World Academy of Science, Engineering and Technology
International Journal of Architectural and Environmental Engineering
Vol:17, No:5, 2023

Strategic Redesign of Public Spaces with a Sustainable Approach: Case Study of Parque Huancavilca, Guayaquil

Juan Carlos Briones Macias

***Abstract*—**Currently, the Huancavilca City Park in Guayaquil is an abandoned public space that is discovering a growing problem of insecurity, where various problems have been perceived, such as the lack of green areas, deteriorating furniture, insufficient lighting, the use of inadequate cladding materials and very sunny areas due to the lack of planning in the design of green areas. The objective of this scientific article is to redesign Huancavilca Park through public space design strategies for more attractive and comfortable areas, becoming a point of interaction in a safe and accessible way. A mixed methodology (qualitative and quantitative) was applied, obtaining information based on surveys, interviews, field observations, and systematizing the data in the traditional weighting of the structuring aspects of the park. The results were obtained from the methodological design scheme of iterative analysis of public spaces by Jan Güell. It is concluded that the use of urban strategies in the structuring elements of the park, such as vegetation, furniture, generating new activities, and security interventions, will specifically solve all the problems of the Huancavilca Park tested in a Pareto 80/20 Diagram.

***Keywords*—**Public space, green areas, vegetation, street furniture, urban analysis.

I. Introduction

PUBLIC spaces in the city of Guayaquil, have been developing in an open way, but nevertheless due to insecurity they have been closed, which are still unsafe spaces where the lack of lighting deteriorates due to lack of maintenance, making the influx to these spaces has decreased by more than 60% [1].

Huancavilca park was developed as a project to recover public space for children's recreation with a surface area of 7,500 m^2. It has landscaped areas, children's games, pergolas, an outdoor gym, sanitary blocks, and a spiral bridge that connects the two internal blocks of the park. Currently, its influx of visitors and even residents has decreased due to the insecurity that exists in the country, making it an isolated place without proper maintenance.

The capacity of the Huancavilca Park was planned for 3,700 people, but currently, due to its location, pedestrian accessibility and being between two main avenues with a high rate of traffic, its influx of people has been decreasing, to the point of having visits in the morning hours of 30 people, in the afternoon of 30 people and in the night of 12 people daily, based on information obtained by interviewing the security guard of the park.

Briones Macias Juan Carlos is with University of Guayaquil, Ecuador (e-mail: juan.brionesmac@ug.edu.ec).

The lack of attention to the needs of the pedestrian and the equipment of the park has created a non-functional and inaccessible design, causing the public space to be underutilized and therefore wasted, generating disinterest on the part of the surrounding population since they do not include areas and services of potential use [2]. The functional conditions applied in the design of the park are minimal, since the furniture is not ergonomic, the lighting is insufficient, the vegetation does not generate thermal comfort or shade, and the materials used in the children's areas and outdoor gym are in very poor condition, creating unsafe and uncomfortable areas.

Being located in the center of the city, it is surrounded by business, commercial, educational, service, and mixed (residential-commercial) activities, where this space functions as a place for recreation, relaxation and part of the increase in green areas in the city. However, it is necessary to redesign the areas that the park currently offers, improving its functional, formal and perceptual conditions in order to attract citizens to make use of this public space [3].

The underuse of Huancavilca Park and society's lack of interest in this public space is the result of a planning failure that, by not considering the needs and interests of its potential users [4], has ruled out the potential of this public space, turning it into in a possible generator of social problems, since its abandonment generates a progressive deterioration that affects the security of the environment. According to the Habitat III Conference in 2017 [4], it stands out that public spaces, such as squares and parks, are among the places with the highest perception of insecurity, where three out of 10 respondents state that they feel unsafe in the squares and parks belonging to the area where they reside.

With the current reality of the COVID-19 pandemic, there has been an interest in reactivating outdoor activities and the use of public spaces and green areas [5], for which the redesign of the park will allow people to leave their confinement to clear their mind and the disconnect from daily activities which will help improve quality of life. This is why the study acquires greater relevance to comply with the current framework of national development and public policies in times of pandemic. It is intended to comply with three programmatic axes of the National Plan for the Creation of Opportunities 2021-2025 to have the sustainable development of the proposal. Generation of employment from the reuse of waste in construction is

established in the economic axis to increase productivity and develop a greater demand.

Second axis (social) guarantees to promote meeting places where the interaction between art, culture and heritage elements is promoted.

In the ecological axis, the use of green areas focused on the preservation of the environment is promoted [5]. According to these antecedents, the redesign of the Huancavilca Park is justified using three conditioning factors such as functionality, form, and perception so that the space is used in its entirety in order to reactivate and stimulate the recreational activity of the park [6]. The final objective of this scientific article is to redesign the Huancavilca Park through public space design strategies [7], to create more attractive and comfortable areas, becoming a point of interaction in a safe and accessible way.

II. Materials and Methods

The project is aimed at redesigning the park from three conditions of functionality, form, and perception of the proposed interventions of furniture, equipment and vegetation, through iterative analysis of user needs and the study of the weaknesses and potentialities of the site to obtain a real solution to complex problems [8]. This document will contribute with a new design of the Huancavilca Park based on the synthesis of results according to the materials and methods to be used.

Approach and Method

The research approach is mixed (qualitative-quantitative), prioritizing the qualitative approach based on secondary information collected in digital libraries, books, site observation (compositive analysis), surveys and interviews.

Quantitative approach with the analysis of the data in a probabilistic statistical way was applied to a monthly study framework synthesis of the most relevant problems to obtain solutions that respond to the greatest number of problems presented on the site.

The inductive method was used since it is based on the study and reasoning of specific facts or cases to reach a general conclusion. The inductive method is applied since it is based on observation and hypotheses are created about a particular phenomenon to obtain general conclusions.

Study Types and Instruments

Two types of applied and exploratory research structured in phases were used for the project.

The applied research was based on the search for theories and the collection of secondary information to obtain a theoretical and conceptual framework for the site.

The exploratory research had as its first phase the search for problems within the site (Huancavilca Park), based on this the field of study was delimited according to the problems identified around its functionality, accessibility, and disuse.

A second phase of observation is based on obtaining data on vegetation and street furniture. The surveys of the selected sample and interviews with park leaders and authorities continue, concluding in a systemic data analysis. This type of research contributes to the understanding of the problem and the needs of the site.

III. Methodology

For the research, an iterative design methodology is applied in which five steps are used for the development of the proposal, this methodology is called Innodriven.

An analysis of solutions is addressed, placing the human being and the environment as research axes, in the search for a triple social, economic and environmental benefit. This methodology forms a design structure that applies strategic planning focused on the analysis of complex problems and solving them collectively.

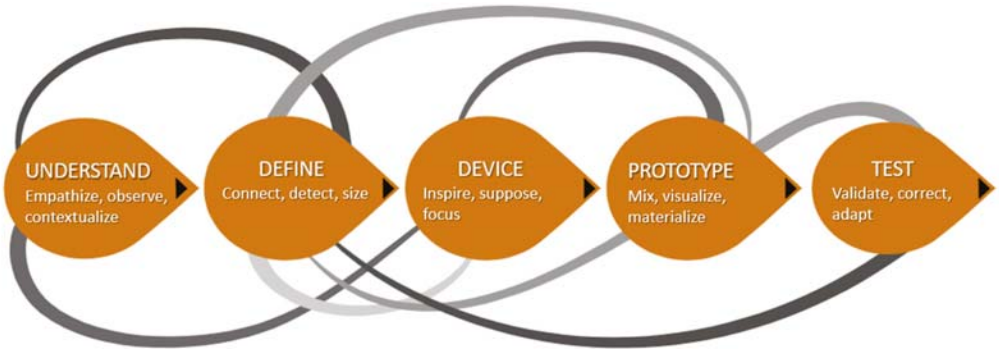

Fig. 1 Methodological outline of the research design [9]

Strategic planning, according to Gehl [10], conceives this scheme as a functional system, by generating an iterative model of analysis, which for purposes of analysis of public space focused on green areas will adopt a neighborhood and sector scale. As a process for the analysis of public space within territorial planning, a simplified systemic approach is studied that reflects an optimal solution for the analysis of green areas in public spaces.

Pareto Chart

The data obtained from the previous analyses will be synthesized in a decision-making graph with an 80/20 structure that will include 80% of the consequences from 20% of the causes [11]. Therefore, a curve graph is obtained with quantifiable data of the most relevant problematic aspects and the actions to follow through recommendations. This diagram

served to recognize the most important needs within the Huancavilca Park and prioritize actions around the conditions and interventions of the study. This diagram was applied to the results study framework.

IV. Results

A. Compositional Elements

For the analysis of the park, its main compositional elements were considered, such as vegetation and urban furniture. This analysis is part of the methodological design in the phase of understanding and defining.

Species currently used in the park employ both native and non-native (introduced) species. The species will be selected by their weighted assessment based on the following characteristics: autochthonous (4), adaptable (3), ecological (2), unsuitable for the environment (1) and introduced (0).

TABLE I
Active Population

Common Name	Type	Assessment	Observation
Tecoma	Introduced	0	Not suitable for the weather
Guayacán rosado	Native	4	N/A
Ceibo	Native	4	N/A
Pimentero brasileño	Introduced	0	Plague
Palo prieto	Introduced	0	Not suitable for the weather
Laurel negro	Native, but not fit for the middle	1	Not suitable for the weather
Neem	Native+ ecological benefits	6	Good smell
Samancillo	Nativa	4	N/A
Cascol	Nativa+ ecological benefits	6	Good shade
Ciprés	Introduced	0	Not suitable for the weather
Roble	Native, but not fit for the middle	1	N/A
Guachapelí	Native+ ecological benefits	6	Good shade
Guayacán negro	Native+ ecological benefits	6	Good shade
Fernán Sánchez	Native+ ecological benefits	6	Good smell
Uva de playa	Introduced	0	Plague
Palo verde	Adaptable+ ecological benefits	5	Adapts to climate and good shade
Algarrobo	Introduced	0	Produces waste
Suche	Adaptable+ ecological benefits	5	It adapts to the climate, good shade, smell and bright colors
Manzana de agua	Introduced	0	Not suitable for the weather
Rosa de montaña	Introduced	0	Plague
Pechiche	Native+ Adaptable+ ecological benefits	9	Attracts pesticide species, hummingbird micro ecosystem, fruit tree
Mango	Native+ Adaptable+ ecological benefits	9	Adapts to climate, fruit tree
Naranjo	Native+ Adaptable+ ecological benefits	9	Adapts to climate, fruit tree
Plátano	Native+ Adaptable	7	Adapts to climate, fruit tree, produces waste
Papaya	Native+ Adaptable+ ecological benefits	9	Adapts to climate, fruit tree
Buganvilla	Native+ Adaptable+ ecological benefits	9	Easy maintenance, colorful tree, good smell
Cyca	Introduced	0	Not suitable for the medium
Crotón Zanzíbar	Introduced+ ecological benefits	2	Very colorful leaves
Heliconia avecilla	Native+ Adaptable	7	Good growth and low maintenance
Ginger	Introduced+ Adaptable	3	Suitable for hot tropical climate
Bijao	Native, but not fit for the middle	1	Not suitable for parks
Cordilínea	Introduced	0	Plague
Cordilínea conga	Introduced	0	Plague
Lengua de suegra	Introduced	0	Not suitable for the medium
Singonio	Native+ Adaptable	7	Low maintenance and fast growth
Helecho Boston	Native, but not fit for the middle	1	Not suitable for the medium
Filodendro limón	Introduced+ Adaptable+ ecological benefits	5	Adaptable to climate, good smell, pesticide
Ixora roja	Native, but not fit for the middle	1	Very delicate maintenance and not suitable for the weather
Ruelia	Introduced	0	Not suitable for the medium
Chavela	Introduced	0	Not suitable for the weather
Cactus cirio	Introduced	0	Not suitable for the weather
Césped San Agustín	Native+ Adaptable	7	Sturdy but needs to be well maintained

By means of the weighting carried out, the species that comply with a qualification of 5 or higher will be chosen. It is obtained that the species that integrate two ecological functions are beneficial for the users.

The urban furniture used in the Huancavilca Park was analyzed under measurement criteria such as functionality and being friendly to the environment. According to the analysis, four non-beneficial elements for the park were obtained, such

as the pergola in which they are found, ecological materials that must be used, waste containers 1-3 that must be structured with recycled materials and having waste separators, with an all-metal enclosure.

TABLE II
URBAN FURNITURE OF HUANCAVILCA PARK

Type of Street Furniture	Material	Comment
Banking 1	Wood and concrete	Functional and environmentally friendly
Banking 2	Wood	Functional and environmentally friendly
Banking 3	Concrete	Functional
Picnic table	Wood	Functional and environmentally friendly
Pergola	Metal and polycarbonate	Functional, but environmentally friendly material should be used
Children's games (traditional)	Metal and plastic	Functional
Children's games (modular)	Metal and plastic	Functional
Exercise machines	Metal and plastic	Functional
Volleyball net	Metal	Functional
Waste containers 1	Metal and plastic	Not friendly to the environment
Waste containers 2	Metal and wood	Functional
Waste containers 3	Metal and plastic	Not friendly to the environment
Vertical Advertising LED Pole	Metal	Functional
Outdoor lamppost	Metal	Functional
Public lighting pole with individual arm	Metal	Functional
Double arm street lighting pole	Metal	Functional
Signage	Metal	Functional, but recyclable material should be used
Sprinkler	Plastic	Functional
Pots	Plastic	Functional, but recyclable material should be used
Spiral Pedestrian Overpass	Concrete, wood, and metal	Not functional
Enclosure	Metal	Not friendly to the environment

TABLE III
DATA AND SAMPLE RESULTS

Population	Confidence Level	Chance of Success	Probability of Failure	Maximum Allowable Error	Sample Size
3.700	1.96	0.95	0.05	0.07	72

For the survey, a probabilistic sample was used by conglomerates based on the average influx of the park in the morning, evening and night hours.

Results of the Interview with Leader 1 – Real Estate (Developer of the Huancavilca Park):

- Interviewee: Leader 1 – Inmobiliar (Developer of Huancavilca Park)
- Answer 1: As a main quality, an urban park must be welcoming, that it be seen as part of nature, even if it is within the city, that green areas be prioritized.
- Answer 2: The park would be more attractive by making it known that it has spaces for recreation, and to spend a pleasant moment either alone, as a couple or as a family.
- Answer 3: One of the strategies to improve security would be to hire enough security personnel to be able to give citizens the peace of mind that they can enjoy the park.
- Answer 4: It is suggested that family recreation should be emphasized as the main function, promoting activities focused on exercise and sports, social gatherings and family recreation.
- Answer 5: Yes, more exercise machines could be added, some kind of lagoon that includes ducks and fish.
- Answer 6: The important thing would be that there is abundant reforestation, there is a constant plan to plant new trees and different varieties of plants.
- Answer 7: Every day maintenance is conducted, since cleaning is also part of maintenance, the cleaning staff daily collects waste from both the interior and exterior of the park. In addition, lawn areas and trees are trimmed.
- Answer 8: Not inside the park, because I believe that green areas must be maintained and cared for, but not reduced. The idea would be to designate park areas outside the park.
- Answer 9: It would be good to include commercial areas, for this space, islands such as cabins could be implemented that are consistent with the style of the park, they would look good and people out of curiosity would come and buy handicrafts or food.

The analysis and interpretation of the survey and interview is part of the methodological design in the ideation phase, in which first-hand data will be obtained to suppose and formulate new ideas for the development of the proposal.

B. Proposal

The redesign of the Huancavilca Park in the city of Guayaquil has been proposed to increase the intensity of the use of space and reduce insecurity in the area, integrating areas that users require, where social, cultural and economic interaction is encouraged for the benefit of the city. It is proposed to improve the design of green areas where the use of native plants is prioritized to minimize maintenance and generate shadows in common areas. It conforms to the methodological design in the proposing phase. The composition of the proposal is based on circular polygons in function of a closed form that fulfills a family meeting function. Sports activities were included with a

volleyball court, the vegetation system is configured according to the ecological benefits analyzed and the implementation of furniture made with recycled materials. From this proactive phase, a redesign of the Huancavilca Park was contributed, creating more attractive and comfortable areas, becoming a point of interaction in a safe and accessible way (see Fig. 2).

Fig. 2 Huancavilca Park Redesign Proposal – 3D Visualization

TABLE IV
PARETO DIAGRAM APPLIED TO THE REDESIGN OF HUANCAVILCA PARK (BASED ON ITERATIVE ANALYSIS)

Huancavilca Park Redesign Proposal					
	Actions and Needs	Qualification	Percentage	Accumulated	% Accumulated
1	Vegetation	20	28%	20	28%
2	Street furniture	18	25%	38	53%
3	Generate new activities	11	15%	49	68%
4	Security	10	14%	59	82%
5	Use of ecological materials	8	11%	67	93%
6	Better planning	3	4%	70	97%
7	Maintenance	2	3%	72	100%
	TOTAL	72	100%		

C. 80/20 Testing

The proposal will be tested in a Pareto Diagram obtaining a decision-making chart with an 80/20 structure to establish an action plan that prioritizes the actions and needs around the redesign of the Huancavilca Park.

According to Fig. 3, it is observed that 80% is represented by the actions and needs that must be corrected because they are more frequent; that is, as a priority it is necessary to intervene in the vegetation, urban furniture, generate new activities and intervene in the security of Huancavilca Park, which would solve the remaining 20% as an indirect effect to these priority interventions.

V. DISCUSSION AND CONCLUSIONS

According to the analysis of the vegetation, it is observed that there are species harmful to the ecosystem of the park, which affects its good maintenance. In the results phase it is recommended to use species that includes two ecological benefits such as adaptability to the environment and maintenance to be profitable with the current conditions of the Huancavilca Park.

It is detailed in the table furniture that they are functional and friendly with the environment, in which four pieces of furniture are observed that do not offer these characteristics, so they are involved in the proposal. The species to be used, in terms of the

conditions of the park with respect to these two analysis variables, shows that its initial design conception needs an intervention to improve the conditions of attractiveness and functionality of Huancavilca Park.

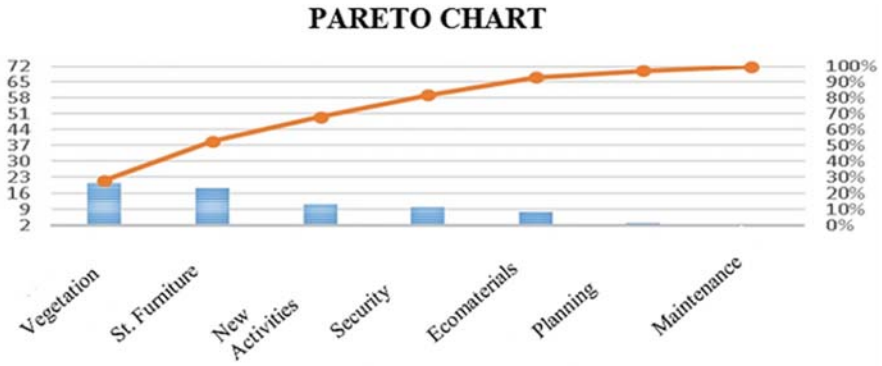

Fig. 3 Pareto chart graphics

The respondents evaluated the condition of use, perception and functionality of the park, leading to the fact that the park is not comfortable, has shortcomings in terms of its maintenance and needs new recreational spaces in relation to the inclusion of new activities. The interview evaluated the technical opinion of the respondents to obtain continuous improvements focused on the safety and materiality of the furniture and maintenance of the green areas.

The testing of the proposal resulted in a direct intervention in the vegetation, urban furniture, generating new activities and intervening in security to indirectly solve the problems of use of ecological materials, planning and maintenance. Therefore, the testing is relevant as it starts from the opinion of the respondents and the iterative analyses of the methodological phase responding to the results obtained.

According to the results found, it is concluded that the proposed improvements are referenced to the study of vegetation and urban furniture as structuring elements of the park. The vegetation chosen for the park is strategically reconsidered so as not to reduce the urban green index of the city and to enable the feasibility of the project, where developing an organic garden using ecological materials and applying landscaping criteria guarantees to exhibit more natural, attractive, and functional green areas, stimulating the senses of park visitors as well as favoring environmental comfort and the natural environment. As a security factor, it was obtained that the maintenance of the luminaires would correspond to a more optimal and viable solution to reduce the rate of violence and insecurity in Huancavilca Park. According to the tests carried out, more reliable solutions were obtained that respond to 80% of the problems that would provide an indirect solution to the remaining 20% with the proposed actions on vegetation, urban furniture, generation of new activities and security. According to surveys, it is identified that active recreation activities are the most accepted and in particular sports are welcomed through a volleyball court.

With respect to other studies carried out, this iterative analysis is relevant for studies of public spaces, which leads to having a direct relationship with urban parks to obtain consistent solutions to complex problems, as indicated by Ghel [10] in his studies of strategic planning; however, this process must be continuous in a subsequent follow-up phase, to establish new actions to revitalize public spaces (in this case Huancavilca Park).

ACKNOWLEDGMENT

Special thanks to the group of researchers that make up this team, where it has been possible to obtain a concise, coherent investigation and a level of experimentation analyzing the territory in an effective way that, thanks to the opening of the Municipality of Guayaquil Canton and the study participants, have reached to get the results.

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