APPLICATION FOR A BARRIER FREE TOURISM IN VALENCIA

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Key words: Accessibility, Mobile Applications, smart cities, tourism

Abstract

Barrier free tourism is increasingly getting a greater attention by the tourist industry, not just for the added value given to the touristic experience, but because of the difference and specialization on a wide market share that the Spanish touristic sector has not been able to fully take advantage of yet. Following this idea, the National Plan for Smart cities (*Plan Nacional de Ciudades Inteligentes*) stands up for smart touristic destinations where innovative technologies should play an important role to improve accessibility. The development of the mobile phone App "Barrier Free-Valencia" intents to offer a useful tool to walk through the city of Valencia guaranteeing a 100% barrier free route. The methodology used for the development is based on the combination of a systematic field work, using free access information provided by the Municipality of Valencia, and calculations based on the Dijkstra algorithm (1959) implemented on a GIS software. To calculate the route, it is used the impedance or crossing difficulty concept where the different urban barriers and low comfort situation areas are identified. The main data used are: presence of lower sidewalks, path narrowing, slopes, steps and noisy pavement. After this data has been identified, the routes are divided into accessible, passable, and not accessible. It is necessary to work on the idea of creating representative single line grids of sidewalks and, therefore, of real paths followed by urban citizens. By doing so, more data can be collected to build a complete Smart City grid. The development of Apps such as Barrier Free will help on the evolution towards more inclusive cities. An idea that is the basic line of our investigation.

Introduction

It has been more than 35 years since September 1980 in Manila (Philippines), within the Manila Declaration made by the World Tourism Organization (OMT), was associated for the first time the term *accessibility tourism*. This declaration recognized tourism as a fundamental right and

key vehicle for human development and recommended to member states regulating tourism services pointing the most important details of tourist accessibility. Since then, there has been a important step forward at least in the legislative recognition of the need to guarantee accessibility to urban and improvement which results into society as a whole and not limited or segregated as until recently it came doing. This recognition has made view that accessibility is just one of the key factors of the concept "quality tourism" that gives guarantee an easy and natural consumption of different types of types of tourism. In this line the "accessible tourism", also called "tourism for all" was incorporated into the Spanish Tourism Plan Horizon 2020 (Consejo Español del Turismo, 2007), in one of its lines of action called "AM3 Accessible tourism - tourism for all". More recently, accessibility has been associated with the concept of "smart city" and has become a hallmark of inclusivity, open and able to function as a platform for coexistence cities, but also of economy and creation innovation. As we noted on the recent National Plan of Smart Cities (Ministry of Industry, Energy and Tourism, 2015), not seem to exist a consensus on the concept of intelligent city or the minimum elements that must be present in a city in order to be considered as such. It can be agreed that the application of ICTs to improve the quality of life of the inhabitants ensuring sustainable economic, social and environmental development are elements common to all definitions. However the National Plan uses a fairly comprehensive definition proposed by the Technical Group Normalización 178 of AENOR (AEN/CTN 178/SC2/GT1 N 003), in which accessibility as a broad concept encompassing both physical access within urban environments such as access to information is clearly highlighted:

"Smart City It is the holistic view of a city that applies ICTs to improve the quality of life and accessibility of its inhabitants and ensures sustainable economic, social and environmental development in continuous improvement. An intelligent city allows citizens to interact with a multidisciplinary and accommodates in real time to their needs time, efficiently in quality and cost, offering open data, solutions-oriented citizens and people services, to resolve the effects of growth of cities, in public and private spheres, through the innovative integration of infrastructure with intelligent management systems."

In this context, it is understood that tourism should play a key role in promoting smart cities, especially in countries like Spain where no city is outside them. Particularly tourism of Valencia is presented with significant opportunities in attracting the demand generated by the group of people with disabilities. Just in Europe there are more than 138 million people-of which more than one third are disabled and the elderly remaining 65 years. The main markets for tourism to Valencia -United Kingdom, France, Germany, Italy and Spain are the countries with the largest population of people with accessibility requirements. Meanwhile, the percentage of people over 60, who in 2000 was 11%, will double going on to 22% of world population in 2050. This will mean two billion people and two billion opportunities for the tourism sector. Our research is based precisely on these precedents and tries to contribute to the objective of achieving smarter tourist destinations, working especially through the implementation of new technologies to improve urban accessibility.

Some data on disability in Valencia

Enjoy an accessible city, achieving the elimination of barriers to personal autonomy and free movement of citizens, it should become one of the main objectives of any policy that seeks to improve coexistence, social welfare and citizen solidarity. The Convention on the Rights of Persons with Disabilities adopted by the United Nations General Assembly on December 13, 2006 and ratified by Spain, establishes the obligation to undertake or promote research and development, and promote the availability and the use of new assistive technologies, including information and communications, mobility aids, devices and suitable for people with disabilities, as well as the obligation to take appropriate measures to ensure access, under equal conditions, the environment physical, transport, information and communications. Among the measures taken should be included therefore the identification and elimination of obstacles and architectural barriers, both in the urban environment and in official buildings.

Meanwhile, and referring to people, the prevalence of disability is very significant. According to the INE, drawn from the "Survey on Disability, Personal Autonomy and Dependency Situations" (Catalan and Abellan, 2008), we sheds very illustrative data shown in Table 1.

Tabla 1. Disability data by age

Interval	Disability
Between 6 and 44	30 in 1.000
Between 45 and 64	100 in 1.000
Between 65 and 79	245 in 1.000
Between 80 and 90	649 in 1.000

Source: "Survey on Disability, Personal Autonomy and Situations of dependency ". 2008

The overall method for Valencia is 99 people in 1000. This figure means that 10% of people in our Region has some kind of permanent restriction. This figure corresponds exactly to the global prevalence of disability highlighted by WHO, which is also 10%.

In Spain the number of wheelchair users is between 400,000- 500,000, predominantly chronic disease (severe bone and joint diseases, neurological diseases, lower limb amputations, heart or lung disease or severe restriction with aerobic capacity, senility), although It should also be considered temporary use of wheelchair due to illness or accident. The number of persons directly or indirectly affected by disability-related issues, is much broader and more significant beyond that resulting from the application of such figures. This suggests that efforts to improve accessibility in cities, redound positively in the vast majority of citizens in one way or another will be beneficiaries of such actions.

Valencia city of accessible urban tourism

Valencia is a city that in the last 10 years has been a substantial turnaround revealing himself as one of the most important urban tourist destinations in Spain. According to data from the latest official tourism statistics, 2015 was a year of sustained growth for Valencia with 1,700,000 passengers. This figure is achieved thanks to a breakthrough in international tourism above 8%.

In particular, after 15 years of efforts, Valencia has established itself as one of the Mediterranean cruise destinations. According to the figures recorded by Turismo Valencia, since 2000 it has grown from 20 stopovers at the port that left 10,219 cruise passengers, the 195 scales that brought 373,013 passengers in 2014, according to data from Port Authority. These figures represent a growth of 900% in the number of ships and more than a 3,500% increase in the number of passengers in just fifteen years (Figure 1).

Figure 1. Valencia cruise tourism growth in 2014
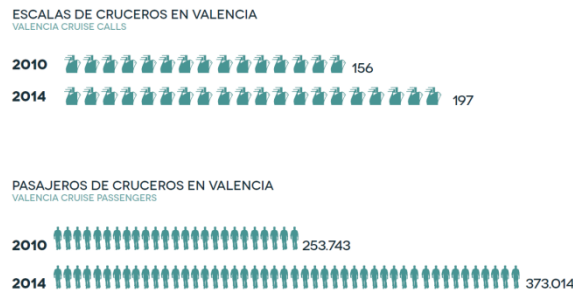
Source: Tourism Statistics, 2014. Ports and Tourism Valencia

The city has improved its offer of infrastructure for cruises, adapting to the trend of the industry and the technical requirements of ships. Now, it is shunted to work on improving accessibility in general and in particular for urban visitors. Just keep in mind that in the last two years around 30% of tourists visiting Valencia had more than 55 years, being especially cruise passengers, a group of tourists whose average age has been over 50 years (Figure 2).

Figure 2. Average age tourists in Valencia, 2010-14
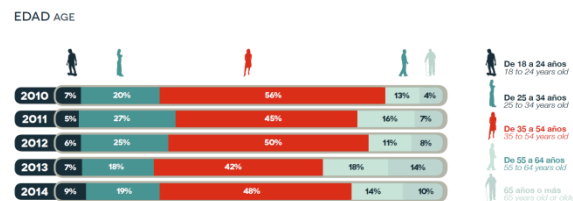
Sources: Tourism Statistics, 2014

The correlation between aging and disability is evident. Currently, 63% of people with disabilities are more than 45 years and it is likely that the incidence of disability continues to grow, since many people develop disabilities at an advanced age. According to a recent study on the economic impact and travel habits of accessible tourism in Europe in 2011, there were 138.6 million people with accessibility requirements in the EU, of which 35.9% were persons with disabilities between 15 and 64 years of age and 64.1% of adults 65 and older. (European Commission, 2014).

Considering all these antecedents, the main purpose of this project "Barrier-Free Valencia" is trying to respond directly to the potential demand for urban accessibility that has been increasing in recent years through the use of new technologies. To do this, we are designing a mobile application that enables users of it to pass through the city of Valencia selecting routes 100% accessible to people so peramente or temporarily, have reduced mobility. These routes are complemented with specific medical recommendations for users based on their reduced mobility condition. Thus complementarily we contribute to: improving self-esteem of those users; contribute to increasing their autonomy; identify the least accessible areas of the city providing them with visibility to face their improvement; associate tourism of the city of Valencia the added value of quality of life, health and wellness.

Methodology and technology used

This project has been possible thanks to the momentum gained for support for performing new preparatory activities coordinated between researchers from the Polytechnic University of Valencia (UPV) projects and the Institute of Health Research - Hospital Universitari i Politècnic La Fe (IIS / HUP La Fe), within the framework of the activities of the Campus of International Excellence VLC / CAMPUS. In the development of this project it has the technical support of the Valencian Cartographic Institute and the collaboration of the City Council of Valencia through their platform "Valencia Open Data". The way to address this objective has been based on the use of spatial analysis supported (Network Analysis) network technology already implemented by the authors of this paper on previous occasions (Temes and Moya, 2014). In this case, it was to solve the problem of an analysis of transport network regardless the directions of the streets previously assessing the degree of accessibility of the same and thus establishing "barriers" for those points where accessibility us can guarantee.

Mapping and data used

For network modeling it has been used mapping "CARTOCIUDAD" developed by the Valencian Cartographic Institute in the area of the city of Valencia and coordinated with the rest of the territory by the National Geographic Institute. Such mapping has been complemented by the pedestrian sections of the OpenStreetMap database and a delineation of the city last orthophotograph. Collectively it has developed a topological network with over 15,000 sections that has been supplemented with the "Open Data" of the City Council of Valencia. Still, all this information has been insufficient to model with accuracy urban pedestrian network as these maps only reflect the axes of the tracks, but is not on them crosswalks, recces, obstacles, etc. To do so it has had to be developed extensive fieldwork throughout the city in which they are working mainly students of the School of Architecture of Valencia. This work, in the first instance has focused on developing a pilot area to serve as a reference to assess the goodness of the method used and its effectiveness. Here we describe this area of study.

Used variables

To calculate availability have found two types of variables that affect the result of the different routes: the physical and street typology.

Next, in Table 2 the different variables taken into account to model detailed network:

Table 2. Types of variables taken into account for the design of the application

| Element.	Description
Recess	In crosswalks, or places to leave the sidewalk recesses are decreases curbs where a person in a wheelchair, for example, is able, independently, to overcome this barrier
Width	Sidewalks or streets of less than 1.20 will consider them as are not accessible to wheelchairs, strollers, walkers, ….
Slopes	The sections of streets or accesses (overpasses, ramps, ...) with slopes greater than 6% consider them as not accessible..
Steps	The sections of streets a step more than five centimeters consider as not accessible.

From the identification of each of these variables on mapping has been considering the current legislation on accessibility both at Valencia with the Order of 9 June 2004, the Department of Land and house, by the Decree 39/2004 of 5 March, the Consell de la Generalitat develops, on accessibility in urban areas, as state-level with the Order VIV/561/2010, of 1 Feb., establishing the basic technical document accessibility and non-discrimination for accessing and using developed public spaces is developed. From that legislation it has considered two levels of accessibility: friendly spaces and practicable spaces. It means a space adapted (art.2 Order June 9, 2004) those spaces, installation, building or service shall be considered suitable if it meets the functional and dimensional requirements that guarantee their independent and comfortable use by people with disabilities. Meanwhile spaces are considered practicable (Article 2 Order June 9, 2004), when the nature of, even without complying with all the requirements that make it adapted, allows independent use by persons with disabilities. It may be used to satisfy minimum character in projects and renovation of consolidated urban spaces.

Operating test pilot on Zaidía and Benicalap Districts

The choice of the area to develop the project pilot test is justified based on their representative value for hosting major morphologies present in the city of Valencia. From the scoping study that was timed to coincide with the sum of six census tracts districts Zaidía and Benicalap, fieldwork took place for a week using instructions previously designed to collect all the information making the most time spent. This information was then restored in a CAD program with the goal of building a tramero that could be categorized as three types of accessibility, allowing calculate routes based on this classification. Routes calculable categories were:
• Shorter route
• Practicable route
• Accessible route

Figure 3. Study area. City of Valencia
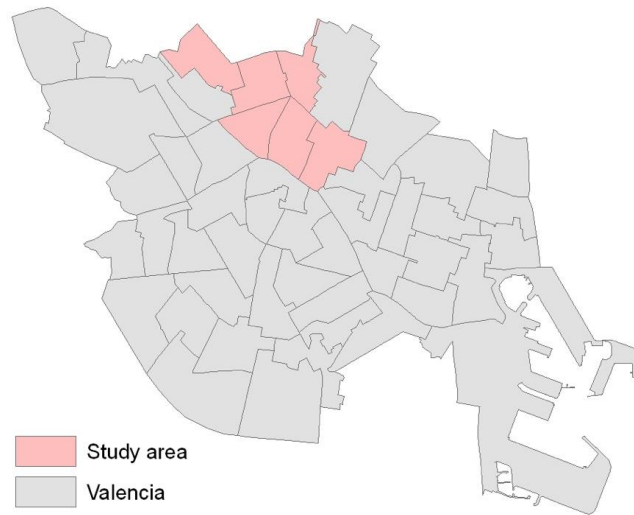
Source: Authors

From the dimensional point of view, the test area consists of a total of 4175 segments with a total length amounts to 183,035 meters (Figure 4). Usually in reachability analysis we are used to working with single-wire axis representing the axis of the streets. Now in this case it is necessary to clarify that for the lifting of this mapping has had to return on every street sidewalks on both sides because they could be situations of different accessibility in each case.

Figure 4. Study area. Single-wire axis

Source: Authors

Once restored street in a CAD software, files a GIS software were exported to proceed with a review of the topological sections in order to detect the following errors (Figure 5):

- Discontinuous stretches that not joined into the network
- Lack of intersection at cross sections
- Lack of connectivity between end stretch

Topological record review was conducted through Arcgis 10.3 software. To do this, previously a geodatabase with all of the axes was designed and submitted to the following rules of topological validation:

- Must not overlap
- Must not have dangles
- Must not have pseudonodes
- Must not self-overlaps

To review whether those rules are fulfilled errors that are detected and reflected in the figure 5:

Figure 5. Study area. Point and line errors

Data_BF_Topology
Area Errors

Line Errors

Point Errors
— Street Axes

Source: Authors

From the detection of such errors it proceeded to correct them using the tools of topological validation of Arcgis. Regarding their compliance with the first rule (Must not overlap), 6 intersections sections that should be merged into one single detected.

With regard to compliance with the second rule (Must not Have dangles), many errors (293 nodes), among which nodes were detected that do not intersect. Now, they were counted as errors all nodes final section of the study area. These were discarded and attention on other dangle nodes. To resolve these errors is performed in individual cases:

- A Snap with a tolerance of 0.5 meters (two nodes within 0.5 meters merge into one)

- A Extend 0.5 meters, extends 0.5m sections until it intersects with another so that there is connectivity
- A 0.5 meter Trim, cut slice up 0.5 sections to avoid small stretches of road that are delineating errors.

Concerning the third rule (Must not Have pseudo nodes) put on notice about the points where a section begins and ends and where two nodes. It really is not an error affecting the operation of calculating routes, but causes data redundancy is best to remove. In this case we eliminated the nodes 1904 fictitious intersections that have occurred.

With regard to the latter rule (Must not Self-Overlap), it has not detected any error. Once corrected mapping, classification and statistics sections of this street map types defined by the axis is reflected in Table 3 and Figure 6:

Figure 6. Stydy area. Axis classification

Tipus

— 01 Tours accesible sidewalks
— 02 Accesible routes throught pedestrian walkways and green areas
— 03 Inaccesible tour
— 05 Practicable tour
— 07 Crosswalk with recess
— 08 Crosswalk without recess
— Proposed new crosswalks

Source: Authors

Tabla 3. Estadística de los tramos de la zona piloto

Tipus	Lenght (m)	% Total
Tours accesible sidewalks	125.497	68,55
Accesible routestrought pedestrian walkways	29.335	16,02
Inaccesible tour	4.630	2,53
Practicable tour	8.178	4,47
Crosswalk with recess	14.842	8,11
Crosswalk wioth recces	365	0,20
Proposed new crosswalks	75	0,04
Total	**183.085**	**100,00**

From the review and correction of the back, it has proceeded to the creation of a rutero using the ArcGIS Network Analyst. Once it built has carried out the verification of the calculation operation performed several routes by checking the result of the three types of categories: shorter, accessible and practicable route. Following is the example of one of those verified in the pilot study tours (Figure 7)

Figure 7. Study area. Calculating a route type

Source: Authors

The lengths of the calculated routes are:

Table 4. Lengths basic calculation

Route	Lenght (m)	% more than shortest
Shortest Route	3.613	
Practicable Route	3.757	3,99
Accesible Route	4.114	9,50

Conclusion

Accessible tourism, acquires a predominant role in the tourism industry, not only by providing added value to the tourist experience, but also by the differentiation and absolute expertise in a broad market segment not currently sufficiently addressed by the Spanish tourism sector . The tourist accessibility has gone on to become an intrinsic factor in tourist quality can no longer conceive of quality tourism, when it is not accessible to all. Is because of this reason that both the design and rehabilitation of facilities or tourism resources shall prevail technical criteria that make a space and its use, contemplating at all times the principle of Design for All or Universal Accessibility accessible concept directly related to the accessibility unnoticed. Achieve smart tourist destination through the contest cutting-edge technology infrastructure. The next steps of this project go through:

- Set up a meeting with the coordinator of the physically disabled in the Valencia Region (COCEMFE) face to present the project confederation and has formed a working group in order to incorporate the suggestions and considerations that may provide for future users

- Extend the pilot to the entire city of Valencia, incorporating information on accessibility of the main tourist destinations. for this we contact the Municipality of Valencia as this information is available for all equipment and museums.

- Designing the application interface, ensuring compliance with the main standards of accessibility (Accessibility Programming Guide for iOS and Android User Interface Guidelines) and translate the app at least into Valencian and English.

In short, the "Barrier-Free Valencia" project aims to increase the autonomy of visitors in our cities and are part of the action lines which aim to achieve more integrated and more inclusive cities tourists.

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