



## Article

# The Hotel Industry in the Metropolitan Region of Rio De Janeiro: An Analysis of the Legacy of Accessibility in Civil Construction Projects Post Mega Events

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**Abstract:** This article aims to analyze the civil construction projects of the hotel industry in the Metropolitan Region of Rio de Janeiro, Brazil, through statistical modeling, regarding the issue of accessibility. The key point of the study was to diagnose how these hotel construction projects were prepared to receive disabled tourists during the period of Mega events. The methodology used is based on an analysis of the data obtained through the Inventory of the Tourist Offer of the State of Rio de Janeiro in the counties of Rio de Janeiro and Niterói, applied to the quantitative of approximately 400 hotel units. From the point of view of civil construction projects, an accurate diagnosis of accessibility was possible, pointing to the development of a benchmarking model. The relevance of the study is also to contribute to raising awareness of the tourist and civil engineering markets relating to people with disabilities or reduced mobility and the possibility of reversing the current scenario in Rio de Janeiro, since it can be emphasized that the investigated hotels do not show the necessary accessibility, due to the small number of hotels that reach the accessibility requirements of Brazilian Association of Technical Standards (ABNT NBR 9050: 2015). For civil construction, there is the accurate confirmation that the hotel industry of the Metropolitan Region is not accessible. For society in general, it has been observed that the Mega events that occurred in the city did not leave a legacy of accessibility.

**Keywords:** construction projects of hotels; hotel industry; NBR 9050: 2015; accessibility

## 1. Introduction

One of the most important aspects of tourism is to provide the visitors an excellent experience, leaving them a good memory, a desire to come back, and mainly the initiative to communicate their experience to other people. It is for this reason that the competitive differential becomes so important in attracting customers in this market, which is divided into several activities and needs various kinds of services to be developed, such as transport, restaurants and bars, local infrastructure, as well as the hotel industry. Therefore, it is essential that the hotel structure of a destination is inserted in local tourism planning as an important generator of income and jobs and also as an infrastructure capable of attracting specific public to the destination.

More and more businesses are concerned with their image and environmental commitment, and have more responsibilities with where they operate. When adopting sustainable practices in the construction and operation of the enterprise, one deals not only with environmental (material) but also social and cultural (immaterial) gains.

According to Saarinen [1] in a considerable part of the literature, it can be inferred that despite the academic efforts in the theorization of sustainable tourism and the analysis of its different implications, there are still difficulties in the diffusion of practical solutions and achievements, and basic concepts are needed to fill this gap.

In 1983, the Brazilian Association of Technical Standards (ABNT) developed the standard NBR9050, which proposed regulation and standardization with criteria and adaptations of accessibility in buildings considering people with disabilities. In its last revision, ABNT NBR 9050, 2015 [2], the standard establishes criteria and technical parameters to be observed regarding the construction, installation, and adaptation of the urban and rural environment, and of buildings to the accessibility conditions.

With the accomplishment of the Mega Events in Brazil, the Brazilian society, in general, generated an expectation in the expansion of the hotel industry and in the sustainable and accessible tourism. There are no studies on accessibility of hotel construction projects with a broad approach, having as a field of study all types of hotel units, be it large-, small-, or medium-sized hotels, whether it is apart-hotel projects, hotels, or hostels.

As part of the economic requirements for sustainable tourism, ABNT [3] defines some hotel business practices that it considers to be safe, feasible, meets customer expectations, and complies with legislation. Particularly about the quality of services, “the enterprise must plan and implement products and services considering the profile and expectations of customers”. In this regard, it is essential to provide information on accessibility for the elderly and children, as well as the existence or not of facilities for attending to special needs individuals (SNI).

For Gharebaghi et al [4] before the 1970s, the role of the environment was not considered important in the definition of disability. In the previous medical model, disability was considered to be a result of or related to diseases and injuries and there are currently criticisms of this paradigm that have led to the development of the social model that understands disability as a product of inadequate social organization. Within this approach, deficiencies are treated as physical properties of the body, while disability results when society fails to provide a barrier-free environment that does not discriminate on the basis of impairment.

According to the World Health Organization [5], the concept of disability has been internationally accepted as “the product of an interaction between features of a person’s body and features of the society in which he or she live”. Functional capacity is understood here as the perceived level of functioning involved in the person–environment interaction. This interaction will be evaluated based on the NBR9050 standard.

In order to have a parameter and norms to follow, in 1983 the Brazilian Association of Technical Standards (ABNT) elaborated the standard NBR9050, which proposed to confer the standardization and standardization of the criteria and the adaptations of accessibility in the buildings taking into account people with disabilities.

More recently, sustainability has become an important issue within companies, stemming from concerns about the depletion of natural resources, wealth disparity, and social responsibility, according to Hallam and Contreras [6]. Being accessible is inherent in the model of contemporary competitiveness.

In the last revision of the standard (ABNT NBR 9050, 2015), it establishes criteria and technical parameters to be observed regarding the design, construction, installation, and adaptation of the urban and rural environment, and buildings to the accessibility conditions. In the establishment of these criteria and technical parameters, various conditions of mobility and environmental perception were considered, with or without the aid of specific devices, such as prostheses, support devices, wheelchairs, tracing sticks, hearing aid systems, or any other which will complement individual needs.

The objective is to provide the autonomous, independent, and safe use of the environment, buildings, furniture, urban equipment, and elements to as many people as possible, regardless of age, height, or limitation of mobility or perception. In this last update, the NBR 9050 emphasizes signaling criteria in public spaces, ergonomics parameters for furniture and urban equipment, interventions in

assets listed by historical patrimony, among other points. Regarding to urban equipment specifically, there are many parameters to be followed depending on the type of establishment.

In order to respect the concept of universal design, seven principles were defined as a way of orienting planning in accessibility construction projects, which were adopted worldwide, to quote [2]:

Equitable Use: Characteristic that ensures that the space or environment is capable of being used by several people, regardless of age or ability. To do so, it is necessary to: provide the same meaning of use for all; eliminate possible segregation and stigmatization; promote use with privacy, security and comfort, while remaining an attractive environment for the user; Flexible Use: makes space serve as many people as possible, respecting their preferences and abilities. In order to do so, it is necessary to offer several ways of use, such as the possibility of use by right-handed and left-handed people, to facilitate the user's precision and dexterity and the possibility of use by people with different times of reaction to stimuli; Simple and intuitive use: it allows the use of the space to be easy to understand, dispensing experience, knowledge, language skills or a high level of concentration by the people; Easy to understand information: it is the characteristic of the environment that values the presentation of vital information in a redundant and readable way for everyone. The information should be presented in different ways (visual, verbal, tactile), so that it is perceived by people with different abilities (blind, deaf, illiterate, among others); Tolerance to error: Allows the risks and adverse consequences of accidental actions to be mitigated. In this way, risk elements must be grouped and isolated or even eliminated, risk or error warnings should be used and options should be provided to minimize failures and avoid unconscious actions in tasks that require vigilance. Low physical effort: the environment or spatial element should offer conditions to be used efficiently and comfortably, with minimal muscle fatigue. To achieve this principle it is necessary to: enable users to keep the body in a neutral position, use reasonable operating force, minimize repeated actions and minimize sustained physical effort; Dimension and space for approach and use: the environment or spatial element must have size and space appropriate for approach, reach, manipulation and use, regardless of body size, posture and mobility of the user. To do this, is necessary: implement signaling on important elements and make comfortably reachable all components for seated or standing users, accommodate hand and hand variations and, finally, deploy suitable spaces for the use of assistive technologies or personal assistants. (Author's free translation based on ABNT NBR 9050, 2015)

In addition to the concept of universal design adopted by ABNT, there are also methodologies to measure the performance of a built environment.

The Post-Occupancy Evaluation (POE) [7] is a tool and diagnostic system that allows the systematic identification and evaluation of critical aspects of construction performance. This system was applied to identify problem areas in existing buildings, test new building prototypes, and develop guidance and design criteria for future installations. Among the many benefits of POE, the main ones are the best use of space, as well as cost and time savings. According to the literature, the first publication with the term "post-occupation evaluation" in its title dates back to 1975 by McLaughlin [8].

In 1997, Preiser & Schramm [9] proposed an expansion to the POE process model for a more integrative structure that resulted in the Building Performance Evaluation (BPE), a research method established to evaluate buildings at different levels of effort and sophistication after being occupied. An important feature of this framework was the time dimension, which took into account the complex nature of performance evaluation in the building delivery cycle as well as the entire life cycle of buildings. The six phases of the 1997 Integrated Framework for BPE are: (1) strategic planning, (2) programming, (3) project, (4) construction, (5) occupation, (6) reuse/adaptive recycling.

In the current Brazilian economic and cultural context, it is observed that technological increase has created opportunities and problems for the development of societies. This panorama makes it possible to place technology as an important engine for the economic development of societies. In the case of the Civil Construction industry and its construction sector of Hotel Units, there is also a significant increase in competitiveness and consumer awareness in relation to a minimum quality standard of the projects offered.

In this way, the sector has presented a real ‘race’ towards the movement of quality. On the other hand, according to Romero & Ornstein (2003) [10], “it is known that the emphasis of research in POE/BPE in Brazil lies in the case studies’ permanent housing, especially social housing”. There is practically no research of the genre in the hotel context, considered a temporary housing, in which it is essential to know the levels of guest satisfaction and physical performance regarding comfort as an instrument of environmental quality control.

These methodologies, added to the already existing study proposed in this article, will enable a more detailed and detailed analysis of the civil construction projects of hotel units and will serve as a basis for future research.

To comply with the principles presented, the means of accommodations care considered urban facilities that meet a complexity of spaces that need to be adapted. The standard ABNT NBR 9050 provides that all existing environments in accommodation locations, such as auditoriums, convention rooms, gym rooms, and swimming pools, should be accessible. In addition, accessible dormitories with bathrooms must be distributed throughout the building, and not isolated from other rooms. Lastly, according to the Brazilian Law of Inclusion of Person with Disability n° 13,146, of July 6, 2015 [11], previously stated, one must reserve the amount of 10% of accessible dormitories.

This article proposes the following problem situation: Are the construction projects of the hotel industry of the Metropolitan Region of Rio de Janeiro sustainable on the dimension of accessibility?

The main objective of this study is to diagnose the civil construction projects of the entire hotel segment of the Rio de Janeiro Metropolitan Region, after the period of the Olympic Games, presenting from the norm NBR 9050: 2015 the hotel model of benchmark and their respective gaps, considering only the accessibility dimension.

The field research limited geographically its practical analysis in the hotel sector of the Metropolitan Region of Rio de Janeiro and its accessibility characteristics. It aimed at understanding how these enterprises are prepared to receive disabled tourists. For this purpose, it was developed a research that had as universe 399 hotels in the Metropolitan Region (361 in Rio de Janeiro and 38 in Niterói). Another delimitation of the research was the adoption of the methodology of INVTUR (of the Ministry of Tourism) to collect primary data.

Based on the primary data collected in the Research Project of the Tourism Offer of the State of Rio de Janeiro, this study was developed using the methodological procedures detailed below.

## 2. Materials and Methods

In this article we will consider: Accommodation equipment and services (hotels and support—hotels, historic hotel, farm hotel, resort, guesthouse, hostel, bed and breakfast, inn and lodging, collective accommodation, convent accommodation, family lodging, transit hotel, spa; other means of accommodation—camping), in the Metropolitan Region of Rio de Janeiro, comprising the cities of Rio de Janeiro and Niterói.

From the data regarding the measures adopted in terms of accessibility, the object of study for the analysis of the sample and its characteristics within the topic of interest was delimited. In this sense, as a case study, was wanted to contribute to our “understanding of individual, organizational, social and political phenomena” [12]. Specifically, it was tried to understand how the hotel organizations of the metropolitan region were prepared for the reception of the deficient tourist.

The universe of the study is the metropolitan tourist region of Rio de Janeiro, which is composed according to SETUR-RJ by the cities Rio de Janeiro and Niterói. The data was collected during the Inventory of the Tourism Offer of the State of Rio de Janeiro research, which was coordinated by the author between the years of 2015 and 2017. The survey began with the collection of secondary data through information from the internet and previous inventories provided by the cities. Subsequently, secondary data were validated and the field research was performed to collect primary data. This data has been validated and now composes this research.

The analysis of the data was initiated using descriptive statistics presenting the data referring to the characteristics of the metropolitan hotel industry, the operation and the main data regarding the accessibility. It should be noted that the sample of the Metropolitan Region was selected because of its representativeness for Tourism, both quantitatively and qualitatively (quality of its hotel facilities, for example) and, given the hypothesis of the work, that there was a legacy of accessibility and sustainability, due to the mega events occurring in the city of Rio de Janeiro.

Because of the complexity of variables and relationships, and in a complementary way, we seek to establish from an ideal conceptual model, to identify patterns and relationship between the various requirements analyzed throughout the study. For this purpose it was used the Multidimensional Scaling technique using the SPSS 13 software (Statistical Package for the Social Sciences 13, IBM, New York, NY, USA), aiming to understand the specificities of the criteria, to relate them to the hotel typologies and to compare them to a model considered benchmarking.

### 3. Results and Discussion

As previously mentioned, the city of Rio de Janeiro has hosted two of the largest mega-sport events in recent times, the 2014 World Cup and the Rio 2016 Olympic Games. With tax incentives offered by the city of Rio de Janeiro, the number of hotel units in the city grew from 19,800 in 2010 to 24,000 in 2014. By March 2016, there would be 37,000 rooms [13]. In 2009, when the capital was elected host city for competitions, R\$10 billion was invested in the hotel sector, according to estimations by the Brazilian Hotel Industry Association—ABIH-RJ [14].

The methodological procedures begin with the analysis using only the data treatment based on the descriptive statistics, aiming to offer a global overview of the hotel segment in what concerns the accessibility issues of civil construction projects. Thus, in the Metropolitan Region, 399 accommodation equipment and services were surveyed and validated, of which 90% are in Rio de Janeiro.

The mean of accommodation with the highest number of establishments are the hotels that correspond to 49.6% and the hostels with 25%, and in much smaller percentages they are guesthouse with 7.5%, the flat/apart-hotel with 6.7%, and with bed and breakfast with 6%, and with far lower percentages the others: 0.2% for family accommodation, pensions, and resorts, and 0.7% for motels.

The multivariate analysis of the data of the means of accommodations by typologies begins. As previously stated, in the present study, information was collected from 399 establishments where several types of accessibility were assessed for special needs individuals (SNI) classified according to Table 1.

**Table 1.** Classification of the studied establishments. Source: Author, 2018.

Type	N	%
Hotel	198	49.62
Hostel	100	25.06
Guesthouse	30	7.52
Flat/aparthotel	27	6.77
Bed and breakfast	24	6.02
Others	14	3.51
Motel	3	0.75
Family accommodation	1	0.25
Resort	1	0.25
Pension	1	0.25
Total	399	100

Next, the presence of each type of accessibility for each type of establishment was studied and it was possible to evaluate that establishments such as Pension, Motel, Family Accommodation, Resort, and Bed and Breakfast are not suitable for special needs individuals (SNI), so these typologies were excluded from the survey. For the multidimensional scaling we do not have interest to present a



column without any association, because it could cause noise in the results. After the exclusion, the establishments were relocated in order to assist in the main objective of demonstrating how the conditions for SNI are distributed for each type of establishment and, for this, the new allocation to the establishments is redefined in Table 2.

**Table 2.** Reallocation of typologies. Source: Author, 2018.

Type	N	%
Hotel	198	49.62
Hostel	100	25.06
Others	44	11.03
Guesthouse	30	7.52
Flat/aparthotel	27	6.77
Total	399	100

From Table 2 we have a new distribution of the objects of the study, aiming to understand within each group which SNI characteristics/conditions are closer to each type of establishment. To perform this analysis, the multidimensional scaling technique (MDS) will be used, which is appropriate to graphically represent “n” elements in a space of smaller dimension than the original, taking into account the distance or similarity that the elements have between them.

The present study evaluates the proximity between each characteristic for SNI and the types of establishments. Models are adjusted to the vicinity to make it clearer to display, to help understand and possibly explain any structure or pattern among the observed or calculated proximities not readily apparent in the collection of numerical values.

In some areas, where the ultimate goal is to analyze a set of more specific proximities, there is the development of theories to explain similarity judgments. In other words, it makes it possible to answer the question “what makes things look alike or different?” The study will check if there are features closer to one type of establishment than others.

In simple terms, a geometric model is sought, where the higher the observed distance or dissimilarity between two observations (or less the similarity), the more distant the points that represent them in the spatial model must be. In general (but not exclusively), it is assumed that the distances between the points in the spatial model are Euclidean.

Finding the set of best fit coordinates and the appropriate value of “m” that adequately represents the observed proximities is the goal of many proposed MDS methods. The best way to work with a multidimensional scaling is to have a small number of dimensions, ideally two or three, because with this we can present more easily the space with all the elements. MDS is a dimensionality reduction technique where the goal is to find a set of points in low dimension that approximate the probable high-dimensional configuration represented by the original proximity matrix.

To perform the analysis it was necessary to verify all the characteristics studied (around 80 characteristics) and to group them into Nets (categories) in order to have more actionable and easy to work characteristics. In Table 3, the percentage of association between the items of each group by type of establishment will be presented.

**Table 3.** Nets and percentage reached by hotel type. Source: Author, 2018.

Nets%	Hotel	Guesthouse	Flat	Hostel	Benchmark
Personnel qualified to receive SNI	17%	6%	3%	0%	100%
Accessible external route	19%	7%	7%	1%	100%
International symbol of access	20%	3%	7%	1%	100%
Place of embarkation and disembarkation	24%	10%	4%	1%	100%
Parking space	11%	2%	8%	0%	100%
Internal circulation area for wheelchairs	24%	10%	9%	1%	100%
Stairs	24%	5%	11%	2%	100%
Ramp	18%	4%	6%	1%	100%
Floor	19%	9%	7%	2%	100%
Elevator	29%	0%	16%	0%	100%
Motorized equipment for internal displacement	7%	0%	0%	0%	100%
Visual signaling	13%	3%	3%	1%	100%
Tactile signaling	6%	0%	0%	0%	100%
Emergency alarm	28%	8%	13%	2%	100%
Communication	10%	3%	0%	0%	100%
Service Desk	8%	3%	0%	1%	100%
Furniture	21%	12%	7%	2%	100%
Restroom	29%	5%	7%	2%	100%
Telephone	14%	3%	7%	1%	100%
Indicative indication of preferential service	36%	17%	15%	4%	100%
<b>Total</b>	<b>198</b>	<b>30</b>	<b>27</b>	<b>100</b>	

From Table 4, where the others are excluded from the analysis, due to the almost no association to any associated SNI characteristics, only the four classifications will be used: Hotel; Guesthouse, Flat, and Hostel. An initial analysis was performed to evaluate the level of eigenvalue and inertia to define the number of dimensions that would be used. Table 5 shows the values for the two measures:

**Table 4.** Dimensions. Source: Author, 2018.

	F1	F2	F3
Eigenvalue	0.134	0.062	0.028
Inertia (%)	59.928	27.612	12.461
% accumulated	59.928	87.539	100.000

As the eigenvalue has a small drop between two and three dimensions and % of explanation accumulated with two dimensions reached 87.539%, we chose to follow with the coordinates of two of the three dimensions, for facilitating the visualization in two dimensions.

In the previous table we present the inertia which explained the level of explanation our data have, but we can use the Stress which has a useful loss function, which is often minimized using a procedure called stress majorization. Metric MDS minimizes the cost function called “Stress” which is a residual sum of squares in the next formula:

$$Stress(x_1, x_2, \dots, x_n) = \left( \sum_{i \neq j=1,2,\dots,N} (d_{ij} - \|x_i - x_j\|)^2 \right)^{1/2}$$

Kruskal (1964) [15] present this formula to understand the level of stress in an empirical method instead of a methodological and present a result which told us, results over 0.2 in terms of stress is poor. In our study we found a stress of 0.1942, which is acceptable and allows us to advance in the analysis.

A table was created with the coordinates of the accessibility characteristics that presented the coordinates of all attributes for the attendance characteristics for SNI and, from it, Table 5 was developed, with the coordinates for each of the four types of establishment:

**Table 5.** Coordinates of characteristics by establishment. Source: Author, 2018.

	Dim 1	Dim 2
Hotel	−0.063	−0.194
Guesthouse	0.732	0.207
Flat	−0.435	0.382
Hostel	0.561	0.242

To present the tables with the coordinates is relevant; however, the appropriate way to present the results is through the maps and, for this, five maps were elaborated where the 80 characteristics organized by Nets in each map will be presented. Table 5 presents the Nets, which are the combination of all the characteristics in a single coordinate, and the percentage reached by each mean of accommodation typology with accessibility.

Table 6 presents the coordinates that generated the map with the Nets and the means of accommodation typologies presented in Figure 1.

**Table 6.** Regrouping of Nets. Source: Author, 2018.

Nets	F1	F2
Personnel qualified to receive SNI	0.445	−0.174
Accessible external route	0.003	0.005
International symbol of access	−0.287	−0.065
Parking space	−0.374	0.249
Internal circulation area for wheelchairs	0.122	−0.049
Stairs	−0.233	0.069
Ramp	−0.199	−0.001
Floor	0.305	0.023
Elevator	−0.530	0.034
Motorized equipment for internal displacement	−0.172	−0.783
Visual signaling	−0.007	−0.163
Tactile signaling	−0.172	−0.783
Emergency alarm	0.192	0.189
Communication	0.288	−0.441
Service Desk	0.332	−0.381
Furniture	0.308	0.115
Restroom	0.007	−0.153
Telephone	−0.161	−0.312

In Figure 1, it can be seen that the whole parking, elevator and stairs part is closer to the Flats, while ramp, internal route, internal area, telephone, bathroom, and all related information visualization are related to Hotels. However, emergency alarm, floor, and personnel are characteristics more related to hostels and guesthouses. This analysis follows the trend that is characterized by flats and hotels investing in infrastructure (more significant financial investment), while hostels and guesthouses prioritize equipment of low cost and the humanized service.

Considering the distribution of the Nets and the number of characteristics of each one, these were grouped by a non-qualitative criteria, for the elaboration of four maps. To facilitate the analysis, the Nets were separated by proximity, since placing all 80 characteristics plus the four types of establishments would generate a map very difficult to visualize.





**Figure 1.** Nets and the means of accommodation typologies. Source: Author, 2018.

In order to analyze mainly from the point of view of civil construction projects, Table 7 was elaborated with the consolidation of the Nets related to the civil construction project, that were reallocated in only four groups, represented in Figures 2–5, respectively. Finally, Figure 6 presents the benchmarking model.

**Table 7.** Consolidation of the Nets Civil Construction. Source: Author, 2018.

Nets	F1	F2
Accessible external route	0.003	0.005
Parking space	−0.374	0.249
Restroom	0.007	−0.153
Internal circulation area for wheelchairs	0.122	−0.049
Elevator	−0.530	0.034
Stairs	−0.233	0.069
Ramp	−0.199	−0.001
Floor	0.305	0.023
Tactile signaling	−0.172	−0.783

Sen (2009) introduced the idea of human capabilities—levels of functioning which everyone in society should be allowed to reach if they wish or require, which include performing key activities in the public realm [16].

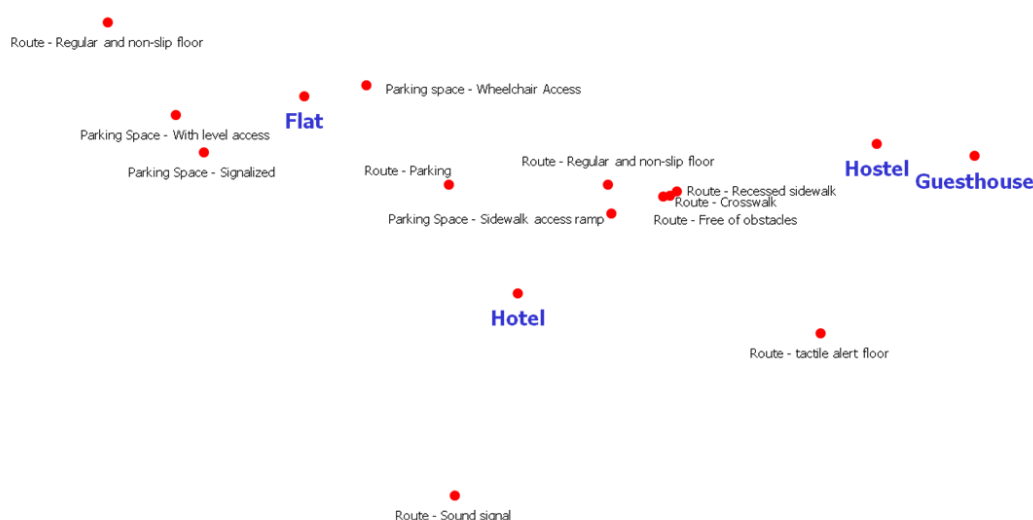
It should be clarified that restrictive factors, in terms of accessibility, in consonance with the universal design can be understood with physical, communicational, social, and behavioral barriers. As it was verified during the study focused on the physical barriers impacting in the civil construction projects, it is clarified the main variables grouped in the study. If not, let us see:

- (1) “Accessible external route” and “Parking Space” considers the displacement of the special needs individual from the sidewalk to the interior of the accommodation and from the parking space to the interior of the building. According to the universal design, the projects must guarantee low physical effort, large dimension to fit wheelchairs, and closer location for approach and use.
- (2) “Bathroom” and “Internal Area” refers specifically to all components of the bathroom, specially the access space, the space for wheelchair rotation, the support bars in correct height and location, the easy and safe access to the shower/bathtub, signs for the visually impaired, among others in accordance with the NBR 9050: 2015 standard. The variable internal area, considers the reception,

the hall, the corridors and the spaces of entertainment (pool, sauna, restaurants, bars, courts, gardens, etc), as well as the furniture (accessible counter, for example).

- (3) “Elevators”, “Stairs”, and “Ramps” all refer to specific elements that guarantee movement between the spaces (restricted and public spaces) of the accommodation, with easily accessible information without physical effort (ramps with correct inclination between floors), ensuring the equitable use of spaces in a flexible way. Finally:
- (4) “Floor” and “Tactile Signaling” that group the variables that include the warnings in the various possibilities, guaranteeing simple and intuitive use. With adequate flooring (tactile, non-slip, for example) requiring no physical effort, specific language skills, high level of cognitive concentration, easy-to-know information that causes flexible use and minimizes the possibility of errors.

In the first map (Figure 2) are the characteristics referring to the “Accessible external route and Parking space”, which were put together because they are two Nets referring to the external area of the building. In the second map (Figure 3) are the characteristics “Sanitary and Internal circulation area for wheelchairs”, which are Nets referring to the internal area of the building. For the third map (Figure 4) are the characteristics “Elevator, Ramp and Stairs”, all these referring to the level change (or floor). In the fourth map (Figure 5) are the characteristics referring to “Floor and Tactile Signaling”, which are characteristics related to the project of finishing in the buildings. These characteristics may not be as important during structural design, but should be considered during finalization.



**Figure 2.** Characteristics of “External route” and “Parking spaces”. Source: Author, 2018.

Figure 2 shows the analysis of the items “External Route and Parking Space”. It is clear that hostels and guesthouses do not invest in these items, especially with regard to vacancies. The flats stand out because, because they are characterized as a mean of accommodation typology where guests stay for longer periods, so, there is a need for parking spaces for common use and SNI. Hotels have an intermediary approach. Possibly depending on its location/neighborhood and the antiquity of the construction project. As the flats are more modern projects tend to have this feature. The signaling of the Routes appears in a distributed and dispersed way leading to a perception that there is no standard for any type of construction project or typology. It can be seen that for these characteristics, the Hotels and Flats have more proximity to most of the characteristics related to the construction project and infrastructure (which require more investments). It is important to emphasize the issue of regular and non-slip flooring for hotel units of the flat type (practically all have) and to the detriment of other units, including traditional hotels.

It is preliminarily concluded that hotels and flats are more accessible from the point of view of external routes, but very below what the regulations require. As previously mentioned, the concept of

universal design has to be respected (based on the 7 principles already mentioned) as a way of orienting the planning of accessibility works (NBR 9050: 2015). Recalling that Principle 4 defines that information should be easy to perceive and should be presented in different ways. Item 7 defines the size and the space for approach and use, regardless of body size or if SNI are allowed appropriate locomotion.



**Figure 3.** Characteristics of “Bathroom” and “Internal Area”. Source: Author, 2018.

Figure 3 shows the characterization of the bathroom item, as well as the sub-items associated with it. The research has no focus on the sub-items, but in the case of bathrooms are being punctuated aiming to highlight their relevance from the point of view of civil construction project. However, the items have not been validated through technical specifications, for example, width of doors, height of benches, etc. Only the existence of sub-items related to toilets were validated.

For hostels and guesthouses, there is no existence of adapted bathrooms in most of the establishments. About the adaptations in the internal areas, once again, it was proven that hostels and guesthouses have these resources (of lower investment and lower impact on the adequacy of infrastructure). In general, when the bathroom is adapted, it meets the principles defined according to the concept of universal design: equitable use; flexible use, low physical effort, and adequate space and approximation.

It is noticed that the hotels have a much more complete and adequate structure for the bathrooms. The hotel units present, therefore, the best result in the bathroom suit adapted for SNI. The research presents the detailing of the existing items in the space “bathroom” allowing a very precise feedback for the civil construction area. However, it can be said that flats, hostels, and guesthouses are totally outside the minimum standards required by the norm.

The adequacy of the bathrooms can be considered the most relevant evidence found reaching the highest referential values, taking into account the universal principles of equitable use, flexible use, low physical effort, and space for approximation and use. Note that the structures for the internal area have the same configuration, not allowing us to affirm that certain typologies meet certain requirements more than others.

Figure 4 deals with extremely important requirements for civil construction projects. In this sense, it is observed that the Elevator appears only for hotel units and flats. Hostels and guesthouses for presenting simpler and smaller projects do not have this item referenced. On the other hand, the item Ramp appears expressively in this type of means of accommodation. The same goes for the hotels and a little less for the flats. The suitability of the Stairs is a recurring item in hotels. The existence of the right elevator with the signaling allows and guarantees the perception of all seven principles of universal design. However, it should be noted that the flats have comparatively lower results and there is also a concern with larger hotel units with stairs, access ramps, and handrails in the internal areas. The lift platform stays as one of the items further than necessary.



**Figure 4.** Characteristics of “Elevator”, “Ramp” and “Stairs”. Source: Author, 2018.

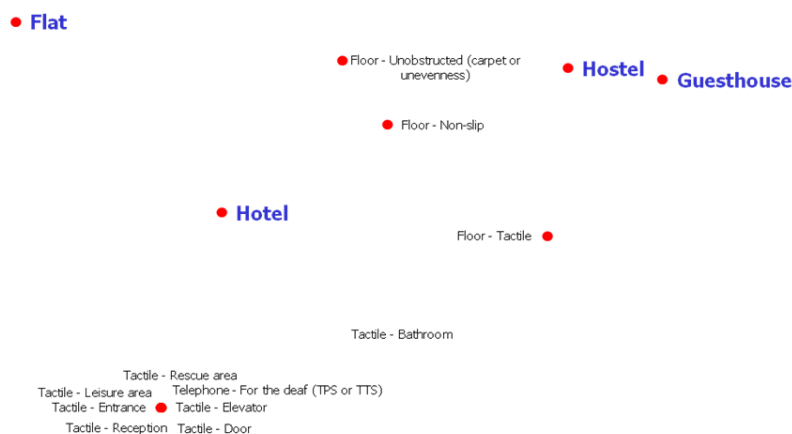
Based on this partial analysis, we can say that with regard to the items “stairs”, “internal spaces”, and “ramps”, there is not a discrepancy between the different means of accommodation for this approach in civil construction projects. It should be noted that this does not mean that all units meet the minimum requirements, only that there is no difference between the various typologies. Later we will deal with a general evaluation, aiming to present quantitatively the differences between the ideal model, the benchmark and the real one for each segment/typology.

It is recalled here that Principle 6 affirms that the low effort for locomotion must be guaranteed, because the environment or the spatial element must offer conditions of comfortable and effective use, with the minimum muscular fatigue for the user. In addition to guarantee of Principles 1 and 2, respectively, which guarantee equitable and flexible use. To this end, the same meaning of use for all should be provided and at the same time flexible for use by SNI.

It is latent to some Flats the concern about mobility specially about elevator and signaling. The hotels stand out for motorized cart solutions. On the other hand, the hostels and the guesthouses, have great dimensions of sight and of floor (avoiding obstacles and with non-slip floor). In a superficial and preliminary way, it can be affirmed that in relation to important items related to infrastructure for the analysis of projects in civil construction, items such as elevator and ample spaces for dynamics do not meet the graphic specifications.

Once again, it is noticed that hostels and guesthouses invest in adaptations of low cost, aiming to minimize impacts for SNI. Still on the concept of universal use and based on the ABNT 9050:2015 standard, equitable use (a feature that ensures that space and environment is used by anyone, including SNI) is recurring in flats and in chain hotels. In the same way the flexible use is guaranteed and so is the suitability of certain spaces.

In Figure 5 it can be seen that these items are neglected in practically all means of accommodations. It highlights only some hostels that adopt non-slip flooring in certain places. Another interesting issue is that is noticed the concern of hotels to have this type of floor only in the entrance and in the reception. However, it is worth mentioning that the norm considers that in the main routes of passage of the guests it is necessary to have a floor appropriate for SNI. The neglect of these requirements affects practically the fulfillment of all the items of the universal design, in particular, the one of tolerance to the error.



**Figure 5.** Characteristics of “Floor” and “Tactile Signaling”. Source: Author, 2018.

Hostels and guesthouses have significant flooring solutions (avoiding obstacles and non-slip flooring). The concept of universal use and based on the ABNT Standard 9050:2015, the equitable use (a feature that ensures that space and the environment are used by anyone, including SNI) is recurring in flats and in chain hotels, so that flexible use ensures the suitability of certain spaces.

The Universal Design process approach suggests an absence of fixed benchmarks, which in itself is understandable considering the vast range of factors that affect people—both as individuals and social beings—within buildings [17].

To facilitate the visualization, a benchmarking model that meets all the characteristics identified in the Nets was proposed. A comparative analysis of the results of the means of accommodation that stood out positively in the accessibility issue was carried out accompanied by the developed benchmarking. In the figure below (Figure 6), the benchmarking can be recognized by the green color, while each of the five best evaluated establishments is represented by another color.

In the analysis of civil construction projects, it is observed that these are relatively new hotel units (some of them inaugurated for mega events) and are chain hotels (which represents an investment capacity in more elaborate and updated infrastructures). However, it should also be noted that the most relevant and impacting items from the point of view of investment in civil construction projects were the items (of these hotel units) that are closer to benchmarking. These are: “bathrooms”, “accessible external route”, “accessible traffic area”, and “signaling”.

It is worth highlighting that the benchmarking values found were considerably low. It means, for the best rated items, on average, the best score reached 37% of the requirements met, which is very low.

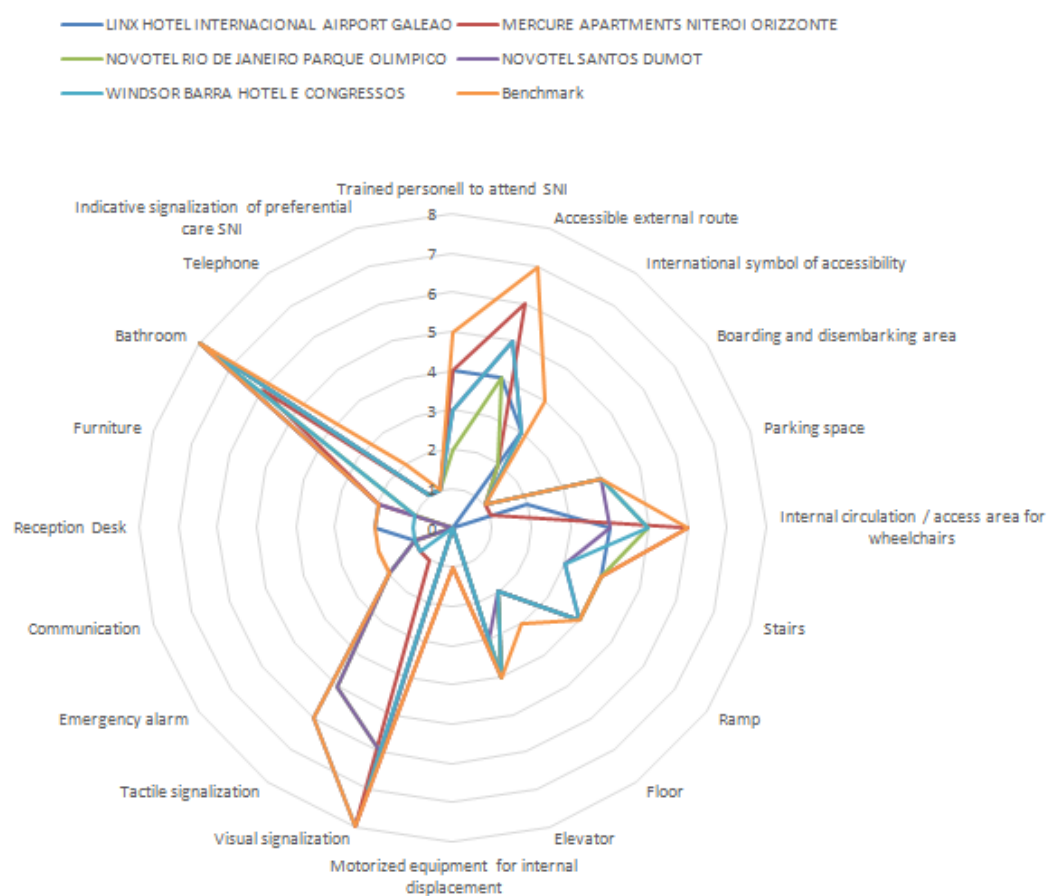


Figure 6. Accessible Hotels and Benchmarking. Source: Author, 2018.

According to Fougeyrollas [18] for people with disabilities to live independently and fully participate in all aspects of everyday life, they must have equal access to the physical environment, the transport infrastructure, and so on.

According to the author, despite significant efforts in recent decades, improving the social participation of people with disabilities is still a very challenging issue for our society. Current urban infrastructures and services are usually designed based on a standard view of people without disabilities, as this study shows in the segment of hospitality projects.

#### 4. Conclusions

The quantitative treatment initiated brings accurate data on how far the hotel industry is in terms of accessibility. Through the multivariate analysis of data is possible to perceive intrinsic aspects of the civil construction projects of each segment (or of each mean of accommodation type).

It was noticed that the large hotel chains, independent hotels, and flats are the ones that invest the most in the infrastructure with the objective of accessibility. On the other hand, it can be seen that the guesthouses and hostels have their civil construction projects under the current regulations standards.

It is clear that the existing norms are not followed for the most part of the accommodations, which accuses a great gap between theory and practice.

Throughout the research, after the diagnosis and based on the multivariate analysis of the data, it was possible to regroup the accessibility criteria that was used and it was verified that 70% of the means of accommodation investigated (out of a universe of 399) complies with only 17% or less of the requirements.

It was also found that the best-equipped mean of accommodation in terms of accessibility reach an average of only 37% of the requirements. That means, the benchmarking found in the present study, for the Metropolitan Region of Rio de Janeiro is 37%, extremely distant from the ideal value.

The theoretical implication to the area of civil engineering and construction projects, is the identification of the lack of accessibility in the hotel industry of the Metropolitan Region of Rio de Janeiro and the gaps presented by each typologies and the identification of regional benchmarking that shows that, from the 399 hotels sample, none approaches the ideal model and the regional benchmarking achieves only 37% of the requirements of the model.

It is noticed that the research limitation is given in the collection of specific information with the hoteliers and in the lack of information of the own managers on the issues of accessibility. In the same way that the present research does not evaluate the quality of the adaptations, as for example, the adaptations related to the accommodations.

It is understood that the study reached its main objective, to present a diagnosis that would allow the identification of the reference values of the Metropolitan Region and its current benchmarking. Likewise, it enabled a broad understanding of the hotel industry reality, generating subsidies in the area of civil engineering (in the development of sustainable and accessible projects), establishing accessibility relationships and different types of hotel projects (based on multivariate analysis of data), and to answer the central question of the work, reinforcing the initial hypothesis that the civil construction projects of the hotel industry of the Metropolitan Region of Rio de Janeiro are not accessible and the execution of the mega events in the City of Rio de Janeiro (World Cup and Olympic Games) did not generate a legacy of accessibility in the hotel industry.

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