ANALYSIS OF UNIVERSAL ACCESSIBILITY AT PUBLIC TRANSPORT STOPS IN THE CITY OF CÁCERES

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ABSTRACT

When dealing with the problems of urban transport, in many cases only the supply and demand, number of users and urban design are analysed, i.e. aspects that influence the operational functioning of the concession of this public service.

The study proposed in this article aims to analyse the situation of public transport stops in the city of Cáceres following the criteria required by current legislation on universal accessibility, trying to identify the architectural barriers encountered by users of the service who have some physical limitation.

Once the existing regulations have been evaluated and the technical requirements to be met have been defined, a critical study of compliance with the legislation in force at the existing bus stops is carried out. Subsequently, solutions are provided in the event of non-compliance in order to solve the adaptation of urban transport in terms of accessibility and the proposal of specific solutions for improvement in various areas under study is formulated. In addition, the main operational problems detected in the accessibility infrastructures for this means of transport are indicated.

After analysing the problems presented by the network of public urban transport stops, it could be pointed out that most of them are the result of a lack of coordination between the general urban development plan and the mobility plan, which prevents the adequate provision of public services.

1. INTRODUCTION AND OBJECTIVES

The city of Cáceres is a medium-sized municipality with deep-rooted habits, one of which is the use of private vehicles for daily commuting and also for mobility from the outskirts to the city centre, which until now has allowed free surface parking, unintentionally facilitating an increase in the use of private vehicles. According to the Infrastructure Plan for Sustainable Urban Mobility (PIMUS) of Cáceres approved in 2014, 55% of the overall mobility of the municipality is carried out by private vehicle.

In this sense, in comparison with other Spanish cities of similar average size, the use of soft modes of transport is low, which can be attributed mainly to two aspects: 1) the topographical conditions of the city and 2) the behaviour of the user who opts for motorised mobility as an indicator of their quality of life.

In relation to public transport, which represents a small percentage of the total number of journeys made by residents in Cáceres (around 9%), the Local Administration is working to increase its share of daily mobility. In order to make the use of public transport more attractive, awareness campaigns are being carried out to promote public transport to the detriment of private transport within the concept of sustainable urban mobility.

The degree of satisfaction shown with the quality of the urban public transport service by users leads to the conclusion that a service is being provided that is adjusted to the particular needs of the city, promoting sustainable mobility and adapting to the economic resources allocated to the financing of this service (Jiménez-Espada, 2016).

A drawback of the current planning and development model of the city of Cáceres is the lack of reserved lanes for public transport, as well as the lack of bans at bus stops, issues that delay the frequency of bus stops, making the use of public transport less attractive and reducing the number of users.

Numerous actions and initiatives have been carried out in the field of universal accessibility, which have been recognised with the following awards: Queen Sofia Accessibility Award 2012 (a distinction that recognises those city councils that stand out for their ongoing work in the field of universal accessibility for people with disabilities) and the Best Accessible Tourism Destination Award 2014 in Spain (promoted by the company ThyssenKrupp, which recognises the efforts of institutions to eliminate architectural barriers and the fight for equality for people with disabilities). To date, there is still much work to be done in Cáceres to achieve universal accessibility for people with reduced mobility.

In (Fernández-Nicolás, 2019), the current urban accessibility in the intramural area of the historic centre of the city of Cáceres is addressed, setting out actions carried out and proposals for future interventions presented to the competent bodies for approval, applying a model for the promotion of urban accessibility to try to achieve tangible universal accessibility for all types of users, sometimes very limited by the existing conditions but which, even without reaching regulatory compliance, could undoubtedly improve the critical points detected.

In urban transport, accessibility depends on the distance and ease of travel from the home to the interchange point and from there to the final destination, including access on the way up and down, as well as the planning of the overall route.

Making public bus transport more attractive and increasing the quality of the service in terms of accessibility can have a positive effect on the main actors involved:

1) For disabled people and people with reduced mobility, who will directly benefit from the improved accessibility of buses. Accessible public transport offers a greater degree of safety for these users.
2) For the service concessionaires, who, by increasing the number of potential users, will improve their bottom line; an adapted bus with accessibility systems (ramp, low floor, etc.) will give security and confidence to people with disabilities, enabling them to shorten boarding and alighting times. In general, there will be greater efficiency in the management of services, which will benefit the companies' objectives.
3) For society as a whole, which will see a general improvement in public transport; this will attract a greater number of users who, in many cases, will abandon the car, helping to increase the environmental quality of the city by reducing pollution, traffic congestion and accidents. Accessible transport ensures safe and comfortable access for all passengers (Vega, 2006).

Transport will be accessible when it allows people to meet their travel needs independently. To achieve this, stations or stops must have the appropriate characteristics to enable all people with disabilities, both physical and sensory, to travel. In addition, vehicles must have the necessary design conditions and technical solutions to allow communication between all persons.

The idea of accessibility and the way it has been promoted by the different public administrations over the last two decades has come to be best expressed in the form of new concepts and approaches such as Design for All or Universal Design and Integrated Accessibility (Alonso, 2002).

The aim of the study proposed in this article is to analyse the situation of public transport stops in the city of Cáceres in accordance with the criteria required by current legislation on universal accessibility and to offer solutions to the existing problems in the event of non-compliance in order to solve the problem of adapting urban transport in terms of accessibility.

2. ACCESSIBILITY IN PUBLIC TRANSPORT

2.1 The bus network in the city of Cáceres

The city of Cáceres has a population of 96,126 inhabitants, according to the latest data consulted at the National Statistics Institute (INE). The municipality has three districts: Rincón de Ballesteros, Valdesalor and Estación Arroyo-Malpartida, which are also served by the city bus. The company SUBUS (belonging to the VECTALIA group), is the

concessionaire of the public passenger transport service in the city. It currently has a fleet of 37 vehicles (29 conventional 12-metre buses, 6 articulated 18-metre buses and 2 minibuses). All buses have a low floor, kneeling system (kneeling) and manual ramp. In addition, two thirds of the bus fleet has a double electric ramp, which is backed up by a manual ramp in the event of a breakdown.

The current bus service in the city of Cáceres has a total of 218 bus stops, distributed around 12 regular lines and 2 occasional lines. Of the 218 existing public transport stops, only 138 of them have a bus shelter.

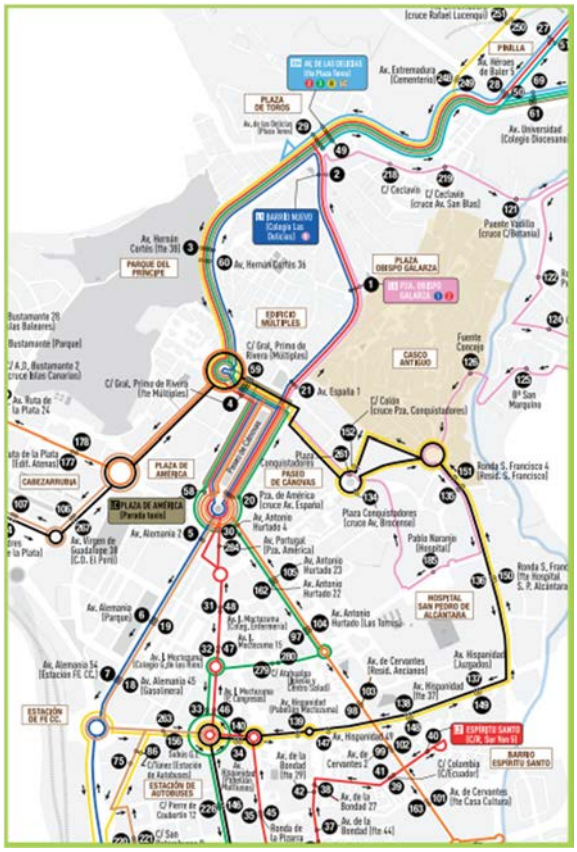

Fig. 1 – Network of bus lines in the city centre (SUBUS, 2020)

With regard to the number of users of this service, it should be noted that in recent years there has been an overall increase in passengers on the lines, which may be due, among other factors, to the management carried out by the representatives of the local administration, who have made a firm commitment to campaigns to publicise the benefits of public transport and have worked in coordination with the concessionary company to implement improvements to the service.

In this regard, efforts have been directed towards modernising and upgrading the urban transport service by contemplating the following measures:

1) Implementation of operating aid systems (SAE) to know the waiting time, mobile applications, recharging of vouchers via internet, installation of USB connections for charging mobile devices on board.
2) Increase in the number of vehicles in the fleet and their integral renovation, as well as the restructuring of lines and the construction of a new city bus station in the city centre.
3) Modification of fares and creation of new types of transport tickets (combined ticket, vouchers for large families, IMAS (Municipal Institute of Social Affairs) social vouchers).

Figure 2 shows the evolution of urban transport passengers over the last 6 years in the city, showing a gradual increase of users using the bus from 2015 to 2019, gaining 355,115 passengers, an increase of just over 8% in 5 years. However, in 2020, ridership plummeted due to the COVID-19 pandemic, with a decrease in ridership of almost 40% compared to 2020.

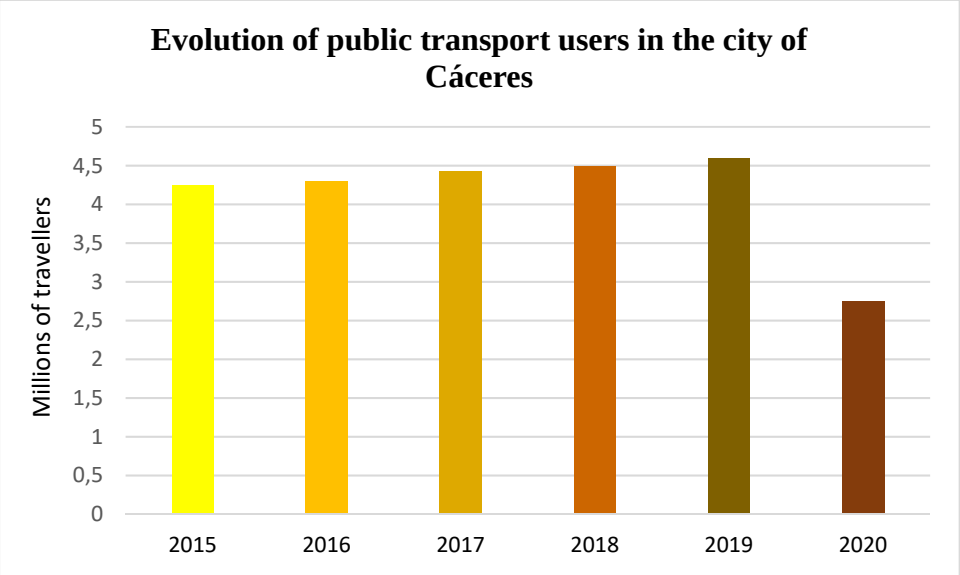

Fig. 2 – Bus passenger registration in Cáceres

2.2 Accessibility issues

According to the Green Paper (Alonso, 2002), the main accessibility problems in urban buses are: the relationship between the pavement and the vehicle, as well as the availability of easy and comfortable boarding systems for all types of users. In addition, other aspects are mentioned such as: space, layout and anchorages for wheelchairs or pushchairs in the vehicles. As basic accessibility indicators, the number of low-floor buses and their proportion of the total are used, and as support indicators, the number of vehicles with ramps and kneeling systems in use and their proportion of the total. In addition, in (Alonso, 2003) White Paper, a series of social and institutional aspects are included, such as: driver training, child buggy access rules and traffic discipline.

The key factors of universal accessibility in transport are usually considered around 4 lines of work: infrastructure, rolling stock, the link between the two and the provision of the service. The guarantee of accessible mobility through public transport is based on the achievement of and compliance with the accessibility conditions set for each of the spaces and moments in the passenger mobility chain. In order to facilitate universal accessibility in rolling stock, (Álvarez, 2011) proposes buses with a low floor and tilting systems for the vehicle that, together with the deployment of small mobile ramps, make it possible to overcome the almost inevitable differences in level with the environment. Buses depend both on the human factor (drivers) and on external factors such as improper parking of vehicles in the vicinity of stops, which make it difficult for the vehicle to get as close to the stop as possible.

Urban transport systems have specific accessibility needs that are determined by the characteristics of these modes of transport, in which there is a large influx of passengers and a frequency that determines the stopping time. These services meet the mobility needs of a population centre and have pre-established routes, subject to specific timetables. They are characterised by seating and standing room and frequent stops. Stops and bus shelters must be accessible to people with reduced mobility and have accessible equipment and furniture (Díaz, 2018). In addition, it is necessary to ensure access to the vehicle by means of low floors, platform lifts, drop-down ramps and kneeling systems. The driving of the vehicle is also important when it comes to guaranteeing the safety of users, who must drive at the appropriate speed for each type of road and avoid driving abruptly. Inside the vehicle there must be spaces reserved for wheelchair users with their corresponding anchorages and safety belts. Likewise, spaces must be reserved for people with reduced mobility.

As indicated in (Alonso, 2010), bus shelters must have information corresponding to the identification, name and route diagram of the lines, as well as a screen that informs users of the location and incidents of the buses on the lines corresponding to that stop.

In Europe, since the early 1990s, the use of low-floor buses on urban transport routes has become widespread (Dols and Vázquez, 2016). According to the information provided in the latest report of the Metropolitan Mobility Observatory (Monzón et al., 2019), it can be said that all of the 14 urban public transport lines in the city of Cáceres have a fleet of buses fully accessible for people with reduced mobility (PRM), the bus being the most accessible means of urban transport for this group, with 100% coverage in operating assistance systems (SAE) and e-ticketing and 10 stops with real-time information panels.

However, public transport stops should be equipped with shelters and perfectly delimited, which in practice is not the case in the vast majority of cases. This fact leads to the appearance of badly parked vehicles that prevent the bus from approaching the bus properly for the boarding and alighting of passengers with reduced mobility and the deployment of the access ramp.

In order to assess the degree of accessibility at public transport stops in the city of Cáceres, the considerations of Royal Decree 1544/2007 are used, whose scope of application in urban buses extends to: stops and rolling stock (vehicles for collective urban transport and with a capacity of more than nine seats, including the driver).

This regulation states that public transport stops and waiting shelters shall be connected to the accessible pedestrian route (IPA) and shall not encroach on it, establishing basic conditions for accessibility in urban transport.

3. RESULTS AND DISCUSSION

The aim of the study proposed in this article is to improve universal accessibility at regular public transport bus stops in the city of Cáceres. In this chapter, taking as a reference the existing regulations that define the technical requirements to be met, a critical study of compliance with the legislation in force (Royal Decree 1544/2007) of all existing bus stops is carried out. Subsequently, solutions are provided in case of non-compliance in order to solve the adequacy of urban transport in terms of accessibility and the proposal of specific solutions for improvement in various areas under study is formulated. In addition, the main operational problems detected in the access infrastructures to this means of transport will be pointed out.

3.1 Bus stops with operational problems

Taking as a reference the regulatory development of RD 1544/2007, of the 218 bus stops currently in service in the city of Cáceres, problems have been detected in 91 of them in terms of universal accessibility, and an inventory has been drawn up, in which the deficiencies are defined on the basis of a series of criteria that help to detect and recognise them.

In the 91 public transport stops analysed, the main errors detected were summarised according to the source of the problem. Thus, the main difficulties were as follows:

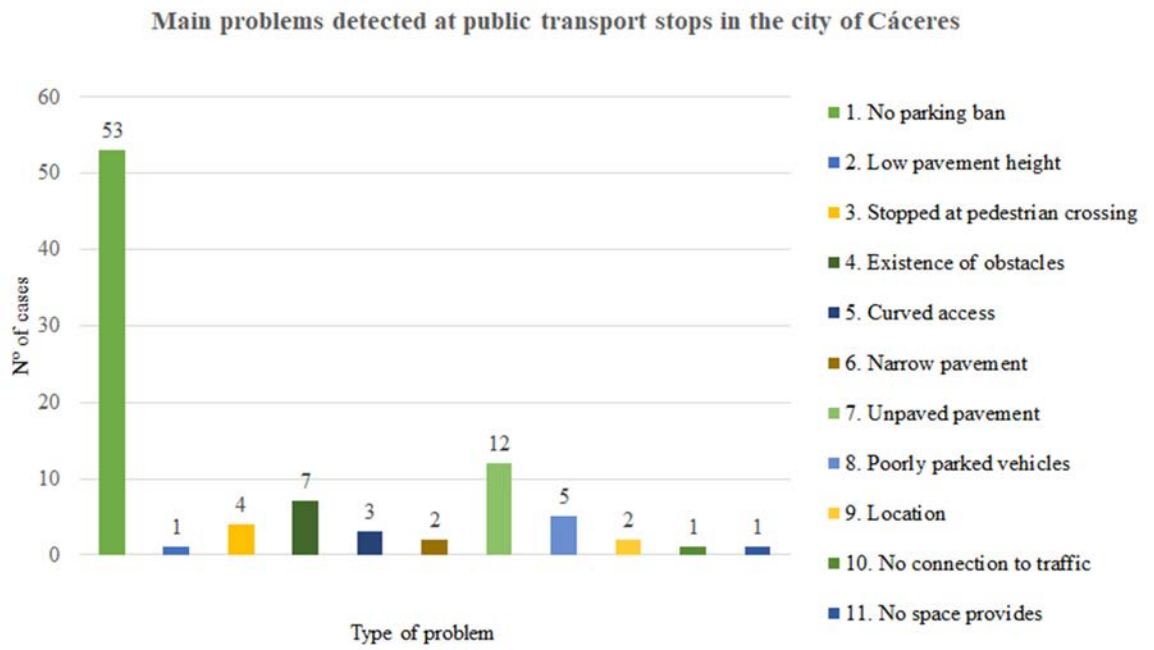

Fig. 3 – Type of problem

The most frequently repeated problem is the lack of parking bans (58% of cases) or, if they exist, they are not correctly signposted. The study shows that a large part of the non-compliances found are due to a lack of planning, as a result of the successive extensions of the network itself in order to solve the problems that have arisen over time in each neighbourhood.

3.2 Proposals for change to improve bus accessibility for people with disabilities

Next, corrective measures are proposed for some specific stops with operational problems of the kind described above, in an attempt to provide standard solutions that can make these stops viable from the accessibility point of view.

By resolving each type of difficulty, the door is opened to propose standard solutions, with the aim of improving journey times and line frequencies, quantitatively reducing the boarding and alighting times of users, thus improving the quality of the service offered to these potential passengers with accessibility problems.

Fig. 4 – Problems type 1, 2, 3

The picture above shows problem typologies 1, 2 and 3. The photograph on the left shows a stop on the university campus with no parking ban for private vehicles, which means that this space is not usually available for buses to approach. It is proposed that the corresponding vertical and horizontal signage be installed to identify the space reserved for public transport. The central image shows a common problem in many cities: the pavement is not high enough for the bus to kneel down. In this case, it is proposed to increase the height of the pavement to 20 cm by means of an anti-slip pavement. The photograph on the right (at 54 Bondad Avenue) shows an undesirable image, the bus stop is located in the middle of a pedestrian crossing. It is felt that it would be appropriate to dispense with the two adjacent parking spaces, widening the pavement in that area and moving the bus shelter away from the zebra crossing and allowing pedestrians to move freely.

Fig. 5 – Problems type 4, 5, 6

The previous figure on the left shows the impossibility of approaching urban transport to the pavement, which is not accessible to people with reduced mobility. The problem is solved by raising the raised kerb to the edge of the road, gaining the necessary area for the location of the stop, which is connected to the pedestrian route by means of a small ramp.

The central image shows that the public transport access is curved. In order to allow the correct approach of the bus, parking is prohibited in the adjacent area, which provides extra space for the vehicle's turning manoeuvre. In the upper right image, a pavement is evaluated that does not comply with the regulations (it is less than 120 cm wide) and does not have a connection for people with reduced mobility. The proposed redefinition of the stop consists of widening the pavement by building a much wider cantilevered platform that connects to the lower level by means of an accessible ramp.

Fig. 6 – Problems type 7, 8, 9

The top left image shows a green area between the pavement and the road, making it impossible for a person with reduced mobility to access the bus. To solve the problem, the pavement should be extended to the edge of the road, thus creating a platform that would allow guaranteed access to urban transport. The central image shows a common inconvenience at bus stops, the indiscipline of the private vehicle driver. The construction of a raised reserved area extending from the pavement to the road would solve the problem. On the other hand, the upper right image shows an example of a poor location of a bus stop immediately after a curve and without a pedestrian crossing nearby, the solution to which is to move it just before the curve (in a straight area), allowing the construction of a bus shelter before a pedestrian crossing.

Fig. 7 – Problems type 10, 11

Figure 7, left-hand side, shows a disconnection with traffic, which could be solved by completing the pavement in the stop area and moving the bus shelter to the centre of this area. On the right-hand side of the image there is no space specifically designated for public transport stops. A rearrangement of the area is proposed, defining an entrance area where the minibus providing the service can stop and turn around by means of a semi-curve. In this way, the bus will not stop in the middle of the street and there will be an area for pedestrians from which the bus can be properly accessed.

Incorrect parking at zebra crossings or bus stops is reduced when there are accessibility features such as low thresholds or platforms. Therefore, it is of particular importance to carry out all those adaptation works at public transport stops that improve accessibility in compliance with the guidelines of RD1544/007.

There are people with reduced mobility who decide to buy non-approved electric scooters to be able to use public transport and who subsequently find that their mobility is reduced because they are unable to use this type of vehicle on the bus. It would be advisable to carry out public information campaigns on accessibility systems on buses.

4. CONCLUSIONS

For the correct development of this work, regular urban passenger transport in the city of Cáceres has been analysed and, specifically, the situation regarding the accessibility of the bus stop network.
Firstly, the conditions of access to public transport stops have been assessed, a service that currently has a total of 218 stops.

Based on the universal accessibility regulations applicable to urban passenger transport (RD 1544/2007), 91 stops have been identified as having accessibility problems for people with reduced mobility and an inventory of these has been carried out, identifying 11 common problems.

Subsequently, corrective measures have been provided for some specific stops that have been adopted as examples and that presented different problems in order to make them accessible.

Having analysed the problems with the network of urban public transport stops in the city of Cáceres, it could be said that most of them are the result of a lack of foresight of new needs, and that they could have been avoided by planning the network in parallel with the development of the new neighbourhoods that have generated these needs.

REFERENCES

ALONSO, F. (2002). Libro verde de la accesibilidad en España: diagnóstico de situación y bases para elaborar un plan integral de supresión de barreras. Editorial Imserso.

ALONSO, F. (2003). Plan de accesibilidad “ACCEPLAN” 2003-2010. Libro blanco. Por un nuevo paradigma. El diseño para todos, hacia la plena igualdad de oportunidades.

ALONSO, F. (2010). Accesibilidad en los espacios públicos urbanizados. Madrid: Ministerio de Vivienda.

ÁLVAREZ, F. (2011). Accesibilidad universal y diseño para todos. Fundación, O. N. C. E. Arquitectura y urbanismo. España, Artes Gráficas Palermo.

DÍAZ, E. (2018). Estudio integral sobre la accesibilidad a los medios de transporte públicos en España.

DOLS, J. F. (2016). Accesibilidad, seguridad y diseño para todos en el transporte.

FERNANDEZ-NICOLAS, J. (2019). Restructuring of a Walled Enclosure Almohade to an Urban Universally Accessible Area: The historical city of Cáceres. Materials Science and Engineering, 471. (9).

JIMÉNEZ-ESPADA, M. (2016). Diagnosis of urban public transport in the city of Cáceres. Procedia Engineering, 161. pp. 1379-1384.

MONZÓN ET AL (2019). Observatorio de la Movilidad Metropolitana. Informe OMM-2017.

VEGA, P. (2006). La accesibilidad del transporte en autobús: diagnóstico y soluciones. Instituto de Mayores y Servicios Sociales (IMSERSO).