Proceedings of 12th IOE Graduate Conference
Peer Reviewed
ISSN: 2350-8914 (Online), 2350-8906 (Print)
Year: 2022 Month: October Volume: 12

Architecture Regionalism, examination of orientation in Taragaon

Prakash Maharjan [a], Sanjaya Uprety [b]

[a, b] *Department of Architecture and Urban Planning, M. Arch, Pulchowk Campus,IOE, Tribhuvan University, Nepal*
[a] maharjan49.prakash@gmail.com, [b] suprety@ioe.edu.np

Abstract
The global applicability of modern architecture has become a serious threat to the local language of architecture. The concept of critical regionalism emerged as a reaction to modern architecture's failure to include the local context of the place and region. Among several regional architectural attributes climate responsive design has been emphasized by several authors like Frampton and other researchers. In Nepal, the emergence of modern architecture after the 1950s and the design projects led by foreign architects like Carl Purscha are said to have given due consideration to the local climatic condition as a key attribute in their designs without any evaluation of such claims. Considering the local climate as a key to the Kathmandu valley's regional architectural character, this study intended to examine the climate response to achieve thermal comfort and energy consumption in the design of the Taragaon Building designed by Carl Purscha The method used for the study included the climate analysis of 10 years data from DHM and simulation of design as it is now using the Autodesk Ecotect 2011 simulation software. The result showed that the building is oriented 15.5 degrees West of South, which it differs by 20.5 degree from best fit orientation suggested by the climatic data i.e. orienting buildings 5 degrees East of South. Even though there is slight deviation in orientation, the result shows no significant change in thermal comfort and energy consumption. It can be concluded that this building best fits the climate of Kathmandu. This study indicates that the buildings built between the 1950s and the 1990s by foreign international architects, which were believed to have regional characteristics, this analysis verifies such assumptions from a climatic perspective.

Keywords
Critical Regionalism, Climate, Building orientation, Carl Pruscha, Kathmandu valley

1. Introduction

As human needs change, architecture is adaptable and constantly adopts new science and technology. Due to the speed of technological advancement, science and technology cannot be restricted to one area and are used throughout the world. Similar to how the architectural style of one location or nation is accepted in another, it is also adjusted to fit the local environment, sociocultural background, and religious beliefs [1]. With the stages of evolution of architectural styles, we have achieved many remarkable buildings. But with the new styles, it lacked a response to culture, context, and its surroundings and didn't create a perfect human living environment that can express human emotions and passions [2]. With widespread modernism, the efforts which are made to highlight regional and local concerns were left behind [3]. Thus, the need arises for an essential need to study architecture related to society, architecture that considers community needs, context, climate, and surrounding environment [2].

An approach called critical regionalism uses contextual factors to infuse Modern Architecture with a feeling of place and purpose in an effort to combat placelessness and lack of meaning. Critical regionalism's architectural aesthetic aims to offer a structure that is established in modern tradition but connected to its geographic and cultural setting. It's not just regionalism in the traditional sense; rather, it's a forward-thinking design philosophy that aims to bridge the gap between the universal and regional architectural languages [4]. Architectural theorists Alexander Tzonis, Liane Lefaivre, and Kenneth Frampton created the term "critical regionalism" in the 1980s to designate works that combine contemporary architecture with local traditions.

Worldwide applicability of modernism almost totally discarded all the "Regional" building attributes. After

leaving British Colonial authority, India adopted modernism as the favored style for new architectural development. However Indian architects began realizing the limitations of modernist architecture by the 1960s as it seemed inadequate to fulfill social and cultural aspirations. The need for critical regionalism was also realized by Indian architects. In order to combat the standardization of architecture brought on by modernism, Indian architects like as Raj Rewal, Charles Correa, and Balkrishna Doshi began implementing the principles of critical regionalism into their projects in the 1970s and 1980s [5].

In a similar vein, Nepal also became open to modern development with the restoration of democracy in 1950. Soon after, the valley became accessible for modern development, a number of projects providing technical support from different nations and international organizations arrived. Due to Nepal's relatively limited expertise with developing modern building types, a wide range of international architects have worked and contributed to the architectural design of the nation.

As a consultant for the United Nations, Austrian architect Carl Pruscha traveled to Nepal in 1965 to assist with the creation of the Kathmandu Valley master plan and preparing a comprehensive inventory of the valley's historical and cultural landmarks. He also worked as an architect, planning and constructing not only his personal home in Bansbari but also the Centre for Economic Development at Tribhuvan University (1970; with Jorgen Rahbeck Thomsen's help) and the Taragaon complex (1971). His project, Taragaon complex at Bouddha can be taken as one of the earliest modern architectural designs in Kathmandu. Deeply understanding different aspects of the valley architecture, he reinterpreted it in his designs by an attempt to blend physical, cultural and spiritual landscape of the valley while maintaining its contemporary expression [6]. However, actual performance of his building complex (Taragaon) in terms of climate is not examined so far. So, this is the fresh area to examine. Thus, this paper aims to examine whether the building is fit to the climate of Kathmandu, as an important part of architecture regionalism.

2. Literature Review

2.1 Regionalism

Regionalism is a shared sense of identity shared by individuals from a certain geographic area who are connected by common language, culture, and ethnicity.

It is the context and traditions of construction in a particular location as seen through the lens of architecture. These structures require a thorough understanding of the local climate, geology, geography, and topography. It is more of a response and almost a replication of the already existing local context and it is much more vernacular in nature. A crucial component of regionalism is the climate. E.g.: Fountains in the courtyard use evaporative cooling (cool water cooling the surrounding air) in hot climate. Geoffrey Bawa developed "Tropical Modernism", suited for the tropical climate of Sri Lanka featuring use of courtyards, the shapes of the roofs, the use of building materials, and various details found inside the house. He suggested a more straightforward design for the roof, reducing the different roof shapes connected to diverse architectural styles to their most basic form: a triangular pitched roof. Such a tactic emphasizes the idea that the roof serves as a shelter and an umbrella, an image that may be related to the straightforward structures in rural Sri Lanka [7].

2.2 Critical Regionalism

The architectural theory of Critical Regionalism was first introduced by Alexander Tzonis and Liane Lefaivre in their 1981 article, "The Grid and the Pathway," and later developed by architectural critic and historian Kenneth Frampton in his 1983 essay, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance." Its original goal was to provide an alternative to the 'International Style' modern architectural crisis, which cried out to be distinguished from the 1980s postmodern architecture that was then being promoted as the primary answer to the issue. A "infrastructure of resistance" that could reconcile global industrialization with regional communities' cultural identities was what critical regionalism envisioned. Therefore, Frampton's critical regionalism should be seen as an assimilation process rather than a style [8]. Kenneth Frampton's "architecture of resistance" emphasizes local site and environmental factors including light, terrain, context, and climate as a means of combating "placelessness" and a lack of meaning in Modern Architecture. The following assessment criteria help identify regionalist architecture:

- Context-specific Architecture

- Historical Knowledge
- Climate Responsiveness
- Materiality
- Ecology and Landscape
- Social and Cultural Appropriateness
- Technology

The modernist idea of "a single house for all countries, all climates" made the modern buildings heavily dependent on mechanical devices for thermal comfort. The range of acceptable thermal conditions separating interior from external was constrained by the transition from open, naturally ventilated rooms to completely sealed ones. something that made modern society even more placelessness. So, one of the ideas of critical regionalism is to respect the climatic aspect of each region and develop architecture in accordance to it.

2.3 Climate

One of the key elements that affects architecture is the climate. Making a study of climate exclusively in relation to architecture is not very acceptable because architecture is a complex product where, in addition to climate, materials, construction methods, and religious, political, and social circumstances have all played a role [9]. The planning, structure, kind of roof, and exterior finishing of architecture are all influenced by the climate:

- Cold to hot climates exist. Cold, in the broadest sense, refers to confined and compact planning. Heat necessitates candor.
- Extremes of heat and cold favor huge, dense constructions. The usage of light constructions is permitted in temperate climates.
- The roof's shape is determined by the snow and rain.
- The treatment of openings and their placements are determined by the amount of daylight, breezes, clouds, and humidity.

2.4 Orientation

In the context of climate-responsive passive design, orientation is a crucial design strategy. Additionally, it is crucial for ensuring thermal comfort and lowering the amount of energy used for lighting, cooling, and other functions. According to study, a home's heating needs can be cut in half or more with the appropriate glazing, insulation, thermal mass, and orientation, which also cuts energy costs and greenhouse gas emissions [9]. Therefore, it is preferable to align the building's longitudinal axis with the East-West direction such that the southern façade absorbs the most heat during the winter and the northern façade absorbs the least during the summer.

3. Methodology

This study is based on qualitative and quantitative methods. For the qualitative method, theories related to regionalism were studied and attributes for defining regionalist architecture were obtained. Among different variables, only the orientation aspect of the climatic attribute was detailed out. Likewise, for the quantitative method, energy modeling, and simulation of selected case building was done. Among buildings in the Taragaon complex, energy modeling and simulation of one smaller unit (longer façade facing south) was carried out using Autodesk Ecotect Analysis 2011. The base simulation model was created as per current construction details, materials, and systems. Simulation was done, with the building oriented as per site condition and discomfort degree hour, heating/cooling load was calculated. Then, the building was oriented to best fit orientation. The results were analyzed and comparative analysis was done, in order to verify whether the findings from existing orientation aligns or contrasts with best fit orientation.

Before energy modeling and simulation were carried out, weather data from the Department of Hydrology and Meteorology (DHM) was analyzed, in order to find the basic local climatic condition of Kathmandu. The following findings were obtained from climate analysis of weather data.

a. The climate analysis showed that the Kathmandu Valley's year-round comfort range is between 20.5°C and 26.5°C.

b. The valley's best orientation advises placing structures facing south to catch the low-angle winter sun. i.e., a building with a long façade facing South and an East-West orientation. More precisely, orienting buildings 5 degrees East of South to receive the maximum solar radiation in winter; this is a suitable option for passive solar heating.

c. Wind analysis throughout the year shows, there

is maximum wind flow of 10 to 20 km/hr from West.

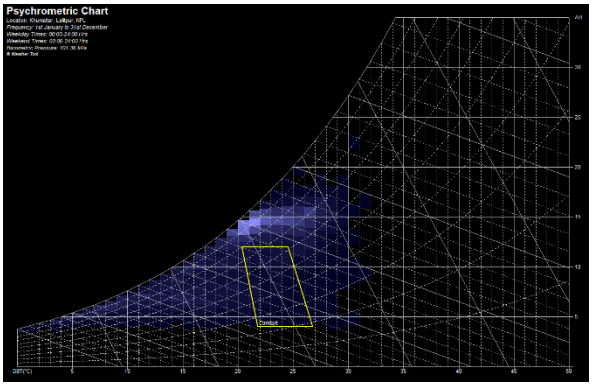

Figure 1: Comfort range for Kathmandu

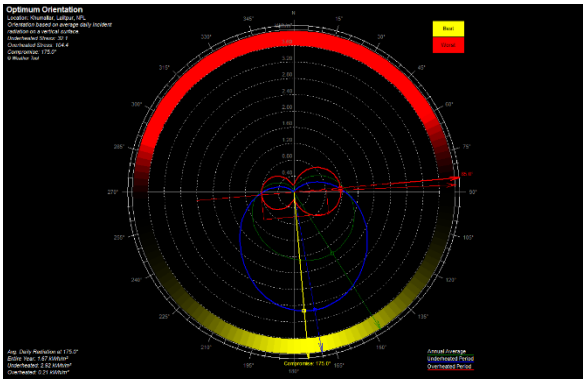

Figure 2: Best orientation for Kathmandu

4. Context of study

Taragaon complex, in Bouddha is the significant project of Carl Pruscha in Kathmandu. The traditional Dharmashalas, which are barrel vaulted buildings used as ”Patis” to lodge pilgrims inside the temple complexes, had an influence on the shape and purpose of the basic unit of Taragaon. As a result, a small square was built in the middle of the 16 small units, that were arranged around a communal house. For this, a brick vault instead of the pitched roofs typical of the valley was selected. The complex was constructed with the intention of creating a Newar village in a nutshell, where Western visitors, including artists, writers, scientists, scholars, and individuals interested in religion, might stay for a few days. Today, it has been transformed into a museum for the preservation, restoration, and documenting of the arts and traditions of the Kathmandu Valley. The facility was eventually restored, rehabilitated, and reopened in March 2014 [10].

Figure 3: Taragaon complex 3D model

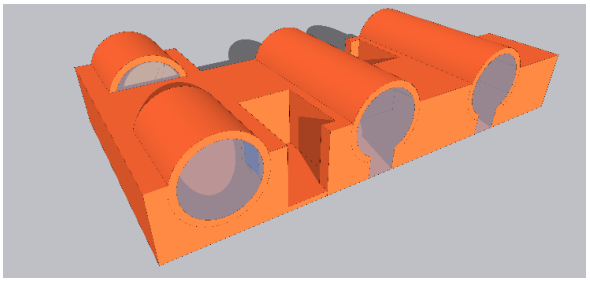

Figure 4: Taragaon, smaller unit at NE

5. Analysis and Results

From observation, it is found that the whole Taragaon complex is oriented 15.5 degrees West of South. So, there is 20.5 degrees of difference between site condition and best orientation suggested as per weather data. Hotel Hyatt Regency to the North of Taragaon complex is also oriented in same angle. It seems that the building responded to East boundary of the site, considering Bouddha stupa as view. However, only 2 out of 5 smaller units have their longer façade facing south to receive the maximum solar radiation.

Simulation of one smaller unit (longer façade facing south) is done in Autodesk Ecotect Analysis 2011. The building has dimension of 57’ x 31’ and 10.5’ height, including vault. Taking comfort range between 20.5°C to 26.5°C and under the condition of natural ventilation. Wall and vault roof of 9” brick masonry. Circular opening of 6mm standard glass. Following observation were taken.

Figure 5: Taragaon complex

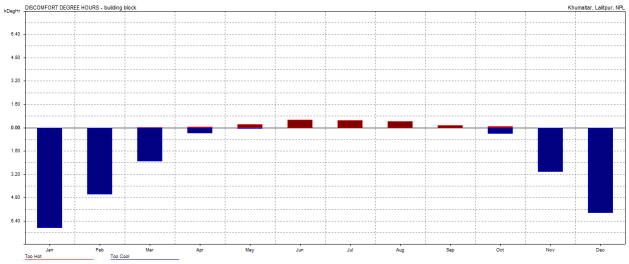

Figure 6: Discomfort degree hour

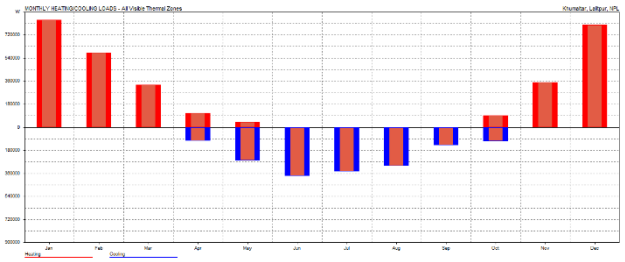

Figure 7: Monthly Heating/Cooling Loads

5.1 Normal condition

From the simulation, it is found that in existing condition with natural ventilation in all visible thermal zones, January and June are the most discomfort months with 6879 DegHrs and 536 DegHrs respectively

With mixed-mode system, results show maximum heating is needed in February with heating load of 6824W whereas maximum cooling is needed in May with cooling load of 4491W.

5.2 5.2 Optimization – 20.5º orientation change (best orientation – long side facing 5º East of South)

With 20.5º clockwise offset of North (best orientation), it is found that, with natural ventilation in all visible thermal zones, the discomfort degree hour in January is reduced to 6876 DegHrs (0.04 percent reduced) and the discomfort degree hour in June is reduced to 532 DegHrs (0.75 percent reduced).

With 20.5° clockwise offset of North (best orientation) and mixed-mode system, results show that heating load needed in February remains same i.e. 6824W whereas cooling load needed in May is reduced to 4461W (0.67 percent reduced)

5.3 Summary

	Normal condition	20.5 º Orientation change – Best orientation
Discomfort Degree	6879 DegHrs in January. 536 DegHrs in June.	0.04% reduced in January. 0.75% reduced in June.
Monthly Heating/Cooling Loads	Heating load of 6824W in February. Cooling load of 4491W in May.	Heating load remains same. Cooling load 0.67% reduced in May.

Figure 8: Results of simulation

6. Finding and Discussion

The climate in Kathmandu is mild and temperate. This place doesn't get too hot or too cold. Even though the temperature does not drop significantly during the winter, traditional valley architecture was developed in response to the chilly climate. Research findings shows that traditional valley architecture makes good use of solar radiation in conjunction with the thermal mass of the building to maintain a suitable interior temperature.

Field observation reveals that brick makes up the thermal bulk of Taragaon's building walls and even the barrel vault roofs. These vaults are constructed from two brick layers placed edge-to-edge with a

coating of bitumen that is readily available locally filling the space in between. The end outcome was the formation of a uniform mass of bricks that significantly cooled. Rain that penetrates the bitumen evaporates at that level, acting as a cooling agent. Ideal transverse ventilation is made possible by the open design of the rooms at both ends. Additionally, it appears that, North-South orientation of the vault construction aids in blocking out unwanted glare from the West through their circular openings.

Simulation result of the selected block shows that, even though there is slight deviation in orientation in between site condition and best fit orientation, there is no significant change in discomfort degree hour. So, the building so far fits according to the climatic attribute of architecture regionalism for Kathmandu. Singh [11] believes that the climate of Kathmandu has been so kind and doesn't think climate as a strong determinant of form in Kathmandu. Additionally, Thapa [12] also accepts that the general idea about climatic idea of the Kathmandu seems sufficient for Carl Pruscha to design early modern building, also reinterpreting valley architecture. Furthermore, Panta [13] also has positive view on climatic response of Taragaon, saying that even though overhangs are not provided, windows has been recessed in order to protect from rain. Also, provision of gutter at edge of vault is constructed in good way.

7. Conclusion

This study represents the simulation result of building orientation as an important aspect of climate. Climate being one of the important attributes of regionalism, from the result it can be concluded that this building best fits with the climate of Kathmandu. There is slight deviation from best fit orientation but the result matches with suggested orientation for Kathmandu i.e., orienting buildings towards the south to receive the low-angle winter sun. Indeed, the study confirms that the buildings built between 50s - 90s by international foreign architects which were claimed to have regional attributes, this paper confirms those assumptions from climatic perspective. However, orientation may be different for other buildings done by famous architects here, further research need to be carried out.

References

[1] R.S. Shah. *Regionalism and Nepalese Architecture*. 1985.

[2] J.M. Khader. *The Architecture of Respecting Context and Surrounding Environment*. 2016.

[3] R. Powell. *Exploring Architecture in Islamic Culture 2- Regionalism in Architecture*. 1985.

[4] A.K. Menon. works of architects and works of tadao ando, in critical regionalism. 2016.

[5] Sanyam Bahga and Gaurav Raheja. An account of critical regionalism in diverse building types in postcolonial indian architecture. *Frontiers of Architectural Research*, 7(4):473–496, 2018.

[6] D. Panta. Critical regionalism, for contextual architectural development in kathmandu. 2022.

[7] A.B. Setiawan. Modernity in architecture in relation to context. 2010.

[8] Juan Carlos Orozco. *A comparative analysis of Kenneth Frampton's critical regionalism and William JR Curtis's authentic regionalism as a means for evaluating two houses by Mexican Architect Luis Barragan*. PhD thesis, Kansas State University, 2011.

[9] JH Ghadlali. Effect of climate on architectural expression. In *Seminar on Architecture*, 1959.

[10] N. Prabhakar. The taragaon museum: one of nepal's first modern building. n.d.

[11] B.M. Singh. Critical regionalism, for contextual architectural development in kathmandu. 2022.

[12] P. Thapa. Critical regionalism, for contextual architectural development in kathmandu. 2022.

[13] A.D. Panta. Critical regionalism, for contextual architectural development in kathmandu. 2022.