

Sustainable Urban Furniture Development Project Reusing Container

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Abstract

The present work seeks the development of urban furniture: bus shelter using sustainable materials. For a model design to review a methodology of bibliographic research of shelter models Brazil and in the Municipality of Manaus, and later analysis of data found in our locality seeking to bring the problem lived daily by the population to select a final structuring of the Project. A bus shelter choice is tailored to environmental, ergonomic and low-cost deployment and maintenance conditions in relation to existing shelters. A structuring of the project of inputs, a possibility to reuse materials, to implement clean energy, to design green constructions for the city, to facilitate transportation of furniture to various places and spaces for PNE.

Keywords: Urban Furniture; Coat of Bus Stop; Sustainability;

1. Introduction

The municipality of Manaus has various types of furniture throughout the city and one of them deserves attention for receiving thousands of people who seek public transportation in the moments between boarding and disembarking, which are the bus stop shelters.

One of the biggest challenges of metropolises, anywhere in the world, is the organization of the public transport system. It is known that the right to "come and go" of all citizens has to be respected, but this is not always what happens. Unfortunately in Brazil most development policies and national and regional investments themselves are focused exclusively on the good circulation of private cars and cargo vehicles.

Isolated cases show attempts to prioritize public transportation in Brazil, seeking to democratize urban mobility and accessibility in a planned way, Curitiba is considered one of the best planned Brazilian cities. According to the architect and urban planner. Blindo (2004), advisor to the presidency of the Institute for Research and Urban Planning of Curitiba (Ippuc), the city's entire transportation system and urban policies in general have been designed and are being executed under the philosophy of prioritizing human, environmental scales. and collective mobility.

Another Brazilian city that has become a reference in public transportation is Uberlândia - MG, which made the transportation system become a reference in the country with high rates of popular approval, the bus corridor system is marked by the characteristic economy of forms. , with the use of line metal profiles. Street furniture plays a decisive role in the presence of people in the most frequented, pleasant and comfortable areas of the city. The distribution of benches, lamps, covers and protections can contribute to encourage a more positive and lively relationship between your visitors of these spaces. (KRAUEL, 2007) The need to use reused materials that could stop in inappropriate places and later cause some damage to the environment due to improper disposal is a way to save natural resources and help future generations to access, by thinking about, the material for designing this furniture model. proposes sustainability in action. The use of the container in civil construction has also shown that it can facilitate the distribution of environments and the adoption of pleasant plastic shapes, particularly considering its malleability and modulation, as well as the original structure allows the adoption of flexibility, as an important element for aesthetic design. of buildings and furniture.

The English term container, known in Portuguese as container, is a device used to carry cargo. At the beginning of the major maritime navigations, the goods were transported in casks, since they were sturdy and easy to handle.

Photovoltaic plates, Garden Superior, Water drainage, recharge point of cell batteries are elements that make up the project structure. In addition to spaces reserved for people with special needs (PNE) to promote local accessibility and advertising as a way to fund the maintenance of the set and maintain its functionality without compromising public revenue.

According to Munari (2008) ergonomics is the science that studies the ways to improve working conditions in the workplace. It makes use of contributions from the knowledge of human autonomy, physiology and occupational medicine.

Technical Norms (NBR's), quality standardization norms (ISO's), consultation with the Municipal Transportation agency and urban furniture companies will be a source of consultation and guidance to the project design

2. Methodology

The applied methodology brings the sequence of procedures to arrive at the prototype of the model to be suggested. It seeks to assist in the design of the bus stop shelter improvement guidelines in conjunction with environmental sustainability, ergonomics and cost-benefit analysis.

Table 01 - Essential Prices Procedures adopted

Phases	
1^a	Search of urban furniture catalogs, with the help of data obtained by SMTU and JCDecaux;
2^a	Costs analysis of prices of materials and services in construction;
3^a	Price research and container dimensions at ENTEC;
4^a	Price research at Ecolux company;
5^a	Photographic records of existing furniture around the world, in the country and made in loco in the municipality;
6^a	Bus shelter ergonomics;
7^a	Use of software (AutoCad 2017, Sketchup 2016) and Brazilian Regulatory Standards (NBR's).

Source: Own author

Cost-benefit analysis is essential for the evaluation of projects aimed at improving and well-being of the population. Costs, positive externalities, negative externalities and benefits are aspects to be considered and will be integral parts of the work to be done.

Some images that demonstrate the types of shelters employed in the city, as well as the state in which they are due to acts of vandalism and other aspects.

For Moraes (2009), ergonomics defines for product projects, control systems, information systems and task operationalization the following parameters: "interfacial, instrumental, informational, communicational, cognitive, movement, spatial / architectural, physical- environmental, chemical-environmental, security, operational, organizational, instructional, urban and psychosocial".

Thus, we sought to identify models directed to the study of the product development process to select the model that most contributes to the project proposal, developing the shelter for people who use public transport, according to the approach adopted.

3. Analysis and Development

3.1 Container Architecture

According to Day (1990), architecture causes environmental damage so that architects have emphasized the environmental dimension, adapting the execution of architectural design to natural processes, which has been called sustainable design.

For a long time it was the ideal system to cope with the great difficulties existing in the loading and unloading operations of goods. Over time, with the development of naval engineering and the consequent construction of ships with higher gravimetric capacities, making the problem go to the background. In this period what mattered most was the resolution of the space problem, since the barrel, although effective, took up a lot of space and was no longer enough for that. Thus, after discussions in the international sphere of maritime transport, a definition of a standard has been reached: the then proposed "packaging" should

be metallic, strong enough, resistant to constant use and of modular dimensions.

The use of containers for the construction of projects brings us many advantages because they are quick to build and very economical, they are environmentally friendly, they are used as transportation for eight years and after being discarded. Often occupying the spaces in ports.

Inappropriate container disposal has inspired major sustainable architecture projects around the world. In addition to having a lifespan for the nautical market of approximately 8 years having a product life of 100, which would generate an average of 92 years of “forced uselessness”, it is also cheaper for a shipping company to buy new containers. than transporting them empty back home, which creates a pile of containers in the ports and is fortunate enough to neglect them, and they can become powerful agents for solving such an essential factor, housing for people. (PLANET CONTAINER, 2011).

3.1.1 Container Types and Dimensions

Although they have several standardized measures, 20' and 40' containers are usually used, approximately a little over six and twelve meters in length, with no major difference for the other dimensions. These measures are standardized due to the standardization of the ships as their bays for both units, and for the 40' one can carry two units of 20', these being the most used.

The average payload of 20' containers is 30 to 33 cubic meters and that of 40' is 60 to 67 cubic meters, while their average payload is 28,000 kilograms. A very important aspect, which we must not fail to mention, is the difference between the usable spaces and the volume actually occupied by the packed cargo, often caused by the incompatibility of packaging dimensions with the available space inside the containers.



Figure 01: Container Types

Source: Planeta Container, 2011

3.2 Sustainability

The use of natural resources is the simplest and most widely used way to produce the environmentally friendly architecture and necessarily has the purpose of obtaining thermal quality by replacing the use of industrialized ones. Sustainable architecture must stick to natural aspects and climate.

Dias (2009) reports sustainable development in organizations that have three dimensions, namely, economic, social and environmental. For the first dimension, sustainable development provides that companies must be economically viable. The second must meet the requirements of providing better

working conditions for its employees. And the third is related to the fact that such organizations must be guided by the eco-efficiency of their production processes and adopt cleaner productions, thus offering conditions for the development of an organizational culture. They should also seek non-contamination of any kind in the environment. Most important in addressing these three dimensions of business sustainability is dynamic equilibrium.

3.2.1 Solar Energy

In search of a power source, capable of meeting all needs, being a clean energy, the solar source.

The concept of solar energy is given to any type of light energy capture (in a sense, thermal energy) from the sun, and further transformation of this energy captured in some form usable by man, either directly for water heating or even as electrical or mechanical energy. (KARDOVSKY, 2010).

The Sun annually provides the earth's atmosphere with $5,445 \cdot 10^{24}$ joules or $1,5125 \cdot 10^{18}$ kWh of energy. This is a considerable value compared, for example, to the total energy produced in 1970 by all man-made systems, which was $2 \cdot 10^{20}$ joules or 0.004% of the energy received from the Sun. Over the course of the century, Increasing attention is being given to studying the possibilities of harnessing this form of energy.

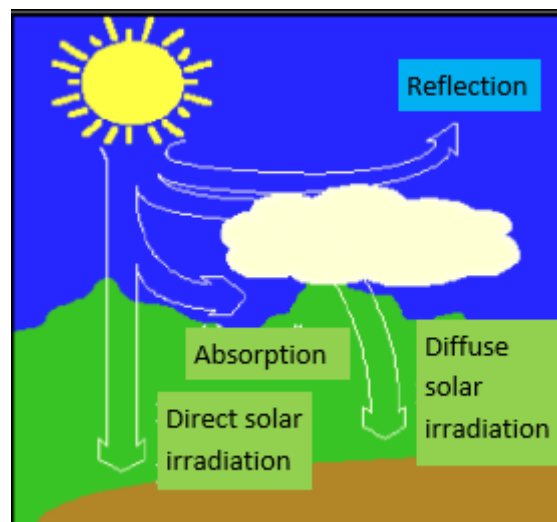


Figure 02: Irradiation Scheme

Source: KARDOVSKY, 2010

This requires a detailed knowledge of it, how much energy is actually available and at what frequency and wavelength.

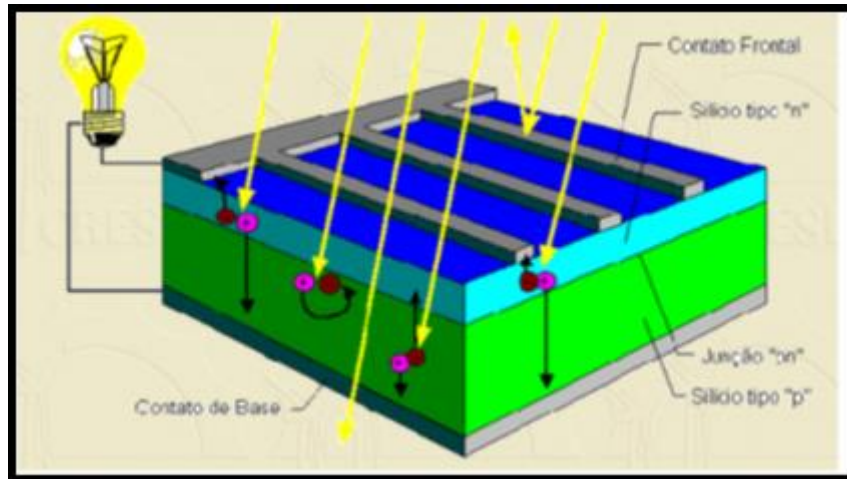


Figure 03: Photovoltaic Plate Operation
Source: KARDOVSKY, 2010

3.1.2 Green Coverage

A green roof, also called a mulch or hanging garden, is a building system characterized by a mulch made of grass or plants. It is installed on slabs or even on conventional roofs and consists of waterproofing and drainage layers, which receive the soil and vegetation indicated for the project. In addition to the aesthetic benefit, green roofs act as thermal insulators on building roofs. For cities, they are a form of vegetated area that, on a large scale, contributes to improving air quality and minimizing the effect of heat islands. In Brazil, the system is still little used and has no standardization. Some cities and states, such as Porto Alegre, Santa Catarina and Guarulhos (SP), have laws and / or instructions that encourage the implementation of green roofs in public and private buildings.



Figure 04: Green Coverage
Source: fastcon.com.br

3.1.3 Vegetation and Maintenance

According to the International Green Roof Association (Igra), green roofs can be of three types:

Extensive: has a garden setting with small undergrowth. The height of the structure, minus the vegetation, ranges from 6 cm to 20 cm. The weight of the set is between 60 kg / m² and 150 kg / m²;

Intensive: includes medium to large plants in a structure of 15 cm to 40 cm. The expected load ranges from 180 kg / m² to 500 kg / m²;

Semi-intensive: This intermediate type has medium-sized vegetation planted in a 12 to 25 cm system. It can carry a load of 120 kg / m² to 200 kg / m².

3.1.4 Components

Regardless of the type, the systems used in green roofs can vary greatly. In a typical application, a green roof can be mounted directly on a slab by applying all the layers in this sequence:

- a. waterproofing layer: usually made with synthetic blankets, it protects the slab against infiltration;
 - b. Draining layer: serves to drain water and also as a filter. Can be made of gravel, pebbles, expanded clay or polystyrene draining blankets;
 - c. Filtering layer: serves to retain particles and can be made with a geotextile;
 - d. Root protection membrane: serves to control the root growth of vegetation;
- and. soil and vegetation.

There are modular systems in which the modules come ready with vegetation, and also systems that use raised floors that store rainwater for subsequent irrigation of vegetation.

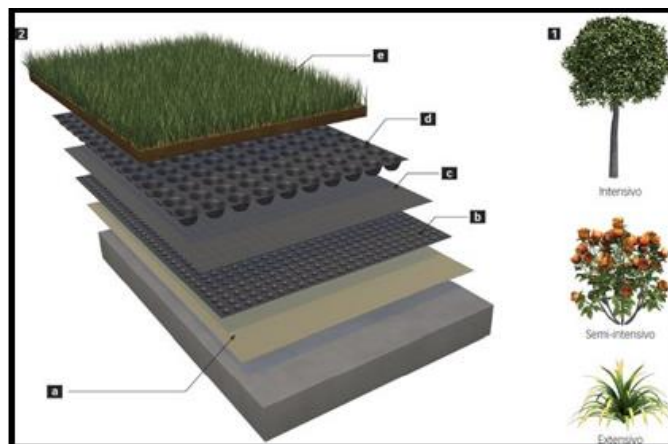


Figure 05: Draining Layers Scheme

Source: fastcon.com.br

3.3 Accessibility

As a definition of accessibility, NBR 14022 states that the user must have the "possibility and condition of range for safe and autonomous use of buses and trolleys." (ABNT, 1997). The main recommendations are that the shelter does not prevent the sidewalk and that there are seats under the shelters, for comfort in the waiting time of public transport. The bus shelter must offer the possibility for the user to use other means

of transport, in an accessible way, besides having safety and comfort conditions.

According to Torres (2006), there should be "care for the user, especially with those who have difficulty staying longer standing, such as people carrying packages and with lap children, elderly and people with reduced mobility." Wheelchair accommodation must be provided in bus shelters with a space of at least 0.80 m x 1.20 m. The circulation area should be 1.20 m wide to allow the wheelchair to pass and stop in the shelter.

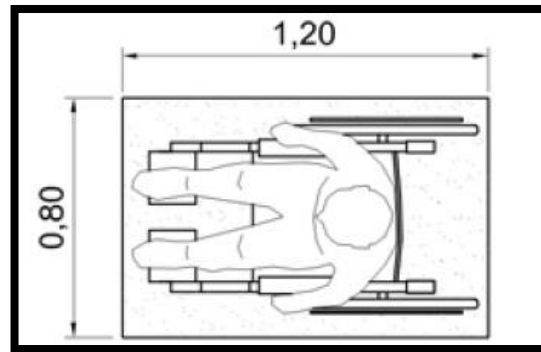


Figure 06: Wheelchair Space
Source: NBR 9050, 2004

According to NBR 14022 (1997), "It is recommended that seating at all accessible stopping points be provided for persons with reduced mobility. The floor must be regular, firm, stable and non-slip under all weather conditions." There are two models of tactile floor, the directional that is used to guide the visually impaired by showing the safe path, and the alert floor that guides you to change direction or signals a hazardous obstacle.

3.4 Models in Use Around the World and in Brazil

Keeping pace with the continued growth and development of cities, urban furniture also needs to develop and keep pace with the emergence of new materials and market trends and should, in addition to enabling new services, provide citizens with sufficient comfort for their accommodation and waiting needs. to get around safely.

In Dubai, United Arab Emirates, bus shelters have air conditioning and wireless internet for their users:



Figure 07: Dubai Shelter
Source: Geograph.org.uk



Figure 08: Shelter in Great Britain
Source: Geograph.org.uk



Figure 09: Shelter in São Paulo
Source: Guto Indio da Costa Design

In Britain, the shelter follows the classic and traditional steel-framed and glass-enclosed side line:

3.5 Models in Use in the Municipality of Manaus

This type of bus stop shelter is a model designed and executed by SMTU itself, by staff members, to serve from new points to be deployed to existing point renovations. It is subdivided into 03 (three) types according to the most demanding location in the city of Manaus:



Figure 10: Type A Model - SMTU
Source: Av. Buriti, MANAUS

3.5.1 SMTU - Type A

The Type A shelter is the largest and has a trapezoidal boarding and disembarkation protection area (3.50m x 9.00m) totaling 47 (forty seven) m² of sheltered area, and 03 (three) seats of concrete for three people of average body height each. Maintenance is the responsibility of the Secretariat itself.



Figure 11: JCDECAUX Model
Source: Av. Colonel Teixeira, MANAUS

3.5.2 JCDECAUX

When we started with JCDECAUX, an exclusive urban furniture company that has 100% (one hundred

percent) coverage in the city of Manaus, the JCDECAUX standard bus shelter, or glass shelter, is characterized by a block dedicated exclusively to publicity. This factor is important for the analysis, as these shelters are funded by other companies for marketing and advertising purposes, thus not constituting a significant expense for the city government. The images below represent the model used:



Figure 12: SEMINF concrete model
Source: Av. Do Turismo, MANAUS.

3.5.3 SEMINF (J. NASSER ENGINEERING)

The next item under consideration, the SEMINF standard shelter, or reinforced concrete shelter, is one of the most recent works in the city. However, it is important to highlight the carelessness that occurred when implementing this stop in the city. In July 2013, the city published the order for approval of the bidding for the construction of 200 (two hundred) concrete model shelters. The value for each shelter model was R \$ 26,000 (twenty six thousand reais) and the total contract value is R \$ 5,314,000 (five million three hundred and fourteen thousand reais) with the construction company J. NASSER ENGINEERING.

4. Proposed Prototype

Analyzing the technical data and architectural arrangements of current models, we come across this, show your suggestion as the lack of structure in the current points located by the city. Seeking to meet the needs of users of public transport taking into consideration climate conditions, safety, accessibility, convenience. Below are illustrative images of the project:

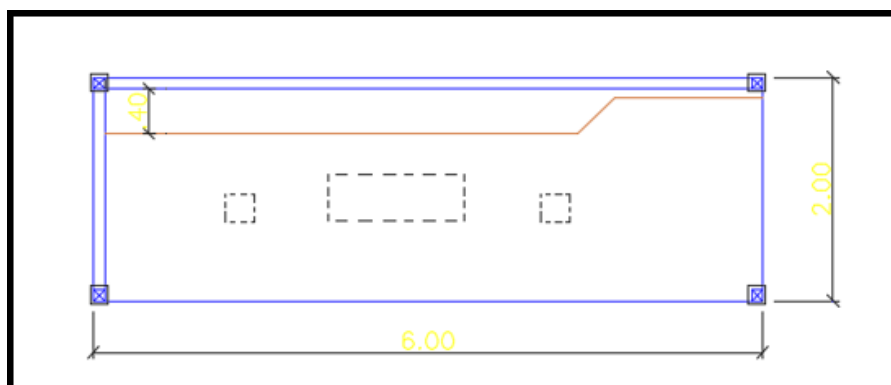


Figure 13: Floor Plan

Source: Own Author, Auto Cad 2017

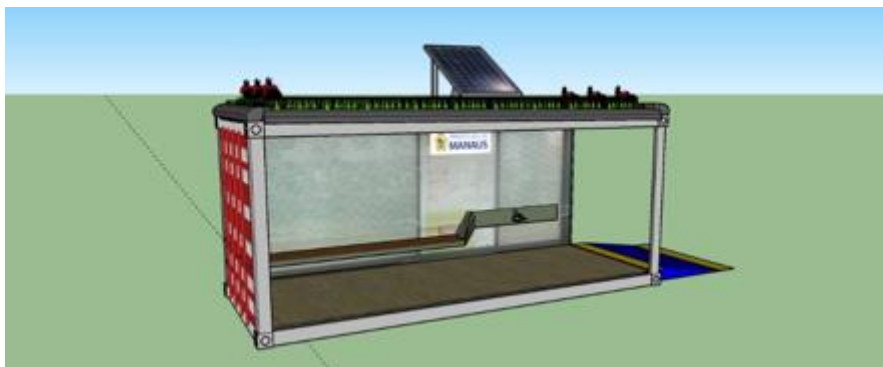


Figure 14: Electronic Mockup Image 01

Source: Own Author, Sketchup 2016

4.1 Technical Data

Table 2: Technical Information.

Dimensions (m)	2.38 x 5.90 / H = 2.38
Container Type	Dry Box-Adapted 20'
Green roof	Intensive Type
Solar plate	Monocrystalline Silicon
LED light fixtures	2x 20 W
8mm Glass Plate (m2)	14.04
Accessibility	Conforme NBR 9050/2004

Source: Own Author

5. Final Considerations

This work showed a solution for the construction of a Urban Furniture through sustainable materials, using container architecture knowledge, and methodology tools a structuring for a project, which will meet the specified objectives, on top of a sustainability concept. Because of these aspects, shelter emerges as a component to minimize population problems, but it is necessary to realize that it is only a temporary factor. More importantly, collaboration between the city government and the population becomes indispensable, as countless acts of vandalism are witnessed and compromise the quality and quantity of the shelters. So even with these difficulties, it was possible to come up with a project that met all the objectives stated in the work. From a satisfactory result, to make the bus shelter with sustainable materials.

6. Acknowledgment

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