World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:7, No:8, 2013

Walkability as a Strategy towards Inclusive Communities: Case of a Portuguese Small Town

Miguel Amado, João Freitas, Eveline Rodrigues, Rosario Ribeiro

***Abstract*—**The United Nations has defined the *inclusive community* as "…promoting growth with equity, a place where everyone, regardless of their economic means, gender, race, ethnicity or religion, is enabled and empowered to fully participate in the social, economic and political opportunities that cities have to offer". In this paper, the concept of *walkability* is viewed as an important tool towards the planning and future development of more inclusive communities. Walking is the cheapest and cleanest mode of travel available to all providing large benefits to both health and local economic development. To demonstrate the validity of this strategy a set of parameters, selected from existing research, were measure, compared and discussed in the existing and proposed scenarios of a Portuguese small town using GIS software.

***Keywords*—**GIS, Inclusiveness, Planning, Sustainability, Walkability.

I. Introduction

THE beginning of this project can be traced to 2003 with the publication of the Natural Park of Sintra-Cascais General Plan, this plan are mandatory that all towns inside its limits be subject to the development of detailed plans by the municipalities responsible. The overall objectives of these plans were: the regulation and control of urban expansion minimizing fragmentation and diffuse land occupation; safeguarding soils of high ecological capacity for agriculture and other ecological services (aquifer recharge, habitat, etc.); develop quality public spaces that enhance the quality of the towns and creates a single unified image for all of them; plan for new areas of contained urban expansion that promote high quality housing and public space with infra-structures and services; resolve issues with illegal housing; enable the self-sustainability of the towns by promoting soft mobility and creating more economic and commercial opportunities [1]. Our team, together with the municipality of Cascais sought to develop a strategy of urban development that promoted these objectives. One of the main vectors of the developed strategy, alongside fundamental ecological considerations, was the aim of developing more walkable and therefore inclusive communities [2], [3].

In order to defend the adopted strategy to municipal officials, elected politicians and ultimately the public there was a need to clearly define the concept and main components of walkability. Many studies, papers and reports on Walkability settled its definition as the way in which the built environment is conducive of the use of walking as a mode of transport or physical activity [4]. The relationship between walking or the ability to walk has been subject of several studies and published papers [5]. A great number of these studies have focused on the relationship between public health, obesity and overweight issues and the built environment [6]-[8]. They have shown the clear advantages of promoting walkability as a mode of transport in communities large and small. Unfortunately walking has long been considered a minor mode of travel in conventional transport planning, consistently undervalued it is an essential ability of the human species, the speed and distance travelled may pale in comparison to other modes of transport but it provides vast benefits such as physical and mental health, reduced transportation costs, improved accessibility (for non-drivers), increased local business activity and employment and greater support for transit [9], [5], [10]-[12]. These benefits underline the basis for the claim that walkability improves the inclusiveness of a community or city as it benefits the most those who are least able to bypass both cost and other social and economic barriers and therefore are most disenfranchised.

Creating inclusive communities is an aim of the Cascais municipality and obviously not just for the town of Murches inside the Sintra-Cascais Natural Park. But what is exactly and inclusive community? The United Nations has defined the Inclusive City as "promoting growth with equity, it is a place where everyone, regardless of their economic means, gender, race, ethnicity or religion, is enabled and empowered to fully participate in the social, economic and political opportunities that cities have to offer [13].The 1999 Human Development report stated that the income gap between the world's richest and the world's poorest has increased from 60 to 1 in 1990 to 74 to 11 in 1997 [14]. The latest report from the United Nations Development Program [13] confirms this trend of a widening gap between rich and poor. Furthermore the report also claims that several factors are affecting the equitable development of populations not only in developing countries but also in richer, more developed and more urbanized ones.

Overall urban planners, health officials and other policy makers may want to drive policies and want to take steps to mitigate these issues in future designs. Identifying and avoiding problems related to walkability might create communities that are more inclusive [15]. Already, the New Urbanism movement advocates urban designs that are more pedestrian friendly include more walkability features than previous suburban such as: bike lanes, lower speed limits,

M. P. Amado is with Departamento de Engenharia Civil, Faculdade deCiências e Tecnologia, Universidade Nova de Lisboa, 2829-516Caparica, Portugal (phone:+351212948557; fax: +35121948398; e-mail:ma@fct.unl.pt).

J. C. Freitas, E. B. Moura, and M. R. Ribeiro are with GEOTPU, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal (e-mail: jc.freitas@fct.unl.pt, ebm@fct.unl.pt, rsa.ribeiro@ fct.unl.pt).

traffic calming devices and traffic circles and fewer vehicle lanes [16].

Although urbanization has been linked with increased economic growth and opportunities it is important to realize that while residents of more urban areas clearly benefit from "urban advantages" like greater access to services and jobs the increased cost of living, in which transportation costs are responsible for a large proportion of family expenditure, can rapidly create a class of urban poor [17]. In southern Europe, where the case study is located, the urbanization rate is expected to go from 67.5% in 2010 to 81.2% in 2050 [17]. It is important therefore, in smaller towns, to create a balance that enables the concentration of services and opportunities but maintaining overall character that made people choose it to live their lives in the first place.

II. Methodology

Evaluating walkability is a difficult process mainly due to the many factors involved in its assessment [18]. It is relatively easy to count vehicles, measure traffic and incorporate vehicle travel models. Indeed civic leaders prefer to be associated with higher perceived importance projects such as highways or major transit, more importantly travelling by foot tends to be stigmatized because of its obvious use by low income people while owning and driving a car can be seen as measure of success [9]. Some authors have claimed that vehicular travel diminishes and walking travel increases where the 3D's (Density, pedestrian-friendly Design, and Diversity) are most developed [19].

The first step of this work was the canvassing of a wide body of research to identify the most important parameters to assess and develop walkability. Three parameters were selected the 3D's [19], are suited to the case study mostly due to their simplicity which makes them easily measurable in various contexts such as denser urban cores or, as in this case, less dense small towns. The first parameter analyzed is density. With this objective a side-by-side comparison of the existing dwelling Density and the density proposed by the Murches Detail Plan followed by a quick discussion on how it may change Murches in the future. The second steps is the study of the existing Land Use Mix (diversity) in Murches and again compare it with our proposed changes and followed by a quick discussion on how these changes may affect the walkability of Murches and the context in which they will be implemented. The final step will look at the Road Network, a concept adapted from the third "D" (pedestrian friendly design) and split into road connectivity, network, condition and design (sidewalks and crosswalks) followed again by a discussion on the context and expected results. In Fig. 1 the proposed methodology described above is outlined: an assessment on the existing and proposed scenarios followed by a comparison and a discussion on how the existing context lead the design changes aimed at improving walkability.

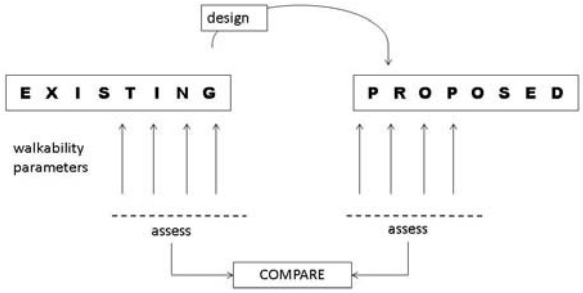

Fig. 1 Proposed methodology

III. Analysis and Results

A. Case Study

The town of Murches is located in the South Western tip of Europe in the Cascais Municipality. This Portuguese small town is part of the Greater Lisbon Metropolitan Area. It is located between the Sintra mountain range and the Atlantic Ocean and is integrated in the Cascais-Sintra Natural Park, (Fig. 2). Demographically it has been growing in population albeit very slowly in the past decade. Its integration in the Natural Park greatly limits possible real-estate or commercial development opportunities. Nonetheless some development has been taking place alongside illegal construction, which occurred mainly in the 1980's and early 90's. As mentioned it was with the objective of integrating new developments, resolving tough social situations and deciding the location of new public services and infrastructure that the Sintra-Cascais Natural Park Plan asserted the need to develop detailed plans for all the towns inside the natural park. Some of the more detailed objectives included: maintaining a low human footprint; developing local economic development through sustainable and non-pollutant industries, sustainable and environmental tourism; enhancing the quality of the housing developments; increase mobility through better walking infrastructure and public transportation; promote more efficient energy uses through rules and regulations in the building sector and private home use; decrease the amount of undifferentiated urban waste; increase the offer of parks and recreation, among others [3].

Fig. 2 Murches, aerial photography

B. Parameter Assessment

1. Density

Density is thought to make walking more efficient [5]. Frank et al. [20] consider that underpinning the issue of walkability or mass transit use is the relative cost of owning, operating and storing a car in different types of development patterns. The ability to live without a car requires mass transit access and walkability supportive environment. Mass transit investments are considered within a cost benefit framework where a greater number of possible users increase the benefits of the project [9]. Residential density is one the simplest way of measuring density and while it has been widely disputed some research shows that a density of greater than 15 dwellings per hectare can lead to walkable communities [20]. Density, as a macro level indicator, influences many factors such as shorter distances to facilities and services and better mass transit availability [21].

Density was assessed using the data collected for the preparation of the new Murches Detail Plan. Field work analysis has also been carried out to describe the total of constructed square meters in the case study area. The survey and analysis data was compared to the expected changes proposed, assuming a scenario of full development of the proposed changes (housing, new commercial sites, parks and public services, etc.). Using GIS, and adapting the method by Leslie et al. [21], a point layer was created for both scenarios in which each point contained information on the number of dwellings (Table I).

TABLE I
DENSITY AND BUILT AREA

	Existing	Proposed
Dwellings	419	546
Dwellings/ha	9.2	12.1
Total Built Area	134819m^2	145585m^2
Total	78894m^2	84874m^2

Murches is a small-town with an area of 45.3ha which functions as a suburb of Cascais, itself a suburb in the Greater Lisbon Metropolitan Area. Typically the pattern of new development focused on medium sized single family homes with substantial garden area. Both market forces and planning restrictions aren't conducive to the development of higher density developments in this area, particularly since it is part of a Natural Park. Nonetheless, as with most Portuguese old towns, it has a more compact, older town center with generally lower quality homes with little or no outdoor space. The planning strategy took advantage of these older areas to re-create the urban center by clustering all owners in new buildings with an additional floor, adding to the area's permitted maximum of two, this enables commercial activities on the ground floors. All existing owners will be awarded a small bonus in terms of dwelling area while maintaining some attractiveness for developers. This will help ensure that development occurs in a reasonable timeframe and in an inclusive manner. Finally all proposed and permitted new dwellings lifted the number from 419 to 546 which indicates a density of 12.1 dwellings per hectare which, although not the desired 15 dwellings/hectare, is a significant increase and gives us confidence that some walkability can be created.

2. Land use mix (Housing, Commercial, Amenities, Public Services)

The development of the new town center and the conversion of some old, but well located homes, has created more, and critically newer, commercial space opportunities. Commerce is essential to the development of local communities. Inclusive communities must enable residents to shop in convenient and walkable destinations that offer public spaces for recreation and fruition, (Fig. 3). The old town center was perfectly suited for this goal (Table II).

The Municipality of Cascais had planned for a new school that would serve not only Murches but some of the surrounding towns. The planning team included that desire into the finished plan as well as reserving parcels for future public service use by the municipality. Using a small stream that passes through the center of the Case Study area the planning team proposed a small urban park with a walkable path that improved mobility for certain routes and created a much needed relief from the built environment, (Fig. 4).

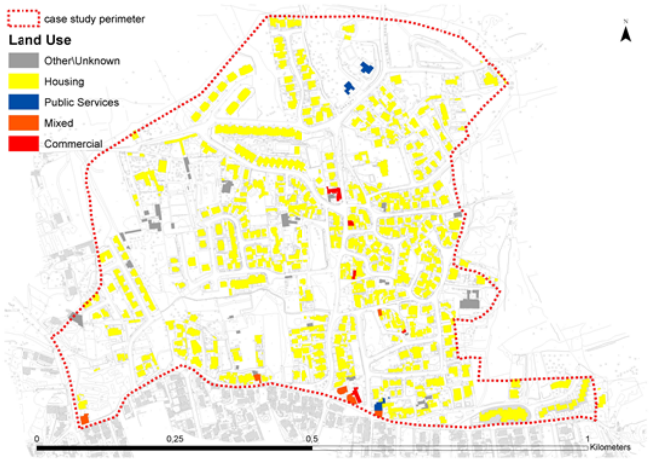

Fig. 3 Land use mix, existing

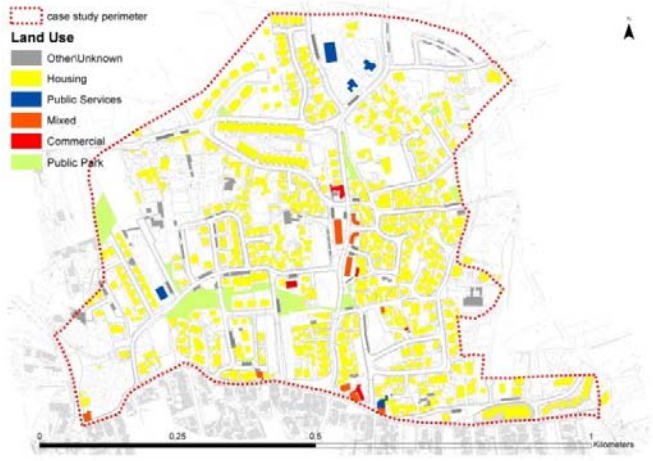

Fig. 4 Land use mix, proposed

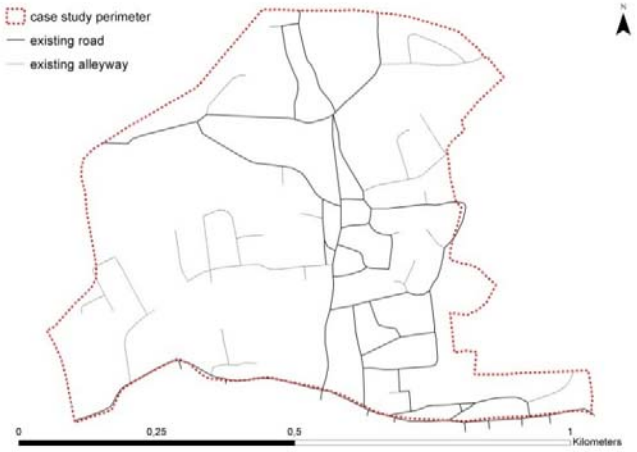

Fig. 5 Road network, existing

TABLE II
LAND USE MIX

	Existing	Proposed
Commerce / Services	12	5
Public Services	3	2
Landscaped area	0	11409m^2

3. Road Network

Road network connectivity is generally regarded as influencing the ability to walk [21], [22], connectivity, meaning the number of connections in a given road network is higher where these connections have 3 or more exits. A low connectivity would be, by example, cul-de-sac heavy road networks where residents have fewer options to get to a certain destination. Grid patterns are most conducive of multiple path choices and can have a positive impact on a resident's desire to walk, [15], [21], [22].

Pedestrian friendly design features such as improved sidewalks, tree-lined streets and others have a positive influence on the willingness to walk [15]. The overall appeal of an environment promotes walkability [23] and studies on the walkability of school children have shown that when auditors revealed poor walkability conditions in home to school routes in the U.S. children walked more to school when micro-level improvements such as sidewalks and better crosswalks were introduced [24]. It is important to measure both micro-level measures like pedestrian friendly design and macro-level issues like connectivity and density, research by [25] showed that in some neighborhoods with good macro-level features can have poor micro design and vice-versa.

4. Road Connectivity

Road connectivity was measured using an adaptation of the method put forward by [21]. After creating road centerline data and creating nodes at each intersection, intersections with 3 or more nodes are then counted to assess the connectivity of the study area, (Fig. 4). A higher number of nodes with 3 or more connections represent more travel choices and easier access, (Fig. 5). The road network was also evaluated comparing the existing and proposed networks in linear terms.

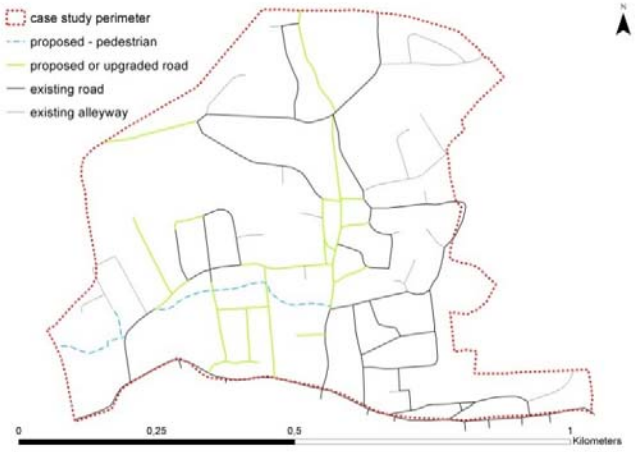

Fig. 6 Road network, proposed

TABLE III
ROAD NETWORK

	Existing	Proposed
Road network linear	7994m	9362m
Road network connectivity (nodes)	78	101

The proposed road network was designed to connect the missing links in the existing web. By augmenting the number of nodes, or intersections in the connectivity of the road network will increase. This will create more options for all travelers but is especially important with regards to walkers as being the slowest mode available any detour will add significant time and may discourage travel all together. Murches suffered from some lack of connectivity between its main north/south and east/west roads that ultimately connect it with neighboring towns. This problem was resolved with the creation of new roads that aim to ameliorate that issue. Furthermore a new walkable path alongside the east/west corridor that leads to the main entrance of Murches was created.

5. Road Network Condition and Typology

Overall road condition was summarized using the field work carried out during the research and analysis stage of the Detail Plan when several forms were filled detailing the status of each road particularly regarding the existence of sidewalks and their maintenance state. Bad condition indicates lack of sidewalks and very poor road surfaces; Medium conditions indicate lack or insufficient sidewalks and minor issues with the road surface (potholes); Good condition indicates adequate sidewalks and good road surface, (Fig. 7, 8 and Table IV).

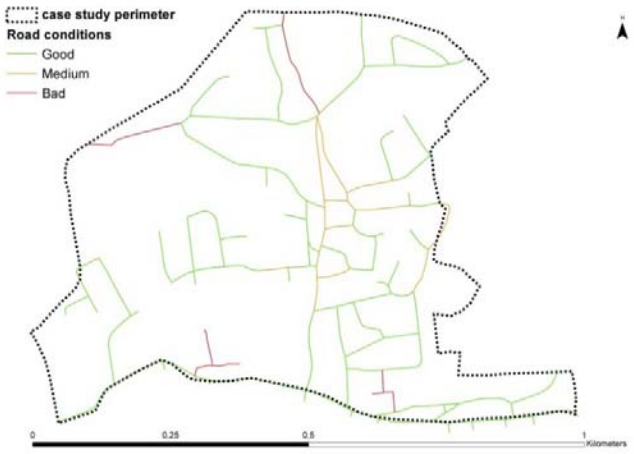

Fig. 7 Road network conditions, existing

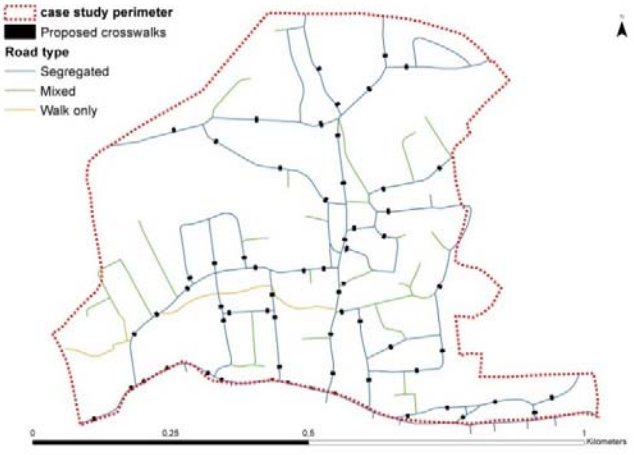

Fig. 8 Road network type and crosswalks, proposed

TABLE IV
ROAD WALKABILITY CONDITIONS

	Existing	Proposed
Roads in bad condition	1853m	0
Mixed roads	0	17995m
Crosswalks	4	63
Sidewalks	24623m^2	13814m^2

C. Parameter Assessment

One of the main tasks the planning team had in order to create a walkable environment was the poor state sidewalks, particularly in the old town center, both in terms of overall maintenance but also in its width. In some of the roads there was no possibility of creating sidewalks according to municipal and national specifications. One of the solutions adopted was the substitution of the pavement and sidewalks in these roads by a single type of pavement consisting of limestone cubes, a stone typology used throughout the Cascais Municipality. This pavement together with vertical signs indicated that the road is mixed with priority given to walking and biking. Murches was completely lacking in crosswalks and although the traffic is light the plan proposed 63 new crosswalks. Capable sidewalks are considered one of the most important features conducive to a walkable environment. Therefore new sidewalks were proposed and others upgraded totaling 13814m^2, a 56% makeover to ensure a minimum of 1,5m of width and where possible 2,25m.

This context assures the ptomotion of better conditions to create more walkable areas in a more urban context (Table III and Fig. 9).

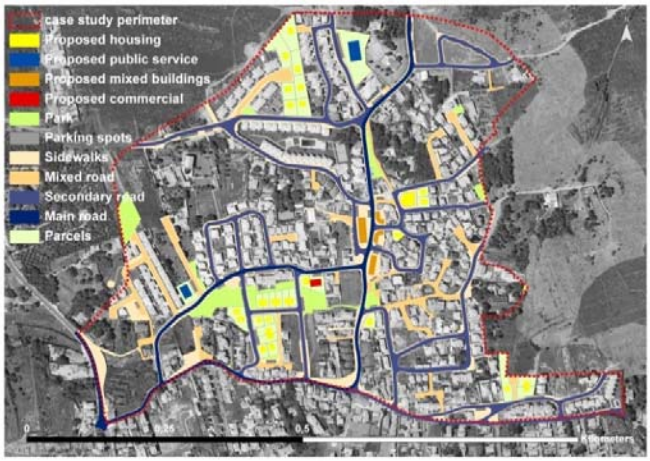

Fig. 9 Proposed changes (Plan)

IV. CONCLUSION

This paper argues that taking a simple strategic vector such as walkability can focus planning initiatives and help them achieve more sustainable towns. Many researchers have long noted that one of the major challenges in the drive for inclusiveness is the planning, designing, building and providing and maintaining infrastructure so that those most in need can adequately access all relevant services, jobs, recreational facilities and other amenities [2], [26]. Planning is the first obstacle in the search for more inclusive communities; this is the reason why walkability needs to be in the forefront of our overall planning strategy.

A determinant factor in urban planning policy is zoning. It determines, not only the type of structure of the area but also the density and of it [27]. One of the main tasks of any Detail Plan is to reconfigure zoning at a more local level to take advantage of the deeper understanding that the making of the plan itself enables, in comparison with municipal or regional level endeavors. In the Murches Detail Plan the team reconfigured the older town center by promoting a new zoning

class that permitted higher density developments. This new center, albeit small, will function as an anchor for further development while creating relevant commercial and service opportunities for all of Murche's citizens. To make it efficient the entire road network was reconfigured, augmented and upgraded, particularly near the new center, to ensure a walkable environment, this was achieved through more sidewalks and of better quality, more crosswalks, upgrading poor distributor roads to mixed roads that prioritize and defend walking and biking and the planning of a new walkway through a park. More commercial and service offerings coupled with new public services will ensure that Murches citizens can satisfy more of their needs in walkable distances. This will, in the future, promote less individual transport use but also that those who can no longer use it or afford it aren´t shut out of community living, (Fig. 9).

In conclusion, by evaluating and comparing the fundamental parameters of walkability in the existing and proposed scenarios the team was able to design a plan that caters to the needs of all citizens by creating a more walkable and therefore inclusive community. By analyzing current trends and research in the urban planning and design field related to walkability a more robust plan emerged, one that can ultimately be better explained to politicians, municipal technicians, community leaders, business men and ordinary citizens in regards to its social, economic and environmental sustainability.

ACKNOWLEDGMENT

The authors would like to acknowledge the support given by the Cascais Municipality to the GEOTPU – Research Group of Spatial and Urban Planning (FCT UNL) in the development of the research for this paper.

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Amado, Miguel P. (M'53) became a Professor at the Universidade Nova de Lisboa in Faculdade de Ciências e Tecnologia in 1993. He has a degree in Architecture, an Msc in Spatial and Urban Planning and a PhD in Environmental Engineering.

He is presently the responsible of the Post-graduation in Sustainable Construction at Civil Engineering Department and Coordinator of GEOPTU research group. He works in Development, Spatial and urban planning with

several Municipalities in Portugal and Governmental Institutions in African countries. Is research field are Development; Sustainable planning and Building.

Prof. Miguel P. Amado is member of Portuguese Architects Association and also of the AIA – American Institute of Architects.