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ENG

Accessibility assessment of three housing states in barcelona's metropolitan area. Tackling the 15-minute city concept and the Diputació de Barcelona requirements

INTRODUCTION

In the Barcelona's Metropolitan Area each person makes an average of 4.1 trips for both occupational and non-occupational reasons, of which at least 50% are made by private car or public transport (Direcció de l'Àrea de Mobilitat i Transport de l'AMB, 2019). A huge percentage of working people, 73.4%, and over 45% of the students are forced to move by motorized transportation to access their jobs and education centres somewhere inside this area or even further (IDESCAT, 2011a, 2011b). In addition, 1.29 million people living in the metropolitan area had difficulties reaching daily services and facilities such as groceries, post offices, education facilities, libraries, sport facilities, leisure and recreational places, basic social services, elder centres and primary health (IDESCAT & IERMB, 2011j, 2011c, 2011k, 2011e, 2011f, 2011g, 2011h, 2011d, 2011i, 2011a, 2011b).

These ways of transportation are translated in CO_2 emissions, resources and money. By decreasing distances, people could go by foot or bike and as a result, all these aspects mentioned would be reduced. Moreover, it has been said that the less time and money invested in travelling to reach facilities the greater the accessibility is (Handy & Niemeier, 1997).

Barcelona city is known for being very well connected and having great range of services at disposal in less than 15 minutes. On the other hand, if it is looked more in detail the peripherical areas of the city are less well connected and less served. And if the city is compared to less denser areas from the metropolitan area, the lack of available services is even more noticeable.

The access to public transport seems to follow the same logic making these areas even more vulnerable. The right to have access to services must be guaranteed to all the population, so something that cannot be normalized and accepted is that there are people experiencing difficulties or even not being able to reach essential services. This lack of accessibility not only has an impact on the way that people move but has also a social impact, turning people in those areas into more vulnerable individuals.

For all these reasons, it is necessary to have ways to measure and detect those shortcomings with the objective of solving accessibility problems. This research is focused on access to the lack of accessibility by foot in high-rise development areas with a mono-functional character. To accomplish that, three main areas have been chosen as case studies, focusing on the detection of deficiencies and needs of those sites.

Regarding the aspects mentioned before, the main hypothesis of the research is to illustrate that the degree of accessibility to services is proportionally related to the accessibility of public transport.

In order to do that, three areas have been selected in the Barcelona's metropolitan area, with similar urban morphology and the same monofunctional design, to be analysed and test the hypothesis under the methodology of the 15-minute city concept.

Each of these areas has a qualification regarding the accessibility to public transport obtained from an advancement of the PDU developed by AMB (Àrea Metropolitana de Barcelona, 2019).

Seeking to prove the assumption raised a set of objectives has been established. Firstly, to analyse the level of accessibility of three different areas and design an index to be able to compare any zone between them. Secondly, to compare the analysed level of accessibility to the services with the level of accessibility to public transport in the three areas.

The 15-minute city concept

The 15-minute city is emerging as the forthcoming sustainable and healthy urban planning model. This new concept of metropolis moves in the opposite direction of urban planning that has been promoted from the last decade, where the different uses of the city were isolated between them: the residential space was separated from the work, the retail, the leisure and the industry (Moreno, 2020). The author describes the ¼ hour city as a pioneer solution to the climate change crisis. The main purpose of this model is to ensure short distances to the amenities reachable by foot and bicycle. Affordable and dignified housing, working place in proximity, shopping nearby, being able to take care of physical and mental health and having access to culture, education and leisure are the needs that aimed to be reachable in the 15-minute area (Moreno et al., 2021).

The alarming numbers of cities impact have made them a focus of attention for organizations such as the United Nations and pursue goals that allow a more sustainable transition. Currently cities only occupy 3% of the planet land but represent over 2/3 of the energy consumed worldwide and generate around 70% of the emissions (Comisión de Objetivos de Desarrollo Sostenible, 2015).

That is why this model of designing people-oriented cities at the same time as it decreases CO_2 emissions has driven

organizations like C40 to promote the Paris 15-Minute City as the model it must implement to accelerate the transition to zero-carbon agenda. They affirm that this model braids together threads of climate mitigation and humanistic urban development, generating a concept that can be implemented in any city despite its shape and size. At the same time, it can boost local economies. (C40 Cities Climate Leadership Group & C40 Knowledge Hub, 2021).

Nevertheless, this concept has been mainly applied to urban dense areas but has not been proven in suburban and vulnerable areas. In some articles, Moreno mentions the 30-minute and 45-minute territory, more oriented to rural areas, but does not develop in depth (Moreno, 2020).

Methods to measure accessibility

Accessibility is the condition of being available and reachable. Places, environments, services and products need to accomplish this essential aspect to be fully practicable, functional and convenient for all citizens (DEJ, 2022). Further from that, accessibility is a remarkable condition in metropolitan areas as it is considered a goal when it comes to urban planning and mobility (Handy & Niemeier, 1997)

According to a study made in 1997 by Handy and Niemeier, being able to access future employment or current employment is what holds people in one place. Also, having at your disposal a rich assortment of goods, services and equipments. Moreover, accessibility associated with walkability is part of the sustainable development goals in the 2030 agenda (C40 Cities Climate Leadership Group & C40 Knowledge Hub, 2021). At the same time, it is one of the biggest challenges that cities and metropolitan areas have to face, due to the existing and imposed vehicular accessibility (Balletto et al., 2021).

Urban planners have used accessibility as a measure to decide where to implement and invest in changes in the use of land for the locals. Although, this concept has been discussed by scholars for more than half a decade with any consensus on which is the most accurate method to do it. Now the real issue is which approach should be used to assess, measure and evaluate accessibility. They can be be grouped into three main subsets: cumulative opportunities, gravity-based measures and random utility theory (Handy & Niemeier, 1997).

Cumulative opportunities

Is the most straightforward type to measure accessibility, as it counts all the possible destinations in the evaluated area. This method weights all the amenities equally, without making any distinction in time travel, cost or user preference. It emphasises the number of opportunities and does not take into account the travel time between the starting point and the limit of the area (Palacios Santana & El-geneigy, 2022).

Gravity-based measures

This methodology is far more complex than the one before, as it evaluates the amenities by distance, time and cost. Besides, it accounts the number of people in the two regions and the distance spacing between them. In that way, this Newtonian physics-inspired method weighs better the amenities and opportunities located closer, while those that are located further away obtain a lower score. Moreover, this model allows to introduce further variables due to its flexibility (Graells-Garrido et al., 2021).

Random utility theory

This last one is based on the choices of individual residents. Weighting the probability of a place being frequented according to particular preferences. It assumes every person assigns a value to each allocation and a second choice would be done as an alternative that will augment the overall value (Handy & Niemeier, 1997).

Peripheries contextualization

According to the definition, a periphery is a part of a whole away from its centre, especially the one of a city. During the last third of the nineteenth century, a large number of people from rural areas emigrated to more industrialized areas. In Spain, Barcelona was by far the city that received the largest volume of immigrants. At that time there was an emerging problem of housing, and as a consequence, these people coming from all along the Spanish state were assenting in different shacks placed in the peripheries of Barcelona (Bisordi et al., 2021)

Between 1950 and 1975 the transformation of the city of Barcelona into a metropolitan area was evident, as it grew by almost half a million inhabitants in less than twenty-five years. This fact highlighted, even more, the existing problem of housing which implied the emergence of construction of massive housing states[1]. The focus was on solving just the housing problem and therefore, integration and accessibility were left in oblivion. Those areas were designed with a monofunctional character and were only intended to be massive residential areas. As a consequence, these areas depended directly on other areas of the city in terms of services, transportation and commerce, as they were equipped with more infrastructure and facilities (Fainstein, 2014). Also, what it can be ensured is the little importance that was given to the urban and social impact that occurred as a result of the actions taken (Harvey, 1988).

They were designed as big blocks of housing without considering what was surrounding them. This isolation is a constant feature that easily evolves into a marginalised urban area, that in some cases still persists to this day. This underscores the amount of information that remains to be collected in order to understand the origin and evolution of the massive housing states.

As it can be seen in the FIGURE 05, these housing states are placed at both ends of the axis of the la Gran Via of Barcelona city. Amador Ferrer i Aixalà points out two big groups: one in the eastern zone guided by the Besòs River and the one in the South around the delta of the Llobregat river. He narrates in detail how those on the Besòs side originate, while those on the Llobregat side are mentioned with the few details obtained in his research of more than 20 years (Ferrer, 1996).

This underscores the amount of information that remains to be collected in order to understand the origin and evolution of the massive housing states.

1 This type of housing has small dimensions and is similar in distribution, shape and quality standards. Hundreds of thousands were constructed consequently during more than twenty-five years from the third quarter of the century..

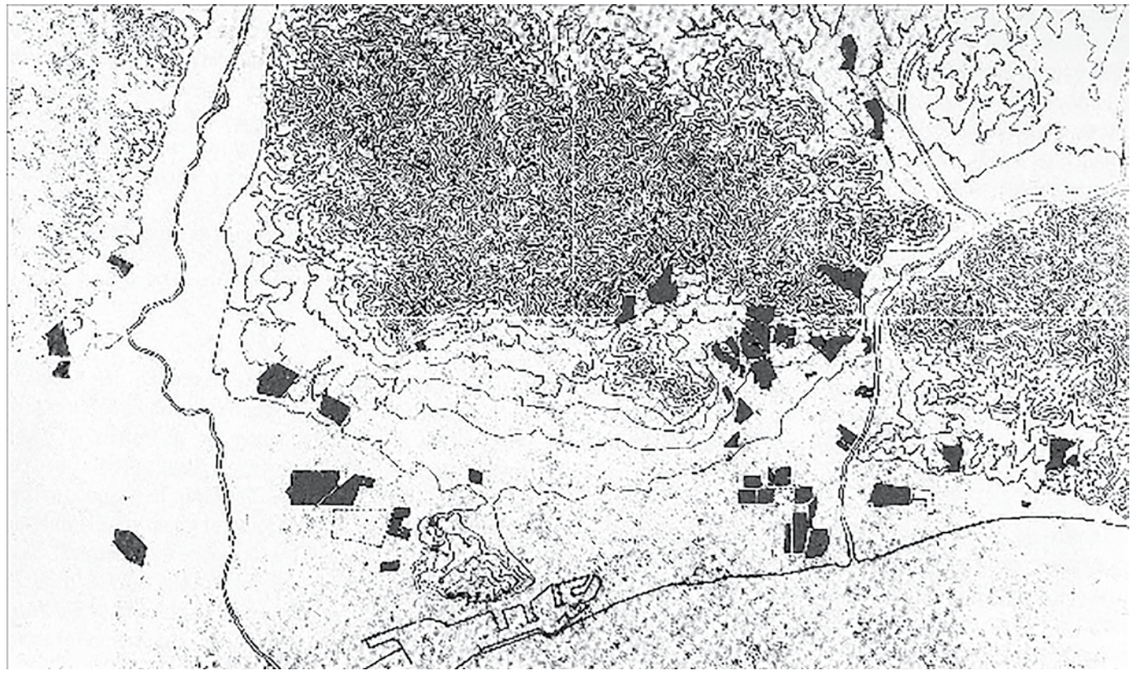

FIG.1 Setelments of the housing states of Barcelona's metropolitan Area. (Ferrer, 1996)

FIG. 03 IPAT 4. Can Ros

FIG. 04 IPAT 7. Sud-Oest del Besòs

FIG. 05 IAPT 1. Canaletes

FIG. 06 Isochrones in order: Can Ros, Sud-Oest del Besòs and Canaletes.

MATERIALS AND METHODS

Detection of the areas

The study aims to analyse accessibility to services and facilities in different areas of Barcelona's metropolitan area. It has been taken as a reference a map made by AMB where the index of accessibility to public transport (IAPT) is shown (Àrea Metropolitana de Barcelona, 2019).

As the purpose is to compare those two problematics some areas needed to be selected to be capable to find correlations between these two aspects. In order to do this, some shared points have been needed between the sites with the intention of starting from similar realities so that the results are easily comparable.

Firstly, they must be located inside Barcelona's metropolitan area. Secondly, the selected areas need to have different ranges in the mobility access index. Thirdly, they have to belong to the same urban morphology. Last but not least, the areas should be located in different municipalities and, if possible, on different sides of the city of Barcelona.

To begin with, a numerical value was given to the colours reflecting the IAPT, to be able to quantify more clearly the value given to each area.

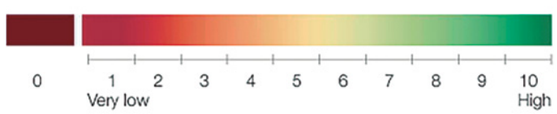

FIG. 02 IAPT value's range. (AMB, 2019)

It was then decided that the morphology chosen would be residential estates, which are characterised by their concentration and homogenisation of blocks of flats and their high population density.

The chosen sites were the neighbourhoods of Can Ros in Sant Vicenç dels Horts located in the east of Barcelona city, Sud-Oest del Besòs in Barcelona city and Canaletes in Cerdanyola del Vallés located on the west side of Barcelona City.

The three neighbourhoods belong to different codifications in terms of accessibility, and their values are equidistant from each other. The follow the criteria stablished as they belong to the same urban morphology, the three cases were built during the third 20th century, and they are located inside Barcelona city and in the two axes that delimit the city, the rivers Llobregat and Besòs.

Measuring the 15-minute walking area

The first thing that needed to be established to measure a 15-minute area was the way of transportation as it could make a huge difference in the resulting surface. The research could have been done with any of the existing ways of transportation in a city, but it was decided to focus on walking accessibility. As the concept of the 15-minute city from Carlos Moreno (Moreno, 2020) has a great presence in the city of Barcelona and in many other big cities like Paris and Melbourne[2].

2 Same concept but applying 20 minutes instead of 15.

As mentioned before, the research measures accessibility from a fixed point to all those services, equipments and amenities reachable in a 15-minute walk.

The first step to evaluate the area is to select the starting point. Since the residential estates were the initial motivation, it has been decided to select a residential building that was located in the centre of it. From this point, and in order to analyse the area that can be covered in 15 minutes on foot, a maximum distance of 1.2 km has been established, but this distance can decrease if the slope of the streets increases. The way to measure the areas was with google maps.

The resulting area has an irregular shape because of its adaptation to the urban morphology and architectural barriers of each site. As a result, only areas where walking is allowed are considered. Also, it includes all those areas and buildings that can be accessed during this time as they would be left out if the streets were considered the limit.

15-minute walking area population

The tool selected to measure the number of amenities needed in an area sets the minimum surface for inhabitant in each category and subcategory. As a result, it was not only necessary to determine the working area but also to know as detailed as possible the number of people living in it.

For this reason, it was decided to use census tracts (CTs), as they are the smallest territorial unit where data can be found. However, the 15-minute walking area (15MWA) perimeter and the CTs borders do not correspond accurately. It was then decided that the population of the CTs that were fully inside the area would be counted entirely. While the ones that were partly within the area would be evaluated individually in order to adjust the figure as tightly as possible. The purpose of that is to narrow down the population number as the results are given in metres per inhabitant. Doing that decreased the population number of each site between an 11% and a 22%. In the case of Can Ros 14,579 people are living in the zone, in Sud-Oest del Besòs 52,557 and in Canaletes is 15,028 (ICGC & IDESCAT, 2021) (IDESCAT, 2021).

Adaptation DIBA tool

In order to analyze the accessibility in the three isochrones some parameters were needed, to do so, a tool created by the DIBA was chosen. This tool was designed to enable municipalities to diagnose the status of the provision of services and facilities to their inhabitants. The tool evaluates the amount of services and equipments needed in a specific area, in order to use it as a guide for the writing of the *Pla Director d'Equipaments (PDE)*. This tool is shaped as a chart with the following information[3]:

- Several categories and sub-categories of the considered equipments.
- The amount of m2 per inhabitant needed for each equipment. There are two different ways to quantify this measure: build area (BA) and surface (SF). BA is the total constructed surface and the SF is the amount of land that is taken up. All the different equipments are measured

3 The following explanation is a personal interpretation as the document does not go with a guide to understand it fully. It was also taken into account a previous guide from the DIBA to make this explanation.

in SF and in some cases can have both measurements: SF and BA.
- The minimum number of people needed to require the equipment. This specification is given in some of the sub-categories.

That chart also categorises the equipments in three ranges:
- Basic Proximity: taking into account all those basic equipments standardised by distance. All of them have a minimum population per unit and are the most needed in a given area.
- Needed Proximity: weighted by distance and population density. In this case, only some of them have specified the population per unit needed. They are necessary but not crucial in short distance area.
- Needed General: takes into account all those equipments standardised by distance. The difference with the first classification is that in this one the equipments need a larger scale as they grant service to a large population. Some of those are needed as services but do not have to be located inside an urbanised area.

After understanding the DIBA tool it has been decided to adapt it in order to use it in a more profitable way, as some of the equipments mentioned were not part of the initial discussion and some of the values needed to be added. Also, an interpretation of each category and sub-category of the equipments has been made to simplify the mapping and the classification. From this, 11 categories with other subcategories were considered in order to evaluate the accessibility to equipments in the case studies. The resulting categories are the following: Health, Culture, Social, Education, Music, Attention & Inclusiveness, Sportive, Adiministration & Supply, Services, Religious and Security.

Amenities mapping

When it comes to the amenities mapping, two different procedures have been made, ending in two different map results that complement one to each other. On the one hand, the tool created by the DIBA standardises the type and the amount of amenities that are needed in a place (Diputació de Barcelona, 2012). Despite that categorisation, some services and amenities that have a huge importance in the 15MC concept were left out (Moreno, 2020; Moreno et al., 2021b). For this reason, it was decided to map separately all these amenities, considering them extra information, and treating the data in a different way.

Before starting to map, it has been defined the parameters and the information needed for all the amenities. Here has been joined the data needed for the DIBA tool and the one required from the software. Also, some other relevant information has been obtained to create a sheet from each one and be able to understand each amenity if its required. The collected information for each amenity is the following: name of the equipment, surface in BA or ST, Address and Coordinates UTM. Then each amenity was classified in its belonging category and subcategory.

DIBA amenities mapping

The amenities that have been previous defined in the DIBA tool have been the ones included in the mapping and the later analysis. The first step has been to download the facilities registered in the AMB's facilities viewer of the studied sites (IERMB, n.d.). Despite having all these amenities mapped, there has been still the need to examine if there were some missing. As a way of archiving the full picture of each site, Google Maps has been used to verify the ones left out. Later, each amenity found was added manually to QGIS with the required information. As google maps does not allow to check the surface of the equipments it has been substantiated with the Sede Elecrónica del Catastro (SEC) (Ministerio de Hacienda y Función Pública, 2022).

Extra amenities mapping

As disclosed before, some amenities would have been omitted if the study had only used the DIBA tool. Henceforth, those equipments and services with big relevance have been kept in consideration creating for each a new category: finance, food, recreation, retail, restaurant Business, professional (Graells-Garrido et al., 2021).

It should be noted that only those services that are directly aimed at the inhabitants of the area have been added and therefore industries and other services aimed at wholesalers have not been taken into account. After having defined the included amenities, the mapping process has been the same as the amenities missing from de DIBA tool. In some cases, the amenities were not registered in the SEC, and as a consequence, these areas have not been taken into account. All the corresponding surfaces have been measured in BA.

Results validation

There have been two ways to measure the mapping results that have been done due to the different methods that have been used. The amenities mapped according to the DIBA tool have used the same tool to evaluate them, and those extra amenities have adopted another methodology.

DIBA Amenities

The DIBA tool has been used to establish the minimum surface needed for inhabitant, it has been used the values that are already given in the table with the resulting modification. As mentioned, each type of amenity has its own value and those values are given by m2 / inhabitant.

In order to evaluate each site in the same way, a variation of the DIBA tool has been created. This has the same structure as the final modification but has undergone some changes to create a new tool to evaluate the results mapped.

In order to take into account those amenities not needed but that are in the area, a new level of accessibility named "Extra" has been added to evaluate them. According to the DIBA tool, they cannot be measured in that way because they do not have the amount of population required. For that reason, they have only been counted as they exist in the area.

It has to be noted that the equipments with an excess of the surface will not be counted, in order to just evaluate the missing surface. It has been done in that to only read the amount of surface that is left. Whereas, if the additional surface was appended to the resulting value, not only would not be able to compare it to the DPE standard value but could go beyond that sum and create some misleading if that value was considered.

As mentioned before, each site of study, Can Ros, Sud-Oest del Besòs and Canaletes, would have its own analysis with the amenities that are needed in accordance with the DIBA accessibility tool. The general layout and the way to operate is the same for all of them.

Each area has different demands and cannot be compared in the way the results are given. Because of that, the final results have been summed up with a value that goes from 0 to 1.

Index of accessibility to services (IAS)

A numerical index value has been created because the results given in the excel table were not easy to compare with the IAPT. It has been decided that the index would go from 0 to 1.

The total surface given in SF and BA needed to be merged to have a unique value from each level of accessibility. As a result, all the data is expressed in a unity fraction. However, only adding the two values together was not reflecting the reality and a weighted sum by the minimum surface distribution on SF and BA was needed. This process has been done for each level and repeated for the final number. As a result, there are three final values; one for each level of accessibility: the Basic Proximity, Needed Proximity and Needed General. To obtain a final and comparable value, another weighted sum of the three different accessibility levels was needed.

IAS	Real (m^2/inhab)	DIBA value (m^2/inhab)	Value (0-1)
BASIC PROXIMITY			**0,72**
BA	1,98	2,29	0,86
SF	0,45	1,10	0,41
NEEDED PROXIMITY			**0,11**
BA	0,34	3,41	0,10
SF	0,07	0,45	0,17
NEEDED GENERAL			**0,15**
BA	0,00	0,11	0,00
SF	0,30	1,94	0,15
IAS FINAL VALUE			**0,34**

TAB. 01 Index values

Last but not least, the extra amenities have also been translated into a value that goes from 0-1. It has not been added to the previous index because they cannot be evaluated in the same way. For that reason, they are counted as existing or non-existing and each area would have its list of extra amenities and only those in the area would be counted. For example, if there are 8 amenities on the list but only 3 of them are in the area the proportion will be 3 of out 8. The figure will be given in a range that goes from 0-1.

These final numbers are just a simplification of what has been analysed, created to compare different sites and see in a quicker way the levels of accessibility to services. However, the complexity of the analysis has been demanding a deeper look at the table, amenity by amenity, to understand fully the reality of each site. For that reason, the final numbers have only been used to find correlations between the three sites and to the IAPT.

Extra amenities

As stated above, some relevant amenities from the 15-minute concept have been left out with the previous tool (Moreno, 2020). Thus, a complementary mapping has been done with those services that did not fit in the categories from the DIBA. The categories that have been created are the following: Finance, Food, Recreation, Retail, Restaurant Business and Professional.

Once all the amenities have mapped in each site, all the areas of each category have been summed to have the total amount of surface. For these amenities, there has been no minimum value required to be in the area. In that way, the resulting number given in m2 / inhab is the final result. As that number does not allow to create any conclusion by itself, it will be discussed and compared between the three sites to see if there is any correlation.

RESULTS AND DISCUSSIONS

DIBA Amenities

The colourimetric scale illustrates the level of accessibility to services in three different areas of the Barcelona Metropolitan Area in relation to the standards proposed by the DIBA in 2010. At first glance, it is clear that the three cases are not in the best condition in terms of accessibility.

In the case of Can Ros the index of accessibility to services (IAS) is 0.28 out of 1, it is the lowest of the three zones. It is also reflected in that darker reddish-orange colour. That means that the standards proposed by the DIBA not only do not reach the minimum established but are under one-third. From this final value of 0.28 36% is from the Basic Proximity, 41% is from the Needed Proximity and the other 22% is taken from the General Needed.

The graph illustrates the index of accessibility to services (IAS) in Sud-Oest del Besòs is 0.34 out of 1, slightly higher than Can Ros. This lighter orange implies that again the standards proposed do not reach the minimum, yet the value goes over one-third. From this final 0.34 out of 1, two-fifths are from the Basic Proximity, two-fifths are taken from the Needed Proximity and the last fifth is from the General Needed.

If we take a look at Canaletes, the light orange in the picture exposes a low degree in the IAS. As can be seen in the graph the value is 0.34 out of 1, having the same result as Sud-Oest del Besòs. From this final 0.34 36% is from the Basic Proximity, 41% from the Needed Proximity and the other 22% is taken from General Needed.

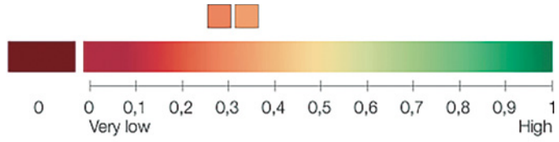

FIG. 07 IAS Index range

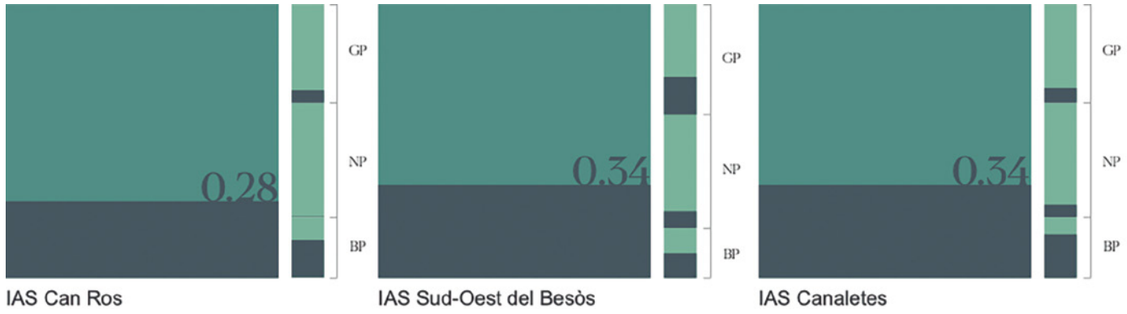

FIG. 08 IAS and percentages of the 3 groups, General Needed, Needed Proximity and General Proximity

Despite the different characteristics of the sites in terms of population, area and location, Sud-Oest del Besòs and Canaletes appear to be in the same situation regarding the amenities accessibility. However, this final value is a simplification and can only be used to compare the areas between them. Furthermore, to know and understand the real state of each area, it is important to take a closer look at each category and subcategory that make up this final value.

As it can be seen in FIGURES 08 the group of amenities with the highest rate is the three cases the Basic Proximity, tracked by the General needed and in last place the Needed Proximity. That last group appears to be the one where amenities are mostly absent or with a very low surface to have a positive impact. This matter and the fact that it accounts the 40 % of the IAS leads to an unfavourable result.

On the other hand, this ranking changes if a close look at the Extra amenities is taken. Can Ros, is the one with more percentage of needless equipments, 58 %. Then Canaletes with 50 % and in the last place, with 42 % Sud-Oest del Besòs.

Extra amenities

The bar charts (FIGURE 09) show the number of square meters of equipments and services per resident regarding the ones categorized in the Extra amenites. At first sight, Sud-Oest del Besòs is the one with more surface by inhabitant with 4.03 m² / inhab. Then Can Ros is in second place with 3.02 m² / inhab and in the last position Canaletes with 2,16 m² / inhab.

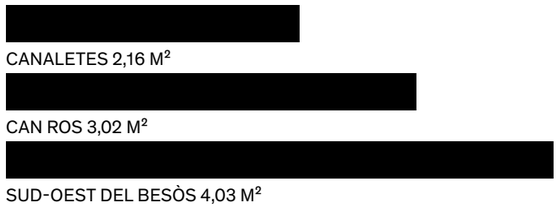

FIG. 09 Canaletes, Can Ros and Sud-Oest of Besòs, Extra amenities value

As we can see in figure 10, in each category of amenities it is drawn a different profile showing in a normalized way the quantity of surface from each area. For instance, it can be highlighted the high presence of Financial and Professional establishments in Can Ros compared to the other two areas. This could be because it is the closest area to the city centre. In addition, Canaletes has the least occupancy of Retail and Recreational, probably due to the high residential component of the area. On the contrary, in the area of Sud-Oest del Besòs, which is included in a big metropolis (Barcelona) has the highest possession in the previous mentioned categories.

Discussion of the results

After discussing the obtained results of the three sites the level of accessibility to services and equipment can change depending on what is accounted. If the focus is on the IAS done with the DIBA recommendations, Sud-Oest del Besòs and Canaletes have the same value, 0.34

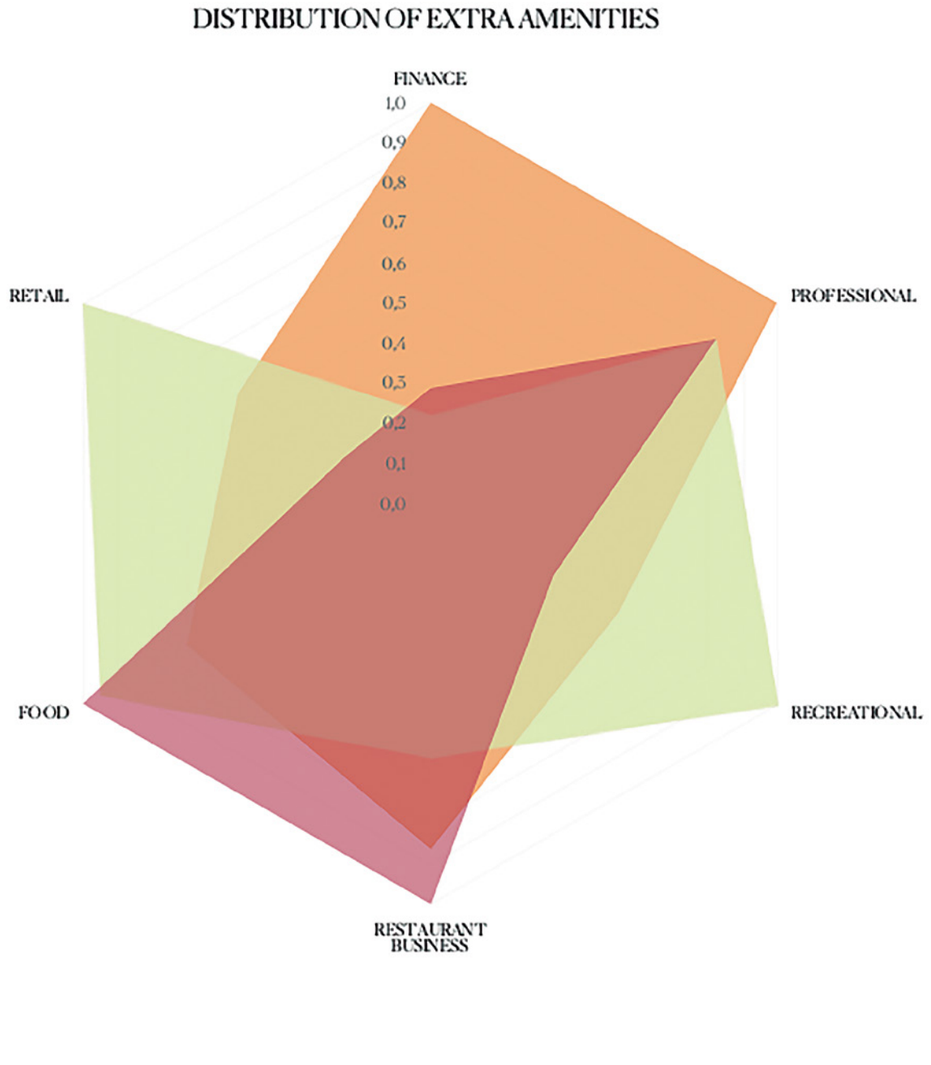

FIG. 10 Distribution of extra amenities in each area by category

out of 1, while Can Ros is slightly below with 6% less of accessibility, having a 0.28 above 1.

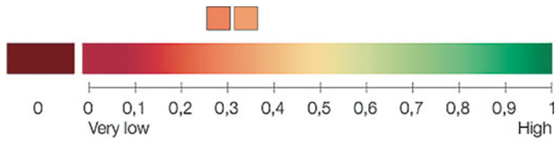

FIG. 11 IAS Colourimetric scale IAS

Just to point out, if just the amenities in the extra category were considered the sites would be placed in a different order, firstly Can Ros with almost three-fifths accomplished, then Sud-Oest del Besòs with a bit more than two-fifths reached and finally Canaletes, in between, arriving to one-half. Nevertheless, this can not be considered in the final discussion because the amenities in this group are intended for more population than the one living in the 15MWA.

On the other hand, and going a bit father and taking a look at the extra amenities results, the positionings changes again. This time the podium is for Sud-Oest del Besòs with 4.03m² / inhab, subsequently, with a 3.2m² / inhab Can Ros if found, and thirdly, Canaletes is placed with 2.06 2m² / inhab.

Before starting to compare the results with the hypothesis the value of each area, regarding the IAPT, would be reminded: Sud-Oest del Besòs, had a 7 out of 10, Can ros was placed in the secondly with a 4 and Canaletes had only a 1 out of 10.

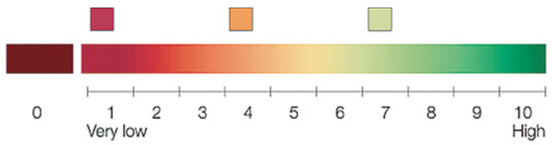

FIG. 12 IAPT (AMB, 2019)

At first sight, if the results of the IAS are compared with the IAPT of the tree sites, there is no apparent correlation, because all of them are placed in a very low position in the IAS. The differences are so minimal that the values seem to be almost the same.

On the other hand, if Extra amenities values of the three isochrones were compared to the IAPT values, the ending standings are the same ones: Sud-oest del Besòs as the most accessible area, followed by Can Ros and finding in the last position Canaletes.

From all this data it can be said that the accessibility to public transport is related to economical activities, which are the ones classified in the Extra Amenities mapping. However, it can not be proved the direct relation of the IAPT with the minimal needed equipments and services required by the DIBA.

From another perspective, what can be gathered from the DIBA results is that the similarity between them is the consequence of the monofunctional architecture, designed 60 years ago for the peripherical areas.

CONCLUSIONS

The results from the project show that the housing states regions chosen by the study have a concerning low level of accessibility to the essential amenities considered by the DIBA. Just some of the amenities have the amount of surface needed that is proposed, and in the majority of the cases where this happens, they have more than the ratio suggested. Whereas, the other equipments in the area just have a smaller amount of surface than the required by the recommendations. What's more, there are some that do not even exist, which leads to a huge problem of accessibility. The final values of the IAS are key to prove and expose the alarming situation. In this aspect, the access to services is not directly proportional to the accessibility to public transport, as the IAS is around 0.28 and 0.34 out of 1.

On the other hand, the economic activities grouped in the Extra amenities mapping seem to be proportional to the IAPT made by the AMB. However, there is no tool to ensure that the amount of services and equipments present in each area is enough for the population living in them. But what it can be concluded is that these activities are not placed in areas that are just residential, and isochrones closer to the nucleus of the city have the highest surface per resident.

Regarding these data and focusing on the shared characteristics from which the areas were chosen, it can be deduced that urban morphology has an influence in the results of the IAS.

The original monofunctional and high-dense design of these housing states seems to still have an effect on these areas. Furthermore, the neglection that these areas experienced 60 years ago, from the administration's standing point, seems to persist according to the given results.

In addition, this design decision seems to influence in the services and equipments categorized in Extra amenities. The majority of the amenities mapped are local businesses, just a few examples belong to large chains.

The fact that the areas were analyzed with a 15-minute walk may not be the ideal one, as the 15-minute city concept is designed to function in city centres with a very high population density. While I was doing the mapping there were some facilities and services that could have been included if the area was a bit bigger, and as a consequence increased the IAS. That, made me consider that smaller living areas, as towns or smaller cities, needed another time measure and that the ideal concept of the 15-minute city from Moreno, is not ideal for all types of urbanized areas.

Additionally, this study has also accomplished to develop a methodology that can be replicable in other areas and very useful from the administration stand point, as it can help to detect the areas with lower deficits on accessibility and take a stand.

Finally, this research could have had two steps more to truly see if the results reflect the reality. The first one, would be to apply the same methodology in l'Eixample of Barcelona city, as it is said that is one of the ideal 15-minute neighbourhoods. The second, would be to add some qualitative information, interviewing and making a survey to the residents of the areas selected, in order to see their perception and experience with accessibility.

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