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Timeless Structures: Unveiling the Vernacular Heritage of Maktampur, Kalaburagi

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Abstract- This research explores the vernacular architecture of Maktampur, Kalaburagi, focusing on its urban old fabric and the relationship between built form and human scale. The architectural landscape of Maktampur, Kalaburagi serves as a testament to the region's rich cultural heritage, showcasing traditional building materials and construction methods that have evolved over centuries. This study aims to document various architectural typologies, highlighting how they resonate with the local climate, social dynamics, and historical context.

By analysing the human scale of these structures, the research uncovers how vernacular designs foster community interaction and support social cohesion. The intricate patterns of spatial organization reflect the values and lifestyles of the inhabitants, enhancing the quality of urban life. Field studies and architectural surveys reveal the adaptability of these designs, which are not only functional but also aesthetically aligned with the surrounding environment.

Furthermore, the paper addresses the contemporary challenges of urbanization that threaten the preservation of Kalaburagi's vernacular architecture. It advocates for the integration of traditional design principles into modern urban planning, proposing that such an approach can bridge the gap between heritage conservation and the demands of modern living. Ultimately, this study aspires to enhance understanding of vernacular architecture's role in informing sustainable urban design strategies, ensuring the legacy of Kalaburagi's architectural identity is sustained for future generations.

Keywords: Vernacular Architecture, Urban Fabric, Human Scale, Cultural Heritage, Traditional Building Materials, Spatial Organization, Community Interaction, Architectural Identity.

1. INTRODUCTION

Kalaburagi, a historic city in Karnataka, India, reflects the rich cultural and architectural heritage of South India. Its vernacular architecture, shaped by local customs and environmental conditions, embodies the city’s historical and cultural identity. This architectural style is distinguished by the use of native materials and traditional construction techniques, thoughtfully adapted to the region’s climate and social practices.

From residential dwellings to religious structures and public spaces, Kalaburagi's architectural landscape showcases a functional yet aesthetically pleasing design that has evolved over centuries. These buildings are not just physical structures but representations of the deep relationship between past communities and their environment. However, despite its cultural significance, Kalaburagi's vernacular architecture faces pressing challenges today. Urban expansion, modernization, and lack of preservation efforts threaten to erase this architectural legacy, putting the city's rich historical narrative at risk. Protecting these structures is crucial to maintaining the connection between Kalaburagi's past and its architectural identity.

2. PURPOSE OF STUDY

This research examines the vernacular architecture of Maktampur, Kalaburagi, emphasizing how traditional building practices embody the region's cultural identity and adapt to its climate. Through an analysis of local materials, construction techniques, and design features, the study sheds light on the architectural significance and evolution of these structures. It also discusses the preservation challenges posed by rapid urbanization, proposing strategies to incorporate vernacular principles into contemporary urban planning to safeguard Kalaburagi's architectural heritage.

3. KALABURAGI LOCATION

Kalaburagi, located in northeastern Karnataka, India, is situated on the Deccan Plateau at a latitude of 17.3297° N and longitude of 76.8343° E. The city's physical landscape is marked by rugged, rocky terrain, typical of the basaltic formations found across the Deccan. With an elevation of about 450-500 metres above sea level, Kalaburagi experiences a semi-arid climate, featuring sparse vegetation and limited water availability.

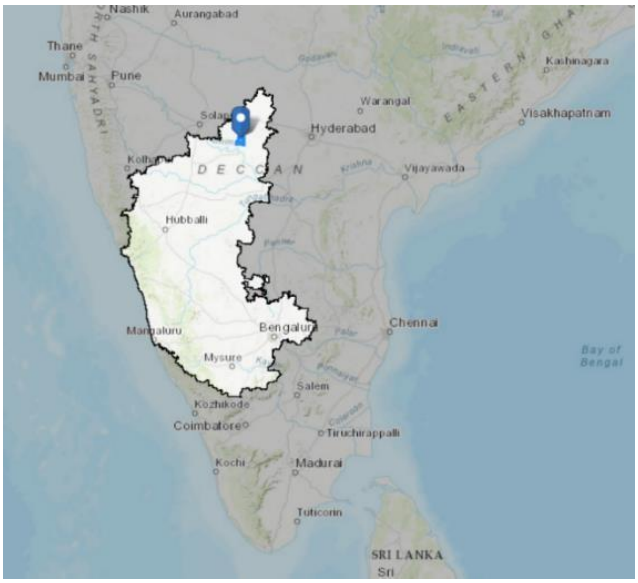

Fig.1. Gulbarga location map (Source: GIS)

The Bhima River, a tributary of the Krishna River, flows nearby, supporting local agriculture and providing a critical water source in the otherwise dry environment. Kalaburagi is strategically positioned approximately 623 kilometres from Bengaluru and 220 kilometres from Hyderabad, making it a key urban centre in northern Karnataka. The region's physical setting, dominated by dry plateaus and minimal river systems, has greatly shaped its agricultural practices, historical evolution, and distinctive vernacular architecture.

4. KALABURAGI CLIMATE

Climate data for Kalaburagi (1981–2010, extremes 1901–2012) [hide]													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	36.2 (97.2)	39.4 (102.9)	43.0 (109.4)	45.1 (113.2)	46.1 (115.0)	46.0 (114.8)	38.4 (101.1)	37.8 (100.0)	37.4 (99.3)	38.2 (100.8)	35.6 (96.1)	35.1 (95.2)	46.1 (115.0)
Mean daily maximum °C (°F)	31.3 (88.3)	34.4 (93.9)	37.8 (100.0)	40.2 (104.4)	40.6 (105.1)	35.6 (96.1)	32.3 (90.1)	31.3 (88.3)	32.1 (89.8)	32.3 (90.1)	31.4 (88.5)	30.5 (86.9)	34.2 (93.6)
Mean daily minimum °C (°F)	16.3 (61.3)	18.6 (65.5)	22.3 (72.1)	25.1 (77.2)	25.8 (78.4)	23.8 (74.8)	23.0 (73.4)	22.5 (72.5)	22.6 (72.7)	21.2 (70.2)	18.5 (65.3)	15.8 (60.4)	21.3 (70.3)
Record low °C (°F)	6.7 (44.1)	9.4 (48.9)	12.8 (55.0)	13.3 (55.9)	17.8 (64.0)	12.7 (54.9)	17.2 (63.0)	16.4 (61.5)	17.8 (64.0)	10.0 (50.0)	7.8 (46.0)	5.6 (42.1)	5.6 (42.1)
Average rainfall mm (inches)	4.1 (0.16)	1.9 (0.07)	5.9 (0.23)	17.2 (0.68)	26.0 (1.02)	109.4 (4.31)	127.1 (5.00)	152.8 (6.02)	194.2 (7.65)	99.9 (3.93)	19.7 (0.78)	4.2 (0.17)	762.3 (30.01)
Average rainy days	0.4	0.1	0.5	1.4	2.3	6.4	8.9	8.9	9.0	5.4	1.6	0.2	45.0
Average relative humidity (%) (at 17:30 IST)	34	28	23	23	28	48	58	61	60	52	43	37	41

Fig. 3. Climatic data (source: https://en.wikipedia.org/wiki/Kalaburagi)

Kalaburagi, in northeastern Karnataka, experiences a semi-arid climate marked by distinct seasons. Summers (March to June) are extremely hot, with temperatures often exceeding 40°C (104°F), accompanied by dry winds that intensify the heat. The monsoon season (July to September) brings moderate rainfall, averaging 700-800 mm annually, influenced by the southwest monsoon. While the rains provide relief, the area remains relatively dry compared to coastal regions. Winters (October to February) are mild and comfortable, with temperatures ranging from 15°C to 25°C (59°F to 77°F), making it the most pleasant time of the year.

The semi-arid conditions strongly influence Kalaburagi's vernacular architecture, where buildings are designed to combat heat. Features like thick walls and open courtyards enhance ventilation and cool interiors, demonstrating thoughtful adaptation to the climate using locally available resources.

5. HISTORICAL OVERVIEW

5.1 HISTORICAL SIGNIFICANCE

During the medieval period, Kalaburagi rose to prominence under the Bahmani Sultanate, which established its capital there in the 14th century. As a significant political and cultural centre, the city thrived, becoming renowned for its unique Islamic architecture and administrative importance.

The Bahmani rulers left an indelible mark on Kalaburagi's architectural heritage, with iconic structures such as the Kalaburagi Fort, Jumma Masjid, and numerous tombs and dargahs. These buildings showcase a distinctive fusion of Persian and Indian architectural styles, incorporating elements like domes, minarets, and intricate stone carvings that reflect the artistic grandeur of the period.

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Following the decline of the Bahmani Sultanate, Kalaburagi came under the influence of several regional powers, including the Vijayanagara Empire and the Deccan Sultanates. These successive rulers further enriched the city's architectural and cultural landscape, leaving behind a layered historical legacy.

In the colonial period, Kalaburagi continued to evolve, though its medieval history remained central to its identity. The British introduced new administrative and educational institutions, adding a layer of colonial architecture that blended with the city's existing historical structures. This mix of medieval, regional, and colonial influences has made Kalaburagi a city of architectural diversity and historical significance.

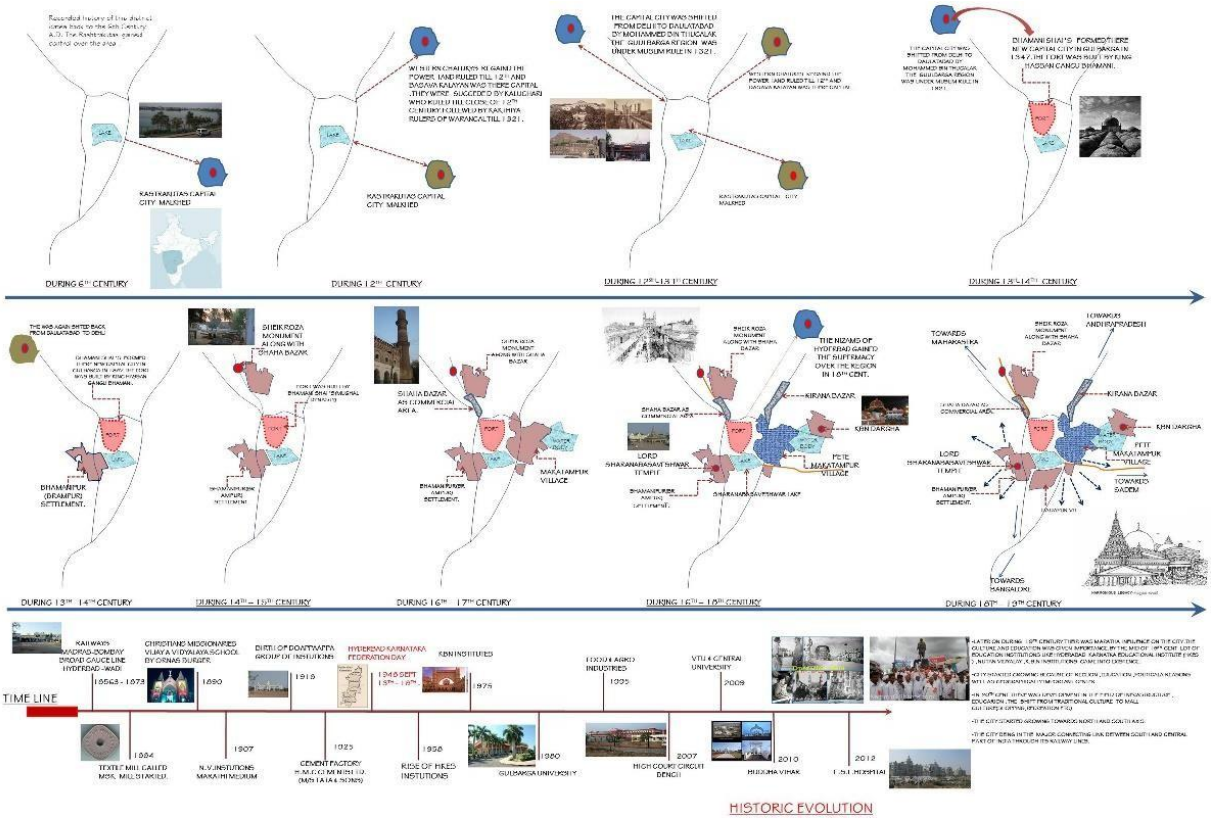

Fig.3. City evolution map, Kalaburagi (source: Author)

5.2 CULTURAL SIGNIFICANCE

Kalaburagi is known for its rich religious diversity, with both Islamic and Hindu communities playing a central role in shaping the city's architectural and cultural landscape. Temples, mosques, and dargahs coexist throughout the city, showcasing its long-standing tradition of pluralism and mutual respect.

Culturally, Kalaburagi is celebrated for its vibrant heritage, encompassing traditional crafts, festivals, and cuisine. The city's cultural fabric is a unique blend of influences from its various historical rulers and local traditions, creating a distinctive regional identity.

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In terms of education, Kalaburagi has been an important hub for learning, particularly during the Bahmani Sultanate. It gained recognition for its contributions to Islamic scholarship, with notable scholars and institutions leaving a lasting intellectual legacy. This emphasis on education continues to shape the city's academic and cultural significance.

6. PLANNING PRINCIPLES OF MAKTAMPUR, KALABURAGI

6.1 PLANNING AND ORIENTATION OF LAYOUT

Maktampur's built fabric features a grid pattern (Fig.4), with streets primarily oriented along a north-south alignment, creating right-angle intersections. This design effectively divides the city into rectangular blocks, facilitating movement and enhancing urban planning. The strategic street orientation maximizes airflow, which is crucial for maintaining comfort in the region's hot, dry climate.

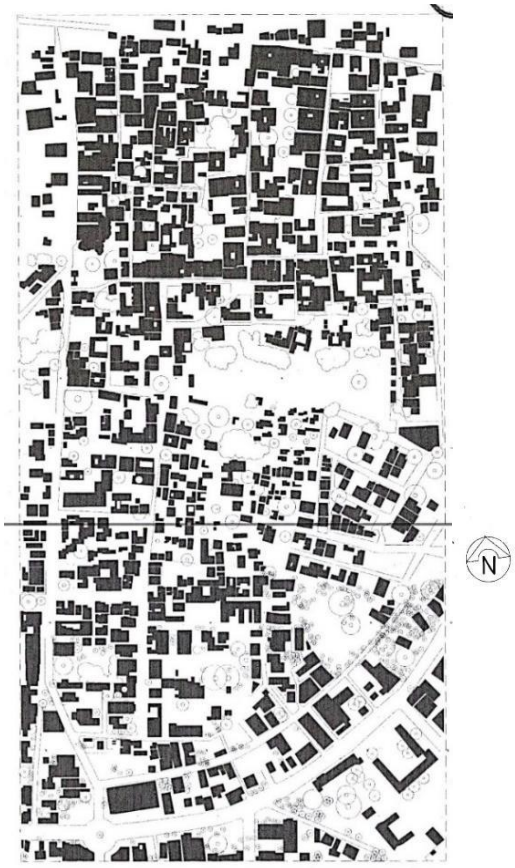

Fig.4. Maktampur (16th-17th century older settlement, Kalaburagi figure ground map (source: Author)

Compact planning is a defining characteristic of Maktampur's architecture, as the built forms are designed to minimize exposure to direct sunlight. This approach reduces heat gain and promotes energy efficiency, making it suitable for the semi-arid environment. The cluster planning of buildings further supports this objective, creating narrow streets that enhance mutual shading, lowering outdoor temperatures and fostering community interaction.

Leisure spaces are integrated throughout the city, providing essential areas for social engagement and relaxation, which contribute to a vibrant urban life. The narrow streets encourage shaded environments that are conducive to community activities, enhancing the overall liveability of Maktampur.

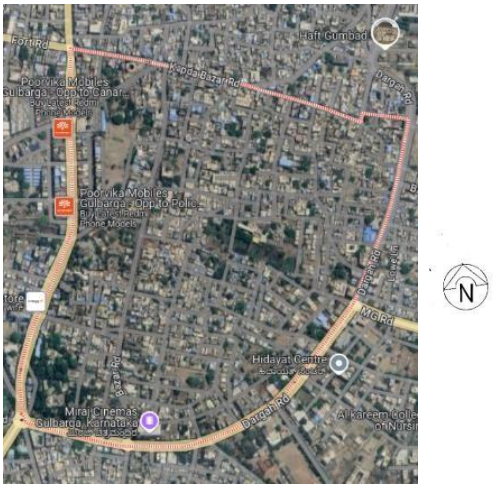

Fig.5. Maktampur, Kalaburagi satellite map

Courtyard houses play a significant role in this context, acting as natural ventilation zones that promote airflow and comfort. These courtyards not only serve practical purposes but also

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create opportunities for social gatherings. By combining compact and cluster planning with leisure spaces, narrow streets, and thoughtful climatic considerations, Maktampur's urban design effectively addresses the challenges posed by its environment, creating a harmonious living space for its residents.

6.2 STREETS AND OUTDOOR SPACES

Narrow Streets for Community Interaction: Design narrow streets (Fig.6) to foster community interaction, enhancing social engagement and creating a sense of safety among residents. These intimate spaces encourage conversations and relationships, contributing to a vibrant neighbourhood atmosphere.

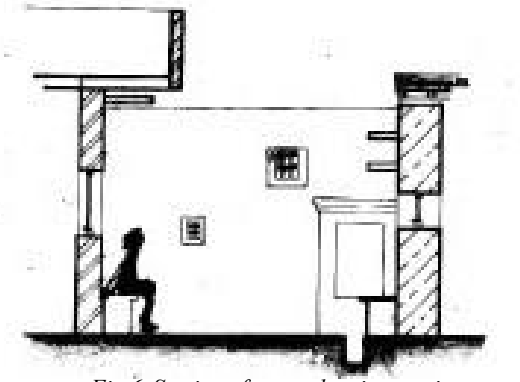

Fig.6. Section of street showing seating (Source: Author)

Human-Scale Streets: Emphasize human-scale street designs (Fig.9) that prioritize comfort and accessibility. By ensuring that pedestrians feel secure and welcomed, these designs promote active participation in street life and encourage walking and cycling.

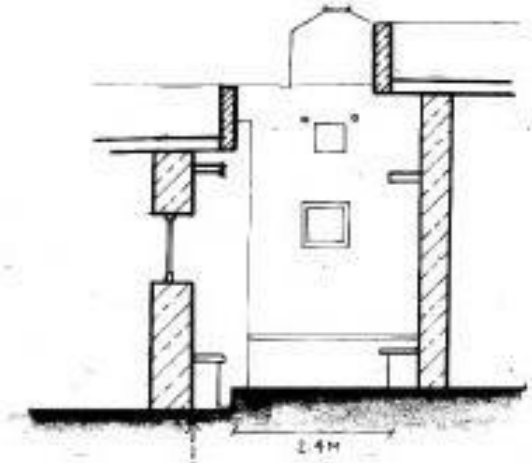

Fig.7. Section of street showing seating (Source: Author)

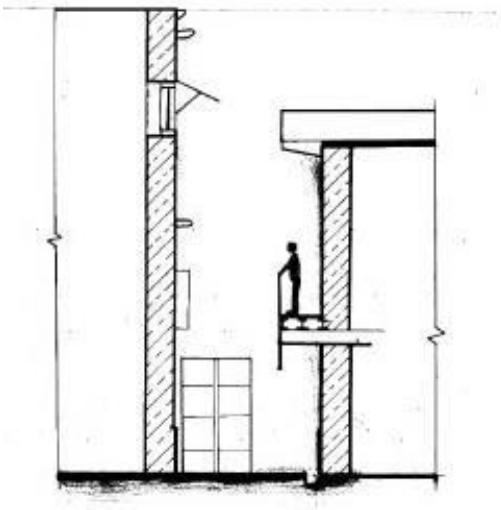

Fig.8. Section of street with balcony (Source: Author)

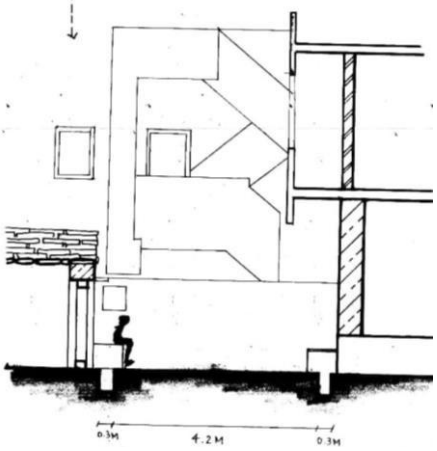

Fig.9. Section of street with human scale (Source: Author)

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Social Spaces: Integrate social spaces like verandas (Fig.9) that act as extensions of homes, facilitating casual gatherings and enriching community life. These areas provide opportunities for residents to connect, fostering a strong sense of belonging.

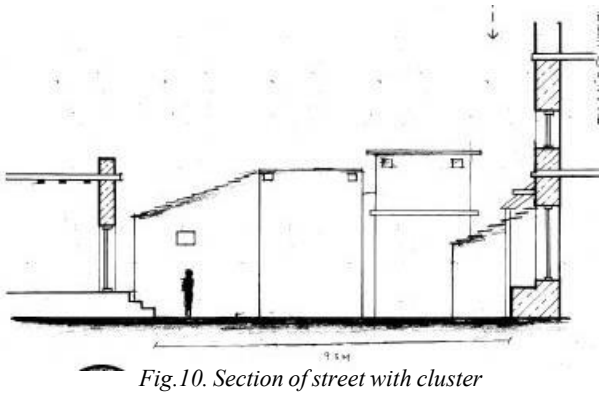

Fig.10. Section of street with cluster (Source: Author)

Building Overhangs and Local Identity: Implement building overhangs (Fig.8) to create shaded streets that offer respite from the sun. The visual character of the streets is further enhanced by the use of exposed materials such as black basalt stone and limestone. Maintaining consistent building heights reinforces local identity, enriching the overall ambience of streets and open spaces, and creating a cohesive urban environment.

6.3 PLANNING HOUSES

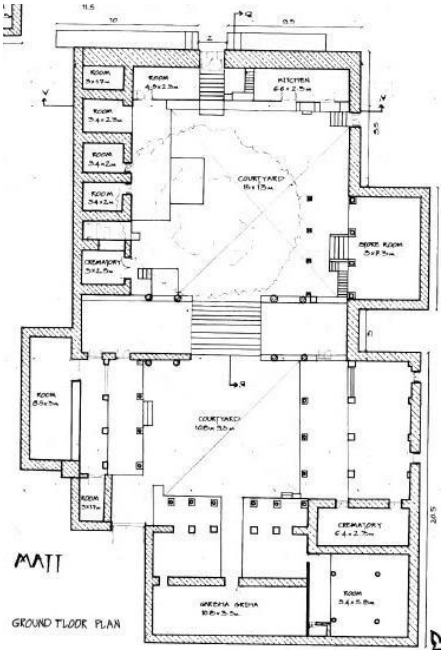

Fig.11. Case 1 - Gadagi matt Ground floor plan (Source: Author)

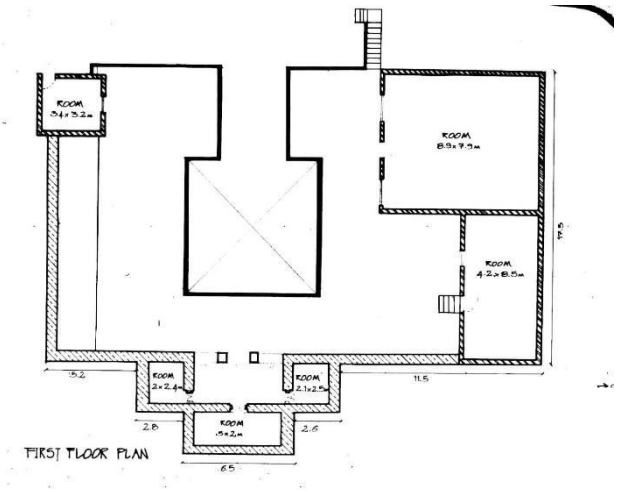

Fig.12. case 1 - Gadagi matt first floor plan (Source: Author)

Rectangular Plan: The rectangular plan is a fundamental aspect of vernacular architecture in tropical hot-dry climates. This layout optimizes space, enhances airflow, and facilitates efficient light distribution. The straightforward geometry allows for functional zoning within the home, making it easier to organize living spaces and utilities.

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Central Access: A central access (fig. 13) route serves as the backbone of the design, providing a clear pathway that promotes easy movement throughout the house. This configuration enhances connectivity between various functional zones, ensuring that occupants can navigate the space effortlessly, fostering a sense of community and interaction among residents.

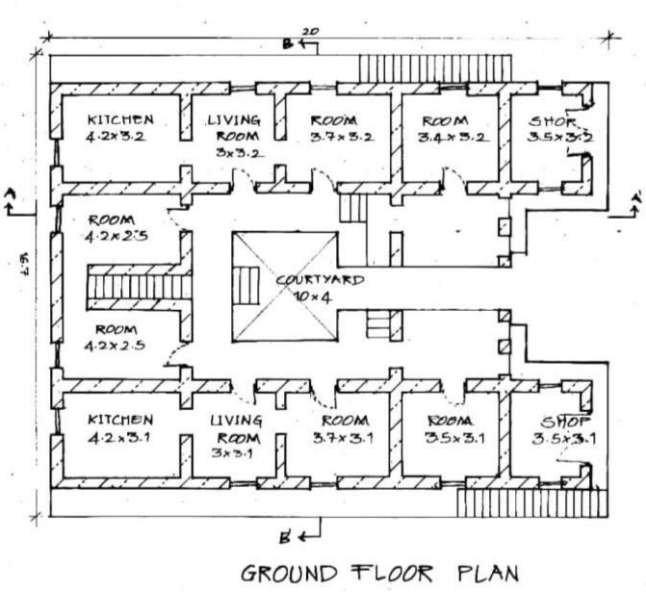

Fig.13. case 2 – Nagamma House ground floor plan (Source: Author)

Courtyard House: The courtyard house (fig15, 19, 20 & 21) design is particularly advantageous in hot climates, offering a sheltered space that encourages natural ventilation and cooling. The courtyard serves as a communal area, promoting social interaction while providing relief from heat, thus enhancing the overall living experience.

Backyard: In addition to the courtyard, the backyard can serve practical purposes such as gardening, storage, or recreation. This outdoor space adds to the functionality of the home, allowing residents to engage in productive activities while enjoying the outdoors in a controlled environment.

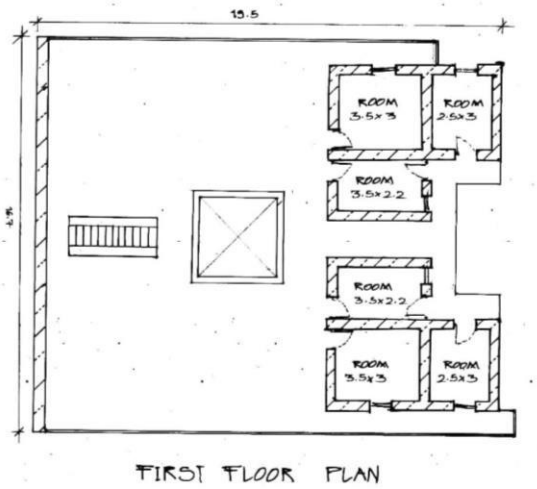

Fig.14. case 2 – Nagamma House first floor plan (Source: Author)

Human Scale: The interior layouts of vernacular houses are designed to be proportionate to human dimensions, ensuring that rooms are comfortable and inviting. Spaces are typically organized around communal areas, like courtyards, which foster social interaction while also serving practical functions. This proportionality promotes a sense of intimacy and safety, making residents feel more at home.

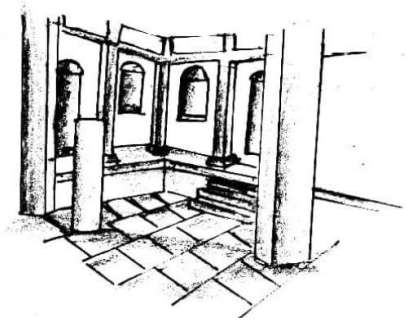

Fig.15. Courtyard (Source: Author)

Thick Walls: Thick walls constructed from materials like black basalt stone and limestone play a vital role in thermal regulation. These materials have excellent thermal mass properties, absorbing heat during the day and releasing it slowly at night, which helps maintain stable indoor temperatures.

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Openings: openings (fig. 16) are limited, with the courtyard serving as a key type of opening and the primary source of light and ventilation. Minimal windows, combined with the presence of only a ventilator in the kitchen, is particularly effective in hot, dry climates. This design promotes a sense of community and enhances comfort, as the courtyard facilitates natural ventilation and reduces heat accumulation, making it an ideal solution for coping with the challenges of hot, arid environments.

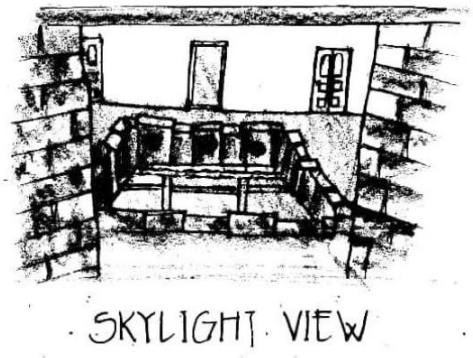

Fig.16. sky light (Source: Author)

The Mansabdar house (Fig 17, 18 & 19) incorporates a double courtyard design that effectively distinguishes between public and private spaces. The outer courtyard is dedicated to public activities and office functions, creating an open and accessible area that encourages social interactions and community events. In contrast, the inner courtyard provides a private sanctuary for family gatherings and relaxation, ensuring a tranquil space shielded from public view. This thoughtful arrangement not only enhances the functionality of the home by clearly defining communal and personal areas but also aligns with cultural traditions and responds to climatic conditions. The design fosters a balance between privacy and social connectivity, promoting comfort and usability while honouring traditional values. By harmoniously integrating these features, the Mansabdar house achieves an ideal combination of openness and seclusion, effectively meeting the demands of both social engagement and personal retreat.

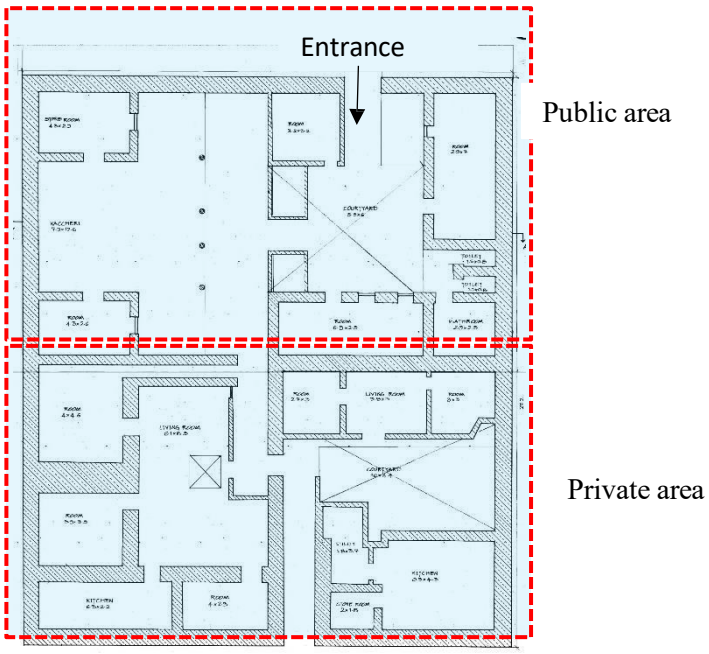

Fig.17. case 3 – Mansabdar house ground floor plan (Source: Author)

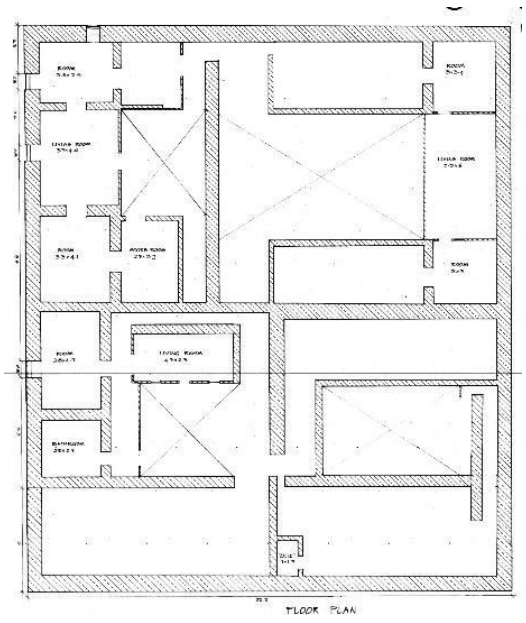

Fig.18. case 3 – Mansabdar house first floor plan (Source: Author)

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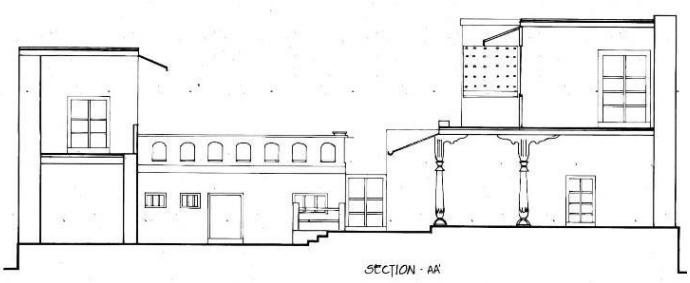

Fig.19. case 3 – Mansabdar house section through courtyard (Source: Author)

Courtyard planning is highly advantageous in hot, dry, and semi-arid climates. Typically situated at the centre of a home, courtyards can be fully open to the sky or partially shaded with overhangs, which help to minimise heat gain by creating shaded areas. These central courtyards play a crucial role in illuminating surrounding spaces with natural light while promoting air circulation through openings in the walls that face the courtyard, enhancing induced ventilation.

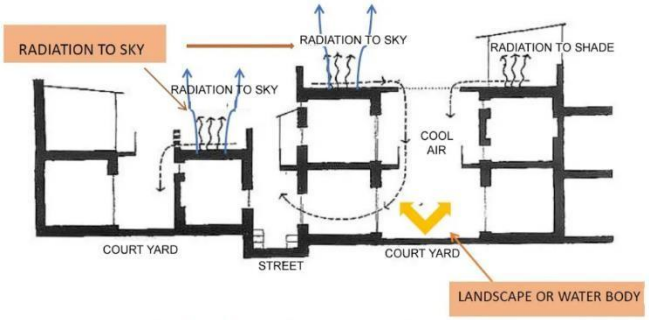

Fig.20. Typical section showing courtyard effect (Source: Author)

In such climates, larger courtyards (Fig. 20) are particularly effective in boosting ventilation, especially when they connect to other courtyards or streets, facilitating cross-ventilation. On the other hand, smaller courtyards provide shelter from the hot, dusty winds that are common in arid regions.

Fig.21. Typical courtyard house

The thermal performance of a courtyard operates on a cycle throughout the day. During the night phase, cool air settles into the courtyard and adjacent rooms, cooling the structure and its furnishings, which remain comfortable until the late afternoon. In the daytime phase, direct sunlight warms the courtyard floor, causing warm air to rise and escape, thus generating convective currents that enhance comfort. The courtyard acts like a chimney while the thick walls help delay the influx of external heat.

As the evening phase approaches, trapped cool air begins to escape, leading to a rise in temperature in the courtyard and interior rooms. After sunset, the courtyard quickly radiates heat to the clear night sky, allowing cooler night air to descend and complete the cooling cycle.

This cyclical process effectively regulates indoor temperatures, ensuring a comfortable living environment in hot, dry climates. Overall, the integration of courtyard design significantly enhances thermal comfort while adapting to the challenges posed by arid conditions.

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Human Scale: Vernacular architecture prioritises human proportions, needs, and experiences, seamlessly blending cultural and environmental contexts to create inviting and accessible spaces. Structures feature relatable dimensions and utilise local materials such as mud, stone, and timber, reflecting regional resources. The incorporation of courtyards, verandas, and semi-open areas creates a fluid transition between indoor and outdoor environments, adapting to daily activities and climatic conditions. Functionality is crucial, with thick walls and small windows effectively minimising heat gain in warm climates. These architectural elements serve as cultural expressions, strengthening the bond between individuals, their communities, and the surrounding environment.

6.4 CONSTRUCTION TECHNIQUES AND MATERIALS

Thick Walls: Thick walls (*Fig.22)*, typically measuring between 3 to 3.5 feet, are essential for insulating interiors against extreme heat. They effectively slow down heat transfer, ensuring cooler indoor conditions during the day while releasing stored warmth at night. These walls have demonstrated remarkable durability, contributing to the longevity of structures that have stood for over 200 years.

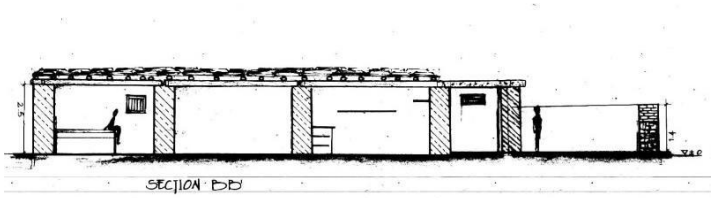

Fig.22. Typical section showing 60cm to 90cm thick wall (Source: Author)

Load-Bearing Walls: Made from resilient local materials, load-bearing walls provide crucial structural support and enhance thermal mass, aiding in the regulation of indoor temperatures. Their durability is vital for maintaining the integrity of buildings over time.

Fig.23.Typical house showcasing Lime stone wall and roof

Stone Construction: In Kalaburagi, stone is a prominent building material, particularly limestone and black basalt, which are abundant in the region. These durable stones possess excellent thermal mass, vital for maintaining cooler indoor environments. Their high thermal capacity allows them to absorb heat during the day and release it at night, effectively regulating the overall temperature of the building while ensuring the structures withstand the test of time.

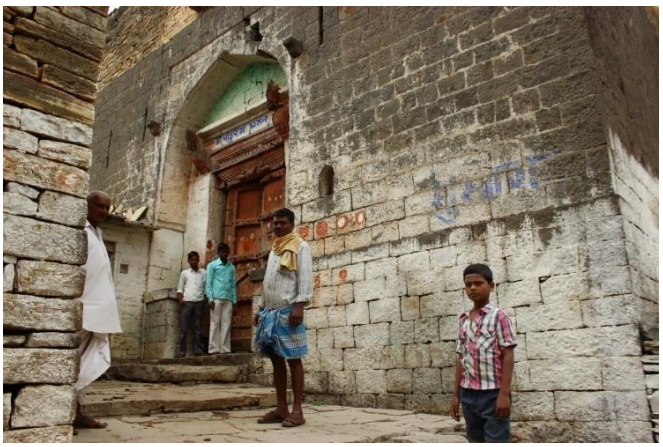

Fig.24.Typical house showcasing Black basalt stone wall

Thick, Multi-Layered Mud and Limestone Roofs: Traditional roofs range in thickness from 25 cm to 45 cm and are constructed in two primary styles.

- First Type: This design features 2-inch-thick stone slabs supported by closely spaced wooden beams and joists. The slabs are topped with lime mortar, along with an additional layer of mud above them. This substantial thickness delays heat entry, making the roof particularly effective for hot climates.
- Second Type: This construction employs jungle-cut wooden logs, over which 1- to 2-inch-thick stone slabs are laid in a sloped configuration. This design ensures effective rainwater drainage while maintaining thermal insulation. (Fig. 23)

7. RESULTS AND DISCUSSION

The examination of Maktampur's vernacular architecture highlights its crucial role in shaping the historical and cultural identity of Kalaburagi. Traditional construction methods, such as thick stone walls and multi-layered mud roofs, effectively respond to the challenges posed by the region's semi-arid climate. The compact arrangement of buildings, characterised by inward-facing designs and central courtyards, optimises natural ventilation and thermal comfort while fostering social interactions that strengthen community bonds.

These architectural features contribute significantly to the area's visual character, reflecting the region's unique heritage and maintaining a human scale that encourages accessibility and comfort. Thoughtful design ensures that spaces are both functional and visually appealing, supporting a balanced lifestyle.

However, rapid urbanisation threatens these architectural gems. Modern development often neglects the historical and cultural significance embedded in vernacular structures, resulting in the loss of traditional techniques and materials, which further erodes architectural heritage.

To safeguard these structures, it is essential to harmonise modernisation with the conservation of traditional practices. By incorporating vernacular design principles into contemporary urban planning, cities can retain their historical essence while addressing emerging challenges. Key recommendations include promoting preservation policies, encouraging community involvement, and implementing educational initiatives to ensure that Maktampur's architectural legacy continues to enrich the cultural landscape of Kalaburagi.

8. ACKNOWLEDGMENT

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9. CONCLUSION

The study of traditional vernacular architecture reveals its essential function in meeting the social, structural, climatic, and functional demands of its time. The current challenge is to harmonise these elements within modern architectural practices, acknowledging the evolution of vernacular architecture through earlier civilisations. This integration requires careful consideration of technological advancements alongside contemporary development.

In vernacular settings, the spaces between buildings are integral to shaping urban and rural environments. These interstitial areas facilitate functional separation, helping to organise different zones while promoting natural ventilation and light penetration, particularly in densely populated areas. They successfully balance privacy with social interaction, enhancing community engagement while preserving personal space. Designed for climate responsiveness, these spaces provide shade in hot climates, conserve heat in colder regions, manage water runoff, reflect cultural aesthetics, and improve connectivity. Additionally, they serve as buffer zones between diverse land uses, enhancing liveability and reducing potential conflicts.

Special attention should be paid to internal courtyards, which function as essential links between the inside and outside environments. These spaces have a profound impact on the social and cultural dynamics of communities, necessitating a balance between their functional and aesthetic roles. Effective design should consider the cultural, social, and climatic aspects that enrich these environments.

Furthermore, it is vital to update existing building codes to preserve local character while aligning with the principles of vernacular architecture. By embracing these considerations, we can foster a built environment that respects historical precedents while accommodating future growth, ultimately enhancing the resilience and vibrancy of our communities.

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