A more agreeable climate in Moroccan housing

The climate in two very different districts — one in the Medina and one in the modern city — in Fez in Morocco is studied by three researchers from LTH. The object is to propose guidelines for urban design in a hot and dry climate.

The proportion of the world's population that lives in urban areas is constantly increasing. The fastest urbanisation is now occurring in Africa and Asia, and it is believed that by about the year 2015 most of the population in developing countries will live in towns. Urbanisation gives rise to great social and economic changes, such as economic growth, which in turn results in higher energy use for e.g. cooling and heating buildings.

Climatic urban design
In order that energy use in the world should be kept at a low level, the way the growing cities are planned and built is therefore im-

View of the Medina in Fez. Owing to the dense development, solar radiation does not penetrate down to street level. Photograph: Karin Grundström
The effect of climate on buildings and housing areas is examined in the project from different standpoints.

- Thermal insulation materials are an essential requirement for low energy use and good indoor comfort. A survey has been made of locally available insulation materials and development work for the production of new, locally made thermal insulation materials is in progress.
- A climatically designed prototype which is one of the buildings at the Ouarzazate laboratory of LPEE has been constructed. The building has been designed through computer simulations and its performance will be evaluated by climatic measurements.
- A case study is in progress in Fez where climatic studies of urban areas have been conducted and a comparative study of traditional and modern housing districts has been made.

Urban climate in Fez
Morocco has a climate characterised by hot summers and cold winters, and powerful solar radiation. The city of Fez consists of two districts of entirely different character and building pattern. The old city, the Medina, is a mediaeval city and an example of the traditional Arabic-Islamic city structure. The modern city ("la Nouvelle Ville") which was planned during the French colonial period according to European town planning ideals from the beginning of this century forms a complete contrast to the Medina.

In these different urban environments, two areas have been studied by climatic measurements and analyses of the urban space.

The Medina
The housing district Seffarine is one of the most densely developed areas of the Medina and is part of the sector where there is the greatest variation of traditional building elements. Movement in this part of the city is still by donkey or on foot. Introverted courtyard buildings surround the narrow streets which cut deep ravines through the city. The street network is irregular, which means that the buildings shade one another. A large number of different traditional building details provide shade at street level.

Closeness gives shade
Measurements from the Medina in Fez show that the temperature here is lower than in the surrounding countryside, which is very remarkable (cities are usually warmer than the countryside, usually referred to as "the urban heat"). In the summer, the maximum temperatures measured in the narrow alleys were as much as 8°C lower than the maximum temperature at the airport outside the city. The principal explanation of this phenomenon is that the buildings are so close that very little solar radiation reaches down to street level. Furthermore, roofs are light in colour and reflect a
lot of solar radiation. The combination of heavy building materials and a dense building development also manages to smooth out the temperature peaks during a summer heatwave.

**La Nouvelle Ville**

The district *Adarissa* is a modern housing area in the new part of Fez, planned and built as a suburb with extroverted linked houses and point blocks. The area has a regular street pattern planned for car ownership. Most of the land is free of buildings and consists of asphalted streets, footways, parking areas and courtyards. Since building development is of low density, both the buildings and the ground surface are exposed to solar radiation, and air movements are greater than in the Medina. It is only in a few places that trees have been planted to provide shade for facades and footways.

*Measurements* show that the area is warmer than the surrounding countryside, by about 2°C during the day. The effect is more pronounced overnight when the temperature difference is 4°C or greater. The reason is that solar radiation absorbed during the day is stored in the heavy building materials and is not given off before nightfall, and that facades and streets are cooled down more slowly than the flat terrain in the countryside.

**The urban geometry**

A comparison of the two areas reveals large differences between the wide streets of the modern area and the narrow streets of the Medina. Generally speaking, summer climate is better in the Medina while winter climate is slightly better in the modern district.

What the two areas have in common is that motorised traffic is insignificant and there is no heavy industrial activity. The extent of heating and air conditioning is also insignificant. There are thus no "artificial" heat sources.

The character of the measured urban climate is therefore almost exclusively due to the urban geometry, the properties of building materials and wind conditions.

Further work on the project will analyze urban climate in greater detail, and experiments to simulate the urban climate have begun. The town planning codes which govern the modern district will also be studied. The aim is to propose guidelines for climatic urban design in a hot and dry climate.

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**Housing Development and Management** (the former LOHS, Lund Centre of Habitat Studies) studies the design, genesis and use of housing and the relationships between the dwelling and its surroundings from local to urban level in an international perspective. The aim is to enhance knowledge of how the processes which lead to good housing conditions and to viable development, particularly for less well-off groups, can be improved.

**Literature**

Two part reports describe the first phase of the project. The reports can be obtained from Housing Development and Management, Lund University, Box 118, S-221 00 Lund, Sweden.

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*Comparison of temperatures* in the modern district and the Medina. *Measurements in July (top) and December.*

*Narrow winding alleys* provide shade in the Medina. Temperature here is lower than in the countryside. PHOTOGRAPH: KARIN GRUNDSTRÖM