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Restructuring of A Walled Enclosure Almohade to an Urban Universally Accessible Area: The Historical City of Cáceres

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Abstract. This article presents the results of an investigation of the current urban accessibility in the within-walls area of the historical complex of the city of Cáceres, included by UNESCO in 1986 on the World Heritage List. The construction of the wall dates back from the 12th century, during the Almohad period in Hizn Qazris. By that time, it was a strategic location for the conquest of Christian territory in the Iberian Peninsula. This enclosure was reinforced with towers and defensive bastions, which, together with the orography, elevated on a tableland, conferred an urban space protected of possible invaders. The study model is based on the comparison of that original city, which today remains as a true reflection of the originally planned, with the legislation on urban accessibility and its "true adaptation" to the significant points of public urban itineraries within the walled city. To develop the research, the data from the geographical information system of the City Council of Cáceres has been used. This implies its heritage databases, architectural settings, street slope maps and other significant factors, for their functional understanding as a model of historical city adapted to the present. The technical-administrative bureaucracy and the preservation of the historical-artistic heritage need to coexist in a close relationship with the City's will of promotion of its patrimonial tourism as a means of funding to preserve the old part as a whole (both in terms of architecture and urban structure). Implemented actions and proposals for future interventions submitted to the competent bodies for approval are presented, applying a model of urban accessibility promotion to try to achieve actual universal accessibility for all types of users. Obviously, very often, the existing conditions set important limitations but, even without reaching regulatory compliance, could undoubtedly improve the critical points detected.

1. Introduction

A large sector of the population composed of the collective of our elders, people who have temporary or indefinite disability and all those who, for different reasons, have difficulties in their relationship with the environment, should find adequate response in this effort integrator, so that they can fully develop their ability to relate and participate in social life. To do so, they must recover lost confidence and boost interest in what they have not had access to, thus improving their welfare indicators. It is not only about making us aware that a considerable number of citizens show mobility problems and that it is necessary to adopt measures to eliminate physical barriers, but that they will not be the only beneficiaries, since the physical barriers are linked and these improvements affect not only these specific people, but the whole population. An accessible city should be conceived from an integrating approach of the diverse elements and the different public policies that end up defining an immovable structure in time. The city



model must be previously studied as social behaviours and the impact on the environment, housing and telecommunications.

The action of man on nature is mainly concentrated in the urban space. The ecology of the city requires a process of reencounter with nature initiated from the city's side. As the vast majority of old cities do not have green spaces, the medium and high socioeconomic segments of society tend to depopulate the centre and choose to live in peripheral urbanizations of more recent construction, in expansive residential areas, with large green areas and low building density. This fact increases the need of transportation and, consequently, environmental pollution.



Figure 1. Situation of the walled city of Cáceres

The study that develops this article is located in the city of Cáceres, Spain, as it can be seen in figure 1. Its urban morphology is made up of a network of medieval, irregular streets. Traced and built in the first place by the Romans, it is later transformed by the Almohade; they cover it with a very hard adobe following the Arab principles of fortification. On January 21, 1949, the Decree declaring Cáceres as a Monumental Ensemble was published, covering the intramural enclosure, the wall and the Plaza Mayor. In 1986 it was declared a World Heritage by UNESCO -United Nations Educational, Scientific and Cultural Organization-, and today it is considered one of the best preserved and most complete urban complexes in the European continent. The old city of Cáceres is in a privileged orographic location on top of a hill that dominates the plain that extends to its feet, and with all the appropriate characteristics to be chosen defensive enclave. The wall, which is preserved to a large extent, circumscribes an oval of approximately 500 m. for 300 m. of major and minor radii, respectively, with a length of 1.2 km, with an ascending orography that favours important unevenness's and an urban structure of steep streets, in many cases, staggered, with two important points of convergence: one inferior in the "Plaza de Santa María" and another superior in the "Plaza de las Veletas". As for the walled enclosure, it finds its elevation at a height of 460.27 meters above sea level, from which a slight declining slope develops, except towards the bank of the frame, whose bed is at elevation + 406.00 meters above sea level. This wall has twenty defensive towers, nine flanking towers, three doors and two accesses, connected with

the different canvases. It should be noted that not all these elements correspond to the Almohad stage, and in other cases you cannot verify their time as there are no visible remains.

The aim of this article is set on studying the current regulations. With universal accessibility strategies in mind, a study of the streets and their sections is carried out. Multiple factors that define them are analysed and categorized according to their final level of accessibility. The final purpose is that the user can have that information in real time and thus obtain freedom of discretion to plan routes and connections of their itineraries of each area of the historical set of the city of Cáceres. In this paper it is analysed the actions implemented in the intramural city of the historical set of Cáceres, to determine what and how it can be learned from these experiences and be able to compare them with others previously done in other comparable historical sets.

2. Universal accessibility

At present, when studying universal accessibility, there is a situation of absolute normative dispersion. In the first place, the scope of general regulations on accessibility can be classified into international, state and regional regulations. Regarding the specific technical regulations, the different national, regional and local regulations must be identified. Finally, other technical regulations should be considered that, in a transversal manner, affect the subject of accessibility, both urban, architectural and transport. In the document prepared as a result of the international convention on the rights of persons with disabilities of 2006, it is explained in its first article that its purpose was to promote, protect and ensure the full and equal enjoyment of all human rights and rights of fundamental freedoms for all persons with disabilities and promote respect for their inherent dignity. It also states that people with disabilities include those who have physical, mental, intellectual or sensory long-term deficiencies that, by interacting with various barriers, may prevent their full and effective participation in society, under equal conditions with the rest. It should be noted that, in the document of this convention, "reasonable accommodation" is defined as necessary and appropriate modifications and adaptations that do not impose a disproportionate or undue burden, when required in a case, to guarantee persons with disabilities the enjoyment or exercise, on equal terms with others, of all human rights and fundamental freedoms.

3. Conservation of historical and artistic heritage

Following what is stated in the Guide to Good Accessibility Practices for Tourist Resources of the World Heritage Cities of Spain, prior to carrying out any intervention, the following should be done:

- Obtain all the information and possible documentation about the monument in question, as well as perform an inspection and data collection in situ.
- Carry out an analysis of heritage values.
- Perform an investigation of the accessibility conditions.
- Prepare a report of conclusions, which allows determining whether to intervene. This should reflect objective data and contain, where appropriate: General intervention criteria, solutions, recommendations and examples of good practices.
- Develop an Action Plan.

Different options can be considered when talking about heritage, so it will be essential to identify the structural and architectural characteristics of the monument, its historical value and its function, both singularly and within its environment, as with the careful study of all these factors will determine the degree of each intervention.

4. Urban renewal

There is no doubt that making an accurate diagnosis of the accessibility conditions of a historical set is a very complex task. Nowadays, most of the bodies in charge of ensuring compliance comply with item lists, in which only regulatory requirements are marked, without even considering other factors. This

system leads to simplistic results, little removed from reality, since the results conclude in a "does not comply", and therefore authorization is not granted to carry out the intervention.

There are other more benefit streams, in which it is stated that in order to face the improvement of accessibility with guarantees, it is necessary to document exhaustively the conditions of accessibility, measure it in a "relative" way with a regulation of how much and under what conditions, evaluate its potential for each intervention, and, finally, visualize the results of the diagnosis and use it as a basis for decision making.

The conservation of the intrinsic values of a monumental site should be understood as reversible actions, which can be modified when industrial developments provide techniques or solutions that improve those adopted.

Regarding the conditions that gather visitors to the monumental city, it should be understood the conditions as one of the variables to be considered in the multivariate analysis, [1]. They may be physical, wheelchairs, crutches, canes, intellectuals or lack of understanding (Accessibility and cognitive abilities: mobility in the urban environment, 2009), sensory, visual or auditory type. For all of them, differentiated solutions must be provided [2, 3], to ensure universal accessibility to the historical and cultural heritage, so that allow your contemplation, enjoyment and admiration in a non-discriminatory way. The same authors point out that the main reason that prevents progress in this objective is often the sceptical attitude, or open rejection, which is based on criteria of conservation or economic reasons. There are projects carried out, such as the PATRAC, within the project "Accessible heritage: R + D + I for a culture without barriers", in which the accessibility of heritage buildings was assessed predefined routes through the combination of geographic information systems (GIS) tools and the millions of point cloud data obtained using terrestrial laser scanners. The GIS demonstrate a great utility linking data, linking alphanumeric information with each other and being able to operate on a specific and defined spatial scope. Added to this aspect is the technique applied by the terrestrial laser scanner, with numerous benefits for the dating of historical heritage.

In the project, once the systematized data collection was made and its dump to a software created for this purpose, a diagnostic methodology was established, and the information of the routes and the elements diagnosed were visualized and edited, presented in several phases, related to the specification of the problem. It must be provided:

- consultation of an intelligent repository of patterns or typical cases,
- the provision of a minimum collection of answers,
- the multicriteria analysis of the selected answers to the virtual application of the solution,
- the evaluation of the impact,
- the feedback with other agents and the recommendation, with acceptance or rejection of the proposed solution.

As one of its conclusions, a criterion for the use of current technological advances was obtained, to study solutions based on augmented reality viewers, intelligent sensors, etc.

In the historic centres, the main area of activity must be developed, where leisure and cultural functions coexist, of importance for the local economy [4]. You should not lose quality of life for its residents, because this will lead to depopulation towards the peripheral sectors of the city [5]. This would cause a substitution of the internal uses of the real estate complex, which would aggravate, even more if possible, the decrease in the urban quality of the historic centre. It is clear that the adjustments in the scope of the urban area must be reasonable [6], and we must resort to the use of all kinds of solutions that the technological market provides us with at present [7], to solve what was not otherwise possible through works or reordering interventions.

5. Accessible tourism

One of the fundamental elements of the historical centres is based on tourism, as one of the stimulating effects [8], to the extent that a part of the economy of many cities is based in urban tourism and its popularity depends on environmental and functional quality, congestion appears as an obstacle to the

development of its potential. If urban recovery is presented based on tourism, it will be necessary to take advantage of the existing elements to prepare them for managing the flow of visitors to receive. It would not be strange therefore that public administrations and business organizations think about developing tools that allow to know the impact of tourism on the urban dynamics of the historic centre of the city of Cáceres, without forgetting its impact on the policies of urban planning to ensure the preservation of this tourism as an element of economic development and global competitiveness.

Currently the project "Cáceres Patrimonio Inteligente" is being developed in the city of Cáceres, endowed with an amount of € 3,782,805.29 co-financed between the Government of Spain and European funds. It is part of the different actions that have been done for some time by the Hon. City Council of Cáceres, such as:

- sustainable and integrating urban development strategy,
- tourism development strategy in the city,
- plan to boost the retail trade,
- promotion of the creation and consolidation of business initiatives, with special attention to innovation.

The lines of action of this project are based on a monitoring of the patrimonial elements to subsequently track and trace the significant values defined, one of them being the flow of tourists through mobile data and flow control systems.

6. Methodology

The information obtained for the present study has been compiled from different sources of information, such as the geographic information system department of the Hon. Cáceres City Council, Cáceres office of GIS, the Cáceres Historical City Consortium, the accessibility technical office of Extremadura and the cognitive accessibility office of Extremadura, different platforms and associations in the field of accessibility, such as PREDIF, Fundación ONCE , etc. as a complement to a vast bibliography and regulations of application, being indispensable for its fitting and correct interpretation the criteria adopted in each visit, meeting or telephone call maintained with the aforementioned interveners. For web accessibility, we went to publications such as "Accessibility in the web portals of the city councils of provincial capitals, 2008" and "Observatory on accessibility of municipal websites, 2010". The different theories presented in congresses on mobility and environmental quality insist on something that is given more importance each day, the city as a living element [9], to resolve accessibility of something different, which happens to be conceived as an index of quality of life, as a factor of attraction of the cities to continue fulfilling their functional objectives of coexisting, progressing and trading in harmony [10] and in this work we have tried to capture that functionality objective of the current city concept, with maximum respect to its history.

In the first place, to determine the methodology to be used in this study, the urban space has been characterized, identifying the constructive typologies of the wall and its surroundings. Secondly, the conditions of accessibility in urbanized public spaces have been evaluated [11, 12], which are defined as that set of pedestrian and vehicular spaces, of passage or stay, which are part of the public domain, or are intended for public use permanently or temporarily and have the status of urbanized land according to the current urban regulations. Once the different variables that may condition the use of the itineraries by the users have been considered, with any type of physical, psychic or sensory limitation, temporarily or permanently, a specific study of the delimited area is made by the Almohade wall.

Because the normative application of Order VIV 561/2010 is practically ruled out due to the material impossibility of compliance, it is assumed that most of the interior routes cannot be called accessible pedestrian itineraries. This is due to the characteristics of the street widths, its longitudinal and transversal slopes, unevenness, steps, free passage spaces, type of paving, etc. Most of the itineraries present a single platform for mixed use. However, as mentioned above, the aim is to propose alternative solutions that guarantee the maximum possible accessibility of the itineraries [13], studying the

promotion of the suppression of existing architectural barriers, in a similar way to the methodologies used in other studies [14, 15].



Figure 2. Identification of accesses to the site

Seven access points are detected, that can be seen in figure 2 as an example. The architectural characteristics of the busy streets are evaluated, identifying the accessible routes, as it is developed in real dimensions, the roads were identified.

Information is collected from the City of Cáceres, Cáceres Consortium historical city and Local Police regarding the information provided to the visitor of the city in terms of accessible itineraries, tourist information points schedules, visiting hours of the monuments of the site and permits for entry of vehicles to the enclosure. The different existing ICTs are studied in support of the promotion of accessible information in the field of study.

In the office design, the different variables have been analysed to carry out a simulation of proposals for accessible routes, considering pedestrian itineraries and those shared with vehicles. In addition, existing barriers have been analysed, categorizing them according to their position and in accordance with their accessibility restrictions.

The type of pavement and its state of preservation, the placement of public street furniture, such as bollards, planters, or private urban furniture, such as terraces or awnings, billboards, etc., are those that initially mark a defining criterion of tours.

Regarding the unevenness of each street, the slope map developed by GIS Cáceres was taken as a basis, made with the LIDAR data of 2012 that the drafting team of the municipal urban planning instrument of Cáceres made for that purpose, as we can see in the figure 3. The slope scale is identified by colours to identify the different sections of the unevenness of the streets.

Likewise, apart from the raster data of the slope map, vector data contributed by the Cáceres Consortium was analysed in terms of the studies of the differences in levels in each street, to calculate the slopes of each one. If the itinerary is developed for pedestrian use only or as a single platform, in which vehicles and pedestrians are mixed, the quality of transit by users may vary substantially, whether they do not have any physical, mental or sensorial limitation or not, it was proved that in certain points of the routes the coexistence between the passage of both is very difficult. For this, the current dimensions of the roads were categorized. In turn, it is extrapolated in vector format to each of the urban roads of the intramural enclosure and part of the surrounding areas.

Different itineraries were made from pedestrian accesses to assess the elevations of the route [16], and to be able to detect the sections to which they are considered critical nodes.

Finally, with all the data collected, a graphic study is carried out to identify the adapted pedestrian itineraries, IPA, in the intramural city, to provide users with the necessary information to make decisions about the route to be carried out, depending on its physical, psychological or sensory limitations. It only focuses on the streets, alleys and squares of the area delimited by the Almohade wall of the monumental city, so that, when it comes to obtaining information from the interior of public or private establishments with access to the public, you should go to the different tourist information points or different mobile applications.



Figure 3. Slopes map of the streets of the enclosure

It is proposed for future studies, to deepen in other aspects such as the analysis of intramural properties that are public or private property, their state of conservation at present, if they are open - inhabited, or closed - in disuse, as well as if they could exist as ruin records in progress for real estate. With this series of data, itineraries could be categorized by urban environments based on these criteria. Likewise, it would be enriching to deepen in this investigation to carry out user perception surveys, to determine the overall level of satisfaction regarding the urban accessibility of the studied itineraries.

7. Results and discussions

The type of monumental city of Cáceres is already inaccessible, attending to its own sense of its existence as defensive fortification against the access of the invaders. Even so, it is referred to the accessibility of its routes and not the urbanization of its streets or squares, where the intervention criteria will be of greater simplicity and realization. Figure 4 shows the base map made, with the identification of the sections according to the conditions of urban accessibility of each one, from the accessible one, in blue, the difficult one in transit, in orange, and the inaccessible, shaded in red colour.

Without forgetting the above, to improve its accessibility, every action will safeguard both the historical value and the architectural and urbanistic, aesthetic level and the quality of the materials used, rescuing as possible the original spatial configuration and emphasizing particularly in the urban elements that make up the city and specifically in the following:

- Band free of passage
- Urban furniture
- Signalling
- Signalization of routes through routing bands (in harmony with the paving of the set)
- Levels
- Area of stay -visual bars.

That is why, to make an effective study of the historic city of Cáceres, it should be identified the original aspects and those added in later centuries, which allow to know exhaustively the invariants of the city model. So far, the results that can be provided from the study carried out are the identifications of the situation of the roads, in terms of their level of accessibility. Likewise, critical points are defined, in which priority must be given when carrying out any type of intervention to improve accessibility.

The actions carried out in terms of accessibility and mobility in the intramural area, up to now, are considered concrete and isolated actions, dependent on a scarce municipal budget. To address this improvement, it must be undertaken as a global strategy, in the whole of the site, and with more and more regular budget items.

The dissemination to the whole group of citizens of the participatory tools of virtual and augmented reality, use of technological tools and other existing applications must be increased, in such a way that all the information of the monumental set is provided to those people who for reason of its limitations could not be accessed.

It is considered of special relevance the elaboration by the municipal authority of a protocol of emergency plans, demanded by the basic norm of self-protection, of civil protection, and of public spectacles and recreational activities, for all those events that are going to celebrate in the intramural enclosure, with special incidence in the assisted evacuation. In addition, these plans should be provided to the public at certain strategic points of the site, or in panels with plans, audios and legible formats for all types of users.

8. Conclusions

Currently there is excessive and scattered regulations to be met, even with incongruities or lack of updates, which greatly complicate the task of technicians who carry out projects in the field of architectural accessibility, and what is a hindrance to supervising and competent technicians of them when granting the relevant authorizations. It is considered essential to carry out in the municipality of Cáceres the elaboration and implementation of an Integral Accessibility and Mobility Plan in the monumental city, nowadays non-existent, in order that all the sectors of the population become aware and involve themselves to ensure the maximum access to places and information of cultural and tourist interest by people with physical and sensory disabilities. The Special Plan for the Protection and Revitalization of the Architectural Heritage of the city of Cáceres must be updated in which the "active management of an accessible tourism" is incorporated as one of its foundations.

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