable material. Normally the repairmen use polyurethane resin. Polyurethane meets all the requirements for a resin under these conditions: good with water, UV, and flexible on the road. Realistically, this could be combined with petroleum jelly or a foil (similar to a garbage bag).

Theoretically, these two could be the solution. The outcomes are compared to a untreated and sanded area as they do now.

8.5.2 Method

An old but unused bathroom tray is divided into four parts where the different methods are applied: as-is, Vaseline, garbage bag and sanded (Figure 8.5). Then the two-component polyurethane is mixed according to the instructions, poured into the tray, and allowed to harden for 24 hours (Figure 8.6).

8.5.3 Results (Figure 8.7)

As-is: it is not possible to separate the two materials by normal means. The ridges under the polyurethane are just visible. This in itself is a possible technique to use.

Petroleum jelly: The materials are not easy to separate from each

other because the polyurethane is reasonably stiff. It is possible by getting a screwdriver under a point and then pulling it. More resin will be needed to ensure that the result looks beautiful. You will get greasy hands from the divorce. I doubt whether there is room, sense, and time for this during a demolition.

Garbage bag: As far as aesthetics goes, this is not a good look. It is very easy to lift the garbage bag. During the demolition of the caravan, these materials would automatically fall apart.

Sanded: Of the four parts, this part looks the best. It seems that because the ridges have been sanded, the polyurethane adheres better to the edges, resulting in a smoother result. You cannot separate the resin from the tray.

8.5.4 Discussion

For a tray where the material is unclear, thus reducing the chances of recycling, it is probably the best idea to sand the bin and then fill it with polyurethane. This gives the repairman a nice result for little effort. Separating the materials is possible but comes with other disadvantages, for example, it is not clear how long the petroleum jelly allows the two materials to sit together and how any heat will play on it. It should also be borne in mind that the tray contains cracks through which the petroleum jelly can run and which can contaminate other parts.



Figure 8.6 Test process

	Removable	Aesthetics	Ease of use	Realistic
No treatment	x	✓	✓	✓
Petroleum jelly	✓	x	✓	x
Garbage bag	✓	x	x	x
Sanded	x	✓	✓	✓

Figure 8.7 Results

	Feasibility	Wear-resistant	Vibrations	Anti-slip	Water-resistant / waterproof	Range of temperatures	Safe for the environment	Recyclable	Applicable on various designs	Price	Aesthetics	Lifespan of repair	Amount of steps	Ease of use	Transportation	
Filling the floor																
Polyurethane	YES	✓	✓	✓	✓	✓	✓	×	○	○	○	○	○	○	○	<i>When the tray is completely filled, polyurethane is the best material to do this with. It is more flexible than epoxy and therefore lasts longer.</i>
Epoxy	YES	✓	×	✓	✓	✓	✓	×	S	S	S	-	S	S	S	
Polyester	YES	✓	✓	✓	✓	✓	✓	×	S	S	-	-	S	S	S	
SMP coating	YES	×	✓	×	✓	✓	✓	×	S	-	S	-	S	-	S	
Cork	NO	✓	✓	✓	✓	✓	✓	×								
Filling the crack																
ABS	NO	-	-	✓	✓	✓	×	✓								<i>Filling the fracture often does not solve the problem because the plasticizers disappear all over the material. When something hard like glue is applied there will be a concentrated stress location and more fractures will occur.</i>
3D Pen	NO	-	-	✓	✓	✓	✓	✓								
Plastic welding	YES	-	-	-	✓	✓	-	✓								
Glue	YES	-	×	-	✓	✓	✓	×								
Silicone	YES	-	-	-	✓	✓	✓	×								
Inserting new layer																
Creating mold	YES	✓	✓	✓	✓	✓	✓	-	○	○	○	○	○	○	○	<i>Plastic welding, as shown in Appendix K on the canoe, is unsightly and requires special tools. Making a mold to create an insert is easier and more widely applicable.</i>
Vacuum forming in place	NO	-	✓	✓	✓	✓	✓	✓								
Scanning and printing	NO	✓	✓	-	✓	✓	✓	✓								
Foil	NO	×	✓	-	✓	✓	✓	✓								
Plastic welding	YES	-	✓	✓	✓	✓	-	✓	-	+	-	S	-	-	S	
Replacing																
Ordering at Adria	YES	✓	✓	✓	✓	✓	✓	✓	○	○	○	○	○	○	○	<i>If you can replace the tray, it is easiest to order the new tray from Adria. In this way, steps such as making molds, material choices and defining precise dimensions can be performed by Adria.</i>
Using old tray as mold	YES	✓	✓	✓	✓	✓	✓	-	S	-	-	S	-	-	S	
Local production	NO	✓	✓	✓	✓	✓	✓	-								
3D Printing	NO	✓	✓	✓	✓	✓	✓	✓								
Taking the tray out and repairing with new material																
Taking the tray out and repairing with new material	YES	-	-	-	✓	✓	✓	×								<i>Creates a hybrid monster without adding benefits.</i>
Barrier between resin and tray																
Barrier between resin and tray	YES	×	✓	-	×	×	✓	✓								<i>This can be done but is probably not durable enough.</i>

✓ = Yes × = No - = unknown S = Same as + = Better than - = Less than

Figure 8.8 Ideas evaluated on the requirements and wishes

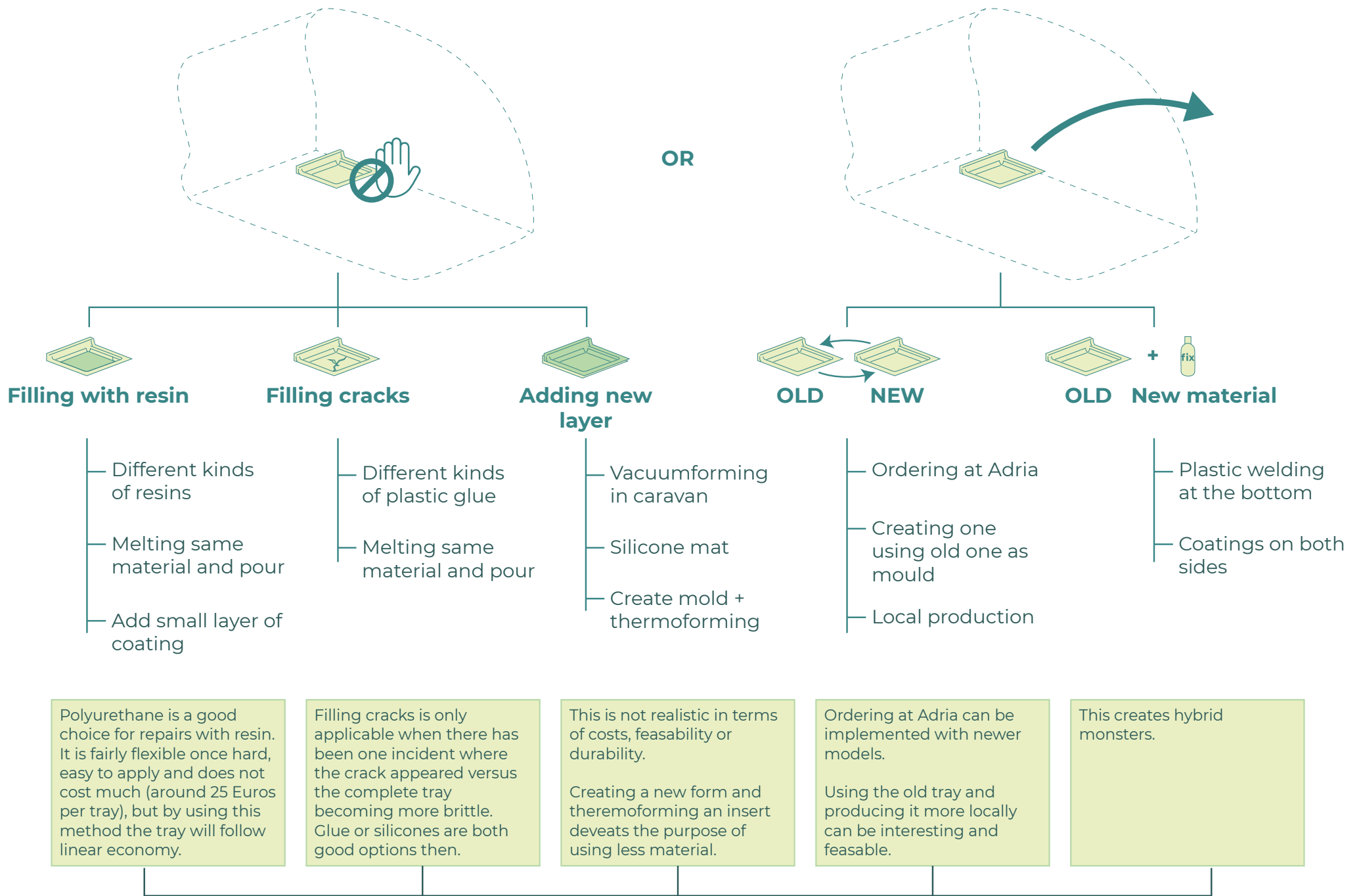
	Applicable on various designs	Price	Aesthetics	Lifespan of repair	Amount of steps	Ease of use	Transportation
Filling the floor with polyurethane	o	o	o	o	o	o	o
Recreating tray by making a mold of the old one	-	-	S	S	-	-	S
Replacing tray by a new one ordered from Adria	-	-	+	+	-	-	S ←
Filling the floor with polyurethane	+	+	S	S	+	+	S ←
Recreating tray by making a mold of the old one	o	o	o	o	o	o	o
Replacing tray by a new one ordered from Adria	S	S	+	+	+	S	S

S = Same as + = Beter than - = Less than

Conclusion: filling the tray with polyurethane is the easiest, most affordable option.

As shown on the right, the only criterea it does not meet is recyclability which is crucial for circular economy. Replacing the tray meets all the requirements but is for now a more expensive compared to the polyurethane. Replacing is not possible for all designs because those might not be in stock or are to old. The number of steps is also higher because there are multiple components that need to be removed in order to replace the tray which also influences the ease of use.

Figure 8.9 Best ideas ranked on wishes



Continues in illustrations on the next page

Figure 8.10 All categories of options

8.6 Ideation

All ideas from the brainstorm (Figure 8.4 and Appendix K) can be categorized as shown in Figures 8.9 and 8.10. Not all ideas meet the set requirements. The only feasible option that complies with all requirements is replacing the tray with a new one from Adria.

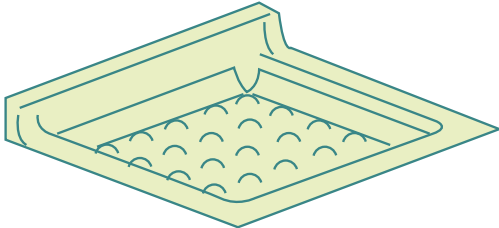
All feasible ideas are ranked using the datum method (Figure 8.9) where each time one option is set as neutral and the other solutions are compared on each wish (Annemiek van Boeijen, 2013).

8.6.1 Datum method

Compared to the current way of repairing, filling the tray with polyurethane, all other options are more expensive, more complicated, or less attractive to use. Although the value of the caravan remains longer due to repairs and that it, therefore, participates in the circular economy, this one part will then never be able to be recycled again. However, there are no other solutions for parts that are no longer (easy) to produce, because too many years have passed and the models are no longer available or because the costs are too high. We can argue that creating one hybrid monster is better than getting rid of the entire caravan. Especially when it is not clear whether with the current waste management systems whether the tray will be recycled when we replace it today. For old, unique, or extreme trays it is therefore logical to continue to use the solution with polyurethane. However, for future designs, it will be better to allow for easy replacement with a tray ordered at Adria.

The options themselves are very divided and it differs per situation how the floors of the past should be repaired. It depends on the condition of the part to be repaired, the shape, the material, the age of the part and the wishes regarding the aesthetics.

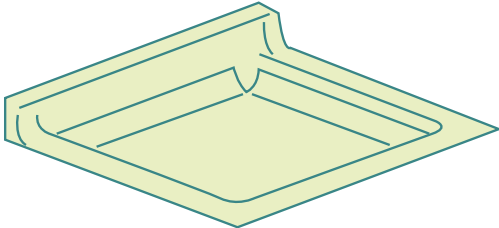
But in general **three groups and solutions can be made:**



Older trays, possible with relief and shapes that are no longer created

These trays mainly break because the plasticizers have been pulled from the plastic. At such a moment it is no longer useful to do spot treatment (e.g. filling the crack). It is unrealistic for the plastic to be recycled and it is hard to order the component. Therefore it makes sense to use polyurethane to extend the life of the entire caravan and thus sacrificing recyclability.

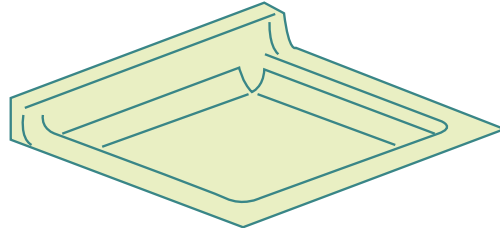
Fill with PU resin



More recent trays that are not being created anymore.

Existing trays, the material of which is known, can theoretically be recycled (e.g. by Adria). Hence, it is better if they are replaced. If these trays are not yet designed in such a way that it is (realistically) possible to remove them, it is also possible to repair them with polyurethane. This method is also advised when these models are no longer produced and ordering is more difficult.

Fill with PU resin or replace



Future trays

Future trays can be designed with repairs in mind. This will make sure that they can be easily (dis-) assembled and ordered. There is less reason to use resin and more ease to replace the entire tray. This way old and new components stay in the circular economy.

Replace

Figure 8.11 Conclusions per group of trays

8.7 Repairs

All trays can be divided into three groups as shown in Figure 8.11.

1. Very old trays

There are a lot of unknown variables. Sizes, materials, designs, production location, assembly and, models are not for sure anymore. Finding the right tools can be a lot of work, they are no longer in stock and they were not designed for the materials that are used currently in production. These are trays that probably caved into the lack of support underneath when the plastic became more brittle. For these trays, the best solution would be to use polyurethane resin.

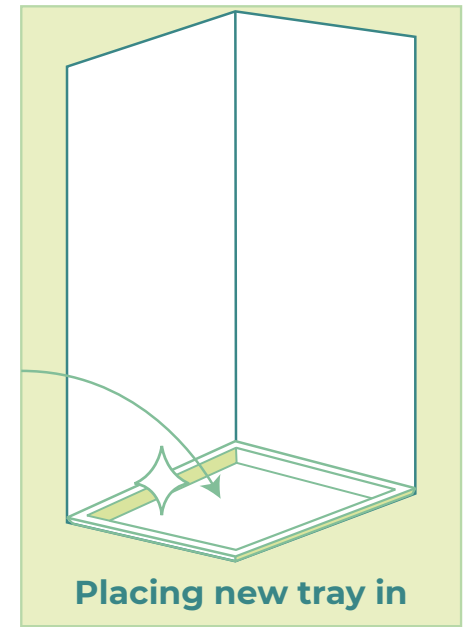
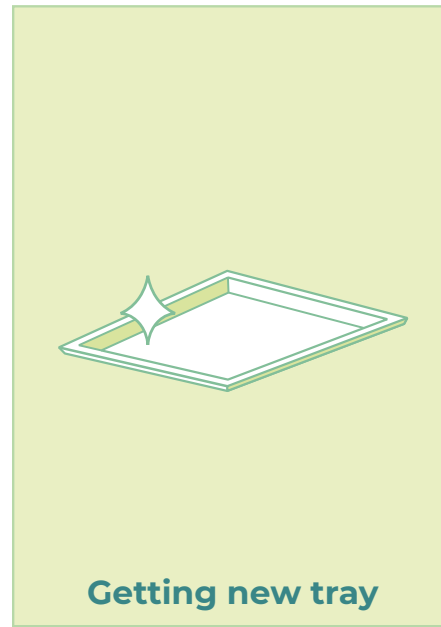
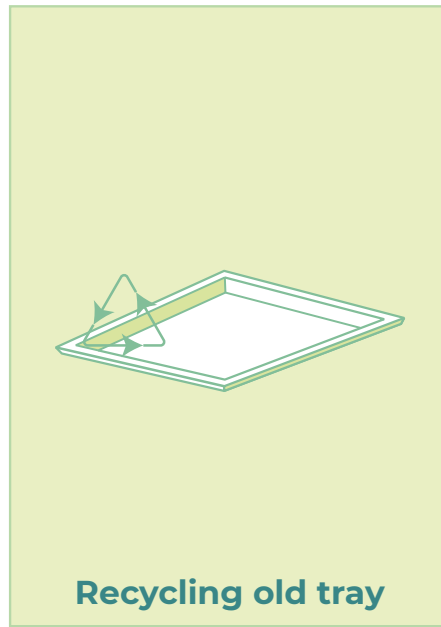
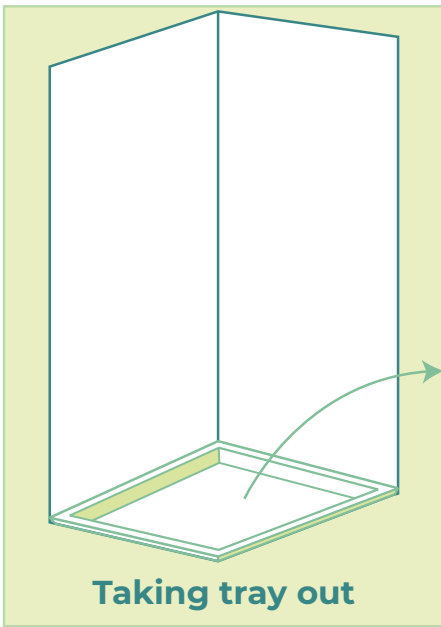
2. Relatively new trays

These will not break to brittleness at this time but rather due to careless use or an accident. It would be possible to know more about these trays, recycle them, and replace them with an identical component. This method of repairs can be done for the coming years but one day those will also be harder to replace for the same reasons and it might be needed to use the polyurethane again. This will be strongly dependant on the administration of Adria in the future. Since they are working on this it could go either way.

3. New trays

Future trays should be replaced when broken. For now, it is hard to repair them sustainably or to create one locally. It would be easier if a form of standardization would take place and tray designs would share some dimensions and be backward compatible. When a customer orders a new tray after years of use, the current model could be sent. This should be combined with making the element easy for removal.

STEPS IN THE REPLACEMENT PROCESS



ADJUSTMENTS TO THE BATHROOM FLOOR DESIGN

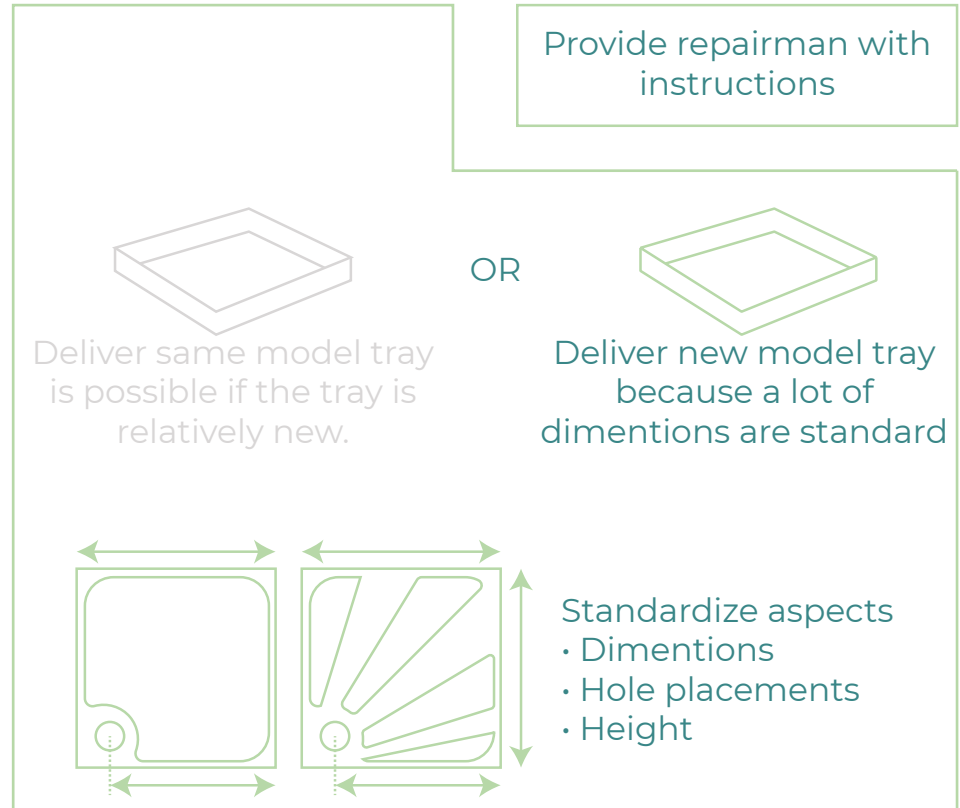
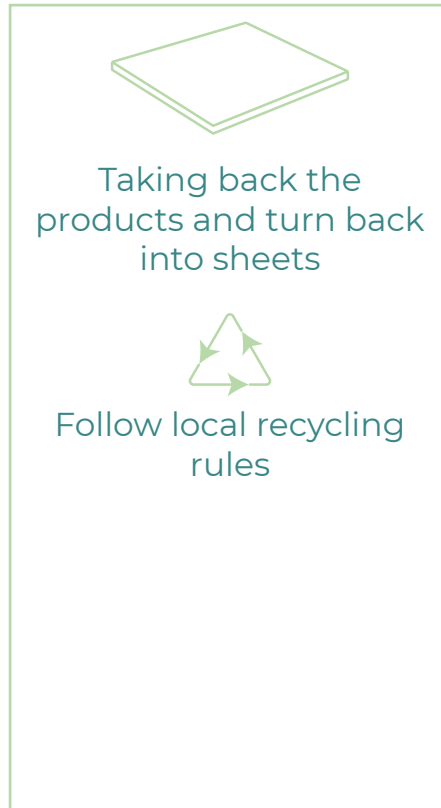
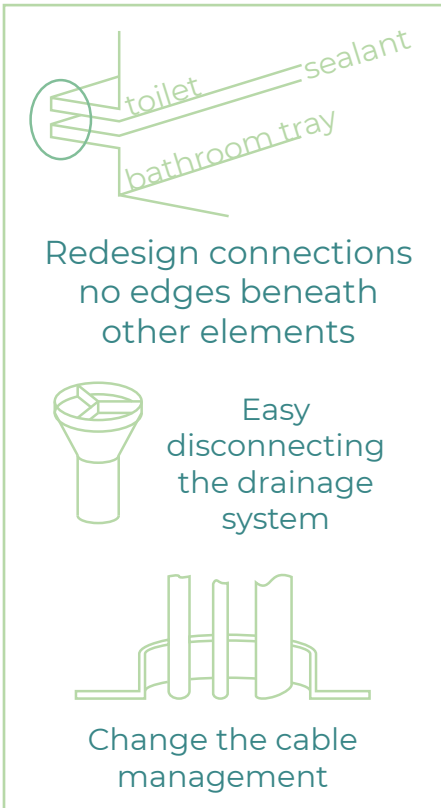


Figure 8.12 Adjustments to the tray per step

8.8 Redesign

Evaluating the current tray design, there are two things to consider:

1. Elements preventing removal or reassembly
2. Aspects which make it more likely the tray will break

8.8.1 Step by step replacement

As shown in Figure 8.12 there are different needs per step. All steps come with their adjustments to either the part, the company, or the working relation with third parties.

Taking the tray out

In the current design, some edges go under other furniture components, in this case, the toilette and a shower part, and are completely enclosed by walls. This is making it hard to take out the tray since other elements must be removed to show how large the tray is or to be able to lift it. Drainage is something that can be disconnected easily if you know which screw to loosen, this is something that can either be in a manual or a sticker on the bottom of the caravan. The cable management is currently going through the tray, making it necessary to cut off all water and electricity while it can also be an indent in the tray still guiding the cables.

Recycling the old tray

Legislation is creating a better recycling program in a lot of countries at the moment so the chances of product plastics being recycled are getting larger every day. It can also be a possibility to take back Adria plastics and turning them into new trays. This is a business direction Adria has not explored yet.

Ordering a new tray

Ordering spare parts are currently taking a long time, but with a larger focus on creating a circular economy and enabling repairs, this will become faster for Adria. There are various possibilities to what is possible to order, Adria can keep stock of all their components, create identical components when asked or standardize their components to make them backward compatible. The last option is logical because it would also eliminate a lot of unique parts and make replacement after many years still possible and affordable.

Installing the new tray

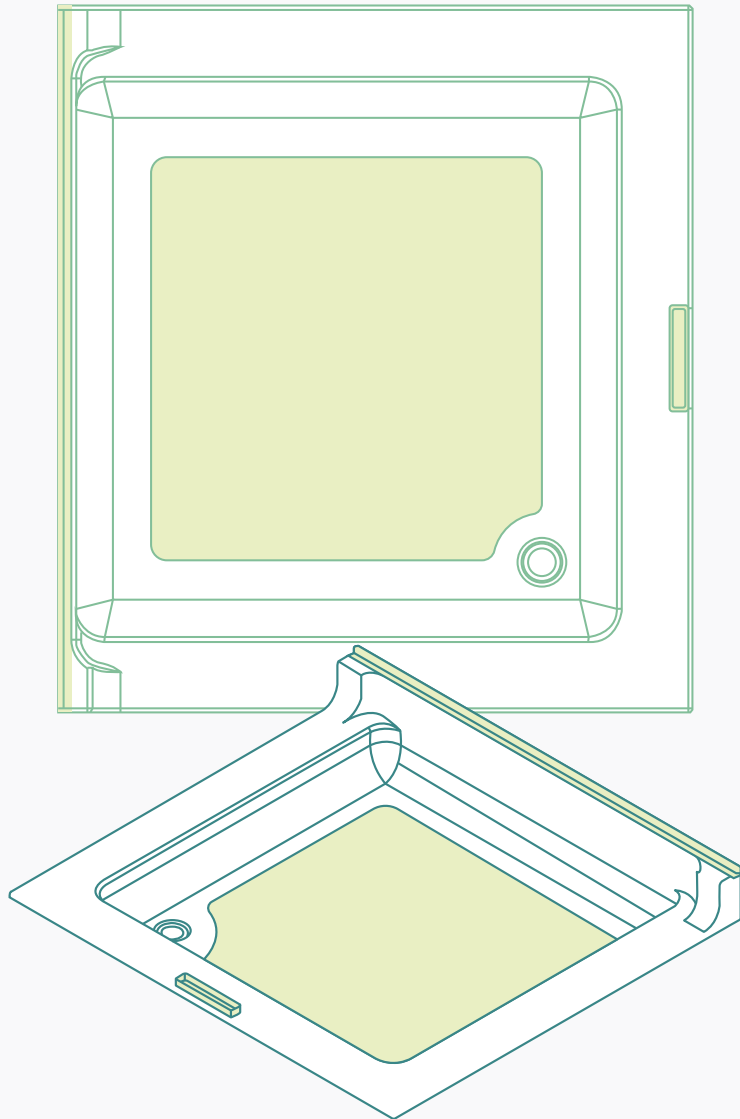
Guidance and instructions will help the repairmen a lot and will enable owners to do it themselves. This does not have to be as foolproof as IKEA but showing the layout of invisible parts and the order of working will already help.

8.8.2 Preventing breaks

1. As mentioned earlier there are three reasons the trays break. The plasticizers get out of the plastic over time making the plastic more brittle and therefore more vulnerable to forces.
2. The floor is not supported well or the materials that are used to support the tray become less flexible.
3. The caravan was in an accident. This can lead to all kinds of damages.

It is not logical to add more plasticizers and it can be possible that the current material is better than before and Adria can unfortunately not prevent accidents. There is however a way to make sure the most critical parts are always supported by removing unsupported areas. In some designs, the standing surface is lifted, creating a gutter at the outer edge. The edges of this standing area are where we see the most damage in older trays. Removing this area can elongate the lifespan of the tray.

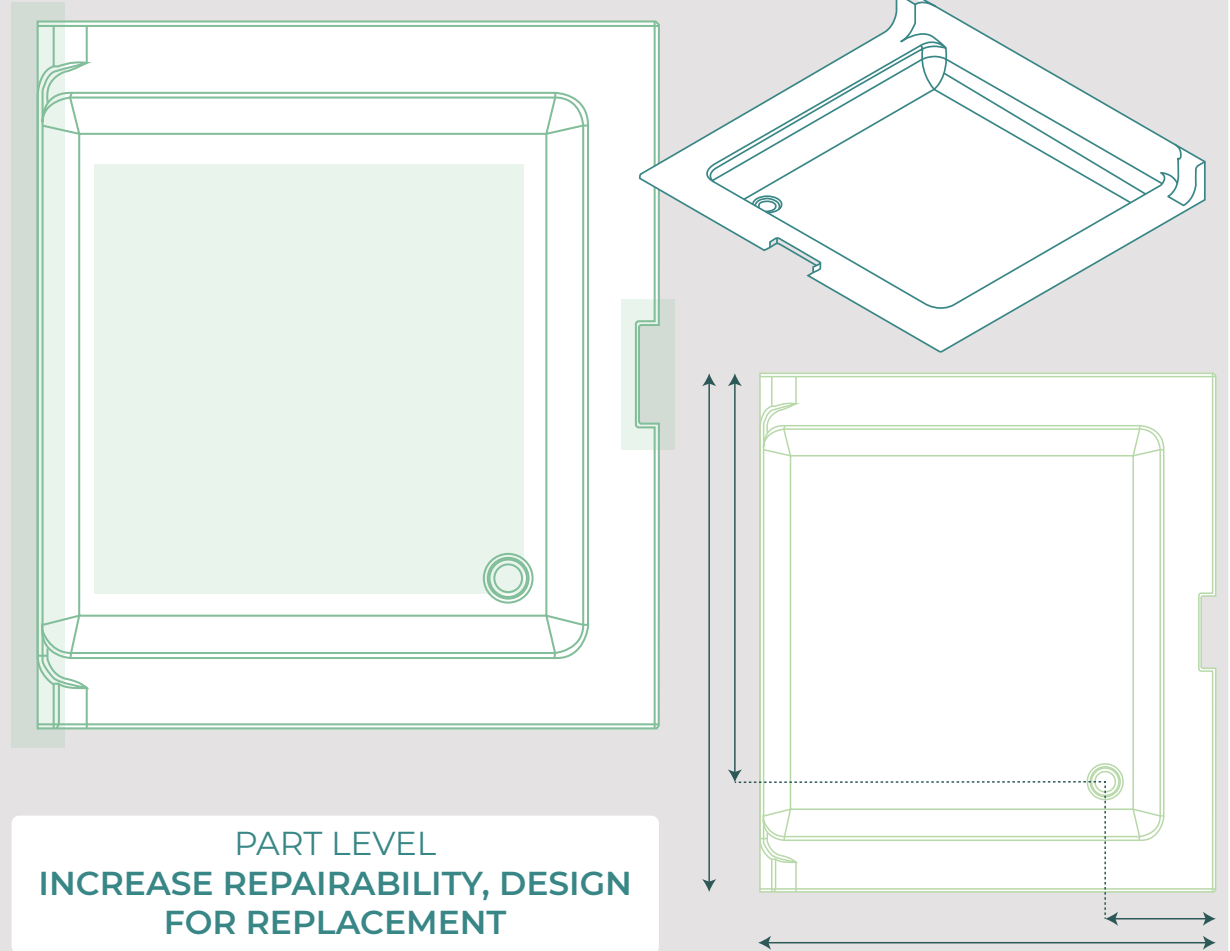
CURRENT DESIGN



IDENTIFY ELEMENTS THAT MAKE REPLACEMENT MORE DIFFICULT

Remove edges - Cablemanagement - Lower standing area

REDESIGN



**PART LEVEL
INCREASE REPAIRABILITY, DESIGN
FOR REPLACEMENT**

**CARAVAN LEVEL
EVALUATE SURROUNDING
FURNITURE**

**ADRIA LEVEL
STANDARDIZE DIMENSIONS AND
PLACEMENTS**

**SUPPORT
MANUALS AND ADVICE**



*Step by step (dis-) assembly
and Adria recommended
brands for silicone and glues.
Offering matching toilettes.*

8.9 Redesign bathroom floor

The redesign is shown in Figure 8.13 which shows it is not just needed to redesign this single part.

8.9.1 Changes per level

Part level

Removing edges, lowering the standing area, widening the cable hole are the adjustments that would make the replacement easier on part level. The tray would still be made from the same material and with the same production methods. These are already highly optimized, affordable, lightweight, and strong.

Caravan level

As far as is visible from all available information; the CAD model and photographs (Confidential Appendix D) nothing needs to change when implementing these adjustments but that should not prevent from evaluation of surrounding elements.

Adria level

Setting these standards might seem like an unnecessary step since it is not expensive to create more unique bathroom floors and several floors can be made with the same molds. By setting a standard future unique dimensions are not only prevented, it is shown that for a critical part that needs to be unique per model and per layout, it is possible to set standards. Other parts can follow after this one. It is still understandable that the floor needs to be mirrored when the door is on the other side, but it can be possible to set standards for all left-door-floors.

New business level

Support, spare parts, and upgrades are easy to create when this part is standard. The assembly manual will last for years. Adria can expand this support by advising on the type of silicone to use to seal the floor in place and offer other bathroom furniture in a matching style. This way people can upgrade their entire bathroom.

8.9.2 Conclusion redesign

The adjustments that are presented are not groundbreaking, they are very simple. The only reason they are not there yet is that the trays were not designed with a circular economy in mind before. The largest change is on a structural level, what sustainability goals does Adria set for herself and how many standard parts are needed to reach that goal. It is possible to think of completely new ways of generating profit when redesigning one part, it is up to Adria to rethink her business strategies.

1 CARAVAN LEVEL
IDENTIFY PARTS

Which parts are:

- most valuable?
- most critical?
- do not have a long lifespan?
- contribute a lot of CO₂?

2 PART LEVEL
DOES IT FIT WITHING THE CIRCULAR ECONOMY? CAN WE REUSE, REPAIR AND RECYCLE?

(RE) USE
Does this part last the complete lifespan of the caravan? →

REPAIR/REFURBISH
Can this part be disassembled within 6 steps? →

RECYCLING
Can this part be recycled? →

3 PART LEVEL
SIMPLIFIED ACTION SCHEDULE TO MEET DESIGN REQUIREMENTS

YES ✓

NO Can this part be made more durable and last longer? → **YES** ✓
NO Then it need to be repairable or replaceble

YES Can a new one be installed? → **YES** Do we have this part in 20 years? → **YES**
NO Why not, what can we change? → **NO** Why not, what can we change? → **NO** Agreements with third parties, standardize dimentionions or find ways to be able to deliver this part

YES ✓ → Will it be recycled? Does the part need additional information?
NO Can we change the material? When do the benefits outweigh the disadvantage of non-recyclability?

4 ALL LEVELS
POSSIBLE SOLUTION DIRECTIONS

Standardize key dimentionions	Change material	Sell Adria second-hand products
Standardize parts between models	Reduce durability but increase ease of replacement	Anticipate innovations
Combine two components	Increase durability and decrease ease of replacement	Design for upgrades
Agree on size with third parties	Modularity	Workshops for partners

Figure 9.1 Global process to fit circular economy requirements

9. Design Guidelines for Other Components

The bathroom floor can act as an example of how easy it can be to redesign parts to fit better within the circular economy. But it only works if all levels in the framework work together. Next to the bathroom floor there are a lot of parts that are unique per model, year and layout. This means there are a lot of different components to review on a part level and find fitting solutions such as standardization or material choices.

Working from most critical, valuable and impactful to the lesser, all components of a caravan should be evaluated (step 3 in the framework). Do they last the complete lifespan of the caravan? Do we want the components to last that long? Are they removable within a few steps? Is it possible to reinstall a replacement part? Are they recyclable at end-of-life?

From the bathroom floor it became clear a large solution is found in the standardization to ensure the option to order after many years. When applied to other components, there will be a lot of benefits. Production costs go down, it is easy to reproduce old design, more components are ordered creating a new way of generating money and in the factory there are less variables per caravan which could increase the processing time. It shows that there are more benefits to changing the parts for better repairs than only the environmental aspects.

9.1 Global process

Identify the components

Evaluating the caravan with a LCA will help choosing focus points on where to start. The caravan can be analyzed on economic value and CO2 impact but Adria can also evaluate the parts that are currently being ordered much. Taking the complete lifespan of the caravan will show which aspects need to change first and will have a large impact on the outcome in the future.

This project showed that there are parts that are valuable based on material, when there is more data and other elements of the LCA are being taken into account (Figure 4.2) the attention and focus point might shift.

The opinion of third parties, such as repairmen and recycling companies, can help a lot since they have experience Adria does not have. They see which aspects are valuable for the owners and which components keep their value long. Changing the reparability and implementing more standards can influence their opinions and which parts are valuable due to their scarcity. Tracking this information over the coming years would be interesting.

Does it fit with reuse, repair and recycle?

When the important or critical parts are identified based on set requirements it can be reviewed how circular economy can help redesign the component.

If it is a part that becomes very heavy or expensive when we design it on durability then it makes more sense to give it a shorter life but make it easier to repair. On the other hand, if it is a part that is very unique per caravan, it is useful if it lasts a very long time because it takes a lot of effort to produce it afterwards or standardize it to make it all backward compatible.

Find solutions per component

The best solution direction must be considered for each component, which can go in many directions such as the directions in Figure 9.1. All redesigns can be reviewed on their effectiveness by comparing LCA results or additional profit options. It is important to redesign parts on a broader level, say all bathroom floors before diving into a particular design. Just as with the bathroom floor, it shows there are only a few dimensions that are important to standardize.



CONCLUSIONS AND EVALUATION

10. Conclusion

This project started with the following assignment: redesign the Adria Action caravan to fit in a circular economy and to have less CO₂ emissions. However, the outcome of this project is not a redesign of a caravan but a framework for Adria to work towards (partial) circular economy. As an example of the functioning of this framework, a redesign of the bathroom floor was done.

Designing caravans for a circular economy involves more aspects than just redesigning the individual parts for reuse, repair and recycling possibilities. First, analytical capabilities, such as LCA and hot spot mapping, are needed to assess the current condition of the caravans and evaluate future improvements. To do this, a different way of documenting will be required within Adria by means of product data management. Next, with an objective way of assessing the caravan, focus points can be found and components can be redesigned using the circular economy ideals. In this way, the initial investment of valuable components retains its value longer, both economically and environmentally. In this industry there are already companies that keep caravans relevant for a longer time through repairs, reuse and recycling, but Adria is no longer involved in these steps.

There are many unique parts in caravans. Design cycles are short and during every cycle the parts are adapted to trends and are optimized in terms of space use and choice of materials. This means that after many years there is a proliferation of parts and re-production is difficult. This makes it more expensive for the consumer to order a part, and thus to remain within the circular economy, than to repair the caravan in their own way which is less sustainable.

One part where this mechanism shows is the bathroom floor. It is a critical part because it protects the frame from moisture, the bathroom is not functional without the floor and it is very difficult to disassemble and reassemble the floor. At the moment, the floor is being repaired with polyurethane, which restores the value of the caravan at that time, but the repair makes the component no longer part of the circular economy. When redesigning the tray, it was

reviewed how repairs can be made easier in the future. This requires minor adjustments to the part and major adjustments at a company level. On a company level, some variables should be agreed on as a fixed standard. This makes future designs backward compatible and therefore makes it easy and cost-efficient to produce an extra part when a consumer orders it.

All steps for Adria to take are summarized in a framework. There are different levels where actions can take place and to become completely circular, these levels must work together. A repairable element will not be repaired if it is not clear how to proceed. A replaceable part is not valuable if a replacement part cannot be ordered. A recyclable material will not be recycled if it cannot be separated from other materials.

This framework shows a possible route for Adria, starting with necessary steps and ending with what the future might look like. Ultimately, the core business for Adria should move from linear production to a support system for existing Adria caravans. This can take shape in numerous ways, such as the sale of individual parts or the leasing of caravans. In this way, caravans not only become more sustainable but also new revenue models will be created for Adria. Combining these steps will create a circular caravan.

11. Evaluation

Main insights that benefit the company:

- Many different factors are needed to measure progress and achieve sustainability. Measuring instruments cannot simply be combined with each other, but can be used with each other. Due to this measurements, clear goals can be chosen and green washing can be avoided.
- Sustainability is not something that can be implemented all at once, but something that needs to grow and requires constant effort. Trends in sustainability are changing and it is not always possible or necessary to have a 100% score in one go.
- Working with third parties, such as TU Delft but also suppliers of appliances, will help to achieve goals. This can be because the company gets more familiar with the methods but also because standardization in the industry will help Adria in the long run.

Main insights for TU Delft

- There is a discrepancy between academic methods and business practices. If the university wants companies to improve, it needs to inform them what the starting point needs to be. Things as a complete bill of materials could help companies to get the most out of one project.

Main insights for Emma

- Planning a project without all information is difficult time wise but also method wise. Asking how the materials look can help with this. This became visible with the eco-analysis.
- Although hard to implement from scratch, designing for a circular economy has a lot of benefits. It creates more profit for various businesses but it also gives the customer more value in the product.
- The caravan industry is on the one hand very modern and tries to innovate various aspects but at the same time it is not innovating on a sustainability aspect. Things as toilets, water systems, double floors and better insulation are marketed as benefits. But there is not one complete LCA present. Working in an environment such as the university, surrounded by people who think sustainability is very important, it is surprising that this mentality is not present in industries made for people to enjoy nature.

11.1 Project

11.1.1 Analysis

Eco analysis

The eco-analysis is not as complete as might be desired. This is mainly because the materials were incomplete and had to be completed by hand, from a distance. The analysis still provides answers and insights, but an analysis with more specified materials would have been better. That would have made it possible to do a more accurate calculation about the recyclability of the product, and therefore assume the participation in the circular economy on the minimal level.

Starting this project, I did not expect to perform an LCA in all possible areas. It was already clear from conversations and available (or absent) literature that little is known about the use of the caravan. Anyone can make assumptions about it, but no one has done systematic research about it (see recommendations point 12.1.1). However, the eco-analysis provides an insight into what the valuable components are.

Completing and analyzing the Bill of Materials (BOM) was a large part of my analysis phase, but it was rewarding because it has made clear which direction Adria should take. With a more complete documentation in the future, Adria could do much of the design in Excel.

The complexity of completing the BOM also shows the difference between the academic and the working world. At the university we often worked with ideal situations, a complete BOM and products from which life cycles are known or can be reasonably assumed. In this case, the BOM was not created to perform analyzes on but to use in the factory and in the office. In order to implement the academic ideas about circularity in the business world, information about what is needed from the companies should be clear.

Field research

The visits to the businesses associated with caravans and motorhomes were very helpful. In this way, information surfaced that was not yet known to Adria. Apparently many people are already unconsciously working on a circular approach to products. Many people see the caravan as an expensive luxury item that should last a long time and it is therefore logical to carry out repairs.

And they are right, because even very old caravans are worthwhile to disassemble for components. Looking at the car of the owner of the demolition company, there is still a lot of value in the caravan at end-of-life.

What could have been better during these visits was better visual documentation. Only after a visit it becomes clear what is interesting. Sometimes these elements are not properly on photo or film. The visits were also not always easy to prepare because the situation was so different than expected.

At the recycling company I asked if I could help with the demolition of a caravan. This was allowed, but I did not foresee the danger that this would entail. The people who do this work really have to keep working so there is little time to analyze their methods with them. A lot of time and sight was lost because I had to move. Of course, demolishing an old caravan provides many insights, both about what survives the ravages of time and what has value for this company, but it is not quite comparable with the models that are produced today. It would have been very useful if it had been possible to disassemble a current Adria caravan.

If anyone would like to do a visit like this I would recommend the months of September to November. According to the companies, these are the busiest months. Most users use the caravan during the summer and then return the vehicles in bulk for repair or recycling. It is likely that this also happens in other countries. It is interesting for Adria and further research to look at this (Recommendations 12.1.1)

Design

The framework and redesign are created based on the insights from the analysis. Most changes proposed are simple and straightforward. The biggest challenge is implementing the ideas in the company. The standards can be thought of with ease but need to be held for the coming years to be effective. As was visible during the last presentation, the mindset and understanding will come when there are actual numbers to discuss. Which means that there needs to be an overview per part on how many unique designs are currently

being produced and how many designs are out there. This will show the impact of standardization (Recommendations 12.2).

However, it is very difficult to repair parts that are not designed for circularity. This is reflected in the, somewhat disappointing, conclusion about repairing old trays with non-recyclable methods. Due to the amount of unique parts that have been made over the years, a one-fits-all option is difficult. If production techniques evolve in the coming years there might be new options and it would be valuable to look at those again. This could potentially be vacuum forming in place, recyclable resins or creating one use molds with ease.

Presentations

Digital presenting was an unforeseen challenge during this project. Although everybody adjusted to the situation quite well, sometimes there were moments that it would have been easier to talk face to face. What I took from the digital presentation is that the slides are more important. Visuals are easier translatable to every screen compared to text since you have no control over the screen size of other participants.

Reflecting on all presentations, I think there has been an improvement each time. Overall I found it hard to find the balance between presenting and talking about the materials. On the one hand, Bas, Erik and Vid always had a lot of suggestions and ideas that were valuable to my process, which took up a big percentage of the available time. On the other hand, if I did not present certain things, it would not be possible to talk about it.

11.2 Feedback from Adria

11.2.1 On the methods

Gaining more knowledge about how LCA and Circular economy works is needed on multiple organisational levels. This will show what is needed, e.g. documentation, to do this and why the focus points are what they are. The more people that get familiar with the methods, the easier it will be to implement changes. Questions such as, can we add 1 kg of silicone to elongate durability can be answered with numbers about the added fuel consumption. Right now these questions get answers with assumptions and green washing.

11.2.2 On the framework

The feedback on the framework was positive. This gives more direction to their sustainability wishes and what actions are needed. During the discussion ideas were brought up on how other companies are implementing these steps and what possibilities arise from it (e.g. reusing the chassis to both lower the CO2 impact and to lower the prices of refurbished caravans).

11.2.3 Redesign bathroom floor

Adria pointed out multiple reasons why there are many unique floors. This is due to changes in the chassis such as the placement of the wheels or the way the wheels are covered. Small changes or innovations in other furniture pieces, such as the toilette, also influence the shape of the tray. There also have been innovations to improve disassembly. This is visible when comparing newer to older trays seen at the recycling company and the tray from CamperService Delft. To them, there is no urgent financial gain to standardize the tray. The moulds, production technique and materials are not expensive. Compared to other components it is cheap to reproduce old trays. It is just, that to the customer, letting Adria reproduce the tray is more expensive than to use the polyurethane. Lowering the costs of reproducing a tray may not be a large financial benefit for Adria but it might be enough incentive for the customer to order a new part instead of creating a non-recyclable component.

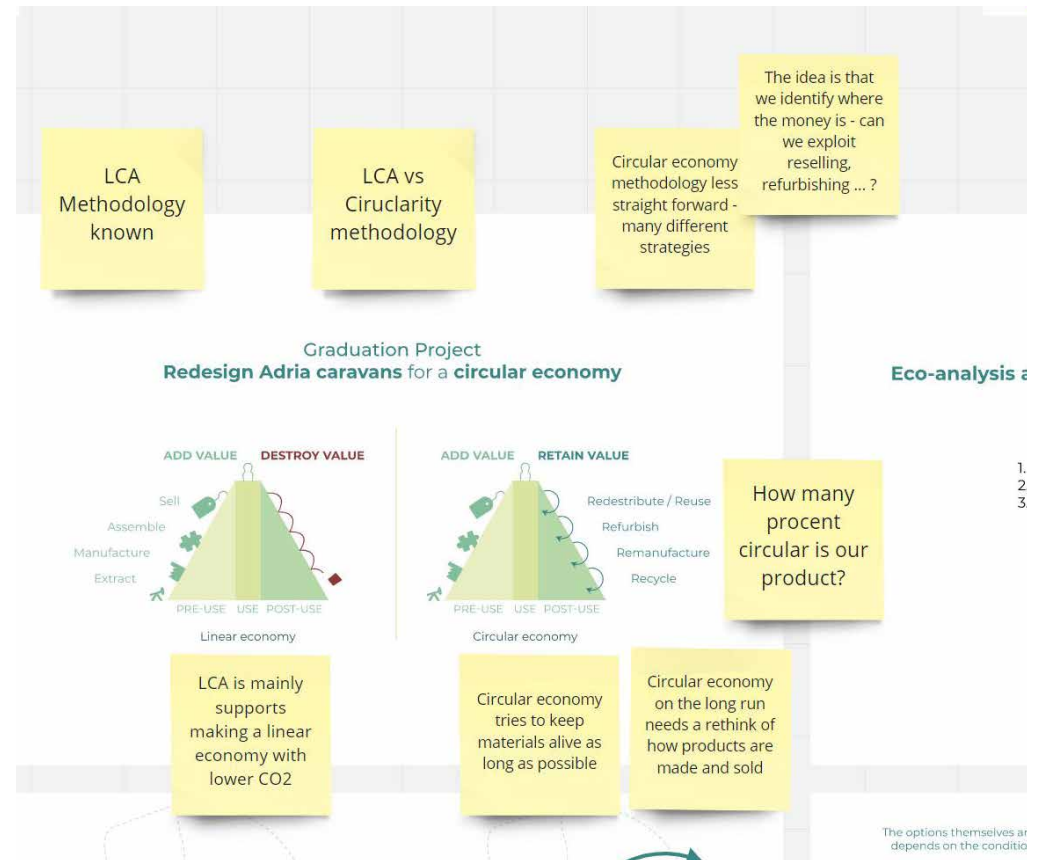
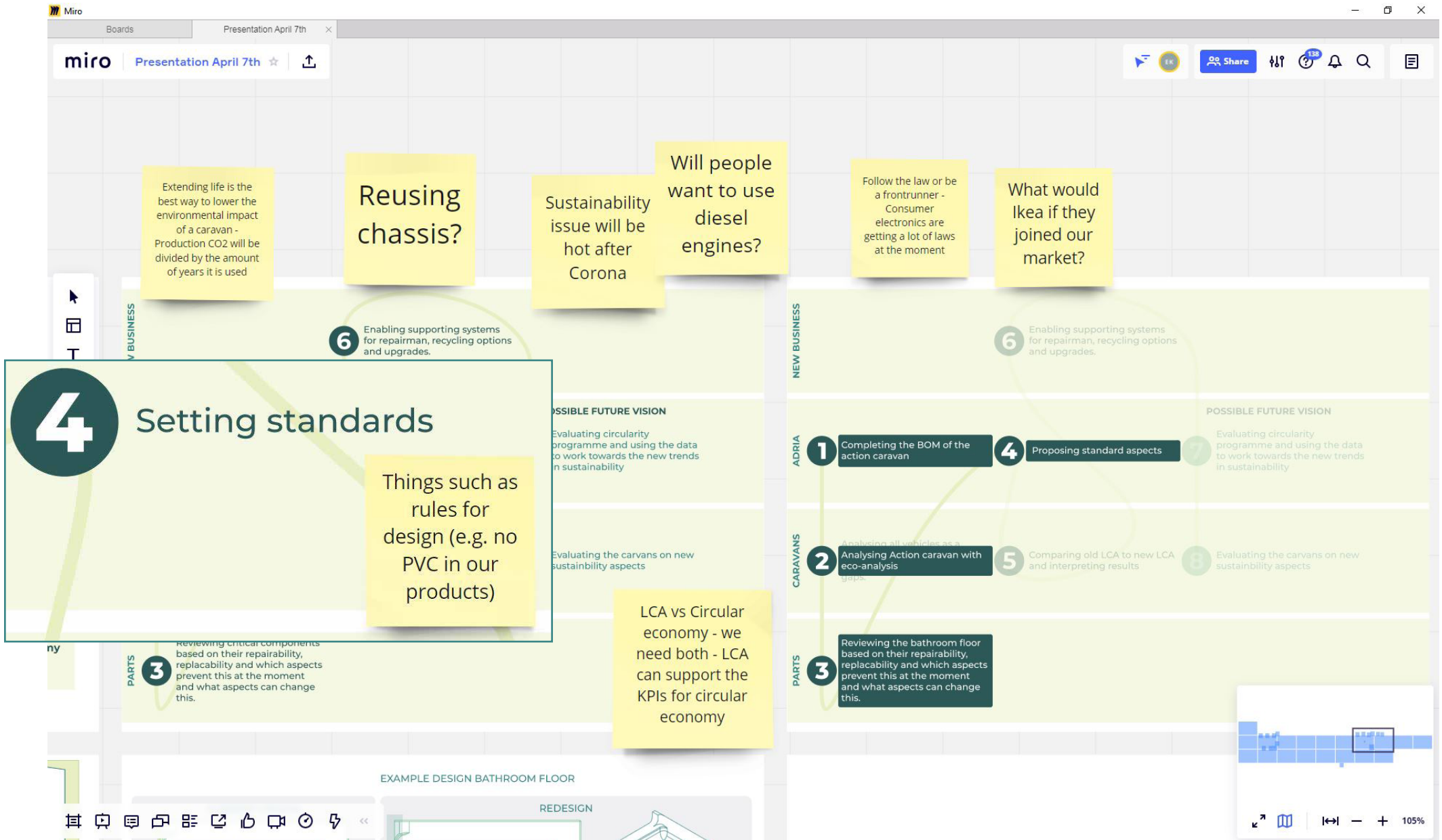


Figure 11.1 Notes on the methodology



11.3 Influence of COVID-19

The largest disadvantage of the COVID-19 lockdown was that travelling to Adria in Slovenia was not possible. Therefore, seeing the production and assembly line was not an option and all information was second-hand through Vid. It is likely that information is lost in translation. Things that are straightforward for Vid might not have ended up on the pictures. Reviewing the materials, some items might not have caught attention. However, there was no other option at this time so we made the best out of it.

For the same reason it was also not possible to disassemble a caravan. This would have been very insightful next to the eco-analysis. I would still recommend that Adria does this to analyse the reparability of the caravans.

Visits, interviews and face to face talks were also limited in The Netherlands. This means it was hard to discuss the project with experts and peers in an informal setting. During other projects in the master it was always nice to have small coffee breaks and talk to other students about their projects and your own. This sparks inspiration and makes you see other sides. There were multiple initiatives to bring graduate students together but it was not the same.

12. Recommendations

12.1 Future research

12.1.1 Complete LCA

Research about the usage of the caravans

- The amount of days that the caravan is actually used will give insights to what the materials go through. It might be that some materials are overdesigned or that some need more attention. It is interesting to know how many maintenance is being done in the lifespan of a caravan. A caravan passport with all repairs done would give insights to which parts break, which are critical and which components are not being repaired by owners.
- Implementing a tracker in all caravans can also be useful, in this way old caravans can be found and the number of kilometres travelled can be known more accurately. There might be some privacy statements surrounding this, but if the owners agree, this would be a very good way to get to know the customers and the usage.
- Fuel consumption probably is the largest contribution to the CO₂ impact. It is unclear how much it is and how the aerodynamics can help to lower this. It would be useful to conduct tests about the added fuel consumption of cars.

Recycling

- This project did the first steps in researching what happens with the caravans at end-of-life. With the recycling programs getting better every year it is valuable to keep track on how this is evolving, how Adria could participate in this and what the differences are per country.
- What are the possibilities to use valuable parts such as the chassis again. Question such as: are there safety regulations, is it possible to place new bodies on old chassis, what adjustment should we make or can this be done by someone else. Reusing Adria components can be a new business model.

12.1.2 Overall industry

Currently, this project only takes in account the perspective of one caravan company. There are however more companies like Adria. All caravan makers work together with just a few suppliers of appliances. If these companies implement a circular economy, this might give a large push to the industry as a whole. Fridges, outlets, heaters, toilets could be interchangeable between vehicles. It is not been researched yet which stakeholders have the most power to make a change and where this change should start to be most effective.

12.2 Adria

- Involve everyone to the sustainability goals Adria is setting, so everyone in the company can give their input on how to improve. This can be done by workshops specified per department. If employees know how LCA's and circular economy work it can be used in the right way.
- Follow the first 4 steps in the Framework (Chapter 7) and then decide what the company should look like in the future. Based on this outcome, other project possibilities with the TU Delft can be discussed.
- Research how many unique components are made in the past, present and how many this should be in the future. This will show the need for standardization. Taking inventory of all parts will be a lot of work but will save time in the future.

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IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name	Kolk	4491	Your master programme (only select the options that apply to you):			
initials	E.E.	given name Emma	IDE master(s):	<input checked="" type="radio"/> IPD	<input type="radio"/> Dfl	<input type="radio"/> SPD
student number	4279514		2 nd non-IDE master:	_____ (give date of approval)		
street & no.	_____		individual programme:	<input type="radio"/> Honours Programme Master		
zipcode & city	_____		honours programme:	<input type="radio"/> Medisign		
country	_____		specialisation / annotation:	<input type="radio"/> Tech. in Sustainable Design		
phone	_____			<input type="radio"/> Entrepreneurship		
email	_____					

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair	S.F.J. Flipsen	dept. / section:	SDE / CPD
** mentor	E. Tempelman	dept. / section:	SDE / MM
2 nd mentor	V. Štiglic		
organisation:	Adria Mobile		
city:	Novo Mesto	country:	Slovenia

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.

Second mentor only applies in case the assignment is hosted by an external organisation.

comments
(optional)
:
:
:

- ! Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair S.F.J. Flipsen date 13 - 10 - 2020 signature _____

Digitally signed by
Bas Flipsen
Date: 2020.10.13 11:08:22 +0200

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 30 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC

List of electives obtained before the third semester without approval of the BoE

★ YES all 1st year master courses passed
 NO missing 1st year master courses are:

name J.J. de Bruin, SPA-IO date 14 - 10 - 2020

Digitally signed by J. J. de Bruin, SPA
Date: 2020.10.14 11:14:33 +0200

J. J. de Bruin, SPA

signature _____

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess. (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: **★ APPROVED** **NOT APPROVED**

Procedure: **★ APPROVED** **NOT APPROVED**

comments _____

name Monique von Morgen date 27 - 10 - 2020 signature _____

IDE TU Delft - E&SA Department /// Graduation project brief & study overview /// 2018-01 v30

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Initials & Name E.E. Kolk 4491 Student number 4279514

Title of Project Circular redesign of the Adria Action caravan

Circular redesign of the Adria Action caravan

 project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

 start date 09 - 10 - 2020 19 - 03 - 2021 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

Adria launched the Action Caravan (Figure 1) 10 years ago to celebrate their 45th anniversary. It is a special product due to the shape, size and design. It is significantly smaller than other caravans in their portfolio and is ideal for two persons. Adria would like to re-launch this product as the Reaction, a more sustainable alternative which is currently not available in this market. The Action Caravan is ideal to use as a starting point since it is less price sensitive and attracts various target groups.

Currently there are no real sustainable movements in the caravan industry. Redesigning the Action to fit a more sustainable lifestyle would be a great marketing tool and would set Adria apart from their competition.

Figure 2 shows the life cycle of the caravan and the different stakeholders. The most important stakeholders are at the start and finish of the current chain. Adria will produce the product and thereby can initiate the change. The maintenance and demolition companies create value from discarded caravans and are in the position to find a better place than landfill. Creating a product that enables these companies to use parts for a longer period or being able to recycle the materials makes the caravan circular without the interference of Adria after production.

space available for images / figures on next page

Personal Project Brief - IDE Master Graduation

introduction (continued); space for images



image / figure 1: Look and feel of the Action caravan, pictures from the Adria Caravan Brochure 2021

Current life cycle of the Action Caravan



image / figure 2: Current life cycle of the Action caravan and Stakeholders

Stakeholders

Producers of materials and parts

- From various places
- No direct influence but states limitations

Adria Mobile

- Assemble their caravans order based
- Celebrate their anniversary
- First steps towards sustainability
- Adria has a big influence on the project and can steer the project in certain directions.

Dealers

- Dealers do not have a direct influence on the product but might be contacted during the process because they know the customers.

Users

- Desire more sustainable alternatives
- Affordable products and repairs
- Do not want to compromise the comfort
- Users will not have a lot of influence
- Indirect users (campings, roadside restaurants etc) will not be involved

Maintenance and demolition companies

- Parts from old caravans are re-used
- Important stakeholders due to knowledge
- End of the chain, these people can make the caravan circular when possibilities are given

Personal Project Brief - IDE Master Graduation

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The current Action caravan is not suitable for a circular economy. It is not easy to disassemble the caravan and reuse or replace elements. Moreover, a big part of the caravan is non recyclable due to sandwich constructions (flooring, walls and ceiling) and laminated panels (Cabinets, doors).

The caravan can become more sustainable with better material and attachment choices, creating a lighter product prepared for a circular economy.

The sandwiched and laminated panels make sure the caravan stays lightweight and affordable while adding insulation, water resistance and comfort. An example of a non recyclable material used is Styrofoam, it is lightweight and is great for insulation. Due to these non recyclable materials, End-of-Life consist of a lot of landfill instead of being recycled.

The new caravan will be assembled in Slovenia by Adria, the transportation from Slovenia to the user will not be taken in to account and due to travel limitations it will be assumed that end of life will take place in The Netherlands.

The overall style and form of the caravan should stay the same since it is recognizable and liked. The design will probably alter since there will be a change at the core of the design.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Redesign the Adria Action caravan to fit in a circular economy and have less CO2 emissions.

A redesign of the Adria Action which will fit a circular economy. The appearance and comfort level of the caravan will remain the same but the environmental impact should reduce by elongating the life span of the complete product and the ways the broken parts can be recycled. The design will be theoretically tested (LCA, simulations) and/or in a simulated environment (scale models, material testpieces).

Personal Project Brief - IDE Master Graduation

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, Stick to no more than five ambitions.

I responded to this project on IDE Graduation opportunities because it was a project with sustainability desires that seemed very genuine. Learning more about the project from Vid I experienced the project as very challenging and broad where a good outcome was possible. I like to believe that the graduation project is a project where you can choose what you like to work on, for me it is very clear I did not want a project where you are creating more plastic products. Creating products that are circular is in my opinion one of the best things to strive for since it would mean we are eliminating waste on the long run.

During the elective Sustainable Design Strategies we worked on a project using multiple strategies. I think this was very nice because you learn how the different methods are useful during the design process. Only eliminating your CO2 emission or just trying to make it circular is not the way to go, ideally you keep all factors in mind when designing. The redesign of the Action caravan is a good starting point in trying to create a sustainability movement in the caravan industry. The design cycles in this industry are very short and models stay relatively similar over the years. Other companies could follow shortly and improvements can be implemented quickly.

A large personal goal is to keep communication clear and easy, which can be a hick-up due to covid and the distance to Slovenia. I think good communication during the project can help me and keep all stakeholders involved. Clear communication is also how I present my work and explain my decisions during the design process. Feedback is easier given when everybody understands the project and the direction it is going in.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

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Initials & Name E.E. Kolk 4491 4279514 Student number

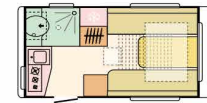
Title of Project Circular redesign of the Adria Action caravan



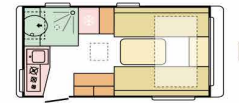
Figure B.1 Action in the Adria Brochure 2021

ACTION

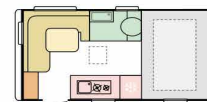
361 LH 
 L 4010 (mm) |
 W 2196 (mm) | 3



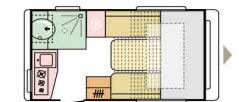
391 LH 
 L 4310 (mm) |
 W 2196 (mm) | 3



391 PD 
 L 4460 (mm) |
 W 2196 (mm) | 2



391 PH 
 L 4310 (mm) |
 W 2196 (mm) | 4



Appendix B - Adria Action

“The Action, the original iconic, light-weight and stylish caravan for active holidays, in three sporty colours. A caravan which always puts a smile on your face and delivers on space, features and comfort. Contemporary interior with smart kitchen, ergo bathroom and comfortable sleeping.”

B.1 Key features

- Iconic exterior shape with sporty graphics.
- GFK polyester body with a choice of colour body mouldings.
- Externally accessible garage storage.
- Panoramic window on all layouts.
- AL-KO chassis and AKS stabiliser coupling.
- Flexible living spaces with elegant interiors.
- Comfortable sleeping accommodation.
- Truma heating with optional electrical floor heating.
- Adria Smart kitchen with 3 burners and best appliances.
- Adria Ergo bathroom with toilet, shower and foldaway sink.
- Controllable lighting for different ambiance.
- Multiple USB ports.
- Loudspeakers with Bluetooth® amplifier.
- Integrated garage solution.

B.2 Compared to other Adria products

This is a bit of an outlier within the Adria portfolio concerning the outside appearance. The interior is more alike other Adria caravans. It is one of the cheapest caravans starting around 18.000 Euros. Competitive caravans from other brands can be found in the Appendix C: Market analysis.

Production and materials can be found in the confidential additional report.

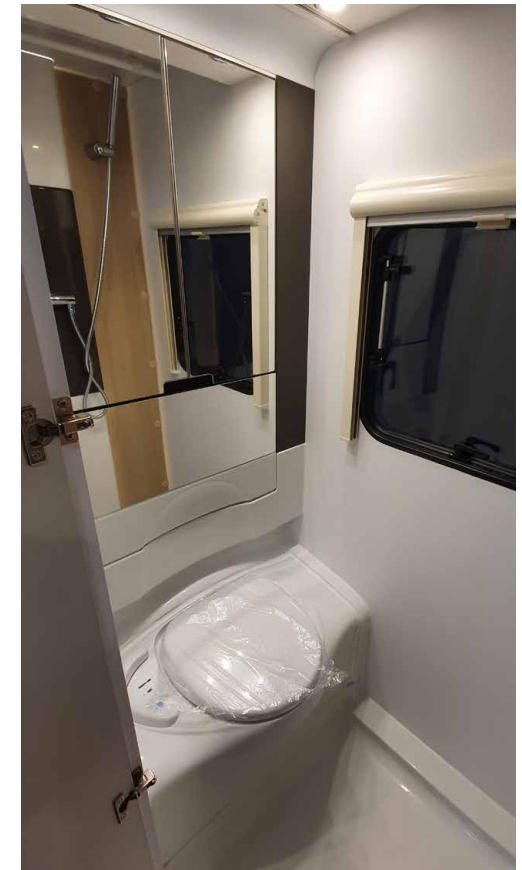


Figure B.2 Interior of Action caravan

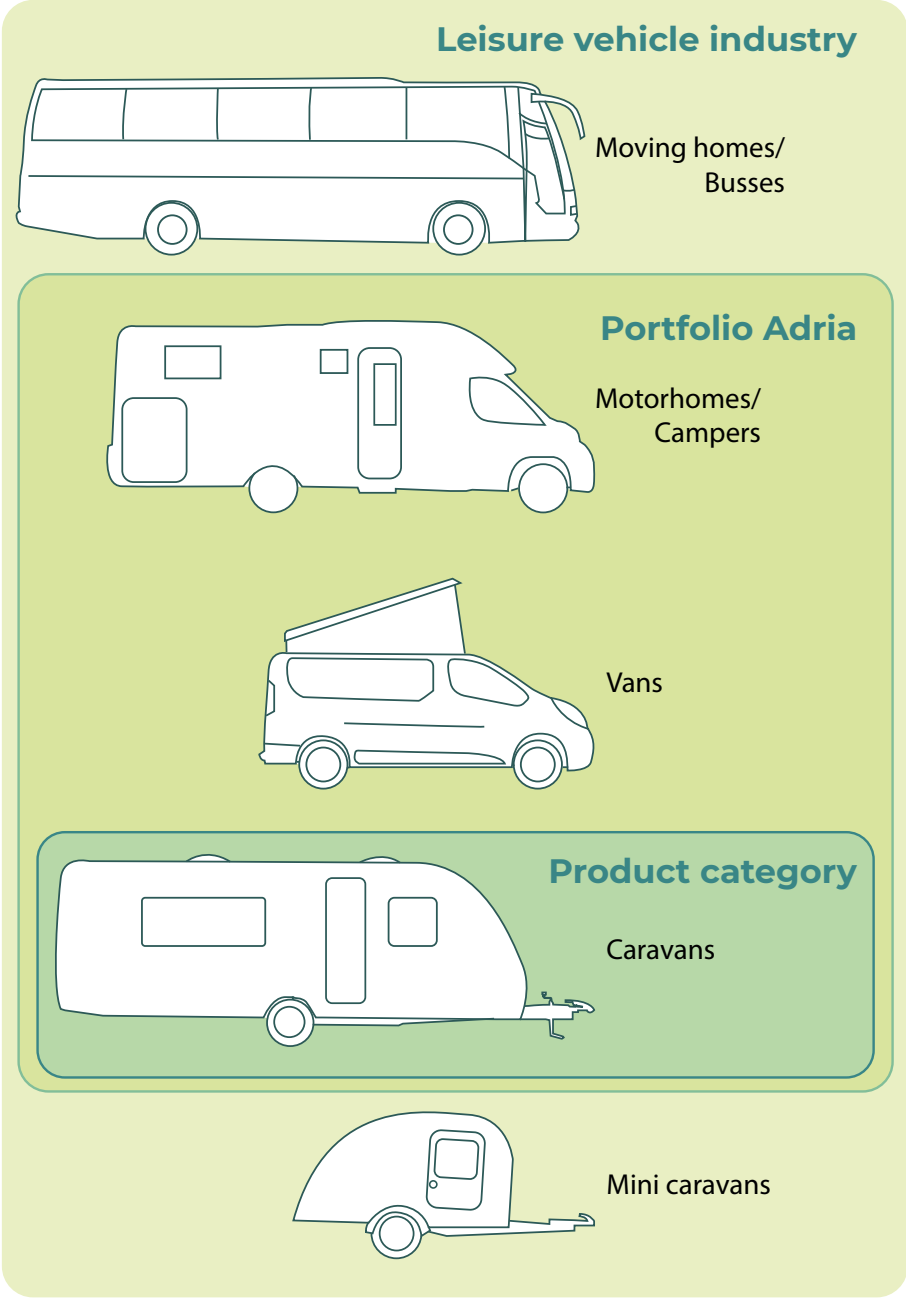


Figure C.1 Products in leisure market. Adria (2020)

Appendix C - Market Analysis

This appendix looks at the functioning of the caravan industry as a whole, comparing brands and comparing similar products to the Adria Action.

C.1 Products

The complete industry consist of multiple leisure vehicles from complete busses to mini caravans. Adria produces Motorhomes, vans and caravans. The focus point is on the caravan category. Within this category the Adria Action is a small caravan, only suitable for two people close to the mini caravan range.

C.2 Design cycle

The classic caravan brands improve all of their models each year and show them on international fairs (e.g. Caravan Salon Düsseldorf) and produce ordered models once ordered. Some dealers buy a few to show and sell on the spot at their showroom but otherwise customer has to wait up to a year on their caravan. Each brand has 4 to 18 models which overall can be customized with a chosen layout and material choice. This creates a very diverse product range. Smaller brands, who mainly produce mini caravans which are lighter than 750 kg have less models and overall are new in this industry. They are flexible enough to make custom caravans.

The bigger caravan brands produce caravans that look very similar, a white boxy look. The difference is on the inside. Customers base a large part on their preferences about furniture. Some brands claim to focus on the German or French market and therefore make certain design choices. Adria is focussed on the whole of Europe.

Caravan brands



Example products



Key take aways

- Three big groups of caravan producers: Knaus Tabbert, Trigano and the Erwin Hymer Group.
- Big industry with large companies
- Large range in price and quality
- Most caravans look similar, white, practical and bulky.
- No sustainability focus.
- 4 to 18 models per brand with material and layout options.

Mini caravan brands



Example products



Key take aways

- Lot of custom design possibilities but less equipment.
- Aimed at younger people
- Smaller companies
- USA companies aim at off-road activities
- European companies make them fitted for lighter (electric) cars.

Main differences between caravan and mini caravan brands

Weight	Equipment	Weather resistance	Target group
The total weight of the minicarvan is lower than 750 kg. For normal caravans a E-lincence is required.	Bigger caravans have a kitchen and a bathroom. Some batteries make sure the user can go off grid for longer than one night.	The insulation makes some caravans useable during all seasons. Heating and air-condition are also available as options in bigger caravans.	The classic caravans are mostly aimed at older couples who can afford them and the smaller caravans are targeted at younger sportive people.

Figure C.2 Caravanbrands

C.3 Competitive brands

Adria is part of the biggest European Caravan producer group. There are various caravan brands similar to Adria located in Europe, this is an overview of all brands researched and a small description.

Caravan brands

Adria	Based in Slovenia, they fall under the trigano group and mainly create standard caravans in the luxury segment.
Beauer	French company who make caravans that expand
Buccaneer	UK Company with luxurious larger caravans.
Bürostner	German company with two 'classic' caravan models. Relatively affordable.
Caravalair	French brand with 'classic' white caravans.
Compass	UK company with luxurious motorhomes, campervans and caravans.
Dethleffs	German company. Caravans starting from 13.790 euros and 1100 kg.
Elddis	UK company with caravans, campervans and motorhomes. Larger caravans.
Eriba	German company with caravans. Present themselves as a cult caravan. Looks like steel looking caravans, distinct design language. They also have 'classic' white caravans.
Fendt	German company with caravans. White Classic Caravans, multiple models.
Hobby	German company with caravans, motorhomes and vans. Large amount of different models. 12.000 caravans and 2.000 motorhomes per year. Seems like Fendt is a part of hobby.
Kabe	Swedish company with caravans and motorhomes. White classic caravans.
Kip	Dutch company with lightweight caravans.
Knaus	German based and a part of Knaus Tabbert, big range of caravans similar to Adria.
Knaus Tabbert	Germany. Biggest competitive group to Trigano. In 2019 Knaus Tabbert had a revenue of 780,4 million Euros, produced 26.000 leisure vehicles and has 3.000 employees (Kampeer Zaken, 2020).
La Mancellle	French brand with larger caravans.
LMC	German company with caravans and motorhomes. Classic white large caravans.
Lunar Caravans	UK based brand who target older couples
Polar	Swedish company with winter proof caravans. Expensive products but ready for all weather types.

Sprite	UK company, a rebranding of swift for the European market. Larger and smaller 'classic' caravans. Affordable.
Sterckeman	French manufacturer with 'classic' white caravans. Produces 10.000 products a year and has 600 employees
Sterling	UK company with sporty looking white caravans. Sterling caravans are a part of the swift group.
Swift	A British brand that is only being used in the UK market.
T@B	German based. T@B is a brand with only smaller sized caravans and apparently is a cult classic with its own comic character.
Trigano	A group of various caravan brands
Weinsberg	German company with the first only completely electrical caravan. Overall very classic design. Interesting is the CaraCito which is completely electric.
Xplore	UK company with caravans. Targeted at caravan beginners White boxy caravans but complete and not very expensive. In longer and shorter versions.

Tabel B.1 Caravanbrands

Mini caravan brands

Barefoot	UK based with one model with retro look
Basoglu	Based in Turkey, make a line of caravans called Caretta. Looks oldschool.
Carox	a Czech company specialized in mini caravans (<750 kg). They offer three models.
Colorado Teardrop Camper	from USA. multiple models suited for USA landscape and off road. Custom build.
Fim Caravans	a Romanian-Bucharest based company, they have two models.
Kulba	Latvian company, two models.
Lifestyle Camper	Ukraine company with mini caravans. They have two models that can be adjusted per client.
Mini freestyle camper	Part of Trigano
Polydrops	futuristic design mini caravan
Pro Camp	Company from Slovak, four models, outdoors, rough terrain and targeted at surfers.
Safari Condo	Canada. Multiple models, looks more like an old fashioned company.
Timberleaf	three models suitable for offroad based in the USA
Tinycamper	minicamper from UK, retro looking

Tabel C.2 Mini caravanbrands



Lunar Ariva



Sterckeman Easy 350CP



Sprite Basecamp



T@B 400 Basic



Knaus Deseo



La Mancelle Liberty



Adria Action



Beauer 2x



Kip Shelter



Caretta Junior



Carox Mini K Family



Barefoot



Fim Caravans



Mini Freestyle 270



Kulba Teardrop Woody



Lifestyle Camper Steeldrop

Figure C.3 Competitive models

C.4 Competitive models

Brand and Name	Price [€]	Weight empty [kg]	Max. weight.	Length [cm]	Width [cm]	Number of beds	Shower
Adria Action 361 LH	18.595	860 kg	1.100 kg	401	220	2	Yes
Barefoot	30.000	960	1200	508	192	2	Yes
Basoglu Caretta Junior		640	1000	421	205	2	No
Beauer 2x	37.330	800	1350	350	195	2	Yes
Knaus Deseo	24.470	1250	1500	599	230	2	Yes
Knaus Sport and Fun	18.980	1047	1300	625	232	4	Yes
La Mancelle Liberty	23.415	1057	1325	581	225	4	Yes
Lunar Ariva	24.000	861	1000	517	204	2	Yes
Sprite Basecamp	23.295	895	1150	510	228	2	Yes
Sterckeman Easy 350CP	14.000	720	900	520	210	2	Yes
T@B 400 Basic	22.883	910	1500	597	225	3	No
Carox Mini K Family	13.000	500-660	750	400	200	2	No
Fim Caravans	12.000	450	750	425	212	2	No
Kip Shelter	18.100	560	715	453	183	2	No
Kulba Teardrop Woody	13.000	450-600	750	381	189	2	No
Lifestyle Camper Steeldrop	15.000	500	750	350	195	2	No
Mini Freestyle 270	17.000	613	750	442	195	2	No

Tabel C.3 Competitive caravans

The compared products are similar when looking at the caravan industry as a whole but these caravans are smaller or targeted at a specific audience. When comparing all individually to the Adria Action, they are very different both in price, weight and target group.

Appendix D - Interview adhesives expert Richard Oosting

Interview Richard Oosting

Richard Oosting is an expert in additives in the BTR market. He helped develop multiple solutions. Since he worked with Polyplastic, a company that makes windows for caravans and other leisure vehicles (Polyplastic, 2020). They have 90% of the market share and therefore when one day their additive supplier could not deliver they called Richard to help them. Richard also owns a caravan and knows how hard it is to get some parts replaced.

D.1 Sealing materials, used to create waterproof connections

Overall easy to remove.

Butyl Rubber

- Is dry and therefore usable visible seems
- Is non recyclable

Butyl rubber is a elastomeric polymer used widely in adhesives and sealants. This material has relatively low strength and exhibit creep under load. It is usually applied from a solvent-based solution (Ebnesajjad, 2011).

PIB (Polyisobutylene)

- Very plastic, a gum like texture and does not harden
- Still removable after 10 years
- Only usable in connections and needs external pressure
- Sticks to most materials
- Can be removed by creating a ball of the material and picking up rest PIB
- Easy to separate from other materials
- Used in a very wide range of products: chewing gum, tires, skincare, explosives.
- Is recyclable since it does not attach to other materials

Butyl and PIB combined

Is available in strips that do not include solvents. It is not always a useful solutions since the strips do not have a filling ability and there are various shapes in a caravan. The tension tolerance is okay but is better with the liquid materials. The vapour density is low.

D.2 Adhesives

Mainly used in the sandwich constructions of wood, polyester and foam.

1. Foam adhesive
2. 1 component polyurethane + atomized moisture
3. Hot melds

They use more and more glue in this industry because it adds in strength and stiffness. Making the profiles and corners more stiff. Weight is also a big factor in decision making. When attaching the furniture to the outside, the whole gets stiffer and can handle certain impacts better.

Polyurethane SNP has a broad adhesion spectrum and is better for the environment. Since you apply multiple millimetres of the adhesive it is easier to separate. This is only when there is room for equipment.

The chassis and the flooring are connected through a more elastic glue. There is a big difference between self-supporting or not. The PVC flooring is mostly connected through a contact glue but they started using tape as well. There is a lot of glue in the caravan since there is a lot laminated wood and plywood.

Polyvinyl acetate

Polyvinyl acetate latex is the basis for the common household 'white glue'. Products of this type are good adhesives for paper, plastics, metal foil, leather and cloth (Ebnesajjad, 2011).

Cyanoacrylate

Cyanoacrylate adhesives are familiar as 'super glue'. They are single part systems that cure in seconds when exposed to damp air. Most surfaces can be bonded, the bonds are strong but somewhat brittle (Granta EduPack, 2020). ERGO 5300 can be used with all kinds of

elastomers (Viba, 2020).

Polyurethane

Polyurethane adhesives have great flexibility and good peeling resistance. Load bearing ability is limited but excellent impact and moisture resistance (Granta EduPack, 2020). Rakoll Icema R 145/31 adheres very well to pre-treated steel plates, anodised aluminium, but also to thermosetting plastics, DKS, PS, GF polyester, hard PVC, ABS, wood-like materials and cement-bound building materials. When using, external moisture is needed (Ostermann, 2020). Poor resistance to moisture before and after cure (Ebnesajjad, 2011).

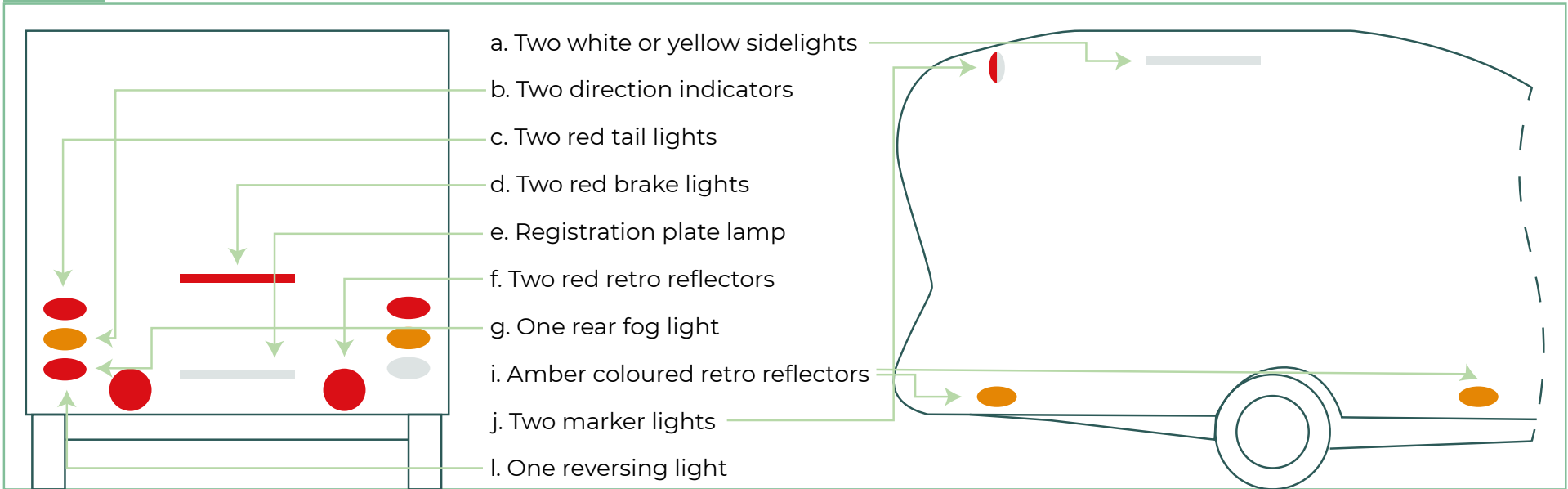
D.3 Health issues

The 'new car smell' is you smelling certain kinds of solvents. Those are not dangerous to your health since it is in very low quantities. There is a bigger issue with those solvents when in the sun, and the temperature exceeds 70 degrees when softeners can melt. In case of fire there can be health risks though.

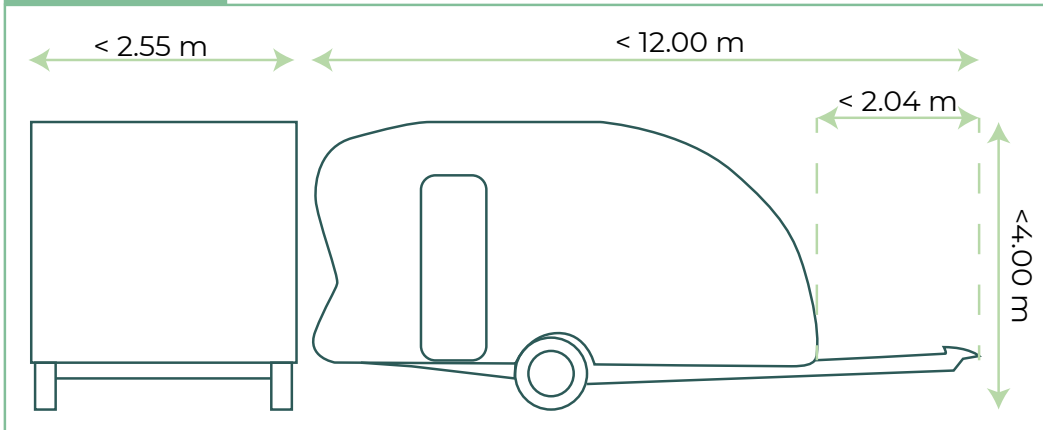
D.4 Tips from Richard

- Give access for tools to glued connections
- Every hole is an access point for moisture
- Look at patents
- The caravan industry is conservative since they cannot handle mistakes. In case of a mistake where the caravan starts leaking they need to retrieve all caravans back which is a logistic challenge as well as a price operation.
- Ethyl acetate is a friendly product but smells really bad
- Adding propanol butyl acetate makes the product smell like candy.
- There is a limited amount of producers and therefore a limited amount of options.

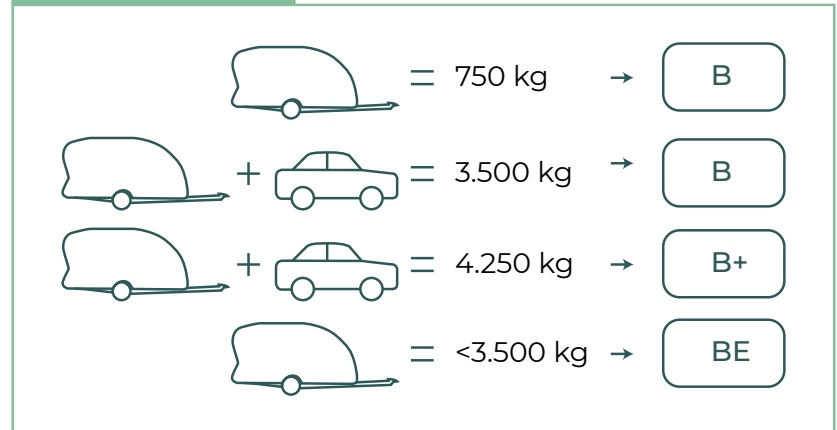
Lights



Dimensions



Required licence



Vehicle registration card

- The number on the numberplate and the vehicle identification number must match the vehicle registration card. The number plate must be legible and the number plate must not be shielded.
- The vehicle identification number must be stamped into the chassis, frame or similar structure and must be clearly legible.

Other remarks

- All attachments, the upper structure to the bottom, batteries, electrical wiring, lights, wheels etc, need to be *proper*.
- The tires on one axle must have the same size.

Figure E.1 Requirements from the RDW

Appendix E - Requirements by the RDW

This appendix contains all regulations made by the RDW (‘Rijksdienst voor het Wegverkeer’/Department of Road Transport)

E.1 Regulations for trailers in The Netherlands by the RDW

The RDW is a public service provider in the mobility chain and responsible for admission of vehicles and their parts, surveillance and enforcement, registration, provision of information and document issue (RDW, 2020). They have a inspection manual for trailers in the Netherlands from which all statements are taken. ‘A trailer of vehicle category O with a maximum authorized mass of more than 750 kg must meet the requirements of this section and be assessed according to the corresponding method of inspection, with additional permanent requirements applicable where appropriate. Artikel 5.12.0’ (RDW, 2020).

Article 5.12.1: Compliance of the vehicle with the vehicle data as well as identification requirements. (RDW, 2020)

4. The number plate must be legible and the number plate must not be shielded.
5. The vehicle identification number must be stamped into the chassis, frame or similar structure and must be clearly legible.

Article 5.12.4 Upper structure (RDW, 2020)

1. The upper structure needs to be attached properly to the chassis.
 2. The support of the loading floor or loading space must be sound.
- Note: there is no further definition of proper (Dutch: deugdelijk)

Article 5.12.5 Battery and trailer wiring (RDW, 2020)

1. The battery of trailers, if present, must be properly attached.
2. Trailer electrical wiring must be properly secured and well insulated.

Note: there is no further definition of proper (Dutch: deugdelijk) or well (Dutch: goed)

Article 5.12.6 Dimensions (RDW, 2020)

1. Trailers other than semi-trailers may not be longer than 12.00 m.
3. For trailers entering service after December 31, 1997, the

horizontally measured distance between the center of the coupling pin and any part at the front of the trailer must not exceed 2.04 m and the horizontally measured distance between the center of the coupling pin and the rear of the semi-trailer do not exceed 12.00 m.

6. Trailers may not be wider than 2.55 m
8. Trailers may not be higher than 4.00 m.

Article 5.12.7 Masses (RDW, 2020)

2. The total mass of trailers must not exceed the maximum permitted mass stated for the vehicle concerned in the vehicle registration register or on the vehicle registration card or the vehicle registration certificate.

Article 5.12.27 Wheels (RDW, 2020)

9. The tires on one axle must have the same size designation.

Article 5.12.28 Suspension system (RDW, 2020)

1. Trailers must be equipped with a properly functioning suspension system. Tires are not considered part of the suspension system.

Article 5.12.41 Doors, loading doors (RDW, 2020)

The lock and hinges of the doors and cargo bed flaps of trailers must ensure proper closure.

Note: there is no further definition of proper (Dutch: goed)

Article 5.12.51 Mandatory lights and retro reflectors (RDW, 2020)

Trailers must be equipped with:

- a. Two sidelights if the vehicle is wider than 1.60 m and was taken into use after June 30, 1967;
- b. Two direction indicators at the rear of the vehicle;
- c. Two taillights;
- d. Two brake lights;
- e. Rear registration plate lamp;
- f. Two red retro reflectors at the rear of the vehicle;
- g. One rear fog light if the vehicle was taken into use after December 31, 1997; the rear fog lamp must be located in or to the left of the median longitudinal plane of the vehicle;
- h. Two white retro-reflectors at the front of the vehicle, if the vehicle was used after December 31, 1997;

- i. Amber coloured retro reflectors on each side of the vehicle, the rear retro reflector on the side may be red.
- j. Two marker lights visible at the front and two visible at the rear of the vehicle, if the vehicle was taken into service after December 31, 1997 and is wider than 2.10 m, or was taken into use before January 1, 1998 and wider than 2.60 m;
- k. Side marker lights if the vehicle was taken into use after December 31, 1997 and is longer than 6.00 m.
- l. One reversing light if the vehicle was taken into use after December 31, 2012.

Article 5.12.53 Colour mandatory lights (RDW, 2020)

- 1. The sidelights and reversing lights must not emit anything other than white or yellow.
- 2. The direction indicators and the brake lights must emit no other than red or amber yellow.
- 3. The rear lights and the rear fog lights must not emit anything other than red.
- 4. The rear registration plate lamp must not emit anything other than white and must not emit light to the rear.
- 5. The marker lights must not emit anything other than white to the front and not to radiate other than red to the rear.
- 6. The side-marker lamps shall emit no other than amber yellow, with the exception of the rearmost side-marker lamp, which may emit amber or red.

Article 5.12.61 Placement of lights and retro reflectors (RDW, 2020)

- 1. For trailers taken into use after December 31, 1967, the lighting, light signals and retro-reflecting devices referred to in Articles 5.12.51 and 5.12.57 must be installed at a distance of not more than 0.50 m from the point of greatest width of the vehicle. The first sentence only applies to direction indicators if the trailer was taken into use after December 31, 1997.
- 2. Notwithstanding the provisions of the first paragraph, the sidelights must be installed at a distance of no more than 0.25 m from the point of the greatest width of the vehicle.
- 3. The provisions of the first paragraph do not apply to the reversing lights, brake lights, rear registration plate lighting, the marking at the rear of the vehicle, rear fog lights and work lights.

Article 5.12.65 Prohibition of lights other than mandatory or permitted (RDW, 2020)

- 1. Trailers may not be equipped with: more lights and retro-reflecting devices than prescribed or permitted in Articles 5.12.51, 5.12.57 and 5.12.57a, and lights or objects in the vehicle that radiate light to the outside of the vehicle.

Appendix F - Complete list of requirements

This list contains all requirements derived from the different analysis methods for the caravan that would be circular.

Dimensions

- Caravan should stay below the 1.100 kg limit
- The caravan must meet all legal requirements considering lights, weight, measurements, etc.

Equipment

- The caravan should have a kitchen, two beds, a bathroom with a toilet, sink, and shower
- The caravan should have a freshwater tank
- The caravan should have electrical outlets
- The caravan should be able to be locked
- The caravan should be able to be entered by adults, children, and dogs
- The caravan should have storage facilities

Operational environment

- The caravan should be able to withstand a wide range of temperatures
- The caravan should be able to withstand UV light
- The insulation and heating should be good enough to make the caravan usable throughout the year
- The caravan should be able to withstand vibrations during transport
- The caravan should be able to withstand normal measures of rain and moist surroundings
- The caravan should be optimized for south European countries
- The caravan must be able to stand still for long periods without drying out or experiencing damage

Lifespan

- The caravan should last at least 30 years with yearly maintenance and used approximately 8 weeks per year

Maintenance

- All components should be repairable in a way
- Critical components, appliances, windows, bathroom elements,

should be easily accessible within 6 steps.

- Replacing components with a shorter expected lifespan than the total caravan, such as appliances, should be possible without damaging other elements.
- Rubbers and sealing should be able to be repaired, added or maintained without damaging the components.

Materials

- All materials should be optimized for a circular economy and therefore need to be recyclable or compostable
- The materials should not be harmful for the environment during the lifespan of the product
- The materials should not be harmful for the user during the use of the caravan

Assembly and disassembly

- The caravan will be assembled in the Adria factory in Slovenia
- It must be able to disassemble the products and subassemblies without extensive knowledge
- The caravan will be dismantled by regular workers of recycle companies

Ergonomics

- The caravan should be usable by adults

Form, colour and finishing

- The caravan should resemble the Action caravan 2021.

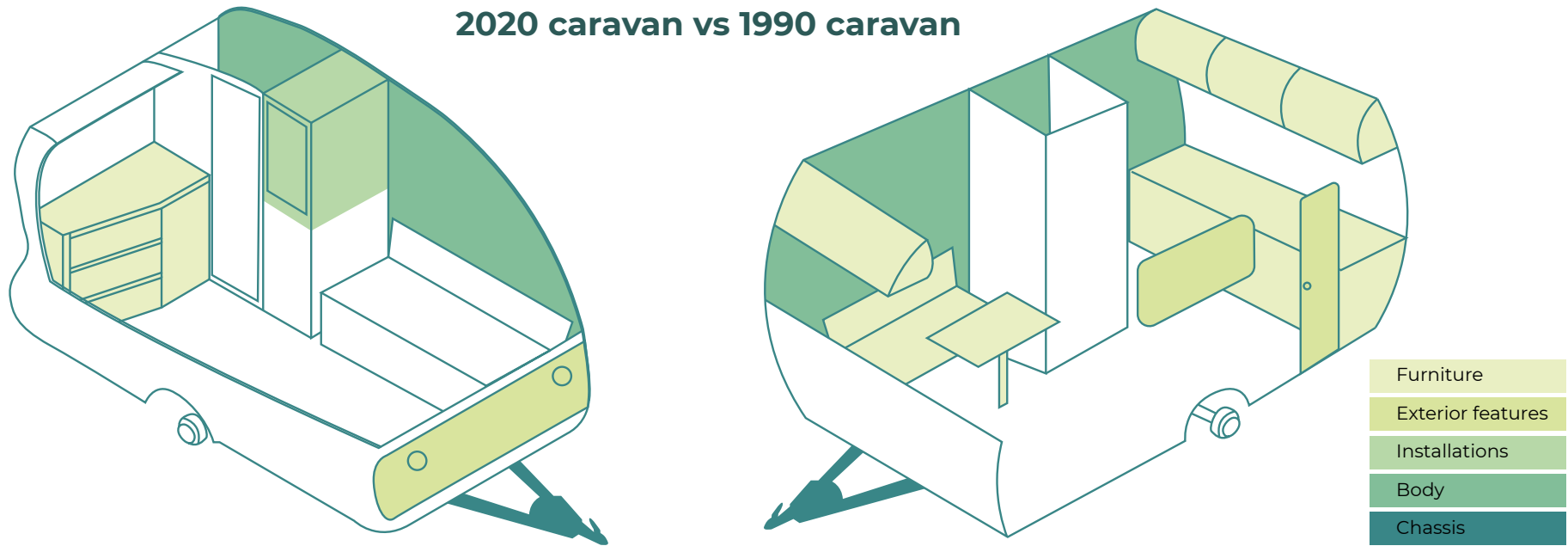
Safety

- The product should not have any loose parts
- The product should be safe in traffic
- All aspects proposed by the RDW must be correct in terms of safety and must be easy to rectify

Marketing

- The caravan should be marketed as a more sustainable alternative
- The caravan should fill a spot in the leisure vehicle market for more environmental aware consumers

2020 caravan vs 1990 caravan



	2020	1990
Attachement furniture and functional elements:	Screws	Nails
Insulation:	XPS	EPS
Furniture panelling:	Laminated plywood	Laminated plywood
Heating:	All around the walls	Isolated heatsource, little distribution throughout the caravan
Equipment:	Fridge, oven, cooker, speakers, multiple electrical sockets and USB chargers, warm water	Cooker, heater, fridge, one place for electrical sockets, warm water
Chassis:	Alko	Alko
Body:	XPS, Wood, Alu sheets glued together	EPs, wood, Alu sheets held together by rubbers

Figure G.1 Comparing a 2020 caravan to a 1990 caravan

Appendix G - Recycling Adria Action

This chapter analyzes how the Adria Action 2020 would be recycled through the current standards.

G.1 Comparing 2020 caravan to the average 1990 caravan

Understanding the way a current caravan would be recycled at this moment, it is needed to compare the two caravans with each other. In essence the caravan has not changed, it is still a body with furniture inside.

Attachment methods

Almost everything in older caravans is nailed or glued to the body from the outside in. It is likely the caravan was made from the inside out and the body was nailed to the furniture to gain stiffness. With the new caravans there are plastic inserts made to screw through enabling future workers to loosen them.

Insulation

Both caravans are insulated with polystyrene. Most older caravans have EPS; Expanded polystyrene (WW-Trading, 2020). Adria currently uses XPS: extruded polystyrene (Adria, 2020). XPS is generally denser, has a high stiffness, reduced thermal conductivity and high water vapour diffusion resistance (Granta EduPack, 2020). Thereby a more suitable choice.

Furniture panelling

This was laminated plywood in 1990s as well. This is also the main waste material from caravans.

Heating

Truma is the main supplier in heaters for years (WW-Trading, 2020), and is still used by Adria (Adria, 2020). The way of heating has evolved from a isolated location to a tough tout distribution system. Equipment: Electrical components such as charging stations and speakers are more and more available and present in newer models compared to 1990. By adding more equipment the caravan is also heavier.

Chassis

Is not changed, the same supplier is used.

Body

The biggest changes are the Styrofoam choice and how well the materials are joined together. The walls in the 2020 are a solid piece where materials are joined together with glue making it harder to separate the different materials in the end, but also protects the construction wood from water.

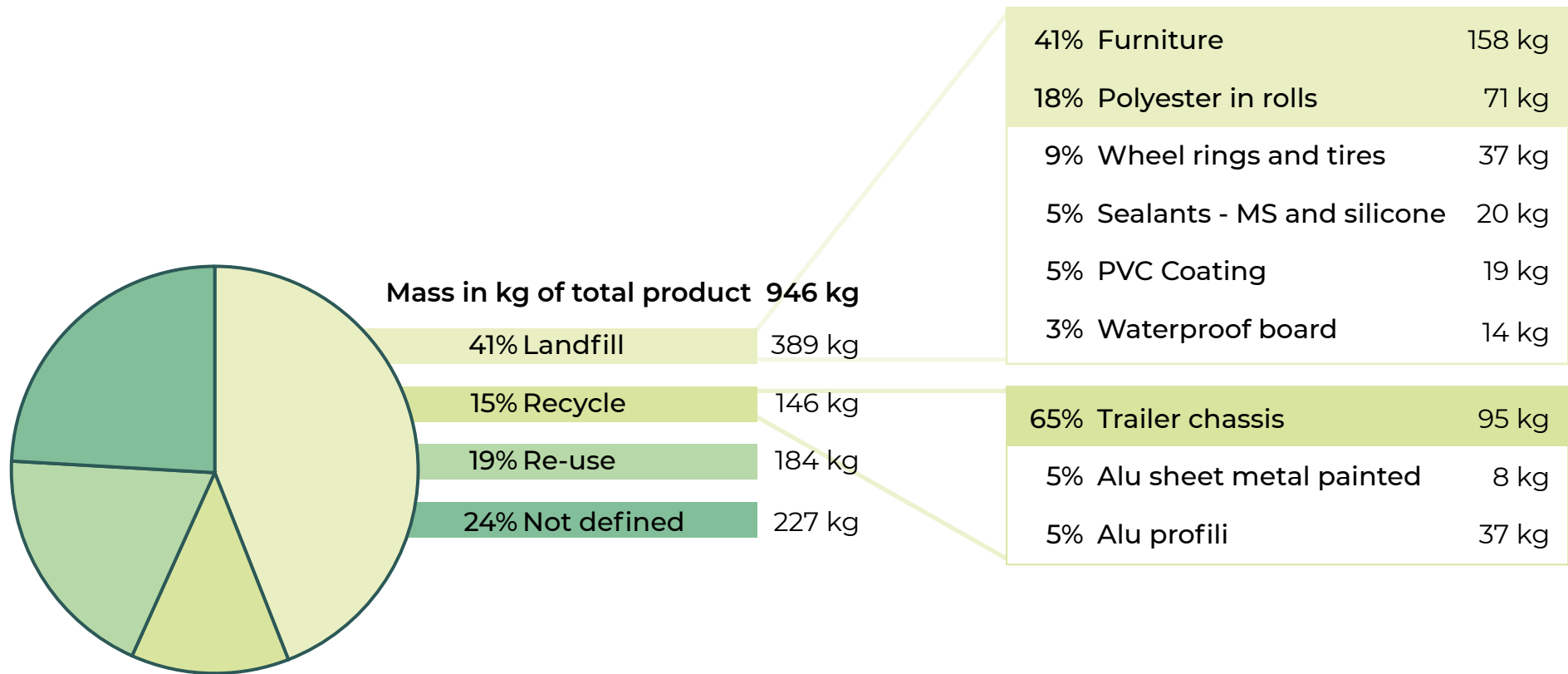


Figure G.2 Overview initial end-of-life methods

G.2 Applying current recycling methods to the 2020 Adria Action

To find the most critical areas for improvement, all elements of the Bill of materials of the Action are categorized according to current ways of recycling. See Appendix C.A for the complete overview of the list.

Assumptions

- All reused items are not accounted in recycle or landfill in this diagram
- The cabinets cannot be reused
- The cabinets are made of a similar laminated plywood
- The worker does not take the time to unscrew hinges, handles and brackets
- All materials the worker wants to save, can be saved
- All items that normally are re-used are clean, complete and up to date
- All items that would be recycled are easy to separate

Conclusion:

To lower the mass going to landfill we should reduce the amount of non recyclable furniture.

Furniture

Re-usable or recyclable	Landfill
Cushions Sinks	All furniture made of laminated plywood e.g. cabinets, seats, beds, doors, shelves

Exterior features

Re-usable or recyclable	Landfill
Windows Doors Lights Hinges	Decorative plating Broken elements Rubbers

Installations

Re-usable or recyclable	Landfill
Heaters Cookers	Heating tubes, broken electronics

Body

Re-usable or recyclable	Landfill
	The body

Chassis

Re-usable or recyclable	Landfill
The chassis	The tires

Figure G.3 Summary of the current recycling method

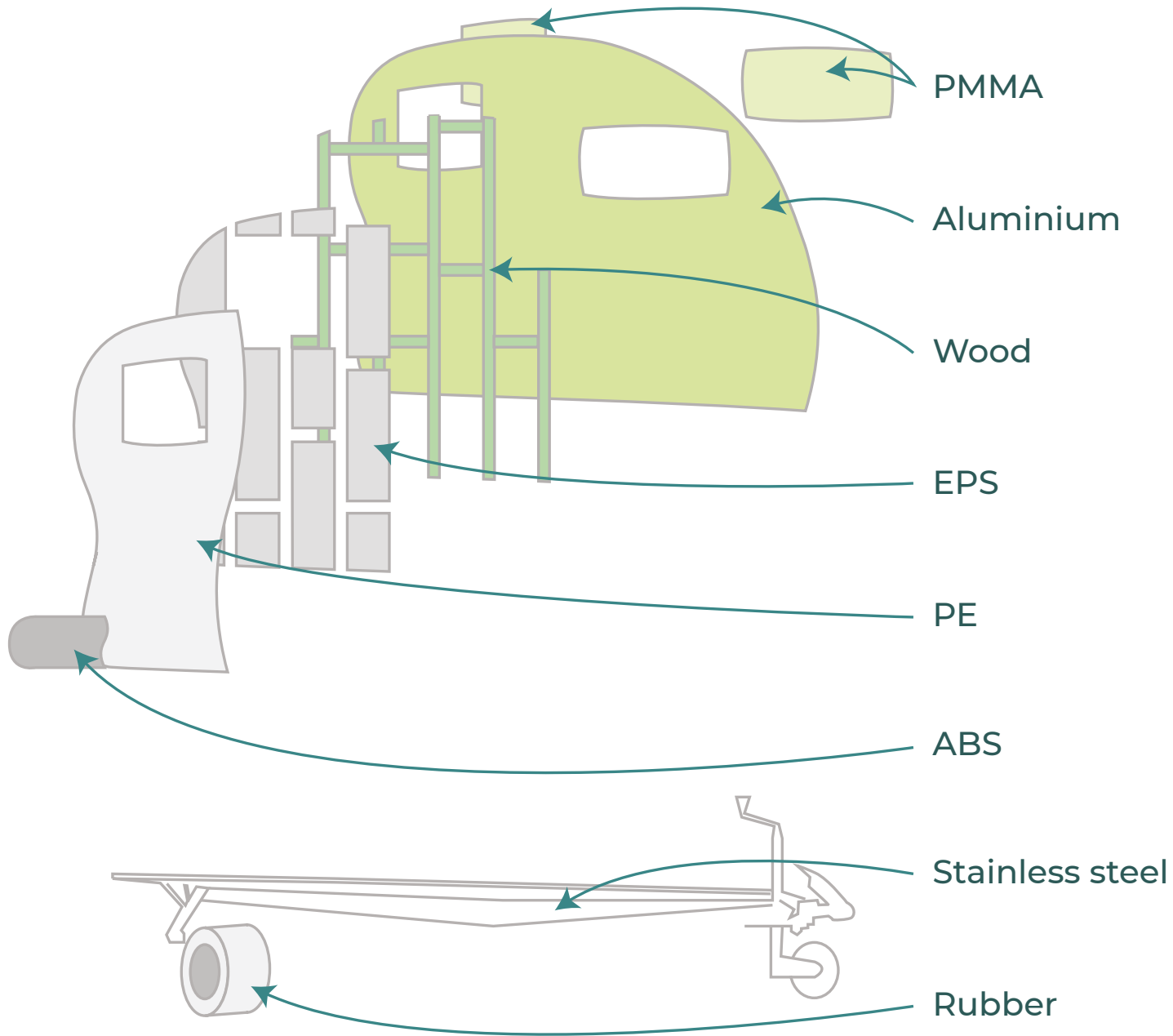


Figure H.1 Body materials

Appendix H - Alternative materials

Overall requirements for new materials

- Recyclable or compostable
- Does not increase the weight of the caravan (too much)
- Does not increase the price of the caravan (too much)
- Service temperatures from -15 to 80 °C
- Should be able to handle some amount of water

H.1 Body

The complete body is responsible for a large part of the CO₂ impact. Therefore it is desired to keep the body in use as long as possible and recycle at end-of-life.

Most of the materials used in the sandwich construction for the walls are recyclable, as long as all plastics are not mixed with other additives or other plastics. What makes recycling difficult is that all parts are glued together, making separation difficult or not completely possible.

Windows

The main function is to be able to look in- and outside and to enable more fresh air in while protecting from outside influences.

- PMMA, is recyclable
- The windows are being reused but not separated for recycling.
- An alternative could be PC, but this has a higher CO₂ /kg (8.11) than PMMA (7.32).

Outer layer

The main function is to keep all construction materials together and to protect the construction and insulation materials from outside influences such as water, impact, and dirt. (Resistance to water and UV). A secondary function is to create an aesthetic that is attractive to the buyer.

- Aluminium in sheets, is recyclable
- PE sheets have comparable properties, could some of the aluminium be replaced with PE sheets just like on the inside?

Structure

- The main function is to keep the walls up, add strength and stiffness.
- Secondary function (as for now) is to enable to attach furniture to the walls

Wood - Pine

- Compostable

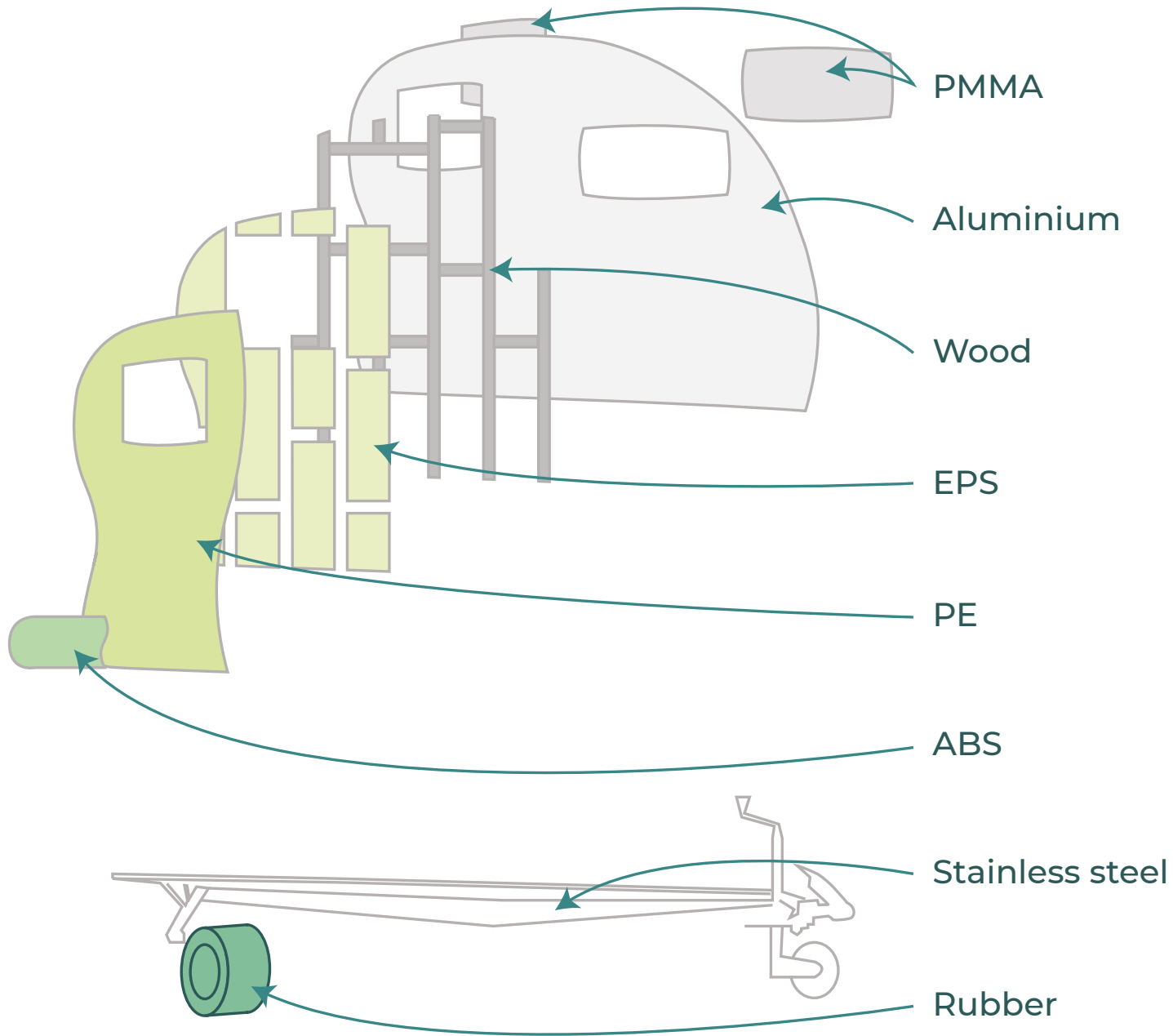


Figure H.2 Body materials

Insulation

The main function is to keep the warmth in and the cold out (thermal conductivity). The secondary function is to give the walls a thickness and to fill up the voids between the wooden structure.

- EPS (Expanded polystyrene) (GRANTA Edupack 2020, 2020)
- Lightweight cellular plastic material
- Not recyclable and not biodegradable

Since EPS does not meet the requirements of a circular economy, it is wise to find a replacement material. In order to investigate whether this is possible without deteriorating in quality, there was a short selection in the Granta Edupack program, which resulted in five possible materials (Table 4.2).

Method:

- 1: Thermal conductivity is set to a maximum of 0.036.
- 2: Setting recycling and/or compostable as a condition
- 3: Setting price limit at 20 €/kg

Out of these, Polypropylene honeycomb is the best option compared to materials based on the other variables such as density and price. It will increase the total CO₂ impact but will help reduce waste overall. When choosing this material it is also needed to change the adhesives since current methods might not stick to PP.

Inner Layer

The main function is to keep all construction materials together and to protect the construction and insulation materials from inside influences such as water, impact, and dirt. The secondary function is to create an aesthetic that is attractive to the buyer.

- PE in sheets and is recyclable
- The sheets are contaminated with glue

Outside decoration and add-ons

The main function is to protect parts that are often hit or that are vulnerable. The secondary function is to create a recognizable Adria look

- ABS is recyclable

Chassis

The main function is to make the caravan to be portable. Needs to be safe during all times and maintenance should be accessible

- Gives a weight limit to the rest of the caravan
- Stainless steel: Recyclable and is being recycled

Wheels

Rubber

- Non-recyclable
- Is in a lot of cases not being handed in due to the costs

Possible to replace them with thermoplastic wheels

Table H.1 Possible replacements for EPS

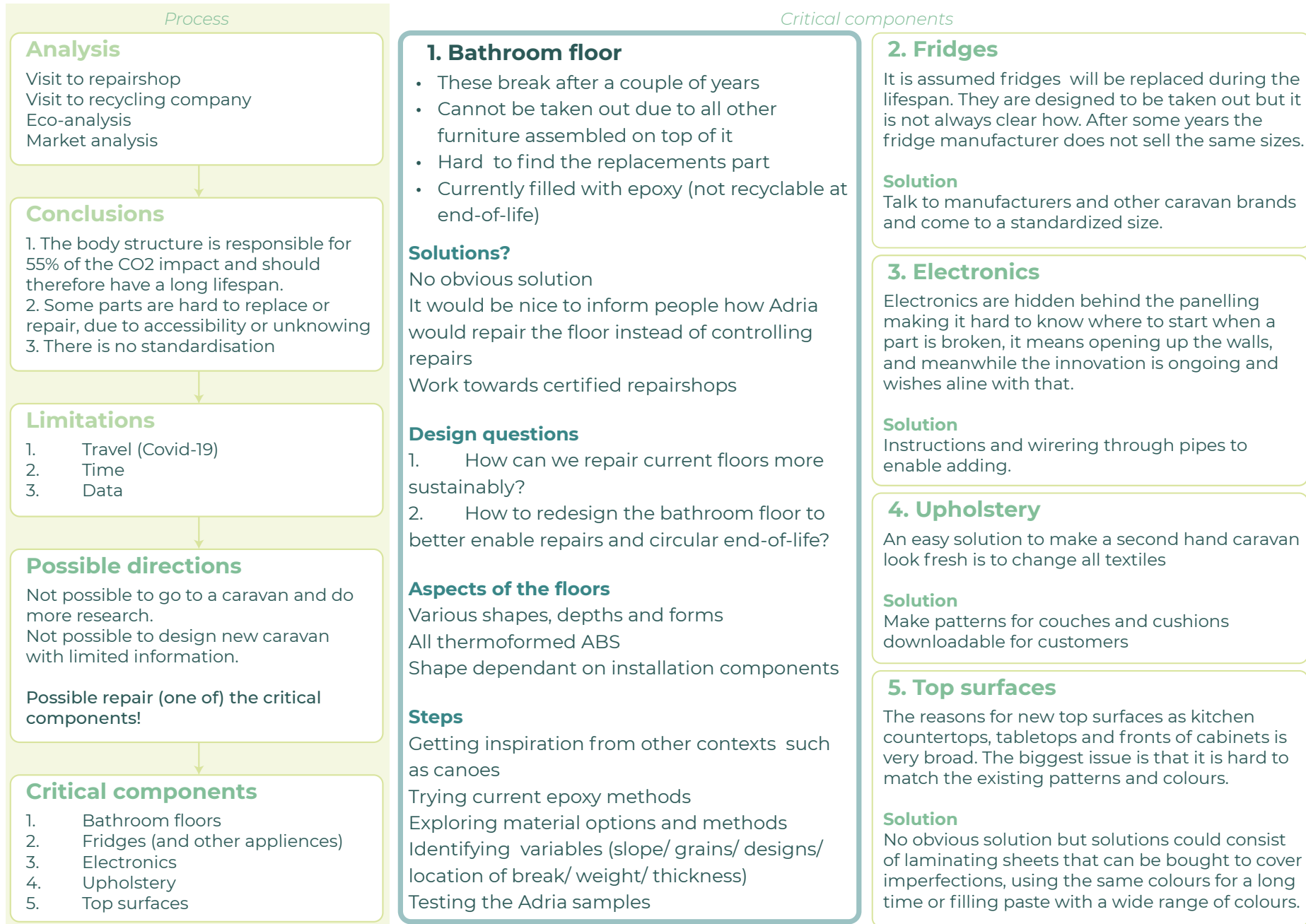
	EPS	Cork (low density)	Balsa	Polycarbonate Honeycomb	Polypropylene honeycomb	Impregnated paper honeycomb (PF, Phenol formaldehyde resin)
CO ₂ /kg	3.56	0.94	0.19	8.11	2.04	1.36
Density kg/m ³	24	120	130	64	44.8	25.2
Price /kg	2.49	3	7.82	19.8	2.99	8.95
Thermal conductivity W/m°C	0.034	0.038	0.035	0.0364	0.035	0.035
Recyclable	No	No	No	Yes	Yes	No
Compostable	No	Yes	Yes	No	No	Yes

Appendix I - Table overview materials and their recyclability

Material	Mass (kg)	parts	CO ₂	€	R	C								
Aluminium	32.62	57	489.31	65.24	Yes	No	Protective foil	0.08	1	0.24	0.24	Yes	Yes	
Aluminium + paper + plastic	1.43	3	16.06	2.14	No	No	PVC	28.12	30	59.05	28.12	Yes	No	
Copper	12.12	35	36.35	65.19	Yes	No	Rope	0.00	1	0.01	0.01	No	No	
Dubbelsided Tape	3.98	13	27.84	7.95	No	No	Rubber	6.53	14	45.73	13.07	No	No	
Foam	0.43	4	1.29	6.46	No	No	Rubber + Metal	7.23	4	50.64	25.32	No	No	
Foam / EPS	58.06	6	206.71	144.58	No	No	Sanding Paper	0.00	3	0.00	0.00	No	Yes	
Glass	3.05	2	4.57	19.82	No	No	Soldering - tin-lead alloys	0.00	4	0.00	0.00	Yes	No	
Glue tape	0.03	1	0.08	0.08	No	No	Stainless Steel	114.20	7	799.40	571.00	Yes	No	
Half plastic/half textile Probably PVC	0.35	3	0.73	0.35	No	No	Steel	30.74	176	61.47	15.37	Yes	No	
Laminated plywood + bit of plastic	191.53	143	67.04	95.77	No	No	Steel + Copper	1.35	1	2.70	0.68	Yes	No	
Light bulb	0.19	5	1.59	27.36	Yes	No	Steel + Plastic	0.46	4	0.92	0.23	Yes	No	
Metal	2.37	2	16.59	11.85	No	No	Steel + Rubber	36.00	1	252.00	72.00	No	No	
Metal + plastic	29.62	2	207.34	148.10	No	No	Textile (Natural)	0.00	1	0.00	0.00	No	Yes	
Mixed materials mainly metals	5.86	10	41.04	29.32	Yes	No	Textiles (Synthetic)	44.84	6	89.67	67.25	No	No	
Mixed materials mainly platics	2.95	4	8.84	8.84	No	No	Textiles (Synthetic) + Plastic	13.86	5	27.71	20.79	No	No	
Other electronics	1.97	4	19.72	102.54	-	No	Thermoplastic	47.08	135	141.25	141.25	Yes	No	
Painters tape	0.28	12	0.28	0.28	No	Yes	Thermoplastic / ABS	46.35	27	183.56	90.39	Yes	No	
PE	0.04	2	0.07	0.04	Yes	No	Thermoplastic / PE	73.25	8	146.51	73.25	Yes	No	
Plastic	2.25	27	6.75	6.75	Yes	No	Thermoplastic + Copper	5.02	47	15.06	27.01	Yes	No	
Plastic + brass	0.63	2	1.81	3.15	Yes	No	Thermoplastic + metal	0.33	4	0.98	0.98	Yes	No	
Plastic + Foam + metal	13.00	1	39.00	39.00	No	No	Thermoplastic + rubber	0.89	13	6.24	1.78	No	No	
Plastic + motor + wires	1.39	2	9.73	6.95	Yes	No	Thermoplastic + steel (spring and shaft)	0.42	6	2.97	2.12	Yes	No	
Plywood	101.30	18	35.45	50.65	No	Yes	Thermoset	35.51	66	106.52	106.52	No	No	
Plywood + plastic HPL	13.11	3	4.59	6.56	No	No	Unknown	0.10	4	0.00	0.00	-	-	
PMMA	31.30	4	228.96	80.13	Yes	No	Wood	27.13	22	13.56	13.56	No	Yes	
PP Foil	0.11	4	0.23	0.14	Yes	No	Wood + Plastic	13.60	1	4.76	6.80	No	No	
							Zinc	0.01	3	0.01	0.01	No	No	
							Totals	1043.07	963	3482.97	2206.99			

Table I.1 All materials in Action caravan and possibilities for recycling (R) or composting (C)

Appendix J - Process - choice for redesign bathroom floor



Appendix K - Brainstorm for the bathroom floor

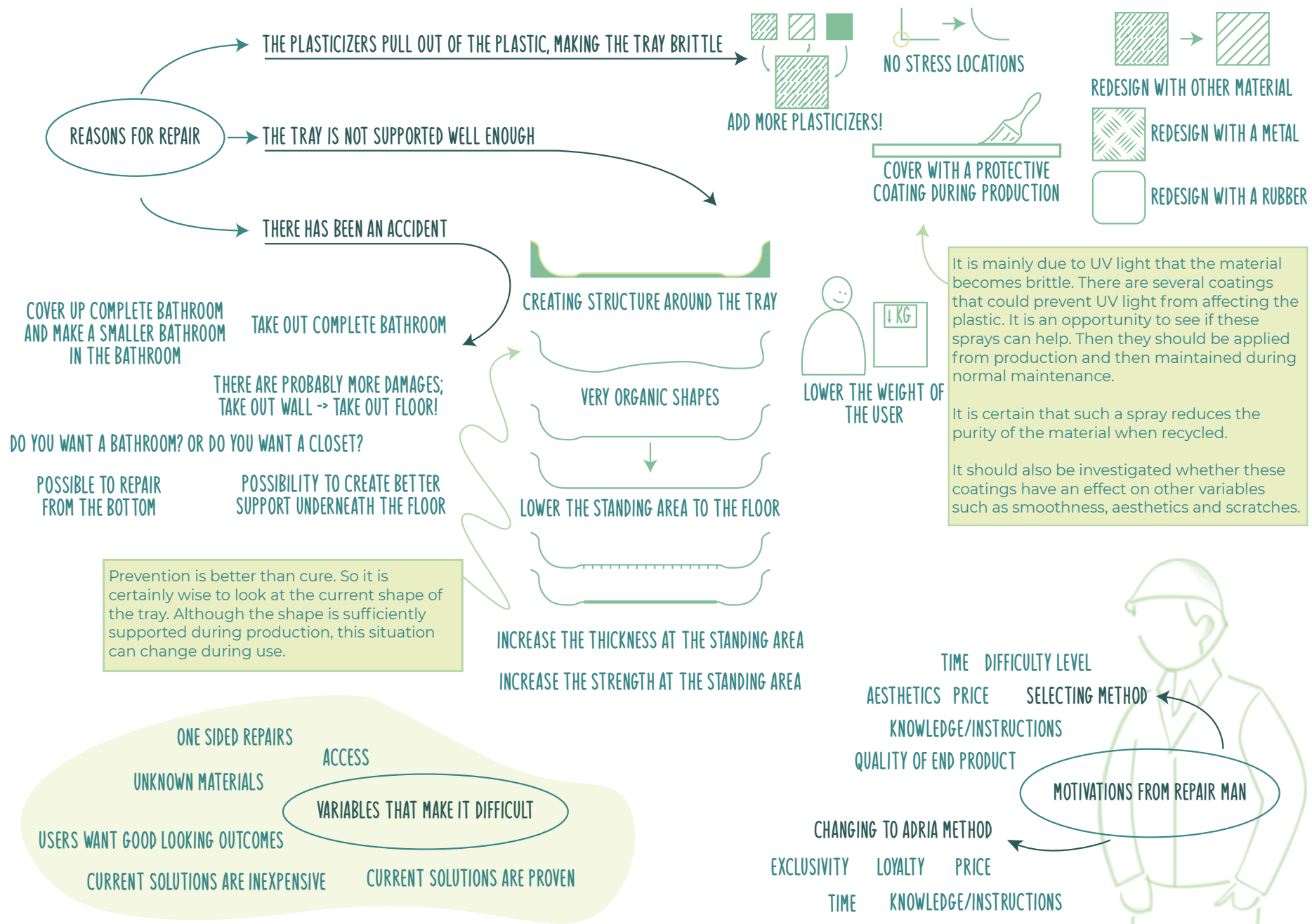
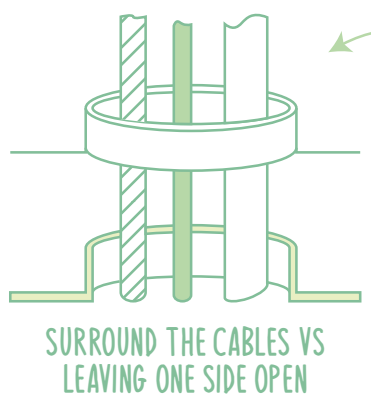
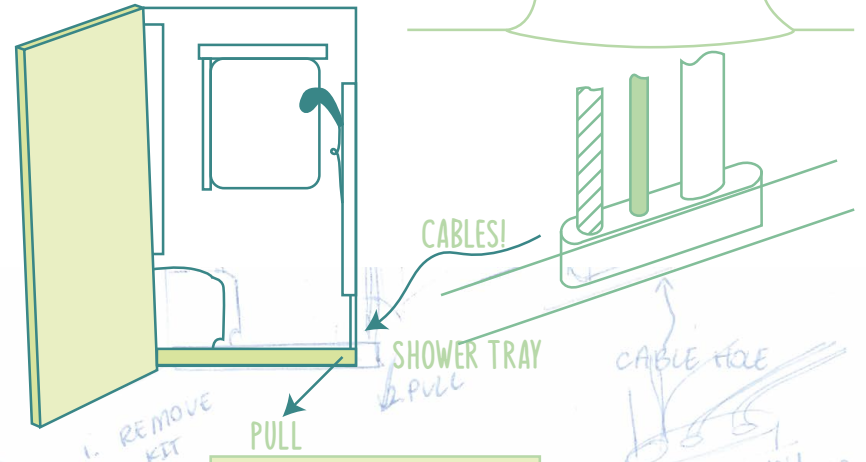
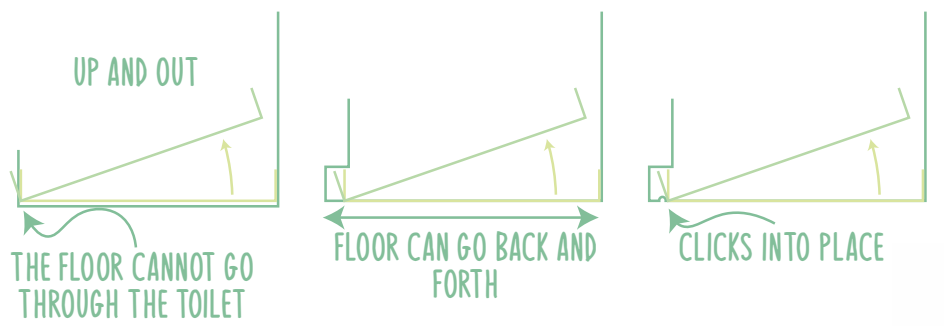
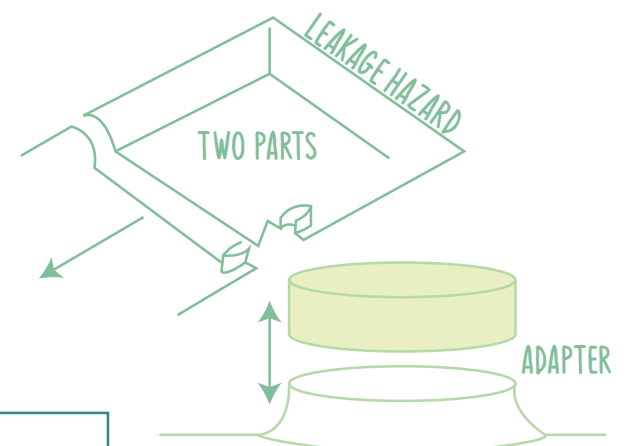
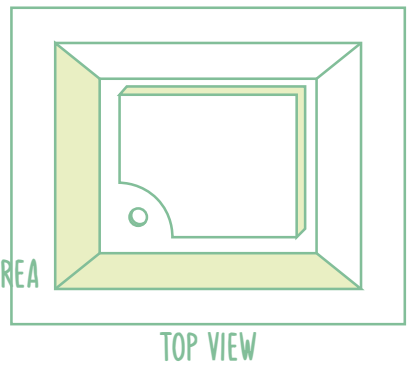
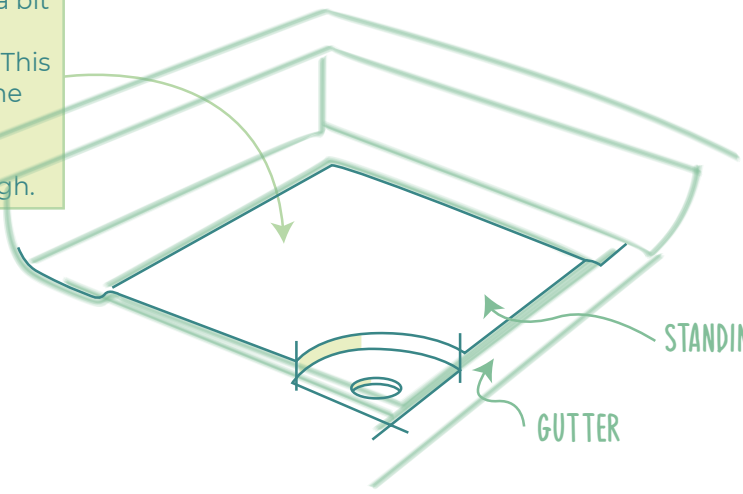


Figure K.1 Brainstorm based on the reasons for repair

The standing area is a bit higher than the surrounding 'gutter'. This means there will come more stresses in the material when not supported well enough.



At this moment all cabling goes through openings in the tray, this makes it difficult to remove the tray only. The cabling can also be clamped between the wall and the tray.

Other motifs on the standing surface can improve the rigidity and durability of the tray. It's just ugly.

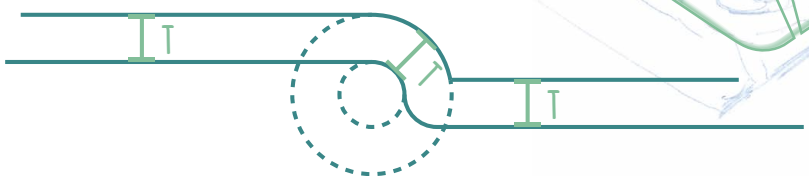
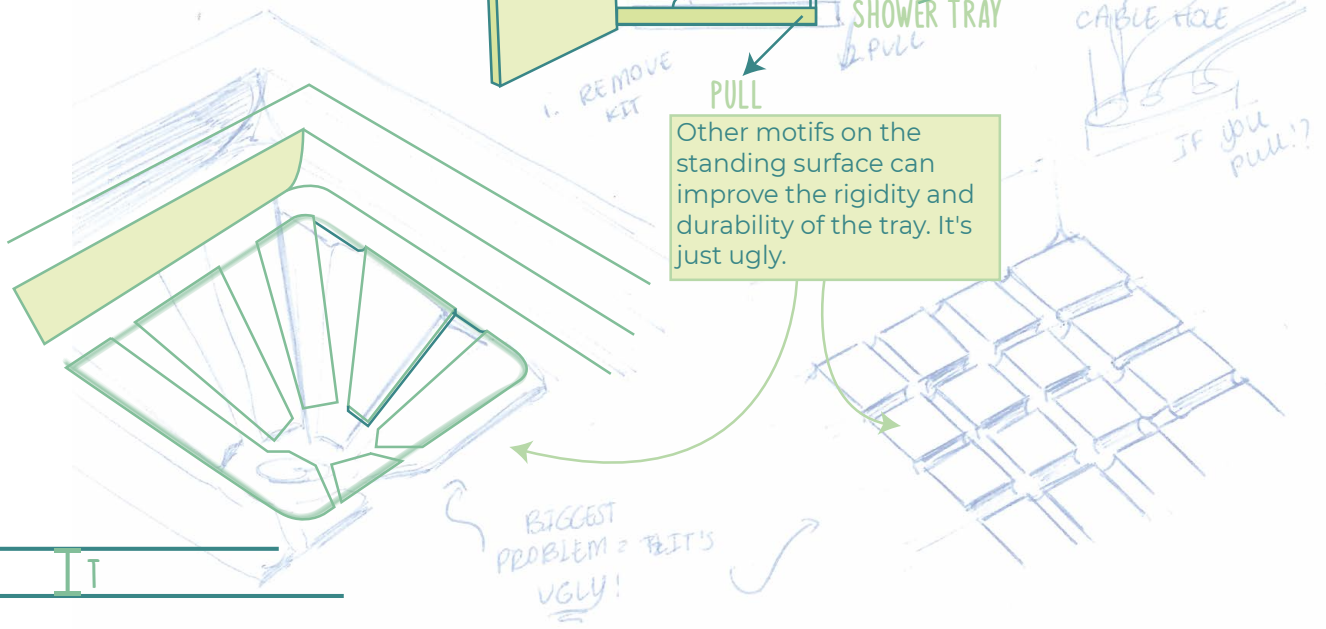


Figure K.2 Brainstorm shape of the tray

COMPARABLE PRODUCTS?

HOW ARE OTHER PLASTIC PRODUCTS REPAIRED?

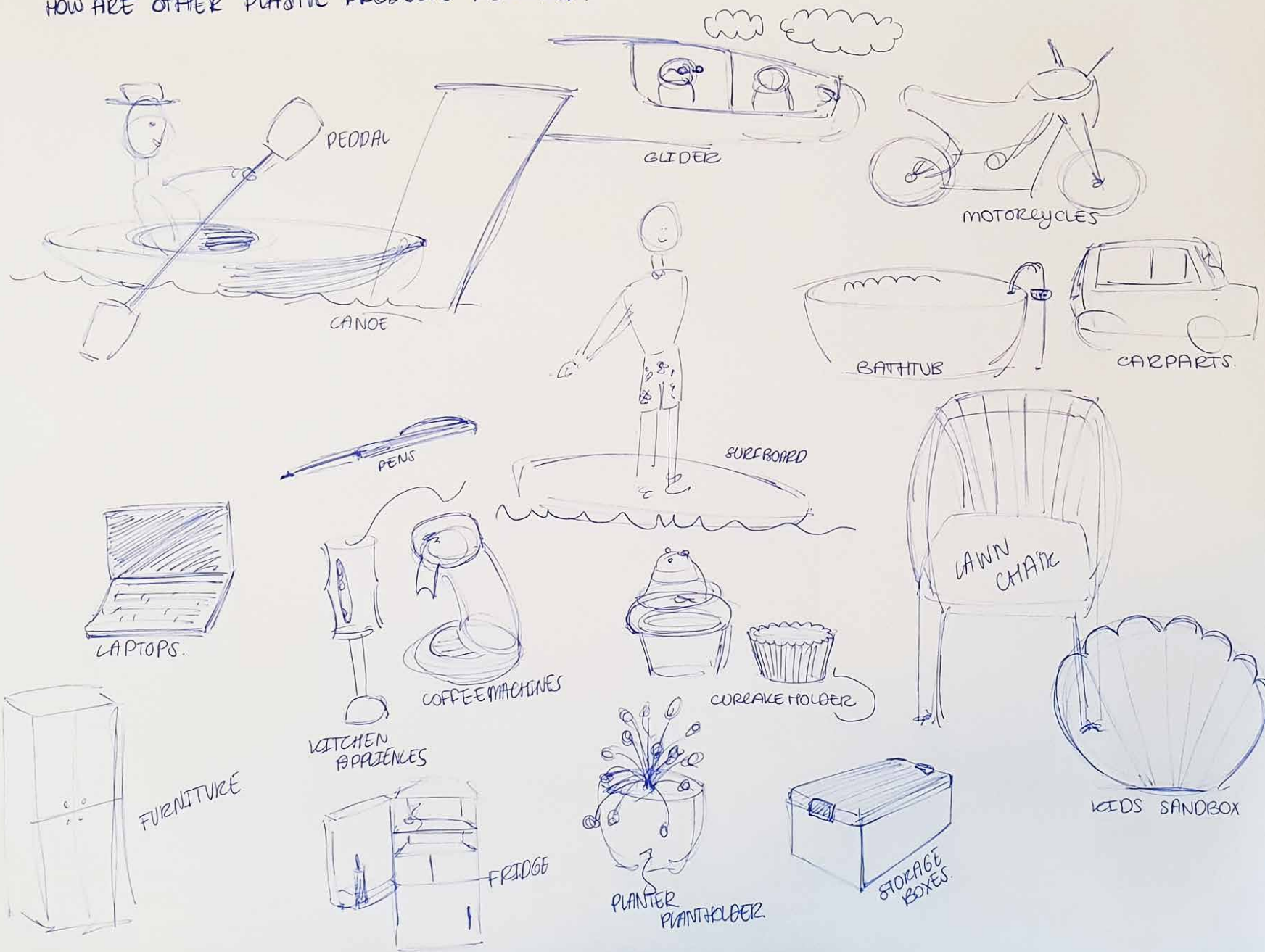


Figure K.3 Brainstorm

Examples of repairs of other products

De Staay-Burn had een fors Gat van de Durance en de Menno-Burn een schuur in de ondernaad. Beiden zijn nu gerepareerd (zie foto's). Met de laskanonnen kunnen ze niet in de boot lassen, dus is er bij de Staay-Burg een forse lap opgezet.



De scheur van Menno hebben ze netjes dichtgelast; daarvan was tijdens de afgelopen clubavond weer niets te merken ;-).



NKSV De Batavier uses plastic welding for canoes (Platenburg)

Canoes can be repaired by plastic welding. Then an extra piece of plastic is placed on top of the hole and the plastics are joined together around the edges.

Ik heb een stukje glasvezelmatje gebruikt voor op de plek van de ontbrekende stukken. Dan kan je een klein beetje van het papje er in gieten en uitsmeren. Smeer het dun uit. Doe je te dikke lagen dan kan het heel lang duren voordat het helemaal hard is. De MEK kan dan immers slecht verdampen. De buitenkant van het plastic wordt namelijk eerst hard.



Dunne laagjes worden snel hard. Breng meerdere en steeds dikkere laagjes aan om het stevig te maken. Als het een beetje harder is geworden kan je het nog een beetje vormen. Ik heb het daarna onder een ventilator een paar dagen laten drogen. De MEK verdampt sneller als het in de wind hangt. Als het hard is geworden kan je het alvast wat gladder schuren.



A private person uses chemical melting with MEK for his engine (Haag, 2010).

Motorcycle parts can be supplemented with new plastic. In this example, the ABS is chemically melted with MEK. For people unfamiliar with chemistry, MEK is a bit like acetone. However, MEK is very harmful to the environment. It is possible to repair a single part in this way, but it would not be convenient to do this on a large scale.

Re: **Douchebak** problemen en onze oplossing

door [redacted] op 21 jul 2012, 23:55



Berichten: 46
Lid geworden op: wo 12 nov 2008, 21:51
Locatie: Amsterdam

Hallo allemaal,

Ons douchebakprobleem hebben wij als volgt opgelost:

We dachten dat de bak er makkelijk uit kon om te vernieuwen maar dat was absoluut onmogelijk zonder de halve camper te slopen. Inmiddels hadden we wel het toilet verwijderd.

Het bleek dat onze bak niet rustte op piepschuim maar op de dubbele bodem van de camper en ook zweefde.

Afbeelding

Wij zijn naar Polyservice gegaan met de camper, daar vertelde men dat de bak van polyester was en goed te repareren met een 2 componenten gietvloer. (PU compound = grijs)

Eerst hebben wij de bak op de dubbele bodem vast geschroefd, daarna de bak geschuurd en ingesmeerd met hechthars waarna de gietvloer erop gegoten kon worden. Zo dik als je zelf wilt (minimaal 4 millimeter dik)

Afbeelding

Uiteraard moet de camper goed waterpas gezet worden en NIET vergeten het putje af te schermen !!!

Afbeelding

Na een aantal uren was het droog en na een aantal dagen volledig uitgehard waarna het in elke gewenste kleur overschilderd kan worden wederom met 2 componenten verf (DDLak). (antislip zand ook mogelijk hebben wij niet gedaan)

Wij hebben gekozen voor middenblauw en voorlopig zijn wij blij met het resultaat.

Afbeelding

Het lijkt een moeilijke klus maar het viel uiteindelijk erg mee, kosten ongeveer 100 euro.

We hopen met dit verhaal mede camperaars aan een (nieuw) idee te helpen.

groet, [redacted]

Laatst gewijzigd door [redacted] op 22 jul 2012, 0:33, 4 keer totaal gewijzigd.

Mijn Hobby is mijn hobby

Hello all,

*We solved our shower tray problem as follows:
We thought that the box could easily be replaced to renew, but that was absolutely impossible without demolishing half the camper. In the meantime we had removed the toilet.*

It turned out that our container did not rest on styrofoam but on the double bottom of the camper and floated.

*We went to Polyservice with the camper, there they told us that the container was made of polyester and can easily be repaired with a 2-component cast floor. (PU compound = gray)
First we screwed the tray to the double floor, then sanded the tray and smeared it with adhesive resin, after which the cast floor could be poured on it. As thick as you want (at least 4 millimeters thick)*

Obviously, the camper must be properly leveled and DON'T forget to shield the well !!!

*After a few hours it was dry and after a few days completely cured, after which it can be painted over in any desired color again with 2-component paint (DDLak). (non-slip sand also possible we have not done)
We have opted for medium blue and for now we are happy with the result.*

*It seems like a difficult job, but in the end it was not that bad, costs about 100 euros.
We hope to help fellow motor home owners with a (new) idea with this story.
regards,*

A person on the camper forum describes her way of fixing the bathroom floor.

Here a user of the camper forum explains how they repaired the bathroom floor with PU. This is a method that returns more often (see also the following pages). People on the internet indicate that this is a good method and are often very satisfied with the end result, both because the problem has been solved and that it gives a decent end result.



I have about 40 minutes processing time, so plenty of time to mix and empty those 2 other jars. Spread the resin a little bit with a spatula or wide putty knife. It flows wonderfully, so unnecessary.



That cap must therefore be firmly on the floor drain, otherwise it will float. I still had that crazy black pitch from a roof hatch somewhere. To make the unloading easier, apply thick Vaseline to that cap with a brush, because it must be able to unload.



I let the floor harden for a few days. The photo shows what the floor drain looks like. The floor has a rough appearance, as it has been sanded with grain 240 to roughen it for better adhesion of the paint. A DD lacquer, also from Polyservice (2-component lacquer). 1 jar with hardener, 3 measuring cups, dilution 1 part harder to 2 parts paint. I paint three times with a day in between, hence the 3 measuring cups. Paint tray, brush and a narrow roller. At a time I use 50 cc paint and 25 cc harder for the first time. Next times I take 40 and 20cc.



I choose the color white, because I find it fresh and I think it matches the white toilet bowl and the washbasin. Perhaps I could have taken light gray, but everyone has their own taste. Total costs: compound € 58 and paint € 34.

A person on the camper forum shows fixing the bathroom floor (Roma, 2015).

Mn vloer in het toiletgedeelte zit erin het is even werk ,maar loont de moeite juiste mengverhoudingen aanhoudt.



My floor in the toilet area is in it, it takes some work, but it is worth doing it yourself. A great product to work with, provided you maintain the correct mixing ratios.

Solutions based on polyurethane (Face, 2015)

In this example it is a floor without a drain.



Broken drains (Arie55, 2020)

In these photos you can see how the edge of the drain shows cracks, as often happens in the rest of the floor.

Brainstorm on repairing products and bathroom floors

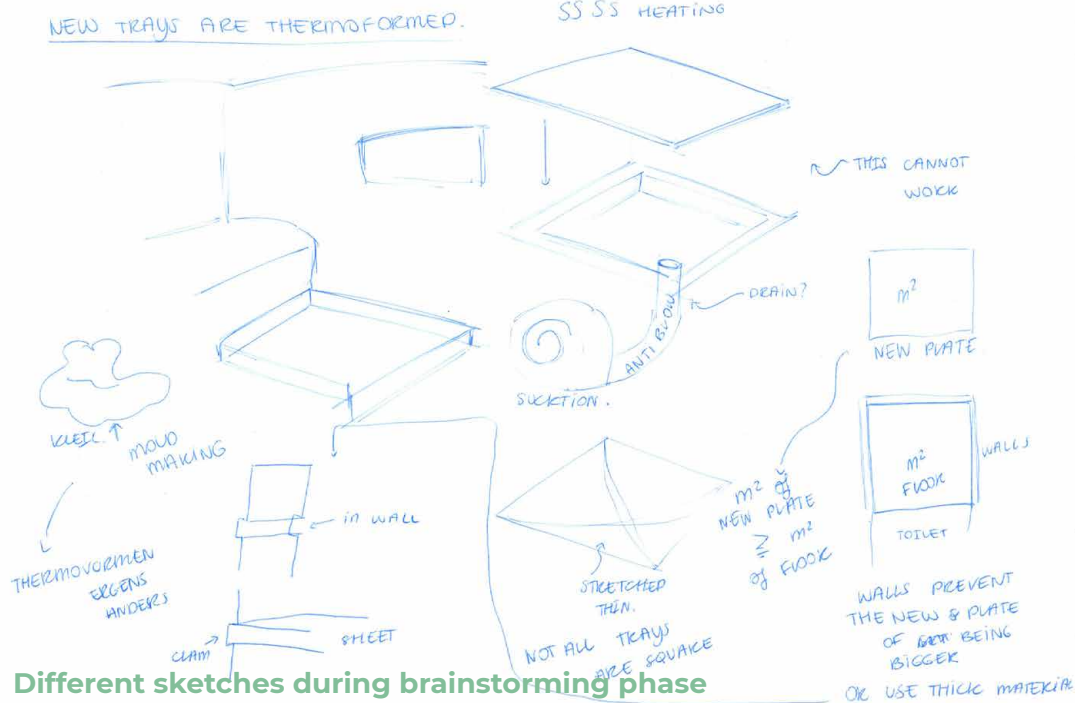
How are items repaired?





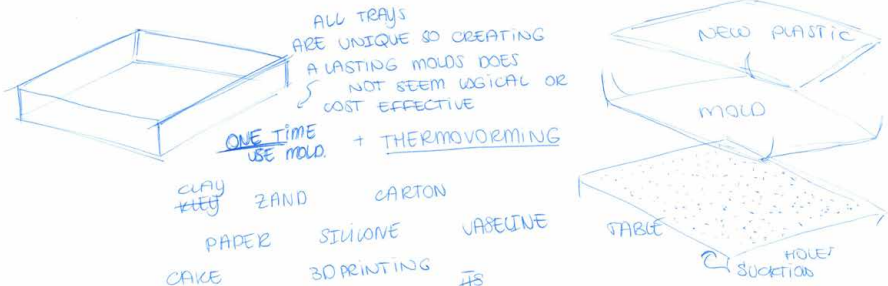
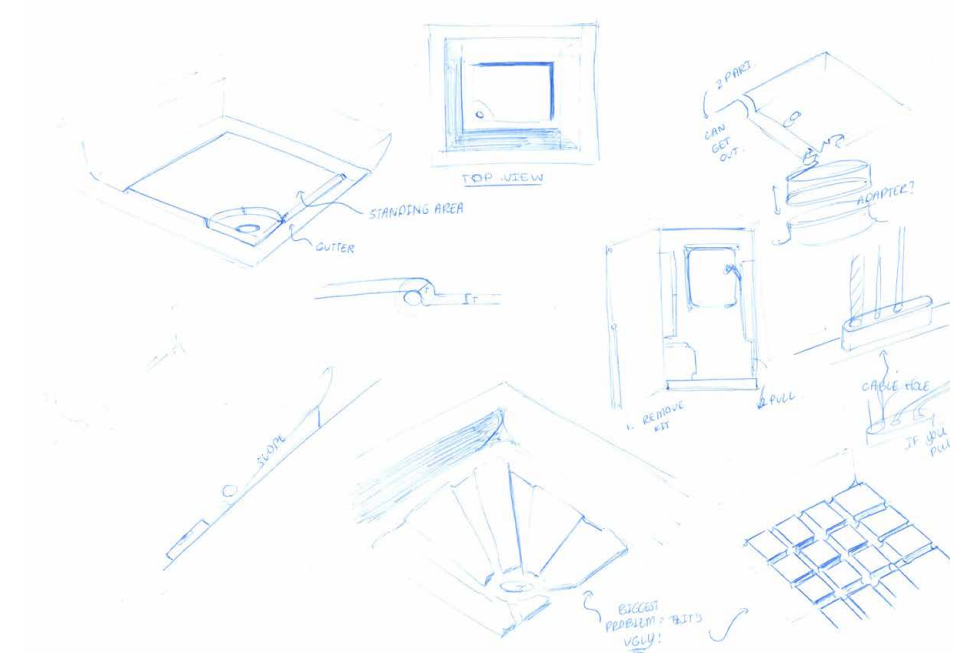
THERMOFORMEN.

THERMOFORMEN © CARAWAN



Different sketches during brainstorming phase

DE EN?	LASSEN	LIJMEN	INPAKKEN	MET BUBBELDES PLASTIC
	PLAKKEN	HECHTEN	MET FOJIE	MET PLASTIC
	LOSSCHROEVEN	VASTSCHROEVEN	MET EEN SCHAAL	MET HOUT
	VERVANGEN MET HETZELFDE	VERVANGEN MET IETS ANDERS	MET STOF	MET GLAS
	DEZELFDE BAK WEER TERUG	ANDER MATERIAAL	MET ALUMINIUMFOJIE	MET VERS HOUDFOJIE
	BAK ERUIT → LIJMEN → ERIN	ANDER ONDERDEEL		
	ONDERKANT LIJMEN	ANDER MODEL		GEEN BAKKAMER?
	ONDERKANT WATERDICHT MAKEN MET EEN JIJNISZAK	ANDERE FUNCTIE		MEER OPZAC
	MET LIJM MET SPRAY MET ZAK	ANDERE AFMETINGEN		
	MET SILICONEN MET KUKK	ANDERE DIKTE		
	MET TIN MET FIEZBAND			
	MET HUID MET EEN DAKDE			
	EEN GOOT	DASSPRAY (WAT IS DAT)		
	METALIC MET VERF MET RITS MET TAS			
	MET FLES			
				WATER WEGHALEN.



ALL TRAYS ARE UNIQUE SO CREATING A LASTING MOLD DOES NOT SEEM LOGICAL OR COST EFFECTIVE

ONE TIME USE MOLD + THERMOFORMING

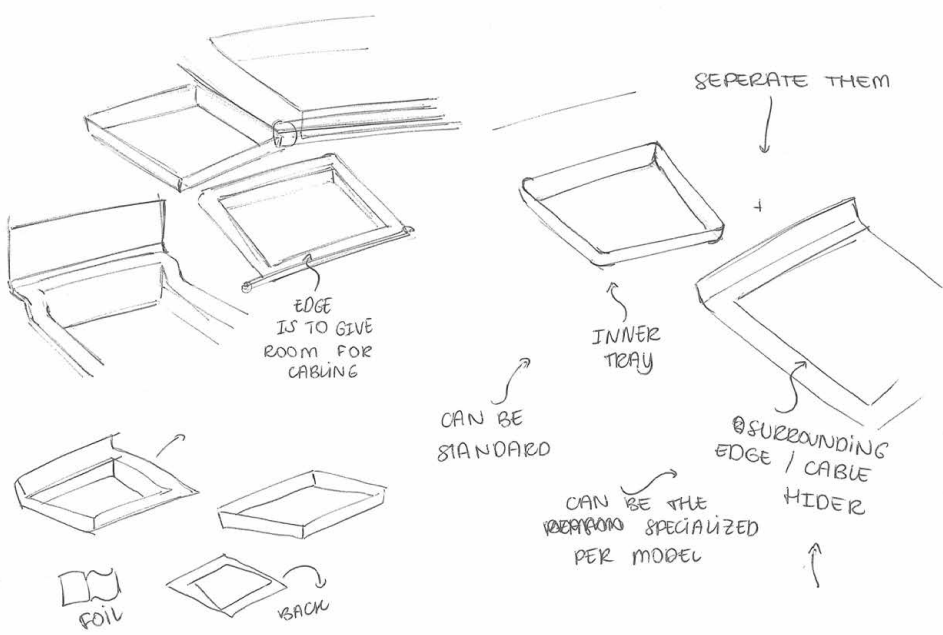
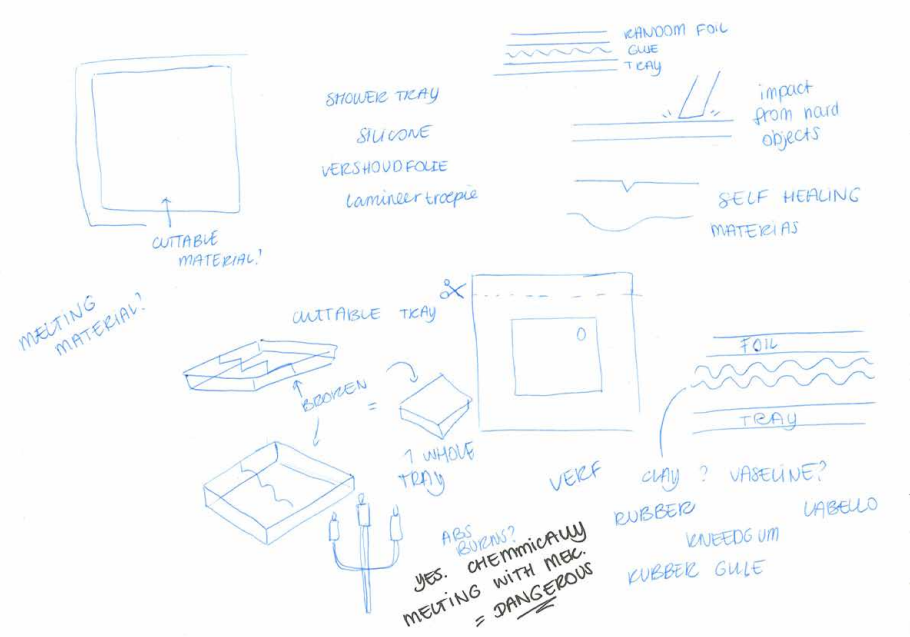
- CLAY
- ZAND
- CARTON
- PAPER
- SILICONE
- VASELINE
- CAKE
- 3D PRINTING
- IS ICE?
- LAK
- PLAYDOH
- KAARS / WAX
- CHOCOLA
- GIPS
- TAPE
- WOOD
- CNC

IS WAX STRONG ENOUGH?

GROOTSTE PROBLEEM IS GEWIKMATIGE VERDELING VAN DE WARMTE EN DAT HET PLASTIC NETJES OVERAL REKT IPV OP SOMMIGE PLEKKEN HEEL VEEL.

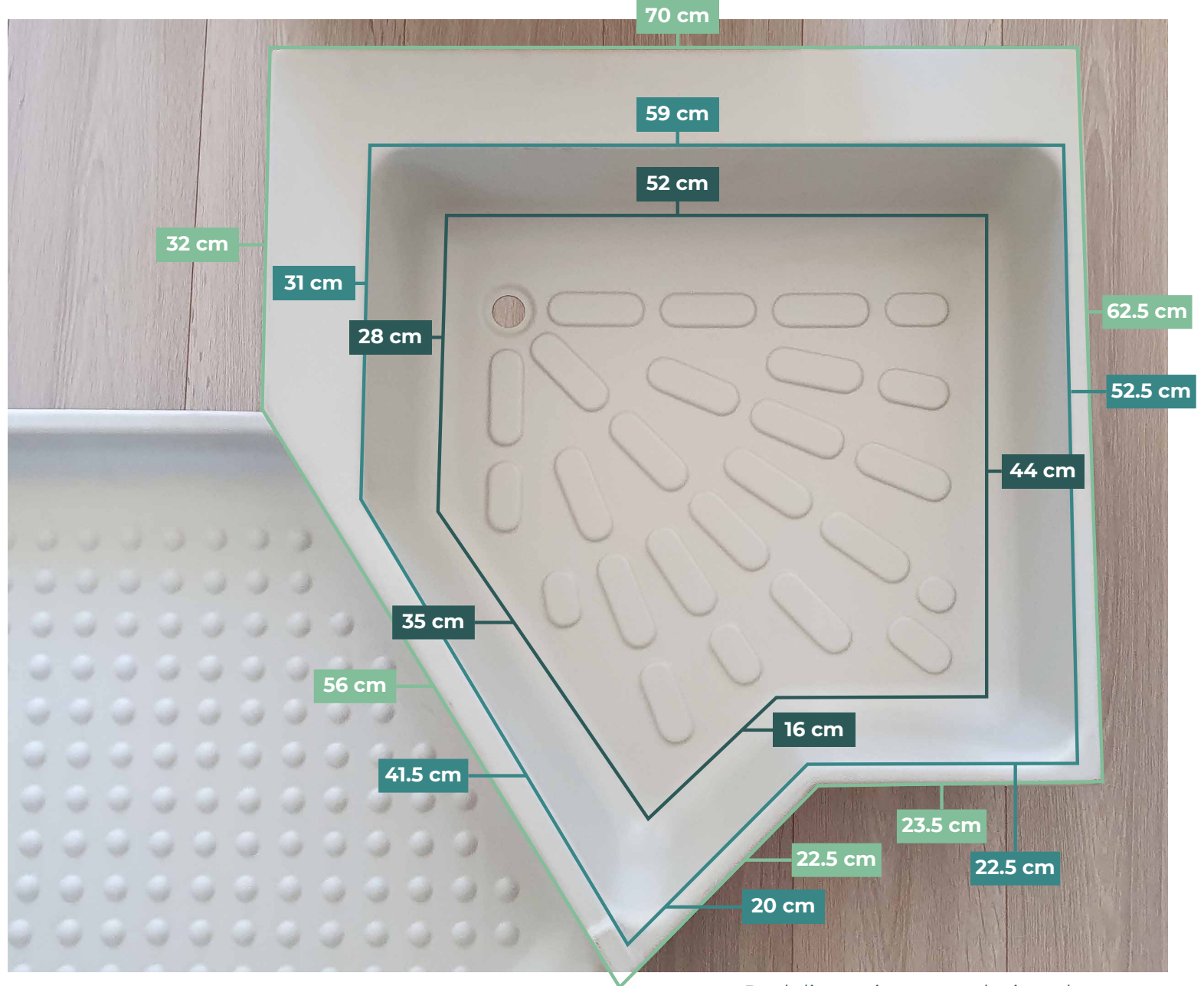
TRADE OFF
WHEN IS IT WORTH IT TO USE MORE MATERIAL THEN IS ACTUALLY BEING USED TO CREATE A RECYCLABLE TRAY?

HOW LARGE IS REENDEBEL GUA
THERMOFORMING ONGEVEER 3000 x 2000 x 1000 mm
DUS GROOT GENOEG MAAR NIET GOEDKOOP?
DIY KAN NIET ZO GROOT



Different sketches during brainstorming phase

Appendix L - Dimensions tested bathroom floor



Real dimensions may deviate due to curves

Figure L.1 Dimensions

Appendix M - Transcriptions visit to Repair company

M.1 Actual Transcriptions in dutch

Opname 1

Hans: Het kan zijn dat ik dadelijk weggeroepen word maar mijn dochter die komt ook even meepraten dan. Iemand van Bovag komt een audit uitvoeren om te kijken of wij volgens de bovag normen werken. Dat hoort zo, dat is bij de rdw is dat ook zo. Met de bovag, waar wij dus lid zijn, van de bovag, van twee afdelingen, een van mobiele recreatie en de andere van de autotechniek. Dan word je eens in de drie jaar word je geaudit en word er gekeken gaat het netjes, hangen er spinnenwebben. En ja, die hangen er nog wel een beetje, ik krijg ze niet helemaal weg.

Emma: Nee te hoog.

Hans: En we doen verkoop hier. Maar dat is niet onze core business. De verkoop die wij hier doen, gebruikte wagens en die gebruikte wagens zijn van relaties van ons. En dat zijn wagens die, waarvan we weten dat het goede wagens zijn. Want er is natuurlijk ontzettend veel te koop wat betreffende campeerautos. We hebben er op het ogenblik een stuk of zes staan, en die staan dan hier, en alles wat buiten staat dat moet nog gerepareerd worden. Dat is geen voorraad. Nouja, voorraad om te werken maar niet voorraad om te verkopen.

Emma: Niet voorraad om bijvoorbeeld delen uit te halen.

Hans: Nee nee. Ik heb een wagen pas aangekocht, ik heb een wagen hier staan die heen in een brand gestaan. Berkel en Rodenrijs is een grote brand geweest drie kwart jaar geleden, en heel veel wagens beschadigd en ik heb een wagen staan die is aan het frond verbrand en ja daar heb ik een donorauto voor gekocht en die gaan we dus strippen en die gaan we op die uitgebrande, of ja die verbrande neus zetten.

Emma: En kan dat een beetje?

Hans: Ja dat kan wel, maar je moet ontzettend rekening houden met de uitvoering van de auto. Kijk het interieur overzetten wat naar jou kant gaat. Ik mag jij zeggen? De interieurs overzetten, dat doen we niet, je kan bijna nooit een gebruikte camperauto kopen die total loss is dat de moter in elkaar gedraaid is en dat je zegt van die mij een gebruikte koelkast of een gebruikte kachel die zijn er gewoon niet. Die zijn er misschien wel maar dat is zoiets dat aanbod is zo klein. Dus deze schade is met name technisch dus de voorruit, de bumper het hele voorcompartiment is verbrand en dat zetten we allemaal over. Dat gaan we allemaal uit elkaar halen en nieuwe draden. Een donorwagen heb je dan gekocht en die koop je dan voor 600 euro en dat is dan veel goedkoper dan een wagen van onderdelen van een sloperij te halen want dit kost 100 euro en dat kost 100 euro en dat en dat en binnen no time zit je al over die 900 euro heen. Dus daarom hebben we die wagen gekocht en die gaan we strippen en dan uiteindelijk gaat ie gewoon via de reguliere weg word hij afgevoerd gaat hij naar een sloperij.

Emma: Ja ik heb een dagje meegelopen op een sloperij

Hans: Hier in de regio?

Emma: Bij Zutphen in de buurt

Hans: Ja hier in de regio zit van Gilst in nooddorp dat is echt een schone sloperij. Alles clean en hele mooie balie als je binnen komt. Prachtig mooi, en daarachter

worden de wagen gestript en wat niet bruikbaar is dat gaat afgevoerd naar het ijzer en proberen ze dan via internet met name heel veel componenten van autos te verkopen. En ene keer hebben ze een campeer auto staan en dan bellen ze mij op en kom even langs, kom even kijken want dan kan ik hem zien want die wagens zijn meestal uitgebrand want een campeerauto gaat niet zo vaak total loss. Als de zijkant eruit gereden word dan, want bij deze, nouja dit is nog wel een oudere, maar als je bij zo'n wagen de zijkant eruit rijd en je heb 25.000 euro schade dan word hij gewoon gerepareerd dan gaat er gewoon een nieuwe zijkant in. En dat maakt hem, hij gaat pas total loss als er brand is. Dus als een wagen in de brand heeft gestaan dan is er haast geen reden meer aan dan gaat hij total loss. En dan is het ook een beetje afhankelijk van hoe groot de brand of dat het is geweest of waar in de stalling dat die wagen heeft gestaan. Daar waren ook wagens bij de van Gilze stonden daar, maar die waren dus ook echt afgefakkeld maar daar heb ik niets aan want ik kan de koelkast er niet uithalen, ik kan de kachel er niet uithalen. Dus die Truma ketels die erin zitten daar heb je wel wat aan, daar kan je nog wel wat mee. Gebruikte koelkast kan je ook nog wel wat mee doen maar het was zo beschadigd dat lukt allemaal niet. Het punt van gebruikte onderdelen van een campeerauto die zijn echt heel moeilijk te krijgen, als je bijvoorbeeld zon raam kapot hebt zo'n plexiglas dubbelwandig daar zijn zo veel soorten in. Dan ga je zoeken en dat kan je niet meer nieuw kopen, via domestic of zijst, je kan ook kijken ofdat je, Willemsen heirin pijnakker, heb je daar wel eens van gehoord?

Emma: Ja daar heb ik wel eens van gehoord

Hans: Die hebben enorm groot magazijn met enorm veel ramen dus daar halen we dan een look a like raam van eigenlijk. Dus wel in Nederland hebben we wel een uniek bedrijfje wat ramen betreft. Als je kijkt wat kussens betreft, wat als kussens zijn doorgezakt, dat krijg je ook want camperautos worden natuurlijk veel ouder dan reguliere personen autos.

Emma: Ja en ook dan reguliere meubels

Hans: Ja. Ja. Dus dan gaat veel langer mee, dus dan zijn er vragen van waar kan ik mijn kussens laten bekleden? Waar kan ik het foam laten verstevigen?

Emma: Ja nieuwe kussens laten maken.

Hans: Ja dus daar zijn dan wel een aantal bedrijven die dat wel doen hier in de regio. Onder andere fobieta shop in Wateringen. Die maakt ook matrassen op maat, als we bijvoorbeeld een wagen verkopen zoals deze die heeft natuurlijk al best een oud matras en mensen zeggen ik wil een nieuw matras erin. Nou dan meten we de maten in, bellen we het door en dan word er een matras gemaakt. Dus dat is wel mooi maar een gebruikte tafel kopen. Dus je hebt van die inklaptafels zodat je er een bed van kan maken. Een tafelblad kopen gebruikt, dat word al weer moeilijker. Dat word alweer een dingetje, daar kom je niet zo makkelijk aan dus dan moet je een nieuw tafelblad gaan kopen. Dan zijn er een aantal mogelijkheden dat je het of bij een merkdealer gaat bestellen maar dan kost een tafelblad 1.100 euro, gewoon een tafelblad hoor. En dat is dan een soort sandwich materiaal, kost gewoon 1.100 euro en dan ook pas over driekwart jaar leverbaar, daar loop je dan tegen aan dat is heel moeilijk in te schatten. En als je zegt van dat moet je zelf maar een tafelblad gaan maken maar dan moet er eigenlijk een meubelmakertje te pas aan komen. Gewoon een houten plankie met een afwerkrandje dat wil net niet eigenlijk. Er zijn bedrijven zoals reimo in Duitsland en Rohma in Nederland en Gimech zijn grote toeleveranciers van onderdelen waarom een tafel en tafelpoten enzo. En dan krijg je

ook alsnog een tafelblad dat ontzettend veel geld kost eigenlijk. Dus dat is, het bestellen van onderdelen voor campeerautos is wel een vervelende. Als het van Adria is dan weet ik wel waar ik moet zijn. Dan weet ik wel hoe ik het moet aanpakken, dan word het ook wel redelijk rap geleverd, twee drie weken. Maar als het over Giotti lijn gaan, italiaans, dan word het lastig, of joint, ik had een wagen die was vier jaar oud, die man was langs een vangrail gegaan die had de deur beschadigd, grote schade, en toen gingen we een deur bestellen, nou dat bestaat ook niet meer, maar dat was helemaal niet te krijgen. Dat was echt niet meer te krijgen. Dus hebben we een algemene deur besteld bij Reimo in Duitsland en die hebben we erin gezaagd. Dan krijg je niet de deur van joint maar dan heb je een algemene deur. Internet is er ook wel veel. Er zijn natuurlijk van die onderdelenboeken waar wij heel veel in neuzen. Toen wij net begonnen mijn compagnon en ik, toen liepen we tegen al die dingen aan. Want waar haal jou nou wat vandaan. We komen allebij uit de personen autos branche en druk op de knop, als ik het nu wil hebben dan heb ik het over een uur.

Emma: Een beetje voor twaalf uur besteld morgen in huis systeem.

Hans: Ja dat gaat heel rap, en dat is dus met campeerautos wel even anders. En dan ga je krijgen, zoeken zoeken en ondertussen weten wij de weg wel te vinden waar we het moeten halen, dat wel. Maar we houden ernstig rekening met lange levertijden. Maar kijk de auto technische onderdelen, de banden remmen enzovoorts: allemaal binnen een uur dat kan allemaal heel snel gaan. Dat is niet heel moeilijk. Maar de echte merkspecifieke dingen aan kampeerauto's die zijn moeilijk en de waterlock is niet moeilijk, een luik is niet moeilijk want daar wordt een teth(?) voor gemaakt. En zo zijn er allemaal wat redelijk, redelijk simpele onderdelen, maar het gaat heel vervelend worden als je een tafelblad moet hebben of een meubelwerk. Dat is ook heel moeilijk te krijgen, heel moeilijk te bestellen. Ik heb dat besteld bij Adria, via uhh Adria heeft natuurlijk webcat he. Dus daar kan je kijken aan de hand van chassisnummer van wat soort delen zitten daar nou in en dan komen we er wel uit, dan kunnen we het wel goed vinden. Alleen als het een meubelpartij is, een bovenkastje bijvoorbeeld, nou dan duurt het ook weer een halfjaar, want die liggen niet in het magazijn.

Emma: Nee, heel veel dingen veranderen ook per jaar, per 5 jaar, en dan wordt het ook eigenlijk niet meer gemaakt.

Hans: Nee dat klopt, en je hebt in de auto branch, de personenauto branch daar hebt je het model, heb je niet ieder jaar een nieuw model. In die kampeerauto wereld is ieder jaar alles weer nieuw. Ze zijn helemaal gek, ze zijn gek, dat moeten ze niet doen.

Emma: Nee ze doen elk jaar een update.

Hans: Een update, een andere lijn, een upgrade, een andere belijning, een ander stukje bekleding.

Emma: Een nieuwe technologie en in ieder geval bij Adria doen ze elk jaar dus zegmaar één model compleet renoveren en dan wat updates daarvan laten doorsijpelen in andere modellen, maar dan heb je dus nooit meer dezelfde eigenlijk.

Hans: Nee, nee dat klopt. Wij zijn heel erg met Adria verbonden hoor, we zijn heel erg Adria gericht enzo. Degene die hier voorheen in het pand zat die was Adria dealer, die verkocht nieuw Adria's. Wij hebben dus met Natascha en Hijn van Tilde heel veel te maken gehad, die kennen ons ook goed. De directeur uit Slovenië die is hier zelfs een keertje geweest. Wel erg leuk.

Emma: Oh wat grappig.

Hans: Om te kijken hoe wij, waar wij autotechnisch tegenaan liepen, dus echt technisch gesproken tegenaan liepen met de kampeerauto's van toen dus en dat was wel goed, nette mensen. Leuk. Die alfa recreatie, het bedrijf dat hier eerst inzat, die was één van de eerste Adria dealers in Nederland en heb ie heel lang alleenrecht gehad van Adria, in uhh dan had je misschien maar drie Adria dealers in Nederland, dus als iemand een Adria wilde dan kwamen ze hierheen en dan was, hoe heette die nou, uhh die vorige eigenaar, was familie, Adria was natuurlijk in Dordrecht, was een familie business, kan even niet op z'n naam komen, uhm en die deed KB caravans en Adria dan en Sunlight?

Emma: Sunliving.

Hans: Sunliving. Uhh Sunliving? Sunlight like to say. En ze bouwden ook nog een soort chalets, stacaravans enzo die familie en toen is dat op een gegeven moment geklapt en toen is het eventjes rustig geweest. Toen zijn Natasha en Hijn ennog iemand die zijn toen daar mee verder gegaan. Maar Simon die hier dat bedrijf had nou die verkocht achter elkaar de meest, uhh grootste verkooppunten van Nederland wat Adria's betreft, maarja toen ging er een ander deurtje open en die werd dealer, die werd dealer en die werd dealer en toen werd de spoeling dunner en toen kreeg hij pijn in zijn buik natuurlijk.

Emma: Ja dat snap ik wel.

Hans: Toen heeft ie Hobby er bij genomen en uhh Hymer heeft ie er toen bij genomen, maar dat werd weer afgenomen, want kijk je moet als dealer zijnde natuurlijk wel voldoen aan bepaalde standaards enzo. En je showroom moet zo ingericht zijn, daar moet niet een Hymer en een Hobby bij staan.

Emma: Ja, je moet niet alle concurrenten naast elkaar zetten want dan uhh (Hans onderbreekt)

Hans: Dat is niet goed, Duindam heeft dat de rest is niet te verstaan door achtergrondgeluid van de fabriek. Dat steekt natuurlijk bij Adria in Nederland. Dat kan ik me best wel indenken, dat kan ik me best wel indenken. Batavus(?) is een mooi merk hoor, hartstikke mooie wagen. Maar ja nogmaals Adria zijn wij heel erg, zijn wij ook heel erg van gecharmeerd.

Emma: Nou ja dus, ze maken dus al die bedrijven maken allemaal nieuwe modellen elk jaar en ze hebben ook geen overlap tussen merken. Dus geen standaardisatie.

Hans: Nee, nee, nee de enige standaardisatie zit hem in de koelkasten en de Truma(?) ketels

Emma: Ja maar dat komt, ja omdat daar ook geen andere leveranciers voor zijn.

Hans: Nee precies.

Emma: Nee, want bijvoorbeeld als je een normale keuken zou kopen dan maakt het niet uit of je die bij Keukenconcurrent koopt of ...

Hans: Nee ja wie dan ook.

Emma: Bij wie dan ook, de kastjes zijn altijd 60 cm breed, en dan kun je ook alle merken wasmachines instoppen want die zijn ook allemaal 60cm breed. En dat zorgt er dus voor dat als je wasmachine kapot gaat, hoef je niet een hele nieuwe keuken te kopen, dat is uhh hier nog niet zo.

Hans: Dat is met de kampeerauto, is dat niet zo. Dat is echt iets wat die standaardisering van kampeer uhh van caravans, kampeerauto's noem ik het, dat bestaat gewoon niet, dat is allemaal maatwerk per stuk.

Marieke komt binnenlopen en Hans moet even weg en komt later terug.

Opname 2

Emma: Het idee is dat ik een circulaire caravan maken. Tijdens de levensduur van een caravan kan hij worden gerepareerd en vervangen en uiteindelijk zou alles moeten worden gerecycled. En waar ik tegen aan loop is dat je het interieur moeilijk kan vervangen. Stel dat je je caravan helemaal netjes zou onderhouden en het is allemaal helemaal goed, er komt geen vocht in etc. Dan kan je alsnog niet na dertig jaar zeggen: ik wil een nieuwe keuken.

Marieke: Nee dat is inderdaad omdat het dan niet meer gemaakt zou worden maar je hebt ook wel heel veel dingen, dat mensen toch wel IKEA kastjes in gaan bouwen. Het is natuurlijk geen maatwerk, maar mensen halen dan de hele caravan leeg en bouwen dan onder andere een keuken van IKEA in. Een vriendin van mij heeft een oude srv wagen gekocht. Die oude srv wagen hebben ze helemaal nieuw gemaakt met ikea keuken, zelf de wc gehaald bij de Ikea en dat is echt een heel mooi project geweest. Die mensen hebben het ook helemaal van A tot B op film gezet en dat is ook echt heel leuk om naar te kijken, hij heet de bot mobiel. BOT mobiel. Als je daar zo in kijkt wat ze daarmee doen dan en die vriendin van mij doet wel vaker ook Amerikanen kopen. Amerikaanse wagens zijn natuurlijk heel gaaf om te zien maar die slurpen benzine. Ik zal eens kijken of ik het kan vinden op facebook. Het zit in naaldwijk. Rick Bot, hij heeft ook wel vaker op camper en caravan sites.

Emma: Oh dan snap ik ook bot mobiel.

Marieke: Ja hij heet zelf Bot. En die heeft dan ook onder andere die srv wagen gebouwd. Maar wat hij ook doet, hij is freelance sloper en omdat hij daar heel goed in is heeft hij een bedrijfje in het buitenland geholpen om een touringbus om te bouwen tot camper. Of caravan. Helemaal mooi maken met alles erop en eraan, dat is heel leuk, je haalt stof van de markt en je maakt gordijntjes en als je een beetje handig bent dan doe je de stofering zelf met stoffen en zo heeft hij dat zo gemaakt. En bij hem kan je ook helemaal stap voor stap zien hoe hij dat gedaan heeft.

Emma: Ja ook hoe het eruit moet eerst.

Marieke: Ja, hoe alles eruit zag eerst. Dat heeft hij ook. Dat is heel leuk om te zien, alleen het motorische gedeelte dat kon hij dan niet zelf dat heeft hij bij een vrachtwagenbedrijf gedaan. Wat hij ook heeft is, water, vanuit de regen, daar spoelt hij dan ook het toilet mee.

Emma: Oh gewoon het grijze water!

Marieke: Ja, om het toch nog een beetje groen te houden. En hij heeft dat heel leuk gedaan daarmee. Want jij wil eigenlijk dingen weten, wat je dan kan gebruiken, als deze eruit gaat wat wil je daarin doen om het bijvoorbeeld weer opnieuw te maken?

Emma: Ja bijvoorbeeld, maar ook waar gaat het mis, het gaat nu bijvoorbeeld mis bij standaardisatie want alles is anders bij elk merk en elk jaar. Dus je kunt bijvoorbeeld ook niet zeggen: ik heb precies deze nieuw gekocht want dan is het niet uitwisselbaar. Dus als ik weet wat er allemaal mis gaat dan kan ik zeggen: aha! Dit is wat we moeten doen.

Marieke: Dus inderdaad, probeer campers te maken met allemaal dezelfde maten kastjes.

Emma: Ja inderdaad!

Marieke: Allemaal 60 x 60 van de ikea.

Emma: Ja dat eigenlijk wel, of dat je bijvoorbeeld tegen de muren van die standaard gaatjes doet waar je zelf je plankjes doet. Dan word het dus ook makkelijk, als je nu een klein koelkastje hebt en je wil een grotere dan haal je een plakje eruit en dan

plaats je die wat hoger.

Marieke: Oh ja ja, dan zet je er een grotere koelkast. Ja inderdaad, dat soort dingen maar ook met gordijnrails en dergelijke, andere leuke kleur gordijnen. Mijn gordijnen zijn vies, makkelijk vervagen.

Emma: Ja en zo denk ik dat er verschillende stappen zijn. Je vader vertelde net ook al dat er nieuwe kussens worden gemaakt, dat is een al een stap, maar dat kan alleen doordat de kussens los zitten. Eigenlijk is het ook wel een beetje stom dat al die kussens een ander formaat hebben, wat wel begrijpelijk is, maar dan kan je dus niet zeggen: "ik koop van de nieuwste caravan alleen de kussens."

Marieke: Nee dat past dan net niet. Wat wel heel veel mensen doen, en wat ook dat bedrijfje doet, is oude kussens, oude stoelen hebben ze opnieuw laten bekleden bij stoelmatter polyservice. Die kan dat heel mooi maken want wat je ook doet, je slaapt niet zo snel op iemands matras waar iemand vies op heeft geslapen.

Emma: Ja als iemand er al 20 jaar op geslapen heeft is het tijd voor een nieuwe.

Marieke: Ja en hun maken van matrasstof maken ze gewoon op maat. Wordt alles gewoon op maat gemaakt. En dat is, dan heb je gelijk een frisse camper ook weer.

Emma: Ja en dat voelt hij ook direct als nieuwer, dan gaat hij ook weer langer mee. Dit is ook gewoon een kwestie van onderhoud.

Marieke: Ja zeker, en dat is echt wel een dingetje dat daarmee te maken heeft. Dat mensen ook echt hun huisje eigenlijk, want het is gewoon je huis.

Emma: Ja het is een huis op wielen.

Marieke: Ja een huis op wielen. En mensen maken het zo leuk en zo mooi als ze maar willen. En, een eigen matje erin een pannelapje onder je ding dat soort dingen. Custom made gordijntjes weet ik het wat allemaal.

Emma: En wat bijvoorbeeld ook een beetje lastig is, vocht is altijd een probleem.

Daar probeert iedereen wat op te verzinnen, maar nog steeds: vocht is een probleem. Maar als het dus eenmaal in dat hout zit dan kan je nu niet zeggen dat je je bankstel eruit haalt en een nieuwe erin zet.

Marieke: Nee dan moet je hem helemaal op maat maken, dan moet je zelf. Dan moet je hem op maat laten maken of zelf maken. Zoals inderdaad wat hij had gedaan. Het is toch ook vaak dat je met andere dingetjes met kastjes en dergelijke dat je dan toch aan de maat moet voldoen van de camper zelf. Je moet gewoon, daarin. En rammelen natuurlijk! Heel veel dingen rammelen natuurlijk dus daar moet je ook wel mee uitkijken dat je alles goed vastzet. Dat je alles goed doet.

Emma: Idealiter zou een caravan of camperbedrijf nog maar een omhulsel maken en dat dat per jaar nieuwe meubels kan kopen, maar dan houd je hetzelfde omhulsel en dan past het er ook in.

Marieke: Ja precies, dat zou mooi zijn. Net als dat je een oude mini koopt dan heb je, mini bedrijf en dan kan je alleen, je kan zelfs het ijzeren gedeelte omzetten. Wat ze ook vaak doen, wij kregen een telefoontje van een sloopbedrijf hier in nooddorp en die hadden vanuit de brand hadden ze campers gekregen. Daar worden dan ook spullen uitgehaald zo van joh heb je nog interesse in een bumper, in een dat, in een raampje, in een luikje. Ja. Maar wij hadden op dat moment niets nodig maar dat word dan ook zo gedaan. Dus er zijn ook wel campers die helemaal verrot zijn, die worden dan naar de sloop gebracht en uit elkaar gehaald.

Emma: dat doen ze dus ook voor caravans. Dus dan is het omhulsel verrot, dat is dan met vocht en dat ruik je ook. Alles is heel vies. Maar dan halen ze de raampjes eruit. Dan proberen ze ook heel veel nog te redden, zodat als jij je eigen caravan uit

1990 kapot hebt daar nog een vervangend raam voor is. Ze proberen dat te recyclen. Dit opzich wel een systeem dat bestaat en al redelijk in orde is.

Marieke: Ja Willemsen in Pijnacker, ken je dat?

Emma: Ja die doen vooral nieuwere caravans. Wat het vooral ook is, is dat niet alles uit elkaar te halen is.

Marieke: Ja het breekt af.

Emma: Ja, dus stel je zou er een nieuw bankstel in laten zetten en je kan dat op maat laten maken dan moet je door heel veel hoepels springen. Maar je kan niet het oude bankstel in zijn geheel eruit krijgen.

Marieke: Nee dan trek je ook het hele vloertje kapot en wat eronder zit.

Emma: Dus bij het vervangen van een bankje moet je veel meer vervangen dan alleen het bankje.

Marieke: Ik weet niet of je wel eens gehoord hebt van een soort spul wat ze in de vloer spuiten, echt injecteren? Een soort spuit met een naald, en dan maak je de vloer weerhard. Trangit heet dat. Dat word eigenlijk, zodra de vloer echt rot is, dan word de vloer ingespoten met Trangit en dan, dat is een vloerverharder.

Emma: Ja het is een expantieschuim.

Marieke: Ja! En wat wij ook wel eens hebben, je hebt bijvoorbeeld van die douchebakken. Die zijn gekrakt. En nu heeft mijn vader een mooie oplossing gevonden en dat is vloevloer. Dat is een soort polyester wat er in die bak gegoten word en dan word het weer een heel mooi vloertje. Het word dan niet meer helemaal met die noppies maar wel dat je er weer op kan gaan staan. En wat ook mooi is, vorige keer hadden we een wielkast die kapot was en die hebben we toen naar een bedrijf gebracht en die maakt ook polyester doppen en ook bakken voor de tuinderij en hij heeft hem een beetje als een soort mal gebruikt en daar heeft hij dat zo gedaan en dan hebben we weer een helemaal mooi nieuw wielkast ding. Zo kan je ook wel weer dingen opknappen.

Emma: Ja opknappen is sowieso een goed idee. Dat is de eerste stap. Als je de wielkast kan vervangen dan is de levensduur van de rest van de caravan ook langer.

Marieke: Ja want dan heb je wel dat de veiligheid dat de steenslag niet tegen de rest aan knalt.

Emma: ja en ik heb nu soms het gevoel dat het lastig word gemaakt door de fabrikanten.

Marieke: Ja kan niet meer besteld worden. Koop maar een hele nieuwe set.

Emma: Terwijl je eigenlijk alleen maar een rubbertje wil.

Marieke: Je onder andere ja, en dat heb je met het motorische en technische heb je dat natuurlijk wel omdat het heel veel fiats en transit zijn en dan heb je al die onderdelen kan vervangen maar zodra het camper gerelateerd word dan word het een spinsel. En lastig gemaakt. Bestel tijd enzo.

Emma: Dat een tafelblad dan opeens 1.100 euro kost. Dat is in het echte leven ook niet.

Marieke: Nee, had mijn vader niet verteld dat hij een tafelblad weer helemaal. Iemand had een, iemand had een ding uit het kastje laten vallen en toen zat er zo'n put in. Dus mijn vader had een soort spul die dan dat gat gevuld. En dat heeft hij een verfdoozjes en dan gaat hij lekker mengen en lekker spettertjes maken dan heeft hij de tafel weer helemaal zoals vanouds gemaakt. Heeft hij dat zo met het gat weer helemaal gerepareerd zo. Kleedje erover niets te zien.

Emma: Dat dan nodig is, is eigenlijk een beetje bizar.

Marieke: Dat er wat op valt dat er meteen zo'n gat in zit.

Emma: Dat ook ja! Maar dat je niet kan bellen en kan zeggen ik wil eigenlijk alleen dit onderdeel.

Marieke: Ja dat je alleen het tafelblad of alleen het bovenste gedeelte dat je een soort kliksysteem hebt. Wat het gebeurd echt vaak dat iemand iets uit het kastje laat flikkeren en er een gat in maakt. Of zo'n glasplaatje waar dan een gasstelletje onder zit, knalt ook altijd kapot. Dat kan ook gewoon zo kapot knallen omdat iemand er iets op laat vallen. Moet je echt heel voorzichtig mee zijn.

Emma: Dat is ook wel een beetje gek, je zou verwachten dat alles in een camper enigszins wat hufferprover is dan ...

Marieke: Ja zeker, maar ze werken toch heel veel met een soort glas. Veiligheidsglas dat dan in allerlei stukjes barst als er wat opvalt maar het is natuurlijk wel snel kapot als je er wat op laat vallen.

Emma: Eigenlijk slecht.

<intermezzo over Mariekes taken in het bedrijf die zeer variëren van boterhamen smeren, receptie en boekhouden en over de Bovag man, waar we graag uit eten gaan etc>

Vanaf 34:40

Marieke: Ik hoor het aan zijn stem als hij aan het afronden is.

Hans: Ja als ik ga schreeuwen

Emma: Ja heel erg bedankt voor het gesprek!

Hans: Sorry voor dit intemezzo. We hadden een klein foutje in de planning want we dacht eigenlijk dat je gister zou komen dus toen ging ik op het kaartje kijken en daar staat op vandaag, maar vandaag had ik hem ook over de vloer. Maar dat is gelukkig allemaal goed gegaan. Zijn er specifieke dingen die je wilt weten. Je zal ongetwijfeld iets in je hoofd hebben wat je graag wil weten.

Emma: Nou wat ik denk is dat de hele industrie richting standarisatie zou moeten gaan. Dat moet ergens beginnen.

Hans: Ja dat moet ergens aanvang nemen.

Emma: En ook, hoe ik het me nu voor me zou zien, is dat je nog wel verschillende buitenkanten hebt maar dat de binnenkant nog verschillende dingen voor worden gemaakt.

Hans: Modulair.

Emma: Ja, en dat is een beetje lastig van het gemiddelde Ikea meubel en de bevestiging in een camper is wel een verschil dus als je dit zo hoort: Maak het zo vast. Anders maak ik overal gaten en dan kan je alles overal bevestigen.

Hans: Ja dan de bouwwijze aangepast moeten worden dus de wijze waarop een module gehangen word of gemonteerd word zou op een aluminium rails moeten komen. Zoiets dergelijks.

Emma: Ja daar dacht ik ook aan, en dan schuif je een nieuw onderdeel erop en een oude eraf.

Hans: Ja of haken. Inhaken en dan borgen aan de onderkant. Zoiets, want als je ziet hoe een kastje eruit ziet. Ik heb daar wel een kastje staan als je het leuk vind kan ik het wel laten zien. Maar dat is gewoon een houten kastje, het is niet dat daar bevestigingsmiddelen aanzitten of dat je weet hoe, dat het allemaal, je had vroeger als je keukenkastje ging maken dan had je een lat en dan keping in gemaakt en dan ging dat aan de muur en daar kwam je kastje aan en dan ging dat zo hop erop en dan boorde je hem hier vast en dan hing die.

Emma: Ja dat is nog steeds bij de Ikea

Hans: Zulk soort dingen word niet in campeerautos gebruikt. Al zou het zoiets al maar zijn dan zou het makkelijker zijn.

Emma: Ja want dan kan je hem ook losmaken.

Hans: Ja je kan haken en dan borgen eraan. Met aluminium frames met om de zoveel, waar mogelijk, want je hebt natuurlijk heel wat ramen in zo'n ding zitten als je daar aluminium strips zou maken met een slot gat erin dus een gat met een sleuf. Dus erin en dan naar beneden dan hangt ie natuurlijk. En dan hangt hij goed ook.

Emma: Nou dus dat soort richtingen. Ik zit een beetje die kant op. Dan moet wel de stap worden gemaakt dat je de buitenkant niet meer de hele tijd gaat aanpassen. Of dat over 20 jaar, je in je huidige camper een heel nieuw muurtje kan zetten met de nieuwe features. Je weet niet wat er gaat gebeuren.

Hans: Of dat je zo'n wagen koop met enclove omdat je je jonge kinderen hebt, dan gaan die kinderen, die zijn dan 17 en die zeggen we gaan naar Marbella toe, ik wil niet meer. En dat je daar dan andere invullingen aan kan geven.

Emma: Juist, en in heel veel caravans en dingen word een douche gemaakt. Word eigenlijk niet zo veel gebruikt behalve door mensen met jongen kindjes. Maar als je twee volwassenen bent en je gaat altijd naar de camping dan hoef je dat douchen helemaal niet. Daar kan je dus ook wat anders neerzetten. Daar kan je ook een kledingrek neerzetten, dan kan je ook zeggen: dit muurtje eruit nieuw muurtje erin.

Hans: Ja ja, daar zit wel wat in. Maar bij een campeerauto daar heb je vaak een natte cel inzitten. Daar zit dan ook het thetford toilet in gemonteerd, staat op een kunststof plaat en daar zijn dan de wanden opgezet. Dus je hebt een kunststof bak en daar zijn dan de wanden op gezet, dat is dan ook afgekit. Waterdicht. Word dat ding ouder dan treden de weekmakers uit het kunststof, word het bros, worden de heren wat zwaarder, trappen ze door die bak heen. Dan krijg een bak, die krijgt een krak, dan moet je die bak gaan vervangen maar dan moet je al die wanden eruit halen en dat is ook een dingetje. En wij maken nu, je zou zeggen doe een nieuwe bak, we hebben daar nu ook zo'n dingetje staan. Ben je wel eens in zo'n fabriek geweest?

Emma: Nee. Corona.

Hans: Oh dat is jammer, want dat zou heel erg leuk zijn. Hoe dat gemaakt word, ik zal je dadelijk even wat laten zien over douchebak en hoe wij dan de keuze maken het is een oudere campeerauto we doen er niet een nieuwe douchebak in maar we vullen hem met twee componenten kunststof en doen we een gietvloer erin zetten. Daar heb ik er nu ook een van staan, zijn we nu mee bezig eigenlijk. En kijk, die vloeren moeten allemaal ondersteunt worden en als je zegt ik haal die natte cel eruit. Een caravan of een campeerauto, een camper reist meer natuurlijk, die reiden van hot naar her en die stoppen ergens en die stoppen ook op punten waar geen faciliteiten zijn zoals een douche. Daarom zal je bijna altijd een toilet en een douchegelegenheid moeten hebben in een campeerauto, de tijd dat douchegelegenheden niet meer in campeerautos zitten, ik denk dat dat nog wel even gaat duren. In caravans zou dat nog wel een goede optie zijn.

Emma: Wat het vooral is, idealiter, je koop vandaag iets voor de behoeftes van vandaag. Je kijkt wel een beetje vooruit want je snap dat de kinderen die je vandaag hebt over een jaar een jaar ouder zijn. Je kunt een beetje vooruit kijken, maar je weet niet echt hoe het gaat veranderen en hoe je behoeftes veranderen. Eigenlijk

zou je willen dat je je caravan mee kan laten bewegen met wat je nodig hebt.

Ook bijvoorbeeld, een koelkastje en een verwarming. Met een groter gezin zou je misschien een grotere koelkast willen hebben.

Hans: Bij kampeerauto's kan dat vaak wel hoor. Een koelkast, een ijskast, van een kampeerauto, doorgaans gaat die een jaar of 12 mee. Zeg, zo ongeveer. Korter dan de auto. Dus dan moet er een keer een vervanging plaatsvinden. En dan heb je bedrijven zoals domestic en thetford, dat zijn de spelers op de markt, die bieden dan koelkasten aan, en die moeten wel aan de nis, de nismaat voldoen. En die gaan we dan monteren. En het is dan zo, de mensen schrikken zich helemaal rot wat zo'n ding kost want als je naar de mediamarkt gaat dan ben je voor 200 euro klaar maar met een koelkast met een kampeerauto dan heb 1.100 euro is helemaal niet zo gek hoor.

Emma: En dan heb je een tafelmodel koelkast!

Hans: Ja ja precies, maar dat komt natuurlijk omdat hij op 12 Volt, 230 en gas geschikt is. En dan is natuurlijk ook geen massaproduct. Het is geen stampproduct van maak er 10.000 per jaar van bij wijze van.

Emma: Ja dat klopt. Die nisbreedte dat zal thetford wel enigszins gelijk houden omdat zij ook wel weten dat die koelkast een keer vervangen moet worden.

Hans: Ja 53, 52, 53 is dan redelijk.

Emma: Ja dus dan kan dan wel, maar wat als ik een stoomoven in mijn caravan wil?

Hans: Ja dan moet er een plek zijn waar die dan moet komen. Want een stoomoven is natuurlijk, je noemt wat, noem zelfs maar een magnetron want kampeerauto's met een magnetron die zijn er niet veel hoor. Want je kan niet, een magnetron erin zetten, want je hebt er eigenlijk helemaal niets aan want omdat je geen 230 volt hebt tenzij je walstroom hebt, tenzij je op een camping staat. Maar als je vrijstaat, dan heb je niets aan een magnetron. Ik kom ze wel tegen die magnetrons, en dat zijn gewoon Blokker magnetronnetjes. die gebruiken ze dan, maar die kan je alleen gebruiken als je bij de camping staat. En dan zeg je nou, dan zetten we er een omvormer in, dat doen we ook, dan maak je van 12 volt 230 volt, maar dan heb je zo'n capaciteit omvormer nodig en ook zo'n capaciteit accu weer.

Emma: Ja en ook veel meer gewicht.

Hans: Veel meer gewicht want een accu, heel veel mensen willen zo'n espresso apparaat.

Emma: Ja inderdaad.

<intermezzo telefoongesprek hans>

Hans: willen ze een nespresso apparaat, dat apparaat trekt 1200 wat dus een piekspanning van 2000 wat, dus je moet een hele grote omvormer hebben, dan koop je een omvormer van 3000 watt met een piek van 4000 watt. Die accu's die erin zitten zijn 80 ampere, dus aan 1 acuu'tje van 80 ampere heb je niets aan dus je moet twee accu's erbij hebben dus dat word echt een batterypack van dattum. En dan kan je nog, dan is het nog zo, dat je maar één kopje koffie kan zetten en dat je dan weer zonnepanelen moet hebben dat ze weer wat opgepiept worden die accu's en dan kan je je tweede bakkie zetten. Dus dat is, zo ver zijn we nog niet hoor, net als met lithium batterijen. Dat is nu nieuw en vers zegmaar. Nou dat, ik sta er van te kijken zo'n lithium batterij, zo'n ding, je tilt hem met je pink op het is net een dummy zo'n showroom model. Het schijnt toch wel te voldoen, maar daar lopen wij nu tegen aan, dat is terzijde hoor, wij lopen nu tegen het punt aan dat de wijze van laden van een lithiumbatterij is wezenlijk anders dan de wijze van laden van een

gezuurde batterij of een gel batterij. Die moet op een andere wijze geladen worden die lithiumbatterij. Dus men denkt dan van we kopen een lithiumbatterij, en dat ding moet helemaal geprogrammeerd worden die batterij, en hij moet op een andere wijze geladen worden. Dus hij kan niet zomaar even simpel vanuit de dynamo, de dynamo van de auto, naar die lithiumbatterij, kan je niet zo maar even een draadje op aansluiten en zeggen van laden maar jongens. Dat doet hij niet, daar raakt de boel ook van in de stress enzo. Dus daar is in de toekomst nog wel heel veel aan te winnen en die batterij packs van lithiumbatterijen dat zou ideaal zijn als dat gaat komen. Dat is licht en makkelijk te handelen, dus dat is wel de grote verandering die nu in kampeerauto's gaat plaatsvinden. En als je zegt, ik wil een, een stoomoven in mijn caravan. Ja dat zou helemaal geen rare optie zijn, totaal niet.

Emma: Uiteindelijk is er maar zoveel upgradable aan een caravan nu.

Hans: Ja er zijn ook heel veel beperkingen he, ja je moet natuurlijk niet in de beperkingen denken dat is ook niet goed. Maar er zijn wel best wel wat beren op de weg.

Emma: Ook qua bereidheid, en gewicht en kosten. Iedereen heeft het al die tijd al zo gedaan dus waarom zouden we dat veranderen?

Hans: Ja nou ja dat is ook een punt. Ik kom uit de automotieve Ford wereld. Ik sta er versteld van, toen ik in die kampeerauto's begon, hoe ze in elkaar gestoken waren. Zo slordig en zo niet.

Emma: Het is nog niet geoptimaliseerd.

Hans: Nee totaal niet, het is totaal de willekeur van degene die hem in elkaar zet, in de fabriek in elkaar staat te prutten dan dat er structuur in zit.

Emma: Auto's zijn echt geoptimaliseerd, doen ze al jaren, echt over nagedacht. Als er een model is, dan word die vaker uitgebracht en dat steeds een beetje beter.

Hans: Dat allemaal, dat evolueert enorm en dat heb je met kampeerauto's niet. Waar ik heel erg van stond te kijken dat een wijze van webcad zoals adria dat heeft en knaus dat heeft, dat dat niet bestond, dat bestond nog niet toen, toen wij hier begonnen toen was dat er niet. Toen was je afhankelijk van microfiches. En dan, ken je dat?

Emma: Nee...

Hans: Nou microfiches zijn een soort foto's voor negatieven, en die gaan in een viewuwer en dan moet je zo draaien, en zo was het in de automotieve ook altijd tot iemand zei: dit is niet handig. Dit gaan we gewoon op internet zetten, gelukkig heeft adria dat heel mooi in zijn webcad zitten. Nou van sommige bouwjaren hoor want het is niet allesomvattend, en dan kan je heel mooi een exploded view van het meubilair krijgen en een exploded view van het, van de zijkant of wat dan ook. En dat staat nog in de kinderschoenen in mijn ogen, het is aan het groeien.

Emma: Ja dat kan heel goed, dat is met meer. Het word ook steeds gebruikelijker dat je verteld dat je als bedrijf verteld waar alles vandaan komt. Waarom zou je dat ook niet doen? Maar in de caravanwereld zegt niemand dat. Iedereen houdt alles dicht en dat stopt ook een beetje de vooruitgang.

Hans: Nee, nee, en als je gaat delen. Dan kan iedereen vooruit. Maar nee het is heel erg eigen, dat ben ik heel erg met je eens dat merk je in de wijze, in de site van hymer kan ik onderdelen bekijken op basis van het opbouwnummer of het chassis nummer. Ik kan in knaus kijken. Ik kan in Adria kijken. En dan westfalia, dat is een beetje een mercedes ding, en dan kan ik via westfalia kan ik dus niet zelf kijken. Maar dan ga ik naar de mercedesdealer, en dan de mercedesdealer die kan wel in

zijn programma. Als het op basis van mercedes is dan. En dan kan ik wel kijken. Dan kan ik meekijken met hun of hun sturen een screenshot. Dus dat is dan. MAar andere merken, rollar team chasson, dat heb ik allemaal niet, dan ben ik afhankelijk van de importeur. En dan heb ik overal wel mijn kanalen en mijn aanspreekpunten. Emma: Ja dat is dus een beetje slecht, jij bent een wandelende encyclopedie geworden en dat is een beetje onzin.

Hans: Ja het is niet nodig, het hoeft niet.

Emma: Terwijl ze ook alles open zouden kunnen maken en dan daar een winstgevend model van kunnen maken. Als hun tafelbladen te vinden zijn en niet 1.100 euro zou je bij hun kopen.

Hans: Want dat tafelblad gaat stuk he, dan valt er een dingetje uit het kastje. Deuk erin. Weet je wat ik dan ga doen, die ga ik opvullen, die vul ik op met wax en dan met mijn kleurdoos ga ik zitten en dan, want ik kan dat goed, ik vind dat leuk, eerst ga ik polijsten, dan smelt ik er wax in die een beetje die kleur heeft en dan ga ik met mijn pallet, en dat ga ik zitten mengen en maak ik die stippies erop en dan ben ik heel trots dat het gat weg is.

Emma: Dat is een helemaal top, maar een beetje onzin.

Hans: Natuurlijk is het onzin als je die uren rekent is niet normaal. Ik heb een werkplaats, een uurloon van 79,85 excl btw wat ik hier reken. Ik ben geen uur, ben veel langer bezig.

Emma: Dus als een tafelblad een normale prijs heeft dan bestel jij er alvast 20. En als alle tafelbladen hetzelfde zijn dan koop je er 100.

Hans: Juist. en men koopt ook veel makkelijk een tafelblad dan, dan als ik zeg het kost 1100 euro. Dan leggen ze er een tafelkleed op, dan is die butts niet meer zo erg. Of bekledingshoezen. Moet je nou eens kijken hoe die bekleding eruit ziet in die wagen. Ja in die tijd was dat wat. Maar nu niet meer. Als je nou zo'n wagen koopt dan ziet het er toch niet uit dan denk je toch ik zou wel nieuwe hoezen willen. Maar die zijn niet leverbaar.

Emma: Ja dan zouden ze het Ikea principe moeten doen. Daar koop je de bank en de hoes los.

Hans: Maar dat bestaat niet hoor. Toevallig ben ik me aan het verdiepen in een Ford, om een andere personenauto aan te schaffen en daar is de bekleding afritsbaar gewoon, van de voorstoelen. Top! Er zit er een met ijsje te knoeien die kleinkinderen en dan krijgen ze eerst een knal voor de kop en dan haal je de hoes eraf. Maar dat is slim. Dat heb ik nog niet gezien.

Emma: En zeker in zo'n camper is dat ideaal omdat het ook een leefruimte is en het gaat sneller mis dan.

Hans: Zeker met als er kindertjes aan te pas, ook oude knakkers laten ook wel eens wat vallen en dan heb je toch een lelijke vlek in je bekleding. En de bekleding word ook steeds lichter, als je ziet, beige, en van dat soort suède, dat ziet er mooi uit, maar potverdorie als je daar wat op laat vallen dan heb je het aan de hand hoor. En het allemaal licht van kleur dus dat word dan wel smoetzig hoor.

Emma: Ja Adria zou gewoon een reinigs-set en een nieuwe lichte hoes kunnen verkopen. Dan hoeft je niet de hele kussens te vervangen maar alleen de hoes.

Hans: Nee klopt en die wagen blijft meer waarde houden. Nou behouden kampeerauto's sowieso wel behoorlijk waarde.

Emma: Anders zou je zo'n muur ook niet vervangen. Dat is dus een beetje de richting nu, en dan vooral ook een focus op het interieur. Het exterieur, het frame,

daarvan is het grote probleem natuurlijk water en vocht en slecht onderhoud.

Mensen weten dat het een probleem is maar ze doen er niet altijd wat aan.

Hans: Wij doen dus het onderhoud in kampeerauto's, en wij adviseren altijd voor de veiligheid gas-afpersen en een vochtmeting. Want je kan vocht indringing hebben, dat kan al twee jaar erin zitten en voordat je het gaat zien, en dan ga je het zien maar dan blijkt dat het hele plafond rot is. Dat het niet meer te doen is. En dan moet enorme reparaties. Ook met die elcove, dus daar, die hoeklijsten, daar zit een kit achter, dan gaat dat wijken, dat hebben ze niet in de gaten dan rijden ze door. Dan is die hele kop, die kan je dan zo beetpakken en dan kan je hem zo <Hans legt hier met zijn hele lichaam uit hoe dat dan gaat> kan je hem, dan moet hij helemaal bloot gemaakt, dan moet hij helemaal geschilderd worden, dan moet er allemaal nieuw houtwerk in gemaakt worden. Kost een partij geld, is niet normaal. En mensen vol trots vertellen: kijk eens wat ik gekocht heb. Nou dan lopen we erom heen en dan is het van wist je dat dat en dat aan de hand is. Dat is, we raden iedereen aan om echt regelmatig die vochtmeting te doen. En dan ja, dakluik eruit, afkitten, raam eruit, en afkitten en dan krijg je, terzijde, leveranciers over de vloer. Kijk ik heb nieuwe kit om de ramen te doen, ja maar ik kan wel aan die nieuwe kit van jou gaan beginnen maar ik ben nou tevreden met wat ik heb en over drie jaar zit die kit die ik nu heb zit nog goed maar wie zegt dat wat je nou hebt, dat weet ik niet. Dus we zijn heel erg behoudend in het gebruik van materialen omdat we daarmee leergeld betaald hebben, en daarmee weten we dondersgoed als we dit gebruiken dan gaat het goed en als we dat gebruiken dan gaat het niet goed. En dan houd je je daaraan vast. Er is ook wel wat die kisten betreft veel innovatie enzo want vroeger deden we zonnepanelen monteren, kisten en schroeven maar dat doen we niet meer, we lijmen, nu lijmen we het hele circus gewoon vast. Daar hebben we zo veel vertrouwen in, schotels, zonnepanelen, we lijmen de hele santemekraam.

Emma: Ja dus bij het exterieur zijn dus veel stappen gezet om dat te optimaliseren en dan loopt het spaak op onderhoud. Dus die verbeterstap ligt bij de eigenaars.

Hans: Daarom stelt iedereen ook dat, een keer per jaar moet je een vochtmeting laten doen.

Emma: Anders heb je dan ook geen garantie meer.

Hans: En anders verval de garantie natuurlijk.

Emma: Dus als ze het frame hetzelfde kunnen houden en rekening houden met aerodynamica etc.

Hans: Ja dat is natuurlijk heel wat anders, kijk rijden met, heb je wel eens gereden met een kampeerauto?

Emma: Nee

Hans: Hier rijd je mee, hiermee, als je hiermee rijd met zoiets <hans wijst naar een oudere kampeerauto> en je rijd dan voel je de wind, die voel je gaan en je moet je vasthouden en je voelt alles zo bewegen en dat komt doordat die alcove erop zit. Deze <Hans wijst naar een nieuwer model kampeerauto> is natuurlijk veel gestroomlijnder. Die, dit is een oud type motor dat is een nieuw type motor, deze heeft kleine wielen, deze heeft grote wielletjes. Dus dit rijd als een personenauto, je zit erop en je schrikt ervan hoe hard of dat hij gaat. Je kant gewoon met de hele stroom 130 140 rijden en dan rijd hij nog goed. Zonder dat je met handen en voeten denkt als het maar goed gaat allemaal. He dat is met zo'n wagen natuurlijk wel. Maar over caravans weet ik niet zo veel te vertellen want ik ben nog nooit met een

caravan weg geweest en ik heb nog nooit, nog nooit met een caravan gereden. Of nouja, wel, maar dat was even hierheen brengen even daarheen brengen. Een reis met een caravan heb ik nog nooit gedaan.

Emma: Opzich is het interieur wel hetzelfde

Hans: Ja constructief, de wijze van opbouw is hetzelfde.

Emma: Dus als je in een camper een koelkast moeilijk eruit haalt dan haal je het in een caravan niet makkelijker eruit.

Hans: Dus ja precies. Maar als je een koelkast eruit halen, die gaat niet door de deur hierzo. Die moet door de voordeur. Maar kijk, hoe dan ook we krijgen hem eruit en we krijgen hem erin want we zijn nogal vasthoudend hiero. En doorzettend. Dus dan gaan we echt oplossingen verzinnen. Zo'n stoel staat op een console, stoel eruit, console eruit en dan toch een dubbel deurs koelkast erin.

Emma: Opzich schroeven ze ook wel veel en dan kan je het dus ook losmaken maar dan moet je er wel bij kunnen.

Hans: Zulk soort dingen, daar loop je tegenaan, als je echt een meubel moet verwijderen dus als je echt de bovenkastjes. Dat zijn geen grappen hoor echt niet.

Emma: Ja in 1990 hebben ze het vanaf de buitenkant geschroefd en daarna pas de bekleding eroverheen gedaan. Dat krijg je dus nooit meer los.

Hans: Zo gebeurt het, als je de verwarming, waar ze dat nu netjes wegwerken, helemaal weggewerkt weg getimmerd die kan je als technicus niet bijkomen. Bij de nieuwe is dat wel beter hoor.

Emma: Er is ook een bedrijf dat rollen maakt met verwarming en dat kan je ook in muren plaatsen. Zij zeggen dat het ook in campers en caravans word gebruikt.

Hans: Nou, ik heb wel mensen, niet voor de want maar wel voor de vloer, dat er tapijten zijn die je op 220 230 aansluit en die zijn dan voor met name voor wintersport. Dan heb je dus een soort tapijt, een soort elektrische deken waar dan hitte doorheenloopt die dus voorzien van warmte en die warmte komt natuurlijk van onderaf en de kou komt ook van onderaf, op wintersport, en dan stijgt de warmte naar boven en dan kan je het wel goed comfortabel houden. Hoewel die ketels de Truma ketels, ook wel goed zijn hoor, ze zetten de warmte wel goed om en het kost je ook wel behoorlijk gas want het is natuurlijk een brander die erin zit. met een brander die zo groot is en die staat dan proee proee zo'n vlam te geven. Hij gebruikt wel behoorlijk wat gas als je hem op wintersport zou gaan, merendeel van de mensen gaat niet op wintersport merendeel gaat op zomervakantie. En heeft dan geen kachel nodig. Staat dan op een camping. Heeft geen warm water nodig, hoogstens om je handen te wassen of om de kleine af te spoelen of een afwassie te doen. Maar dan staat die ketel niet heel vaak aan.

Emma: Het gebeurt ook wel eens dat de ketel aan staat om de condensatie tegen de muren tegen te gaan.

Hans: Ja dat kan, omdat je natuurlijk, redelijk vochtig atmosfeer en je leeft erin en je slaapt erin en je ademt erin en dan moet je ventileren. Maar als het heel erg koud is dan gaan de ramen beslaan. Die zijramen zullen dus niet beslaan maar die wel, die grote enkelglas. Als iemand erin slaapt is het beslagen als de pest. En dan zie je dan aan dat ze erin liggen en niet goed ventileren, en de veiligheid van die verwarmingsketels daar ben ik wel tevreden over. Zit heel veel bewaking, omdat wij natuurlijk sleutelen aan die dingen zijn er heel veel bewakingsmomenten om te kijken dat er geen koolmonoxide in je kampeerauto kan komen. Dat is wel heel erg goed afgeschermd. Daar hoor je heel weinig narigheid over en de nieuwe type

ketels, verwarmingsketels hebben ook een die kunnen ook op diesel gaan. Dus dit type gaat gewoon op gas, maar er zijn ook die modellen zoals deze die ook op diesel gaan vanaf de dieseltank en ook 230 volt kunnen. Dat is ook wel erg mooi want als dan aan de kant staat ben je niet meer afhankelijk van het gas en dan kan je ook elektrische kookplaten die zijn er ook natuurlijk. Maar als je dan gaat koken moet je wel 230 hebben natuurlijk.

Emma: Je kan dan niet van de weg af.

Hans: Nee maar de wijze van innovaties de laatste jaren vind ik wel dat de kampeerauto bouwers beter bezig zijn. Ik vind wel dat ze dan een slag aan het slaan zijn. Ook dat oubollige, zoals Hymer heel lang gehad heeft, dat is nu een beetje aan het vertrekken en het neigt ook een beetje naar botenbouw toe, botenbouw hebben ook allemaal van die glanzende houten randjes met chromen lijstjes, aluminium lijstjes erin zoals bij die wagen dan. En dat is heel chique. Zelfde als bij deze, zit het bed in het plafond dus dat het bed uit het plafond zakt, vind ik ook een goede optie eigenlijk. Kastjes zakken mee en het hele circus. Technologie die daar achter zit, want dan gebeurt er iets met de stroom, stroom dippie ofzo en dan krijg je een probleem dat hij niet meer op zijn basis afstelling zit en dan stopt hij op deze hoogte of op die hoogte en dan moeten er weer allemaal configuraties plaatsvinden om dat ding normaal naar boven en naar beneden te kunnen krijgen. Maar dat is ons probleem, wij moeten, door goed de documentatie bij te houden ons producten eigen maken. We moeten natuurlijk steeds moderner, wij gaan niet op cursus voor hoe gaat het bed omhoog bij die wagen, wij gaan niet op cursus waarbij Adria van hoe haal je een kastje los zo werkt dat niet. Maar we gaan wel over bij Gimech een verhaal over de nieuwe type verwarmingsketels en de nieuwe types koelkasten. Daar doet Gimech wel heel erg actief cursus en bijscholing in verstrekken en dan gaat Ronald die is echt caravanmonteur z'n leven lang al en dan heb ik nog een jongen die gaan daar dan naartoe en die maken zich dat eigen. En met de technologie wat auto's betreft, de autotechnische kant dat houden we ook bij en die geven dan cursussen over nieuwe vormen van dieselinjecties en noem het maar op. En wijze van diagnose stellen dat gaat middels een 16 pins computer aansluiting en dan lezen we hem uit en dan hebben we uitleesapparatuur en daar zijn verschillende soorten in en daar kan je mee een diagnose stellen wat er autotechnisch aan de hand is. Maar ook met die Truma ketels die kan je ook uitlezen, dan kan je ook hup stekertje erin.

Emma: is dat een goede vooruitgang?

Hans: Ja dat vind ik wel een goede vooruitgang, dat vind ik een goede ontwikkeling. Dus in de oude types zoals deze kan je niet uitlezen. Die heeft niet zo'n seriële ingang maar die heeft het weer wel. Bij die moet je gewoon uitgaan van je gezond verstand en welke sturing. En dan kom je er wel achter maar met dat uitlezen van de computer van de ketel en koelkasten dat is wel een stap in de goede richting.

Emma: En als iemand hier komt, wat is dan het vervelendste om te moeten vervangen?

Hans: Het vervelendste om te vervangen dat is, ik denk dat dat, als je een koelkast moet vervangen en je weet niet de juiste maatvoering is niet leverbaar dan moet je second best en dan moet je ook gaan verbouwen en dan moet je plankjes weggaan halen en verplaatsen. Dat is het meest vervelende, daar gaan veel arbeidsuren inzitten. Dan heb je een koelkast van 1100 euro en dan heb je ook nog eens 600 euro aan arbeidsloon om dat ding erin te prakken. Dat is wel vervelend. En ik vind zelf

ook die regenwaterlekkages, dat is dan bouwtechnisch, vind ik ook erg vervelend want je doet iemand een offerte van ja ik denk daar 4 dagen mee bezig te zijn en je bent er 5 dagen mee bezig. Dan verreken je je je en dan mis je 1 arbeidsdag, 8 uur, 800 euro. Even snel gezegd, en dat gooi je er dan achter en dat vind ik dan wel weer zuur. Ook zuur voor die persoon, want ze kopen, stel men koopt aan, heeft die gekocht, wij gaan hem controleren, ja ik heb hem net gekocht, ja meneer weet u dat de bodem helemaal rot is achter die schot. Regenwater loopt langs die rand, die kitrand is niet goed, het water komt beneden, het loopt in die vloer, over zo'n breedte, over de hele lengte moet alles bloot gemaakt worden, alles eraf, moet het hout eruit gepelt worden moet er nieuw hout ingemaakt worden je bent zo 3 dagen bezig, echt. En dat is iets dat ik wel verveld vind. Ik vervang liever een luifel, een raam, een koelkast. Dingen die, pats pats pats dan weet je waar je aan toe bent. En weetje wat ook best wel veel voorkomt is dat de regelenheid een EBL, die regelt dus de aansturing van de verlichting, de koelkast, loopt de motor wel, loopt de motor niet, de lading van de huishoudaccu. En die EBL gaat stuk, dan is dat ook wel weer een probleempje. En wij huren iemand in, een electronicus, die is hier heel vaak en die repareert die dingen en ik zal dadelijk even daar laten zien hoe dat er uit ziet, dat moet je niet doorvertellen. (het was chaos red.) Hij bijt zich erin vast, en hij is echte electronicus dus hij doet op printplaat niveau die dingen repareren. Daar hebben wij veel geluk aan dat hij hier zo vaak is. En dat we daarmee iets kunnen bieden. Zelfde is met schotels, televisieschotels, dat is ook een ding niet normaal. Dat gesodemeter met join en kanal digital, die, daar hangt een satelliet in de lucht en die zendt uit. En dan gaan ze die kernvelden weer veranderen en dan moet die schotel weer op een iets andere stand gezet gaan worden en dat is ieder keer weer, en updates en updates en bij die schotel gaat het zus en bij die andere gaat het zo.

Emma: Weer geen standaardisatie

Hans: Nee totaal niet, en daar word ik gek van. Dus daar ben ik mee gestopt.

Emma: Dus eigenlijk word je gek van alles dat variabel is waar geen standaardisatie in is.

Hans: Met name elektronisch gezien op die schotels, nou ja een schotel monteren dat gaat wel maar dan heb je hem gemonteerd en dan doet ie het en dan zijn ze 14 dagen, twee maanden of een half jaar weg en dan komen ze terug met nee hij doet het niet. Hij doet het niet, nee de update moet erin gezet worden ja dat heb ik niet doorgekregen van kanal digital. Maar dan moet er weer een update ingedraaid worden en ben de ene wagen, merk schotel, gaat het zo en bij het andere merk gaat het zo dus bemoei me al niet meer met schotels, ik bemoei me alleen met de kampeerauto en dan met de name de techniek eigenlijk. En schotels, dat doet Egbert dan, die electronicus. Dus dat maakt het wel complex dan eigenlijk, kijk als er een lampje niet brand dan ga je zoeken en dan kom je erachter dat er een lampje kapot is nou simpel. Maar wel heb ook wel eens, linkerkant van de caravan doet t niet en de rechterkant doet t wel, ga je zoeken zoeken zoeken, en dan blijkt dat in de fabriek hebben ze een verbinding gemaakt, echt het is te gek voor woorden, zo door het plafond, en die hebben ze geschoten met van die vierkanten nieten, ze die schieten ze zo tik tik tik maar dan gaat het wel zo tak tak tak hup die draad zit vast, plaat erover en klaar. Wij meten, hier wel stroom daar geen stroom dan zit er tussen hier en daar, dan zit het tussen de bekleding, kom je er achter dat die nietjes dwars door de isolatie van de stroomdraad en dan gaat het werken en dan snijd ie door en dan kortsluiting. Wat een toestand. Nou dat zijn wel bijzondere dingen die je dan

tegenkomt.

Emma: Hoe komt dat!

Hans: Hoe hebben ze dat in godsnaam zo bedacht, niet normaal. Ik heb buiten op het terrein heb ik een airstream caravan staan, die zijn in Amerika gebouwd om op 130 volt te werken. Dat is daar de standaard, maar hij is in Nederland en degene waar, op de beurs, die pakt de stekker en die duwt hem erin, maar dat is 230 en dus poef zegt dat ding en de hele alle verbrand. Daar hebben we er heel veel werk aan gehad om dat om te bouwen naar 230. Allemaal nieuwe bedrading allemaal nieuwe lampen.

Emma: Is dat dan nog de moeite waard?

Hans: Hij heeft 11.000 euro betaald daarvoor, dus ik vond het wel de moeite waard.

Emma: Als het jou caravan was geweest, had je het dan gedaan?

Hans: Dan had ik het ook gedaan want dat ding is 50 60 duizend euro waard. Heel bijzonder ding is het niet normaal. We hebben er blauw parket ingelegd, helemaal glanzend, want het is van Era makelaars en de kleur is rood, knal blauw. Het is een makelaarspartij in Nederland en die gebruikt hem om op beurzen neer te zetten. Hij wilde ook nog een televisie erin hebben die hij zo naar buiten kon draaien maar hij moest nog eerst even bekomen van de schrik van 11.000 euro van dat ding opknappen. Hij wou ook polijsten en een dak airco erop, nieuwe ramen erin, echt heel leuk. Echt een hebbeding en zo'n ding blijft gewoon zijn waarde behouden maar dat is een feit. Daarom is het die investering ook waar. Die meneer die barst van het geld en heeft hem al jaren en hij wil hem gewoon niet kwijt, en ik geef hem gelijk ook. Maar als je bijvoorbeeld, mensen kopen een oude camper en die gaan hem opknappen. Met name jongen mensen die kopen een Mercedes 508808, dat is zo'n ME wagen. Zo'n oude brandweer wagen of een oude ME wagen, gaan ze timmeren en maken ze houtje touwtje maken ze een kampeerauto van. Maar die motor die maakt zo veel herrie, dat zijn meestal wagens uit 1985, en dat gaat horen en zien, maar het is een mate van lifestyle. Hun willen dat ding zo hebben, hun willen Europa door gaan reizen en dan timmeren ze de hele rotzooi in elkaar en dan gaan ze ermee op reis. Dat vind ik wel leuk, vind ik leuk dat ze dat doen, en wij doen dan de elektrische voorziening meestal en het auto technische deel. Ik vind het heel dapper dat ze dat doen en van die avonturiers zijn dat en dan met low budget proberen ze dat toch Europa door te crossen voor 1 of 2 jaar. Maar goed het is maar net wat je wil. Meestal kunstenaars, kunstzinnige types, of mensen die heel veel met yoga doen die een bepaalde mindfulness willen bereiken. Weet ik het veel. Ja waar doen ze het van. Ze is dan ook fotografe ook nog. En dan maakt ze fotos en fotoshoots en die verkopen ze dan weer, en daar komen ze dan mee rond. Dat is heel bijzonder hoe dat leven in elkaar steekt. Maar ja, de aard van klanten, ik kan niet over caravanklanten praten maar wel over campers, is heel divers, sommigen gebruiken hem heel veel, anderen die hebben er een maar gebruiken hem amper want ze hebben een arbeidzaam leven dus ze kunnen niet weg want ze moeten werken. Komen volgend jaar en dan hebben ze 3000 km gereden. Maar anderen die komen en dan hebben ze, dat is ook wel het leuke van het contact met je klanten, die stappen in en die rijden Scandinavië in en die rijden via Moermans helemaal, die komen een partij end weg die rijden gewoon 15.000 km in een ritje en die zijn overal geweest, in Rusland, Lapland ik heb er eentje gehad die is naar China geweest met een hele grote Iveco, soort vrachtwagencamper, in een groepsreis naar, liggen vechten met een paar Chinezen omdat de motor moest weer

gerepareerd worden en toen was hij gerepareerd en toen woude ze nog meer geld hebben. Echt, en dat was een oudere heer, maar ook echt een avonturier maar ook echt gewoon naar Peking toe. Dat is toch bizar. En dan foto's met erbij, heel fotoboek en dan had hij ook nog een vlog en dan keken we daarna van waar zat hij dan. En nou dan zat hij daar. Dat is zo leuk om te volgen. Dus ik weet van heel veel klanten hoe hun ervaringen zijn, maar ook hoe hun familiale toestanden zijn. Mensen met ziektes en met een gebrek enzovoorts en die toch op reis gaan. We weten heel veel van onze klanten, we hebben een heel groot klantenbestand. Heel groot, het is echt. Er zijn maar weinig bedrijven die alles onder een dak doen dus, camperdeel en autotechnisch deel want dat word meestal, word het campergedeelte word wel gedaan maar het autotechnisch deel daarvoor moet je maar naar de garage gaan. Daarvoor, hebben wij dan toch wel een goede business in. Zal je even een hoekje laten zien zo her en der?

Emma: Ja!

<rondleiding>

Hans: Hier als je erin stapt, dan zie je de vloer in de badkamer die hebben we dus met een epoxy behandeld omdat dat ding helemaal aan bakklappen getrapt was en dan moet er nog een tweede laag op en dan daarna komt er weer witte epoxy overheen om het weer netjes te maken dus dan ziet het er weer fris uit. Maar die wanden die staan dus op die bak dus je kan niet zo makkelijk zeggen we vervangen die bak even.

Emma: Ja dat is niet handig eigenlijk. Want hoe vaak gaat een wand kapot?

Hans: Een wand gaat alleen kapot als er een grote aanrijding is of als er een grote waterlekkage geweest is. Dus dan, die wand, daar gebeurd, het gebeurd amper dat we een wand vervangen. En vaak laten we de oude wand dan zitten maar zetten we er een stuk meubelplaat tegenaan omdat je ander zo vreselijk veel weghalen om bij die echte wand te komen dat het niet loont om dat te doen. Dan moet je heel het binnenwerk eruit slopen.

Emma: En hoe vaak gaat zo'n natte cel bak kapot?

Hans: Nou dat, dat gebeurd best wel vaak.

Emma: Dan zouden ze het eigenlijk andersom moeten opbouwen.

Hans: Kijk dit is nou zo'n complete bak. En als je nou ziet wat het materiaal is, dat is gewoon hartstikke, kijk je denk wel dat is wel stevig maar je moet hem goed ondersteunen aan de onderzijde maar als het ouder word. De vorm maakt het stijf en de opvang aan de onderkant maakt het stijf, en dan op een gegeven ogenblik. Constructief zou er een verstevigingplaat onder moeten zitten en goed aan de onderkant moeten zitten. Want als het ouder word dan word het bros en dan word het, dan kan je het zo breken.

<geklets over andere dingen, als je een onderdeel wil bestellen bij Hobby moet je het faxen want ze hebben geen e-mailadres>

Einde

M.2 Translations to English

Recording 1

Hans: It is possible that I will be called away immediately, but my daughter will also come and have a chat with me. Someone from Bovag is coming to carry out an audit to see whether we are working according to the bovag standards. That is the way it should be, that is the way it is with the Rdw. With the bovag, where we are therefore members, of the bovag, of two departments, one of mobile recreation and the other of car technology. Then once every three years, you are audited and looked at, there are cobwebs. And yes, they still hang there a bit, I can't quite get rid of them.

Emma: No, too high.

Hans: And we sell here. But that's not our core business. The sales we do here, used cars and those used cars are from our business relations. And those are cars that we know are good cars. Because there is, of course, an awful lot for sale here. At the moment, we have about six of them, and they are here, and everything outside is still to be repaired. That is not stock. Well, stock to work but not stock to sell.

Emma: Not stock to take out parts, for example.

Hans: No no. I have just bought a car, I have a car standing here in a fire. Berkel en Rodenrijs was a big fire three quarters of a year ago, and a lot of cars were damaged and I have a car that burned to the ground and yes, I bought a donor car for that and we are going to strip it and put it on the burned out, or yes, on the burned out nose

Emma: And is that possible?

Hans: Yes, it is possible, but you have to take the design of the car very much into account. Look at transferring the interior to your side. Can I tell you? We don't transfer the interiors, you can hardly ever buy a used motorhome that is completely disassembled, that the engine is twisted together and that you tell me there are no used fridges or used heaters. Maybe there are, but that is the sort of thing that is so small on offer. So this damage is mainly technical, i.e. the windscreen, the bumper, the whole front compartment has been burned and we are transferring all that. We are going to take all that apart and make new wires. You will then have bought a donor car and you will buy it for EUR 600, which is much cheaper than getting a car made of parts from a junkyard because it costs EUR 100 and that and that and in no time at all you will be over EUR 900. So that's why we bought the car and we are going to strip it and then eventually it will just go via the regular road and it will be transported to a junkyard.

Emma: Yeah, I spent a day at a junkyard

Hans: Here in the region?

Emma: At Zutphen

Hans: Yes here in the region is van Gilst in emergency village that is really a clean junkyard. Everything is clean and very nice when you come in. Beautiful, and behind that the car is stripped and what is not usable is transported to the iron and then they try to sell a lot of car components via the internet. And once they have a camping car and then they call me and stop by, come and have a look because I can see it because those cars are usually burned out because a camping car is not so often totally unloaded. When the side of the car is driven out, because with this one, well this one is still an older one, but if you drive out the side of the car and you have 25.000 euro damage then it will be repaired and a new side will go in. And that

makes it, it only goes completely loose when there is a fire. So if a car has been on fire, there is almost no reason for it to go into total loss. And then it also depends a bit on how big the fire was or where in the shed the car was parked. There were also cars near the van Gilze, but they were really burnt off, but that doesn't help me because I can't take out the fridge,

I can't take out the stove. So those Truma boilers that are in there are useful, you can still do something with them. Used fridges can still be used, but they were so damaged that they didn't work. The point of used parts of a camper that are really hard to get, if you have a broken sun window for example, such a plexiglass double-walled there are so many types. Then you go looking and you can no longer buy new ones, via Dometic or side, you can also see if you, Willemsen heirin painkiller, have you ever heard of it?

Emma: Yes, I've heard of them

Hans: They have a huge warehouse with lots of windows, so we get a look a like window from them. So in the Netherlands we do have a unique company when it comes to windows. If you look at the cushions, what if the cushions have sagged, that's what you get because motorhomes are of course much older than regular passenger cars.

Emma: Yes and also regular furniture

Hans: Yes. Yes. So then there are questions of where can I have my cushions upholstered? Where can I have the foam reinforced?

Emma: Yes, I can have new cushions made.

Hans: Yes, so there are a number of companies that do that here in the region. One of them is the phobia shop in Wieringen. They also make made-to-measure mattresses, for example, if we sell a car like this one that already has an old mattress and people say I want a new mattress in it. Well then we measure the measurements, we call it in and then a mattress is made. So that is nice, but buy a used table. So you have these folding tables so that you can make a bed out of them. Buying a used table top makes that more difficult. That's going to be another thing, you don't get that easy, so you have to buy a new tabletop. Then there are a number of possibilities that you can order it or from a brand dealer, but then a table top costs 1,100 euros, just a table top. And that is a kind of sandwich material, costs 1,100 euros and will only be available in three quarters of a year, which is very difficult to estimate. And if you say that, you have to make your own tabletop, but then you actually have to use a furniture maker. Just a wooden plankie with a finishing edge, that's just not what you want. There are companies such as Reimo in Germany and Rohma in the Netherlands and Gimech are large suppliers of parts why a table and table legs and so on. And then you get a table top that actually costs a lot of money. So that is, ordering spare parts for motorhomes is a nuisance. If it's Adria's, I know where to go. Then I know how to do it, it will be delivered fairly quickly, two or three weeks. But if it's about Giotti line, Italian, then it gets difficult, or joint, I had a car that was four years old, that man had passed a crash barrier that had damaged the door, great damage, and then we went to order a door, well that does not exist anymore, but that was not to get at all. That was really not obtainable. So we ordered a general door from Reimo in Germany and we sawed it in. Then you don't get the door of joint but then you have a general door. There is also a lot of Internet. Of course, there are a lot of spare parts books that we look into. When we were just starting my partner and I, we ran into all these things. Because where do

you get something from? We both come from the passenger car industry and press the button, if I want to talk about it now, I'll talk about it in an hour. Emma: A little before twelve o'clock tomorrow, ordered in the house system.

Hans: Yes, that's very fast, and that's a bit different with motorhomes. And then you get it, search and in the meantime we know where to get it, that is. But we are serious about long delivery times. But look at the car's technical parts, the tyres brakes and so on: all within an hour that can all be done very quickly. That is not very difficult. But the real brand specific things about motorhomes are difficult and the waterlock is not difficult, a hatch is not difficult because a teth(?) is made for that. And so there are all reasonable, fairly simple parts, but it's going to be very annoying if you have to have a tabletop or furniture. That is also very difficult to get, very difficult to order. I ordered it from Adria, via uhh Adria of course has webcat he. So you can take a look at it on the basis of the chassis number of what kind of parts are in there and then we can

come out of it. Only if it is a piece of furniture, an upper cabinet for example, well then it takes another six months, because they are not in the warehouse.

Emma: No, a lot of things change every year, every 5 years, and then it isn't actually made anymore. Hans: No, that's right, and in the car branch, the passenger car branch where you have the model, you don't have a new model every year. In the motorhome world, everything is new every year. They are crazy, they are crazy, they shouldn't do that.

Emma: No, they update every year.

Hans: An update, another line, an upgrade, another line, another piece of upholstery.

Emma: A new technology and at least at Adria they completely renovate one model every year and then let some updates seep through to other models, but then you'll never have the same model again.

Hans: No, no, that's right. We are very much connected to Adria, we are very Adria-focused and so on. The person who used to sit here in the building was an Adria dealer, who sold new Adrias. So we have had a lot to do with Natascha and Hijn van Tilde, they know us very well. The director from Slovenia has even been here once. Very nice.

Emma: Oh how funny.

Hans: To see how we ran into the motorhomes we used to drive, so technically speaking we ran into them with the motorhomes of those days and that was good, neat people. Nice. That alpha recreation, the company that was first in here, that was one of the first Adria dealers in the Netherlands and had a very long exclusive right to Adria, in uhh then maybe you only had three Adria dealers in the Netherlands, so if someone wanted an Adria then they would come here and then, what was the name, uhh the previous owner, was family, Adria was of course in Dordrecht, was a family business, can't come to his name for a while, uhm and he did KB caravans and Adria then and Sunlight?

Emma: Sunliving.

Hans: Sunliving. Uhh Sunliving? Sunlight like to say. And they also built a kind of chalets, mobile homes and so on that family and at one point it folded and then it was quiet for a while. Then Natasha and Hijn and somebody went on with it. But Simon, who had that company here, had sold the most, uhh, biggest outlets in the Netherlands for Adria's, but then another door opened and he became a dealer, he became a dealer and then the flush became thinner and of course he got pain in

his stomach.

Emma: Yes, I can understand that.

Hans: Then he took Hobby and uhh Hymer, but that was taken away again, because as a dealer you have to meet certain standards and so on. And your showroom has to be furnished in this way, not a Hymer and a Hobby.

Emma: Yes, you shouldn't put all the competitors next to each other because then uhh (Hans interrupts)

Hans: That's not good, Duindam has that the rest can't be understood because of background noise from the factory. That is of course the case with Adria in the Netherlands. I can well imagine that, I can well imagine that. Batavus(?) is a beautiful brand of car. But once again, Adria, we are very, very charmed by it.

Emma: Well then, they all make new models every year and they don't have any overlap between brands. So no standardisation.

Hans: No, no, no, the only standardisation is in the refrigerators and the Truma(?) boilers

Emma: Yes, but that's because there are no other suppliers for that either.

Hans: No, exactly.

Emma: No, because if you were to buy a normal kitchen, for example, it doesn't matter whether you buy it from Keukenconcurrent or ...

Hans: No yes, whoever.

Emma: Whoever you buy from, the cabinets are always 60 cm wide, and then you can put in all the brands of washing machines because they are all 60 cm wide as well. And that means that if your washing machine breaks down, you don't have to buy a whole new kitchen, uhh that's not the case here.

Hans: That's not the case with the motorhome. That is really something that the standardisation of camping uhh of caravans, camper vans, I call it, that simply does not exist, that is all custom-made per piece. Marieke walks in and Hans has to leave for a while and comes back later.

Recording 2

Emma: The idea is that I will make a circular caravan. During the lifetime of a caravan it can be repaired and replaced and eventually everything should be recycled. And what I run into is that it is difficult to replace the interior. Imagine that you would maintain your caravan completely tidy and it's all right, no moisture gets in, etc. Then you can't say after thirty years: I want a new kitchen.

Marieke: No, that's indeed because it wouldn't be made anymore, but you also have a lot of things that people will build IKEA cupboards in. Of course it's not custom-made, but people will then empty the whole caravan and build an IKEA kitchen, among other things. A friend of mine bought an old srv car. They made the old srv wagon completely new with ikea kitchen, got the toilet at the Ikea and that was a really nice project. These people have also filmed it from A to B and that's really nice to watch, it's called the bone mobile. BOT mobile. If you look into that and see what they do with it, and that friend of mine often buys Americans as well. American cars are of course very cool to look at, but they slurp petrol. I will see if I can find it on facebook. It is in the needle district. Rick Bot, he is also a frequent visitor to camper and caravan sites.

Emma: Oh then I also get bot mobile.

Marieke: Yes, his name is Bot. And he built that srv car, among others. But whatever

he does, he is a freelance demolition worker and because he is very good at it, he has helped a small company abroad to convert a touring bus into a camper. Or caravan. Making it all beautiful with everything on it, that's great fun, you take fabric from the market and you make curtains and if you're a bit handy you do it yourself with fabrics and that's how he made it. And with him you can see step by step how he did it.

Emma: Yes, also how to get it out first.

Marieke: Yes, how everything looked at first. He did that too. That's very nice to see, only the motor part he couldn't do himself, he did that at a truck company. What he also has is water, from the rain, which he flushes down the toilet with.

Emma: Oh just the grey water!

Marieke: Yes, to keep it a bit green after all. And he did that very nicely with it.

Because you actually want to know things, what you can use, if it gets out, what do you want to do to make it again, for example?

Emma: Yes, for example, but also where does it go wrong, for example with standardisation, because everything is different for every brand and every year. So you can't say, for example: I bought exactly this new one because then it is not interchangeable. So if I know what is going wrong I can say: aha! This is what we have to do.

Marieke: So yes, try to make campers with all the same sizes of cabinets.

Emma: Yes indeed!

Marieke: All 60 x 60 of the ikea.

Emma: Yes, that's right, or that you put your own planks against the walls of those standard holes. That makes it easy, if you now have a small fridge and you want a bigger one, then you take a slice out and put it a bit higher.

Marieke: Oh yeah yeah, then you put a bigger fridge there. Yes indeed, that sort of thing but also with curtain rails and the like, other nice colour curtains. My curtains are dirty, they fade easily.

Emma: Yes and so I think there are different steps. Your father just told me that new cushions are being made, that's one step, but that's only possible because the cushions are loose. Actually it's a bit stupid that all those cushions have a different size, which is understandable, but then you can't say: "I only buy the cushions from the newest caravan".

Marieke: No, that just doesn't fit. What a lot of people do, and what that little company also does, is have old cushions and old chairs re-upholstered at chairmatter polyservice. They can make that very nice, because whatever you do, you don't sleep so fast on someone's mattress on which someone has slept dirty.

Emma: Yes, if someone has slept on it for 20 years, it's time for a new one.

Marieke: Yes and they just make them from mattress fabric. Just make everything to measure. And that's, then you'll have a fresh camper again right away.

Emma: Yes, and he feels that as a newer person, it will last longer. This is also just a matter of maintenance.

Marieke: Yes, it is, and that's something that has to do with it. That people really are their house, because it's just your house.

Emma: Yes, it is a house on wheels.

Marieke: Yes, it is a house on wheels. And people make it as much fun and as beautiful as they want. And, having your own mat in it and a potholder underneath your thing that sort of thing. Custom made curtains I know all about

Emma: And whatever is a bit tricky, moisture is always a problem. Everyone tries to come up with something, but still: moisture is a problem. But once it's in that wood, you can't say that you take out your sofa and put a new one in.

Marieke: No, then you have to make it to measure, you have to do it yourself. Then you have to have it made to measure or you have to make it yourself. Like indeed what he had done. It's often the case that you have to match the size of the camper itself with other things with cupboards and the like. You just have to, in there. And rattle of course! A lot of things rattle of course, so you have to make sure that you secure everything properly. That you do everything right.

Emma: Ideally, a caravan or motorhome company would only make a shell and that it could buy new furniture every year, but then you keep the same shell and it would fit in.

Marieke: Yes exactly, that would be nice. Just like buying an old mini, then you have a mini company and then you can only, you can even convert the iron part.

Whatever they often do, we received a phone call from a demolition company here in the emergency village and from the fire they had gotten campers. That's where things are taken out, so you are still interested in a bumper, in a window, in a hatch. Yes. But we didn't need anything at the time but that's how it is done. So there are some campers that are completely rotten, they are then taken to the demolition and taken apart.

Emma: that's also what they do for caravans. So then the casing is rotten, that's with moisture and you can smell that too. Everything is very dirty. But then they take out the windows. Then they also try to save a lot of things, so that if you break your own caravan from 1990, there is still a replacement window for it. They try to recycle that. This in itself is a system that exists and is already reasonably sound.

Marieke: Yes Willemsen in Pijnacker, do you know that?

Emma: Yes, they mainly do newer caravans. What it is most of all, is that not everything can be taken apart.

Marieke: Yes, it breaks down.

Emma: Yes, so suppose you had a new couch put in it and you could have it made to measure and then you would have to jump through a lot of hoops. But you can't get the old sofa set out in its entirety.

Marieke: No, you'd also have to break the whole floor and what's underneath.

Emma: So when replacing a bench, you have to replace a lot more than just the bench.

Marieke: I don't know if you've ever heard of some kind of stuff they inject into the floor, really inject it? A kind of syringe with a needle, and then you make the floor hard again. Trangit is called that. In fact, as soon as the floor is really rotten, the floor is injected with Trangit and then, that's a floor hardener.

Emma: Yes, it is an expansive foam.

Marieke: Yes! And whatever we have, you have those shower trays, for example. They are practical. And now my father has found a nice solution and that's a flow floor. That's a kind of polyester that is poured into the tray and then it becomes a very nice floor again. It's no longer entirely with the noppies, but you can stand on them again. And what's also nice, last time we had a wheel arch that was broken and we brought it to a company and it also makes polyester caps and also bins for the horticultural industry and he used it a bit like a mould and he did it like that and then we have a nice new wheel arch thing again. That way you can also refurbish

things.

Emma: Yes, it's a good idea anyway. That's the first step. If you can replace the wheel arch, the lifespan of the rest of the caravan will also be longer.

Marieke: Yes, because then you have the safety that the rubble won't bump into the rest.

Emma: Yes, and I sometimes have the feeling that it's made difficult by the manufacturers.

Marieke: Yes, you can't order anymore. Just buy a whole new set.

Emma: When all you really want is a rubber.

Marieke: Among other things you have yes, and you have that with the motor and technical because it's a lot of flats and transit and then you can replace all those parts but as soon as the camper becomes related it becomes a spinel. And made difficult. Order time and so on.

Emma: That a tabletop suddenly costs 1,100 euros. That's not in real life either.

Marieke: No, hadn't my dad told me that he wanted a tabletop all over again.

Someone had a, someone had dropped a thing from the cupboard and then there was such a hole in it. So my father had some kind of stuff that filled that hole. And he has a paint box and then he mixes it up and makes nice splashes and then he has made the table again just like it used to be. So he repaired it with the hole.

Dress about it nothing to see.

Emma: It's actually a bit bizarre that this is necessary.

Marieke: It's striking that there's such a hole in it right away.

Emma: That too! But that you can't call and I only want this part

Marieke: Yes that you only want the tabletop or only the upper part that you have a kind of click system. What it really often happens is that someone flickers something out of the cupboard and makes a hole in it. Or a piece of glass with a gas stove underneath it always breaks. It can also just explode because someone drops something on it. You really have to be very careful with it.

Emma: That's also a bit crazy, you'd expect everything in a camper to be a bit more loutish than ...

Marieke: Yes, but they work a lot with a kind of glass. Safety glass that cracks into all kinds of pieces when something stands out, but of course it breaks quickly when you drop something on it.

Emma: Actually bad.

<intermezzo about Marieke's tasks in the company which vary very much from butter greasing, reception and bookkeeping and about the Bovag man, where we like to go out for dinner etc>

From 34:40

Marieke: I can hear it in his voice when he is finishing.

Hans: Yes when I go to scream

Emma : Yes thank you very much for the conversation!

Hans: Sorry for this intemezzo. We had a little mistake in the planning because we actually thought you were coming yesterday so then I went to look at the map and it says on it today, but today I had him over the floor as well. But fortunately that all went well. Are there any specific things you want to know. You will undoubtedly have something in your head that you would like to know.

Emma: Well what I think is that the whole industry should move towards

standardisation. It has to start somewhere. Hans: Yes it has to start somewhere.

Emma: And also, how I would imagine it now, is that you still have different sides but the inside is still being made up for different things.

Hans: Modular.

Emma: Yes, and that's a bit tricky of the average Ikea furniture and the mounting in a motorhome makes a difference when you hear it like that: Attach it like this.

Otherwise I make holes everywhere and then you can attach everything anywhere.

Hans: Yes then the way of construction has to be changed so the way a module is hung or mounted should be on an aluminium rail. Something like that.

Emma: Yes, that's what I was thinking, and then you slide a new part on and an old one off.

Hans: Yes or hooks. Hook it in and then secure it to the bottom. Something like that, because when you see what a locker looks like. I do have a locker there if you like, I can show you what it looks like. But that's just a wooden cupboard, it's not that there are fasteners on it or that you know how, you know all that, you used to have a lath and then a twig in it when you made your kitchen cupboard and then it went to the wall and there your cupboard came and then it hops on and then you drilled it here and then it hung.

Emma: Yes that's still the case with the Ikea

Hans : Such things are not used in motorhomes. Even if it were something like that, it would be easier. Emma: Yes, because then you can detach it as well.

Hans: Yes, you can hook it and then secure it. With aluminium frames with every now and then, where possible, because you would have a lot of windows in such a thing if you made aluminium strips with a lock hole in them, so a hole with a slot. So in it and then down it hangs of course. And then it hangs well too.

Emma: Well, that kind of direction. I'm a bit in that direction. Then you have to make the step that you don't have to adjust the outside all the time. If that's the case in 20 years' time, you can put a whole new wall in your current camper with the new features. You don't know what will happen. Hans: If you buy such a car with an envelope because you have your young children, then those children, who are 17 and we say they are going to Marbella, I don't want any more. I don't want to go any more. And that you can then give other interpretations.

Emma: Right, and a shower is made in a lot of caravans and things. Not really used that much except by people with young children. But if you're two adults and you always go to the campsite, you don't have to take a shower at all. So you can put something else there as well. You can also put a clothes rack there, then you can also say: this wall out new wall in it.

Hans: Yes yes, there is something in it. But with a camper you often have a wet cell in there. That's where the thetford toilet is mounted, stands on a plastic plate and that's where the walls are set up. So you have a plastic container and the walls are put on top of it, which is sealed. Watertight. When that thing gets older, the plasticisers come out of the plastic, it becomes brittle, the men get heavier, they kick through the tray. Then you get a container, it gets a crack, then you have to replace the container, but then you have to take out all those walls and that is also a thing. And we are now making, you could say do a new bin, we now have such a thing standing there. Have you ever been to one of those factories? Emma: No.

Corona. Hans: Oh that's a pity, because that would be very nice. I'll show you how it's made, I'll show you a little bit more about the shower tray and how we make the choice. It's an older motorhome, we don't put a new shower tray in it, but we fill

it with two components of plastic and we put a pouring floor in it. I now have one of those as well, we are actually working on it now. And look, those floors all need to be supported and if you say so, I'll take that wet cell out. A caravan or camper van, a camper van travels more naturally, they travel from hot to hot and they stop somewhere and they also stop at points where there are no facilities such as a shower. That is why you will almost always have a toilet and a shower facility in a camper, the time when shower facilities are no longer in camper vans, I think that will take some time. In caravans that would still be a good option.

Emma: Above all, ideally, you buy something for today's needs. You look a little ahead because you can see that the children you have today will be a year older in a year's time. You can look a bit ahead, but you don't really know how things are going to change and how your needs are going to change. Actually, you would like to be able to move your caravan with what you need. Also, for example, a small fridge and a heater. With a larger family you might want to have a bigger fridge

Hans: This is often possible with motorhomes. A fridge, a refrigerator, from a camper, usually lasts about 12 years. Say, something like that. Shorter than the car. So it has to be replaced sometime. And then there are companies like Dometic and Thetford, the players on the market, who offer refrigerators, and they have to comply with the niche, the niche size. And we are going to assemble them. And the thing is, people are scared of death of what such a thing costs, because if you go to the media market, you are ready for 200 euros, but if you have a fridge with a camper van, then 1,100 euros is not so bad at all.

Emma: And then you have a tabletop fridge!

Hans: Yes exactly, but of course that's because it is suitable for 12 Volt, 230 Volt and gas. And of course it's not a mass product. It's not a stumping product, make it 10,000 a year, as it were.

Emma: Yes, that's right. Thetford will keep that niche width somewhat the same because they also know that the fridge has to be replaced sometime.

Hans: Yes 53, 52, 53 is reasonable then.

Emma: Yes, that's possible, but what if I want a steam oven in my caravan?

Hans: Yes, there must be a place where it can be installed. Because a steam oven is, of course, you name it, even a microwave, because there aren't many motorhomes with a microwave. Because you can't put a microwave in it, because it won't do you any good because you don't have 230 volts unless you have shore power, unless you are on a campsite. But if you are free, then a microwave oven is no good at all. I do come across these microwaves, and they are just blokker microwaves. They use them, but you can only use them when you are at the campsite. And then you say, we put in a converter, that's what we do, you turn 12 volts into 230 volts, but then you need such a capacity converter and such a capacity battery again.

Emma: Yes, and a lot more weight too. Hans: A lot more weight because a battery, a lot of people want an espresso machine like that. Emma: Yes indeed.

<intermezzo phone call hans>

Hans: if they want a Nespresso machine, that machine pulls 1200 watts with a peak voltage of 2000 watts, so you have to have a very large inverter, you buy a 3000 watt inverter with a peak voltage of 4000 watts. The batteries that are in it are 80 ampere, so 1 acute of 80 ampere is of no use to you so you need two batteries, so that really is a battery pack of big. And then you can, then it's still true, that you can only make one cup of coffee and then you have to have solar panels to be able to

get those batteries recharged again and then you can make your second cup of coffee. So we haven't got that far yet, just like with lithium batteries. That is now new and fresh, so to speak. Well that, I'm looking at one of those lithium batteries, one of those things, you lift it with your little finger on it it's like a dummy showroom model. It seems to be sufficient, but we are now running into that, that is an aside, we are now running into the point that the method of charging a lithium battery is essentially different from the method of charging an acid battery or a gel battery. It must be charged in a different way to that of a lithium battery. So people then think that we are buying a lithium battery, and that thing has to be completely programmed into that battery, and it has to be charged in a different way. So it can't just simply go from the dynamo, the dynamo of the car, to the lithium battery, you can't just connect a wire and say charge it, boys. It doesn't do that, it gets into a lot of stress and so on. So there is still a lot to be gained in the future and those battery packs of lithium batteries would be ideal if that were to happen. That is light and easy to handle, so that is the big change that is now going to take place in camper vans. And if you say one, I want a steam oven in my caravan. Yes, that wouldn't be an odd option at all.

Emma: In the end, there is only so much upgradeable to a caravan now.

Hans: Yes there are also a lot of restrictions, of course you don't have to think in the restrictions, that's not good either. But there are quite a few bears on the road.

Emma: Also in terms of willingness, weight and cost. Everyone has done it all this time, so why should we change that?

Hans: Yes well that is also a point. I come from the automotive Ford world. When I started in those motorhomes, I was amazed at how they were put together. So sloppy and so not.

Emma: It has not yet been optimised.

Hans: No, not at all, it is totally the randomness of the person who assembles it, who is able to put it together in the factory rather than having structure in it.

Emma: Cars have really been optimised, they've been doing that for years, really thought about it. If there is a model, it is released more often and a little better.

Hans: All that, that evolves enormously and you don't have that with motorhomes. I was very surprised to see that a webcad like Adria has that and Knaus has that, that it didn't exist, that it didn't exist then, when we started here it wasn't there. Then you were dependent on microfiches. And then, do you know that?

Emma: No...

Hans: Well microfiches are a kind of photo for negatives, and they go into a viewer and then you have to turn like that, and that's how it was in the automotive industry until someone said: this isn't convenient. We are just going to put this on the internet, fortunately Adria has it nicely in his webcad. Well of some years of construction, because it is not comprehensive, and then you can get an exploded view of the furniture and an exploded view of it, from the side or whatever. And that is still in its infancy in my eyes, it is growing.

Emma: Yes that's possible, that's with more. It is also becoming more and more common for you to tell a company where everything comes from. Why shouldn't you? But nobody says that in the caravan world. Everyone keeps everything closed and that stops progress to some extent.

Hans: No, no, and if you are going to share. Then everyone can move forward. But no, it's very personal, I very much agree with you that you notice that in the wise, in

the hymer site I can look at parts on the basis of the construction number or the chassis number. I can look in knaus. I can look in Adria. And then westfalia, that's a bit of a mercedes thing, and then I can't look through westfalia myself. But then I go to the Mercedes dealer, and then the Mercedes dealer can do that in his programme. If it is on the basis of mercedes then. And then I can watch. Then I can watch with them or send them a screenshot. So that's that. But other brands, rollar team chasson, I don't have all that, then I depend on the importer. And then I do have my channels and contact points everywhere.

Emma: Yes, that's a bit bad, you've become a walking encyclopaedia and that's a bit nonsense.

Hans: Yes it's not necessary, it doesn't have to be.

Emma: While they could also open up everything and turn it into a profitable model. If their tabletops could be found and not 1,100 euros you would buy from them.

Hans: Because that tabletop breaks, a little thing falls out of the cupboard. Dent in it. You know what I am going to do, I am going to fill it up, I am going to fill it up with wax and then I am going to sit down with my colour box and then, because I am good at it, I like that, first I am going to polish it, then I am going to melt some wax in it that has that colour and then I am going to use my pallet, and I am going to mix it up and make those dots on it and then I am very proud that the hole is gone.

Emma: That's great, but a bit of nonsense.

Hans: Of course it's nonsense if you calculate those hours is not normal. I have a workshop, an hourly wage of 79.85 exl VAT which I charge here. I'm not an hour, I work much longer.

Emma: So if a tabletop has a normal price then you order 20. And if all tabletops are the same then you buy 100.

Hans: Right. and it's easy to buy a tabletop, then when I say it costs 1100 euro. Then they put a tablecloth on it, then the butts aren't that bad anymore. Or upholstery covers. Just take a look at what the upholstery looks like in that car. Yes, in those days that was something. But not anymore. If you buy a car like that it doesn't look like that, you think I'd like new covers. But they are not available.

Emma: Yes then they would have to do the Ikea principle. There you buy the sofa and the cover separately.

Hans: But that doesn't exist. Coincidentally I'm looking into a Ford, to buy another passenger car, and there the upholstery can be unzipped from the front seats. Top of the line! One of them is messing with ice cream and then they get a bang for the head and then you take off the cover. But that's clever. I haven't seen that yet.

Emma: And certainly in such a motorhome it's ideal because it's also a living space and it goes wrong faster than that.

Hans: Certainly when it comes to children, even old marbles sometimes drop a bit and you still have an ugly stain in your upholstery. And the upholstery is getting lighter and lighter as you can see, beige, and that kind of suede, that looks nice, but by golly, if you drop something on it, it's all over the place. And it's all light in colour, so that's going to be smooth.

Emma: Yes Adria could just sell a cleaning set and a new light cover. Then you wouldn't have to replace the entire pillow but only the cover.

Hans: No, that's right and that car will retain more value. Well, motorhomes retain a lot of value anyway.

Emma: Otherwise you wouldn't replace such a wall. So that's the direction we're heading in right now, and especially a focus on the interior. The exterior, the frame, of course, the big problem is water and moisture and poor maintenance. People know it's a problem, but they don't always do something about it.

Hans: So we do the maintenance in motorhomes, and we always advise gas extraction and a moisture measurement for safety reasons. Because you can have moisture penetration, that can have been in there for two years and before you start seeing it, and then you start seeing it but then it turns out that the whole ceiling is rotten. That it can no longer be done. And then huge repairs have to be made. Even with the elcove, that is, the corner frames, there's a sealant behind them, then they give way, they don't notice that, then they drive on. Then the whole head is there, you can grab it like that and then you can <Hans explains here with his whole body how that works> you can make it, then it has to be exposed completely, then it has to be painted completely, then all new woodwork has to be made in it. A lot of money is not normal. And tell people proudly: look what I bought. Well then we walk around it and you know that that and that is going on. That is, we advise everyone to do that moisture measurement on a regular basis. And then yes, take out the roof hatch, seal it, take out the window and seal it and then, by the way, you get suppliers on the floor. Look I have new sealant to do the windows, yes, but I can start using your new sealant, but I'm satisfied with what I have and in three years time the sealant I have will still be in place, but who says that what you have now, I don't know. So we are very conservative in the use of materials because we have paid a lot of money for learning, so we know perfectly well if we use this then it goes well and if we use this then it doesn't go well. And then you stick to that. There is also a lot of innovation in the use of sealants, because we used to assemble solar panels, we used to apply sealants and screws, but we don't do that anymore, we glue, now we just glue the whole circus. We have so much confidence in that, saucers, solar panels, we glue the whole sand stall.

Emma: Yes, so many steps have been taken to optimise the exterior, and then the maintenance is at a loss. So that improvement step lies with the owners.

Hans: That's why everyone says that once a year you have to have a moisture measurement carried out.

Emma: Otherwise you no longer have a guarantee.

Hans: And otherwise the guarantee will of course lapse.

Emma: So if they can keep the frame the same and take aerodynamics etc. into account.

Hans: Yeah, that's a lot different, look, have you ever driven a motorhome?

Emma: Nee

Hans: You drive with this, with this, if you drive with something like this <hans points to an older camper> and you drive you feel the wind, you feel it go and you have to hold on to it and you feel everything moving like this and that is because the alcove is on top of it. This <Hans points to a newer model motorhome> is of course much more streamlined. That one, this is an old type of motorbike that is a new type of motorbike, this one has small wheels, this one has big wheels. So this one drives like a passenger car, you sit on it and you are startled by how fast or that it goes. You just drive the whole stream 130 140 and then it still rides well. Without thinking with your hands and feet as long as it goes well. With a car like that, of course it is. But I don't know much about caravans because I've never been away with a caravan and

I've never, ever driven a caravan. Well, yes, I have, but that was just bringing it here for a while. I have never travelled with a caravan before.

Emma: The interior is the same from the point of view

Hans : Yes, it is constructive, the way it is set up is the same.

Emma: So if it's difficult to take out a fridge in a motorhome, it's no easier to take it out in a caravan.

Hans: So yes, exactly. But if you take out a fridge, it doesn't go through the door here. It has to go through the front door. But look, anyway we get it out and we get it in because we are rather tenacious here. And persistent. So then we will really come up with solutions. Such a chair stands on a console, chair out, console out and then a double door fridge in it.

Emma: They also screw a lot and then you can loosen it, but then you have to be able to reach it.

Hans: That's the kind of thing you run into when you really have to remove a piece of furniture, that is, when you really have to remove the top cabinets. Those are not jokes.

Emma: Yes, in 1990 they screwed it from the outside and then put the upholstery over it. So you never get that off again.

Hans: That's how it happens, if you tidy up the heating, where they now neatly conceal it, you can't recover it as a technician. That's better with the new ones.

Emma: There's also a company that makes rolls with heating and you can also place that in walls. They say that it is also used in motor homes and caravans.

Hans: Well, I do have people, not for the rigging but for the floor, that there are carpets that you connect to 220 230 and they are for winter sports in particular. So then you have a kind of carpet, a kind of electric blanket through which heat flows that provides warmth and that warmth comes from underneath of course and the cold also comes from underneath, on winter sports, and then the heat rises to the top and you can keep it comfortable. Although these boilers are the Truma boilers, they convert the heat well and it costs you quite a bit of gas because of course it's a burner that's inside. with a burner that's that big and that's able to give proee proee such a flame. It uses quite a lot of gas if you go on winter sports, most people don't go on winter sports most of them go on summer holidays. And then it doesn't need a stove. Then it is on a campsite. Doesn't need hot water, at most to wash your hands or to rinse the little one or do a washing-up. But then the boiler is not turned on very often.

Emma: It sometimes happens that the boiler is on to prevent condensation against the walls.

Hans: Yes this is possible, because you have a natural, reasonably humid atmosphere and you live in it and you sleep in it and you breathe in it and then you have to ventilate. But if it is very cold then the windows start to fog up. So those side windows won't fog up, but they will, that big single glazing. If someone sleeps in it it is fogged up like a plague. And then you can see that they are in there and don't ventilate properly, and I am satisfied with the safety of those boilers. There is a lot of surveillance, because we are, of course, tinkering with these things, there are a lot of surveillance moments to make sure that no carbon monoxide can get into your camper. That is very well shielded. You hear very little unpleasantness about this and the new type of boilers, boilers also have one that can run on diesel. So this type just goes on and on, but there are also models such as these that also run on diesel

from the diesel tank and can also run on 230 volts. That is also very nice because if you stand on the side, you are no longer dependent on gas and then you can of course also use electric hobs. But if you are going to cook, you have to have 230 volts of course.

Emma: You can't get off the road then.

Hans: No, but I do think that the way in which innovations have been made in recent years has improved the camper van builders' work. I do think that they are doing a good job. The old-fashioned stuff, like Hymer had for a long time, is now leaving a bit and it also tends a bit towards boat building, boat building also has those shiny wooden edges with chrome frames, aluminium frames in them like with that car. And that is very chic. Same as this one, the bed is in the ceiling, so that the bed sinks out of the ceiling, I also think it's a good option actually. Cabinets sink along with it and the whole circus. Technology behind it, because then something happens to the current, current dipper or something like that and then you get a problem that it is no longer adjusted to its base and then it stops at this height or at that height and then all configurations have to take place again to be able to get that thing up and down normally. But that is our problem, we have to make our products our own by keeping a good documentation. Of course we have to become more and more modern, we don't go on a course on how to raise the bed by that car, we don't go on a course in which Adria's idea of how to loosen a locker doesn't work that way. But at Gimech we are going to tell a story about the new types of boilers and the new types of refrigerators. Gimech is very active in providing training and further education and then Ronald, who is a real caravan mechanic all his life, goes there and then I have a boy who goes there and they make it their own. And with the technology as far as cars are concerned, the car technology side, we keep up with that and they give courses on new forms of diesel injection and you name it. And we use a 16 pin computer connection to make a diagnosis and then we read it out and then we have reading equipment and there are different kinds of reading equipment in which you can use to make a diagnosis of what is going on in the car. But also with those Truma kettles you can read them out, then you can plug them in.

Emma: is that good progress?

Hans: Yes, I think that's good progress, I think that's a good development. So in the old types like these you can't read out. It doesn't have such a serial entrance, but it has it again. With this one you just have to start from your common sense and what kind of guidance. And then you find out, but reading out the computer of the boiler and refrigerators is a step in the right direction.

Emma: And if someone comes here, what is the most annoying thing to have to replace? Hans: The most annoying thing to replace is, I think that if you have to replace a fridge and you don't know the right size is not available then you have to do some rebuilding and then you have to take away the shelves and move them. That is the most annoying thing, it involves a lot of working hours. Then you have a 1100 euro fridge and then you also have 600 euro in labour to put that thing in. That is annoying. And I also find those rainwater leaks very annoying because you make someone an offer of yes, I think it takes 4 days and you're working on it for 5 days. Then you settle your score and you miss 1 working day, 8 hours, 800 euros. To put it bluntly, you throw that in the balance and I find that sour again. Also sour for that person, because they buy, suppose they buy, we are going to check it, yes I just

bought it, yes sir you know that the bottom is completely rotten behind that shot. Rainwater runs along the edge, the sealant edge is not good, the water comes down, it runs into the floor, over such a width, over the whole length everything has to be exposed, everything has to be removed, the wood has to be peeled out, new wood has to be pickled, you are so busy for 3 days, really. And that is something I find bored. I would rather replace an awning, a window, a fridge. Things that, pats pats pats then you know where you stand. And you know what also happens quite often is that the control unit has an EBL, which controls the lighting, the fridge, does the motor run, does the motor not run, the charge of the household battery. And if the EBL breaks down, that is another small problem. And we hire someone, an electrician, who is here very often and who repairs these things, and I will show you in a moment what that looks like, you don't have to tell me. (It was chaos saved.) He bites himself into it, and he is a real electrician so he does these repairs on a circuit board level. We are very lucky that he is here so often. And that we can offer something with that. Same with dishes, television dishes, that's not normal either. It is the same with dishes, television dishes, that is not normal either. And then they are going to change those core fields again and then that dish has to be put on a slightly different position again and again and again, and updates and updates and with that dish it goes sister and with that other dish it goes like this.

Emma: No standardization again

Hans : No, not at all, and that drives me crazy. So I stopped doing that.

Emma: So actually you go crazy with everything that's variable and not standardized.

Hans: Especially electronically on those saucers, well, mounting a saucer is possible, but then you have mounted it and it works and then they are gone for 14 days, two months or six months and then they come back with no. It doesn't work. It doesn't work, no the update has to be put in, yes I didn't get that from channel digital. But then an update has to be put in again and one car, brand of dish, goes like this and with the other brand it goes like this so I don't interfere anymore with dishes, I only interfere with the motorhome and especially the technology. And dishes, that is what Egbert does, that electronics gadget. So that's what makes it so complex, look if a light doesn't light up then you start looking and you find out that a light is broken. But sometimes, the left side of the caravan doesn't work and the right side does, you go and look for it, and then it turns out that in the factory they have made a connection, really it's crazy for words, through the ceiling, and they have shot it with staples from the squares, they shoot it with a tap tap tap, but then it goes like this branch branch branch the wire is stuck, plate it over and ready. We measure, if there is no current here, then there is no current between here and there, then it is between the cladding, you find out that the staples go straight through the insulation of the current wire and then it starts to work and then it cuts through and then it short-circuits. What a state of affairs. Well, these are special things that you come across then.

Emma: Why is that!

Hans: How in God's name did they come up with that, not normal. I have an airstream caravan outside on the grounds, they were built in America to work on 130 volts. That's the standard there, but it's in the Netherlands and the one where, at the fair, it pulls the plug and pushes it in, but that's 230 and so poof says that thing and the whole thing burns. We had a lot of work to convert that to 230. All new wiring, all

new lamps.

Emma: Is that still worth it?

Hans: He paid 11,000 euros for it, so I thought it was worth it.

Emma: If it had been your caravan, would you have done it?

Hans: I would have done it because that thing is worth 50 60 thousand euros. It's not a very special thing. We put blue parquet in it, all shiny, because it's from Era brokers and the colour is red, bright blue. It is a broker's party in the Netherlands and it uses it to put it on stock exchanges. He also wanted to have a television in it that he could turn out in a flash, but first he had to recover from the scare of EUR 11,000 of that thing.lifestyle. They want to have that thing like that, they want to travel Europe and then they put the whole mess together and then they go on a journey with it. I like that, I like that they do that, and we usually do the electrical supply and the car technical part. I think it's very brave of them to do that and of those adventurers they are and then with a low budget they try to cross Europe for one or two years. Anyway, it is just what you want. Mostly artists, artistic types, or people who do a lot of yoga and want to achieve a certain mindfulness. I don't know. Yes, what do they do it from. She is also a photographer. And then she makes photos and photo shoots and then they sell them, and they make ends meet. That's very special how life works. But yes, the nature of clients, I can't talk about caravan clients but I can talk about campers, it's very diverse, some use it a lot, others have one but hardly use it because they have a working life so they can't leave because they have to work. Come next year and they will have driven 3000 km. But others who come and then they have, that's also the nice thing about the contact with your customers, who get in and who drive into Scandinavia and who drive via Moermans all the way, they come to a party end road that drive just 15.000 km in a drive and they have been everywhere, in Russia, Lapland I had one that has been to China with a very large iveco, kind of truck camper, in a group trip to, fighting with a few Chinese because the engine had to be repaired and then it was repaired and then they wanted more money. Really, and that was an elderly gentleman, but also really an adventurer but also really just going to Beijing. That is bizarre. And then there were photos with them, a whole book of photos and then he also had a vlog and then we looked from where he was sitting. and now he was sitting there. That is so nice to follow. So I know from a lot of clients what their experiences are, but also what their family circumstances are like. People with illnesses and disabilities and so on, and who go on a journey anyway. We know a lot about our clients, we have a very large customer base. Very large, it is real. There are very few companies that do everything under one roof so, motorhome part and car technical part because that is usually done, the motorhome part is done but the car technical part for that you just have to go to the garage. For that, we have a good business in it. Would you like to show a corner here and there?

Emma: Yes!

<Tour>

Hans: Here when you step in, you can see the floor in the bathroom, which we have treated with epoxy because that thing was completely stepped on baking flaps and then a second layer of white epoxy comes on top of it to make it look fresh again.

But those walls that are on that tray so it's not so easy to say we'll replace that tray.

Emma: Yes, that's not really convenient. Because how often does a wall break down?

Hans: A wall only breaks down if there is a major collision or if there has been a

major water leak. So then, that wall happens, it hardly ever happens that we replace a wall. And often we leave the old wall in place but put a piece of furniture plate against it because you take away so much to get to the real wall that it doesn't pay to do so. Then you have to tear out the entire interior.

Emma: And how often does a wet cell bin break down?

Hans: Well, that happens quite often.

Emma: They would have to build it the other way around. Hans: Look at this complete bin. And when you see what the material is, that's just great, you think it's sturdy but you have to support it well on the underside when it gets older. The shape makes it stiff and the support at the bottom makes it stiff, and then at some point. Constructively there should be a reinforcement plate underneath and it should sit well on the underside. Because when it gets older, it becomes brittle and then it becomes brittle, so you can break it.

<Clatter about other things, if you want to order a part from Hobby you have to fax it because they don't have an email address>

End

Appendix N - Transcriptions from visit Recycling company

N.1 Actual Transcriptions in dutch

Opname 1 - Ramen losmaken

Emma: Altijd bij de bocht? Bij het hoekpunt? Met losmaken.

Jan: Beginnen bij de bocht ja.

< Gestommel en geritsel, raam word losgemaakt door schroevendraaiers tussen het rubber en het wand paneel te zetten >

Emma: Dan vraag je je toch af hoe ze het er ooit in hebben gekregen.

Jan: Dan doe je met een touwtje, in het rubber, onderaan, en dan kruis je hem. Een aan de buitenkant en een aan de binnenkant en dan pak je dat touw en dan trek je dat rubber naar je toe. En als je dan meer speling geeft dan bij dat touw gaat hij los. Dan valt hij er automatisch overheen.

Emma: Dat weet u goed te vertellen

Jan: Met de autoruiten is dat hetzelfde.

<gestommel>

Jan: Dit het belangrijkste he

Emma: De ramen?

Jan: De ramen

Emma: Die zijn nummer een?

Jan: Ja en die dakies.

Emma: En zoiets als sanitair?

Jan: Jawel dat haal ik er ook nog allemaal uit.

<Geschroef, Jan haal hier het dakraampje los>

Jan: Dit zijn zo rottingen hoor, er zit vaak kit aan de bovenkant.

Emma: Voor de waterdichtheid

Jan: Ja

Jan : Dit is eigenlijk kapot.

Emma: Waar zie je dat aan?

Jan: Hier komt regen naar binnen, er hoort hier een dakje op te zitten. Eigenlijk.

Emma: Die is dan niet meer de moeite waard? Als hij kapot is?

Jan: Nou misschien iemand voor de scharnieren.

Emma: oh ja.

<Dakje komt los>

Emma: Oh hier zit inderdaad al die kit. Is dat nog nat of is dat al droog?

Jan: Dat is zo rotwerk. Nou dan moet ik er buiten op. Dan gaan we even naar buiten.

<We gaan uit de caravan>

Emma: hier heeft ook kit tussen gezeten toch? Oh dat is nog wel vochtig

Jan: Ja.

Opname 2 - Ramen losmaken

Jan: Als er toevallig nog mooie deurtjes zijn, die naar de douche toe. En de buitendeuren. Je hebt ook caravans met diefstal natuurlijk. Met de buitendeuren.

Emma: hoe bedoel je dat?

Jan: Dan kunnen we die deur weer verkopen.

Emma: Omdat iemand zijn deur is gejat?

Jan: Nee door inbraak in de caravan dat ze die deur vernielen.

Emma: Oh aha. Is het dan niet makkelijker om gewoon zo'n raampje eruit te halen?

Als je gaat inbreken in een caravan.

Jan: Zo'n raampje. Ja t is eigenlijk makkelijker als je het weet.

<Jan schroeft bijbehoren weer vast aan het raam >

Jan: Dit duurt eigenlijk te lang he.

Emma: Ja?

Jan: Vind ik wel.

Emma: Waarom doe je ze niet gewoon in een zakje en plak je die erop?

Jan: Ja eigenlijk moet je een zakje hebben en dat erin doen. Maar sommige mensen weten het niet he hoe het zit. Kunnen ze het zien. Dan hebben ze een idee ervan.

<volgende raam>

Emma: Nu weten we bij deze hoe het moet.

Jan: Ja hetzelfde als bij die.

Opname 3 - Zekeringskastje

Emma: Oh electriciteitsdoosje

Jan: Zekeringskastje

<Jan schroeft het zekeringskastje los. Het zekeringskastje ziet er net zo uit als zekeringskastjes nu>

Emma: Is dat een ding dat niet uit de mode is geraakt?

Jan: Dat is als je kortsluiting had. Knap die eruit. Dan kan het niet in de brand vliegen.

Emma: Dat is wel fijn. Mensen willen nog wel een zekeringskastje van twintig jaar geleden?

Jan: Dit hoeft niet van twintig jaar geleden he. Dit ga je gewoon. Deze is van 80. Dan 40 - 30 jaar. Dat is dit ding niet

Emma: Oh nee zo. Zal ik hem over het hekje leggen.

<We leggen alle onderdelen die we willen houden over het hekje>

Opname 4 - Meubilair

Emma: En wat gaan we hiervan redden? Scharnieren?

Jan: Niks. Nee Als je echt alles wil bewaren dan moet je wel zo veel ruimte hebben.

Opname 5 - Keukenblok

Gestommel tot 1:56

Emma: En zoiets is ook niets meer waard? Want het lijkt wel goed.

Jan: Ja dit bewaar ik. Je hebt altijd mensen die een los aanrechtblokje hebben zonder dit blad.

Opname 6 - Badkamer

Emma: Ja laatste gedeelte

Jan: Ja hier nog een takje, oh die is ook kapot.

<Hoe schroeft Jan het sanitair weg, het sanitair is vastgeniet aan de wanden>

Emma: Wat vind je ervan?

Jan: Allemaal kapot.

Emma: En de douchebak? Die zit gewoon los.

Jan: Ja de afvoer.

Opname 7 - In de auto met Jimmy

Vanaf 0.55

Jimmy: September, oktober is voor ons altijd chaos

Emma: Ja dan wil iedereen van zijn caravan af, dan hebben ze de laatste zomer gehad.

Jimmy: Ja.

Jimmy: Had je zelf geen auto, is het niet handiger om met je eigen auto te rijden?

Emma: Ik heb geen auto.

Jimmy: Oh echt?

Emma: Ja, En ik woon in delft. Daar is een auto niet handig. Kan je niet parkeren en je kan nergens komen.

Jimmy: Ik kom niet zo heel veel in Delft alleen voor kerk om te leveren en Duindam caravans

Emma: Ja dus ik ben met het openbaarvervoer, duurde vier uur.

Jimmy: Je was vier uur onderweg!?

Emma: Ja hier in de buurt ligt het treinverkeer plat.

Jimmy: Je moet er wel wat voor over hebben. En hoelang moet je nu nog naar school dan?

Emma: Tot maart.

<Jimmy hangt even een aanhanger achter zijn vrachtwagen>

Jimmy: Wat heeft jou studie met caravans te maken dan?

Emma: Het heeft niet direct iets met caravans te maken. Voor mijn afstudeerproject wil ik een circulaire caravan ontwerpen en vandaar dat ik dacht ik ga kijken wat ze er nu mee doen.

Jimmy: Ja en wij zijn natuurlijk de enigsten die dat doen.

Emma: Ja eigenlijk wel. Dus dat, deze studie heeft niet perse met caravans te maken maar met alles dat geen kleding of huizen is.

Jimmy: Ja oke.

Emma: Het kost veel ruimte zeg al die caravans.

Jimmy: Ja niet normaal.

<Jimmy overlegt met Diego>

Jimmy: Ja en niet alle caravans worden gesloopt dus het is de hele dag heen en weer. Slepen en trekken. En ik kan niet aan het personeel komen, het is onwijs moeilijk om aan mensen te komen.

<gesprek over personeel/corona>

Vanaf 08:30 word Jimmy gebeld

Vanaf 09.12

Emma: Voor de boot

Jimmy: Ja voor de boten. Is de gemeente bloemdaal.

Emma: Jij komt dan ook overal.

Jimmy: Ik rij heel nederland door. 100.000 km per jaar en dan moet ik daarnaast ook nog een heel bedrijf runnen. We hebben drie vestigingen he. Hier in Brummen hebben we de sloopcaravans, Apeldoorn heb ik de normale caravans en kampeerwinkel en in boshof heb ik alleen het exclusieve dus vanaf 7500 en verder.

Emma: Dan heb je nog wel iemand nodig.

Jimmy: Ik heb op dit moment geloof ik wel 250 caravans.

Emma: Dat is echt veel.

Jimmy: En iedereen rijdt af en aan maar er komen er nog steeds meer binnen dan dat er weg gaan.

Emma: Waardoor komt dat denk je?

Jimmy: Ja kijk ik kan hier in nederland

<jimmy word gebeld>

Vanaf 11.30

Jimmy: Waar hadden we het nou ook weer over ik ben het alweer kwijt.

Emma: Dat er meer caravans binnen komen dan weg gaan.

Jimmy: Waardoor dat komt, omdat ik natuurlijk in nederland rijd. In nederland is dat met een paar uurtjes gedaan. Hun naar polen zijn 4 dagen onderweg om heen en weer te komen. Dus vandaag 8 boten, een Adria en een knaus opgehaald vanmorgen en die chaffeur haalt nou ook nog een knaus op en dat zijn natuurlijk al 12 binnenkomen en er gaan er maar 6 weg. En die stacaravan dat zijn er al 13 vandaag. Dat is 1 dag en er gaan er maar 6 weg.

Emma: En de meeste caravans gaan naar polen?

Jimmy: Het is 50/50. De ene helft word gesloopt en de andere helft word verkocht. Voor mij is slopen eigenlijk interessanter. Dat levert meer geld op maar ja geen mensen en geen tijd.

Emma: Waar zit dat geld hem in? Je laat ook heel veel achter.

Jimmy: Ja hout en spullen. Alleen in de ramen en interieur dat is het meeste waard. Hout is niets waard. Een caravan word opgebouwd van binnen naar buiten, als je hem gaat slopen, wij slopen van buiten naar binnen en alles is geniet. Je krijgt dat hout er nooit netjes uit. Ik heb wel eens mensen die een poging wagen hoor. Dan bellen ze of je interieur hebt en kastjes ofzo. Dan zeg ik dat heb ik wel, wij slaan dat kapot maar kom maar. Je hebt natuurlijk afvoerkosten voor dat hout moet ik gewoon betalen om dat af te voeren. En dan laat hun dat er zelf uit halen en dan hebben ze wel een paar kastjes maar dat is eigenlijk niets. Is ook niet mooi want dan heb je alles beschadigd. Ik weet niet of je dat hebt gezien maar als je dat kastje hebt dat tegen de wand aan zit dan die is erin geniet. Als je dat eraf haalt kan je nooit meer vast want je kan nooit een schroef schuin weg erin draaien. Dus dan moet je klosjes en klemmetjes vast gaan zetten nou dat moet je niet willen. Als jij een camper of een caravannetje aan het opbouwen bent.

Emma: Opzich is dat wel jammer.

Jimmy: Je hebt nou gewoon heel veel afval ervan. En heel veel werk want je hebt alles drie keer in je handen. Jan sloopt t uit elkaar, die laat het in de caravan liggen, vervolgens moet ik dan hier naar de stort rijden, moet ik het met de hand er weer uit pakken en op de afvalstapel gooien en dan word de rest van de caravan uit elkaar geknepen.

Emma: en als er eenmaal vocht in een caravan zit, in de platen dan kan je dat niet vervangen zonder ook de kastjes eruit te halen.

Jimmy: nee. die moeten er altijd uit.

Emma: Dus dat is een beetje zonde. Mijn doel zou dus zijn om dat op te lossen.

Jimmy: Denk je dat dat gaat lukken?

Emma: Ik denk dat dat wel kan, maar ik denk dat er een commercieel beeld is, dat mensen het moeten willen kopen en aan het eind moet Jan weten dat het kan. Er zitten meer aspecten aan dan ik die zeg dat alles schroefbaar is.

Jimmy: Wij zijn nou in Polen bezig een nieuwe caravan te laten bouwen. Helemaal van polyester maar ook de banken, toilet en het wasmeubel uit één stuk polyester.

want nu heb je dat sowieso een caravan heel snel gaat rotten onder de bankjes rot hij altijd, een wastafeltje in een caravan is eigenlijk altijd kapot. Dat zag je net al, als Jan dat meubeltje eruit probeerde te halen. Als het uit 1 geheel is kan het ook niet kapot gaan en als het wel kapot gaat dan is het heel makkelijk te repareren.

Emma: Dan haal je het hele ding eruit en zet je een nieuw ding erin.

Jimmy: Of je laat hem gewoon repareren want als jij alles van polyester hebt doe je een polyestermatje erin, schuren plamuren en overspuiten.

Emma: Daar zit wel wat in. En aan het eind, zou je dan al het polyester van elkaar scheiden?

Jimmy: Ik denk als jij hem helemaal klaar hebt dat hij dan langer heel blijft.

Emma: Ik denk sowieso dat veel van die caravans jij hebt staan redelijk oud zijn en dat nieuwere caravans een stapje naar voren hebben gemaakt.

Jimmy: Dat denk ik niet. Bij die pool staat een Engelse caravan op. Wat Jan nu aan het slopen is is tussen de 80 en de 90. Die op de vrachtwagen van die pool staat is van 99 en die is net zo rot als die oude caravans.

Emma: En heb je daar ook wel eens wat gehad van zeg: na 2010?

Jimmy: Alleen Engelse caravans. Dus alles wat in engeland gebouwd word dat is slecht.

Emma: En als je nou zelf een caravan zou kopen, wat zou je dan kopen?

Jimmy: Een Fendt of een Tabbert, dat zijn goede caravans. Een hobby heel veel verkocht maar dat komt omdat het wel een relatief goedkope caravan is in heel veel luxe. Ik heb twee jaar achter elkaar een splinternieuwe hobby gehad en ik was twee jaar achter elkaar ook ellende.

<Intermezzo over caravan salon en hoe alles op elkaar lijkt>

Vanaf 18.02

Jimmy: Er zijn nul verbeteringen en het komt ook allemaal uit dezelfde fabriek.

Emma: Ja je hebt iets van drie groepen die caravans maken. En wat ze vaak doen als verbeteringsslag is meer lijm. Maar dan moet Jan het wel uit elkaar slaan. Dan heb je wel gewichtsbesparing en dan kan je verwarming toevoegen oid.

Jimmy: Ik heb in Polen hout in mijn handen gehad, dat was net zo licht als een veertje.

Emma: Ja dat is vooral lijm waarschijnlijk. Opzich is dat wel cool maar je kan er nooit meer wat anders mee maken.

Jimmy: Maar een caravan verandert ook niets. Als je een caravan hebt van de jaren 80 of van nu 2000 of 2010. Het is bijna allemaal op dezelfde manier.

Emma: Ja het is een doos met meubeltjes erin. Komt ook doordat hun doelgroep niet heel erg veranderd is, mensen die dit 30 jaar geleden wouden kopen doen dat nu nog.

Jimmy: Je hebt natuurlijk al een caravan van 9 of 10 duizend euro. Als jij een jong gezin hebt.

Emma: Ik weet niet of iedereen heeft dat heeft liggen.

Jimmy: Kijk je moet iets hebben wat een ander niet heeft. Nu komen er steeds meer, toen ik 10 jaar geleden begon lachte iedereen mij uit dat ik in de oude sloopcaravans stond te trekken. maar als je nu met dure auto's rijd en dat het goed met je gaat dan gaan ze je na-apen. Als je nou op marktplaats kijkt dan krijg je wel 30 bedrijven die zeggen dat ze een sloperij hebben.

Emma: En is dat ook echt waar?

Jimmy: Nee nee nee ik doe het alleen. Ze doen het alleen om die caravans op te halen en dan te verkopen. Wij zijn de enige die daadwerkelijk zo veel onderdelen hebben liggen. Dan heb je Willemse in pijnaker nog zitten, die hebben voornamelijk nieuw en jong gebruikt, oldtimer caravan club dan.

Emma: Toch zit er wel geld in, waarom doen zij dit niet ook?

Jimmy: Ja de meeste. Ik heb nu ook weer twee jongens uit Groningen zijn ook studenten. Die hebben zich in de coronatijd verveeld en die hebben ook een advertentie geplaatst voor gratis caravan ophalen en die krijgen nou toch weer een paar caravans en die hebben ze weer op internet gezet en weer verkocht. Kijk. Als jij 3 - 400 euro aan een caravan verdient hoelang moet je daar voor werken zo direct als student bij een baas. Dan verdien je ook 10 of 12 euro in het uur. nu heb je opeens 3 of 4 honderd en daar hoef je dan veel minder inspanning voor te doen. Die jongens zijn nou in de coronatijd begonnen en die klimmen nou wel hard omhoog. En ik heb er geen last van, ik heb toch werk zat.

Emma: Jij denkt doe dat, neem wat caravans mee

Jimmy: Ja. Ik heb er veel te veel.

Emma: Jij kent dus iedereen wel die dit doet?

Jimmy: Ja de meeste ken ik wel. 12 jaar loop ik erin mee. Wij komen natuurlijk over. We kopen natuurlijk ook gewone caravans. Die jongens die net begonnen zijn hoef je geen caravan van 5000 euro aan te bieden. Die kopen ze toch niet daar hebben ze geen geld voor. Wij kopen natuurlijk alles. ook als een camper van 30 of 40 duizend euro staat, die kopen we ook. Maar in Nederland zijn er nu helemaal geen beurzen. Misschien dat Caravana in Januari doorgaat.

Emma: Dan ga ik daar ook wel weer heen. Ik vond het wel grappig om te zien. Mijn Duits is eigenlijk niet goed genoeg voor zoiets

Jimmy: nee maar bij alle stands van de grotere jongens is ook wel een Nederlands of Belgische verkoper hoor.

<intermezzo over caravan salon en Jimmy word gebeld>

Emma: Weer een caravan.

Jimmy: Ja.

Emma: Is het dan zo dat je richting Februari weer veel minder caravans hebt, dat het weer allemaal past op die plaats?

Jimmy: Nee dan begint het ook wel weer. Het is nu september oktober heel druk, dan ben ik in november nog bezig met opruimen. December heb ik het terrein bijna leeg. Januari is dan ook nog een beetje klungelen. Maar Februari begint het seizoen weer voor ons. Inkopen voor de winkel. Caravanetjes komen weer tevoorschijn uit de stallingen. Eerste caravans worden bij de dealer afgeleverd dus komen inruil caravans binnen. Mensen die nu een nieuwe caravan kopen of besteld hebben laten hem, een deel ervan, laat hem in februari uitleveren zodat er ze ermee in de voorjaarsvakantie weg kunnen. Als ze dan een caravan in te ruilen hebben, dan krijgen wij die dan weer.

Emma: En dan is het weer volle bak tot september?

Jimmy: Ja dan loopt het redelijk vol. De 6 weken bouwvak is alleen de winkel druk, hoef ik zelf niet te rijden dan zit ik zelf op de camping. Wat dat betreft heb ik wel een ideaal beroep want de hele zomervakantie kan ik aan het zwembad liggen.

<intermezzo over het OV en hoe vroeg we opstaan, Jimmy parkeert de aanhanger>

Opname 8 - Na de stort

Jimmy: Ik heb er voor jou ook een uit laten draaien

Emma: oh cute! 27 euro

Jimmy: Dus de losse caravan was 450 kg en levert 27 euro op aan metaal en het afval was 90 kg en kost 16 euro. Zijn geen wereldbedragen.

Emma: Zijn geen wereldbedragen maar als je 250 caravans hebt dan begint het wel ergens op te lijken.

Jimmy: En deze caravan was zo slecht, zo weinig onderdelen dan krijg ik sowieso al 150 euro erbij om hem op te halen en dan nog de onderdelen die overblijven worden eruit verkocht. Maar goed als je nou voor 1 caravan speciaal uit brummen moet rijden en je gaat de tijd bereken dan blijft er onder aan de streep nul over dan moeten de onderdelen de winst opleveren. Maar een voorraam levert ook 150 op.

Emma: Dan zei jan ook al. Snap ik wel, is ook niet veranderd

Jimmy: En je hebt gewoon heel veel mensen die camper of een dingetje gaan bouwen die kunnen die gewoon gebruik en mensen die al zo'n caravan hebben waar het raam kapot van gaat. En als je dan een raam hebt van een hobby van de jaren 90 daar is gewoon niet aan te komen. Die zijn allemaal kapot. Als je daar wel een goede van hebt dan kan je ook gewoon 3 of 400 honderd voor krijgen.

Emma: Je weet dus niet van te voren of je er echt wat aan gaat hebben?

Jimmy: nou ik laat de mensen, hoorde je net al, of hij rijbaar is, of er een kenteken bij zit, of hij bij huis staat of op een camping staat, staat hij aan huis en is hij rijbaar dan is het vaak gewoon een mooie caravan. Staat hij op een camping en zijn de banden lek en dat soort dingen dan is het rotzooi laat ik de mensen eerst een foto sturen en aan de hand daarvan kan ik bepalen of er voldoende onderdelen voor ons aanzitten, zitten er geen voldoende onderdelen aan dan betalen die mensen 150 euro.

Emma: en 150 euro is alsnog niet heel veel geld om van je spullen af te komen.

Jimmy: En je kan hem verder ook nergens inleveren. Want als een particulier, ik ben de enige die hier die caravans zo heen mag brengen. Dan mag niemand anders doen.

Emma: Waarom niet?

Jimmy: omdat er te veel afval aan zit. Daar hebben hun te veel werk van. Als nou iedereen hun caravan brengt en hun hebben dadelijk 20 caravans in de week dan is gewoon een zo'n grijpkraan de hele week bezig zo'n caravan uit elkaar te sorteren.

Emma: en dan houden ze er verder ook niets aan over.

Jimmy: Nee. Alles heeft met geld te maken.

Emma: Dat maakt deze opdracht ook een beetje lastig. Je kan echt prima de perfecte caravan maken maar uiteindelijk gaat het om geld en dan word het commercieel gezien niet meer zo handig.

Jimmy: Caravanonderdelen zijn nou eenmaal hartstikke duur.

Emma: ook omdat er maar weinig producenten van zijn

Jimmy: Ja. Als jij een kachel hebt, dat is van truma dan is al sinds 60. Dat word nog steeds gebruikt, precies dezelfde kachel alleen ander omhulsel erom heen.

Emma: Ja er zijn natuurlijk, voor jou gevoel, best wel veel caravans, maar het zijn er ook weer niet zo veel dat het zinvol is voor een ander bedrijf om ook dat soort onderdelen te gaan maken.

Jimmy: Nee dat is in iedere caravan anders.

Emma: Ja er is één bedrijf hier in Nederland, dat maakt al die ramen. Het is niet meer realistisch dat er nog een ander bedrijf ook dit soort ramen gaat maken.

Jimmy: WC's is allemaal thetford. Mensen zijn het ook zo gewent. WC vloestof van

thetford word het beste verkocht ook al zijn er zo veel betere. Maarja. Einde.

N.2 Translations to English

Recording 1 - Loosening windows

Emma: Always at the bend? At the corner point? With loosening.

Jan: Start at the turn yes.

< Rustling and rustling, window is loosened by putting screwdrivers between the rubber and wall panel >

Emma: Then you wonder how they ever got it in.

Jan: Then you put it with a string, in the rubber, at the bottom, and then you cross it. One on the outside and one on the inside and then you grab that rope and then you pull that rubber towards you. And if you give more slack than that rope, he'll go off. Then he automatically falls over it.

Emma: You know how to tell you that

Jan: With the car windows it's the same.

< Rumbling >

Jan: This is the most important thing

Emma: The windows?

Jan: The windows

Emma: Who's number one?

Jan: Yes and those rooftops.

Emma: And something like plumbing?

Jan: Yes, I'll get all that out of it.

< Screwed, Jan here remove the skylight >

Jan: These are so bad things though, there's often kit at the top.

Emma: For waterproofing

Jan: Yes

Jan: This is actually broken.

Emma: What do you see that from?

Jan: Here comes rain coming in, there should be a roof on here. In fact.

Emma: Isn't it worth it anymore? If it's broken?

Jan: Well maybe someone for the hinges.

Emma: oh yes.

< Roof comes loose >

Emma: Oh here is all that kit. Is that still wet or is it already dry?

Jan: That's such a bad job. Well, then I have to get out of it. Then let's go outside.

< We're getting out of the caravan >

Emma: there's kit in there, right? Oh, that's still damp

Jan: Yes.

Recording 2 - Loosening windows

Jan: If there happen to be nice doors, go to the shower. And the outside doors. You also have caravans with theft of course. With the outside doors.

Emma: what do you mean?

Jan: Then we can sell that door again.

Emma: Because someone was stealing his door?

Jan: No by breaking into the trailer that they're destroying that door.

Emma: Oh aha. Isn't it easier to just take out a window like that? If you're going to break into a trailer.

Jan: Such a window. Yes, it's actually easier if you know.

<Jan screws back to the window >

Jan: This is actually taking too long hey.

Emma: Yes?

Jan: I think so.

Emma: Why don't you just put them in a bag and stick them on?

Jan: Yes, you should actually have a bag and put it in it. But some people don't know what's going on. They can see it. Then they have an idea of it.

<next window>

Emma: Now we know how to do it.

Jan: Yes the same as with that.

Recording 3 - Fuse Box

Emma: Oh electricity box

Jan: Fuse Box

<Jan screws the fuse box loose. The fuse box looks just like fuse boxes now>

Emma: Is that one thing that hasn't gone out of fashion?

Jan: That's if you had a short circuit. Handsome ones. Then it can't catch fire.

Emma: That's nice. People still want a fuse box from 20 years ago?

Jan: This doesn't have to be from 20 years ago. This is just what you're going to do.

This one's 80. Then 40 - 30 years. That's not this thing.

Emma: Oh no. I'll put him over the fence.

<We put all the parts we want to keep over the gate>

Recording 4 - Furniture

Emma: And what are we going to save from this? Hinges?

Jan: Nothing. No, if you really want to keep everything, you have to have so much space.

Recording 5 - Kitchen block

Rumbled until 1:56

Emma: And something like that isn't worth anything anymore? Because it seems like okay.

Jan: Yes I keep this. You always have people who have a loose counter without this leaf.

Recording 6 - Bathroom

Emma: Yes last part

Jan: Yes here's another twig, oh it's broken too.

<How Jan screws away the plumbing, the plumbing is attached to the walls>

Emma: What do you think?

Jan: All broken.

Emma: And the shower tray? It's just loose.

Jan: Yes the drain.

Recording 7 - In the car with Jimmy

From 0:55

Jimmy: September, October is forever chaos for us

Emma: Yes then everyone wants to get rid of their caravan, then they've had the last summer.

Jimmy: Yes.

Jimmy: Didn't you have a car of your own, isn't it more convenient to drive your own car?

Emma: I don't have a car.

Jimmy: Oh really?

Emma: Yes, and I live in Delft. There's a car that's not convenient. You can't park and you can't get anywhere.

Jimmy: I don't come to Delft very much just front church to deliver and Dunesdam caravans

Emma: Yes so I'm on public transport, took four hours.

Jimmy: You were on the road for four hours!?

Emma: Yes, in the neighborhood, the train traffic is down.

Jimmy: You must have something for it. And how much longer do you have to go to school?

Emma: Until March.

<Jimmy hangs a trailer behind his truck>

Jimmy: What does your study have to do with caravans?

Emma: It doesn't have anything to do with caravans. For my graduation project I want to design a circular caravan and that's why I thought I'd go see what they do with it now.

Jimmy: Yes, and of course we're the only ones who do.

Emma: Yes, actually. So that, this study is not necessarily about caravans but with anything that is not clothing or houses.

Jimmy: Yeah okay.

Emma: It takes up a lot of space say all those caravans.

Jimmy: Yes not normal.

<Jimmy consults with Diego>

Jimmy: Yes and not all caravans are demolished so it's all day back and forth. Drag and pull. And I can't get the staff, it's incredibly hard to get people.

<staff/corona, Jimmy gets called>

From 09:12

Emma: For the boat

Jimmy: Yes to the boats. Is the municipality flowering.

Emma: You go everywhere.

Jimmy: I drive all over the Country. 100,000 km a year and then I also have to run an entire company. We have three branches. Here in Brummen we have the demolition caravans, Monkey thorn I have the normal caravans and camping shop and in Boshoff I only have the exclusive so from 7500 and beyond.

Emma: Then you're going to need someone else.

Jimmy: I think I have 250 caravans at the moment.

Emma: That's a lot.

Jimmy: And everybody's driving off and on, but there's still more coming in than leaving.

Emma: What do you think that's all about?

Jimmy: Yes look I can here in uk

<jimmy gets called>

From 11.30

Jimmy: What were we talking about again I lost it again.

Emma: That more caravans come in than leave.

Jimmy: That's because, of course, I drive in the Netherlands. In the Netherlands, this was done in a few hours. They are on their way to Poland for 4 days to get back and forth. So today 8 boats, an Adria and a Knaus picked up this morning and that chauffeur picks up a Knaus and that's of course already 12 coming in and only 6 are leaving. And that mobile home, that's 13 today. That's one day and only six of them leave.

Emma: And most caravans go to Poland?

Jimmy: It's 50/50. One half is demolished and the other half is sold. For me, demolition is actually more interesting. That's more money, but yes, no people and no time.

Emma: Where's the money in it? You leave a lot behind, too.

Jimmy: Yes wood and stuff. Only in the windows and interior that is worth the most. Wood is worth nothing. A caravan is built from the inside out, if you demolish it, we demolish from the outside to the inside and everything is enjoy. You'll never get that wood out properly. I've got people trying. Then they call if you have interiors and lockers or something. Then I'll say I have, we'll smash that, but come on. Of course, you have drain costs for that wood, I just have to pay to dispose of that. And then let them take that out themselves and they'll have a couple of lockers, but that's basically nothing. It's not pretty either, because you'll have damaged everything. I don't know if you've seen that, but if you have that locker that's on the wall then it's in it. If you take that off, you can never hold it again because you can never twist a screw in it. So you're going to have to lock up your ass and clamps, well you shouldn't want to. If you're building a camper van or a caravan.

Emma: That's a shame.

Jimmy: You just have a lot of garbage from it. And a lot of work because you have everything in your hands three times. Jan demolishes it apart, he leaves it in the caravan, then I have to drive here to the landfill, I have to take it out by hand and throw it on the waste pile and then the rest of the caravan is squeezed apart.

Emma: and once there is moisture in a caravan, in the plates you can't replace that without also taking out the cabinets.

Jimmy: no. They always have to come out.

Emma: So that's a bit of a shame. So my goal would be to fix that.

Jimmy: Do you think that's going to work?

Emma: I think that's possible, but I think there's a commercial perception that people should want to buy it, and at the end, Jan needs to know it's possible. There are more aspects to it than I say that everything is screwable.

Jimmy: We are now in Poland building a new caravan. All made of polyester but also the sofas, toilet and the wash furniture from one piece polyester. because now you have that a caravan is going to rot very quickly under the benches he always rots, a sink in a caravan is actually always broken. You could see that when Jan tried to take that piece of furniture out. If it is from 1 whole it can not break and if it does break then it is very easy to repair.

Emma: Then you take the whole thing out and put a new thing in it.

Jimmy: Or you just have it repaired because if you have everything from polyester you put a polyester mat in it, sand plaster walls and respray.

Emma: There's something in that. And at the end, would you separate all the polyester?

Jimmy: I think when you've got him all set, he'll be around longer.

Emma: I think a lot of those caravans you have are quite old and that newer caravans have taken a step forward.

Jimmy: I don't think so. At that pole, an English caravan is on. What Jan is demolishing now is between 80 and 90. The one on that pole's truck is 99, and it's as rotten as those old caravans.

Emma: And have you ever had anything like that: after 2010?

Jimmy: Only English caravans. So anything that's built in the UK is bad.

Emma: And if you were to buy a caravan yourself, what would you buy?

Jimmy: A Fendt or a Tabbert, those are good caravans. A hobby sold a lot but that's because it is a relatively cheap caravan in a lot of luxury. I had a brand new hobby for two years in a row and I was also miserable for two years in a row.

<Intermezzo about caravan salon and how everything looks alike>

As of 6.02pm

Jimmy: There are zero improvements and it also all comes from the same factory.

Emma: Yes you have something like three groups that make caravans. And what they often do as an improvement stroke is more glue. But then Jan has to break it up. Then you do have weight savings and then you can add heating oil.

Jimmy: I had wood in my hands in Poland, which was as light as a feather.

Emma: Yes that's mostly glue probably. In itself, that's cool, but you can never make anything else with it.

Jimmy: But a caravan doesn't change anything either. If you have a caravan from the 80's or now 2000 or 2010. It's almost all the same way.

Emma: Yes it's a box with furniture in it. It's also because their target audience hasn't changed very much, people who wanted to buy this 30 years ago still do so today.

Jimmy: Of course, you already have a caravan of 9 or 10 thousand euros. If you have a young family.

Emma: I don't know if anyone has that lying around.

Jimmy: Look, you have to have something that someone else doesn't have. Now more and more are coming, when I started 10 years ago everyone laughed at me that I was pulling in the old demolition caravans. But if you drive expensive cars now and you're fine, they're going to be after-monkeys. If you look at marketplace, you get 30 companies that say they have a scrapyards.

Emma: And is that really true?

Jimmy: No no no I'm doing it alone. They only do it to pick up those caravans and then sell them. We are the only ones who actually have so many parts lying around. Then you have Willemse in Pijnacker, who have mainly used new and young, old timer caravan club then.

Emma: There is money in it, why don't they do this?

Jimmy: Yes most. I now have two boys from Groningen are also students. They got bored in the corona time and they also placed an advertisement for free caravan

pickup and they get a few caravans and they put them back on the internet and sold them again. View. If you earn 3 - 400 euros from a caravan, how long do you have to work for it as directly as a student with a boss. Then you also earn 10 or 12 euros in the hour. Now suddenly you have 3 or 4 hundred and you have to put in a lot less effort. Those guys started in the coronary season, and they're climbing up a lot. And it doesn't bother me.

Emma: You think do that, bring some caravans

Jimmy: Yes. I have way too many.

Emma: So you know everyone who does this?

Jimmy: Yes, I know most of them. 12 years I'm in it. We come across, of course. Of course, we also buy regular caravans. Those guys that just started you don't have to offer a 5,000-euro caravan. They don't buy them, they don't have the money. We buy everything, of course. even if a camper van of 30 or 40 thousand euros is standing, we also buy it. But in the Netherlands there are now no fairs at all. Maybe Caravana will continue in January.

Emma: Then I'll go back there. I thought it was kind of funny to see. My German isn't actually good enough for something like that.

Jimmy: no but at all stands of the bigger guys is also a Dutch or Belgian salesman though.

<interlude about caravan salon and Jimmy gets called>

Emma: Another caravan.

Jimmy: Yes.

Emma: Is it so that towards February you have a lot less caravans, that the weather all fits in that place?

Jimmy: No, it'll start again. It is now September October very busy, then I am still cleaning up in November. December I've almost emptied the grounds. January is a bit of a squat. But February starts the season again for us. Buy for the store. Caravans reappear from the sheds. First caravans are delivered to the dealer so caravans come in in exchange. People who buy or have ordered a new caravan now let him, part of it, have it delivered in February so they can leave with it in spring break. If they have a caravan to trade in, we get it again.

Emma: And then it's full again until September?

Jimmy: Yes, it's going to be pretty full. The 6 weeks of construction is only busy, I don't have to drive myself then I sit on the campsite myself. In that respect I do have an ideal profession because the whole summer holiday I can lie by the pool.

<interlude about the public transport and how early we get up, Jimmy parks the trailer>

Recording 8 - After the waste site

Jimmy: I had one out for you, too.

Emma: oh cute! 27 Euros

Jimmy: So the loose caravan was 450 kg and yields 27 Euros in metal and the waste was 90 kg and costs 16 Euros. Aren't world amounts.

Emma: Aren't world amounts but if you have 250 caravans it starts to look like something.

Jimmy: And this caravan was so bad, so few parts i get 150 Euros anyway to pick it up and then the parts that remain are sold out. But if you have to drive for one caravan especially out of brummen and you calculate the time then there will be

zero left at the bottom of the line then the parts have to yield the profit. But a front window also yields 150.

Emma: Dan said jan. I understand, hasn't changed either.

Jimmy: And you just have a lot of people building a camper or a little thing who can just use it and people who already have a caravan like that that breaks the window. And then if you have a window of a 90s hobby there's just not to come. They're all broken. If you do have a good one of them, you can just get 3 or 400 hundred for that.

Emma: So you don't know in advance if it's really going to help you?

Jimmy: well I leave the people, you just heard, whether he's drivable, whether there's a license plate, whether he's at home or on a campsite, he's at home and it's often just a nice caravan. If it is on a campsite and the tires are leaking and things like that, then the mess is i let people send a picture first and on the basis of that I can determine if there are enough parts for us, there are not enough parts to it than those people pay 150 Euros.

Emma: and 150 Euros is still not a lot of money to get rid of your stuff.

Jimmy: And you can't turn him in anywhere else. Because as a private citizen, I'm the only one who gets to bring those caravans here. Then no one else can do it.

Emma: Why not?

Jimmy: because there's too much trash on it. They have too much work to do. If everyone brings their caravan and they have 20 caravans a week, then just one of those grab cranes spends all week sorting out such a caravan.

Emma: and then they don't get anything out of it.

Jimmy: No. Everything has to do with money.

Emma: That also makes this assignment a bit tricky. You can really make the perfect caravan but in the end it's about money and then it doesn't get so useful commercially.

Jimmy: Caravan parts are very expensive.

Emma: also because there are very few producers of

Jimmy: Yes. If you have a stove, that's from truma then it's been since 60. That's still used, the exact same stove just different casing around it.

Emma: Yes, of course, there are quite a lot of caravans for you, but there are not so many that it makes sense for another company to start making that kind of parts.

Jimmy: No, that's different in every caravan.

Emma: Yes there is one company here in the Netherlands, that makes all those windows. It is no longer realistic that another company will also make this kind of ramen.

Jimmy: TOILETs is all thetford. People are used to it that way. Toilet liquid from thetford is best sold even though there are so many better. But yes.

End.

Appendix O - Interview Repair expert Peter Murn from Adria

O.1 Slovenian interview

Uvod: Za diplomski projekt ustvarjam bolj trajnostno prikolico Action. S podaljšanjem življenjske dobe prikolice lahko zmanjšamo vpliv na okolje. To lahko dosežemo z izboljšanjem kakovosti ali z lažjo zamenjavo delov. Da bi vedeli, katere dele je treba izboljšati, je treba vedeti, kaj se trenutno lomi. Odlično bi bilo, če bi bilo v tej temi nekaj spoznanj. Za vodenje teh spoznanj sem oblikoval nekaj vprašanj:

Najpogostejše napake prikolic

Katere napake se pogosto dogajajo? Ali se to zgodi med sestavljanjem, uporabo, prevozom? Ali se te napake večkrat zgodijo v življenjski dobi ene prikolice?

[PETER MURN] Z vidika postavljenega vprašanja so to tri vrste napak, ki so specifične za vsak process:

- pri proizvodnji je največ napak pri poškodbah vgrajenih delov, kot tudi napake sestave in napake, npr. električnih vodnikov, vodovodne napeljave in ogrevanja. napačnih priključitev. Vpogled v stanje napak, bi moral podati nekdo iz PS, ker jih jaz ne poznam v dovolj velikem obsegu.

- pri transport se pojavljajo predvsem poškodbe na zunanosti, kot so razne praske na površini sten in lomi raznih plastičnih oblog ali svetil. Te napake niso tako pogoste, vendar se jih ne da popolnoma eliminirati zaradi različnih nepredvidenih dejavnikov.

- pri uporabi se teh napak pojavi lahko bistveno več. Vzroki so lahko zelo različni in se gibajo od neustrezne uporabe proizvoda, do odpovedi kakšnega od vgrajenih sistemov, elementov ali vgrajenih aparatov. Lahko se pokažejo tudi napake neustreznega projektiranja in uporabe novih materialov, še posebej pri novo razvitih proizvodih. Te napake se predvsem pojavijo z pričetkom proizvodnje novega produkta, ki pa so kmalu odklonjene in popravljene v proizvodnem procesu. Napake se seveda lahko pojavljajo večkrat in je odvisno predvsem od strokovnega popravila in kvalitete vgrajenih rezervnih delov.

Kateri rezervni deli so najbolj naročeni?

[PETER MURN] Največ rezervnih delov se potrebuje pri sklopih ali delih, kjer je večja obremenitev pri sami uporabi. To so predvsem zapizala, ključavnice, spone, stikala, ročice, uporabne površine, plastični deli, skratka deli, kjer je možnost obrabe ali odpovedi zaradi bolj intenzivne uporabe le teh.

Kaj so drage napake? To je lahko posledica dragih delov ali časa, ki je potreben za zamenjavo delov.

[PETER MURN] Drage napake so, če je potrebno popravilo ali menjava večjih vgradnih delov, kot so stene streha, pod, okna, vrata, Predvsem je tako popravilo drago, ker je v tem vključeno ponavadi veliko število ur, da se taka vrsta napake popravi. Za menjava stene na Action je potrebno cca 20-25 ur , kar ponavadi predstavlja glavno stroška. RD niti ne predstavljajo sorazmerno velikega stroška pri tem.

Kdaj se prikolica pokliče nazaj?

[PETER MURN] Prikolica se lahko pokliče nazaj, kadar se na njej v garancijskem roku pojavijo napake ali poškodbe, ki jih trgovci ali ne znajo dovolj dobro popraviti ali pa so stroški popravila v AM nižji. Lahko pa tidi pokličemo proizvod, da se vrne v AM, če se zgodi kakšna napaka, za katero bi jo želeli analizirati in ugotoviti vzroke.

Deli, ki jih je težko popraviti

Katere dele je težko popraviti?

[PETER MURN] Predvsem velike težje dostopne dele, kjer se zahteva določen nivo znanja in izkušenj, kot tudi menjava delov, kjer je potrebno razdreti še kaj dodatno, da se do the delov lahko dostopa in zamenja. Predvsem so to deli same nadgradnje – stene, strop, pod.

Na kateri točki bi bil nasvet za nakup nove prikolice?

[PETER MURN] Takoj, ko se pričnejo večje odpovedi vgrajenih delov in postane popravilo nerentabilno. Ni pravila koliko let. Naši proizvodi imajo življenjski rok zelo dolg in ne tako poredko lahko srečate prikolice, ki so še vedno v uporabi tudi 40 let stare. To se doseže samo z temeljitim vzdrževanjem in normalno uporabo.

Kako lahko zamenjate opremo, ki je sestavljena na zadnji strani kot plinski hladilnik?

[PETER MURN] Vsi vgrajeni sklopi so projektirani na nači, da se jih lahko odstrani in zamenja z novimi. Hladilnik je vgrajen z notranje strani in se ga lahko brez težave izvleče ven in odstrani skozi vhodna vrata, ki so ravno prav široke za take stvari. Vse je preišljeno tudi s strani servisibilnosti.

Kdaj bi prikolico odpisali? Kaj lahko uporabniki / serviser / oblikovalci storijo, da to preprečijo?

[PETER MURN] Kot napisano že v enem prejšnjih odgovorov. Ni pomembna starost ampak način uporabe in redno vzdrževanje. To se odloči sam lastnik, kdaj bo zamenjal prikolico. Serviser , oblikovalec, proizvajalec nimajo tega vpliva na uporabnika.

Kateri so drugi vidiki, na katere je treba posvetiti pozornost?

[PETER MURN] S strani proizvajalca, smo dolžni zagotavljati kupcu ustrezen proizvod, ki mu bo služil brez velikih popravil in posegov, ter mu zagotavljati določeno podporo in dobavo RD vsakim proizvedenim produktom in s tem naše delo še zdavnaj ni končano. Potrebno je proizvode spremljati na trgu, pridobivati čim več uporabnih informacij s strani trgovcev in uporabnikov, ter po možnosti vse analizirati ter ustrezno uporabiti pri projektiranju in proizvodnji novih produktov. Edino na ta način (na napakah in izkušnjah) lahko dosežemo veliko izboljšav, ki so kasneje predvsem zadovoljstvo naših kupcev, ki to cenijo.

O.2 English Translation

Introduction: For my graduation project I'm creating a more sustainable Action caravan. By elongating the life-span of the caravan we can reduce the environmental impact. This can be done by improving quality or by making it easier to replace parts. To know what parts should be improved it is necessary to know what is currently breaking. It would be great if there could be some insights in this topic. To guide these insights I have formed some questions:

1. The most common defects in caravans

- Which defects happen often? Do these happen during assembly, use, transportations? Do these defects happen multiple times during the lifespan of one caravan?

From the point of view of the question, these are three types of errors that are specific to each process:

- during production, most defects occur due to damage to installed parts, as well as assembly errors and faults, e.g. electrical conductors, plumbing and heating. incorrect connections. An insight into the state of errors should be given by someone from PS, because I do not know them to a large enough extent.
- During transport, damage to the exterior occurs, such as various scratches on the surface of the walls and breakage of various plastic linings or lamps. These errors are not so common, but they cannot be completely eliminated due to various unforeseen factors.
- Significantly more of these errors can occur during use. The causes can be very different and range from improper use of the product, to the failure of any of the installed systems, elements or installed appliances. Mistakes in improper design and use of new materials can also occur, especially in newly developed products. These defects mainly occur with the start of production of a new product, which are soon rejected and corrected in the production process. Defects can, of course, occur several times and depend mainly on professional repair and the quality of the installed spare parts.

• **What spare parts are ordered most?**

Most spare parts are needed for assemblies or parts where there is a greater load during use. These are mainly latches, locks, clamps,

switches, levers, usable surfaces, plastic parts, in short parts where there is a possibility of wear or failure due to more intensive use of these.

- What are expensive defects? This can be due to expensive parts or due to the time it takes to replace the parts.

Expensive defects are when it is necessary to repair or replace larger built-in parts, such as roof walls, floor, windows, doors. Above all, such repair is expensive because it usually involves a large number of hours to correct this type of defect. It takes about 20-25 hours to replace a wall on Action, which is usually the bulk of the cost. RDs do not even represent a relatively large cost in doing so.

- When does a caravan get called back?

The trailer can be called back when defects or damage occur on it during the warranty period, which the dealers either do not know how to repair well enough or the repair costs in AM are lower. However, we can call the product to return to AM if an error occurs for which we would like to analyze it and determine the causes.

2. Parts that are hard to fix

- What parts are hard to fix?

Especially large hard-to-reach parts, where a certain level of knowledge and experience is required, as well as the replacement of parts, where it is necessary to tear something extra so that the parts can be accessed and replaced. Above all, these are parts of the superstructure itself - the walls, the ceiling, the floor.

- At what point would the advice be to buy a new caravan?

As soon as major failures of installed parts begin and the repair becomes unprofitable. There is no rule for how many years. Our products have a very long lifespan and not infrequently you can find trailers that are still in use even 40 years old. This is only achieved through thorough maintenance and normal use.

- How can you replace equipment that is assembled on the back like a gas fridge?

All installed assemblies are designed in such a way that they can be removed and replaced with new ones. The refrigerator is built-in

from the inside and can be easily pulled out and removed through the front door, which is just right wide for such things. Everything is also thought out by serviceability.

3. When would a caravan be written off? What can users/repairmen/designers do to prevent this?

As written in one of the previous answers. It is not the age that matters, but the method of use and regular maintenance. It is up to the owner to decide when to replace the trailer. The service technician, the designer, the manufacturer do not have this influence on the user.

4. What are other aspects that need attention?

On the part of the manufacturer, we are obliged to provide the customer with a suitable product that will serve him without major repairs and interventions, and to provide him with certain support and delivery of RD to each product produced, and thus our work is long over. It is necessary to monitor products on the market, obtain as much useful information as possible from traders and users, and, if possible, analyze everything and use it appropriately in the design and production of new products. Only in this way (on mistakes and experience) can we achieve many improvements, which are later primarily the satisfaction of our customers who appreciate it.