



Architectural structure and environmental performance of the traditional buildings in Florina, NW Greece

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ABSTRACT

This paper presents various aspects, which characterise the traditional architecture in the town of Florina, north-western Greece, and can be related to bioclimatic and environmental architecture. The study is based on the documentation and the analysis of the architectural and bioclimatic aspects of a sample of forty (40) remaining houses of the 19th and the beginning of the 20th century. The analysis of the architectural aspects concerns the building typology, the form, the materials and the construction techniques, whereas the analysis of bioclimatic aspects involves the thermal behaviour of the building shell, the thermal and the visual comfort conditions. The aim of the study is to document and assess, both qualitatively and quantitatively, all the afore-mentioned aspects in order to draw conclusions concerning the principles, which characterised this architecture and can be integrated to the refurbishment of existing buildings or the design of new ones in traditional surroundings.

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1. Introduction

The vernacular and traditional buildings in every area are a product of the accumulated experience and practice of many centuries and can constitute a continuous source of knowledge. The use of local materials and the harmonisation with the local environment and climate are some of the factors, which contribute to the distinct architectural identity of every area. This is the main reason why various researchers have examined traditional and vernacular buildings throughout the world with respect to bioclimatic and environmental architecture. These researches deal with the subject of the environmental performance of traditional architecture in two different ways: qualitatively and quantitatively. The qualitative approach involves the assessment of the environmental performance of the different elements of buildings and/or settlements in relation to the prevailing climatic conditions [1], whereas the quantitative approach is based on in situ measurements of different climatic parameters outside and inside the examined buildings, which lead to conclusions concerning the thermal performance of the houses [2,3].

For the wider area of the Balkan Peninsula, of which Greece forms part and where the traditional architecture of the period in question (19th–beginning of the 20th century) presents many common characteristics, previous studies concern areas of Former Yugoslavia [4–6], Bulgaria [7], Romania [8,9] and Turkey [10–12]. For Greece, earlier studies dealt with vernacular architecture in general [13] and in northern Greece in particular [14]. More recent studies include traditional settlements in Phokida in mainland Greece [15] and on the islands of Tinos and Andros, in the Cyclades [16]. Finally, for north-western Greece, previous studies analyse the bioclimatic aspects of the traditional buildings, which are found in Florina [17], various other towns [18] and settlements [19].

This study focuses on the town of Florina, in an attempt to detect, document and analyse the design principles and the elements of its traditional architecture of the 19th and 20th century. It should be noted that the term “traditional” is preferred over the commonly-used term “vernacular” because the buildings in question form part of an architecture, which was not spontaneously constructed by its inhabitants according to their needs, but was instead built by master-builders and tradesmen (*sintechnies* or *bouloukia*) using specific draft drawings and model plans. Rapoport [20] uses the term “pre-industrial vernacular” to describe this category of buildings identifying it with the term “traditional”.

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The study is mainly based on a large-scale in situ research, which included the documentation of forty (40) traditional buildings (in Table 2, 39 of the 40 houses are presented due to restrictions of space and format). These buildings are actually the only ones that remain from the period of the 19th century. From this research, data concerning the typology, the form, the materials and the construction techniques of the buildings are presented. Bibliographic research is also used for the presentation of the general data of the study area (geographic location, climate, topography, ground composition, historical data), which, due to the restricted size of the paper, are briefly presented.

First, the different aspects of the traditional architecture, namely the typology, the form and the building materials and techniques, are analysed. After that, the bioclimatic behaviour based on issues of thermal and visual comfort conditions throughout the year, is presented. The analysis of the bioclimatic behaviour of the buildings mainly concerns the prevailing thermal and visual comfort conditions, is based both on in situ experimental measurements and on computer-aided analysis with the use of software, and is analysed in the corresponding paragraphs. Finally, conclusions are drawn in order to outline the design principles, which characterised this architecture and can be related to bioclimatic architecture.

2. General data on geography and climate

2.1. Geographic location

The prefecture of Florina is located in north-western Greece, close to the prefectures of Kastoria, Kozani and Pella. The town of Florina is the capital of the prefecture and lies in a mountain valley, which is crossed by a river from West to East. The longitude of the town is 21° 23'59" North, its latitude is 40° 46'58" East, and its altitude is 662 m.

Florina is situated in a valley with a main axis running from West to East, which is crossed by a river. As a result, the fabric of the town is directly related to the geo-morphology of its position. It is characterised by a predominantly linear development, with the main streets being parallel to the river and running from West to East (Fig. 5).

The examined houses are situated on both sides of the river bank. The southern side is steeply sloped and mountainous, whereas the northern side is more flat. Ground composition is rocky on the southern side (many small quarries were situated there), while on the northern side the ground is unstable and muddy, because it formed part of the river's overflowing and deposit zone.

2.2. Climatic data

The prefecture of Florina has a cold continental climate, with long, cold and humid winters and short, warm and dry summers.

The mesoclimate of the area is affected by the presence of large mountainous volumes. The climate is characterised by significant inter-seasonal and diurnal differences, due to the high latitude and the morphology of the area [21] (Table 1).

The mean maximum temperature in December reaches 6.3 °C, the average temperature is 2.2 °C, while the mean minimum temperature is –1.6 °C. The mean maximum temperature in January (coldest month of the year) reaches 4.6 °C, the average temperature is 0.5 °C, while the mean minimum temperature is –3.5 °C. The mean maximum temperature in February reaches 7.3 °C, the average temperature is 2.7 °C, while the mean minimum temperature is –1.7 °C. The corresponding relative humidity values are 81.8% for December, 82.1% for January, and 78.1% for February. Florina has relatively high precipitation values during the winter period, with a monthly average value of 86.2 mm for December, 57.6 mm for January, 52.3 mm for February and about 12 days of rain per winter month. The direction of the prevailing winds is South-West during December, West during January and North during February. The area is characterised by an extended snowing period, which starts in December and ends in March.

The mean maximum temperature in June reaches 26.2 °C, the average temperature is 21 °C, while the mean minimum temperature is 12.5 °C. The mean maximum temperature in July (hottest month of the year) reaches 28.8 °C, the average temperature is 23.1 °C, while the mean minimum temperature is 14.4 °C. The mean maximum temperature in August reaches 28.7 °C, the average temperature is 22.5 °C, while the mean minimum temperature is 14.2 °C. The corresponding relative humidity values are 59.8% for January, 57.4% for July, and 58.3% for August. Florina has relatively high precipitation values during the summer period, with a monthly average value of approximately 34 mm, and about 6.4 days of rain per summer month.

Apart from the afore-mentioned climatic data, the climate classification for Florina was defined using the software Meteor-norm v4.0 [22] to generate hourly climatic data, which were then imported to the software Weather Tool v1.10 [23]. The psychrometric charts generated with the Weather Tool, for the winter and the summer period for the outdoor environment of the town of Florina, demonstrate that climatic conditions are way beyond thermal comfort during the cold period (Fig. 1). The comfort zone is set by the software and varies for the winter and summer period.

3. Architectural structure

3.1. Building typology

The typology of the traditional houses of Florina is based on three basic elements: the private room (*oda*), the open space (*hayat*) and the closed, common space (*sofa*) [24,25]. The private room (*oda*) is a closed living space with a square plan, which houses all the basic functions of the family life, such as eating, sleeping, and receiving guests [24]. The *hayat* is a semi-open, transitional space,

Table 1
Monthly climatic data values for Florina derived from the years 1961–1997 [21].

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean min temp (°C)	–3.5	–1.7	1.3	5.1	9.2	12.5	14.4	14.2	11.2	6.9	2.5	–1.6
Average temp (°C)	0.5	2.7	6.7	11.6	16.8	21	23.1	22.5	18.4	12.6	7	2.2
Mean max temp (°C)	4.6	7.3	11.8	16.7	22	26.2	28.8	28.7	25.2	19	12.1	6.3
Rel. humidity (%)	82.1	78.1	70.9	64	63.4	59.8	57.4	58.3	63.9	72.1	78.7	81.8
Aver. rainfall (mm)	57.6	52.3	57.9	57.9	58.9	37.3	34	31	41.1	62.1	69.4	86.2
Days of rain	12	12	12.3	11.3	11.2	7.4	6.1	5.8	6.1	8.4	10.8	12.9
Wind direction	W	N	W	W	W	W	N	N	W	N	N	SW
Wind speed (m/s)	2.5	3.3	4.1	4.6	4.8	4.8	4.6	4.3	3.5	3.4	3.2	2.5

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