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ORIGINAL ARTICLE

Construction design zoning of the territory of Iran and climatic modeling of civil buildings space

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Abstract Considering the natural and climatic characteristics of different regions of Iran coupled with modern construction techniques and materials make it possible to make design decisions to create comfortable conditions for its residents. It is stated that improvement of a microclimate in houses in many respects depends on the choice of construction methods. In order to improve the microclimate for the basic areas, the Iran typological requirements and recommendations on improvement of a microclimate of residential environment are defined in the present study for both houses and city multi-storey build-up areas. On the basis of the typological requirements, experience of historical traditions, modern tendencies, and preservation of environment, construction methods for the four allocated design-building zones are developed. Using the recommended construction methods, town-planning principles of designing houses and principles of microclimate formation, which is determined by their space-planning and architectural-constructive decisions, were formulated. Effective design of civil buildings was developed on the basis of quantitative and qualitative characteristics of the environment, environmental factors affecting the climate, climate-ecological modeling of space, layout of the climate, and environmental zonings of territory of Iran. Among the construction design zones (CDZ) determined by certain relationship of climatic conditions and the available local construction materials; four CDZs are singled out considering the well-established designs and the existing design-construction base. The results of the research form a basis for general scientific, methodological, architectural, and planning principles of designing residential and public buildings. Moreover, some recommendations on developing of Iranian modern architecture of civil buildings with regard to national, Islamic, and cultural traditions are provided.
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1. Introduction

The Iranian civil architecture is an important part of entire Islamic cultural heritage. Its development is inherent in the very traditions and sequence of historical development, similar to other Muslim world countries: intensive urban development (mid-20th century); development of the traditional style

(70s–80s); appeal to the national architectural heritage and traditions (mid-80s of 20th century).

Concerning the Iranian architecture, there is a tendency toward the study and making full use of the types historically generated for planning structures of civil buildings of traditional architectural forms and architectural details in modern architectural construction practice. This tendency was particularly developed since 90s of 20th century, and the use of national traditions in modern civil building grows and develops constantly. The experience of the Iranian national culture and traditions of architecture throughout a centuries-old history of development of civil buildings left a legacy of many wonderful examples that reflect the views of the society in dealing with the issue of design and architecture. The analyzed architectural analogues and references have formed the information base of research and became the basis for comparative scientific analysis (Moradchelleh, 2008).

Problems of traditional structural morphology, existing structures and materials in the architecture, dependency on climatic and seismological conditions, the wind mode, and other objective factors are especially relevant as ever.

2. Features of a construction base

Lessening the adverse climatic features is achieved by the centuries-old practice of construction materials, natural (stones, wood, cane, clay, lime, and sand) and artificial materials (tubular and integral brick, glass), to create a comfortable environment. It is notable that even today, in a combination with rolled metal and monolithic reinforced concrete, the traditional construction materials perform the functions of bearing and protecting designs.

The range of traditional materials used in construction of civil buildings is based upon the local availability, and used as follows: (a) natural stone (granite, a shell rock) available in abundance and of high quality, served as a bearing and decorative material of which ornaments of various kinds were made; (b) marble from domestic quarries and from other countries was often used as furniture or mosaic for decoration of interiors and exteriors of religious buildings; (c) wood (pine) served as skeletons of walls, span covers of halls and domes; (d) in the form of gypsum, stucco as a decoration material for columns, vaults, and domes.

The common material for walls of houses that were constructed in recent years was adobe (grizzle) brick – "hesht", with the size of $10 \times 20 \times 35$ (40) cm, made from yellow clay of a particular viscosity. The foundation was made as a massive monolithic basis – a mixture of clay, lime, gravel, and water. In seismically active areas, the design was reinforced by a wooden skeleton.

Wooden window frames in the walls facing "hyatt" had a variety of shapes; rectangular, arched, or wing (lancet). Stone arches were constructive elements for doors and window apertures, and an ornament of façades and interiors. The use of glass as well as decoration of houses with multi-colored stained-glass windows has a long tradition in Iran (since XII century). Small various forms of windows facing the lanes are often equipped with metal or stone lattices. Sometimes separate glazing in two layers in cold regions is used.

Among span covers, flat beamed, vaulted or domical shapes were common. Boards were placed on round or rectangular wooden in section beams. Below they were lined with planks on the wrought iron nails, and on top were plastered with thick mud brick mixture – clay and straw. Roofs were paved with

Table 1 Zoning construction base of Iran.

No.	Type of construction industry	Construction design zone			
		Northern CDZ 1	North-western CDZ 2	South-eastern CDZ 3	Southern CDZ 4
1	Brick industry	Provincial centers	Provincial centers	Provincial centers	Provincial centers
2	Glass industry		Tehran, Qazvin	Esfahan, Yazd	
3	Cables and wires	Amol, Provincial centers	Tehran, Shakhrod, Provincial centers	Provincial centers	Provincial centers
4	Construction machinery and equipment	Rasht	Arak, Tabriz	Shiraz	Ahvaz
5	Woodwork and lumber	Gonbad-Kavus	Tehran	Behshaher	
6	Marble slabs and items		Sanandaj, Mashhad	Esfahan, Zahedan	
7	Gypsum and gypsum items			Semnan	
8	Ceramic roof tile	Sari	Hamadan	Behshaher	
9	Reinforced concrete items	Provincial centers	Tehran, Tabriz Provincial centers	Esfahan, Provincial centers	Provincial centers
10	Steel rebars and rolled metal		Qazvin	Esfahan, Nishabor, Miyane	Ahvaz
11	Cement industry	Neka, Minodash	Tehran, Qazvin, Mashhad, Shahrod	Sofiyan, Bedjnord	Provincial centers
12	Electric materials and equipment	Gonbad-Kavus	Tehran	Esfahan, Shiraz	Provincial centers
13	Rolled aluminum and aluminum products		Arak		
14	Thermal insulation materials and items	Provincial centers	Tehran, Mashhad, Provincial centers	Esfahan, provincial centers	Provincial centers
15	Brick and ceramic siding	Rasht	Mashhad	Esfahan, Yazd	
16	Varnish and paint materials	Rasht	Tehran, Qazvin, Karadj	Shiraz	
17	Roofing and moisture proofing materials	Provincial centers	Tehran, Gazvin, Tabriz	Esfahan, provincial centers	Provincial centers

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