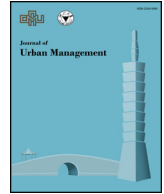


Contents lists available at [ScienceDirect](#)

Journal of Urban Management

journal homepage: www.elsevier.com/locate/jum

Review of environment responsiveness of building regulations in Jaipur

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ARTICLE INFO

Keywords:

Building regulations
Environmental responsiveness
Jaipur City
Urban planning

ABSTRACT

India is a country of diverse culture, traditions, and customs at the same time it is also a land of diverse geographical and climate zones with almost all type of climate, geographical conditions and ecosystems of the globes found in different parts of the country. These factors also affect the design, development and quality of the urban form and urban landscape i.e. urban built and unbuilt environment. The admixtures of geo-climatic conditions, socioeconomic conditions and resource availability form a set of unique urban ecosystem require a specific set of building regulations and development guidelines for the sustainable urban development of any city or urban area. The analysis of the urban planning system in India highlights a general prototypic practice of developing building codes and guidelines in the country. This paper attempts at analyzing the building regulations in India for environmental sustainability with special reference to by-laws and building codes applicable to Jaipur city and try to address the case-specific regulatory intervention.

1. Introduction

The advent of urbanization, especially after the industrial revolution in European countries, has evolved into a global phenomenon experienced currently by almost all the countries. It has become an integral part of modern economic growth and contributes to protecting people from more local environment burdens, but the large scale and rapid urbanization in India have led to a situation of chaos in the absence of adequate urban planning and management guidelines and regulations (Jawaid & Khan, 2015). The development of the building and construction sector to accommodate growing urban population has also developed as significant sector contributing to the employment and revenue generation, but at the same time, it is also a major contributor of greenhouse gas emission and an intensive consumer of energy. Building accounts for 40% of total energy consumption and contributes over 30% of CO₂ emission (Iwano & Mwasha, 2010; Murphy, 2012; Pan & Garmston, 2012; Tulsyan, Dhaka, Mathur, & Yadav, 2013; Chandel, Sharma, & Marwaha, 2016) hence the process of urbanization itself is sometimes blamed for contributing to climate change and other global environmental burdens (Jawaid & Khan, 2015).

The life cycle assessment of the buildings also point out the use of energy-intensive building materials which produce a significant amount of CO₂ and greenhouse gasses and the operational phase alone contributes more than 50% to greenhouse gasses (GHG) emissions and is highest energy consumer (80–85%) (Sharma, Saxena, Sethi, Shree, & Varun, 2011). The building sector's energy use in India is rising continuously with the growing population and urbanization and has doubled since 2000 with residential buildings in

Peer review under responsibility of Zhejiang University and Chinese Association of Urban Management.

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<https://doi.org/10.1016/j.jum.2018.06.001>

Received 11 February 2018; Received in revised form 18 April 2018; Accepted 3 June 2018

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urban area accounts for a major chunk of consumption and residential energy consumption also slated to change dramatically from 10% in 2013 to 41% by 2040 due to rising incomes, appliance ownership and demand for cooling (IEA, 2015). The energy production and power generation in India is largely dependent on fossil fuels, and coal accounts for over 70% of energy generation (IEA, 2015) which also produce a significant amount of CO₂ and other greenhouse gasses which has emerged as a major environmental concern.

The level of urbanization in India is projected to increase from 31.2% in 2011 ([census of India, 2011](#)) to more than 50% by 2050 ([Jawaid & Khan, 2015](#)) with an estimated addition of 404 million urban dwellers between 2014 and 2050 ([United Nations, 2014](#)). As per the current trend, the growth of urban population in the country is not only explosive but also highly skewed ([Jawaid & Khan, 2015](#)). The Class I Cities (population above 1 lakh or 0.1 million) which accounts for 70.20% of urban population in 2011 and out of this Million plus (population above 10 lakh) Metro cities alone accounting for more than 40% of total urban population ([Census of India, 2011](#)), and are still set dominate the urban scenario. The obstinate increase in urban population is liable to create demand for the building stock for residential as well as non-residential purposes which is yet to be constructed under various schemes by the government agencies, market-driven private developers or individuals, etc. and the major chunk of development will be residential to cater to the urban housing demand which is still inadequate.

The study of building regulations for environmental protection in India is limited largely to energy and energy performance or regulation and the built form as discussed in the subsequent sections. The building regulations specifically in relation to the residential built environment have not been dealt in detail, its nature and relations have not been thoroughly explored. It is very important to investigate the impact of building regulations on urban environment in the multi-cultural communities, particularly Metropolitans, where the large-scale and rapid urbanization have led to a situation of chaos in the absence of adequate urban planning and management guidelines and regulations. It is valuable to examine the role of building regulations (specifically the aspect of urban environmental quality and its environmental responsiveness) in the design of built form and urban landscape, and its application to Jaipur city in particular and the country as a whole. The present study highlights the analysis of building regulations applicable to Jaipur city in India (as a case study) for environmental responsiveness and environmental sustainability, in order to highlight the case-specific regulatory intervention required to enhance the urban environmental quality and to achieve the goal of urban development of Jaipur city.

The subsequent sections first discuss the urban environmental scenario, environmental policies and legislations, and building regulations, codes and guidelines at the national level, since the local building regulation in one way or the other regulated and guided by the national regulations. It is followed by a brief description of the Jaipur city, its planning, historical trajectory, the urbanization and environment trend. The penultimate section is focused on the discussion and analysis of environmental considerations in the building regulations applicable to Jaipur city and the paper finally concludes in highlighting the immediate area of interventions for enhancement of existing building regulations and their implementation to make them environmentally responsive and sustainable.

2. Urban environmental policy and building regulations in India

The densely populated metropolitan areas of the world especially in developing countries like India are ecologically most sensitive and fragile due to limited land for urbanization, huge population and population growth coupled with high population density. The rapid rate of urbanization, depleting vegetation and water resources, excess pollution and waste generation resulting in ecological imbalance and climate change have added to the misery of the urban environment in these cities due to lack of efficient planning and absence of effective building regulations ([Grosso, 1998](#); [Kumar & Pushplata, 2013](#)). The unprecedented outward sprawling growths with a fast-growing urban population in metropolitan cities in India over last few decades resulted in tremendous pressure and demand for urban land in the periphery resulting into consumptions of a vast stretch of fertile agricultural land for urban and residential developments. Some of the major factors attributed to sprawling development are a lack of apposite building regulations, planning policies and land management mechanism to regulate the intensity of the development within and around the urban centres ([Ahmed & Dinye, 2011](#)).

The serious challenges to environment-conscious urban planning have been posed by decrease of land available for building, already existing housing shortage and backlogs together with deterioration of ancient building stock, especially when the economic profitability of land use and maximum built-to-ground exploitation, are far highest priorities for urban developers rather than environmental protection, solar and wind access, quality of built spaces, etc. ([Grosso, 1998](#)), resulting in problems of unplanned growth, illegal squatters and settlements which pose a big challenge to the quality of urban environment. This is despite the fact that India is among the few countries in the world to incorporate the concern for the environment in its constitution (Article 21, 38, 48A, 49, 51, DPSP, etc.). The special provisions were made in the constitution for safeguarding the environment and natural resources through 42nd Constitutional Amendment Act (CAA) of 1976 ([Khan, 2015](#)). In addition to this a number of other legal steps have also been introduced to protect the urban environment in the country by all levels of government – Central, State and Local from time to time ([Bhutani & Mazumdar, 1998](#); [Khan, 2015](#)). Some significant legislations for environment protection are as follows:

- The Wildlife Protection Act, 1972
- The Water (Prevention and Control of Pollution) Act, 1974
- The Forest Conservation Act, 1980
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment Protection Act, 1986
- Public Liability Insurance Act, 1991

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