

COMFORT AND FUNCTIONALITY IN A CARAVAN DESIGN

Abstract: *In this paper I will present the design of a caravan, taking into account the two main characteristics found in the description of such a product, namely functionality and comfort. With the ultimate goal of generating a lower cost, I will focus on making space as efficient as possible, making as many multifunctional components as possible, without neglecting the choice of the right materials.*

Key words: *caravan, product design, functionality, comfort, low cost, space efficiency, multifunctional components, suitable materials*

INTRODUCTION

Caravans, 2 or 4-wheel vehicles towed by cars are design products that are still current even after 1933 since the first caravan that was made just for the pleasure of traveling. This has been achieved because caravans have evolved constantly, although their main function has not changed.

Starting from the definition of the two concepts of comfort and functionality, the caravan has to ensure, through all the material conditions, a civilized, pleasant, comfortable and hygienic existence, also presenting the quality of being functional.

There are a multitude of types of caravans for everybody's tastes, but the main factor that differentiates them is the cost.

The main purpose of caravans has not changed a lot; therefore, many caravans from the 1950s to 1970s still exist today and are restored by vintage caravan lovers for their reuse, resulting in a very expensive production and purchase cost.

Even new small caravans have fairly high costs, with world's major caravan manufacturers focusing on producing products for a demanding, over-average income consumer.

I started this work with the desire to create a product that would appeal to another category of buyers, namely, young couples looking for a convenient way of moving with just what is strictly necessary, at much lower prices than new products that are now on the market.

This new segment of consumers, young couples looking for mobility but also enjoying the comfort of an ordinary room, has as their main factor in choosing such a product - the price.

Designing the caravan for young people without children starts by setting their minimum needs and criteria that positively influence the cost.

Creating an adequate space is done by respecting the principles of product design, both in creating multifunctional components inside the caravan and in organizing and obtaining the shapes of the product, choosing the materials and setting its attributes, also taking into account the principles of manufacturing and assembling.

2. PRODUCT DESCRIPTION

My contribution consists in designing a caravan concept that uses a very small space, the living room having the size of 2.5m in length, 2m in width and 2m in height, without neglecting the necessary comfort and functionality of the whole ensemble.

To design a new and better product, I had to answer a number of questions: "How can I improve the existing products?", "Does my trailer meet other needs than the 10 years ago products?", "What can I improve?"

Having the overall picture, I chose what features the caravan must meet: to be a small room that meets the minimum needs, rest, hygiene, food, comfort, also having an aerodynamic exterior shape and a minimum weight to keep consumption of fuel as small as possible and can be towed by a less powerful car.

Being a tractable small caravan, the conceived product will only have one shaft, one entrance door, the dimensions chosen for the exterior being small, 3m long x 2m wide, so as not to generate additional costs of production in terms of the materials used, the caravan being also suitable for camping in small places.

Since it is a multifunctional product, the caravan will be equipped with a fresh water tank of 120 l and 100 l of waste water, an instantaneous boiler, electric power, ventilation or air conditioning system, luggage space, all of which have a space of 0.5m x 2m in the back of the caravan, in the trunk.

Since the product is intended for use by two people, it will only have one double bed and a sufficient space so as not to create discomfort in various situations because of this.

The caravan will present a simple, modern design with clearer lines, some evolved shapes leading to luxury, which causes a high cost, and the multifunctionality of the components makes the caravan be spacious on the inside.

The caravan itself is a multifunctional product, but has in turn a series of multipurpose facilities.

The concept will present a panoramic window across the front of the caravan, providing brightness when needed, for example during meals.

Because it is a product designed to be sold at a low cost, design has to please the user through different features, such as appearance and maximum efficiency of

space using multifunctional components, so that the investment returns as profits, a lower price attracting more buyers.

3. ANALYSIS OF CURRENT STATE OF SUBJECT

3.1. Case study

There are caravans on the market for those who want the luxury of a large caravan with spectacular facilities as well as for those looking for simplicity in the design of a small caravan.

Far from the stoves and stained glass windows of the past, today's caravans are equipped with all sorts of modern technologies.

I studied 3 types of caravans of some major manufacturers:

Table 1
Comparative analyses of 3 types of products

Producer	Bigfoot	Pursuit	Jayco
Model	 25B17.5G [1]	 550-4 [2]	 Journey 19,61-4 OB [3]
Overall length [m]	5,31	5,71	6,12
Overall height [m]	2,64	2,59	2,84
Overall width [m]	2,44	2,23	2,47
Interior headroom[m]	1,93	1,96	1,97
Base dry weight [kg]	1442	1392	2040
Number of axes	1	1	2
Fresh water [l]	120	-	164
Black water [l]	83	-	82
Number of beds	1	3	1
Number of people	2	4	2+1 kid
Number of doors	1	1	1
Number of windows	4	9	6
Price [€]	21 000	19 000	37 000

3.2. Critical analysis of existing solutions

Beauer, through the 3X caravan, solves the design problem in regard to the small size of the teardrops both on the road and during the camping (fig. 1).

The 3X is small when towed, but it expands to three times its original size when parked for the night.

By pressing a button, the caravan increases in 20 seconds to full size, providing ample interior space.

In the fully enlarged room, there is space for the bedroom, bathroom, kitchen, living room and dining room.

Inner bodies are designed to join each other when the caravan is closed, which means that as soon as it is extended, it is ready for use.

The bedroom has a double bed and the compact bathroom has a shower, sink and a toilet with a tank.

The living area has a large table and a sofa that converts into a double bed.

The kitchen has a two burner stove, a 130L fridge, sink, wardrobes and storage space.



Fig. 1 Beauer 3X [4]

Safari Condo Alto's "Newbie" carriages are a very popular range in recent years (fig. 2).

They are made of very light materials and thanks to the "teardrop" design, they are very easy to tow, even by small cars.

This caravan has a ceiling that comes up at the push of a button to provide enough standing, making it comfortable despite its small size.



Fig. 2 Newbie [5]

In both cases chosen for study, caravans prices contrasts with the small size because the technology that determines the possibility of enlarging space in any form, increases the price.

4. CONCEPT AND DESIGN

4.1 Development of own design variants caravan

Firstly, I studied various interior plans of the various caravans on the market and taking into account the good parts found in several situations, I have created various plans of different sizes for setting the areas inside the caravan (fig. 3).

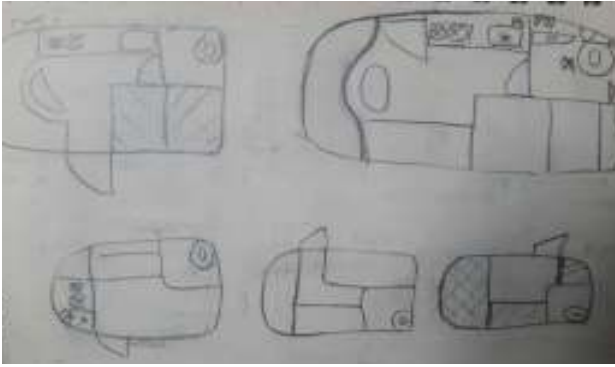


Fig. 3 Interior layout - sketch

Then with the help of CATIA software, I made several plans on the scale to see more clearly if the chosen dimensions are appropriate (fig. 4).

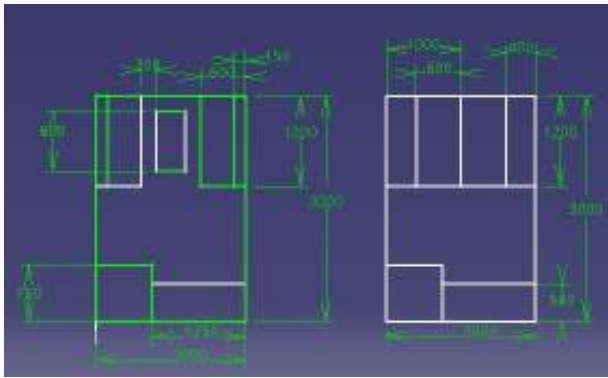


Fig. 4 Interior layout - CATIA

4.2 Adopting a custom solution for caravan design

Regarding the choice of the outside shape of the caravan, I will take into account the principles of aerodynamics, and I will make the caravan in the form of a drop / tear (teardrop), keeping the height of 2m for the caravan's living space, the roof starting to descend for the 0.5m side of the trunk (fig. 5).

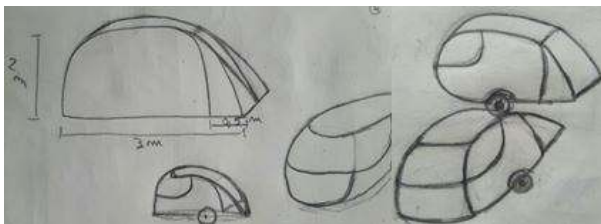


Fig. 5 The exterior - sketch

The combination of an aerodynamic shape and a lower weight is an asset in terms of low fuel consumption; for this reason, the front of the caravan will be rounded.

Inside the caravan there are 3 main areas: the rest and dining area, the cooking area and the toilet (fig. 6).



Fig. 6 The interior - sketch

Being a miniature living room, the caravan is divided into areas with different functions, but some areas have a double role, for example, to optimize space, one of the two sofas that creates the relaxation area, shows a drawer that turns into a coffee table, while by extending her legs, it expands into a dining table or turning into bed, thus causing the rest area (fig. 7).

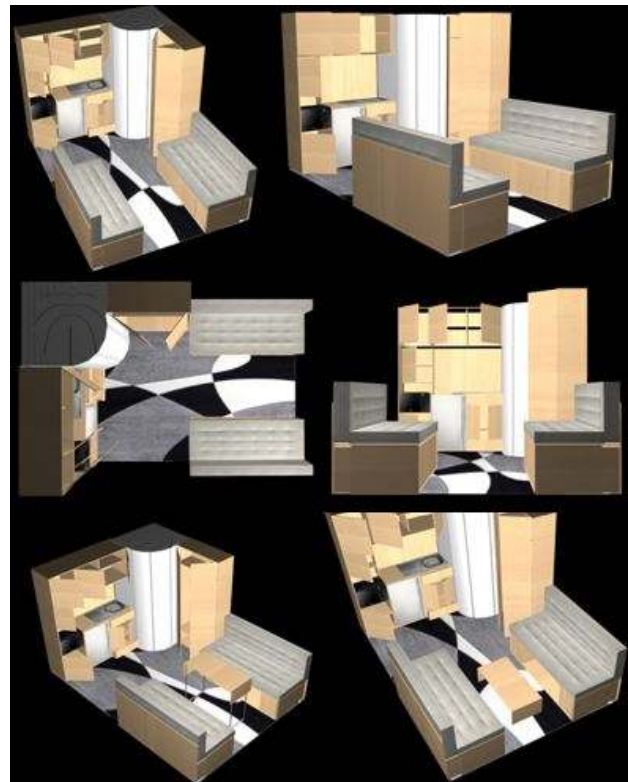


Fig. 7 The interior – rendering 3ds Max

The sofas are multifunctional, representing the relaxation area when used as such, as well as the dining area when one of the drawers it is pulled and turned into the table, or as the rest zone when extending the two frames on the edge and so forming a bed, together with the backrest of the sofa.

The seat portion is placed on a frame that can be pulled, leaving behind a lower area, requiring the pillow to be thicker, so that when the bed extends, the pillows form a flat surface (fig. 8).

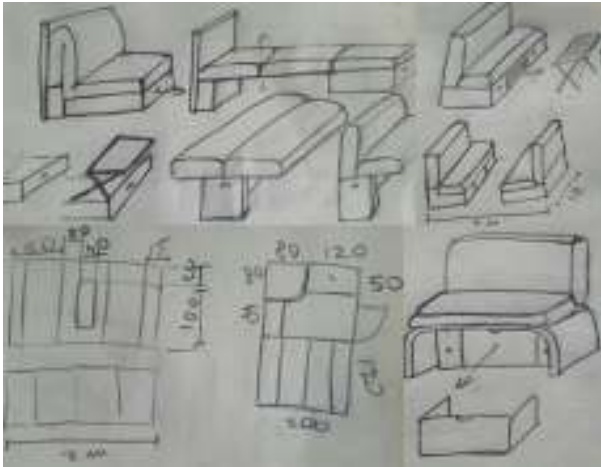


Fig. 8 Sofas – bed - sketch

The table will represent one of the three drawers that the sofa has, the other five drawers being used as a storage space.

The dimensions of the two sofas (fig. 9) are given by the size of a small bed, but enough for two people, 120cm x 200cm and a height up to the mattress surface of 0.5m.

The height of the sofa was chosen to allow for a sufficient width of the drawer that is used as the 45cm table, and the length of 80cm. Like the coffee table, it has a height of 45cm as the drawers.

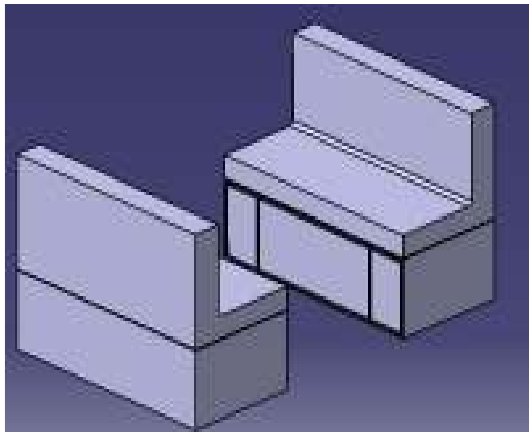


Fig. 9 Sofas – modeled in CATIA

The table has two sides that prevent it from falling out of its intended place as a drawer, and a hitch inside that does not allow it to be pushed backwards, that place being storage.

The table has 2 tubular metal legs that fold in on the inside, offering 80cm in height.

The mattress is attached to the mobile side of the sofa, and when it is extended it pulls the backrest, the bedding time being very short (fig. 10).



Fig. 10 Steps sofas+bed – rendering 3ds Max

For the cooking area, I have created a module that will incorporate everything that is needed to prepare food in optimal conditions (fig. 11).

The mini kitchen is equipped with various components, such as a refrigerator, an electric oven with a hob, a sink with a drying area, a trash can and various storage spaces.



Fig. 11 Kitchen layout – sketch

The kitchen will be spacious enough to be used for long vacations, with 2 drawers and 6 cupboards, one of which, the one under the sink is intended for the garbage bin.

The countertop surface is at a height of 90cm, has a length of 1.20m and a width of 50cm, there being enough space for the placement of the oven and the sink and still remaining space for preparation.

The place of the refrigerator was chosen in the middle so as to create an equal distance between the 3 important points, the hob, the fridge and the sink.

The space under the sink was reduced due to the drain, so it was placed a small cutlery drawer and a garbage bin.

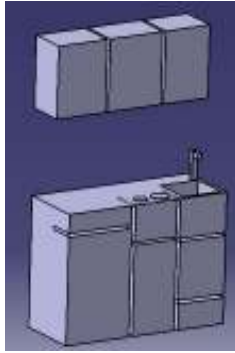


Fig. 12 Kitchen module – modeled in CATIA

The place behind the hob was also used, placing some shelves. The space above the countertop was occupied by 3 cabinets equal to a total length of 1.20m, a width of 0.5m and a height of 0.5m (fig. 12).

The sink has a space of 0.4m, like the hob and fridge.

I chose to make all the cabinets with doors to avoid the fall of stored objects during the road but also for aesthetic reasons, in order not to create a loaded / disordered image that would negatively charge a small space in which two people live (fig. 13).



Fig. 13 Kitchen module – rendering 3ds Max

Even the toilet space was streamlined, the toilet bowl being incorporated into a single sanitary object alongside the sink whose faucet can be raised and used as a shower, the caravan presenting the concept of wet bath (fig. 14).

As for the toilet, it has a small sink over the water basin so that it saves water, the one used to wash the hands reaching the tank for reuse.



Fig. 14 Toilet module – sketch+model in CATIA

The sink mixer can be used to shower with a long enough hose to retract into the outer edge of the toilet tank.

I chose to create this component in order to occupy as little room in the bathroom as possible so there is enough space to have a shower, the bathroom has a small size, the space efficiency being a priority.

Above the sink there is a cupboard for storing the necessary items and in the corner in front of the toilet a garbage bin trapped on the wall to avoid slipping from the water used in the shower (fig. 15).

An idea to create extra comfort was to place a curtain with the role of covering the cupboard, toilet and sink in order to avoid their continuous water spraying.

In the middle of the bath, there is a drain, which is connected to the waste water tank of the caravan.

The toilet door is a semi-circular one, which opens like a shower door by sliding it to the right, inside. The bathroom has an area of 0.8m² and a height of 2m.

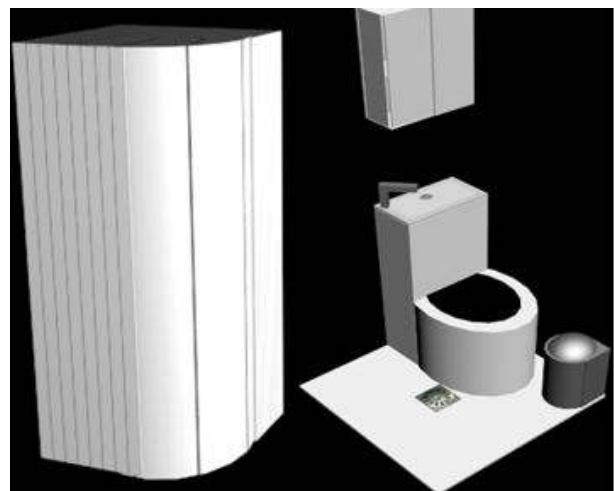


Fig. 15 Toilet – interior+exterior – rendering 3ds Max

The kitchen and the bathroom are joined, both of which are located behind the caravan to be easily connected to the tanks in the caravan and to avoid unnecessary consumption of materials such as pipes and hoses, but also to be near the instantaneous boiler avoiding water scattering.

In the caravan, there is also an additional storage area between the bathroom wall and one of the two sofas in front of the caravans access door (fig. 16).

In the space left unoccupied by different components, a carpet with a modern texture and print will be installed.

The caravan's access is on the right side, in order not to be on the carriage side in case of stops, with a width of 0.5m, being very spacious.

All of the furniture in the caravan is made of the same type of material, chipboard, with the same thickness and color, so as not to visually load the space through different colors and textures, but also to generate a lower price, the technology the fabrication being the same for a fairly large set of objects in the caravan.

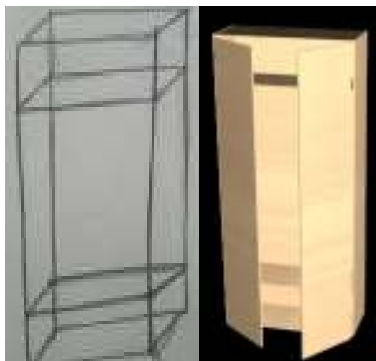


Fig. 16 Additional storage—sketch + rendering 3ds Max

I chose to use melaminated chipboard (PAL) and not medium density fibreboard (MDF), as it has an affordable price and the furniture is easy to make even in a wide range of colors when the consumer chooses the caravan's colors.

The chipboard has some mechanical properties such as scratch, staining, and cracking resistance, which make it the optimal candidate for caravan furniture, and the planks are available in a variety of thickness [6].

To bring more comfort in addition to creating basic needs, the caravan could be equipped with a flat-screen TV, sitting on the roof, which could be used by rotating it in a horizontal position when not in use.

5. GRAPHIC-VISUAL IDENTITY

Complex logo design, text+simbol, for a caravan designed to young people.



Fig.16 Complex logo type

By choosing the symbol of a piece of grass and the "step outside", the logo encourages spending time outdoors.

It fulfills certain principles of the logo design, such as the styling principle, because the message is clear [7].

6. CONCLUSIONS

In conclusion, the concept of the caravan presented is a new one, with many multifunctional elements, with modern, qualitative and low-cost components, the use of space being done in a very efficient manner.

7. DIRECTIONS FOR FURTHER DEVELOPMENT

As far as designing the exterior of the caravan, I will design a more aerodynamic form, I will place as many windows as possible to allow natural light to penetrate, I will consider the ease of disassembly for maintenance, repairs or recycling and I will design the pieces to be so that they are easy to insert.

In the future research design study I will process the caravan's body, choose and model the windows, I will make a study on the price change after choosing a panoramic ceiling over the two sofas, which could reduce the number of windows and the possibility of making the exterior door slide on a rail, rather than being classic.

I will design special furniture seats to help self-centering assembly parts reduce the number of manufacturing steps, the cost of technology, materials and labor, in order to lower the caravan's final cost [8].

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