São Paulo Modern Architecture: A pioneering experience in sustainability matters

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ABSTRACT: The present paper focuses modern architecture of São Paulo and the workmanships of pioneering architects linked to the so called "Paulista School", in the period between 1940 and 1960, looking forward to demonstrate the sustainable concern of the designs carried through at this time.

Architectural fitness has always been present in this city, the biggest industrial and economic center in Brazil, with a different context from other cities in Brazil.

When modern movement in architecture was introduced, a new attitude of design concerned environment acquired more strength and vigor, becoming evident by the use of architectural elements such as shading devices, panels, shutters, latticework and by a sensible implantation and buildings orientation.

Outstanding models can be checked within the works of well-known architects of São Paulo. As their buildings could not support "active" devices and resources due to financial and technical difficulties in an incipient building industry, original and creative solutions were proposed with the only use of available materials and human resources. Thus they can be considered pioneering in matters of the sustainability, either on bioclimatic approach or in the efficient use of the material resources, but in its brainstorming that confers to the São Paulo architecture a cultural identity.

Conference Topic: 8 Traditional Solutions in Sustainable Perspective
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1. MODERN ARCHITECTURE AND THE SUSTAINABILITY CONCERN

In paper presented at the 18th International Conference on Passive and Low Energy Architecture on November 7-9, 2001: "PASSIVE AND LOW ENERGY ARCHITECTURE EDUCATION FOR CHANGE IN SOUTH AMERICA", John Martin Evans referred to brazilian pioneers on sustainability approach mentioning the works of Oscar Niemeyer, Lúcio Costa, Roberto and Affonso Eduardo Reidy brothers, all architects belonging to the so called "Carioca School" hosted in Rio de Janeiro and mentors of the spreading and prestige of the Brazilian modern architecture development: The control of light and sun through the design of shading devices was a clear expression of the modern movement in the region. The correct design of these new architectural elements required an integration of technical concepts with architectural design objectives [3].

When does that concern appear? The true frontier of the Brazilian architecture is the Palácio Capanema, old Education and Health Ministry, planned by Alfonso Eduardo Reidy, Carlos Leão, Emani Vasconcelos, Jorge Moreira and Oscar Niemeyer, under Lúcio Costa coordination and with consultancy of Le Corbusier. That building shows in its Southeast façade a great glassed surface, in the models of Modern Movement canons, however the Northwest façade brings a break-sun (brise-soleil ) that, if on one side there is no doubt in being inspired in the proposal of Le Corbusier for the reurbanization plan of Argel, in another way they were the Brazilian architects who first put the theory in practice. The northwest façade is a clear adaptation proposed to the local reality, in the measure movable fibro-cement horizontal sheets are used, fastened by great concrete vertical sheets to assure brightness in the dark days. The brise plan was separated the façade in boxes of 5 for 2 meters, with depth of 1,30 meters, with 3 horizontal panels fastened in their sides, 50 cm ahead of the windows, to facilitate the dispersion of the heat that is formed between the break-sun and the building interior. The brises were calculated for the noon sun of summer in the zenith and for a winter sun to 45 degrees [8].
Figures 1 and 2: Education and Health Ministry: northeast façade and Lucio Costa sketches showing the shading devices operation.

The Ministry architect’s staff perception to identify the problems that would happen with the direct proposal transposition of natural light use of the Modern Movement for the reality of Rio de Janeiro reality, there is: excessive brightness, the daylighting inconvenience and excessive thermal load and its proposal to solve these problems through architectural element that could control and filter this light, it was, in a first moment, a practical intention, but was transformed in an attitude that marked the Brazilian architecture deeply, directed it to the context question, do not forgetting the clarity search, a Modern Movement characteristic.

Starting from the Palácio Capanema, with its brise soleils, the plans should consider the regional differences and the context needs: everyone, with the same moderns renewal purpose, they looked for in there plans the same Brazilian language for the functionalist postulates - they get to resuscitate the old trellises, old cobogós and traditional façades tiles covering and everything more than it could serve as bridge between the authentic past and the present valued already by the armed concrete, with their stilts, terraces, gardens and break -suns, the famous brise soleils. [5].

2. SÃO PAULO CITY ARCHITECTURE

The São Paulo municipal district is located at 23° 32’ 36” of south latitude and 46° 37’ 59” of longitude West of Greenwich, being crossed by the Capricorn tropic. It engages the called São Paulo plateau, which more frequent altitudes are between 715 and 900 meters above the sea level. The geographers classify the São Paulo city climate as Tropical of Altitude, that is on polar and tropical masses collided directing influence, marked by a big thermal variation accentuated by the altitude, with two stations well characterized: the hot and the cold and the rainy between dry station alternate. The higher meddles temperatures happen between November and March, being accentuated in February while the low happens in July. The annual maximum averages are of 25°C and the low of order of 7,5°C. The medium width of the daily variation is of the order of 8,5°C. The dominant air current in all of the times all year are in the sense East-Southeast-South as a result of the high and low cells pressure that originate the Atlantic-tropical and continental-equatorial air masses. It is considered the following light available to São Paulo city, considering conditions of medium cloudiness, true solar time valid for the 10 or 14 hours: 33 000 lux in the summer solstice, 28 150 lux in equinoxes and 18 050 lux in the winter solstice. It is city characteristics the incidence of the noon Sun almost perpendicular to the earth surface during the summer and the incidence of the sun to the dawn or at dusk in an almost perpendicular angle to the vertical illuminant plan, besides the high incident solar radiation, as direct radiation in sunny days, or as in form of diffuse radiation during the cloudy days [7] [10].

The concern with the adaption to the place in the architecture of São Paulo city can be detected in the pioneering studies of Vítor da Silva Freire and Alexandre de Albuquerque about day lighting and aeration, establishing the necessary relationships between buildings heights and the streets and avenues widths, studies those that culminate with the publication, in 1916, of the book Day Lightning - orientation and streets width, buildings heights, with Vítor Freire foreword. Starting from his work, the subject of the day lighting entered definitively in the codes and, in the 20’s by Arthur Sabóia’s hand, it represented in the Municipal district works Code, that had the merit of turning accessible for all the planners scientific rules of all polytechnical teachers[5].

Significant changes happen 20’s, 30’s and 40’s in the architecture of São Paulo city, with strong reflexes in the day lighting natural and thermal illumination control, as you can verify in the Gregori Warchawchik, Flávio de Carvalho, Rino Levi, Alvaro Vital Brazil, Bernard Rudofsky, Vilanova Artigas, Eduardo Kneese de Mello and Franz Heep’s works.; evidently, even due to the ministry building, the Le Corbusier influence is powered with their 5 points of the new architecture. An element series began characteristic in the day lighting, illumination and thermal control: the brise soleil, movable panels as blinds, louver doors, trellises, awnings, grills, “cobogós” or drained elements, the darker edge, the internal patio, the “pergola”, the controlled zenithal light, among others solutions.
The São Paulo city architects also adopt brise soleil as fundamental element for the day lighting, thermal and brightness control, as it maybe verified in plans as the Estado de S. Paulo (1946) and Itália building (1956), both of them by Franz Heep, and in the 5th Avenue Building (1959) by Pedro Paulo de Melo Saraiva and Miguel Juliano, where the northeast façade is protected by a brise soleil adjustable made by aluminum that forms a continuous panel of high to lower or the Banco Sul-americano Building, nowadays Itaú, by Rino Levi, Roberto Cerqueira Cesar and Luis Roberto Carvalho Franco(1963) where aluminum horizontal movables brises protect the northeast façade that forms a continuous panel and the southwest façade receives the same brises just the superior part of the window of the pavement type, is notice that the brise proposal crosses the functional subject and it is also imposed as important plan composition element.

But the brise was not the only protection element used; it also diffused the use of movable panels as persian blinds, shutters, trellises, awnings, grills, “cobogós” or drained elements; those elements are used in São Paulo city in the project in the Sociedade Plavinil Building plans, by Rino Levi and Associates (1961-1969) and in a series of architect’s Oswaldo Bratke works. That was a master of light and sun modulation with those architectural elements.

The internal patio is used by Bernard Rudofsky in the Frontini (1939) and Arnstein (1941) houses and explored by Rino Levi in the Philosophy and Letters Sedes Sapientiae College (1941) organizing the several spaces around a patio surrounded by
marquee. In that work the areas of internal circulation are illuminated through walls of glass bricks that close the structure spaces. In Rino Levi residences you can meet the internal patio associated to an ingenious pergola set for instance in the architect’s house all the rooms go back to one of the three internal patios, while the internal galleries are just protected only by a cement *brise-soleil*, that shows the architect’s concern with constructive aspects and solutions for the climate. To acclimatize the atmospheres naturally, Rino Levi established a specific relationship among architecture - nature and interior - external, through the space continuity, tropical brightness control and of nature presence.

The shadow offered by the edge is worked still by Vilanova Artigas in their first plans with powerful influence of Frank Lloyd Wright architecture; in the subsequent phase that beginning becomes a great shadow, as it can be verified in plans as the Itanhaém School (1960-1961), the Guarulhos School (1961), the Santa Paula’s Club Boat Garage (1961-1963), and others. The idea of the zenithal light appears in the FAU – Faculdade de Arquitetura e Urbanismo plan (1961-1969) by Vilanova Artigas, where a diffuse zenithal light illuminates the atmospheres evenly and in the Santo André City Hall (1965-1969) where Rino Levi elaborates a zenithal light carefully controlled.

3. METODOLOGICAL ASSESSMENT FOR SUSTAINABLE APPROACH

In order to analyse these building with principals of sustainability it was chosen the methodological assessment called *ABIHA* – *Arquitetura de Baixo Impacto Humano e Ambiental* (Architecture of Low Human and Environmental Impact) proposed as a result of PHD research from Roberta Kronka Mülfarth. This methodological assessment was developed in order to help professionals using ABIHA. It is key that goals are established during all stages of building lifecycle. These goals approach not only environmental features, but also the social, cultural and economic ones, which are the “human” aspects of ABIHA [8].

The assessment is composed by filing forms, separated in four (04) areas that should be analysed: humans, site, building and materials. These forms were called:

- Reduction *Humans* Impact evaluation form
- Reduction *Site* Impact evaluation form
- Reduction *Building* Impact evaluation form
- Reduction *Materials* Impact evaluation form

These filing forms were developed to be applied in the whole building lifecycle. Thus the application in buildings from Modern Architecture did not disturb the focus of this research, and it was possible to identify some features that were fundamental to analyse the sustainability level of these buildings.
This methodological approach was set up as starting point to a bigger range of researches using the Architectural School of Mackenzie and USP as an experimental site, including the application forms of ABIHA.

CONCLUSION

The concern in develop the connected architecture to the vanguard, but assisting to the climate conditions and reflecting the local culture, attests the pioneering Brazilian architecture concerning sustainability, before the even of that term to exist.

Affonso Eduardo Reidy following manifestation confirms that concern: one can not deny that the Brazilian Contemporary Architecture shows characteristics that distinguish and check them, even to their more different accomplishments, a certain family air. That common denominator is a result of factors group presence, like the following ones: an architects particular sensibility to the regional conditions, tends constant concern of obtaining appropriate solutions to the climate, developing the most varied protection systems against the heat, the ones which, a lot of times, they constitute elements of great plastic wealth; integration of the structure as outstanding element of the composition, offering, frequently, motivation to its formal aspect; almost always the find of clear and simple solutions, even for the most complicated problems, that are solved with generosity and amplitude. The flora wealth, the landscape drama and the sun power, maybe responsible for the tendency, quite frequent for a certain formal exuberance. [4]

That manifestation seems to appear for an option for an adapted architecture to the area, to the local culture, to the climate, that takes to the development of protection elements exemplified previously that, besides they provide adapt comfort conditions, they offer plastic wealth to the conception. With that context propose that slope of São Paulo city architecture stood back of the vulgarized reproduction of the call International Model and also of exotic models of folkloric character, as the colonial retaking or the creation of an assumed indigenous influence, without leaving of emphasizing a local conscience and - why not - national. There was like this a clear international recognition of the produced architecture, however in that recognition felt so much for the similarities as for the differences practiced architecture in another countries, without leaving of being original. That proposal generates a São Paulo city identity in the architecture and sustainable pioneering idea, that will detach it while production as an integral part of a building’s dynamic ecological system, and we can not say that the building design has reached a technological and ecological integration in response to user need in Brazilian building culture.

4. REFERENCES
