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Traditional Rural Environment and Sustainable Architecture: A Case Study in Moratalla (Murcia, Spain)

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Abstract: This paper attempts to demonstrate the relationship between sustainability and vernacular architecture, being focused on a specific research carried out in the old part of Moratalla, a town in Murcia (Spain). This study has been possible thanks to the collection of 265 field records with in situ data so that quality and quantity can be measured. All these are distinctive parameters of vernacular architecture of the centre in the middle ages, what teaches us an important lesson of how traditional construction is environmentally friendly and sustainable, thus leading to more practical bioclimatic architecture. The current study relies on an agreement between the catholic university of Murcia (ucam) and the town council of the aforementioned town (moratalla), what gives an idea of its importance. Some recommendations have been included at the end of the paper to be taken into account by municipal legislation so that our building heritage can be preserved and maintained.

Keywords: *Rural Environment, Spain, vernacular architecture, Moratalla*

1. Introduction

The town of Moratalla can be found in Murcia, exactly in the Northwest part and, because of its old area and its archaeological sites, it is recognised as one of the most significant historical centres in the region. Furthermore, due to the amount of sheltered areas all over its extensive municipality, it has always been the perfect scene for settlements. One of Moratalla's most significant cultural and historical values is undoubtedly its traditional architecture; it is important to mention here its streets, which are winding and perfectly adapted to the hills under them, leading to picturesque and charming squares. At the same time, the beauty of Moratalla is enhanced by different temples and noble houses distributed everywhere. Nowadays, all its rich history, which remains reflected on buildings and streets, monuments and other archaeological sites, is bound to become a defenceless and silent landscape with the process of gradual abandonment of traditional ways of life and the passing of centuries. In this way, this research attempts to make Moratalla more known and popular, while, at the same time, its purpose is to contribute to perpetuate the area. Concerning issues related to sustainability, it is relevant to refer to the current concern for this aspect in the present model of urban development, nowadays committed to the amount of resources involved in the process. The study of traditional architecture leads to sustainability criteria that exploit the characteristics, called passive, of the elements constructed so that the excessive consumption of resources and power sources are damped in the building process. Thus, highlighting and discovering the bioclimatic aspects of these traditional buildings may help to improve building criteria and, in this way, the consequent outcome.

Figure 1: Panoramic view of Moratalla

2. State of the Art

Sustainability: The most widely accepted definition of sustainable development appeared in 1987. From that day, sustainability means meeting the needs of the present without compromising the capacity of future generations to satisfy their own needs (Word Commission on Environment and Development WCED). The extensive spreading of the concept of sustainability highlights in a clear way the crisis of the conventional concept of development to the extent that the unsustainability of the current process of development and modernization is acknowledged (Cano, Cendra & Stahel, 2005). The purpose of this research is to throw light on these key elements, inherent in the part of the old town centre of Moratalla and, at the same time, in other historical centres of the Mediterranean. A good way to contribute to these sustainability criteria that society demands nowadays is by explaining, defining and spreading them. Today, the present development trend, more committed to an excessive use of the available resources by means of the industrial and technological development, has forgotten the importance of their respectful and rational exploitation, being still more present in traditional architecture. Thus, overall sustainability could be defined and understood as the increase in social and economic capital, in a way that the consumption of natural resources is minimized (Antequera, González & Ríos, 2005). As Casado points out (1996), construction materials' main effects on environment are: energy consumption, solid waste production, depletion of the ozone layer and the greenhouse effect, as well as other environmental factors that lead to destabilization.

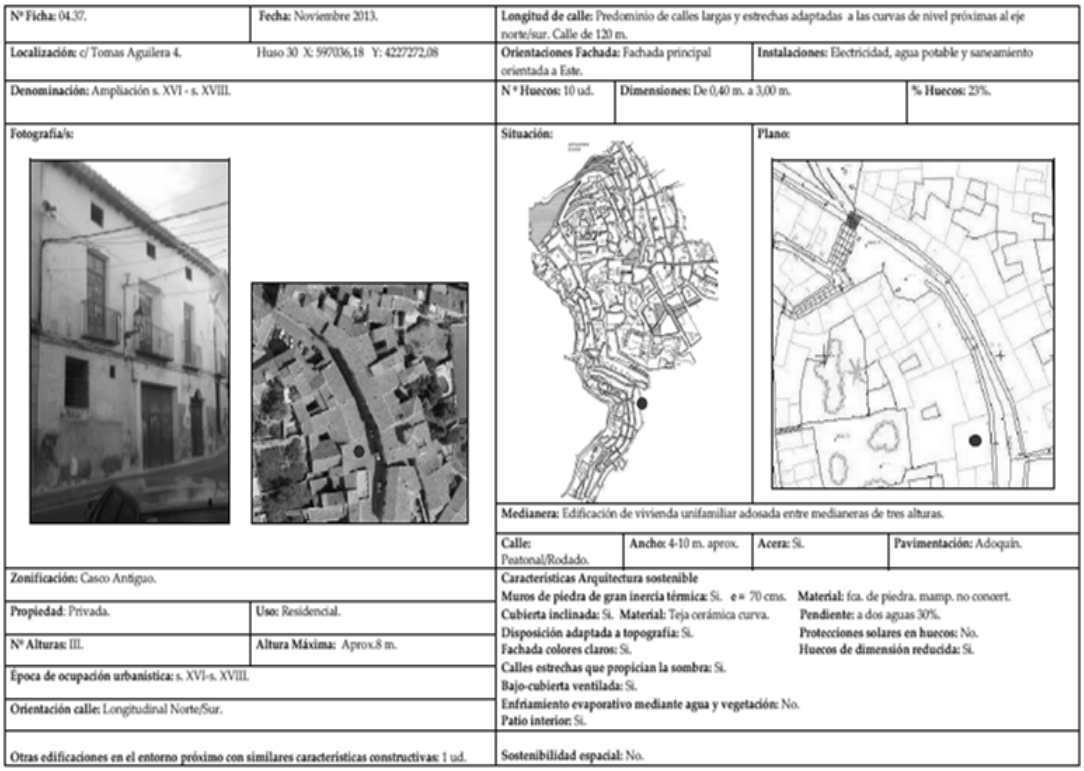
The employ of sustainable techniques and materials could be linked to a more and more desirable localism, reducing carbon dioxide resulting from transportation pollution (Acosta 2005). Therefore, the development of small and medium enterprises in local or regional areas and the promotion of culture are so important in order to reduce transport distances. In this way, for the benefit of sustainable construction, decentralization in the production of raw materials and finished products is a desirable strategy. At the same time, it is also worth highlighting at this point that the construction sector, for the sake of greater sustainability, must encourage refurbishing, entire areas or smaller ones, such as buildings and neighbourhoods (Gaja, 2008). There can be little doubt that the large park built adds value to our society and, under the demographic stagnation that afflicts our country, it is an opportunity as well to stop the extensive urban growth undergone by peripheral districts and suburbs of our cities and towns. They are further and further from city centres and services, what leads to longer distances among development dependent centres and greater need to travel as a consequence. The result is, thus, that our city centres are usually forgotten and empty, often relegated to marginal and slum neighbourhoods or tourism. In our opinion, refurbishing can add value to obsolete buildings which in most cases are located in central points of towns and cities, what is a powerful weapon in favour of sustainability. In spite of some pessimistic tendencies towards this emerging environmental problem, we could emphasise some positive aspects, such as greater predisposition towards the sustainability in our model of the Mediterranean compact city, since its configuration fits better inside a more sustainable prototype after the changes needed (Garcia, 2010).

3. Methodology

The present study, focused in Moratalla, is limited to its historical centre, and more specifically to an area whose first city planning is referred to an expansion held between two centuries: 17th and 18th. While the entire old centre of the town is used for the study, at this point, the partial results obtained for this sector are shown, being this a relevant area for future research. After revising some literature, it was decided to use several real examples as a method of study, so that construction features could be analysed. In this way, this would lead to draw relevant conclusions for the field. This process highlights for direct observation of the phenomenon studied. In this concern, Moratalla is sufficiently representative of traditional architecture related to rural environments in our region and even within the Mediterranean Sea. 41 field records with in situ data have been used for the analysis of the area (fig.2). Two clearly differentiated parts can be found in the record. Firstly, general architectural data of the studied buildings are reflected such as UTM coordinates, location with postal address, , preferred use, aerial and front pictures number of floors, date of planning implementation, existing facilities, sidewalks, finishing material, location maps, type of property, and so on. Secondly, a series of starting hypotheses (based on the book by Neila) is suggested, regarding the characteristics of the sustainable architecture in that area, such as proposed vegetation, walls of high thermal mass, arrangement adapted to topography, façade in light colours, cooling by vegetation and water evaporation, interior courtyard space, type of roof and materials, spatial sustainability (based on the overlapping of spaces within a same place), etc.

A research was developed in the municipal archive so that data could be identified and organised, and the Alcabala Excise of 1566 (fig.3) can be pointed out as the first historical document that showed the names of some of the oldest streets of the town centre in Moratalla. By means of these findings, we could differentiate four zones within the old town centre, among which those expansions carried out around the 16th century and until the 18th century are emphasized. This area (fig.4) develops around the Main Street (former "corredera"), what allows us to confirm and quantify the starting hypotheses. It cannot be forgotten the fact that the records do not collect the whole of the buildings present in the field of research but, according to their environmental importance, a selection of them has been chosen.

Figure 2: Model of field record



Nº Ficha: 04.37. | **Fecha:** Noviembre 2013.
Longitud de calle: Predominio de calles largas y estrechas adaptadas a las curvas de nivel próximas al eje norte/sur. Calle de 120 m.
Localización: c/ Tomas Aguilera 4. Huso 30 X: 597036,18 Y: 4227272,08
Orientaciones Fachada: Fachada principal orientada a Este.
Instalaciones: Electricidad, agua potable y saneamiento
Denominación: Ampliación s. XVI - s. XVIII.
Nº Huecos: 10 ud. | **Dimensiones:** De 0,40 m. a 3,00 m. | **% Huecos:** 23%.
Fotografía/s:
Situación:
Plano:
Medianera: Edificación de vivienda unifamiliar adosada entre medianeras de tres alturas.
Calle: Peatonal/Rodado. | **Ancho:** 4-10 m. aprox. | **Acera:** Si. | **Pavimentación:** Adoquín.
Zonificación: Casco Antiguo.
Propiedad: Privada. | **Uso:** Residencial.
Nº Alturas: III. | **Altura Máxima:** Aprox.8 m.
Época de ocupación urbanística: s. XVI-s. XVIII.
Orientación calle: Longitudinal Norte/Sur.
Otras edificaciones en el entorno próximo con similares características constructivas: 1 ud.
Características Arquitectura sostenible
Muros de piedra de gran inercia térmica: Si. e = 70 cms. **Material:** fca. de piedra. mamp. no concert.
Cubierta inclinada: Si. **Material:** Teja cerámica curva. **Pendiente:** a dos aguas 30%.
Disposición adaptada a topografía: Si. **Protecciones solares en huecos:** No.
Fachada colores claros: Si. **Huecos de dimensión reducida:** Si.
Calles estrechas que propician la sombra: Si.
Bajo-cubierta ventilada: Si.
Enfriamiento evaporativo mediante agua y vegetación: No.
Patio interior: Si.
Sostenibilidad espacial: No.

4. Data Analysis

The starting hypotheses in the buildings studied have been clearly and concisely revealed by the data analysis. The characteristics studied in this paper are based on the book by Neila and they refer to different characteristics, such as constructive, compositional, distributional and finishing ones. Thus, the relationship between rural buildings and environmental architecture is shown, contributing to a first and necessary knowledge of the situation, what means a previous step for its spreading and consequent preservation. The tables below summarize some of the findings and offer the sustainability measurement present in vernacular architecture in this cluster located in the Mediterranean area. Therefore, the following information can be extracted from the mentioned data: East and West are the most preferred exposures in this area, what is concluded from the position of a street with clear North-South exposure and that has been determined by a strong adaptation to the topography, following an ancient path or gateway into the town of Moratalla (fig.5). In terms of the percentage of solid walls and apertures or fenestrations in façades of the area studied, it has been found that, since it is a space that follows a certain order depending on the importance of the street, the values are significant according to their degree of perforation.

Figure 3: Extract of the Alcabala Excise of 1566

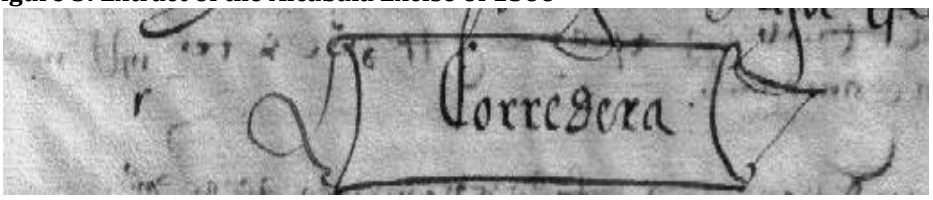
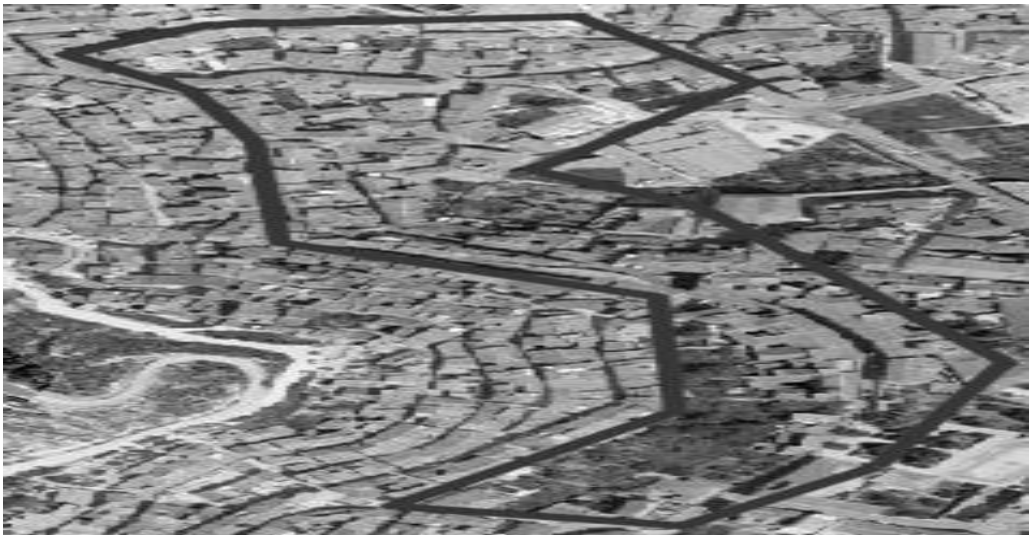


Figure 4: Delimitation (16th-18th centuries)



The maximum number that can be reached is 55% and the average number goes around 30%, as it can be checked. Concerning the existence of solar protection, its presence is also perceived with a percentage of 90%, showing the good preservation of the area – it is important to say that, due to its location and access to road traffic, it is the most populated of the old town centre (fig.6). Fenestrations in the façades or small sized apertures (fig.7) are present around 34%, giving an idea of the lack of this feature. This happens because planning permission for larger apertures was allowed at a later date, having also into consideration the importance of the street. This parameter also allows to passively controlling in the facing walls summer solar radiation.

Figure 5: Façades exposure and apertures in them
Compositional characteristic

	EAST	SOUTH	WEST	NORTH
Units	24	0	17	1
Minimum	18%	0%	15%	32%
Maximum	55%	0%	35%	32%
Average	33,62%	0 %	29,23 %	32%

Figure 6: Protection in apertures
Constructive Characteristic

	Units	%
With Protection	37	90,25 %
Without Protection	4	9,75%

Figure 7: Percentage of apertures with reduced and non reduced dimensions (0,50 m.)
Compositional Characteristic

	Units	%
Apertures with reduced dimensions	14	34,15 %
Apertures with non reduced dimensions.	27	65,85%

Figure 8: Percentage of interior courtyards
Distributional Characteristic

	Units	%
With interior courtyard	24	58,53 %
Without int. courtyard	17	41,47%

Figure 9: Percentage of spatial sustainability
Distributional Characteristic

	Units	%
With spatial sustainability	10	24,39 %
Without spatial sustainability	31	75,61%

Figure 10: Percentage of cooling by vegetation and water evaporation
Finishing Characteristic

	Units	%
With cooling	0	0 %
Without cooling	41	100 %

Figure 11: Walls thickness in high thermal mass
Constructive Characteristic

Units	Maximum.	Minimum	Average
41	80 cm.	50 cm.	60,90 cm.

Figure 12: Types of roof
Constructive Characteristic

	Units	%
Simple Slanting Roof	12	19,68 %
Complex Slanting Roof	30	49,18 %
Flat Roof	19	31,14 %

Figure 13: Image of a building in Main Street, 52

Regarding the existence of interior courtyards which help to regulate the temperature of the rooms that lead off from them, it can be noticed that there is a presence of 58%. This is quite significant due to the importance that builders in those days gave to this bioclimatic solution. We must say that the old part of the town has the highest percentage of this feature, since there is room for improvement (fig.8). Furthermore, spatial sustainability is understood as the overlapping of different spaces under different ownership in the same plot, what was traditionally used by the locals in order to solve their space requirements (the volume was not increased by this way). In this sector, this figure reaches a percentage of 25%, which is quite low if we compare it to other areas in the same old town centre. Nevertheless, it is worth emphasizing that this solution of achieving more space from neighbouring properties to meet one´s needs is considered an important factor in the sustainability of the original building (fig.9). The evaporative cool-

ing by means of water or vegetation refers to the presence of these agents in traditional construction solution in order to improve the quality of air. With a rate of 0% in façade solutions (nil presence), it has been noticed that this feature is present in other areas of adjacent building, as well as in public gardens and squares (fig.10). Concerning walls construction, it is important to mention that the construction by means of not coordinated wide masonry was the most commonly used solution for two main reasons: to increase thermal insulation and to bear walls, which reach a maximum thickness of 80 cm. in some cases (fig. 11 and 14).

In general, the complexity of big plots with interior courtyards becomes apparent in the roofs most commonly used. As figure 12 shows, the solution of slanting roof in ceramics tiles occurs nearly up to 50%, what makes the entire old town centre look perfectly adapted to its environment and gives it a special continuity. Furthermore, all the features that have been mentioned and quantified unequivocally mark the relationship between environmental sustainability and vernacular architecture of the area, certainly adding as well the rational use of available resources in the immediate environment so that construction solutions are achieved. This shows an absolute respect for the environment, lesson that we should learn in order to reduce pressure on energy costs and the consumption of natural resources (Neila, 2004).

5. Conclusion

The main conclusions obtained thanks to this research revolve around quantifying and determining the features of environmental architecture related to the vernacular architecture of the area selected in the town of Moratalla. Its clarification and value should be a tool to better understand and appreciate our built heritage for intervention and future actions that could be carried out. In this paper, a summary of a comprehensive research project that covers the old town centre of Moratalla (Murcia) has been included, since 265 records with field data are being developed and being assigned to the local council under a collaboration agreement existing with UCAM (Catholic University of Murcia).

Figure 14: Stone masonry in detail

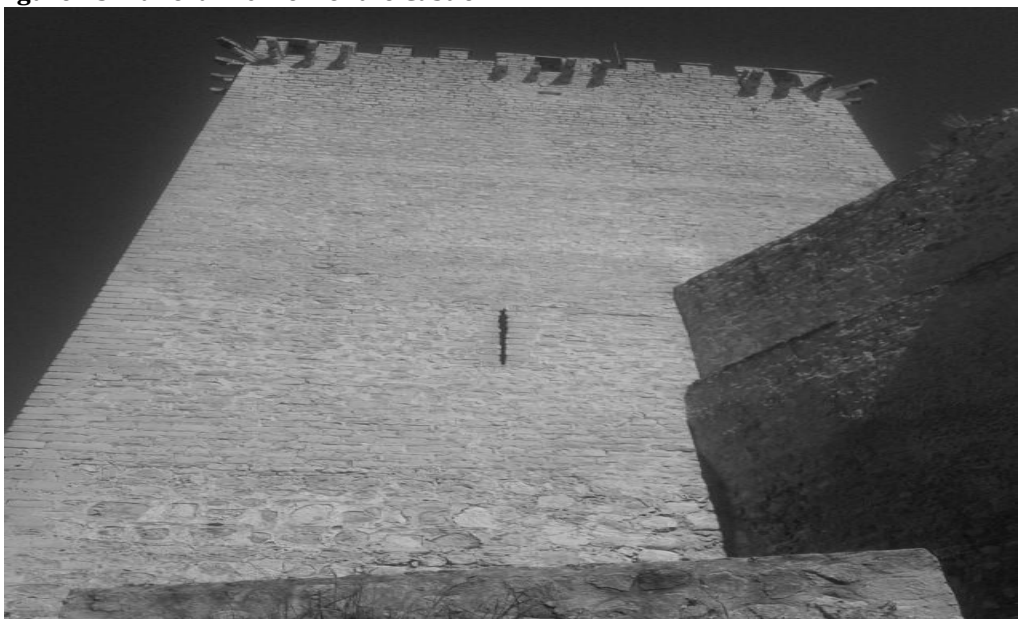
The actions that have been taken have a great value of what in the future might be the documentation or background information improvement and comprehensive refurbishing projects taking into consideration the characteristics that have been defined here. In this respect, it is important to mention that, from this study, an Integrated Action Plan in the old town centre could be developed, overseeing a comprehensive refurbishing of the area which should take into account criteria of Sustainable Architecture. In this way, a long path has been started, where the following issues cannot be forgotten:

- Promoting and generating associationism among neighbours so that the actions needed for the environment can be determined and taken accordingly.
- Removing the presence of substandard housing while slowing down the growth of the city and the use of land consequently. Reconsidering the concept of liveability in the area to make it more dy-

namic and more flexible in favour of a more sustainable refurbishing. Instead of the development of scattered building, encouraging the consolidation of the model of compact Mediterranean city.

- Enhancing the use of renewable energy in the area while energy rehabilitation occurs. Improving public spaces and facilities since they are not plentiful.
- Adjusting the General Plan to this significant historical and cultural area so that the criteria are more clearly defined for sustainable architecture.
- By establishing a clear management and feasibility plan with public-private origin, the purpose is to develop measures so that social and economic rehabilitation of the area is not significantly changed from its main residential use.

Figure 15: Panoramic view of the Castle



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