Analysis of Performance Standard ABNT NBR 15575:2008 with Emphasis on the Luminic Performance, in the Context of Brasilia.

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ABSTRACT

This study is a review based on the theoretical analysis of the Performance Standard ABNT NBR 15575:2008 focused lighting and in the performance standards or other national and international sources relevant to the topic, as well as discussion of possible applications or difficulties of implementation in accordance with the criteria of the standard and its likely consequences, especially for users and professional construction of Brasilia, Brazil. Aims to produce a consultation document, the undergraduate and graduate students on luminous performance, based on the ABNT NBR 15575:2008, emphasizing the reality brasiliense through examples of buildings that have some type of control element for natural lighting. Ramble on possible impacts of implementing the standard in the professional, the market and for customers.

KEYWORDS: *Performance Standard ABNT NBR:15575, luminic performance, the control element.*

I. INTRODUCTION

The performance of Brazilian buildings as well as their constituents have been the subject of discussions by experts in the areas of construction and the like, so long ago, having a focus from mid-2002 when there was the first attempt to create a standard that contained evaluative parameters appropriate to the Brazilian reality. Since then, the documents and work done from these meetings resulted in the Performance Standard ABNT NBR 15575:2008 that through requirements (qualitative) criteria (quantitative) evaluation methods and includes topics such as: acoustic performance, thermal performance, performance luminic, leak, fire safety, functionality / accessibility and others. This article has emphasis on the luminic performance, highlighting the requirements, criteria and evaluation methods applied in a generalized, since the standard does not cover the use of that item for individual systems as structural systems, systems of internal floors, fencing systems and internal external roofing systems and hydro-sanitary systems. The article also seeks to make a merge between what is stated in the standard elsewhere on this kind of performance and the reality of Brasilia focused on the use and control of natural lighting.

II. OBJECTIVES

- Produce a consultation document to undergraduates and graduate on luminic performance, based on standard ABNT NBR 15575:2008, emphasizing the reality brasiliense through examples of buildings that have some kind of control element for day lighting;
- Ramble on possible impacts of the application of the standard in the professional, the market and the customers.

III. LITERATURE REVIEW

The pursuit of energy efficiency in the world is a consequence of the reality in which there is a shortage of material and energy resources available. According Galasiu and Veitch (7) in 2006, the literature shows a strong preference for the use of daylight with wide acceptance by users and professionals, as has been recognized by the research community building, eg in the creation of Subtask a: perspectives and user requirements, under the IEA Task 31,"Daylighting Buildings in the 21st century", according to the International Energy Agency - IEA (9).According to the Department of Energy, as part of efforts to reduce the production of greenhouse gases and preserve the natural environment, office buildings should consume less

energy. Share of commercial buildings in the U.S. electricity consumption in 2002 was reported by 35%, according to the U.S. Department of Energy (13). And in Canada, offices and other institutional buildings, consumption values were collected in 30% (12). The lighting in these buildings represents about 15% of the total energy consumed and can be reduced with the adoption of elements of lighting control and designed to take advantage of the natural light available. Ideally, these elements fostering a correct level of light transmission relative to solar orientation in order that these vents affect the minimum thermal performance increasing energy avoiding the need to increase cooling or heating systems. Cuttlefish (4) questionnaires applied in England and New Zealand to investigate the users' perception regarding the importance of openings that take advantage of natural lighting. Were asked whether they considered the windows an important feature of a workplace and, if so, how it was important to them and why. Almost all respondents (99%) thought that the offices should have openings (windows) and 86% considered the natural lighting as their preferred source lumen.

The preference for natural lighting was attributed to the belief that working with daylight results in less stress and discomfort of working with electricity, but as the author noted that this belief does not define the use of artificial lighting is harmful to health. College students surveyed in Canada by Veitch et al. (10) about their knowledge, beliefs and preferences for lighting provided similar data. When Veitch and Gifford (11) refined their questionnaires and examined the issue again through a mixed sample of office workers and college students, once again observed that people believed that the daylight is preferable. In the search for Biner and Butler (5) in 1989 held in Indiana, USA, it was found that users' preference by the size of the openings (windows) varied according to the type of space. Contrary to previous research showed a general preference for large windows, this study provided evidence that large windows were not the preferred choice for most areas. Rubin et al. (1) in 1978 found that most of the occupants of offices equipped with closed shutters prefer settings that had little to do with the position of the sun or the daily and seasonal weather conditions. The experiment was conducted over three periods of 10 days in October, February and July. The results showed that the incidence of closed shutters on the south side was higher (about 80%) than in the U.S. (about 50%), which suggests that its occupants shutters used to prevent penetration of sunlight and superheating their offices. However, most of louvers or shutters have been designed with the flaps open and not closed, which suggests a preference for a view of the outer.

3.1 Energy Efficiency Law in Brazil

Law No. 10.295, of October 17, 2001, discusses the maximum power consumption, or the minimum energy efficiency for machines manufactured or marketed in the country and contributes to combat waste. According to Haddad in 2002 (8), despite the current circumstances, it is important to note that energy efficiency can not be tied to just conjunctural issues, but should be a practical purpose the National Energy Policy, through actions aimed at, for example, add value and develop technology, preserving the environment and introducing, in the domestic market, products with higher energy efficiency. The government's actions have contributed to advances in the field of energy production when they were created regulatory agencies (ANEEL - Brazilian Electricity and ANP - National Petroleum Agency), and forced the public utilities to take steps contractual restraint and combating waste as well as technological development.

3.2 Procel

According Eletrobras in 2011 (6), Procel aims to guide the consumer in the purchase, indicating the products that have the highest levels of energy efficiency within each category, thereby providing savings in your account electricity. It also stimulates the production and marketing of more efficient products, contributing to the technological development and environmental preservation. The seal is voluntary and all products must be analyzed and tested in laboratories recognized and reputable indicated by the PROCEL. The criteria set out in Regulation Procel Energy Saving - 2011.

3.3 Performance Standard ABNT NBR 15575:2008

Performance evaluation of lighting in buildings takes into account the natural and artificial lighting. In both cases, the requirements must be observed human visual comfort, which include factors such as illuminance appropriate to the activity performed and the visual field of glare free. According to ABNT NBR 15575-1:2008 (2) during the day the dependencies of the building housing should receive natural light convenient, arising directly or indirectly from the outside, through adjacent rooms. And at night, the artificial lighting system must provide satisfactory internal conditions for occupancy of the premises and circulation in environments with comfort and security. Defined these two basic conditions of illumination, the standard approach of separately for each of these situations requirements, criteria and evaluation methods.

3.3.1 Natural Lighting

The requirement for natural light provided by the rule is the need for all environments receive amounts of natural light, of course, during the day. As a criterion, the ABNT NBR 15575-1:2008, p. 22 (2), presents minimum satisfactory for ambient light only natural lighting. As the assessment of natural lighting standard has three methods. The first is the analysis of the project through established premises, the second is through the method of calculation and the third by measuring spot.

3.3.2 Artificial Lighting

The requirement for artificial lighting according to ABNT NBR 15575-1:2008 (2) consists of providing artificial lighting conditions satisfactory internal according to other standards generally prevailing for the occupation of premises and movement in environments with comfort and security. As a criterion, the standard states that the minimum, intermediate and superior to artificial lighting environments must be in accordance with the ABNT NBR 15575-1:2008, p. 23 (2).The methods of evaluating compliance with the standard is set at the same applied to natural lighting. Design analysis, method of calculation and measurement in situ. Concern explained by the standard of performance is not the sole intent aimed at prioritizing the quality in construction, as well as meeting the needs and comfort of users. Along the same lines, but directed the use of natural light can cite the Draft Standard ABNT 02:135.02-001 (3) which arose from the requirement, evidenced by the society and building projects that implement the concept of energy efficiency and visual comfort, seeing more and more use of renewable resources and less environmental degradation and its inputs or raw materials. This draft standard has the intention to disseminate and collate existing information, providing professionals related to the field of construction tools to implement mechanisms to monitor and enjoy natural light, increasing the luminal performance without compromising thermal performance.

The scope of this draft standard is divided into:

General terms, which are determined or confirmed the terms used in academia as azimuth, artificial sky, zenith lighting, area or time zone among others. Components that lighting is divided in general and classification. Item is in general informed the penetration of light in the building if it is lateral, overhead, overall, driving, etc. Classifying the item is placed on the element type in which no penetration, for example, windows, skylights, domes, sun products, atrium, etc. Defining the characteristics of each. Control elements which consist of protective feeders or natural lighting to the interior of the building. Typically transmit light diffusely or with less intensity, reducing the thermal impact and therefore the use of artificial cooling. Can cite the shelf light, shutter, eaves, awnings and other element leaked.

IV. BACKGROUND OF THE STANDARD

Brasilia, only 50 years old, considered a symbol of the city architecture and urbanism of the modernist twentieth century, renowned for its organization and planning focused on concern for the well being and quality of life of its inhabitants, has presented problems, common oldest cities, mainly linked to performance in the construction is related to the quality of materials or services, both in the design and execution. One of the great dilemmas has been the adoption, for economic and commercial, architectural typologies from countries with temperate climate that cause disorder in environmental comfort item as well as increase in energy consumption by making the least efficient buildings and loss of free cooling systems. The blame for this can be attributed to the lack of a proper design process and enforce laws that force fiscalizatoria a serious study of the use of artificial light and natural light with the right choice of control elements and pass without any prejudice to the thermal performance.

In order to solve these issues in an objective and based on measurable parameters there is an effort on the part of local and national professional environment, regulate and approve the ABNT NBR 15575-1:2008 (2).
To that end, despite the steady increase in fully glazed facades, in Brasilia, there are examples of applicability of elements of lighting control in older buildings and demonstrate the feasibility of using them without cosmetic damage and executives that actually what notes is just the opposite where these elements are fundamental and integral part of the body and buildable design project.

Examples of such inserts the following architectural works:

a) Esplanade of the Ministries

The control element predominant in the west facade of the ministries, shown in Figure 1, are vertical blinds, commonly called louvers. This type of element is intended to partially or totally block the entry of natural light, and in most cases be adjusted. The concern with the sunlight eventually become intrinsic feature of the building.

Figure 1 - Vertical blinds (louvers), control element in the west facade of Ministries in Brasilia, Distrito Federal (ARAÚJO, SIMÕES & SPOSTO, 2012)

b) SCS (South Commercial Sector) – Building Morro Vermelho in Brasilia, Distrito Federal

The control element prevalent in North facade of the building shown in Figure 2 are movable eaves, but if they are positioned so the perpendicular openings can also perform the function of light shelf, leading to a diffuse light to the interior of the rooms.

On the south facade, Figure 3, to receive less insolation put up just a brise to block or direct the light occasionally, probably in the summer.

Figure 2 - Eaves mobile (ARAÚJO, SIMÕES & SPOSTO, 2012)

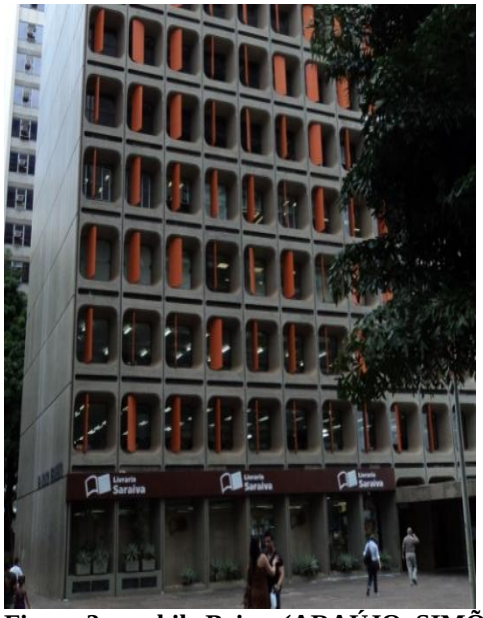

Figure 3 - mobile Brises (ARAÚJO, SIMÕES & SPOSTO, 2012)

c) SQN (Super Quadra North) 206 in Brasilia-Distrito Federal

In block are present, two types of control elements made of concrete. The first, Figure 4, is classified as a hollow, popularly called Cobogó, and is at the service facade. The second, Figure 5, and there is the overhang presence of the same both on the façade of service as the main façade. Interestingly, both are in the peculiar way in which they were designed and how to define all perception and composition of facades.

Figure 4 – Cobogó (ARAÚJO, SIMÕES & SPOSTO, 2012)

Figure 5 – Eaves (ARAÚJO, SIMÕES & SPOSTO, 2012)

d) DNIT (National Department of Transport Infrastructure)

The building DNIT in Sector Municipalities in North-Brasilia Federal District, Figures 6 and 7, has made fixed louvered elements in concrete, which were probably leased in accordance with the solar orientation, protecting from direct incidence and allowing natural ventilation.

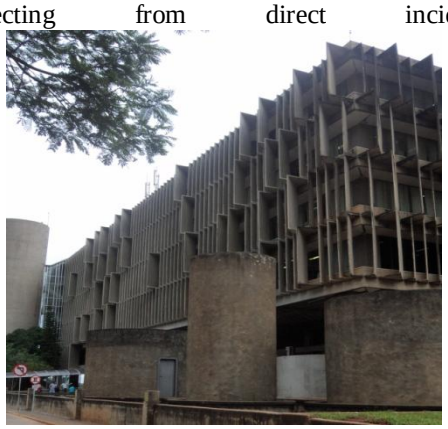

Figure 6 - Venetian Fixed open view (ARAÚJO, SIMÕES & SPOSTO, 2012)

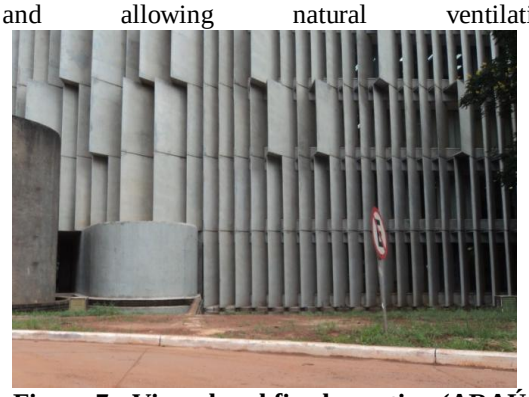

Figure 7 - View closed fixed venetian (ARAÚJO, SIMÕES & SPOSTO, 2012)

e) W3 North Brasilia Shopping

The Building of Brasilia in Brasilia Shopping-Distrito Federal, Figure 8, is basically composed by a glass skin without any barrier that provides shading to the interior spaces, the only element existing control is smoked tempered glass which is not the most suitable for the climatic profile of Brasilia.

Figure 8 - Tinted tempered glass (ARAÚJO, SIMÕES & SPOSTO, 2012)

From what has been observed in buildings brasilienses, it appears that the market demand is still a major factor for the application of the control elements on the facades, because there was a greater presence of them in

older buildings made of concrete, sometimes with metal inserts and typological modernist trends. Unlike the more recent constructions which mostly have smooth translucent facade without any component dosing of sunlight that refer to an aesthetic seen as bold and contemporary technology.

V. CONCLUSION

The issue of energy use worldwide and in Brazil as well as being guided by discussions and conferences, must now be faced considering creative solutions and alternatives. It is necessary that both the construction and the use of this logo is adapted to new paradigms characterized by limited energy sources. Brazil has a climate that enables the reduction of energy consumption of buildings. Due to the existence of a celestial vault among the brightest in the world, allowing to dispense with artificial lighting for most of the day. And because the temperature differences between summer and winter in most parts of Brazil are small, providing a comfortable operation of buildings with minimal energy expenditure. But, it is essential to emphasize that the lighting should be designed for the user of the building. To the right sizing of a day lighting system should pay attention to:

a) Right sizing the openings of buildings, considering the amount and type of light that falls on them, leading to visual comfort;
b) One should be particularly careful with the thermal efficiency of the surface area of the window is limited in luminous efficiency. Thus, the ideal is to use only the illuminating surface required, besides the use of control elements against direct sunlight;
c) The clearer the surrounding surfaces and the interior of the building, the better the performance of the lighting system;
d) Right sizing the lighting system through the establishment of certain visual activities and characteristics of who performs;
e) It should also consider the quality and capacity of energy bulbs, in sizing the artificial lighting system.

Therefore the application of sustainability concepts increasingly widespread throughout the world and the increasing technological development of building components is presumed that the market trend is brasiliense well as global change, although it will take a few years, and value beyond aesthetics, concepts such as functionality, durability, recyclability and performance.

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ACKNOWLEDGEMENTS

The Pós-Graduate Program in Structural and Construction at the University of Brasilia (UNB) for providing the opportunity to discuss the issue in its research.