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EDITORS' NOTE

The editorial board is pleased to announce that Journal of Research in Architecture and Planning (JRAP) has become a bi-annual journal from 2011. The spring issue of each year will publish papers having general topics related to Architecture, Urban design and planning, whereas, the fall issue of each year will be a thematic issue.

This spring issue of 2011, was supposed to follow the general topic format but due to the thematic nature of the papers received, it mainly revolves around the topic of built heritage and its conservation. The papers included, range from topics of urban conservation to monument restoration, encompassing the various scales and genres in built habitat conservation, preservation, restoration and revival.

The present issue is an attempt to widen the understanding of conservation issues related to design, management, operation and maintenance which confront the concerned profession and professionals, especially those in the developing world. The papers attempt to present different concepts, methods, techniques and systems such as that of documentation, inventories, community participation and technical training which are pertinent and applicable in the developing world.

Advocating the use of inventories as a means of understanding and solving area and building conservation issues, to improving infrastructure in walled cities as a means of historic quarter up-gradation, to reviving traditional planning and energy efficient techniques in town planning and construction, these papers attempt to provide a wide range of approaches to conservation and its related issues.

From walled city cores to monument restoration, the papers deal with a varied scope of topics within the very complex issues of built heritage conservation. However, the topic of intangible heritage and its importance in the restoration process remains dormant and appears briefly across board. It is planned that a future volume of JRAP will deal with this topic separately.

It is hoped that this volume will add to the existing body of literature on the given theme and will promote new ideas, concepts and practices.

Editorial Board

INVENTORY OF HISTORIC PLACES: A SYSTEMATIC METHOD FOR THEIR IDENTIFICATION, EVALUATION AND DETERMINING SIGNIFICANCE PART I: CORE DATA AND INVENTORY FORM

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ABSTRACT

Systematic inventory and recording is an effective and primary tool for facilitating good management and understanding of historic towns, cities and areas. This paper presents a method developed for inventory recording in the context of under-resourced countries not having efficient and well formed systems for definition, protection and preservation of their heritage properties. The paper focuses on an inventory format designed through a research undertaking in Sindh, the southeastern region of Pakistan, taking its historic towns as case studies. The research outcomes are presented in two sequential papers: the first part discusses Core Data Index Form (CDIF) and inventory layout in detail. The discussion expands on contributions and practical utility of database outputs compiled as a manual of inventory forms for use by heritage managers and decision makers to develop better understanding and management mechanisms for enlisted properties. Considerations for recording field data are explained in detail. The second paper presents comparison of two case study towns, where the developed method was applied for documentation.

***Key words*:** Heritage inventory, listing criteria, degree of value, historic places significance, inventory database.

INTRODUCTION AND BACKGROUND

Historic environments contribute towards establishing the identity and unique character of any place. Realization of their irreplaceable value is however, not well recognized especially in the under-resourced developing regions, resulting in an absence of initiatives for their documentation and study to define significance values and attempt preservation. Their destruction goes unchecked leaving most historic towns vulnerable to pressures threatening the existence of their unique fabric.

Mid 20th century marks the emergence of area-based conservation, particularly in Europe where entire towns or historic districts were designated as conservation areas. This created a need for inventory and listing of existing historic fabric; gathering information on its qualities, condition, materials, usage, style, and other related aspects, and develop planning policies for better management and conservation. Recording, inventory or listing of cultural property is defined as the process for 'documenting what is there' or the 'capture of information which describes the physical configuration, condition and use' of historic places, identified for protection at regional, national or local levels. Comprehensive inventories are recommended in all major international conventions for heritage protection as essential for developing better understanding of the 'wider historical, social and architectural contexts' of any place; and considered indispensable not only for 'definition, interpretation, education, protection, conservation, planning, rehabilitation and heritage management' (CoE, 2001; p18), but also as an effective tool for creating public awareness and inculcating support for their legislative protection. The main purpose of heritage inventory is not only to develop a record but to facilitate an understanding for analyzing the forces and constraints which have weighed on a place and must be taken into account for managing future developments with coherence and harmony (CoE, 2001).

RESEARCH METHODOLOGY

This paper presents a method developed to assess historical and cultural built form traditions, using systematic documentation as a tool for analysis of historic environments. The adopted methodology uses available resources and information, building upon it through methodical data collection from field surveys; using a pre-designed 'Core Data Index Form' (CDIF) for mapping and inventory listing of heritage properties. The CDIF, a primary outcome of the research process, has been designed to capture data that substantially covers tangible and intangible aspects, the

complexity of historic traditions and the importance of fragile natural and environmental resources. It was first pilot tested and then applied for inventory documentation of two historic towns in Sindh[1], Pakistan (Figure 1).

Research undertaken internationally in the area of heritage documentation provides with a well established contextual frame of reference. The theoretical base for this research is derived from existing methods (ICOMOS, 1996, 1987; CoE, 2001; Insall, 1986); reviewed and adapted for the local context of case study region. The ICOMOS '*Principles for Recording of Monuments, Groups of Buildings and Sites*' (1996) define the basic content of a record and guidelines for building up these records. The '*Guidance on Inventory and Documentation of the Cultural Heritage*' (2001) consolidates all previous efforts and experiences, giving a detailed guideline for structuring, planning and managing inventories of buildings/ monuments, archaeological sites and museum objects. The CDIF developed for this research and being presented in detail is based on these principal documents of heritage recording, and additionally includes data considered essential for addressing the lack of existing information on historic towns in the case study region of Sindh.

The historic towns in case study area, being under- researched and not documented, it was felt essential that an inductive approach be adopted for field survey. Such an approach for inventory documentation, termed as an 'exhaustive' listing (CoE, 2001) is not a common practice due to constraints of resources. Case studies from among the developed countries indicate such an approach being applied in the context of small historic towns; especially in the European region. In larger cities the shortfalls of not adopting this approach is compensated with well developed organizational setups having trained professionals dealing with heritage properties. Within the South Asian region, India has recently made efforts through its educational institutions to initiate this approach of inventory documentation. Mentionable work in this context is being developed in Ahmedabad and Jaisselmer through institutional collaborations; but these are still in their early stages hence sufficient information is not available to do a comparable analysis. The most striking difference between developed countries and the under-resourced cases is the administrative structure which, in the latter case, is almost non-existing when it comes to dealing with issues of area conservation. The proposed inductive

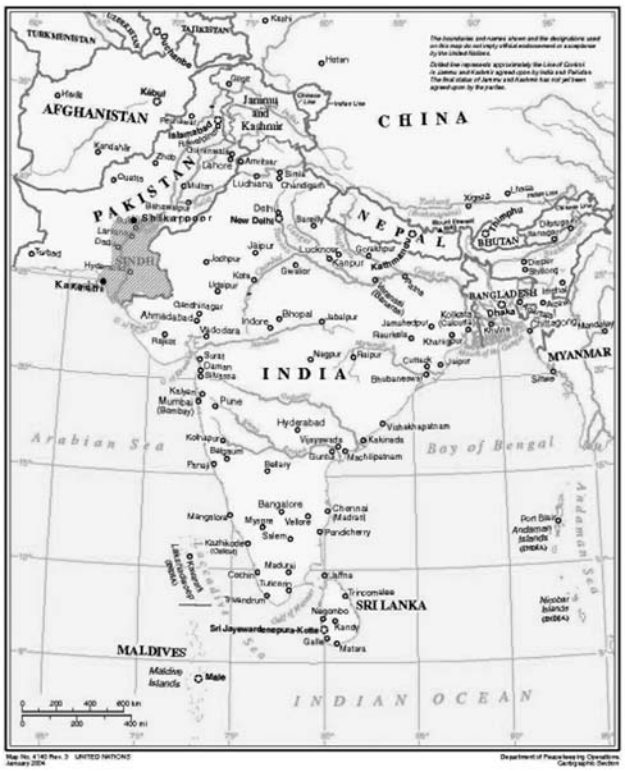

Figure-1: Regional map showing location of Sindh and its two chosen case study towns.

approach to inventory documentation is primarily being advocated to compensate for this deficiency and overcome the lack of existing knowledge on historic urban environments in the case study area.

The CDIF has three sets of information: usage and physical condition of fabric, architectural or historical merits and socio-economic data on residents/ users/ owners of the listed properties. In addition to specific data on individual properties – more generalized town level information on transportation links, infrastructure, street patterns, and other aspects of the built fabric, the topographical features as well as the natural/ manmade threats attached to the area, are recommended for inclusion in the recording and mapping process as part of the town/ city's background information treated as common to all listed properties, and thus not mentioned within the inventory form. This additional data is useful for gaining a holistic understanding, necessary to evaluate the degree of changes, transformations and extent of preserved historic character; and also for formulation of policies and proposals

1 The province of Sindh forms the south-eastern part of Pakistan; it is identified as a distinct entity on grounds of its linguistic and socio-cultural identities. The boundaries of Sindh are largely defined by natural features of the landscape; Kirthar Mountin ranges on the west, the Thar and Rajasthan Desert on the east forming borders with India, the Runn of Kutch in south and the Arabian Sea on southwest.

for effective use, management and maintenance of historic places, which however, is not discussed in detail here.

INTERNATIONAL STANDARDS:

Core Data, Recording Process, Criteria and Management of Inventories

The definition of cultural properties has evolved to include within its domain a wide spectrum of man made, natural, tangible and intangible aspects, making it inevitable to involve various organizations and departments for national heritage management. For a smooth exchange of information and efficient collaboration between organizations/ departments, it is essential to maintain inventories on a standardized and exchangeable format, ensuring a consistency in the database. Essential 'core data' elements and standards developed and approved internationally aim to facilitate classification of individual buildings and sites (Table 1). This comparative table reflects on the level of standardization achieved internationally for developing inventories of historic places.

Table 1: A comparison of 'core data' identified by ICOMOS (1996) and CoE (2001), reflecting on the level of standardization achieved through these two documents.

'Principles for the Recording of Monuments, Groups of Buildings and Sites' ICOMOS (1996)	**'Guidance on Inventory and Documentation of the Cultural Heritage' CoE (2001)**
1. **Name** of building/ group/ site	1. **Name** & **References** ▪ **Name** of building ▪ **Unique reference** number ▪ **Date of compilation** ▪ Recording **organization** ▪ **Cross reference** to different records (documentation, photographs, drawings, textual, bibliographic) ▪ Cross reference to archaeological records ▪ Cross reference to environmental record
2. **Unique ID** reference number	
3. **Date of Compilation**	
4. Recording **Organization/ Person**	
5. **Cross References** (photographs, records, reports, bibliographic references)	
6.**Location** (description, aerial photographs, maps, plans, address,, street reference)	2. **Location** ▪ **Administrative unit** (state/ province, geopolitical unit, administrative division) ▪ **Address** (postal name, number in street or road, name of street/ road, locality, town/ city, postal code) ▪ **Cartographic reference** ▪ **Cadastral reference**/ land unit
7. **Building Details** ▪ Type, form, dimensions ▪ Interior/ exterior characteristics ▪ Nature, quality, cultural, artistic, scientific significance ▪ Material of Construction ▪ Decoration/ ornamentation ▪ Inscriptions ▪ Services, fittings, machinery ▪ Ancillary structures, gardens ▪ Date of origin (authorship, ownership) ▪ Use	3. **Functional Type** ▪ Building type ▪ Building category (broad functional type) 4. **Dating** ▪ Period ▪ Century ▪ Date range ▪ Absolute date 5. **Persons/ organizations associated** 6. **Building materials** and **construction technique**
8. Assessment of **current condition**	7. **Physical Condition** ▪ **Integrity of building** (demolished, ruined, remodeled, restored) ▪ **State** (good, fair, poor, bad)
9. Assessment of **conflicts and risk**	
	8. **Protection/ legal status**
	9. **Notes** ▪ Historical summary ▪ Comments

A systematic inventory process requires establishing a pre-defined 'criteria for listing' to ensure inclusion of all properties that represent 'the *essence* and *style* of an area'; its character and unique qualities through a range of elements including groups of buildings, structures like bridges and water towers, objects like sign posts, trees, sculpture, open spaces both natural (gardens, parks, river banks) and hard (plazas, squares), layout and pattern of streets, topographical features, views/vistas and archaeological resources (Jameison, 1990; p14). National or regional level inventories continuing over long periods require constant updating, refinement and revisions; these are thus envisaged as an 'ongoing' process with a flexiblility to incorporate changes over time. Managing and sustaining the process requires careful thinking, vis-à-vis financial support, budgeting for un-anticipated discovery during documentation adding expenditure, ongoing and evolving evaluation of significance and value designation, constant updating of the database, continuity in staff training, and finally the responsibility of information dissemination for public benefit.

In economically impoverished countries like Pakistan, heritage conservation has a very low priority on the official agenda for planning and development. Community support for conservation is thus purely dependent on association, appreciation or bonding towards the place – a sense of ownership towards it; as incentives of financial or technical support offered to property owners in the developed world, are difficult to arrange. In such a context the heritage inventory process can only be realized if incorporated and supported through academic research process, producing outputs with practical utility and potential for creating awareness and understanding for importance of historic environments. In addition, the disemmination of such research outputs is an important aspect which can be achieved through use of modern technology and web based information dissemination sources; but due consideration regarding ground realities of lacking resources should be kept in mind. Often the feasibility of complete reliance on technological support is not possible thus the value of hard copy publications cannot be denied.

THE CDIF

The CDIF (Figure 2a, 2b, 2c, 2d, 2e) presented here has two parts; part 'A' focusing on 'Building/ Site Data', and part 'B' focusing on 'Socio-economic Data' of residents and users of identified properties. The developed CDIF uses core data entries proposed in ICOMOS and CoE documents summarized in table 1, as the baseline. But it expands further on additional information considered essential in the case studies' context. Fields from 1 – 14 originate from the existing two references, but slightly modified for better understanding at a local level. Addition of the analytical data (field 15) and socio-economic data (section B) in the CDIF is a contribution of this research approach, addressing the existing lack of understanding and information on heritage sites in the case study areas' context. Following is an explanation for the different fields of data included in the CDIF:

Part 'A': Building/ Site Data

This part contains objective and analytical information for specific property, including data on the built form, its physical condition, architectural features, ownership/ occupancy status and location.

1. **Name and references** include present name, as well as older name/s of the property known through sources such as inscriptions, historic maps, gazetteers, or official documents/ records. The reference is a unique ID for each property, linking all its corresponding records and files in the database and other software. Previous references such as enlistment number[2], or previous listing, documentation or designation references should also be recorded in this field, allowing for a detailed catalogue of information connecting previous and new sources.

2. **Location** includes complete address with plot number, street name, postal code (if any), locality/ city/ province name and GPS coordinates (important particularly for isolated properties on outskirts or periphery of the city).

3. **Functional type** records the **original function**, irrespective of usage at the time of listing. The eleven pre-defined major categories listed in 3.1 include:

i. Public monuments/ civic amenity/ public utilities
ii. Educational/ Institutional
iii. Religious/ Worship
iv. Health/ Welfare
v. Commercial

2 'Enlistment number' is the official reference maintained by the Department of Culture, Government of Sindh for the listed buildings of Karachi.

PART A:
Building/ Site/ Urban Element Data

CORE DATA INDEX FORM
(Historic Buildings, Monuments and Sites of Heritage Significance)

1. Name and References:	
Name of Building:	
Reference ID:	
Cross References:	

2. Location:		
Complete Address:	Plot No.:	
	Street/ Road:	
	Locality:	
	Postal Code:	
2.2 City:		
2.3 State/ Province:		
2.4 GPS Co-ordinates:		

4. Dating:

4.1 Const. Date:

4.2 Period of History:

- ☐ **Pre Colonial (Before 1842)**
  - i. Hindu Rulers ☐
  - ii. Sammas ☐
  - iii. Arghuns ☐
  - iv. Kalhoras ☐
  - v. Talpurs ☐
- ☐ **Colonial History (1842 – 1947)**
  - vi. Renaissance Revival ☐
  - vii. Gothic Revival ☐
  - viii. Neo Classical ☐
  - ix. Indo Serosemic ☐
  - x. Hybrid ☐
- ☐ **Post Independence Styles (1947 –1970)**
  - i. Art Noveau ☐
  - ii. Art Deco ☐
  - iii. Bauhaus ☐
  - iv. Early Modernist ☐
- ☐ **Modern History (1970 – till date)**

5. Associated Persons / Organizations:

Names	Role	Date
	Architect/ Designer	
	Builder	
	Patron	
	Occupier	

6. Materials /Construction:

6.1 Building Materials:

	Walls	
	Roof	
	Floors	
	Ceiling	

6.2 Structural System:

	Load Bearing	
	Timber Frame	
	RCC	
	Other	

7. Legal Protection:

Type	Date Granted

3. Functional Type

3.1 Category	3.2 Building Type/ Cultural Site
☐ I. Public Monuments/ Civic Amenities/ Public Utilities	*a. Bell Tower/ Minar* ☐ *b. Memorial* ☐ *c. Graveyard* ☐ *d. Public Hall* ☐ *e. Public Library* ☐ *f. Orphanage/ Old People's Home* ☐
☐ II. Educational/ Institutional Building	*a. School* ☐ *b. College* ☐ *c. University Campus* ☐ *d. Madrassa* ☐
☐ III. Religious/ Worship	*a. Temple* ☐ *b. Church* ☐ *c. Mosque* ☐ *d. Tomb/ Shrine* ☐
☐ IV. Health Care/ Welfare	*a. Hospital* ☐ *b. Dispensary/ clinic* ☐
☐ V. Commercial	*a. Shop* ☐ *b. Market/ Bazaar* ☐ *c .Caravanserai* ☐
☐ VI. Industrial	*a. Factory* ☐ *b. Rice/ Flour Mill* ☐
☐ VII. Agricultural	*a. Barn* ☐ *b. Granary* ☐ *c. Well* ☐ *d. Canals* ☐ *e. Cultivation Fields* ☐
☐ VIII. Military	*a. Fort* ☐ *b. Check post/ Watchtower* ☐ *c. Battlefield* ☐ *d. Barrack* ☐ *e. City Wall/ Gate* ☐
☐ IX. Residential	*a. Palace* ☐ *b. Haveli* ☐ *c. Bungalow* ☐ *d. Apartment* ☐ *e. Row House* ☐ *f. Vernacular living spaces* ☐
☐ X. Open Spaces/ Natural Sites	*a. Park/ Gardens* ☐ *b. River Side/ promenade* ☐ *c. Lake/ Reservoir* ☐ *d. Wildlife Reserve* ☐ *e. Orchards* ☐ *f. Grazing Land* ☐ *e. Urban square/ Piazza* ☐
☐ XI. Urban Elements/	*a. Archway/ doorway to street* ☐ *b. Entrance/ Gateway* ☐ *c. Well/ Drinking Fountain* ☐ *d. Pedestrian bridge* ☐

3.3 Functional History:

Type	Date	Category

Recording Organization / Individual:

Date of Compilation:

1/5

Figure-2a: Page 1 of the CDIF including primary data on the building/ site/ urban element.

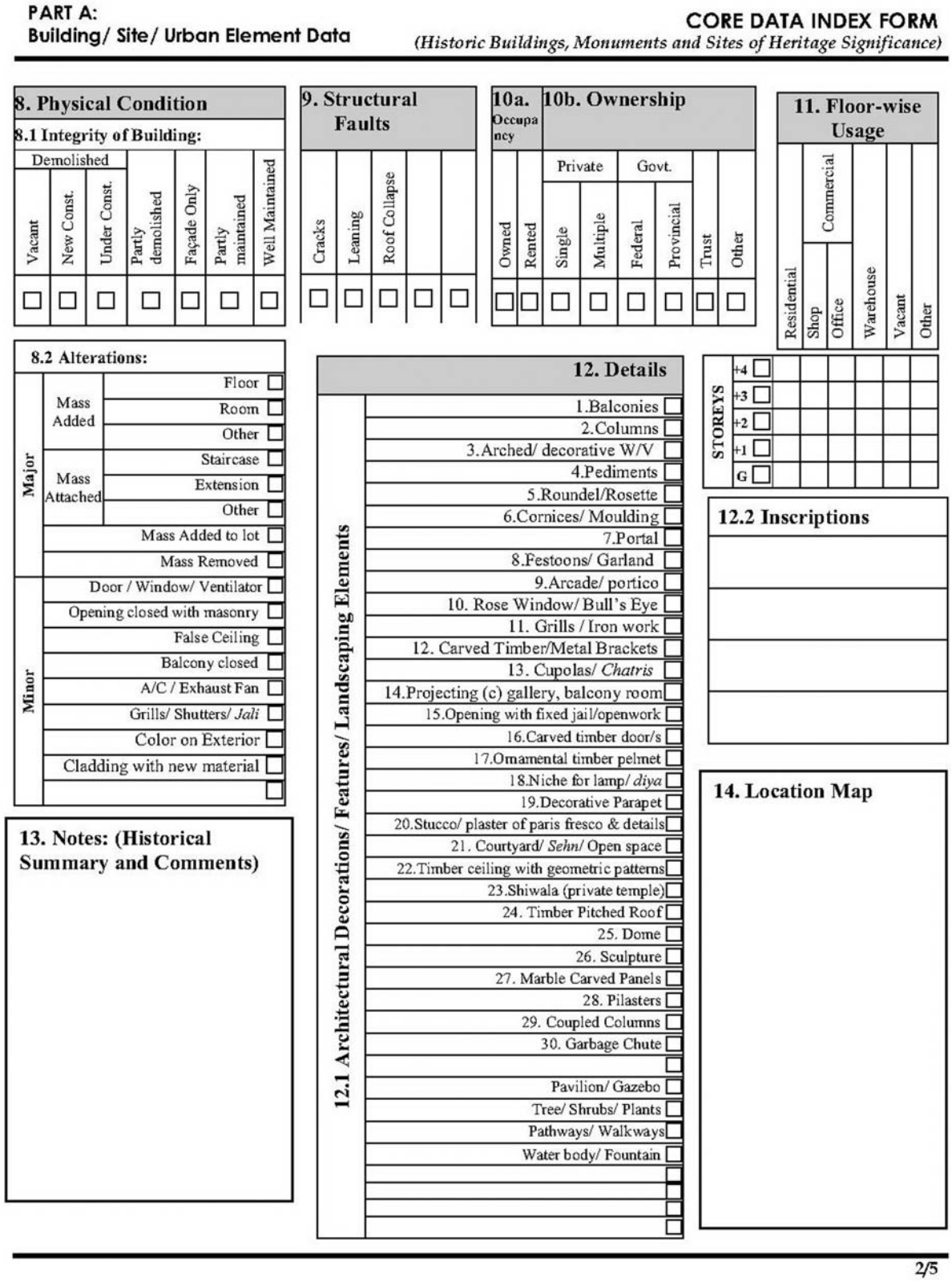

Figure-2b: Page 2 of the CDIF including architectural details of building/ site/ urban element.

15. Analysis of Value

15.1 Parameters for Merit	
This includes the aesthetic merits of any property in terms of its; (10pts) ☐ **external architectural features, including decorations etc.** (10pts) ☐ **representative of typical or unique plan typology** (10pts) ☐ **evidence of unique craftsmanship** (10pts) ☐ **record of variation in construction materials and building technology**	**i. Architectural Interest**
Open spaces and natural sites that; (10pts) ☐ **emerged as an expression of the urban cultural patterns** (10pts) ☐ **contribute in maintaining an ecological balance on an environmental level**	**ii. Environmental/ Natural Asset**
This particular parameter helps in identifying the historic value in terms of; (10pts) ☐ **representative social, cultural and economic values** (10pts) ☐ **representative military history** (10pts) ☐ **innovation in technological and engineering contributions**	**iii. Historic Interest**
Association of any property with; (20pts) ☐ **an important national/ local personality** (20pts) ☐ **link with an important historic event** (20pts) ☐ **being first of its type, tradition, technology, etc.**	**iv. Historical Association**
Involves inclusion of properties which themselves do not have much architectural character or historical importance but; (10pts) ☐ **contribute to the group value of an area or cluster**	**v. Group Value**
(20pts) ☐ **Landmark Value** (10pts) ☐ **Public eminence/ Significance** (20pts) ☐ **Rare survivor and expression of cultural/ construction tradition** (20pts) ☐ **Unique urban element or building type**	**vi. Other**

15.2 Locational Value	
A. Property having **Independent Compound**	
with **Public** Open Spaces, Visible from main road	☐(20pts)
with **Private** Open Spaces, visible from main road	☐(15pts)
with **Public** Open Spaces, not seen from road	☐(15pts)
with **Private** Open Spaces, not seen from road	☐(10pts)
B. Property with **Facades on Streets/ Roads**	
Corner Plot with **Three Facades** on St. & Main Rd.	☐ (20pts)
Corner Plot with **Two Facades** on Main Roads/ Streets	☐(18pts)
Corner Plot with **Two/ Three Facades** on Streets	☐(10pts)
Sandwiched Plot with **Two/ Three Facades** on St./ Main Rd	☐(18pts)
Sandwiched Plot with **One Facade** on Main Road	☐(15pts)
Sandwiched Plot with **One Facades** on Street	☐(10pts)
Sandwiched/ Corner plot **inside dead-end** street	☐ (8pts)
C. Remotely Located on the **Outskirts of City** with Access from Secondary Roads	☐(20pts)

☐**1st Degree Value (150 – up to 90 points)**		☐**3rd Degree Value (below 69 – up to 50 points)**	
☐**2nd Degree Value (below 89 – up to 70 points)**		☐**4th Degree Value (below 49 – up to 20 points)**	

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Figure-2c: Page 3 of the CDIF including analytical information on the building/ site/ urban element.

PART B: Resident/ User Data

CORE DATA INDEX FORM
(Historic Buildings and Monuments of Architectural Heritage)

Number of Resident/ User's Units:	
Number of portions or separate resident/ user units in the building;	
	Name of Key Person
1.	
2.	
3.	
4.	

Building Name and Reference:	
Name of Building:	
Reference ID:	

Note: *Part B of the Core Data Index Form will be filed separately and stored in a secure storage.*
A separate Sheet of Resident/ User Data will be filled for each family/ user unit listed for any building.

Socio-economic Data of _____ 's Family:

1. Family Type	**Extended**	**Parents & Married sons/ daughters** ☐
		Married brothers/ sisters ☐
	Nucleus	**Only parents & unmarried children** ☐

2. Religious Affiliation	**Hinduism** ☐	**Other** ☐	**Mention Below**
	Islam ☐		
	Christianity ☐		

3. Details of Resident Family Members:

	Name	Age					Sex (F/M)	Relation to Key Person	Profession/ Education	Marital Status
		0-15	16-25	26-44	45-69	70+				
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

4. Visiting Family Members:

Do you have family members who live in other cities, but visit occasionally for short durations?	YES	☐	**How many?**	
			Where from?	
	NO	☐	**How often?**	
			Duration of stay?	

5. Association with the Place	**5a. How many generations of the family has lived here?**	
	5b. How long have you been living in this house?	
	5c. How long have you been living in this city?	
	5d. If from another place, where from?	

4/5

Figure-2d: Page 4 of the CDIF including basic data on the resident/ user.

6. Occupancy Terms				
Rented	Owned	Pugree	Caretaker	Other
☐	☐	☐	☐	☐

6.1 If resident is a caretaker;	
a. Where does the owner live?	
b. How frequently does the family visit here?	
c. What is the duration of visits?	
d. What is the frequency of visits?	
e. What time of the year do they visit?	

7. Other Property	7a. Do you have any other property in the city?	YES ☐ NO ☐	7b. Do you have any other property in the elsewhere?	YES ☐ NO ☐

8. Family Income	8a. Number of earning members in the family?		8b. What is the approximate monthly income?	5000 – 15000+ / 20,000 – 50,000+ / Above 100,000

9. Mode of Transportation Used for Commuting to;

		Private Car	Motor Cycle	Bicycle	Bus	Walk	Taxi/ Rickshaw	Other
1.	Work							
2.	School/ College							
3.	Grocery/ Shopping							
4.	Visiting family/ friends							
5.	Recreation/ Leisure							
6.	Prayer/ Worship							

10. General Questions		
	10a. How would you ratify your relationship with neighbors?	Very cordial ☐ Just acquaintance ☐ Do not like to interact ☐
	10b. Do you feel any security concerns in the city or neighborhood?	
	10c. Where do you prefer to go for leisure/ recreational activities with family?	
	10d. Would you like to identify any problems vis-à-vis living in this house?	
	10e. What are your future plans for this property?	
	10f. Do you feel this building has any value as a national/ city's heritage and history?	
	10g. How frequently do you get repairs/ renovations done in the building?	
	10h. What do you like the most about this place?	

Figure-2e: Page 5 of the CDIF including basic data on the residents/ users.

vi. Industrial
vii. Agricultural
viii. Military
ix. Residential
x. Open spaces/ Natural sites
xi. Urban elements

Each of the eleven function-based broader categories include a range of uses from which exact original use of property (if known) is noted either by selecting from listed options or adding in the list as a new finding (Figure 2a). The change in function over the properties' life span is docmented in 3.3 as a record of functional history which would also indicate the changes in ownership, if any.

4. **Dating** includes exact date of construction, if known through an inscription or published/ official documents or administrative record. If unknown, properties can be broadly dated under a specific period style based on analysis of architectural vocabulary and detailing. Where such classifications do not exist, inventory data itself can become a source for developing categories of stylistic trends existing in specific study area.

5. **Associated persons/ organizations** includes information on the architect/ designer, builder, patron, and/ or association with any personality of national significance known through historic documents and publications.

6. **Materials/ Construction**

6.1 ***Building materials*** includes data on materials used in construction, particularly for the main elements like walls, roof, floor and ceiling.

6.2 ***Structural System*** identifies the type of construction through three pre-defined systems - load bearing, timber frame and reinforced cement concrete (R.C.C). Other types or combination systems observed can be added as a finding of field research.

7. **Legal protection** includes designation through either national or international legislative support system, such as UNESCO - World Heritage List, World Monuments Fund Watch List or Federal/ Provincial listing of protected properties.

8. **Physical condition** records the present state and structural integrity.

8.1 ***Integrity of building*** includes following pre-defined categories:

- **Demolished** buildings with further classification regarding present state on plot, i.e. vacant, under construction or new construction (source of information on buildings no longer existing is either through historic maps, gazetteers, books, old photographs or previous listing).
- **Partially demolished** buildings include those having a collapsed portion of building façade, or partly/ completely collapsed roof or upper floor.
- **Façade only** identifies buildings having only their external shell still intact; entire interior being completely demolished/ collapsed.
- **Highly deteriorated** buildings include structurally intact properties, but having a high degree of disintegrated architectural elements (including missing door/ window shutters, carving panels, timber/ stone decorations), or having suffered various forms of vandalism.
- **Partly maintained** buildings include those existing in a livable condition, but having undergone changes affecting their external appearance, either due to haphazard alterations or lack of regular maintenance and repair works.
- **Well maintained** buildings having a homogenous outer appearance, with no alterations that damage or deface the external façades.

8.2 Alterations are categorized under two main groups:

- **Major alterations** include the following subgroups:
  Mass added (i.e. floor, room or any other structural mass added to the building - directly adding dead loads on the existing structural system).
  Mass attached (a staircase, an extension or other such additions - adding transverse loads to the existing structural system).
  Mass added on the lot i.e. added structures on the plot's open spaces; not having any impact on the structural system but only affects built-up/ open area ratios, and the overall profile of site, especially if such additions have massive proportions.
  Mass removed i.e. any parts or portions that have been removed or demolished; their prior existence being identifiable only through either the layout or traces on site or known through old photographs.
- **Minor alterations** include a range of changes in material finishes and/ or architectural features (eg. original design or materials of doors, windows, balconies, or addition of air-conditioning units/ exhaust fans, or addition of grills/ shutters/ *jalis*, change in original external color, external cladding with new materials such as tiles or cement plaster).

A broad analysis of the variety of alterations observed

indicates that these have been in response to changing needs and requirements of residents – who in the absence of effective regulatory systems and technical support for historic buildings implement the required changes according to their available means and understanding. The range of changes coming under the category of 'major alternations' include, additional floors and rooms or extensions. Changes coming under 'minor alterations' are mostly related to maintenance and repair resulting in tempering with original materials (particularly mortars and plasters); which are often removed and replaced with cement. A third category of alterations is linked to the desired improvement of service spaces by the users; including plumbing, electrical and airconditioning fixtures. The inappropriateness of these is basically due to a lack of sensitivity towards the original fabric and an absence of good practice examples to serve as role models. All alterations change the buildings' external appearance; mostly having a negative and defacing impact. Some may be reversible, but more often alterations are permanent and impossible to revert without further damage to the structure. Where alterations are well planned, positively contributing to the buildings' development phases they must be considered important and thus retained in restoration proposals. Detailed analysis of alterations however, is required at the stage of conservation/ restoration interventions; thus not considered within the scope of inventory process.

9. **Structural faults** include cracks, leaning, roof collapse and other noticeable structural deformities.

10. **Ownership**, grouped under three main categories includes:
- Private (subgrouped as either single or multiple)
- Government (subgrouped as either provincial or federal)
- Trust (including religious, community based or charitable trusts).

11. **Use by floor** includes information on usage for each floor including the combination of uses and extent of usage. This latter aspect is an important indicator for identifying the percentage of vacant properties, and their state of maintenance. Pre-listed usages in CDIF include residential, commercial (shops, offices), warehouse, vacant; those in addition, can be listed under 'other'.

12. **Details**
- **Architectural decorations/ features/ landscaping elements** include external architectural features of buildings, and enhancing landscaping elements in case of open space. This is an open-ended data field provided with only a preliminary list of common features and blank spaces to include new elements identified through field research. Data collected through this process has the potential to be developed into a thesaurus of local terminology in cases where such information does not pre-exist.
- **Inscriptions** on buildings having informative text on property; recorded through detailed photography.

13. **Notes** include descriptive summary on important historical developments or other relevant observations reflecting on the significance or history of the property, gained through local oral sources.

14. **Location map** marking the property within the block or immediate streets, with road names and demarcation of specific plot boundary.

15. **Analysis of value** gives an evaluation on each property determining its place in one of the four value based groups through a numeric calculation system and in addition, identifying its specific 'parameters of merit'. This analytical output provides an understanding for the potential and value of the listed property, clarifying the reason for listing and pinpointing the aspects to be safeguarded. The numeric calculation for values has a 10 point base system (taken up for ease of calculation); each property's total value is a sum of total points it collects under the 'parameters of merit' and the 'locational value' (Figure 2c). Based on the results of this analysis each property is assigned a degree of value group.

15.1 Parameters of merit are listed under six main groups:

i. **Architectural interest** includes four aspects:

External architectural features including decorations, ornamentation and details, that contribute towards the character and quality of the urban fabric. Interior features of value vis-à-vis traditional interior decorations are not taken into consideration as these remain beyond the scope of urban ensembles, the only exception being the courtyard/ *sehn*, as it is identifiable from outside due to a low wall or placement of building mass on the plot parcel which, in turn, contributes to the streetscape.

Plan typology includes buildings having 'unique' or 'typical' traditional plans, having particular relationship between plot-parcel, street and building masses; either

repeating in a distinctive pattern, or unique and of interest as an exceptional case. Buildings considered have minimum or no alterations in terms of additions or removals. This data is based on a rough idea on plan typology gained from external observations - studying the relationship of the plot parcel with building mass, its proportions and placement, and the street.Where defined typology for traditional buildings does not pre-exist, the data collected can help develop typological classifications for specific case studies.

Unique craftsmanship includes buildings using traditional materials and crafts, such as elaborate carvings on stone, timber, brick, wrought/ cast iron details, timber screens, stucco decorations, traditional tile work, sculpture, representing high quality contributions of master craftsmen. This aspect has a qualitative judgment, as similar features of lower degree craftsmanship are not considered.

Record of variation in construction materials and **building technology** includes properties having traditional construction materials, no longer in common use for new constructions. Examples showing unique or innovative building technology are also included for this value.

ii. **Environmental/ Natural asset** includes features/ elements contributing to the character or setting of a place (such as riverbanks, canals, agricultural fields, water reservoir, grazing fields, parks, public gardens, urban squares); these are listed under two subgroups:

Open spaces having emerged as an **expression of the urban cultural pattern** including congregation spaces for special occasions/ festivals, informal open areas of social interaction within a neighborhood, public squares or piazzas, promenades, and other similar features.

Open spaces that **contribute to the ecology** of the area or contribute towards its **environmental quality**; these include natural reserves, woodlands, marshlands, orchards, agricultural fields, irrigation canals and other similar features.

iii. **Historic interest** includes three aspects: **Social, cultural and economic values** represented by almost all historic buildings built in a particular time. If continuously in use, they reflect upon changes taking place with time, in trends for use, materials, forms of decoration, etc., indicating socio-economic and cultural transformations in the society, its living traditions and its growth or degeneration.

Military history represented by places that might have lost their original use, but still exist either as redundant or reused properties.

Innovation in technology or engineering includes extraordinary works or examples having brought a breakthrough in existing practices, introducing new developments or daring experimentation (eg. works of extraordinary engineering, use of new construction technology, innovative use of old or new building materials). Modern icons of change in architectural trends are also considered.

iv. **Historical association** of property or place with: **Important personality** being a residence, birth place, place of death, or place of any other important incident in the life of a national or local hero.

An event considered as part of the nations' historical development or in the case of local history a major event given importance in the history of that particular place; or **first of its type, tradition or technology** contributing towards making of local or national history, having especial significance in historical developments of a particular trend, in regional or local context.

v. **Group value** identifying properties not having sigular importance but contribute towards the overall character of the urban fabric, in terms of scale, proportions and essence of the historic area as a group or a cluster.

vi. **Other** additional aspects of merit enhancing value or significance of any property include: **landmark value** of well know building or place, **public eminence** of an amenity building, or a **rare surviving example** of a past tradition, or a **unique building type**. This is an open ended field allowing inclusion of new discoveries or unknown aspects of places. Through this exceptional additional quality the total numeric value is enhanced, thus systematically elevating the property to a higher degree value group.

15.2 Locational value evaluates the property's placement in the context of city's circulation, based on its contribution to the fabric in terms of visibility and accessibility. The pattern of urban fabric and its circulation layout/ hierarchy influences or impacts the

perception of visitors and users; thus it is relevant to how a city is read. Sub-categories developed for this aspect are based on classification, firstly on basis of plot-parcels and then on street patterns and the massing/ placement of built up areas on the plot. Three main categories identified here include:

A. **Properties having an independent compound** with one or more structures. The given value is based on visual permeability and level of public access to the open spaces within the compound. Public access spaces have higher numeric value than those for private use only. Similarly the visibility of structure/ open spaces from the street or main road is considered as a higher contributor to the urban fabric than those enclosed within high and visibly impermeable walls.

B. **Properties with façades on streets/ roads** having the same plot line and building line. Values assigned are based on the number of façade/s contributing directly to the street/ road. Properties on corner location with three façades are given highest value, followed by those with two, and lastly one façade on street/ roads. Furthermore, city level circulation hierarchy is the other determinant, with buildings placed on main roads being more visible, given a higher value than those located on secondary streets.

C. **Properties located on the outskirts or periphery of the city** or outside historic quarters including isolated monuments or places of historic significance, such as historic graveyards, shrines, tombs, caravanserais, mostly located near the highways or main approach roads or accessible through secondary roads. These, being important and well known landmarks, are given a higher degree value as they serve as anchor points to the city's periphery.

Part 'B' Resident/ User:

Socio-economic data, not recommended in international 'core data' standards, but advisable for inclusion in the inventory process if the eventual objective of documentation is its use as a resource for development of proposals and guidelines to initiate economic revival and urban regeneration in historic towns. Socio-economic data can provide useful insight on societal dynamics, and help in guiding policy formulation for the betterment of assoiciated communities. However, its dynamic nature makes it useful only if recorded at a time when possible implementation of planning policies is being considered. Part B of CDIF is designed to record basic and generalized data on residents and users; their level of association and attachment with the property and the city (Figure 2d, 2e). The collected data provides an understanding on daily life patterns, educational/ professional background, religious affiliations, and level of interaction or integration within the community. This part is useful only for policy making stages, thus proposed not to be made part of the inventory form and also not discussed in detail here.

INVENTORY FORM

The core data on listed properties collected through field survey process, after being compiled as a database is finally converted into a catalogue of inventory forms for all listed properties, complete with key maps identifying location of each enlistment and giving an overall contextual understanding of the entire city and its environs. The document is produced using MS Access software; the final layout of inventory form being designed on a single A4 page giving comprehensive information related to a particular property including pictures and a location map, along with analytical information enabling the understanding for significance and values attached to specific case. In response to the need for creating a wider understanding and awareness regarding listed properties the format of developed inventory form is kept simple and user friendly, so that the document (if published and disseminated for public access) can serve as a guide and manual for managers, decision makers, researchers or others wishing to gain knowledge of the listed heritage. Giving regard to a difference in character of the two case study towns the final layout also incorporates slight variations, enhancing case specific characteristics and requirements. In forms used for Karachi (Figure 3a, 3b, 3c, 3d), a street montage/ profile is given at the bottom, whereas for Shikarpoor (Figure 4a, 4b, 4c, 4d) this space was utilized for adding more photographs of details as the photography constraints due to narrow and winding street pattern in the city, made it practically impossible to develop any montages or street profiles.

INVENTORY FORM FOR HERITAGE PROPERTY

NED Ref. No:	**DAP-NED/000174**
H.F Register Ref. No:	**KAR/MAR/005**
Name of Building:	**Max Denso Hall & Library**
Complete Address:	**MR-1/ 152, M. A. Jinnah (Bunder) Road, Marriott Road**
Date of Construction:	1886
Enlistment No:	1995 -176 1997 -094
Ownership:	Government (Provincial)
Building Type:	Civic Amenity
Present Status:	Well Maintained
Occupancy:	Owned
Alterations:	Minor
Building Height:	G+1
Threat Level:	Good State of Condition
Architectural Features:	Roundals, Arches, Balconies, Cornices/ Molding, Decorative Parapet, Rosette,

Parameters for Merit:

- (10pts) external architectural features, including decorations, etc.
- (10pts) representative of typical or unique plan typology.
- (10pts) evidence of unique craftsmanship.
- (10pts) record of variation in construction materials and building technology.
- (10pts) representative of social, cultural and economic values.
- (10pts) contributes to the group value of an area or cluster.
- (20pts) landmark value.
- (10pts) public eminence/ significance.
- (20pts) corner plot with three facades on street/ main road.

Degree of Value	Usage
1 st Degree (110 pts)	Ground Floor: Commercial First Floor: Commercial Second Floor: – Third Floor: – Fourth Floor: –
Location and GPS Coordinates	

Location Map

Photos of Details

Photo / Montage Indicating Streetscape Setting:

MARKET QUARTER

SEPTEMBER 2007

Figure-3a: Sample of Karachi Inventory Form.

INVENTORY FORM FOR HERITAGE PROPERTY

NED Ref. No:	**DAP-NED/000307**
H.F Register Ref. No:	**KAR/MAR/024**
Name of Building:	**Mohsin Ali Building**
Complete Address:	**MR-1/ 142/ 1, M. A. Jinnah (Bunder) Road**
Date of Construction:	1930
Enlistment No:	1997 -113
Ownership:	Private (Single)
Building Type:	Commercial
Present Status:	Partially Maintained
Occupancy:	Owned
Alterations:	Minor, Major
Building Height:	G+2 +1
Threat Level:	High Degree Threat
Architectural Features:	Arches, Pilaster, Cornices/ Moldings, Decorative Parapet

Parameters for Merit:

- (10pts) external architectural features, including decorations, etc.
- (10pts) representative of typical or unique plan typology.
- (10pts) evidence of unique craftsmanship.
- (10pts) record of variation in construction materials and building technology.
- (10pts) representative of social, cultural and economic values.
- (10pts) contributes to the group value of an area or cluster.
- (15pts) sandwiched plot with one facade on main road.

Degree of Value	Usage
2nd Degree (75 pts)	Ground Floor: Commercial
Location and GPS Coordinates	First Floor: Vacant
	Second Floor: Vacant
	Third Floor: —
	Fourth Floor: —

Location Map

Photos of Details

Photo / Montage Indicating Streetscape Setting:

MARKET QUARTER

SEPTEMBER 2007

Figure-3b: Sample of Karachi Inventory Form.

INVENTORY FORM FOR HERITAGE PROPERTY

Parameters for Merit:

- (10pts) external architectural features, including decorations, etc.
- (10pts) record of variation in construction materials and building technology.
- (10pts) representative of social, cultural and economic values.
- (10pts) contributes to the group value of an area or cluster.
- (20pts) corner plot with three facades on street/ main road.

NED Ref. No:	**DAP-NED/000312**
H.F Register Ref. No:	**KAR/MAR/029**
Name of Building:	**Rehan Building**
Complete Address:	**MR-2/ 13, Ram Bharti Street, Marriott Road, Fakhr matri (Newnham) Road**
Date of Construction:	—
Enlistment No:	1997 -118
Ownership:	Private (Single)
Building Type:	Commercial, Residential
Present Status:	Partially Maintained
Occupancy:	Owned
Alterations:	Minor, Major
Building Height:	G+2
Threat Level:	Second Degree Threat
Architectural Features:	Arches, Cornices/ Moldings, Pilaster, Timber Pitched Roof, Bossed Stone Masonry, Courtyard

Degree of Value	Usage
3rd Degree (60 pts)	Ground Floor: Commercial First Floor: Warehouse Second Floor: Vacant Third Floor: — Fourth Floor: —
Location and GPS Coordinates	

Location Map

Photos of Details

Photo / Montage Indicating Streetscape Setting:

MARKET QUARTER

SEPTEMBER 2007

Figure-3c: Sample of Karachi Inventory Form.

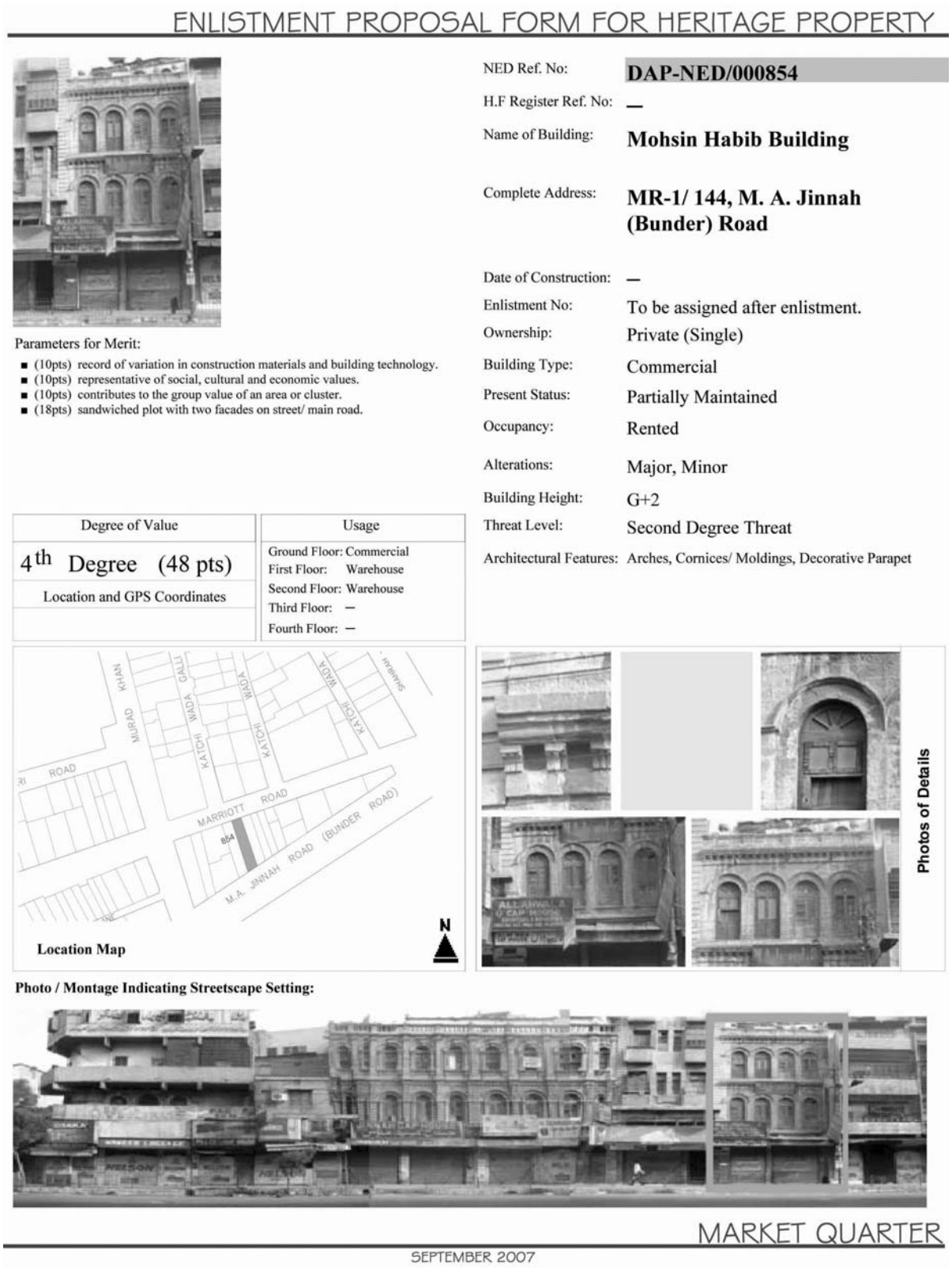

Figure-3d: Sample of Karachi Inventory Form.

Figure-4a: Samples of buildings from Karachi in the four groups of 'Degree of Value'.

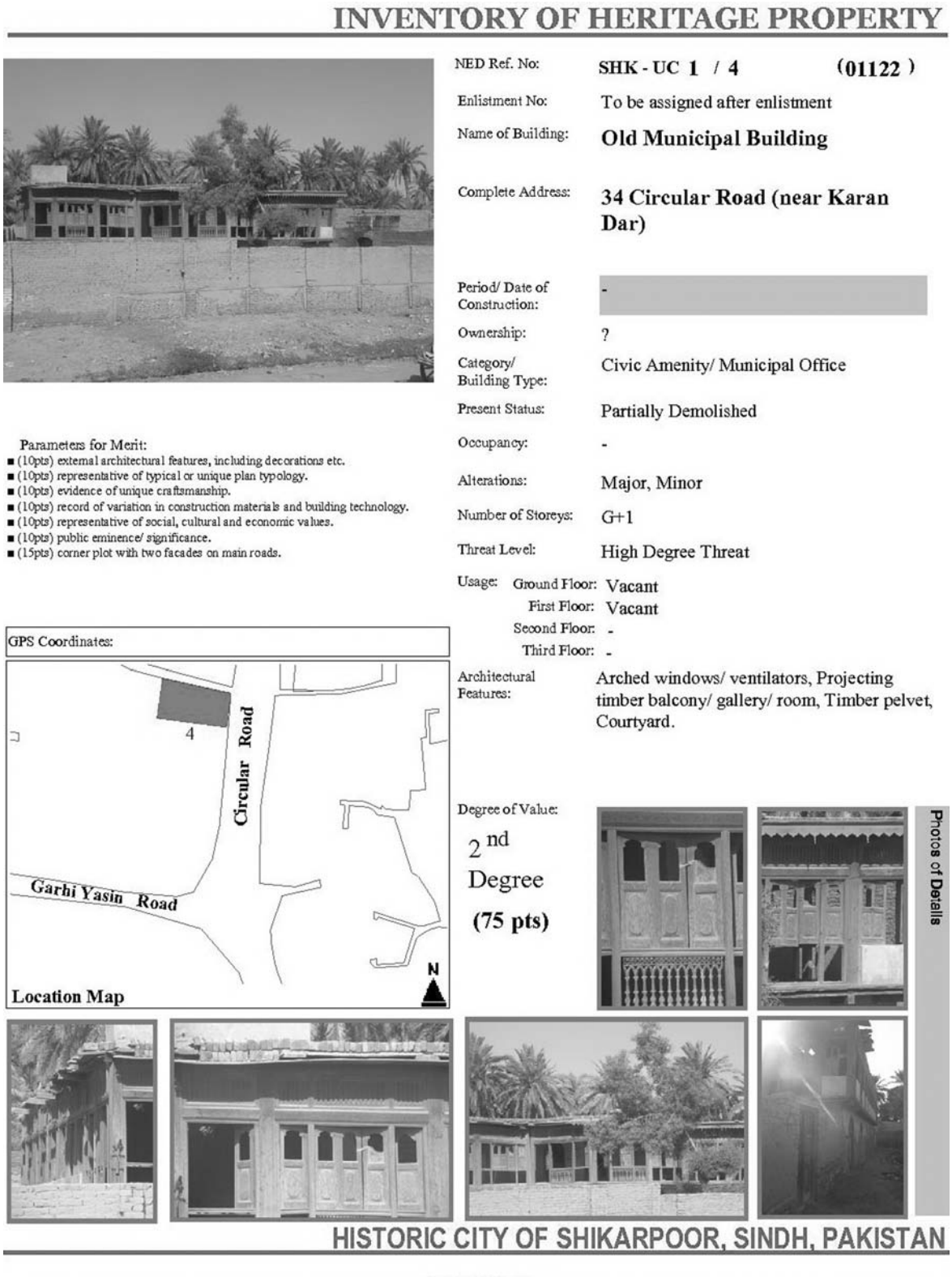

Figure-4b: Samples of buildings from Karachi in the four groups of 'Degree of Value'.

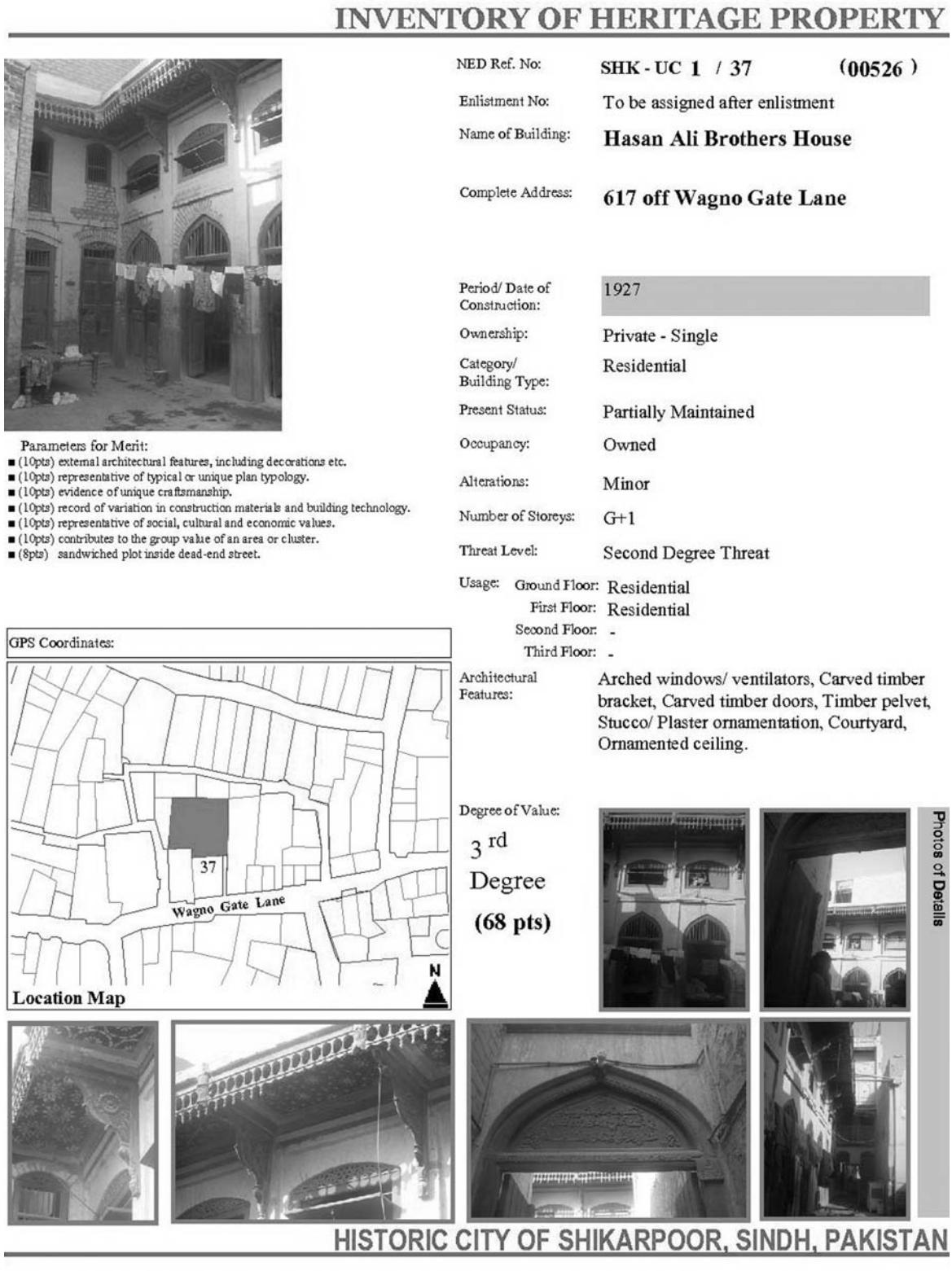

Figure-4c: Samples of buildings from Karachi in the four groups of 'Degree of Value'.

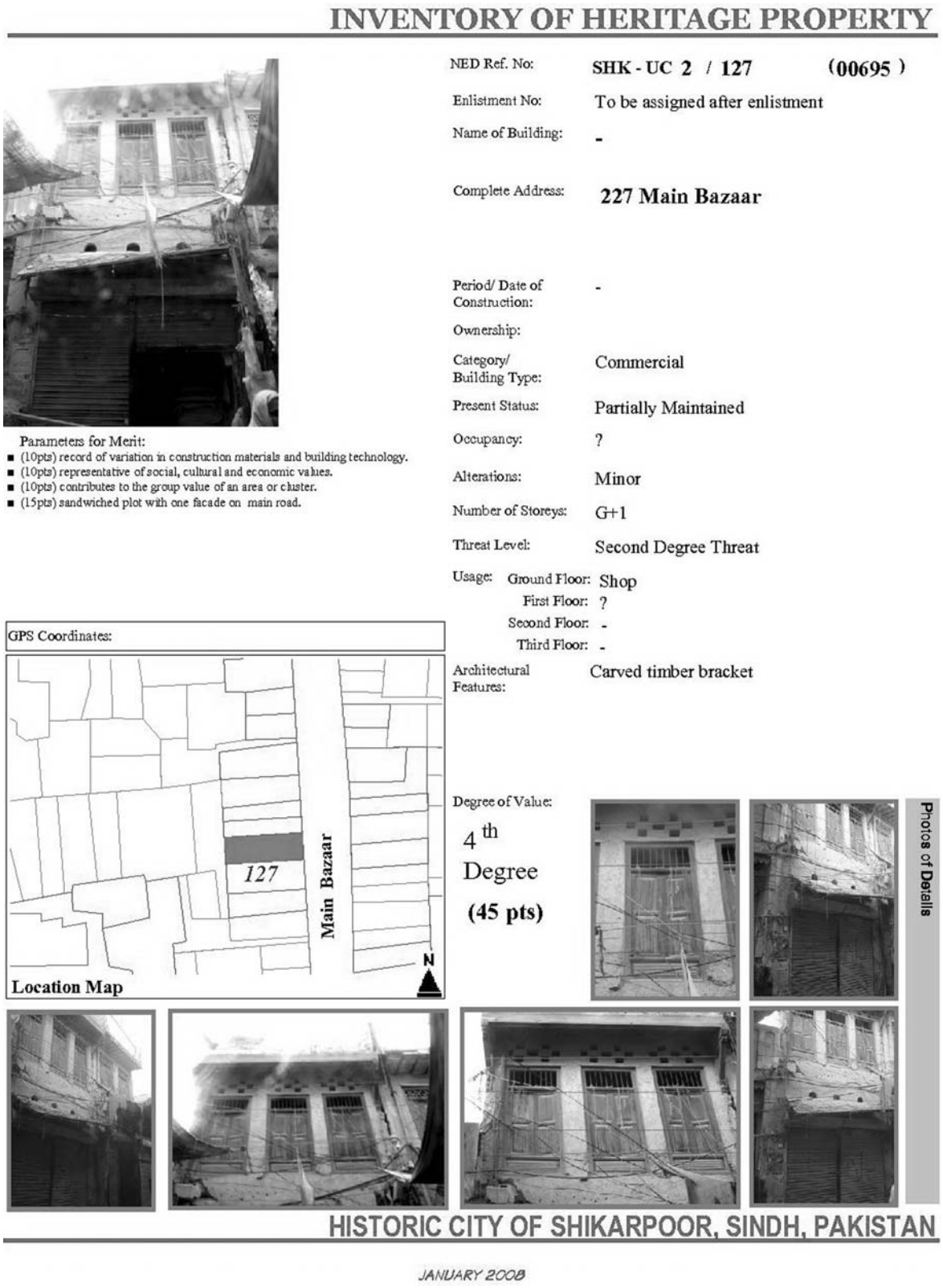

Figure-4d: Samples of buildings from Karachi in the four groups of 'Degree of Value'.

In addition to the basic information on specific properties there are two important outputs resulting from analysis stage, and included in the final inventory form. These data fields are the value based grouping and threat level:

- **Value based grouping**

Inventories carried out on city/ town or national/ regional level, include large numbers of buildings or sites, which should be graded according to their degree of significance for convenience of management. The method developed through this research uses parameters of merit for evaluation and defining value based grouping for each property. The numeric value points are divided into four value based groups:

- 1^{st} Degree Value (90 -150 points)
- 2^{nd} Degree Value (70 – 89 points)
- 3^{rd} Degree Value (50 – 69 points)
- 4^{th} Degree Value (20 – 49 points)

Through this value-based grouping similar properties in terms of architectural quality and significance value group together (Figure 5); each group has a specified range of value points, but each property within can have differing set of merit parameters. The method of property analysis developed in the CDIF (field 15) allows for an enhanced evaluatin of each property rather than restrictive pre-formed and generalized groups. This value driven analytical method allows for an indepth understanding of property values, making the inventory a self explanatory tool for professionals, managers, administrators and others associated with individual property to understand its essence and take decisions accordingly, not compromising on the individuality of each case.

The graded grouping can facilitate development of general guidelines, rules and policies for management and conservation, separately for specific group, including incentives for property owners, encouraging better maintenance and guidelines on extent of allowable changes inside/ outside/ around the buildings. For higher degree value groups more restrictive regulations on changes and repairs should be formulated, whereas for lower degree value groups these can be more flexible.

- **Threat level**

Through an analytical correlation of data defining present usage and physical condition, the threat level to each property is determined. All enlisted properties are classified under three groups; high degree threat, second degree threat and good state of condition.

High degree threat includes buildings that are fifty percent or more vacant, and/ or have 'partially demolished', 'façade only' or 'highly deteriorated' physical condition; thus they are identified as requiring urgent attention and immediate preventive measures.

Second degree threat group includes partially maintained properties.

Good state of condition identifies well maintained properties.

Through the identified value based groups and threat level, priorities for financial support and urgency of action for focused conservation works can be established, especially for properties in higher degree value group and under high degree threat.

USAGE OF INVENTORY CATALOGUE

The practical applicability and usability of inventory document was tested with concerned government departments in Karachi where an administrative structure already exists for monitoring of the listed heritage. A research project 'Karachi Historic Buildings Re-survey 2006-2009', has been initiated by Department of Architecture and Planning, NED University in collaboration with the Department of Culture[3], Government of Sindh. At conclusion of first phase of this project, inventory documents for nineteen previously listed historic quarters were produced which are now being used by the heritage monitoring/ advisory committee as a source of reference to facilitate decision making on listed buildings. In Shikarpoor, however, a lack of existing administrative unit responsible for heritage management makes practical applicability more challenging. The university however, intends to submit the compiled documentation to aquire official listing status for the identified properties, and further liase with local city government for implementation of measures for protection.

3 Within the provincial government set-up the Department of Culture, GoS, working under the Culture Ministry, has the responsibility of dealing with issues of historic properties in Sindh and implementing the Sindh Cultural Heritage Preservation Act 1994. In Karachi this department receives support from the Karachi Building Control Authority for monitoring and regulating listed properties.

CONCLUSIONS

Undertaking heritage inventory listings at a regional or national level is a work of large magnitude, incorporating within its scope a diverse range and variety; thus it cannot be achieved without collaboration of different local organizations. Developing a replicable method for inventory and heritage recording being the main objective of this research, the focus has been on defining with clarity the established criteria and the analysis process for assigning values to listed properties, thus ensuring consistency in results. The method recognizes a need for flexibility to incorporate changes as the process matures and expands to different cities and regions, allowing adaptation to case specific requirements and modifications. However, these must remain within defined parameters, structure and format to maintain standardization and compatibility, allowing gradual building-up of national database and exchange of information between different organizations.

The main strength of the method is its use of existing information as a base (literature review of secondary sources, existing listings, maps, survey sheets, satellite images) and building upon whatever is available, through a largely inductive approach – depending on field data and updated information of on-site conditions in conjunction with socio-cultural and economic aspects, based on which the whole analytical process is structured. The systematic documentation method takes into account different components of the built fabric, including buildings, open spaces and other urban elements. This combined with an understanding gained through literature review on history of the place, enables envisioning the entire city in a holistic manner; from identification of its historical developments and growth to the various period contributions and influences, as well as the changes that occurred due to socio-economic and political transformations.

The value driven analytical part added in CDIF and inventory form facilitates in understanding exact parameters of merit and values for each property identifying the reasons for listing. In addition the parameter of 'locational value' and its detailed sub-categories is an important contribution of this research. The hierarchical value system for properties in respect to their place or location in the urban context was developed to correspond with the central focus of this research on urban ensembles and their contribution to the overall environment and character of the built fabric, as envisioned in the public realm. Through this systematic sieving process for grading, the listed properties classified into four value based groups allow dealing with each group with a different level of regulations, monitoring or policy making initiatives, at conservation planning stages. The method also incorporates flexibility to allow adding new discoveries through the research process, capturing regional diversity and enriching the research outcomes through an ongoing process. This particular approach was adopted to overcome the gap in existing knowledge on historic environments in the case study region of Sindh. The benefit gained from a directional, self guiding and self explanatory format of the inventory process and its final output is that professionals, administrators and other users or beneficiaries would be able to understand the essence of the exercise and be able to take initiatives without entirely depending on experts in the field, overcoming to a certain degree the hurdles faced due to a lack of trained heritage conservation professionals presently working in the region, where the few involved organizations or institutions have to train their staff while on job.

REFERENCES

CoE (2001) "Guidance on Inventory and Documentation of the Cultural Heritage", Strasbourg, Council of Europe Publishing.

ICOMOS (1987) "Washington Charter on Historic Towns and Urban Areas", www.icomos.org.

ICOMOS (1996) "Principles for the Recording of Monuments, Groups of Buildings and Sites", www.icomos.org.

INSALL, D., Morris, C. (1986) "Conservation in Chester: Chester City Council Conservation Review Study", Chester, Chester City Council.

JAMIESON, W. (1990) "Recording the Historic Urban Environment: A New Challenge". Bulletin of the Associate for Preservation Technology, 22 (1), pp.12-16.

ORBASLI, A. (2008) "Architectural Conservation: Principles and Practice", Oxford, Blackwell Science Ltd.

STOVEL, H. (1990) "Heritage Recording: Growth of a Profession" Bulletin of the Associate for Preservation Technology, 22(1), pp.5-8.

INVENTORY OF HISTORIC PLACES: A SYSTEMATIC METHOD FOR THEIR IDENTIFICATION, EVALUATION AND DETERMINING SIGNIFICANCE PART II: CASE STUDIES

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ABSTRACT

Systematic inventory and recording of historic places is an effective tool for facilitating good management and understanding of historic towns, cities and areas. This paper presents a method developed for inventory recording in the context of countries that are under resourced, and thus do not have effective management procedures for definition, protection and preservation of their heritage properties. The paper focuses on an inventory format designed as an outcome of a research undertaken in Sindh, the southeastern region of Pakistan, taking its historic towns as case studies. The research outcomes are presented in two parts: in the first part the inventory form was discussed in detail. This second part presents a comparison of two case study towns, having very different situations in terms of scale and management structure, where the developed method of heritage inventory was applied for documentation.

Key words**:** Heritage inventory, significance of historic places, Karachi, Shikarpoor, Sindh.

INTRODUCTION AND BACKGROUND

Systematic and methodical inventory documentation is a key to develop in-depth understanding for historic places - their significance, values and potentials. It is through comprehensive documentation that a holistic perspective on places can be achieved to guide a way for preservation, sustainable growth and economic viability (Lichfield, 1988; Burman, 1995; Pickard, 2002). Part I of this paper presented the method developed through a research undertaken in the context of Sindh, Pakistan, for systematic documentation of historic towns; a 'Core Data Index Form' (CDIF) discussed in detail in that part. This method for town scale inventory and documentation was pilot tested in a small area within the prime commercial zone of Karachi, and then applied through extensive field research to two historic towns of Sindh, Karachi and Shikarpoor, both having very different development patterns and characteristics of the built environment. This paper presents a comparison of the two case studies and discusses the potentials and constraints of the developed method in the light of experiences gained through inventory documentation undertaken in the two towns. The aim is to bring forth issues that require to be taken into account while dealing with disparate case studies, as the varying context may require flexible adaptation in spite of a standardized format.

METHODOLOGY

The developed method (as discussed in part I) includes several stages; a literature review of secondary sources to develop an understanding of the historical background of case study towns, focused primarily on identifying different periods of history, stages of development and period influences on built fabric; collection of available information including previous listings, maps, survey sheets; collection of updated field data through survey; analysis of data; and finally the identification of problems and causes of threat to historic places. For Karachi an existing listing of 581 protected heritage properties was taken as a starting point for preparation of the field survey, whereas for Shikarpoor only an official notification declaring the entire city as protected existed without any supportive listings to identify historic properties.

Data Compilation[1]

The field data collected through the standardized CDIF was compiled as an Excel database maintained as a master file including all available information on listed properties compiled together. The layout of database fields is designed to keep all building information clustered together and socio-economic information placed together. Pictures of properties are compiled separately, with identification numbers assigned

1 The choice of specific softwares mentioned here is due to their availability in the existing working environment at the researchers' base. However, in expansion of the process to national level where similar facilities do not exist, other possibilities of free software and web options for dissemination of information should be explored to make the compiled database more accessible and easily usable.

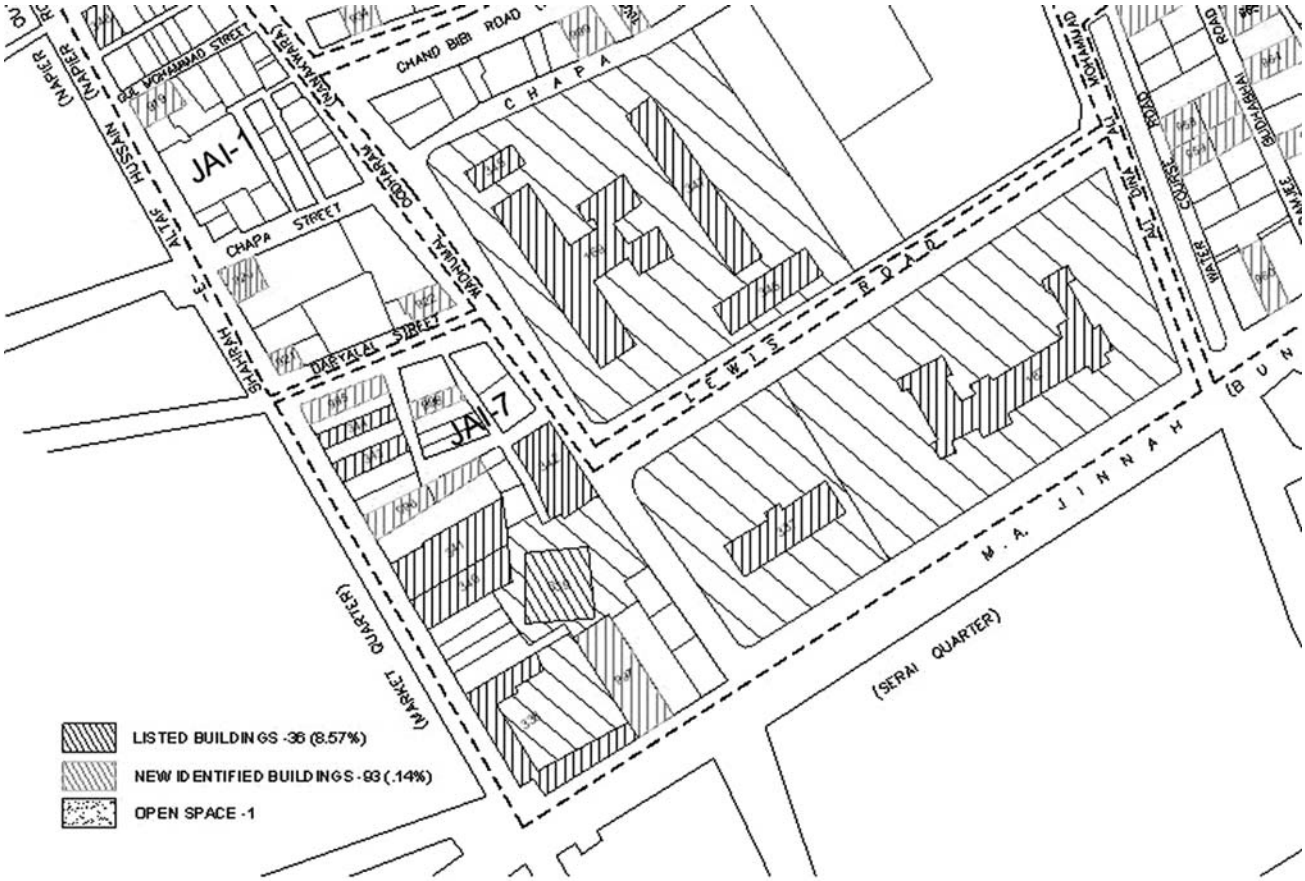

Figure-1: Sample for demarcating properties with more than one building on the same plot and open spaces around them.

according to the database entries. From Excel database the relevant fields required for final inventory layout are imported into Access, through which the inventory compilation is generated. The key maps are developed in AutoCAD, marking listed properties with their unique ID identified in the main database. For Karachi a distinction is made between previously listed and new identified properties through color coding. For properties having more than one building blocks and/or open spaces, the entire plot is marked and each listed building on the lot identified separately. Open spaces are hatched with thin and widely spaced lines, whereas the building blocks are hatched with thicker and dense lines (Figure 1).

THE CASE STUDY TOWNS: KARACHI AND SHIKARPOOR

Reference of Context and Comparison of Case Study Towns

Following is a comparison table for the two documented towns giving an idea of the differences existing between the selected case studies.

In terms of scale, representation of historical periods and the level of expansion, Karachi and Shikarpoor are not comparable. Differences between the two provided an opportunity to understand the variety of situations that can be experienced in the region. From the level of existing documentation and available information, to the system of administration and the character of the built fabric, variations may exist from case to case, requiring the method to have the capacity to adapt local situations. Following is a brief historical profile of the two cities to give an understanding on the difference in their background and historical contexts.

Karachi: Historical Background

Karachi's historic significance lies in being the oldest surviving sea port of Sindh that has remained functional due to a favorable geographic location. Karachi started to grow from a small fishing village called 'Kolaji-jo-Ghat' in the late 1720s and became an important trading port of Sindh

	KARACHI	SHIKARPOOR
History	Origins of urban history date back to 1720s but actual urbanization and expansion of the city started during colonial times dating 1840s. Today the expansion of city limits is almost 20 times beyond its colonial extents.	Founded in 1617 and by late 18^{th} century became one of the most important trade towns in Sindh; at a time in history even exceeding the capital (Hyderabad) in population. Expansion of city limits beyond walled city has not been too extensive, and its present municipality limits remain more or less the same as in colonial times.
Area/ Population	The area of Karachi has grown from (73.94 $miles^2$) 192km^2 with a population of 56,753 in 1870's to (1390 $miles^2$) 3600km^2 with a population of more than 15 million at present.	Shikarpoor has grown from a population of 38,107 in 1870s to a population of 1,34,883 in 1998. The area has increased from approximately 0.42km^2 of walled limits to 10km^2 at present.
Administration	Karachi being a metropolitan city, has a more complex organization than any other city or town in Sindh. Its Municipality comes under the City District Government (CDGK), whereas a separate development authority (KBCA/ KDA) controls building regulations and developments. In addition, there are independent organizations such as the various Cantonments and the Port Trust, having their own regulations applicable within their individual jurisdiction. For administrative purposes the city is presently divided into eighteen towns and six cantonments.	Shikarpoor is administered by the District Government and the Town Municipal Administration (TMA). For administrative purpose it is divided into eight union councils, which work under the district and town administration. The city is governed under the 'Sindh Local Government Ordinance of 2001'.
Documentation Available	▪ A list of 581 buildings notified as heritage properties, in nineteen historic quarters along with their location maps (HF, 1994; HF, 1996a; HF, 1996b; HF, 1996c; HF, 1996d; HF, 1996e). ▪ Detailed Survey Sheets, with plot numbers and demarcation of each plot. ▪ Satellite image of the entire city from Google Earth. ▪ Historic map of Karachi showing cantonment, city and the environs, dated 1869-70 (scale 6"= 1 mile). ▪ Map of Karachi's historic quarters from Baillie (1890). ▪ Karachi's development has been through a planned process, with several consecutive master plans, thus the growth pattern is very well documented.	▪ No formal listing available. However, a list was developed from buildings mentioned in the Gazetteers, and a list of 40 buildings attached as supplement to Cousens (1930) 'Antiquities of Sindh'. ▪ Combined Map of Shikarpoor 1915 (scale 200 ft. to an inch) (only a poor quality image available) ▪ Detailed survey sheets of Shikarpoor, undated (scale 1"=80') (covering only walled city area and some area on the east side where the British Cantonment was established) ▪ Survey Plan of Shikarpoor, 1986 (scale 1:10,000) ▪ No master plans for the city exist. ▪ The 'Historic City of Shikarpoor' has been notified in 1998 as protected under the Sindh Cultural Heritage Preservation Act 1994.
Nature of Historic Fabric/ Character of the City	Most of the historic quarters of Karachi are from the colonial period and the architecture and fabric strongly represents characteristics of that period. The buildings are mostly built in stone, except for those belonging to the 1940s and later periods, being RCC structures.	The form of the historic walled city is very well preserved, having construction in traditional architectural style, using timber, mud and brick. However, many new buildings have been built in recent years within the walled city limits, after demolition of old structures. The developments on the peripheral areas of the city are mostly of an informal nature, with isolated examples of buildings having architectural merit.

Table-1: Comparison between the two case study towns.

towards the end of 18th century, when a family of Hindu merchants facilitated its peaceful cession from the Khan of Khelat to the Talpur rulers of Sindh (Duarte, 1976). Several historians however, date Karachi's origin to even earlier times, associating it with 'Crocola' of the Greeks (Postans, 1843). Towards the end of 18th century Talpurs ordered construction of fortifications at the island of Manora, whereas the walled city enclosing an area of 35 acres developed separately on the mainland. Prior to British conquest, Karachi served as an outpost of Talpur Mirs, mainly functioning as a customs check post and harbor. Manora Fort was conquered (unopposed) by the British forces on 31st January 1839, who established their cantonment some distance away from the walled city.

After Sindh's conquest in 1843, Karachi became an important British cantonment and additionally served as the focus of commerce, trade and development. Karachi was considered as the safest sea port on the Indus delta. Realizing this potential the British equipped the port with modern facilities during the late 1850s; concurrently they introduced railways connecting the port with rest of the region northwards and eastwards. These developments boosted economic prospects of the city attracting trade associated communities to settle here, resulting in a rapid growth and expansion of the city (Khuhro, 1998; Hasan, 1999). Karachi has ever since remained a focus for migrants both from within the country and across its borders; the impetus continuing throughout decades following Partition in 1947 till present times (Ansari, 2005; Hasan, 2011).

During the colonial period, a large business district developed along the axis linking the port with cantonment and European quarters, embellished with prestigious offices and establishments of both foreign and local businesses (Baillie, 1890; Feldman, 1960). Extensive suburbs also developed, adorned with luxurious bungalows of rich merchants, businessmen and British officers. Grandiose public buildings were commissioned to express the symbolized power of the British Empire. Karachi of today is considered a legacy of the colonial period: most areas conventionally understood and acknowledged as its historic quarters date from 1843-1947 (except for the original walled city areas termed as 'native quarters' in Colonial period maps) making less than 10% of the city's present built-up areas (Figure 2). This historic built fabric is an interesting expression of not only

Figure-2: Satellite image of Karachi showing demarcation of the present administrative boundaries of eighteen towns. Hatched areas show the historic quarters, which make less than 10% of the city's present built-up areas.

the colonial power at its peak but also the growing economic strength of local communities, predominantly Hindus and Parsees, who commissioned local craftsmen to produce masterpieces of traditional building crafts. Added contributions of post-Independence developments that have made an impact on the city's built environment, include the extensive refugee re-settlement schemes, iconic architectural contributions of late 20th century (Hasan, 1999; Khuhro; 1998; Mumtaz; 1995; Mumtaz, 1999) and lately the industrial investments that have further magnified the economic prospects. The post-Independence contributions from 1960s – 80s include the first iconic State establishments in the first capital city (shifted to Islamabad in 1968), international architectural influences brought through local architects (trained abroad), and internationally renowned architects commissioned for prestigious government projects.

Literature review indicates Karachi's first division into administrative quarters, by Belasis (Collector of Karachi) in 1858, dividing the city and its suburbs into 14 quarters, excluding the cantonment; by 1880s it was divided into 26 quarters (Baillie, 1890). Towards end of the 19th century more than one cantonment were established, each having an independent jurisdiction and authority. By 1905, five more quarters were added to the municipality limits; and by 1941 the city grew into 44 quarters, grouped under eight administrative wards (Lari, 1996; Naeem, 2004). Presently Karachi has an administrative division of eighteen towns and six cantonments. It is the largest and most populated city (exceeding 15 million) of Pakistan, its growth rate beyond any anticipated figures, has resulted in unplanned and uncontrolled developments completely disregarding the environmental sustainability of natural resources in and around the city. Karachi is the only city in Pakistan for which extensive listings[2] of historic buildings, including those other than 'monuments' already exists; given protection under the 'Sindh Cultural Heritage Preservation Act (1994)'.

Shikarpoor: Historical Background

The town of Shikarpoor, established in 1617 by Daoodpotras, became the most important town in Sindh from the view-point of trade, commerce, banking, and to a great extent political interests in the region, during the 18th and 19th centuries. Towards mid 18th century, it came under complete control of Afghans (under Durani Empire) who encouraged Hindu merchants to settle here and carry on trade through Afghanistan to Central Asia and India. It soon became a city having a Hindu majority in an otherwise Muslim dominated region. In 1824 the Talpur Mirs gained peaceful possession of Shikarpoor; however, they were required to pay an annual tribute to the Afghans. Irregularity in these payments caused frequent incursions by the Afghans, claiming their arrears. In 1839-40 during the Afghan campaign British troops used Shikarpoor as their military base, from where supplies and other provisions were ensured for the sustenance of their army. In 1843 with Sindh's annexation, Shikarpoor became part of the British Empire. During the first two decades the British saw it as an important city, making it the district headquarters and a military cantonment. But 1860s onwards, the focus gradually shifted; Sukkur (in the south) and Jacobabad (in the north) superseded Shikarpoor as administrative and military base respectively. Towards the end of 19th century Shikarpoor suffered a decline in its trade activities largely owing to the introduction of railways (1858-61) and development of Karachi port (1870s). But the final blow to the city's socio-economic structure and prosperity came with Partition in 1947, when its affluent Hindu population migrated to India and other parts of the world (Markovits, 2000).

Shikarpoor was originally a walled city having a circumference of 3800 yards and with eight gates guarded at all times; the activities of trade caravans remaining outside the walled limits (Postans, 1840-41). The historic core within walled limits has narrow winding streets and alleys, many of which terminate as dead-end lanes. The original layout is well preserved even today; till today accommodating only pedestrian traffic. The colonial period extensions of the city developed on the east (cantonment areas) and south (administrative offices) of the walled city area. The historic fabric of Shikarpoor is represented by traditional constructions in timber, mud and brick. However, this is rapidly changing and new constructions in cement concrete are increasingly replacing the traditional buildings. The famed covered bazaar of Shikarpoor cuts across the centre of the walled city area along N-S axis. A comparison of the survey map and historic map of 1915 with present satellite image shows minimal growth beyond the colonial period extensions. However, densification of these later period built-up areas can be observed.

Presently Shikarpoor is considered as a medium sized, tertiary level town of Sindh on the basis of its urban facilities, having a population of 0.13 million (census 1998). The town has easy access by road and railway, thus well connected

2 In 1994-97 nineteen historic quarters of Karachi were surveyed by the NGO 'Heritage Foundation' who compiled a list of 581 buildings and got them notified as protected heritage by the Department of Culture, GoS.

with major cities on the national grid.

Before embarking on the field survey, the process undertaken involved preparation of base maps including downloading satellite image (from Google Earth), collection of survey sheets having detailed information on plot lines and numbers of each parcel and other available information from different sources. All collected information was superimposed to produce a comprehensive base map used for field survey.

In the case of Karachi, availability of detailed maps for the entire city and a pre-existing list of protected buildings made survey process easier and better organized according to quarter boundaries. Buildings already listed in the nineteen historic quarters were marked on the satellite image using information available from official notification and published documents.

In Shikarpoor the survey team worked with limited supporting facilities. Satellite image and map of administrative union council boundaries used in the final document were available only at a later stage of field data compilation[3]. Detailed survey sheets of only the historic core (undated; scale 1inch = 80 feet) or (1:960) were available only after arrival in Shikarpoor. Due to limitation of photocopying facilities in Shikarpoor these could be reproduced only in small segments corresponding to A3 size sheets. The survey was thus undertaken by dividing the city in small A3 fragments, later put together as a jigsaw puzzle. Special arrangements had to be made for taking the original survey sheets to Karachi, and scanning them for use as a base for digitized AutoCAD maps. Based on availability of maps having different level of details for different areas of the city, the methodology for field work had to be slightly revised; dividing the city's municipality limits into three different zones. Each zone was surveyed according to the level of available information and the overall character of the area. The first zone included the entire area within walled city limits and its immediate extension eastwards; covered in detailed survey sheets (1inch = 80 feet) and surveyed on foot, street by street, identifying and marking all properties according to the pre-defined listing criteria. The second zone covered an area for which limited information on plot divisions and numbers was available from a 1915 map. Updated maps on this area are not available. The character of this zone was defined by vehicle oriented street layouts, allowing the survey to be undertaken by driving through major roads and identifying properties for inclusion in inventory document. The third zone covered areas beyond the extent of the 1915 map; their only source of information was 1986 survey plan (1:10,000). Only landmark buildings mentioned in the map were spot-listed in this zone.

BENEFITS AND OUTCOMES OF THE SYSTEMATIC RECORDING PROCESS

A. Acquiring base maps and retrieving their information: Different types of maps (including historic maps, satellite images, city survey maps and plot or parcel division maps) were superimposed to filter in required and useful information on changes in plot demarcations, phases of the city's expansion, demarcation of administrative divisions and changes in usage of properties or areas. Information gained from different maps was put together to gain valuable interpretations. The experience of searching for relevant maps in the two case study towns required exploration of different sources and government departments and organizations highlighting the absence of efficiently managed public archives. For Karachi, Karachi Building Control Authority (KBCA) was the main source for acquiring detailed maps of the entire city, except cantonment and port trust areas. For Shikarpoor the core historic area's maps (walled city and colonial extensions) were available from the Revenue Office and the 1:10,000 scale survey maps were available through Survey of Pakistan.

B. Identification and demarcation of historic areas: Review of secondary sources and historic maps helped develop an understanding of historical developments and the growth of city, enabling identification of historically significant areas. In the case of Karachi many of these areas were previously not included in the listing process. Through the research process, limits of historic areas were redefined and areas other than the nineteen listed quarters have been identified for extending the inventory survey. In the case of Shikarpoor, secondary sources helped identify the growth pattern, limits of historic core and municipal limits. The method enabled use of historic maps and gazetteer descriptions to identify historic areas of city which are proposed to be considered as heritage conservation zones in planning policies to achieve their effective management. Historic maps also help identify isolated monuments, located on city periphery outside the limits of historic quarters, or as isolated units in newer parts. An approach restricting the listing process within predefined historic areas would overlook such cases. Thus it is recommended that the entire

3 Accurate information on this was not available in Karachi. During field work visits to the city this information was collected from relevant local department.

city limits must be considered for comprehensive listings; however, the method for surveying different areas may vary according to their significance and character.

C. Benefits of a methodical process: In Karachi's case a previous listing of heritage buildings already existed, but the scientific and systematic re-survey using the method developed for this research identified deficiencies of previous listing approach. Without a defined criterion or methodology the previous process resulted in missing out significant information. The apparent focus seems to have been limited to the colonial period (stone) buildings, disregarding other period contributions representing the rich variety of architectural styles/ trends in the historic fabric. In the case of Shikarpoor the entire city had been notified as a protected heritage in 1998, but no specific listings were prepared. The ambiguity and discrepancy in what should be considered as cultural property and given legal protection resulted in confusion among decision makers and administrators. A well defined criterion for listing, developed through present research undertaking gives an understanding of the region's and the case study town's historic context, ensuring that contributions from different periods are given due importance and representative cases are identified in the listing process. The process also gives clear definitions on values of significance considered worthy of preservation.

D. Record of the lost fabric: Incorporating historic research into the methodology enabled identification and documentation of lost historic fabric. In the case of Karachi, 51 buildings from the 581 enlisted and protected properties were found to have been demolished. The previously published documents (HF, 1996) served as a historic record, providing information on the original fabric. However, the lack of more detailed information and photographic record in the previous process leaves a gap in information available for these demolished structures. For Shikarpoor, while previous listing did not exist, historic documents and residents provided information on a number of such cases and their photographs were accessed from personal archives. It should be noted that a few buildings have also been demolished since the 2007 inventory survey undertaken for this research.

E. Richness of the historic fabric: In Karachi the systematic documentation process using pre-defined criteria resulted in the identification of more than 900 properties either having similar characteristics as the 581 previously listed ones, or representing different periods' developments and architectural trends, reflecting a rich variety and diversity in the historic fabric. These were earlier overlooked, reflecting on the inconsistency in the previous listing process (Figure 3). For Karachi, mapping of previously listed and newly identified buildings together shows a much denser and richer historic fabric that still survives within the historic quarter, indicating a higher potential of the city centre for an integrated urban conservation exercise (Figure 4).

F. Usefulness of collected data: Compilation of the database and developing a correlation between various findings led to the identification of problems and their main causes. Inclusion of information on present physical status, occupancy status and level of alterations in identified buildings helped in determining the level of threat posed to these properties. Buildings which are completely or more than fifty percent vacant, or partially demolished properties, or those with only the façade remaining are all identified as cases under 'High Degree Threat' thus requiring urgent attention and the need for intervention by authorities to ensure their survival. In both case studies, the observations of socio-economic conditions of the area led to the identification of major factors having direct implications on the maintenance of buildings or the lack of it. Unresolved issues of evacuee[4] properties, uncertainty of ownership, extremely low rental values derived through existing '*pagri*[5] system' of tenancy, all show a direct correlation with the present dilapidated condition of many listed properties. Analytical evaluation of data also enabled value based grouping of buildings. This graded classification allows for formulation of different set of regulations for the different groups. Detailed data on architectural features also has utility for initiating development of a comprehensive thesaurus of local architecture and defining plan typologies and period style classification for the case study towns.

G. Additional information to be recorded during survey: An approach incorporating the urban context and topographical features to gain an overall understanding of the fabric around listed buildings is of significance; it enables an environmental assessment of the historic area, and allows evaluation on the level of damage/ change or potential risks/ threats or degree of preservation, in the vicinity. In Karachi's case the impact of new multi-storeyed constructions, was observed as the most overwhelming change having a negative visual impact on the area's historic character. Thus building

4 The term 'evacuee property' is used for buildings that were abandoned by the migrating Hindu community at the time of Indo-Pak Partition. All such properties were taken over by the Evacuee Trust, and their new ownership was settled under claims made by incoming Muslim refugees. However, the case of many evacuee properties still lies unsettled.

5 Term of tenancy through which an amount is paid at the time of agreement, and the monthly rent becomes a very nominal amount.

Figure-3: Comparison of listed with newly identified buildings in Karachi. Lack of defined criteria and systematic method in previous listings process, resulted in missing out many buildings having similar attributes as those identified for listing.

Figure-4: Sample map of one historic quarter of Karachi; (above) showing only previously listed buildings and (below) the same area with listed and newly identified buildings and open spaces. The latter gives a comprehensive picture, indicating a denser historic fabric.

heights for each plot parcel were recorded as the most representative indicator of change. Whereas, in Shikarpoor unused areas with rubble of demolished structures and new constructions were seen as having the most negative environmental impact. This additional information is not made part of the inventory document; it is useful only for an overall evaluation of the fabric and developing planning policies. Recording this additional information while undertaking the survey takes little extra effort, but if left for a later stage, can prove to be extremely time consuming and exhaustive. The indicator of change may vary for different places depending on the prevailing development patterns and geological/ topographical features of the terrain. Thus the decision for what to record can only be made while undertaking the field survey and surveyors should be trained to develop the ability for these decisions.

I. Inclusion of open spaces/ natural sites: A comparative study of maps from different periods provides an insight to the state of preservation or destruction of natural features and open spaces. Pressures of commercialization or densification often result in reduction of open spaces allocated as public parks and playgrounds. Identifying open spaces and natural resources, and incorporating them as part of the listing process, provides a holistic picture of built-up areas in relation to open spaces or natural resources, and allows issues of sustainability to be addressed through an approach of more efficient integrated planning.

J. Importance of photographs and photography skills: Photographs proved to be useful field data, especially during analysis and evaluation stages; an effective media for conveying the significance and value of listed properties to the administrators, decision makers and managers. For best results surveyors must have a prior awareness of the format of inventory form, consciously covering all possible views and details of the property. The number of photographs can vary from case to case depending on the level of architectural detailing and craftsmanship employed. Choosing the five or six photographs for use in the inventory form requires careful consideration as these should convey the essence of the listed property and avoid repetition. The main picture must capture the entire building or as much of it as possible from its front, and pictures of details should cover as many of the significant architectural features as possible. Additional images, not used in inventory forms, are useful in analysis process for rechecking and verifying data at compilation stages.

K. Maintaining consistency in evaluation: An important aspect of the inventory process is the standardization of analytical evaluation, particularly when working with a large group of people and also when listings continue over long periods. Although the parameters are listed in the same form, but their interpretation by each individual might differ, bringing out inconsistent results. Thus a clear articulation for each of the values within the criteria should be done through an explanation supported by graphics or a range of samples/ examples at a stage when substantial numbers of properties (within a specific case study area) are evaluated, thus standardizing the qualitative analysis to some extent. Members of the field survey team should be given a detailed orientation and on the job training, before allowing them to work independently. However, it must be realized that with the spread of study to larger areas or to other cities this standardized articulation needs revisiting to verify if it addresses and justifies the variety of samples and variations being recorded. A useful exercise for consecutive batches of properties being evaluated is to study their images, tabulated according to value based groups, checking if the judgment across the various batches is consistent or not. This exercise would help check inconsistencies, achieving a certain level of consistency throughout the process.

CONCLUSIONS

The research findings indicate a lack of existing knowledge on traditional environments of Sindh's historic towns and at the same time suggesting an immense potential for conservation activities in the region. The method developed for inventory documentation of historic places having been tested in two very different case study towns shows a robustness and adaptability for different circumstances and case specific issues. Training of surveyors and other team members is however, crucial for understanding the historical developments of study areas and their implications on built environments. The most challenging aspect of the proposed method is maintaining consistency in the qualitative evaluation stages, through checks and controls to ensure similar perceptions in interpreting the collected data and following the defined guideline. This may be difficult to manage, especially when working with larger groups or when projects continue over long periods with changing personnel. This issue is of greater concern in large cities like Karachi, but in smaller cities it can be controlled by undertaking the entire city's survey at one instance, as was done in the case of Shikarpoor. Encouraging group discussions and close co-ordination among team members to exchange experiences and perceptions on the logic and understanding of the method is one effective way of overcoming the challenge of consistent interpretations. Close supervision and scrutiny of final document is also important, and must be done by the more experienced members of the team.

A comparison of the two case study towns indicates existing variations between places vis-à-vis availability of documents and other sources, depending on present status of the city/ town and its administrative setup. For certain places the possibility of not having any detailed maps also exists, requiring explorations into methods for developing base maps using satellite images. Cases having few information sources would require extra cross-referencing from official documents such as the revenue or taxation records maintained by local governments. While working in smaller cities it is also essential to establish links with city administration and the community to gain cooperation and support during field work. In the two case study experiences this was not necessary in Karachi but in Shikarpoor undertaking surveys would have been impossible without seeking local support. The aspect of lacking information in the case of Shikarpoor resulted in extrapolating required CDIF entries through primary field data, nevertheless compilation of required data was accomplished to a degree of satisfaction and required standardization in both cases. Experiences in usage and application are however, a bit different. In Karachi due to existing departments and possibility of closer co-ordination between the research institution and government departments responsible for heritage protection, better levels of implementation of inventory data and its associated recommendations is already happening. In the case of

Shikarpoor progress is much slower due to non-existence of effective management institutions. Efforts are however, being made by the research organization to overcome these hurdles and develop better liaison possibilities to share their technical expertise with local administration.

In the context of Pakistan there is a need for empirical research with a flexibility that incorporates the inconsistencies of existing administrative structure and lack of well established archival system. Long term policies to sustain the process and maintain its continuity are also crucial, and can only be made possible through political support and close collaborations between different government departments, organizations and educational institutions. The lack of documentation based information and knowledge on historic environments has been a major factor retarding professional growth in the field of heritage conservation and management in Pakistan, resulting in weak national policies that have failed to create any positive impact for protection and revival of historic towns and sites. Availability of heritage inventory database provides an opportunity for progressive and well directed actions. Standardized documentation methods could encourage collateral exchanges and community based co-operations, helping to generate opportunities for local capacity building and professional training, through on the job training programs, thus overcoming the present deficiencies of trained heritage conservation professionals in the country.

REFERENCES

(1871) "Karachi Cantonment, City and Environs 1869-70". Calcutta, Surveyor General of India.

(1985-86) "Survey Plan of Shikarpoor". Rawalpindi, Survey of Pakistan Offices.

ANSARI, S. (2005) *"Life After Partition: Migration, Community and Strife in Sindh 1947 - 1962",* Karachi, Oxford University Press.

BAILLIE, A. F. (1890) *"Kurrachee: Past, Present and Future"*, Thacker Spink & Co., Calcutta.

BURMAN, P. P., R.; TAYLORS, S. (Ed.) (1995) *"The Economics of Architectural Conservation",* York, Institute of Advanced Architectural Studies.

COUSENS, H. (1929) *"Antiquities of Sindh: With Historical Outline"*, Government of India, Central Publications Branch.

DUARTE, A. (1976) "*A History of British Relations with Sind 1613 – 1843",* Karachi, National Book Foundation.

FELDMAN, H. (1960) *"Karachi Through a Hundred Years; the Centenary History of the Karachi Chamber of Commerce and Industry 1860 - 1960",* Karachi, Oxford University Press.

HASAN, A. (1999) *"Understanding Karachi",* Karachi, City Press.

HASAN, A., RAZA, MANSOOR (2011) *"Migrations and Small Towns in Pakistan",* Karachi, Oxford University Press.

(HF, 1994) *"National Register: Historic Places of Pakistan; Karachi Document Two – Karachi's Serai Quarter"*, Karachi, Heritage Foundation.

(HF, 1994) *"National Register: Historic Places of Pakistan; Karachi Document Three – Saddar Bazaar Quarter"*, Karachi, Heritage Foundation.

(HF, 1996a) *"National Register: Historic Places of Pakistan; Karachi Document Four – Artillery Maidan & Rambagh Quarter"*, Karachi, Heritage Foundation.

(HF, 1996b) *"National Register: Historic Places of Pakistan; Karachi Document Five – Market & Jail Quarters"*, Karachi, Heritage Foundation.

(HF, 1996c) *"National Register: Historic Places of Pakistan; Karachi Document Six – Karachi Cantonment & Manora Island"*; Karachi, Heritage Foundation.

(HF, 1996d) *"National Register: Historic Places of Pakistan; Karachi Document Seven – Old Town, Bunder, Macchi Miani & Railway Quarters"*; Karachi, Heritage Foundation.

(HF, 1996e) *"National Register: Historic Places of Pakistan; Karachi Document Eight – Ranchore Lines, Preedy & Napier Quarters"*; Karachi, Heritage Foundation.

JAMES, E. (Ed.) (1915) *"A Forgotten Chapter of Indian History as Described in the Memoirs of Seth Naomul Hotchand (1804 - 1878) of Karachi - Translated by Rao Bahadur Alumal Trikamdas Bhojwani"* Exeter, William Pollar and Co.

KHUHRO, H., MOORAJ, A. (Ed.) (1998) *"Karachi Megacity of Our Times",* Karachi, Oxford University Press.

LARI, Y., LARI, M. (1996) *"The Dual City Karachi During the Raj",* Karachi, Oxford University Press - Heritage Foundation, Karachi.

LICHFIELD, N. (1988) *"Economics in Urban Conservation"* Cambridge, Cambridge University Press.

MARKOVITS, C. (2000) *"The Global World of Indian Merchants, 1750-1947: Traders of Sind from Bukhara to Panama",* Cambridge, Cambridge University Press.

MUMTAZ, K. K. (1995) *"Architecture in Pakistan"* Butterworth Architecture.

MUMTAZ, K. K. (1999) *"Modernity and Tradition: Contemporary Architecture in Pakistan",* Karachi, Oxford University Press.

NAEEM, A. (2004) "Karachi: Loosing its Historic Face". *NED Journal of Research in Architecture and Planning,* 3**,** pp.78-91.

PICKARD, R., PICKERILL, T. (2002) "Conservation Finance 1: Support for Historic Buildings". *Structural Survey,* 20**,** pp.73-77.

PICKARD, R., PICKERILL, T. (2002) "Conservation Finance 2: Area Based Initiatives and the Role of Foundations, Funds and Non-Profit Agencies". *Structural Survey,* 20**,** pp.112-116.

POSTANS, T. (1840-41) *"Town of Shikarpoor; The Trade Carried on Between that Town and Kandahar and the Silk Trade between Shikarpoor and Khorasan"*, Memoirs on Sind. Selection from the Records of the Bombay Government.

POSTANS, T. (1843) *"Personal Observations on Sindh",* London, Longman, Brown, Green and Longmans.

THE IMPACT OF INFRASTRUCTURAL SERVICES ON TRADITIONAL ARCHITECTURE AND URBAN FABRIC OF THE WALLED CITY OF LAHORE

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ABSTRACT

Present Walled City of Lahore is essentially a traditional town transformed largely into a colonial city during 20th century in context of its built environment in general, and infrastructural services in particular. Ninety nine years of the British occupancy of the city has tremendously changed its physical character, layout plan, infrastructural services, road networks, construction techniques, building materials, and connection with outer settlements etc. The pace of these topographical changes within the Walled City of Lahore (WCL) remained slow, throughout the centuries. The housing units of the WCL have been demolished and reconstructed repeatedly. This process has re-shaped its urban fabric, changed its topography, internal layout, and the dynamics of streets.

Before the introduction of infrastructural services[1] the urban fabric of the WCL exhibited identifiable architectural characteristics. The unplanned and ad-hoc provision of infrastructural services has substantially damaged the heritage buildings[2] of the WCL, in particular during the last sixty years[3]. Today clean drinking water is not available to the inhabitants/residents of the WCL. Sewer and storm water drainage system is working inefficiently. The web of electricity and telecommunication cable has brought visual and aesthetic impairment to the façades and streetscape of the WCL.

This paper documents the extant situation of these infrastructural services, exploring their impact on traditional architecture and urban fabric of the WCL, concluding with recommendations for strategic planning to protect the historical building remains and urban heritage belonging to different historical eras.

***Key Words*:** Walled City of Lahore (WCL), Heritage, Urban Fabric, Infrastructural Services, Urban Design, Urban Planning, Restoration, Urban Conservation, Colonial City, Sustainable Development of Walled City, Traditional City.

ACRONYMS:

LESCO:	Lahore Electricity Supply Company
PTCL:	Pakistan Telecommunication Corporation Limited
PHA:	Parks & Horticulture Authority
SNGPL:	Sui Northern Gas Pipeline Limited
SDWCLP:	Sustainable Development of the Walled City Lahore, Project
WCA:	Walled City Authority
WCL:	Walled City of Lahore
WASA:	Water and Sanitation Agency

1. THE CITY WITHIN WALLS

According to Lahore Master Plan 2006 (AKCSP 2008a), the larger city of Lahore measures an area of almost 2300 square kilometers with a populating of more than seven million[4]. The Walled City of Lahore was an old settlement dating to before its occupation by invaders from Central Asia during 11th and 12th centuries. It had remained a nexus between Central Asian regions, Delhi and Multan Sultanate throughout the centuries. Within its walls, a dense urban fabric is present. The Mughal Emperors spent a few years of their lives in Lahore Fort[5] and constructed some significant historical buildings within the WCL. However, they mostly

1 Infrastructural services include electricity, water supply, Sui gas, telecommunication, sewer and rain water drainage.
2 Heritage buildings in WCL include multistory housing units, *havelies,* historical mosques and shrines, wrestling arenas, city gates, etc
3 After establishment of Pakistan in 1947, the mass immigration of non-Muslims from WCL to India offered opportunity to settle new community that did not have any association with heritage buildings.
4 Projected population is based on Census 1998 figure of 5.1 million.
5 Only Emperor Akbar stayed for 14 years in Lahore from 1585-1599 A.D. he then again shifted his capital to Agra.

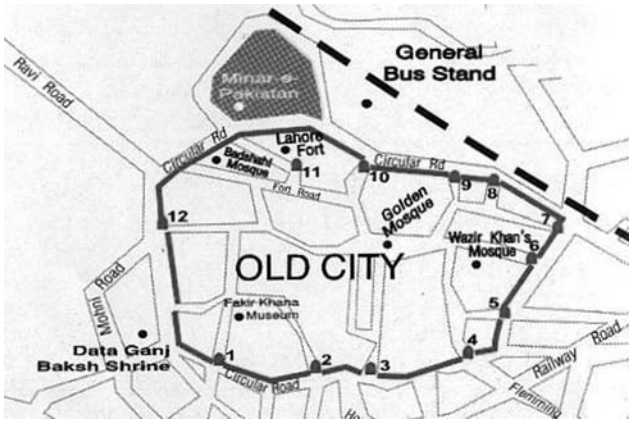


Figure-1: Walled City of Lahore, Main zoning.

constructed extensive monuments outside its periphery[6]. The link of the WCL to Central Asian route, as it appears, was on North-Western corner and was extended towards Delhi through the South-Eastern fringe. (Figure 1)

Today's Walled City of Lahore comprised 22,800 property units[7], spreading over an area of 2.7 square kilometers (AKCSP 2008b), and is enshrined within a Circular Garden that is heavily encroached by the public and private buildings. Just outside this Circular Garden[8] is a Circular Road or a Ring Road in modern urban terminology, connects the WCL to the outer areas which were mostly populated during the Colonial Period[9].

Today, almost 70% built up land area inside the WCL has been commercialized by whole sale traders. The residential population has decreased from 250,000 to 160,734 in the last forty years (AKCSP 2008c). The daytime occupancy of the business related people increases to more than 400,000 during peak shopping hours. There are 1460 illegal encroachments in the Circular Garden, around the WCL[10]. Only few hectares of the Circular Garden now remain green as public parks which are being maintained by the Parks & Horticulture Authority (PHA).

Figure-2: An arial view of the Walled City of Lahore.

2. INFRASTRUCTURAL SERVICES IN WCL

The introduction of infrastructural services is not a very old phenomenon when compared in relation to the existence of the WCL. At present there are four line-agencies, providing infrastructural services within the premises of the WCL, one is provincial and other three agencies are Federal[11]. WASA is responsible for providing potable water extracted from the aquifer through a number of tube-wells installed in and around the old city, particularly in the Circular Garden. The sewer and storm water is also collected from the WCL and drained out at various stations in main service areas. For storm water and sewage drainage, diverse range of typologies of systems has been introduced at various places in the WCL. In some areas, open drains and at others covered pipe drainage systems are working presently. (Figure 2)

Lahore Electricity Supply Company (LESCO) is mainly responsible for the provision of power to illuminate the

6 Shalimar Garden, Jahangir, Noor Jahan and Asif Jahs' Mausoleums, Dai Anga Mosque and Tomb, Chau Burgi, Shrines of Hazrat Mian Meer, Shah Chiragh Lahori, Meeran Mauj Darya Bukhari, Abdul Razzaque, Shah Abu al Mu'ali etc are located outside of the WCL but were constructed during the Mughal period.

7 Data is based on Topographical Survey completed by AKCSP for SDWCLP with the help of GIS.

8 This Circular Garden was a moat during Sikh regime that was filled with earth and converted into a garden.

9 Before Colonial Period, the people settled within walls because of the fear of invaders.

10 These also include five number Police Station buildings, eleven private and government school buildings, three number grid stations of LESCO, twenty two number tube water-wells installed by WASA, an office of Tehsil Nazim, several mosques, shrines and shops.

11 Water and Sanitation Agency (WASA) is a provincial department and Lahore Electricity Supply Company (LESCO), Sui Northern Gas Pipeline Limited (SNGPL), and Pakistan Telecommunication Corporation Limited (PTCL) are federally administered agencies.

housing and commercial units located within the WCL. For this purpose, there are three grid stations located in the Circular Garden that not only serve the WCL but also other areas outside the WCL[12]. These grid stations have thus become heavily loaded to cater for the imminent requirements, though now a fourth grid station has been proposed outside Kashmiri Gate by LESCO[13].

Pakistan Telecommunication Corporation Limited (PTCL) provides telecommunication and cable television network services to the residents of the WCL. Both landline and mobile telephone services are available for housing and commercial units within the WCL. In some areas wireless telephone system is also provided to facilitate the users. At a very small level, underground fiber-optic cable is provided.

Sui Northern Gas Pipeline Company Limited (SNGPL) is the service provider for natural gas and its network. The gas is mostly used for cooking and heating purposes, its industrial usage is minimal within the WCL.

3. EXTANT SITUATION OF INFRASTRUCTURAL SERVICES IM WCL

The following sections describe the existing situation of these infrastructural services.

3.1 Water Supply

The WCL is supplied with potable water from various tube wells located in the Circular Garden. Presently, there are twenty one tube wells out of which only seven are functional. These tube wells are directly connected with the water supply pipelines without any water reservoirs or disinfection measures. The Lahore city as a whole, has more than 160 tube wells (WASA Record) drawing drinking water from the aquifer below the ground.

Currently the water supply system is supported by tube-wells, pumps, pipelines, and reservoirs that are generally in poor conditions requiring minimum regular maintenance. The tube-wells are setup with an injection treatment system. The issue of clean drinking water exists over the supply and usage of chemicals for the treatment process. The practice of illegal connections is a major source of contamination in water supply system that ultimately affects the health conditions of the residents living within the WCL. (Figure 3)

Figure-3: Tube Well located in Circular Garden.

Borehole logs of four tube wells[14] (WASA Record) shows that the wells conform to one of the following (AURECON 2009a);

1. Well hole size 26" (650 mm) diameter with a 20" (500 mm) diameter mild steel housing for the first 210' (64m) to 270' (82m) followed by 10' (250 mm) fiberglass casing (galvanized) to the bottom of the hole at between 600' (182m) to 750' (228m) below the ground surface. The design capacity of the tube wells is given as 4 cusec (0.113 cusec or 113.3 l/s).

2. Well hole size 20' (500mm dia) with a 16" (400mm dia) mild steel housing for the first 220' (67m) followed by 8" (200mm) fiberglass casing (graveled) to the bottom of the hole at 520' (158m). The design capacity of the tube well given as 2 cusec (0.057 cusec or 56.6 l/s).

WASA has used two basic designs of tube wells with a capacity of 2 or 4 cusec each. Borehole logs reflect that the water is collected from various semi-confined aquifers delineated by clay layers. The pumps, being connected directly into the supply pipes, are operated at an average of about 18 to 20 hours daily. For electricity outage hours some tube wells are run by generators. The water table of Lahore is dropping at the rate of 4' to 6' per year (WASA Record) (Figure 4).

12 Bhati Gate and Mochi Gate Grid Stations also serve the areas outside WCL like Data Darbar and its vicinity, Gawalmandi and its vicinity.
13 LESCO started constructing Grid Station in 2004-05 but SDWCLP stopped it as it was considered another intervention in the Circular Garden.
14 These are located in the areas of Iqbal Park, Yakki Gate, and Tehsil Garden.

Figure-4: Water Supply Connections in Street.

In the past years, two water reservoirs were constructed for the storage of water. One of these was located at Langay Mandi, the highest point of the WCL, having the water storage capacity of one million gallons. It was constructed in the later decades of 19th century during the British period. 18 feet high columns constructed of bricks hold four separate steel tanks. The other reservoir is located outside Masti Gate with the capacity of 100,000 gallons. It is an underground RCC tank and was constructed to increase the storage capacity for the residents of the WCL.

The Langay Mandi reservoir is filled with water extracted by five tube wells located in the vicinity of Masti Gate. These tube wells operate round the clock. This reservoir is filled three times daily. The water distribution system is opened at three intervals i.e. from 04:00 to 08:00, from 13:00 to 15:00 and from 17:00 to 20:00, making a total time of nine hours daily. Langay Mandi reservoir rises between 8" to 9" per hour during the fill (WASA Record).

Due to lack of water pressure, the consumers are left with no choice other than using water pumps to pull potable water directly from the supply line to their over head water tanks. This practice results in negative pressure in pipes that contaminates the water by sucking impurities from the old deteriorated pipes. During the Later decades of 19th century, cast iron (CI) pipes were used for distribution of water. However, it reuse have now been replaced at various places by ductile iron (DI), with asbestos or fiber cement pipes below the ground and hot dipped galvanized steel pipes above the ground level (AURECON 2009b).

No metering system exists for measuring the water for an individual household. The consumers are charged flat rate, based on floor area for residential units and a fixed rate for industrial and commercial usage.

Figure-5: Open Sewer Drainage System in Walled City.

3.2 Extant Situation: Waste Water

Surprisingly, the WCL has no separate system for waste water disposal. It is the sewer system that let the rain water to flow out. This combined system has given birth to a severe problem of solid waste that is collected into the sewer pipe, choking the system. WASA plans to separate the sewer and waste water drainage, in the long term (Figure 5). This combined stream at present ends at the outer periphery of the WCL in an open concrete and brick lined drain. On the southern side of the WCL, the open drain starts at the Delhi Gate while flowing towards the pump station, situated in the Circular Garden near Bhati Gate. The flow velocity is not enough to take the solid waste along with. On the northern area of the WCL, a drain starts at Masti Gate and flows toward the north-east corner of the WCL, where it is connected with the Greater Lahore drainage system. No Treatment Plant is installed in the close proximity of the WCL. All the effluent is collected and thrown in River Ravi that has become severely polluted by such irresponsible measures.

3.3 Existing Situation: Storm Water

Since decades, the storm water is collected combined with the waste water through an open-lined drainage system at the WCL. From the alleys and streets, it is collected in a drain at the periphery of the WCL that is further drained out into an out fall drain and pumped from Babu Sabu Outfall station. In the first and second Punjab Urban Development

Projects, almost two-thirds of the streets were upgraded by providing concrete cover over the open drains. This raised the surface level of the streets, sometime even higher than the ground floor level of existing building units. In the second part, trunk sewer was also laid down. Existing covered drains leave no option for collection of storm water through combined drainage system. At certain points where the concrete slabs are broken, solid waste along with storm water enters into a combined drain that causes various problems of blockage.

During heavy rains, the combined sewer over flows and the water collects in the Circular Garden as a pond that is ultimately infiltrated or naturally evaporated.

3.4 Existing Situation: Electricity

The infrastructural services in the WCL have been provided on an ad-hoc and emergent bases without any planning and future vision. The electricity provided to the WCL is separate in terms of High Voltage (HV) and Medium/Low Voltage (MV & LV)[15]. There are three major grid stations (132/11kV) from where electricity is provided to the WCL and its neighborhood. These three grid stations[16] are fed from Ravi, Lahore, Band Road and New Kot Lakhpat 220 kV substations (LESCO Record). (Figures 6 & 7)

The Fort grid station containing outdoor air-insulated equipment is placed in a fenced compound underneath fabric mesh netting that protects against foreign objects (AURECON 2009c). It is the oldest grid station dating back to 1980. It is fed through the greater Lahore transmission network through an overhead line to Ravi grid station and an underground cable to Bhati Gate grid station.

Bhati Gate grid station contains outdoor transformers coupled with indoor gas-insulated switchgear. This nature of equipment uses pressurized Sulphur Hexafluoride gas instead of open air to control the arc of a current fault (AURECON 2009d). This grid station is connected through two under ground transmission lines, one from Fort grid station and the other from Rewaz Garden grid station. This grid station mostly caters for the western region that is outside the WCL and only a small region of WCL is served through this grid station.

Figure-6: Bank of transformers near Masjid Wazir Khan.

Figure-7: Transformer and Electricity Services near Masjid Wazir Khan.

Mochi Gate grid station also contains outdoor transformers coupled with indoor gas-insulated switchgear within a fenced compound (AURECON 2009d). It is connected to the greater Lahore transmission network through two underground transmission lines; one cable to Badami Bagh grid station and second cable to McLeod Road grid station.

The eastern zone of the WCL and eastern and southern regions outside WCL are fed through this grid station. Both Mochi and Bhati Gate grid stations were constructed during 1994-95 and are in good condition.

The Medium Voltage/ Low Voltage (MV/LV) electrical network that supplies the WCL is not properly and systematically designed for a heritage city and is in fact

15 LESCO Transmission is held responsible for HV network and LESCO Distribution looks after MV/LV network within the walled city.
16 These three Grid Stations are located at The Fort, Bhati Gate and Mochi Gate

damaging the visual impact of the heritage buildings inside the WCL. The MV (11kV) network is laid down as overhead cable that hangs from various posts, buildings or whatever is available in the streets. Visually it appears to be unmanageable, but in fact LESCO has given little importance to proper designing and urban aesthetics. These cables include bare conductors within an arm-length reach with bare jointing infect cansin possible.

Within the WCL, pole-mounted oil cooled Transformers of 11kV/400V have been erected on the roads where ever some space is available. In busy and congested areas, clusters of Transformers occupy the public areas. Such cluster type arrangement of pole-mounted transformers reflects the unplanned and haphazard approach of the service provider. Variety of electricity meters ranges from older electromechanical meters to latest meters. These meters are located outside the houses, fixed on the walls to minimize the pilferage of electricity.

3.5 Existing Situation: Telecommunication

Telecommunication services within the WCL are also provided without much thoughtful planning and designing. The services provided are land-line telephone, wireless telephone, mobile phone services and cable television services. The PTCL has constructed Shahalami Exchange near the WCL to operate the connections there. At most of the places, telecommunication copper cables are interwoven with electricity cables in a way that these can not be separated. (Figure 8)

Although PTCL provides television cable services, yet there are number of third party cable service providers working within the WCL. PTCL has no near future plan to provide improved version of cables like fiber optics. Unfortunately, the satellite television service is expensive in Lahore that may reduce many cables in the streets and alleys.

3.6 Extant Situation: Sui Gas

(SNGPL) remained reluctant in providing gas connection within the WCL for many years. Finally, the political pressure resulted in providing gas in narrow streets and alleys but not less than 8' in width. But now they have provided the service to the streets equal to 5' in width. For such narrow streets, the meters are installed in the beginning of the street and an open GI pipe line goes to the houses. Trunk gas pipe lines are buried underground. Currently a variety of meters are used for commercial and residential units. For domestic connections, SNGPL is using G1, 6 or G4 type of meters (AURECON 2009e). (Figure 9)

The existing outer gas main pipeline next to the Circular Garden is a 6-inch Mild Steel (MS) pipeline with an opening pressure of 70-90 psi (SNGPL Record). Within the WCL, this MS pipe line is reduced to 4 and finally to 2 inch-diameter MS pipeline with an operating pressure of 20 to 25 psi. The house connections are normally 2 inches MS pipeline and at house connection regulators, the pressure is reduced to 0.217 Psi (AURECON 2009e). The current residential gas consumption during the summer months is for eight hours per day at the rate of 60 to 70 cft/hour.

4. IMPACT OF INFRASTRUCTURAL SERVICES ON URBAN FABRIC

Electricity, water supply, Sui gas and telephone are the essential basic services for a modern day life. Without their existence, there is no concept of life in urban and rural areas.

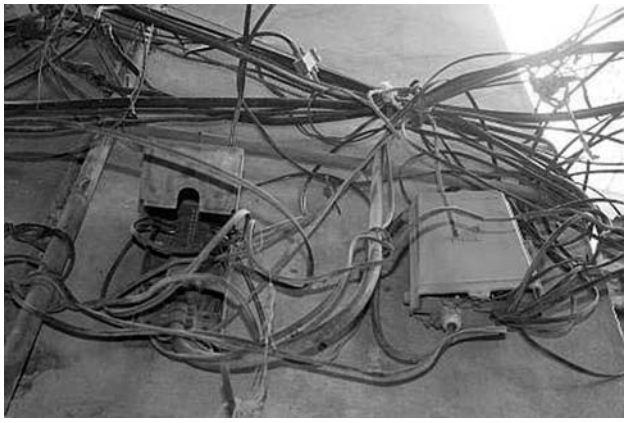


Figure-8: A Network of Telephone & Electricity Cables.

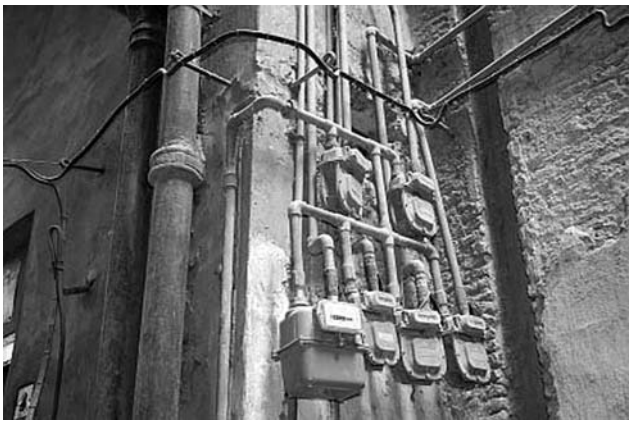


Figure-9: Meters for Sui Gas Supply Lines.

Figure-10: Lahori Gate of Walled City ... Impact of Infrastructural Services.

However heritage buildings pay the price when occupants utilize these services and their consumption is gauged to pay the monthly utility bills through metering. (Figure 10)

The infrastructural services are no doubt an essential need of today's modern life, but their layout plans and provision as practiced is a matter to ponder and re-think. The employees of the line agencies who are the service providers are engineers by profession and are not trained to work within urban areas where heritage buildings exist. Whenever such service is provided, the only intention or consideration of the Sub Divisional Officer or Executive Engineer is lighting up the bulb or to make available the water connection or to provide an operative telephone service for the household. Their leisured, irresponsible, non-professional and insensitive attitude has resulted in the damaging of the architectural features of the heritage buildings located within the WCL. (Figure 11)

The impacts of infrastructural services posed on the traditional WCL and its urban fabrics are as follows:

4.1 Impact of Distribution Units of Services

Infrastructural services when reach the serving areas are normally distributed through small operating units placed in the public areas of streets, roads, or leftover open spaces owned by the government. These distributing units for instance, are transformers for electricity and distribution cabinets for telephone etc. Their placement has certain operational limitations of distance. However, then convenience of location and presence in the foreground of the heritage buildings damages the viewing point.

Figure-11: Maryam Zamani Mosque ... Impact of Infrastructural Services.

Transformers[17] of an average capacity have been installed on the roads supported by vertical steel poles that not only hamper the vehicular and pedestrian traffic flow but also encourage the encroachments by offering a space for day-shops. There is no space in between the built up area and the paved or metal road where such services may be located like on a modern planned housing society. Hence such solutions do not work here properly and successfully. Due to non-availability of space, several transformers are installed at various places presenting a view of bank of transformers. The inter-woven electricity, telecommunication and television network cables obstruct the visibility of design motives having heritage value.

4.2 Impact of Entry Points of Services

In order for infrastructural services to enter into a (heritage) building, mostly the external wall is damaged by making a hole in it. No drilling equipment may be used to achieve this resulting into a de-shaped and over-sized puncture into an old masonry wall. Since a number of cables and pipes enter or exit from the building hence the intricate design motives are destroyed. The external surfaces of the facades are visually and structurally injured when connection cables are pulled from supply line to the individual building unit where a metering device is fixed on external wall. This practice has brought damage to the heritage buildings of the WCL.

4.3 Impact of Metering Devices

Presently, three metering devices are installed on the external

17 Mostly 200 to 300 KVA Transformers are installed in the walled city, because of their easy handling while replacing or repairing.

wall-surface of each house i.e. for water supply, electricity and Sui gas. For multistory structures and that is the case in almost all the units in the WCL the numbering of these metering devices is multiplied for each building.

The fixing of these metering devices on the external wall surface is not systematic, laching order devoid and of aesthetics. The old brick masonry walls do not hold strongly the nails or screws for a long period of time. The line agencies do not allow installing these meters within the house premises because of pilferage possibilities. The external walls of heritage buildings with beautiful architectural details have lost their character by accommodating these services.

4.4 Impact of Water and Sanitation System

Similarly, the water supply, sewer, storm water, gas pipelines and their related installations have damaged the outer skin of these heritage buildings. The leakage of water finds its way into foundations of old walls and causes differential settlements of buildings or street flooring[18].

Due to low pressure of water, the ejector pumps are installed at the door-step of the buildings in the street that is a public space. These pumps have also become a source of water leakage. The filled up areas as well as old building structures do not allow space for underground as well as overhead water tanks for storage purpose.

In narrow streets or less than five feet width, the Sui gas and water supply pipelines are laid on the floor surface or clamped on the walls. One can see the web of these pipelines and cables in the streets hiding mostly the architectural details and design motifs of left over buildings. Due to poor workmanship and the absence of regular effective maintenance, these streets usually over flow. The solid waste is collected through these sewer pipe lines that causes regular blockage in flow.

4.5 Impact of Services on Streets and Streetscape

The streets and alleys in the WCL have been affected at two levels due to the provision of infrastructural services. One is streetscape and its furniture and the other on the level of its pavement.

The erection of street components of infrastructural services[19] in road side area not hampers the vehicular and pedestrian traffic flow as well as influence badly affects on the visual impact of streetscape. The identifiable elements of the traditional cities and heritage are visually polluted for visitors. Furthermore these infrastructural service components encroach upon the possible space for street furniture. Temporary daily-shops that close up informally under them future hinder the smooth flow of traffic.

In old days there was no practice of paving the streets. The open-drains for waste water were made on two sides of streets and the central area was used for pedestrian movement. When underground services were laid down in place of open drains it became essential to pave the street surface with some flooring material like brick-on-edge, flat-brick paving, tough-pavers of concrete etc.

Along with the underground drainage services, the problem of blockage occurs. For cleaning purpose and giving access to underground pipes, manholes were introduced at regular intervals. Due to the occasional absence of manhole covers, sometime these became death holes and sources for collection of waste. The repeated paving of the streets has resulted in a raised surface street level and heritage buildings of the WCL have became lower in level. This has led to various problems causing increase in rapid deterioration and damaging of the building structures.

5.0 RECOMMENDATIONS

The old buildings of WCL are rapidly deteriorating because of unmanaged, poorly administered and ill-planned layouts of infrastructural services by the individual line agencies. The living environment of residential buildings is becoming un-hygienic. The moist environment directly affects the quality of life. Because of rapid deterioration rate of old buildings, new multi-story RCC frame structures of commercial land use are rapidly replacing the old heritage buildings of WCL.

The infrastructural services within the WCL are administratively controlled by the provincial as well as federal agencies. These various controlling authorities have little or no mutual co-ordination and interaction while laying down their services in field. These agencies work independently without consulting and cooperating with each other. For the case of greater Lahore, this approach may be appropriate to an extent but for the case of the WCL it has proved to be a total failure. There is a need to constitute

18 These historical buildings have been constructed over layers of several meters filling.
19 These includes transformers, telephone and electricity poles, Distribution Boards of PTCL and SNGPL, etc.

legislation to declare the WCL as an independent entity in its administrative and technical sphere.

The electricity, gas and telecommunication services should be lent from the federal agencies like WAPDA, PTCL and SNGPL and should be controlled and maintained by the Walled City Authority (WCA) which is planned to be established as an independent body having full expertise and control within the walls of the old city[20].

Use of heavy capacity transformers[21] can reduce their number substantially within the WCL. Further, instead of their erection on the road or street areas, small plots at regular intervals may be purchased within the WCL to accommodate services like transformers, PTCL boxes, etc. Service corridors under the surface of roads and streets will provide sufficient space to accommodate cables, pipes, and supply lines. The visual and aesthetic aspect of these heritage buildings cannot be improved until all these infrastructural services do not go below the ground level.

For water supply, under ground reservoirs have to be constructed outside the walls of old city. The water may be disinfected and pumped into the housing units of the WCL with the pressure so that it can reach the water tanks placed at roof top of the old buildings for availability of water at 24/7.

The collection of solid waste and its regular disposal is an important feature for up-gradation of the living conditions and quality life. The sewer and storm water drainage system should not to receive solid waste, which is a major cause of blockages in the system. Complete paving of streets will not allow the water to penetrate into the foundations of old buildings.

Once the infrastructural components will go underground, then the rehabilitation component may be restored. This will inch changes in facades to revive the homogenous character of street-elevations. It requires an integrated coordinated approach[22] for restoration of the physical components and an independent approach at administrative level.

Project Management Unit of Sustainable Development of the Walled City Lahore Project (SDWCLP)[23] that is working with the technical support of the Aga Khan Cultural Service for Pakistan (AKCSP) since July 2007 for the last four years is required to be re-constituted into a regular technical office of the WCL Authority. The project implementation timeline cannot be spread on a span of few years. It is a regular and an on-going process; hence a regular technical and administrative office need to be established continue and maintain the process of restoration of heritage buildings of the WCL.

20 A legislation named as "Walled City Act 2010" has been framed by SDWCLP with the help of AKCSP through a legal Consultant. In April 2011, it has been passed by Cabinet Division and is ready to place before Punjab Assembly for its final approval.

21 Report by AURECONS Engineers suggests the usage of 1500 kVA transformers but LESCO engineers are not agreed upon due to their handling and repairing issues.

22 AKCSP in its Preliminary Strategic Framework has suggested the same approach where as in beginning (2006-07) when project started, it was planned to get executed the infrastructural services component from the concerned line agencies after designing from the consultants. For the purpose, PC-I was also got prepared but could not be implemented.

23 SDWCLP was established in year 2006 by Planning & Development Board (P & D) of Government of Punjab with the loan agreement from World Bank, for completion of the project within four years time period. In the first phase, only an area of Royal Trail (*Shahi Guzargah*) starting from Delhi Gate and ending to the Maryam Zamani Mosque that is 11% of the total WCL's area and 1.6 km long was planned as pilot project. PC-I was prepared and preliminary socio-economic surveys were carried out by the Urban Unit (another initiative of Government of the Punjab to address the urban issues). In year 2007, after public-private partnership with AKCSP and its role as technical wing, proposed project approach was changed to "Integrated –Coordinated Design Concept" for infrastructural as well as rehabilitation components.

REFERENCES

AURECON, 2009a, Lahore Walled City Project- *Integrated Infrastructure Conceptual Design*-Draft Final Report: Volume-I "Integrated Infrastructure Planning". p.12

AURECON, 2009b, Lahore Walled City Project- *Integrated Infrastructure Conceptual Design*-Draft Final Report: Volume-I "Integrated Infrastructure Planning". p.16

AURECON, 2009c, Lahore Walled City Project- *Integrated Infrastructure Conceptual Design*-Draft Final Report: Volume-I "Integrated Infrastructure Planning". p.26

AURECON, 2009d, Lahore Walled City Project- *Integrated Infrastructure Conceptual Design*-Draft Final Report: Volume-I "Integrated Infrastructure Planning". p.27

AURECON, 2009e, Lahore Walled City Project- *Integrated Infrastructure Conceptual Design*-Draft Final Report: Volume-I "Integrated Infrastructure Planning". p.38

AKCSP, 2008a, The Lahore Walled City: *A Preliminary Strategic Framework*, Draft Report Prepared by Aga Khan Trust For Culture (AKTC) & Aga Khan Cultural Services Pakistan (AKCSP) under Historic Cities Programme. p.5

AKCSP, 2008b, The Lahore Walled City: *A Preliminary Strategic Framework*, Draft Report Prepared by Aga Khan Trust For Culture (AKTC) & Aga Khan Cultural Services Pakistan (AKCSP) under Historic Cities Programme. p.7

AKCSP, 2008c, The Lahore Walled City: *A Preliminary Strategic Framework*, Draft Report Prepared by Aga Khan Trust For Culture (AKTC) & Aga Khan Cultural Services Pakistan (AKCSP) under Historic Cities Programme. p.8

Hankey, Donald, Conservation of the Walled City: Case Study, Lahore Pakistan, South Asia Infrastructure Sector Unit, The World Bank Washington D.C. USA

LESCO, Office Record of Executive Engineer, Lahore Electricity Supply Company.

SNGPL, Office Record of Sui Northern Gas Pipeline Limited Lahore

WASA, Office Record of Directorate General Water and Sanitation Agency, Lahore.

ANCIENT IRANIAN URBAN STRUCTURE AND ITS SITUATION IN CONTEMPORARY CITY

*Nayerehossadat Mousavi**

ABSTRACT

The main topic of the article is based on studying the structure of historical Iranian cities. Most of the ancient Iranian cities have had recognizable skeleton and structure, which have been expanded from the most public places of the city such as Bazaars (market places) and Squares to the most private parts like neighborhoods. This type of unique organic structure organized the city form and the development of the city occurred within this framework.

There are lots of examples of such cities, that have maintained their main structure and their historical form can be easily identified even upto the last fifty years. Some cases of these structures and constituents (such as their axes and joints) are mentioned in this article.

However, if we consider the current condition of Iranian cities, we will see that the major growth of cities in the contemporary era- specifically in recent decades, has happened outside of the historical zone, whilst the physical structure of old city is suffering from severe erosion and disintegration, it is still coherently interwoven with the social structures and values. The disintegration and erosion of the old urban fabrics and diffusion of city landmarks, neither show the unified structure nor transform the valuable ancient pattern into a major issue.

The main pattern of the old city's structural body and its basis which had been constant, have been transformed due to diffused and unorganized development of the cities. As a result of the disorganized but continuous urban growth, the pattern of city structures which had its roots in the history of the city underwent metamorphosis. The structures of ancient Iranian cities which have had unity, integrity and regulation are collapsing within this irregular growth and are remaining as broken frames of the city.

To find suitable strategy for dealing with historical cities which are collapsing internally and expanding towards their suburbs, we have studied the definition of the main structure of a city and the perspective of the theorists in this respect so that we can provide a framework for sustainable development for these historic cities.

Additionally, this paper studies the ideas of structuralisms and the definition of the structure of the city, structure of ancient Iranian cities and its component (joints and axes) through a few examples. Afterwards, it refers to some examples of expanding ancient cities. In light of these examples, it will present solutions and strategies to achieve sustainable development and structural regulations.

Key Words: Urban main structure, Iranian old city structure, joints and axes, sustainable development.

MAIN STRUCTURE OF HISTORICAL IRANIAN CITIES

A city structure is comprised of a main part, as a spine and a network of various land uses in addition to elements which integrate the city as a unity, its order extend & to the furthest urban fractions such as residential districts. The expression (urban main structure) is used regarding a certain part of the city, in which physical and behavioral centralization (density) takes place, and other constructions throughout the city fill the gaps between these main sectors following its order as fillers (Hamidi & others, 1997, p1) (Figure 1).

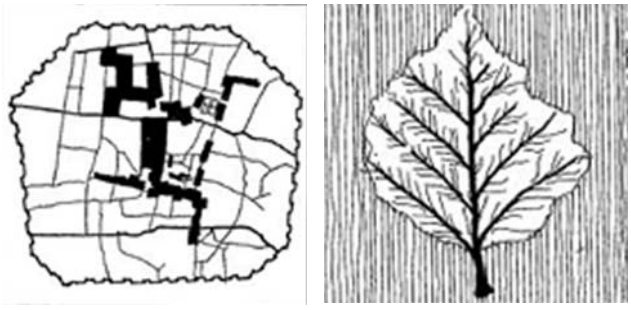


Figure-1: Comparison Structure of a city (old Tehran) and structure of a tree or leaf.

* Master in Urban Fabric and Architectural Conservation and Revitalization from Fine Art Faculty, University of Tehran.

In Iranian cities, locations of various physical main factors and elements regarding the city, its functional characteristics, access organization to the city(internally/externally), and access to different urban main elements indicate a certain type of urban "main structure".

Some Iranian theorists have rendered theories regarding this kind of structure and its rules. Herein, I mention the theories of Nader Ardalan, extracted from his book "The Sense of Unity":

Ardalan believes that the urban order is similar to crystal fractions, which have been polarized by means of a magnet. In traditional cities, this magnet is the Bazaar (old market), mobility system, and fractions are stores, karvansarais, schools, mosques and public baths. The market is begun and ended by gates or a canonic area such as a mosque. Different routes also are drawn from this main path. From his point of view, cities are similar to human skeleton and have certain structures.

This area is the center to the city but it's not just a central point in space, rather it moves length wise as time goes, therefore, it produces the linear movement of the Bazaar (Figure 2). This paradigm provides the possibility of development and growth. In a comparison between this paradigm and a living creature, one can say that Bazaar begins from a point which is presumed as the head, and grows cell like a natural model, then continues to the heart of the city which is the Friday mosque, and then reaches the city's gateway (Darvazeh). In this structure while the Bazaar grows as a spine for the city, pedestrian paths grow toward residential districts as ribs. Inside this structure, crucial urban organs such as; public baths, schools, guest houses (karvansarai), warehouses, bakeries, water storage rooms (Abanbar), cafes and merchants stores are situated and developed (Ardalan & Bakhtiar, 1973, p93).

Among Iranian cities, Isfahan is one where the structure is recognized as the most elegant and beautiful. In this city, the Bazaar, Naghsh-i-Jahan square and its quarter buildings, Charbaghstreet, Zayanderood River and its historical bridges form a main structure. It is interesting to know that this structure still holds complete adaptability and has been able to cope with all modern requirements therein (Figure 3).

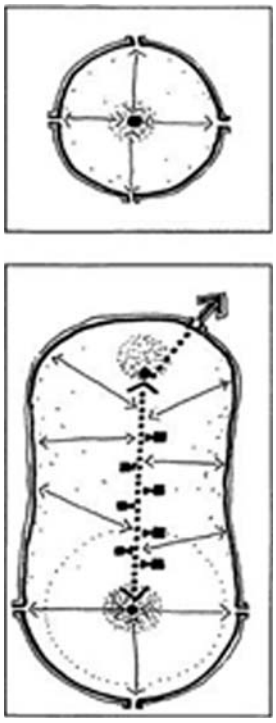


Figure-2:
Source: Ardalan & Bakhtiar, 1973, p 89.

Figure-3: The integrated structure of the city Isfahan.
Source: Ardalan & Bakhtiar, 1973, p 127.

The main structure of the city broadly speaking maybe defined as a grid and axes, urban components and collections in which its fractions assume different roles with regard to each other, a role which they don't assume individually:

1. Bazaar (Iranian traditional market): It is a spine of the city structure in which commercial, social, cultural, religious and political urban activities take place.

2. The city center complex: Includes the city square and Jamia Mosque, in which social, cultural and religious urban activities take place. This collection is situated at the midst of the Bazaar

3. Arg (The castle) collection: Includes the Arg, the Arg square and the government school and mosque. It is the political center of the city and is situated at the end of the Bazaar line.

4. Urban main axes: These axes on one hand connect residential districts to Bazaar by means of indirect access and on the other hand, provide access to the outer area of the city through the urban gates. Public functionality is the most important usage of the buildings on the edges of these axes.

5. Residential districts: These districts are the main urban units and by means of their main access connect to the main structure.

6. Darvazeh (city gateway): These are inlets which provide access to the city from outside or out of the city from inside by means of urban axes.

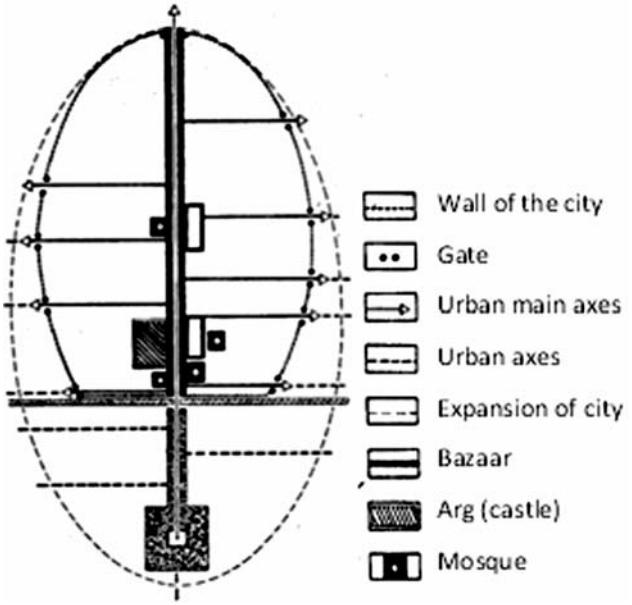


Figure-4: The symbol sketch of an Iranian Urban Structure. Source: Mirmiran & Vaezi, 1989, p30.

7. Baroo (The tower and enclosure of the city): This comprises the outer urban layout, encloses and integrates it (Figure 4).

Finally, it could be said that traditional structure of Iranian cities is comprised of various elements and axes which are interconnected by means of spaces called “joints”. There are some rules governing these joints which provide a certain special integrity and order of Iranian urban structure (Figure 5).

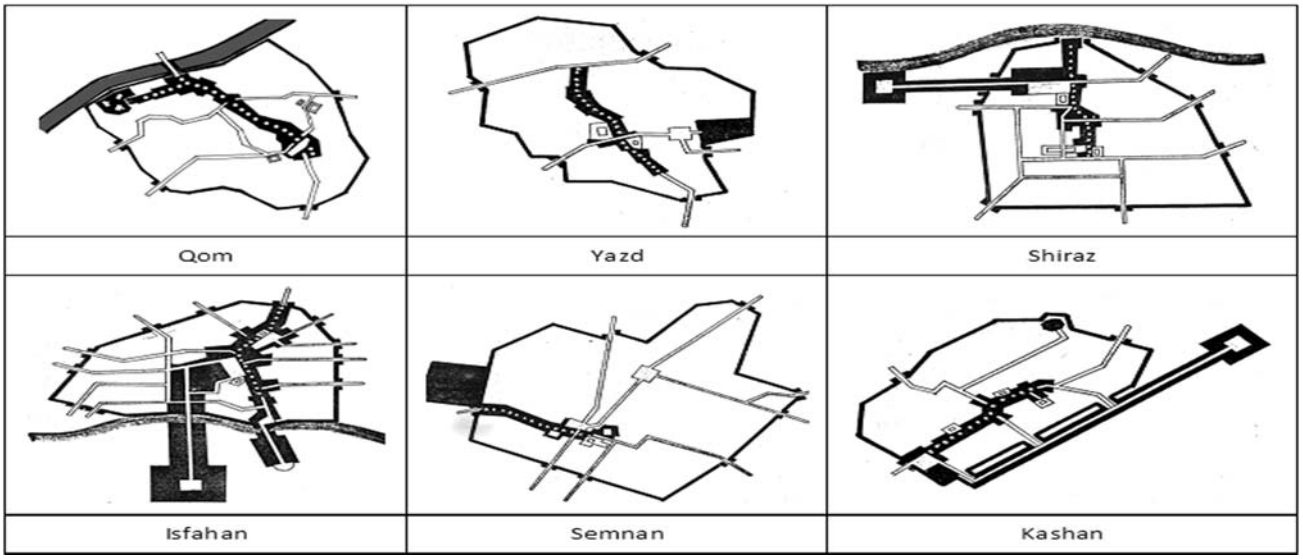


Figure-5: Examples of Iranian ancient urban main structure.

Urban Connections, "Joints", in Iranian Urban Structure

As mentioned, the urban structure is comprised of urban axes, elements and collections which through the passage of time have been developed on the basis of the urban scale hierarchy, and have been interconnected by means of several joints, thus providing a coherent urban fabric. In this integrated structure, urban joints have supreme importance; these joints connect the urban spine and the market to urban accesses, and from there to district's spinal cores and finally to residential districts, even in residential units and vice versa (Figure 6). Also in the past the growth of the structure occurred with adding new joints to the old structure. The growth of the Isfahan main structure in 17A.C (Safavid period) occurred with constructing Naghsh-i-Jahan square as a new connection which joined the old part of structure to new constructed parts (Figure 7).

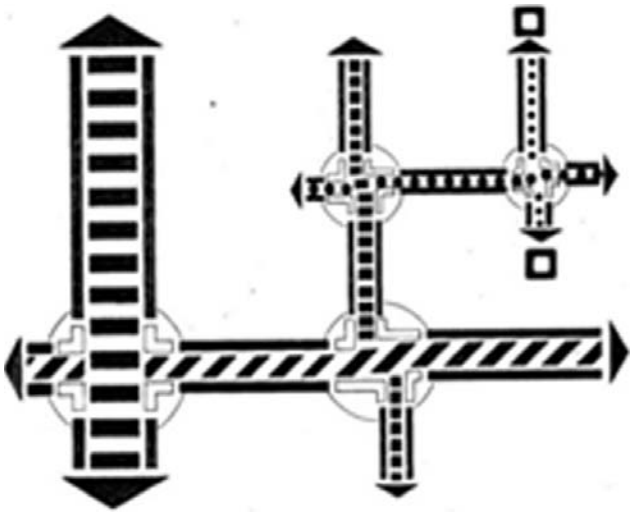


Figure-6: The symbol sketch of the scale ranking mechanism between urban joints.
Source: Mirmiran & Vaezi, 1989, p 51.

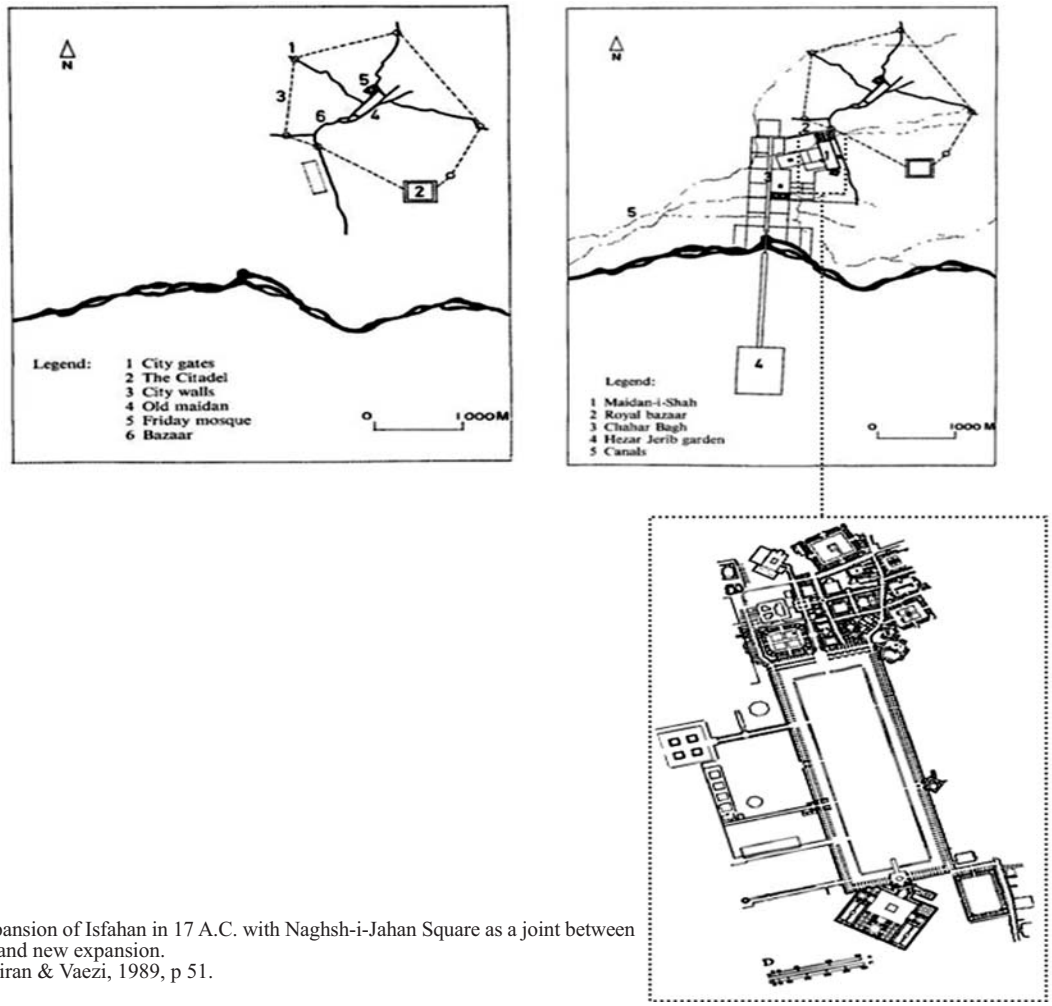


Figure-7: Expansion of Isfahan in 17 A.C. with Naghsh-i-Jahan Square as a joint between old city parts and new expansion.
Source: Mirmiran & Vaezi, 1989, p 51.

Joints have four main rules within the urban structure:

1. Connection of urban axes to each other and to the main part of the structure (the Bazaar).

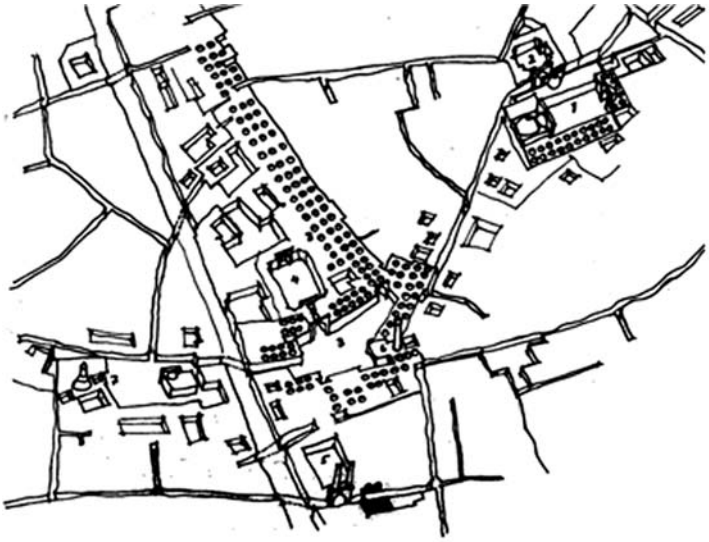
2. Changing the functional character of urban accesses from one point to another.

3. Linear development of urban axes.

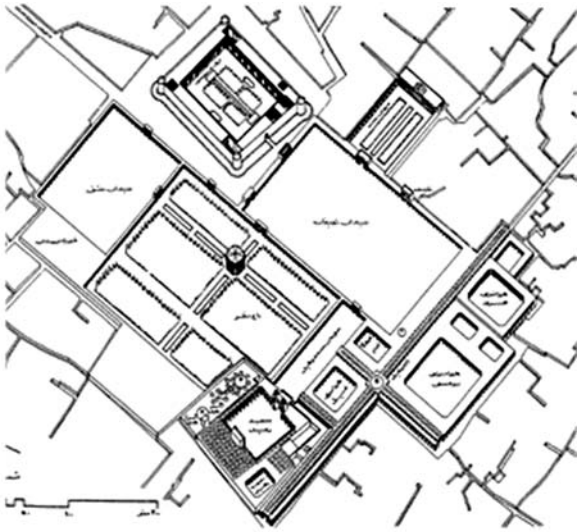
4. Reorientation of urban axes and the urban main structure (urban development).

Since the joints are urban nodes and connect streets and axes, they contains the main activities and usage of the city according to the level of importance of the streets.

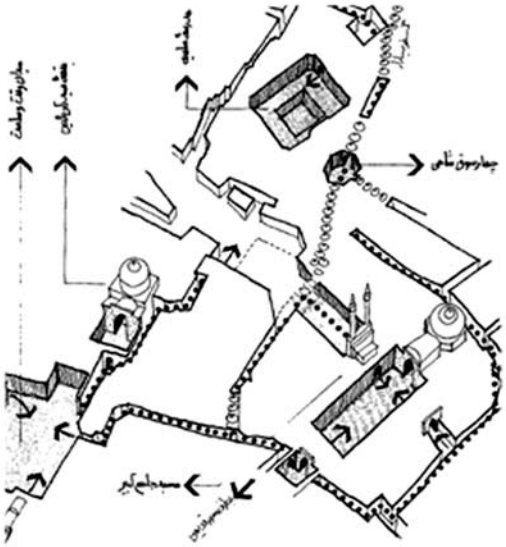
Cases of Urban Joints in Iranian Old Cities



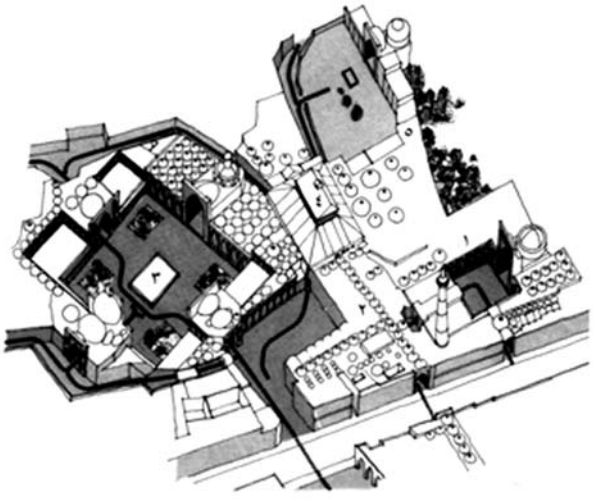
Old Square complex in Qom



Karimkhani complex in Shiraz



Jame` mosque entrance joint in Yazd



TekyePahneh joint in Semnan

Iranian Cities Structural Change

After Rezakhan (a colonel who brought down the Qajar dynasty and became the king) and the beginning of Iranian modernization, vast measures were taken regarding the physical changes in cities. These activities mainly began from 1931 and continued till 1951.It was in this period that most Iranian cities underwent shortsighted changes and variations not programmed and foreseen. These changes included: widening narrow and old streets, applying a rectangular grid with its main structure as new streets network, and also changing old districts, constructing new squares and buildings emulating the West. In general, one must say that all these vast changes in that period are the very clear sign of moving towards modernity discarding the historical concept of Iranian cities (Mashhadizadeh Dehaghani, 1995, p388) (Figure 8).

Streets at the beginning of the century, in addition to imposing a new urban structure, entered into the Iranian urbanism in opposition to spatial and functional old structure of cities, and still continue to exist. “The notion of rapid outward development of cities due to the declaration of the “Open Ports” Policy by the current government was another reason. These efforts were to discredit current structures, not starting any new” (Izadi, spring 2001, p35) (Figure 9).

Though by the arrival of the modern period crucifying old cities seemed unlikely, what's happening now in Iranian cities nevertheless is the continuation of the same thing. In addition, destructive development and fragmented restoration projects are rampant. So, a structure which has been developed over several centuries has undergone dramatic changes in recent decades, and urban development instead of going by its traditional structure, is now destroying it.

The structure of the Iranian ancient cities which have had unity, integrity and regulation are collapsing within this inconsequent and irregular development and are remaining as broken frames of the city[1].

Figure-8: The direct streets of modernization period in Hamedan (top) and Mashhad (bottom).

Figure-9: Urban structure changing in Hamedan through the modern direct streets.

1 Such dramatic changes that are still ongoing in Iranian cities are the results of comprehensive and detailed plans by companies and implementations of municipalities under the governmental approval and financial supports. These plans in recent years under the name of renewal and rehabilitation plans (1992-1994) and especial plans for problematic urban fabric (1993-1997) were done; this trend still is going on in many cities.

Some theories have been offered by some Iranian theorists regarding cities which historically and structurally are significant but are now being destroyed and transformed internally. These theories propose to give a proper theoretical framework and so that current and future urban changes and structural measures continue on that basis.

Accordingly the hypotheses of these theories are:

- A city as a growing whole (line and organ) must have a main structure of its important components and bases, supporting and strengthening the urban form.
- Due to today's urban complexities and their problems, total planning is ineffective but by planning according to the main structure of cities, good planning could be achieved.
- The best way to face the present disintegrated and disjointed cities is to understand the structure features and its foundation.
- The main structure of cities as their organizer, in addition to making the city and its components coherent by its adaptability, keeps its integrity over time.
- The most appropriate structure for present cities is their traditional structure and a development on that basis.
- A correct organizing of urban main joints and axes as the main parts of urban structure enhance the public life and activities.
- A successful urban planning may only come true by allocating the historical urban structure to the main and principal activities therein.

In this article, it has been tried to prove these hypotheses by using structuralist scholar's theories.

Theoretical Framework to Face Current Condition of Iranian Cities with Historical Structures

Nowadays cities are complex therefore, recognizing a city's ordering forces and the struggle to organize it in relation to the cities components would ease developments and promote control over the city changes. (Hamidi & others, 1997, p32)

In contrast to functionalists, structurists approach the city as a whole (in their word: Gestalt). (Bazrgar, 2003, p55)

Advocates of this opinion rejected efforts to ascertain the final form of the city (total design), and offered the theory which says planners and architects must design main parts of a city, and the rest be left at the hand of people themselves.

Designers such as Christopher Alexander, B.V Doshi, Edmund Bacon, Fumihiko Maki, Aldo Rossi, David Crane, Roger Transik and others have offered theories regarding urbanism, on which brief discussions will be presented in this chapter.

Edmund Bacon and the Theory of "Organizing the Urban Main Structure"

Bacon believes that any project for any part of the city must be consistent with the main urban structure. Furthermore it must be flexible enough as to provide developmental possibilities if necessary. So, a powerful strength of unity is provided within the organization and buildings will be brought into a unity context.

According to Bacon the main structure is the organizer power of the city, and if the designer puts most of his efforts thereon, he'll be more successful.

He introduces the abstract of his theories in one single phrase:

"Though the leaves go and come each fall and spring, the trunk and branches of the tree remain, and it is they that determine the form of the tree."(Bacon, 1974, p306)

Christopher Alexander and the Theory of "The Growing Whole"

This theory is produced upon the concept of urban structure and structurism in design, and poses the feeling of vivaciousness in cities, a phenomenon which is a result of a certain way of designing and existed in historical cities.

Alexander thinks about the growing whole and says that, we feel this quality very strongly, in the towns which we experience as organic. To some degree we may know it as a fact about their history. To some degree we can simply feel it in the present structure, as a residue.

In each of these growing wholes, there are certain fundamental and essential features:

First, the whole grows piecemeal, bit by bit.

Second, the whole is unpredictable. When it starts coming into being, it is not yet clear how it will continue, or where it will end, because only the interaction of the growth, with the whole's own laws, can suggest its continuation and its end.

Third, the whole is coherent. It is truly whole, not fragmented, and its parts are also whole, related like one part of a dream to another, in surprising and complex ways.

Fourth, the whole is full of feelings always. This happens because the wholeness itself touches us, reaches the deepest levels in us, has the power to move us, to bring us to tears and to make us happy.

All traditional towns have these features in their growth. But the modern practice of urban development does not have these features. It does not deal with growing wholes at all (Alexander, 1987, p14) (Figure 10).

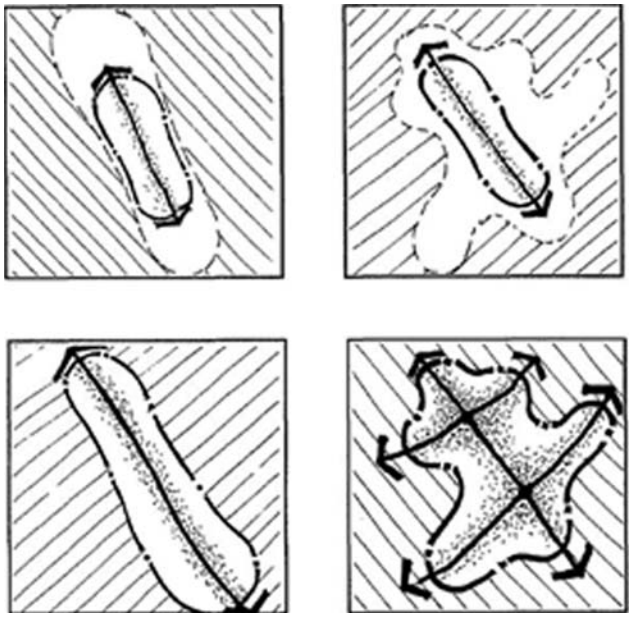


Figure-10: The growing whole.

Kenzo Tange and the Theory of "The Revitalization of the Current Structure of City and Linear Structure"

He believes that the boost in movement is not the reason for traffic problems in cities, but it is the urban structure which cannot afford to provide the needs regarding moving from point to point in cities. This phenomenon is worse in cities with the street pattern of central-radius, and leads to immobilization of urban functions.

We've understood that, in addition to functionality, we need some kind of a structure in the combination process of functional units. Nowadays, the combination of functional units is less inclined to unity, and more towards numerousness, and based on improvisation. We've learnt from our experiences that landmark and signs must be generated from, and within the process and measures regarding the organization of the structure.

He explains the necessity of this view point as follows:

A large city with 10,000,000 people is a phenomenon occurring in the second half of the 20th century. And in order to survive, it requires a structure conformant, appropriate to this time. The medieval radius pattern of cities with a centralized traffic and a line of buildings is no more an appropriate structure; however, constructing a totally new city is not a solution, reconsidering the contemporary structure and revitalizing it could be one (Tange,1966) (Figure 11).

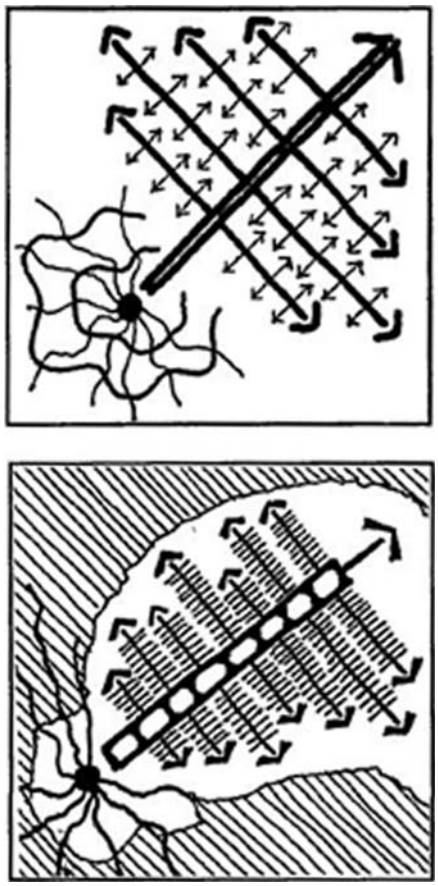


Figure-11: The linear structure of Tokyo designed by Kenzo Tange. Source: Hamidi & others, 1997, p 13.

Aldo Rossi and the Theory of "Urban Main Structure"

He believes that cities have a main structure through which they are connected to the history. It is a collection of elements made by man, which has some sort of integrity. This is a man-made combination with its components integrated. He views cities as a collection of totalities, each of which consists of a complete entity on its own and which are connected to one another through the main structure components that have their unique identity but are interwoven to each other by means of the main structure. This main structure explains the historical urban evolution. Rossi believes that the main structure doesn't belong to a certain period and must be studied in the length of history. This main structure can adapt and make itself appropriate for each period (Rossi, 1986).

Kevin Lynch and the Theory of "Landmarks Organization Network and the Image of Cities"

He believes cities to be a physical unity which is perceived and observed by people therein. Mental order is necessary to make a cognitive map out of cities. So, the final image of a city in the mind represents clear images, identifiable landmarks (from city blocks and spaces) and perceptual ability to depict it. Differences and similarities influence the structure of a city. He believes that today's urbanism must look for urban landmarks in each period, identifying a value organization and system of landmarks through the history (Lynch, 1960) (Figure 11a).

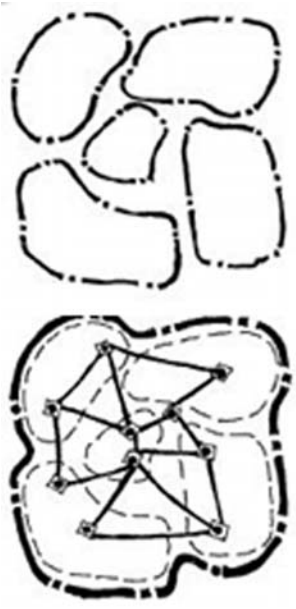


Figure-11a: A value organization and system of landmarks. Source: Hamidi & others, 1997, p 7.

CONCLUSION AND SUGGESTIONS

The above mentioned theories could be integrated as a way of approaching the current condition of historical Iranian cities in relation to their structure.

According to the theory of Organic growth (Alexander), it is preferred to locate the further development inside cities rather than investing on outer lands. Bacon's theory proposes organizing the structure of a city as the essence of city developments. Lynch emphasizes on the legibility of cities by considering the hierarchy of its perceptual elements as the most important step in designing cities. Rossi considers the historical structure of a city as its main structure. Tange points at conserving the current structure of cities as much as possible; in case it is not responsible for residential needs, he proposes reconsideration, which is adaptable to further developments.

In historical Iranian cities (as it was mentioned earlier) while there is a physical/functional efficient structure which after centuries is recognizable and functions, theories about structuralism are useful too. Linear structure with the ability to grow (as it has been growing during centuries) works as an organic growing whole where its components enhance its integrity. This structure due to its special physical, social, economic and cultural opportunities provides a context for sustainable development and it leads the trends of development towards internal lands.

As a conclusion, for completing city constructions among such cities the first and the most crucial step is to recognize the city's structure and its role during the history. Understanding the structure and its features in different scale from the whole city to districts in addition to, analyzing its components (axes and joints) would be the best lead in prioritizing renewal actions and urban revitalizing and it is the best catalyst for the future developments orderliness. Here joint (conjunctions) are most important because revitalization of urban centers is a widely accepted way of leading developments.

To sum up, the conclusions are:

- Internal urban development and investment and efforts to develop a city from within instead of its outer development by keeping its traditional structure.

- Revitalizing the main urban structure which has developed throughout the history.

- Planning for the main structure of the city, allocation of its main spaces to important functions as public territories, and leaving the neighborhood's developments to urban codes and construction's guidelines.

- Urban linear development continues in order to provide coherent growth any time.

- Providing a legible hierarchy of urban landmarks can clarify the growth path of cities and create a better perceptual image.

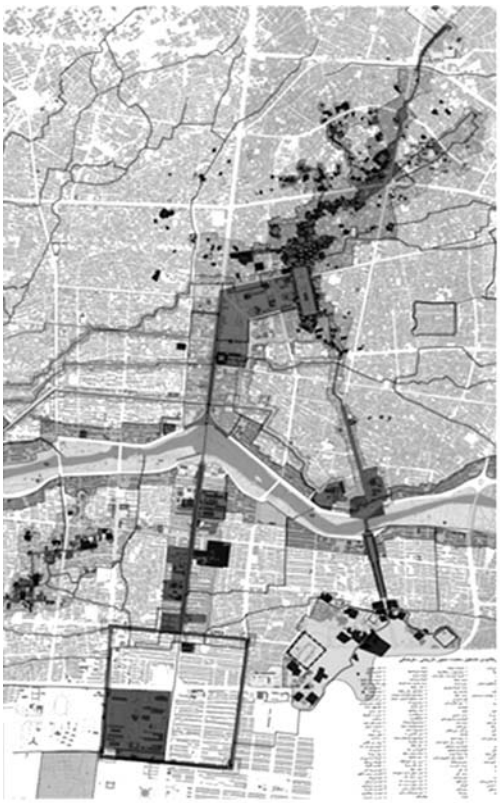
Cases of Historical Organizing Urban Fabrics Project According to Structural Concepts

Comprehensive plans for revitalizing historical/cultural path which were to consider the organic structures culturally/historically in order to regenerate them, in addition to rehabilitation and renewal plans for historical fabrics are presented here, as improvement plans based on designing according to the historical structures.

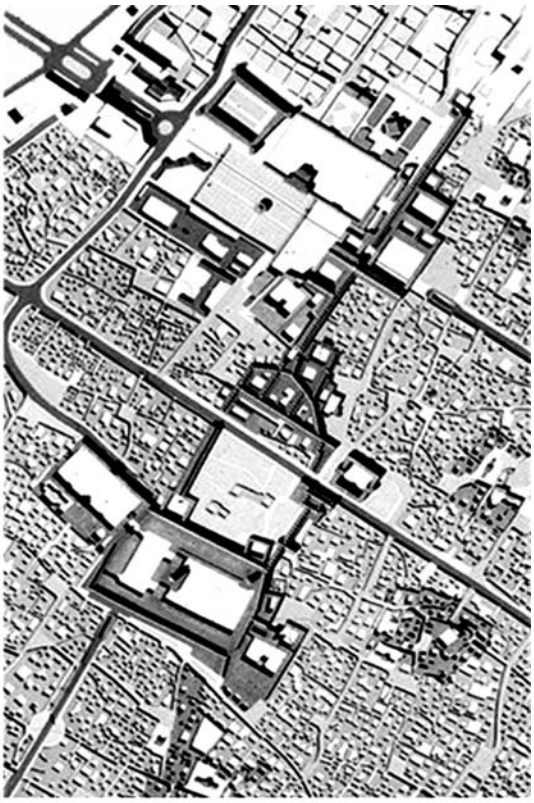
The Year 1990 was the beginning for a new era in approaching the historical urban fabrics in Iran. Since then urban fabrics have been considered separated from the whole city plans. From then onwards, multidimensional city structures and its context have been considered (IZadi, spring 2001, p38).

Considering this new approach, the commission of urbanism and architecture began revising the historical sites and plans based on following the structural order. Recognition of the structures and proposing guidelines in order to cohere the historical structure to the modern fabrics was the essence of them. The result of their attempt was primitive guidelines for Urban Design projects but some unreasonable expectations caused the failure.

Among these cities those who had a stronger structure gained better projects. That is why cultural and historical revitalizing and improvement projects in cities such as; Isfahan, Shiraz, Tabriz, Yazd, Kerman, Hamedan, were better due to their spinal cord structure, mostly as in the Safavid period cities, where the unity of physical structure is more evident. This is a principal reason approving the hypotheses of this article that the more coherent the structure of a city is, the more successful functions and order it gives to further developments. As a result, in cities that have lost their integrity with segregated spaces, plans especially regenerating plans should be concerned on the main structure of cities including axes and joints in order to be more successful.



Isfahan urban main structure planning



Shiraz urban main structure planning

Organizing Cultural and Historical Main Structure of Shiraz and Revitalizing the Karimkhan Complex

In this project revitalizing the spine of the historical city was intended which includes Bazar and Shahcheragh complex, as it is inscribed in the map; these two complexes are not well connected, there are some cuts between them by machine based streets.

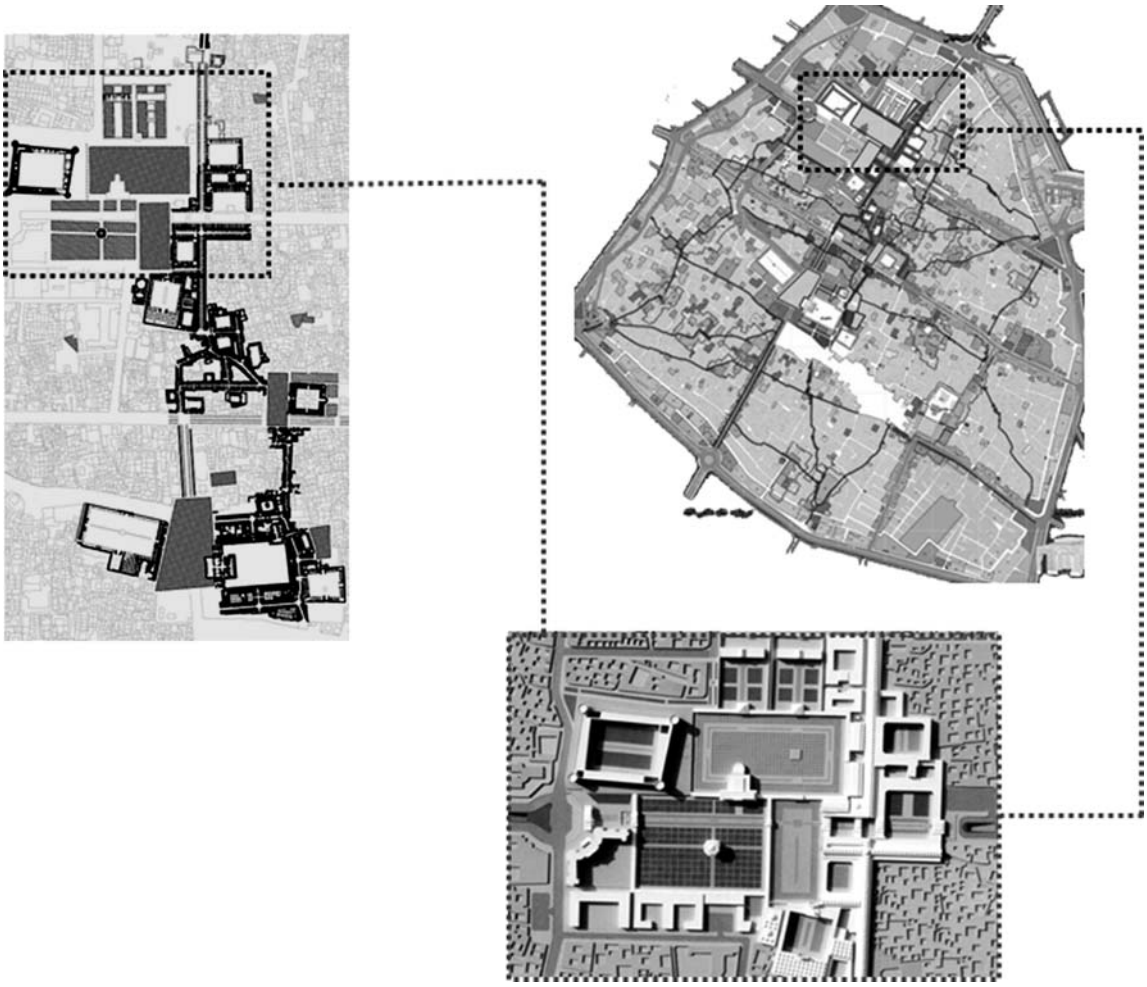
Project suggestions which are according to the structure situation within the city of Shiraz include:

A. Enhancing and organizing the Shahcheragh complex.
B. Revitalizing (reviving) the Karimkhan complex.
C. Improving the quality of the space between A and B.
D. Developing the main structure.

Rreviving the Karimkhan complex:

This project is inspired by the cultural and historical spaces of Shiraz.

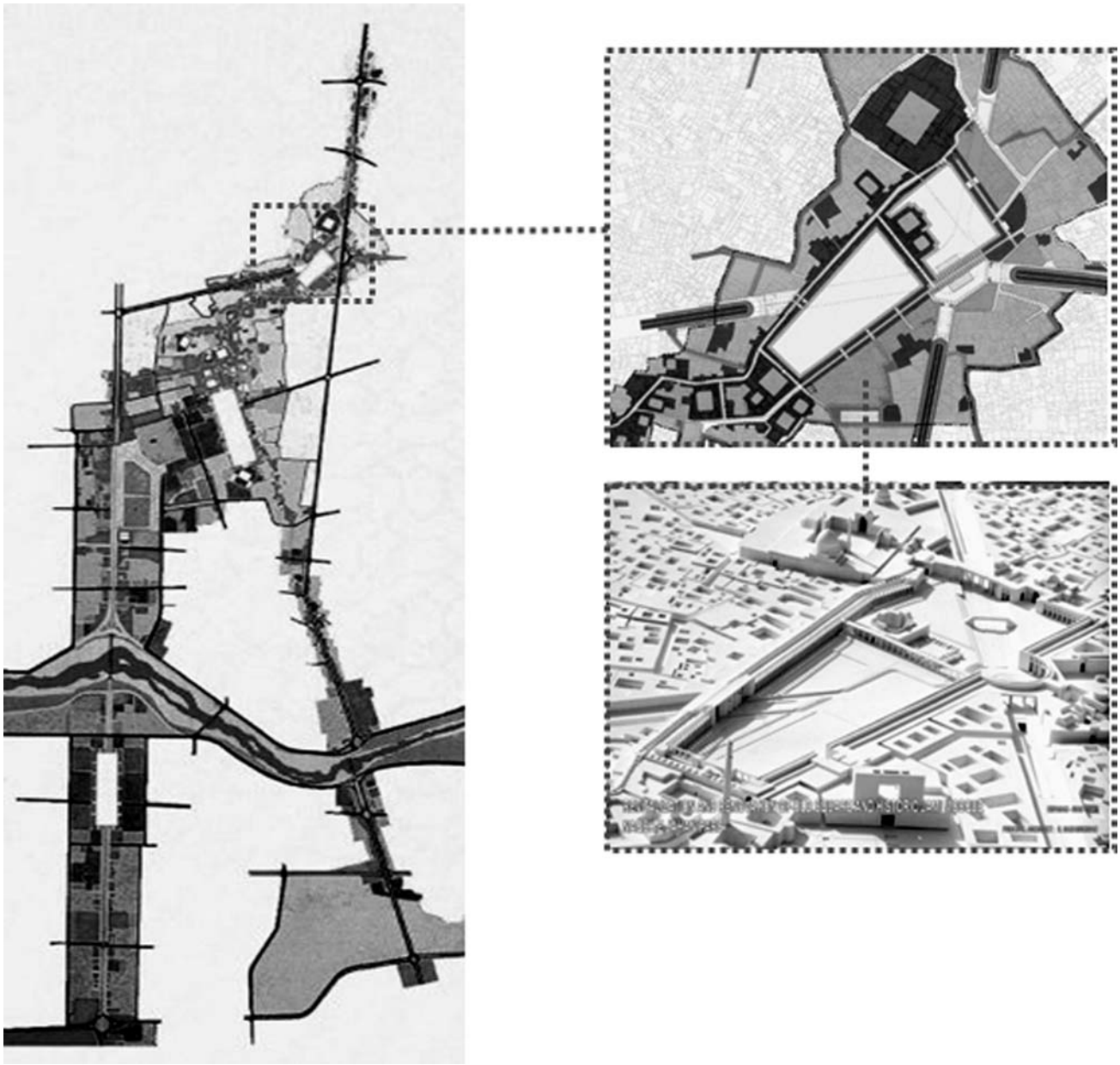
Its objective has been re-establish unity between the two complexes and revitalize the Toopkhaneh square of Shiraz. Revitalizing and recreating spaces of the Zand period such as the artillery square, BagheNazar, and the frontier of the Vakil mosque, and also depiction of the arena of guest houses Roghani, Gomrok, and Ghavam, and reconnecting to the market, have been suggested in the project. It says that, the narrow Zand street which now crosses the complex would turn into a wide pedestrian walkway. Implication of the Zand access in the Karimkhan complex will result in recreation of the market and Karvansaray cut off thereby. The roadway between the Roghani Karvansaray to the municipality square has been proposed to turn into a subway. This project is under construction and the subway of the Zand Street is already finished[2].



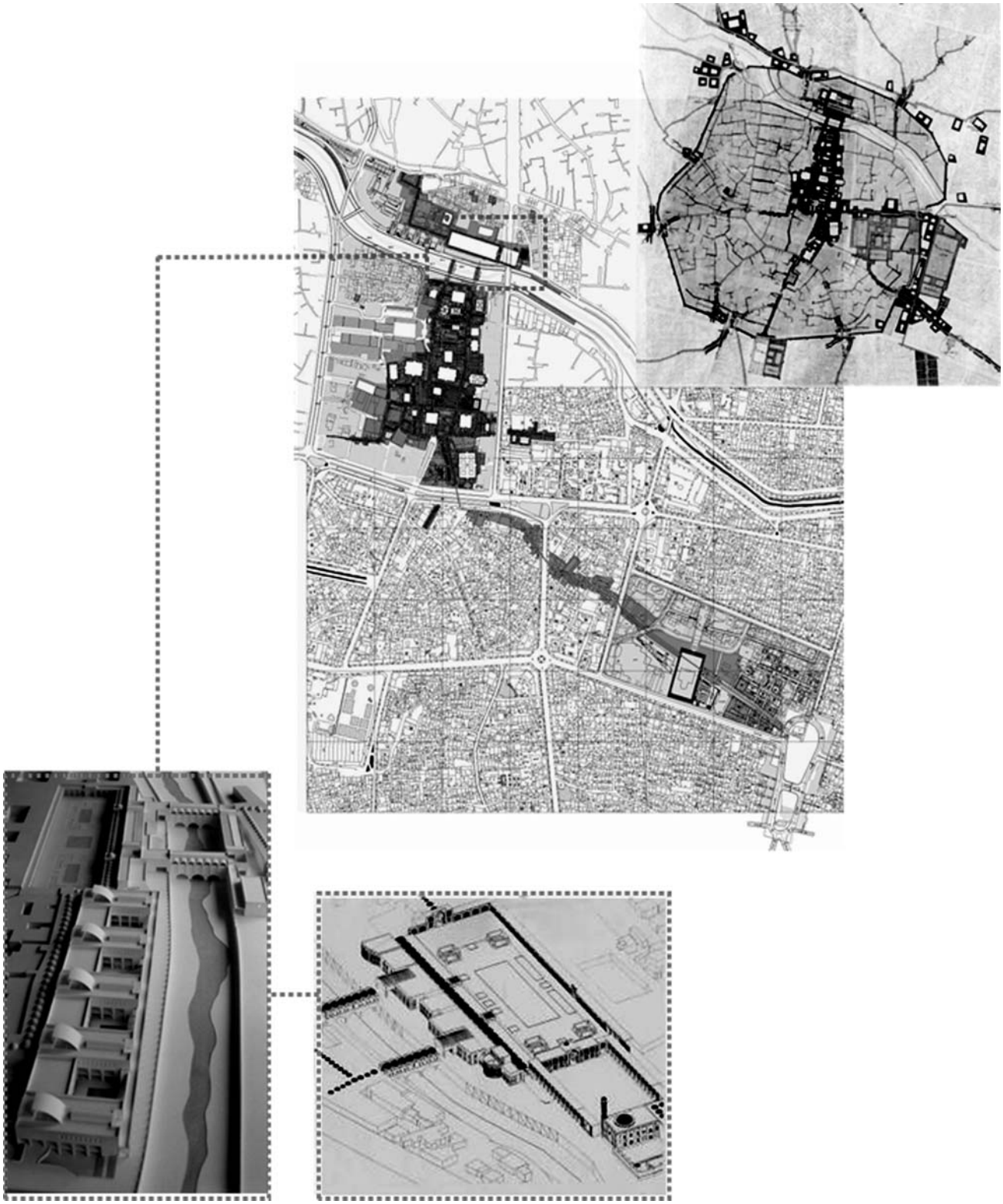
2 Engineer adviser of Naghsh-i-Jahan Pars planning report, Summer 1998.

Revitalizing and Organizing the Cultural and Historical Main Structure of Isfahanan Old Square Complex

The main structure of Isfahan is it's cultural and social city spine which is a distinct example of structure in Iran. This path has always been structurally important and even now the main structure of the city is based on it. This complex starts southward, from the old square and the Ateeq mosque, and ends at the HezarJarib gardens in the slope of the Saffeh mountain. This is the place where Isfahan university and some branches of housing districts are located. Now the question remains: has any strategic planning had any role in the construction of these places?



Organizing Cultural and Historical Main Structure of Tabriz and Reviving the Saheb-ol-Amrand Bazaar`s Bridges



CONCLUSION AND SUGGESTIONS

The results from this research show that the historical fabrics of cities that now consist of the main part of the centers of cities, as structure of the city, would find a new existence. Therefore, connection between the old and the new structure of cities by following the principle of spatial organizing of its components in the holistic approach towards cities could be one of the best strategies in regenerating cities. Rearranging the structure of city development projects and defining the role of regeneration in this process would improve the outcome of plans.

For implementation of plans the first and the most crucial step is to recognize its structure during the history. A good perception and understanding of the main structure can be the best guide in prioritizing the revitalization plans. Also recognizing the main structure and analyzing it and its components (joints and exes) and revitalizing it as the public realm in different scales could be the best catalyst for future developments. Here joints are most important and revitalizing the city centers as city complexes and neighborhoods would lead the development to internal lands.

Tissdel & Oc in their article" *Safer City Centers: Reviving the Public Realm"* consider the role of public realm in the process of historical city center revitalization and they assess this policy as a motive for development. By taking this policy, in addition to enforcing the structure of the city, the unifying factor would be stronger.

Finally, setting up an organization or an appropriate management system in the current chaotic condition and settling organizational conflicts like those of the municipality and the cultural heritage agency in managing the historical fabrics, would prevent useless efforts and end up in more successful implementations.

REFERENCES

ALEXANDER, Christopher (1987); A *New Theory of Urban Design*, Oxford University Press, New York.

ARDALAN, Nader and Bakhtiar, Laleh (1973); *The Sense of Unity*; The Chicago Press, Chicago.

BACON, Edmond (1974); *Design of Cities*, Thames and Hudson, London.

BAZRGAR, Mohammad Reza (2003); *Urban Planning and Urban Main Structure*, Shiraz, in Farsi.

CABE Space (2004); *the Value of Public Space*, London, CABE Space.

HAMIDI, Malihe and the others (1997); *Urban Structure of Tehran*, Tehran, in Farsi.

IZADI, mohammadsa`id (2001), "*A Survey of Urban Restoration Experiences in Iran"*, Quarterly Journal Development and Rehabilitation (HAFT SHAHR), spring 2001, pp32- 42, in Farsi

LYNCH, Kevin (1960); *The Image of the City*, , Cambridge MA.

MASHHADIZADEH Dehaghani and Nasser (1996)*; an Analysis of Urban Planning Characteristic in Iran*, in Farsi, Iran University of Science & Technology, Tehran, Iran, in Farsi.

MIRMIRAN, Hamid, SiyamakVaezi*, old urban main structure of Isfahan, designing an urban joint*, Architecture M.A thesis, University of Tehran, Tehran, in Farsi.

OC, T. and TIESDELL, S. (1997b); towards safer cities, in: OC, T. and TIESDELL, S. (eds) *Safer City Centers: Reviving the Public Realm*, pp. 1– 20, Paul Chapman Publishing Ltd. London.

ROSSI, Aldo (1986); *The Architecture of the City*, MIT Press, Massachusetts.

SULTANZADE, Husayn (1991); *Urban Spaces in the Historical Texture of Iran*, Tehran, in Farsi.

TANGE, Kenzo (1996); *KenzoTange*, Verlag, Zurich, Switzerland.

EXPRESSION OF PAYING TRIBUTE TO THE SAINT: DECORATIVE VOCABULARY ON THE TOMB OF AHMAD KABIR

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ABSTRACT

The recently discovered tomb of Ahmad Kabir[1], situated east of village Chhata Pohar and west of village Jhandirwa near Dunyapur, Lodhran district (Figure 1**)** in Pakistan is unique in history of architecture in Pakistan (Hassan, Mahmood et. al. 2002, 15-18). The discovery of the tomb further strengthens the ideas of strong eastern Persian (mainly Islamic) and South Asian (inspired from Hindu and Buddhist tradition) relationship and their culmination into a new vocabulary of architecture emerged in the early thirteenth century This paper analyses these design elements for the first time in detail with reference to tomb architecture in Pakistan. In particular the Hindu religious design tradition and its assimilation in Muslim tomb has been rarely discussed adequately in any scholarship and therefore became focus of this paper. The paper is divided into three parts. The first part placed the tomb in its architectural context prevailing in the respective time. The second part discussed the Central Asian and Arab influence which was brought to the region during Ghaznavid and Ghorid period. The local Hindu and Buddhist art influences on the tomb are discussed in the third part. The architectural features of the tomb in relation to the other monuments of the region have been discussed in the last part. The paper finally concludes with importance of the tomb in the history of architecture in Pakistan and impact of meeting of eastern and western cultures and resultant new form in architecture.

Key Words**:** Ghurid period architecture, architecture of Punjab, cultural impact on architecture, tomb architecture, early Islam in India.

I

The tomb of Ahmad Kabir is located in a small graveyard surrounded by fields. Nothing much is known about the life history of the saint from original or modern sources, nor is any epigraphic evidence of the saint found on the monument.[2] It is believed that he was a respected personality of his time and therefore, a magnificent tomb was built after his death. An inscription on the south façade (Figure12 and Table 1) provides information on the date of construction of the monument and will be discussed slightly later. The tomb of Ahmad Kabir is one of the oldest surviving monuments of Pakistan built during Ghurid Period. Although monument suffered from the ravages of the time but due to constant repair the original walls still survives but roof comprised of dome were rebuilt. Comprehensive documentation of the

1 Attention to this tomb was first drawn in a short article by Hassan, Mahmood et. al. in Museum Journal 2002, 15-18 National Museum Karachi. Since then no significant research has been carried out on the subject.

2 According to local tradition the saint belonged to Hashmi clan. The family tree of Hashmi clan meets up with their ancestor (549 – 619), who was the head of the clan. He was married to Fatima bint Asad and was an uncle of Prophet (PBUH).

tomb began in March 2008. Measure drawing and extensive photography was undertaken in four field trips. Comparative studies on the decorative design vocabulary were carried out at libraries of Dumbarton Oaks and Massachusetts Institute of Technology between July and September 2008 and subsequently conclusions were formulated and opinions were sought from experts to confirm the authenticity of the ideas presented in the paper.

Ghurid Empire (Ghafur M.A 1960, Tadgell, Christopher 1994, Badaoni, A.Q 1970, Beveridge H. 1986) was spread over eastern Iran, Afghanistan, Pakistan and western India. The existing studies are mostly focused on Ghaznavid period architecture with reference to north western Pakistan (Khan, Muhammad Nazir 1985, Hamid, Muhammad 1921), Afghanistan (Schlumberger D 1952, Bombachi, Allession 1966, Wilson R.P 1985) such as Lashkari Bazaar and Palace of Masud II etc. or focused their attention on Delhi Sultanate monuments beginning from Qutub Minar and Quwat-ul-Islam mosque at Delhi. (Meister, Michael W. 1972, Joshi 1972, Brown, Percy 1942) The Ghurid period architecture mostly remained unattended. Until now only Ghurid period monuments of Afghanistan remained feature of attention (Cohn-Wiener, Ernet 1959, Chirvani, Melikian 1968, Wilson R. P 1980). The discovery of Ghurid period monuments in Pakistan only recently generated some interest in the study of interaction of local Hindu, Buddhist and Islamic traditions and consequent emergence of new architectural forms in the subcontinent.

The buildings produced in Punjab and upper Sind during Ghurid period and prior used local materials in the construction of buildings. In the plains of Punjab, upper Sind and Baluchistan brick was the principal building and finishing material. However, in the hilly areas of Northwest Frontier Province stone was used in the construction of buildings. Patan Minara, a Hindu temple in Rahim Yar Khan, and Muhammad bin Qasim Mosque at Aror, rebuilt in the 10^{th} century, were completely executed in fair face brickwork (Khan, A.N 1987-88). The brick construction has a long tradition in the region. The Indus valley sites of Harappa and Mohenjodaro (3000-1500 BC) show the complete use of brickwork in the construction. Similarly the pre-Islamic tombs in Khuzdar and Chagai District were also built in brickwork. The technique of dome construction came to this region from Khurasan and Helmund regions of Persia during the Zoroastrian period (Ashkan, Maryam and Ahmad, Yahya 2009, Farooq, A Aziz 1988, Ali, Taj 1991, Edward, Holy1991). These monuments were mostly plain from outside except Zoroastrian tombs which were decorated with terracotta plaque tiles decorated with variety

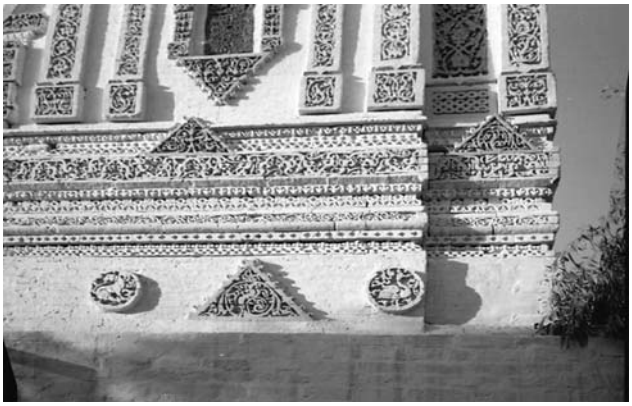

Figure-2: Tomb of Ahmad Kabir showing the lower part of the tomb just above plinth.

of themes. However, the themes of decorative designs of Ghurid period monuments were completely different from earlier examples (Husain Talib 1987, Khan A.N 1987-88). The use of glazed tiles in Multan region started around 1150 AD with the construction of tomb of Shah Yusuf Gardez.

The decorative vocabulary developed in fair face brick monuments constructed in the region in the twelfth century continued for the next three hundred years until the arrival of the Mughals in 1526. The contemporary examples of such monuments are the tombs of Khaliq Walid, Saddan Shahid and Muhammad bin Harun. The decorative vocabulary on the tomb of Ahmad Kabir is unique and different from other examples mentioned earlier (Figure 2). This paper discusses the architecture and decorative vocabulary on Muslim saint derived from Muslim and Hindu sources to pay tribute to the saint.

Lodhran district in which this monument is located came under the rule of Shihab ud Din bin Sam, popularly known as Muhammad Ghori, who after marching from Ghazni through Gomal Pass, conquered Multan along with neighboring territories of the region. By this time the dominating religion of the area was Hinduism and had its own specific design tradition. During Ghurid rule Multan region was ruled by Ali bin Karmakh from 571 AH -582 AH, whereupon he was promoted to a position of pre-eminence in Lahore. Ali bin Karmakh did several architectural projects including the construction of tomb of Khaliq Walid. Thus, Ghurid dynasty is considered to be a turning point in the architectural, cultural and political history of the subcontinent. The tombs belonging to this period and identified in the region indicated the cultural exchange between the two regions of Khurasan and Punjab and assimilation of ideas and themes culminating in to a new

design vocabulary which sustained in the later periods. After Ghori's death in 1206, his Indian viceroy Qutbuddin Aibak (r.1206-1210 AD) became an independent ruler and founded the Delhi sultanate. The other monuments belonging to this period, besides the tomb of Ahmad Kabir, are tomb of Khaliq Walid (Edward, Holly 1990, Ali, Taj 1991, Farooq A A1988, Khan, Ahmad Nabi 1990) and Saddan Shahid (Hussain, Talib1997, Lundkhore, Ali Muhammad 1988, Ali, Taj 1993, Flood, Finbarr Bary 2001).The architectural vocabulary used in these monuments reflects the relationship with the continuity of local Hindu elements as well as influences from the architecture of Khurasan and areas beyond.

The tomb of Ahmad Kabir, like other tombs, has a square plan which is a most common tradition of the region (Figure 3 & 4). A square platform on which two graves rests lies in the center of the tomb chamber. On each side of the square plan, openings are kept in the middle of the wall for entrance as well as to admit light and ventilation into the interior. The main entrance lies on east side and is accessed by a flight of steps. An entrance to a building facing east was usually preferred in local Hindu temple architecture. These steps were built in the recent years. The tomb is almost a cubical structure rested on high plinth and surmounted by a dome. The square plan, high walls and finely covered dome, is a familiar arrangement. It is commonly found in the Zoroastrian tombs of Baluchistan built between fourth to sixth centuries AD. Muslim tombs of similar form are very common in Afghanistan as well as Central Asia from tenth century onward such as Samanid tomb in Bukhara and tomb of Baba Hatem in Emam Sahib, Afghanistan (Chirvani, Melikian 1972, Cohn-Wiener, Ernst 1939, Pinder-Willson, Ralph 1980 Casimir and Glatzer 1981, Casimir, Michael J and Bernt Glatzer 1971). The dome rests on a circular drum which starts directly from the zone of transition and has squinch arches having pendentives at every corner. The original dome fell down and the present one was rebuilt in recent years.

From the exterior the square plan having two feet wide and four inches deep offsets at each corner. The incorporation of offsets by reducing the thickness of the walls was a general design tradition found in Hindu Shahiya temples of Salt Range (Rehman, Abdul, 1990 Meister, Michael 1999) as well Pattan Minara near Rahim Yar Khan (Vat, Mahdu Sarup 1927). Similar theme was followed also in tomb of Saddan Shahid, a contemporary tomb located in Muzaffargarh district. The opening on all four sides of the tomb crowned with trefoil arches is a common feature in the funerary architecture of Indus valley. Except the east side opening all other openings is blocked with recent terracotta grills. The niche

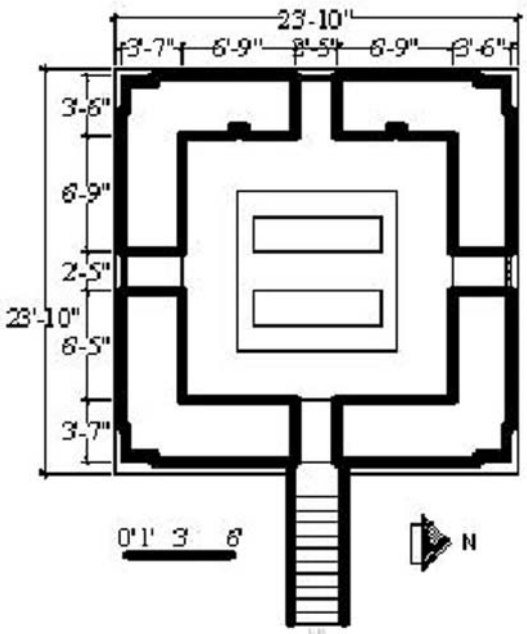

Figure-3: Plan of tomb of Ahmad Kabir.

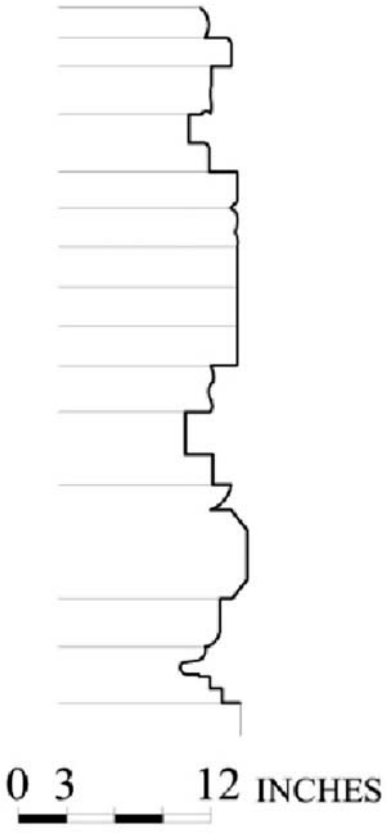

Figure-4: Corner profile of tomb of Ahmad Kabir. It is strongly inspire from local Hindu Shahiya temples.

of the west side opening is used as mihrab. Similar openings are found in the temples of Salt range, in particular one temple at Mari and Kafir Kot south.

In terms of structural form, the square plan is transformed into a circular form by means of squinch arches. The squinch arches have corbelled pendentives to strengthen the zone of transition. The existing examples of the tombs in the region indicate that transformation from pendentives to squinch arches were gradual. This transformation was in two steps. In the first step corbelled arch was employed followed by true squinch arch which was later frequently used in Ghaznavid, Khilji and Tughluq, Syed and Lodi period tombs and mosques of subcontinent (Prasad, Pushapa, 1984). The earliest example (early 11^{th} century) of true arch in Punjab is found in Giri Mosque in Margalla Hill (Rehman Abdul 1991)**.** However it is frequently found in Ghurid and later period monuments but similar feature is also found in the tomb of Saddan Shahid.

II

The monument was built in fair face brickwork with ornamentation carried out in cut and dressed brickwork. It has recently been lime washed by local villagers but rich surface decorations still represents the glory of building arts and craft tradition of early sultanate period. It is the earliest tomb in Pakistan where such as extensive calligraphy is found on a monument. It is also a classical example of culmination of Hindu and Islamic architectural design traditions and thus decorative vocabulary is unique to pay tribute to the saint. In this tomb the verses from Holy Quran (Islamic tradition) and animal figures (Hindu tradition) coexist and executed in cut and dressed brickwork. This uniqueness of coexistence of animal figures and verses from Holy Quran is evident from several reasons. The tomb seems to have been built jointly by Hindu craftsman or Muslim craftsman who recently got converted from Hinduism and a Muslim craftsman trained in Khurasan or other central Asian regions. It is also plausible that Arabic inscriptions may have been executed by a craftsman from Khurasan. The assumption is based on the fact that high standard of Naskh and Kufic calligraphy found on the monument was the work of very experienced craftsman who was very well acquainted with the Arabic language and the art of writing. The animal figures and other motives found in the region must have been the work of local artists. Since these saints were revered by the people of all faiths, therefore the level and nature of craftsmanship found in these monuments reflect the joint efforts of the people of all faiths (Allen, Margret Prosser 1991, Flood, Finnbar Bary 2009).

The tomb rests on a plinth eight feet four inches high from the ground surface. This was done partly to protect it from the devastation of river floods and partly due to the existing tradition of building construction. Traditionally all important buildings such as temples and tombs of important saints lying in flood prone areas are always rested on high plinth. At the same time Buddhist and Gandhara period monuments of the region, such as stupa's always had high plinth. Similarly the Hindu Shahiya temples of Salt Range and temple (Miester, Michael 1999) at Patan Minara (Talbot W.S 1903) also rest on high plinth (*jagati*). The high plinth also indicates the sacredness of the tomb as well as creates monumental effect to the building. The high plinth can also be seen in many other tombs of the Ghurid Period such as tomb of Khaliq Walid, tomb of Saddan Shahid and later period Sawi Mosque(Khan, Ahmad Nabi 1983). According to local people the plinth was embellished with cut and dressed brick work like tomb of Saddan Shahid but in the recent repairs the entire face were covered with plane modern brickwork which can be restored.

From the point of view of decorative treatment of façade, the tomb may be vertically divided into four parts. The first part comprised of high plinth. According to local inhabitants, the plinth was decorated with cut and dressed brickwork but recently in recent renovation it was clad with fair face brickwork. Similarly the north eastern corner was also repaired few years ago. The second part is most ornate in great density (Figure 5). It begins with triangular motives alternating with circular medallions bearing animal motives. These motives begin seven inches above the plinth and one foot five inches high. Each face had four medallions, two on the either side of the openings separated by triangular motif. Just above these motives run horizontal bands to a height of three feet three inches. The profile of these bands

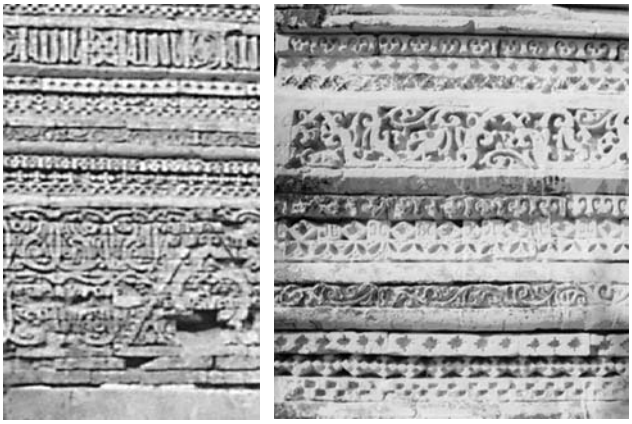

Figure-5: Detail of decorative friezes just above plinth: Tomb of Ahmad Kabir

has close similarity with the Hindu Shahiya temple which shows the continuity of local tradition of architecture. The lower most bands consist of square and diamond pattern which are also found in temple at Kalar in Attock district. Similarly vine scrolls are also found in close proximity with Hindu temples of western India. One of the close examples may be Rajarani temple at Bhubanesvar built around eleventh or twelfth century A. D. Such patterns were also found in later Muslim monuments in Gujarat and Ajmer. The third part comprised of openings in the middle of façade flanked by Gavaksa niches on either side of the openings. All the frames on three sides of gavaksa niches are inscribed in Kufic script with *Al-Mulk-o Lilah* (Figure 6). On top of these frames lies a series of merlons. The entire decorative part is again framed on three sides with a border having floral design. The vertical panels on the either ends are either inscribed with verses from Quran or simply treated with floral decoration. The top most part, comprising parapet, was executed in brick masonry having some floral decorations which is visible in the southern facade. Finally a hemispherical dome resting on circular drum covers the structure. Vertically each facade is terminated with an elaborate epigraphic band.

The elevations are almost identical on all four sides except some little variations in decorative scheme (Figure 8). These medallions bearing animal motives are different on different sides (Figure7). Similarly, the gavaksa niche on the eastern end of south side bears some inscriptions. The corners walls of the tomb have offsets which makes the façade aesthetically pleasing. These offsets are inscribed with calligraphy but the eastern end of north façade, northern end of east façade and northern end of western façade are blank without any calligraphy. The decorations on medallions and inscription on each façade vary from one façade to another. On the north façade, just above the plinth, lie four medallions. The decorations on them are mostly damaged except second from east end and bear figure of swan. The decorative friezes are similar on all four sides. The gavaksa niches on either side of the opening bear the inscription of Sura *Ikhlas* (chapter 112). The northwestern corner vertical panel inscribed with 2nd verse of opening chapter of Quran, while the northeastern corner was rebuilt in plain brick masonry. On the east side the main entrance lies in the middle of eastern façade. Only two medallions survive on the north eastern side, the other two on south eastern side are missing. The two surviving animal motives on the medallions are swans. The gvaksa niches on both sides bears Sura *Kauther* (Chapter 108). The vertical panel on the south eastern corner is inscribed with last portion of verse 20 from sura *Shura* (42). The southern façade is very fascinating and full of information. All the four medallions

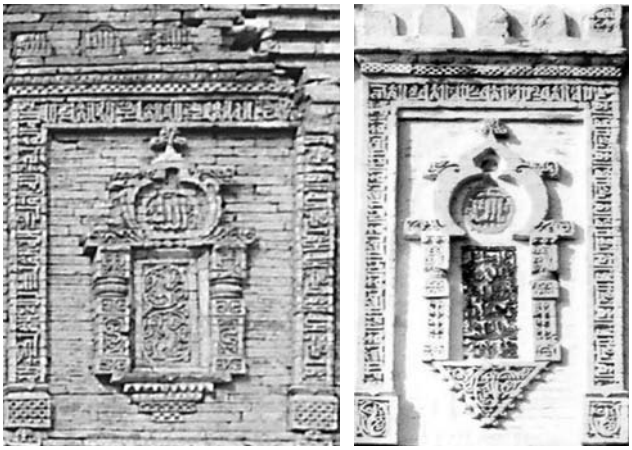

Figure-6: Comparison of Garuda niches between tomb of Ahmad Kabir (Right) and tomb of Saddan Shahid (Left). The nich of Saddan Shahid is more squarish while on the tomb of Ahmad Kabir is more elongated.

Figure-7: Circular medallion having animal figures (camel on the right and bull on the left) and triangular motif in the middle.

are intact. Beginning from east side and ending towards west the figures depicted on the medallions are in the following sequence. (i) swan (ii) lion (iii) horse and, (iv) boar. The most fascinating aspect of this façade is the inscriptions in the gvaksa niches. The niche on the southeastern side bears inscription in sharda script whereas inscription on the south western side is executed in Arabic script and gives the date of construction of the monument which is described slightly later. The vertical panels on the either ends bears floral decoration. Finally the western façade have similar decorative scheme as given in the case of eastern façade. The gavaksa niches contain *sura Kauthar* on both sides. The animal figures on circular medallions from north end towards south are in the following order (i) elephant (ii) lion (iii) horse and (iv) boar. The vertical panels at the corners contain verse from *sura rehman* on the north western end inscribed from top toward bottom. Second verse of opening chapter in the south western end is inscribed from bottom towards top.

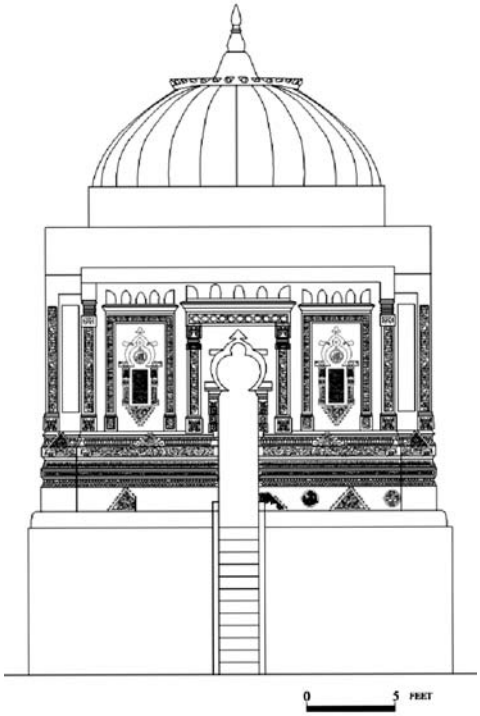

Figure-8: East elevation of Tomb of Ahmad Kabir.

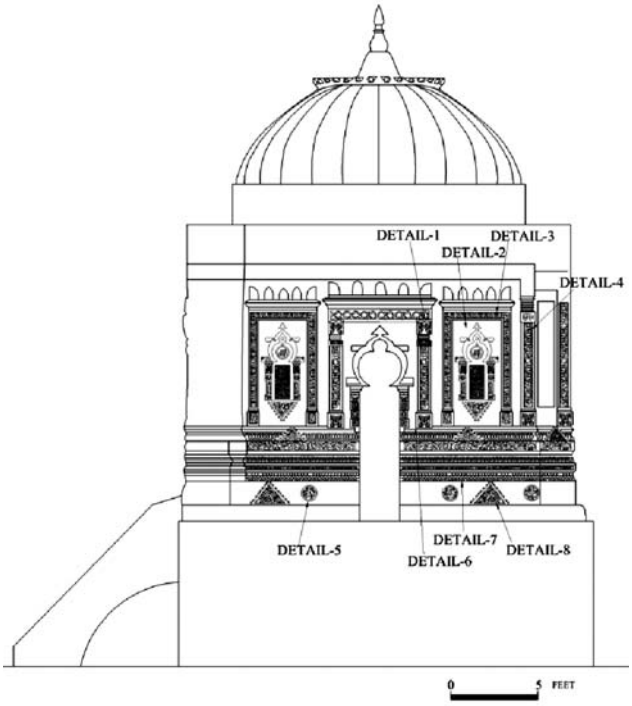

Figure-8a: North elevation of Tomb of Ahmad Kabir.

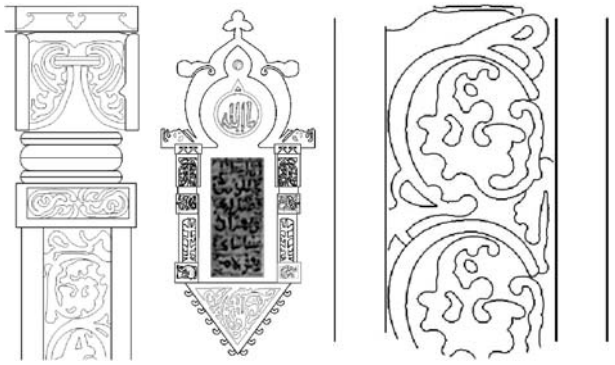

Figure-8b: Details of Tomb of Ahmad Kabir.

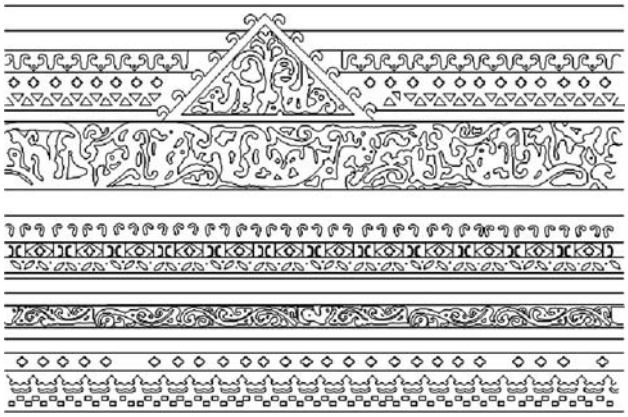

Figure-8c: Details of Tomb of Ahmad Kabir.

As mentioned earlier, the monument is the result of culmination of Islamic and Hindu tradition and vocabulary of design were chosen from two faiths to pay tribute to the saint by constructing such a magnificent monument. The Islamic tradition is in the form of inscriptions taken from Holy Quran whereas the animal figures were taken from Hindu sources. Both of these decorative elements are described separately in the following paragraphs.

The extreme right hand side offset panels on northern, eastern and western façade are inscribed in high relief with second verse from Holy Quran which states: In the name of Allah the Most Beneficent, the Most Merciful. The verse is inscribed from bottom to top like the tomb of Saddan Shahid. The rest of the façade is horizontally divided into three parts. There is a trefoil arch opening in the middle of each façade flanked by trefoil gavaksa niches. Opening and niches on each side are framed by high relief border. These niches are inscribed with verses from Holy Quran in cut and dressed brickwork. On the east façade the left hand side niche is inscribed with *sura Ikhlas* (chapter Purity of Faith) while the right hand side niche has *Sura Al-Kauthar.* The two sura's (chapters) are, for the first time, inscribed on any monument in Pakistan. Both the niches in the south side are inscribed with *Sura Ikhlas* (Figure 9).

The *sura* focuses on the theme of the unity of Allah and it is such that there is no reality or no true and permanent existence except His. Moreover, every other being acquires whatever power it possessed from the effective power of Allah which rules over this world. "*He begot none, nor was He begotten*," means that reality of Allah is deep rooted, permanent and everlasting .No changeable circumstances ever affect it. Its quality is absolute perfection at all times. The quality of "One" includes the renouncement of a father and a son. Finally "*there is none comparable to Him*" means that no one resembles Him in anything or is equivalent to Him in any respect, either in the reality of being, or in the fact that He is the only effective power, or in any of His qualities or attributes. The message of Quran is universal and valid for all times to come.

From the concept of unity of God, stems a perfect path of life based on the explanation of human existence and whatever outlooks, bases and traits it stimulated. Such a path is based on the worship of God alone, whose is the only real and permanent being, and whose will is the only effective power in the world. It is the path that makes its followers turn towards God alone and seek refuge in Him in times of need and fear, happiness and discomfort, luxury and hardship.

Sura (Chapter*) Al-Kauthar* (Abundance) is chapter no.108 of Al-Quran. It concerns solely Prophet Muhammad (P.B.U.H), cheering him up and assuring him of happier prospects in his struggle. In it God threatens the enemies of the Prophet with destruction while directing the Prophet on the path of thanksgiving.

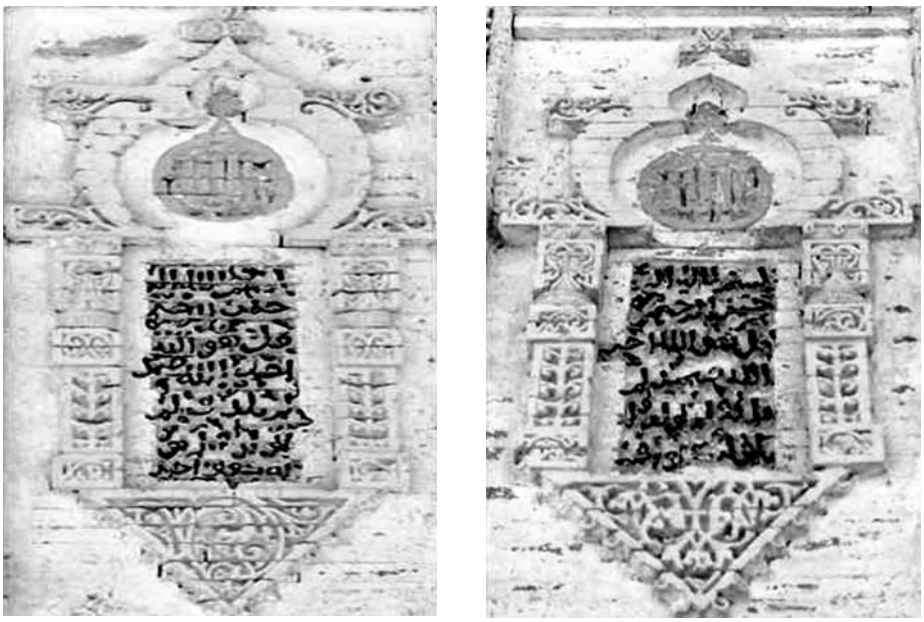

Figure-9: Two different gavaksa niches with Quranic inscriptions *of Sura Ikhlas.*

The *sura* refers to some non-believers from Quraish who viewed the Prophet and his mission with no small degree of antagonism. They used to say about the Prophet that he was a man with no posterity, referring to the early death of his son. This will end his mission. This sura was therefore, revealed, comforting the Prophet and assuring him of the abiding and profuse goodness which God had chosen for him and of the deprivation and loss awaiting his persecutors.

The selection of the sura for the tomb is very relevant and appropriate in the context of early thirteen century when Islam was being introduced in the subcontinent. The belief in Allah and his messenger is the most essential prerequisite in the faith of Islam and these sura's convey the message to the people to look towards God and His prophet in all matters. The life and death is in the hand of Allah and this world is a temporary abode of man. Therefore they follow the path chosen for them. These Quranic verses on the building reminded the visitors that these saints followed the same paths which are equally applicable for others for all time to come. The acceptance of Allah as supreme and belief in prophet Muhammad (PBUH) as His messenger is the prerequisite of the Islamic faith. This decorative scheme is repeated on the east and west side.

The inscription on the vertical panel in the south eastern corner of east façade is from chapter *shura* verse 20 which states that "but he will have no share in (in the blessings of) the life to come" (Figure 10). The complete verse states that "To whom who desires to harvest in the life to come, We shall grant an increase in his harvest; whereas to him who desires [but] a harvest in this world, We [may] give something thereof- but he will have no share in [the blessing of] the life to come (Daryabadi, Maulana Abdul Majid 1991). Again the believers are asked if they want reward in this world or the next world; if they desire reward in the next world they will have to do good deeds.

The vertical inscription on the north western corner panel of the western façade is partially legible. It tells us that "all that lives on earth or in the heaven is bound to pass away" (Daryabadi, Maulana Abdul Majid 1991). (Figure 11). This verse of chapter *Rehman* is commonly found on the graves across the Muslim world. It reminds believers that nothing is permanent and every one will have to return to God. The most fascinating inscription lies on the south western niche on the south façade (Figure 12). It gives two valuable information. Firstly, the tomb was built during the reign of Shihab al Din the month of of Rabi ul Aakhir in the year 600 AH. This date coincide with the reign of Shihab al Din Ghori.

Three styles of calligraphy have been used in the monument. The verses of Holy Quran in gavaksa niches and side panels have been inscribed with in naskh while bands framing the gavaksa niches on three sides are inscribed with *al mulk o lilah*", are executed in floriated Kufic script. The corner offset vertical panels are inscribed in *tuluth*. The variety of scripts used in the monument makes it a fine specimen of architecture. Such bands framing the openings, niches or simply dividing the bare facades into horizontal or vertical divisions is frequently met in Khurasan and Central Asian regions. The most significant example is Madrassa Shah-i- Mashad near Herat. The Madrassa is dated by a foundation inscription to 571AH /1175-1176 AD.

Figure-10: Vertical inscription on the northwestern corner of west façade in thulath script.

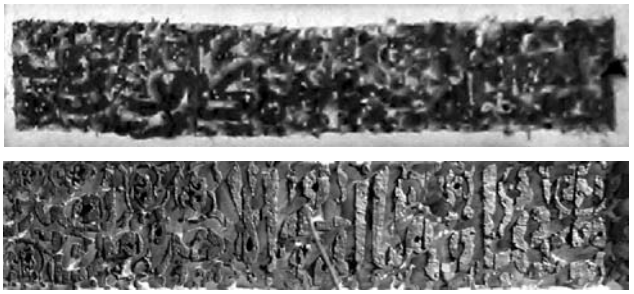

Figure-11: Vertical inscription on the south eastern corner of east façade in thulath script.

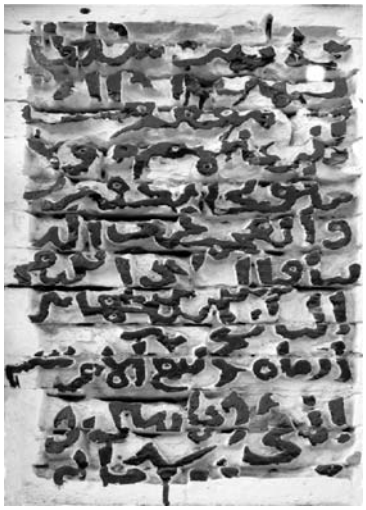

Figure-12: Inscription in the gavaksa niche on south west corner of south façade in western kufic.

L -1 The Amir . . . the Sultan	L. 1 الأمير السلطان
L -2 the great. . al-Malik	L. 2 المعظم. . . . . .الملك
L -3 (May Allah) forgive all of them (all the believers)	L. 3 غفر عنهم الأجمعين
L -4 This took place during the reign of the 'Amir al-'Arab	L. 4 وكان ذلك بدور أمير العرب
L -5 wa 'l-'Ajm 'Akram al-Du-	L. 5 والعجم أكرم الد
L - 6 -nya wa 'l-Din Ashhar	L. 6 نيا والدين أشهر
L -7 al-Bayan Shihab al Din	L. 7 اليان شهاب الدين

Table-1: Detail of date of construction in the inscription in gavaksa niche on the southwestern end of western façade.

III

The uniqueness of the tomb lies in the first series of ornamentation just above the plinth (Figure 13). This level of ornamentation is symmetrical on either side of the opening. On both sides of the opening there are right angle triangles followed by medallion then an equilateral triangle and then medallion. The medallions bear animal motives. Although depiction of animal figures is rare in Muslim tombs but this tomb represents the culmination of Hindu and Islamic themes together in a monument. This is a unique example where complexity of decorative motifs shows the beginning of new tradition of Islamic architecture of Pakistan. The animals depicted on the monument have a strong connection with the Hindu mythology where certain animals and birds have strong religious significance. At the lowest level and just above the plinth level animals such as bull, goose, horse, lion, bear, camel, etc are depicted. The basic positioning of these motives shows the importance of both Hindu and Muslim faith. The master craftsmen showed the qualities and abilities of the saint through the birds and animals whose significance is given as follows:

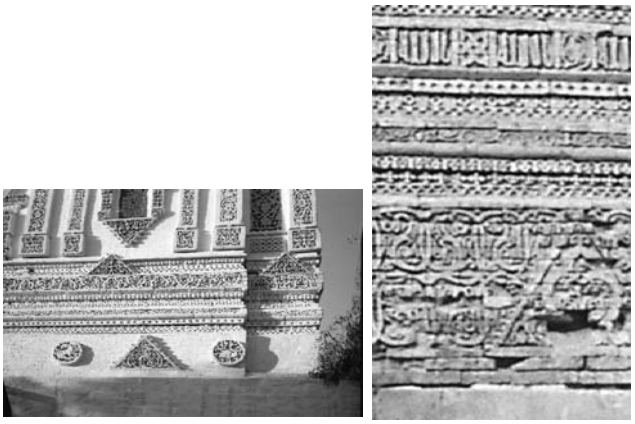

Figure-13: Detail of decorative friezes on the tomb of Ahmad Kabir (left) and tomb of Saddan Shahid (right)

Swan or Chakravaka., is a Hindu iconic device and refers to Brahmani Duck The bird represents fidelity, since they appear to mourn when separated from their mates (Figure 14). The demise of the saint and depiction of duck on the tomb is logical correlation since he is separated from others. The representation of ducks on the funerary monuments continued to exist till the early years of 16th century. A frieze of duck is also found on the tomb of Jam Nizam ud Din at Makli built in 1509 AD (Dani, Ahmad Hasan 1982).

Figure-14: Swan on South Facade.

Figure-15: Boar on West Facade.

In the contemporary examples, scroll of ducks is also depicted on the door frame of Bilesvara temple at Hanagal Fort buit in the late 11th century. Vitthala Temple is considered as the most impressive and most ornate of all the temples at Hampi (Longhurst A.H 1995). The presiding deity of the temple is Lord Vitthala (form of Lord Vishnu). The foreground of the sanctum is made by the 'mahamandapam' (pillared hall), which is tremendously ornamented. The pedestal is engraved with friezes of the swan, the horse and the warrior. A long frieze of delicately carved hamsas can be seen in Hoysalesvara temple at Halebid (Rowland, Bengamin 1953). In contemporary examples a frieze of hamsas is also found in the interior of corbelled dome of Shahi Masjid Khatu.

Boar is third of the 10 incarnations (avatars) of the Hindu god Vishnu (Figure 15). According to the Hindu tradition when a demon named Hiranyâksa dragged the earth to the bottom of the sea, Vishnu took the form of a boar in order to rescue it. They fought for a thousand years. Then Varâha slew the demon and raised the earth out of the water with his tusks. The myth reflects an earlier creation legend of Prajâpati (Brahmâ), who assumed the shape of a boar in order to lift the earth up out of the primeval waters. Boar is revered in Hinduism and therefore, depicted on the Vishnu temples. The western groups of temples in Khajuraho (built between 9th and 10th century AD) are famed for its exotic sculptures (Punja, Shobita 1991). Close to the south entrance, the Varaha temple dedicated to the god Vishnu has an intricately carved 10-tonne statue depicting him incarnated as a wild boar. Near the north gate is a similar pavilion containing amazing two-meter-long polished sandstone carved statue of the bull, Nandi (Javid and Javeed 2008).

The scholar Curt Maury (1969) traces the origin of the boar-cult in the "distant past, when its original focus may have been a female rather than a male divinity, as may be inferred from such images as that of the boar-headed Yogini in the Chaunsath Yogini temple at Bheraghat [Madhya Pradesh, India]." The most monumental representation of the varaha avatar of Vishnu is in a cave at Udayagiri, near Bhopal, dating from the beginning of the fifth century (Kramrisch, Stella 1965). It may be interesting to note that the Mughal emperor Jahangir was so irritated on seeing a stone sculpture of Varaha Avatar of Vishnu in a temple at Pushkar (near Ajmer) that he ordered to smash it and throw into the tank.

Horse is an important animal in the Indian history. It was known to the first inhabitants of Rana Gundai I phase in Baluchistan and Anau in Turkestan (c.3500-300BC). The most notable mythological conceptions concerning the horse is its association with sun whose daily passage across the sky is believed to be accomplished in the chariot drawn by four fast flying horses (Figure 16). The horse seen to disappear every evening with sunset and to reappear the following morning with sun rise, became a symbol of death, of resurrection and even of fertility. The association of the horse with the sun and water cosmology and fertility is well reflected in the Indian legends. In Rg Veda the horse to be sacrificed is referred to as great friend being made ready for the banquet of gods. The depiction of horse is also found in

Figure-16: Horse on the North Facade.

Figure-17: Lion of the South Facade.

Figure-18: Camel on SE Facade.

Hindu temples. One of the beautiful examples is found at Darasuram at Tamil Nadu (12th Century AD) where motif of the wheel and horse was introduced to make the mandapa a ratha, Chola (Sivaramamurti, C 1974). The representations of horse in Indian art are too numerous to be counted. However, the use of horse motif reached its apogee in the Horse Court at Srirangam, near Trichinopoly, which has a colonnade of furiously fighting horses, each rearing up to a height of nearly nine feet.

Lion is another animal in Hindu mythology which is considered as a vehicle of Durga Mahisasuramardini (Figure 17). It played a very prominent part in the conflict between Devi and the Demon and symbolizes the destructive fury of the goddess. Lion is a symbol of power and considered as guardian and therefore placed at the entrances of important buildings. The Hoysaleshwara temple at Halebid is one of the finest temples in India in which Ramayana and Mahabharata epics are shown more effectively than in any other temple (Settar, S 2003). Besides general life themes rows of animals such as lions and elephants are shown (where no two animals are identical). In this context the lion is depicted on the tomb of Sheikh Ahmad Kabir. Some Mughal specimens of carved lions are also known, for example on the gateway of Sarai Nurmahal (E. Punjab) and the Jahangiri Mahal, Lahore Fort (Parihar, Subash, 1991). But their representation is always clumsy, as if the carver had never seen a real lion. Lion continues to remain a dominant motif in Indian architecture even to this day, particularly in popular architecture. There is hardly any temple built even today without a pair of sculptured lions at its gate. In contemporary Ghurid period architecture lions are found on the thresholds of the royal chambers of churasi Khamba Mosque , Kaman and Qutub mosque, Delhi.

Camel or Ushtra, a Buddhist /Hindu iconic device, a vehicle or object upon which image of the deity sits (Figure 18). The term Ushtra refers to a camel which is ridden frequently by calm or peaceful deities. It is often associated with the diety Hemanta-rajni and others. In Hindu tradition the camel is sacred to the diety Skukra or Sukra (Allen, Margaret Prosser 1991).

The above examples of depiction of animals derived from Hindu mythology (Stutley, Margret.1985. Bunce, Fredrick W. 1997)[36] shows the importance of the saint by the local Hindu community. The mythological relationship of animals with Hindu religion clearly shows the sacredness, humbleness and piety of the saint and represents another way of expression of paying tribute to the saint.

An inscription in Sharda script on the southeastern side of southern facade provides some detail of donations given for the construction of tomb (Figure 19). The Sharda or Sharada

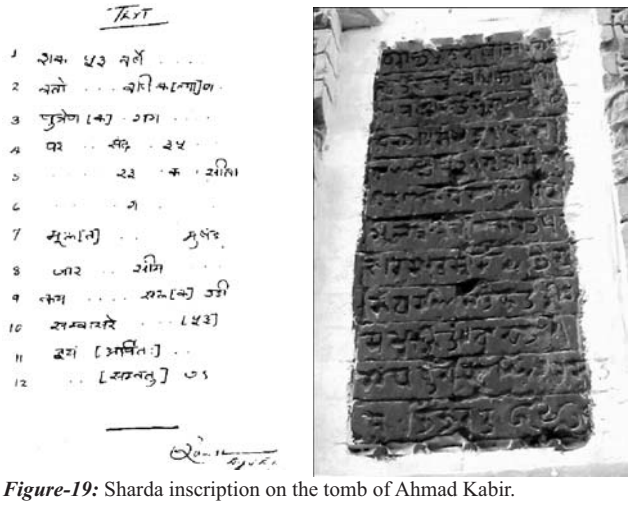

Figure-19: Sharda inscription on the tomb of Ahmad Kabir.

alphabet found mostly in north western parts of Pakistan and developed from the script during the second half of the 8th century AD. The earliest known inscription in the Sharda alphabet dates from 774 AD and was discovered in a village called Hund, capital of the Hindu Shahi dynasty, located on the Indus River in the North Frontier Province of Pakistan. The inscription contains 12 lines. It is dated in Sake (regional reckoning) 53. The inscription seems to record some donation (the details of which are not legible). It mentions in line 2 and 3 *Kalyana putrena* and Sita in line 5. Numeral figures of 35 and 23 are written in line 4 and 5 (probably indicating the amount of donation made). This is the only monument of Islamic period where Shards script has been used.

The tomb can be accessed only from the east side where a long flight of steps lead to the tomb chamber. In the local tradition the face of dead bodies always face *qibla* (direction of Kaba) and therefore, the tombs always have entrance either from south or east side. In Indian tradition the entrance of a Hindu temple is preferred to be on east side but there are several examples where entrances are located on west or south side. In the Ghurid period the general preference was east side where as in later sultanate period monuments such as tomb of Baha ud Din Zakariya and tomb of Rukn-i-Alam (Hillenbrand, Robert 1974), the entrance was kept on south side. There is not any strict rule for the south side entrance but according to the local popular tradition the visitor must enter from the side facing the feet of the saint (south side) and then going anticlockwise through east, north and west side finally pray on west side in the mihrab and then exit from south side.

IV

Like other contemporary tombs such as Saddan Shahid, the interior of the tomb of Ahmad Kabir is simple without any embellishment. Compared with its rich exterior, the interior is devoid of calligraphy or any other ornamentation. The squinch arches at four corners of walls convert the square plan into the circular base of the drum over which hemispherical dome rests. Each squinch arch is characterized at its base by a cone of dentil belling (Figure 20). This arrangement provides additional strength to the overhead dome. This system of construction draws its inspiration from the monuments of Khurasan and Central Asia (Hillenbrand, Robert 1992). The system of construction of dome developed gradually in the Indus Valley. The Zoroastrian tomb rested on pendentives. The next stage was squinch arches based on corbelling of bricks. This system is found in its contemporary tomb of Khaliq Walid in Kabir Wala district in Pakistan The exterior details and decorative patterns are

Figure-20: Squinch arch in the interior the tomb.

executed in cut and dressed brickwork in an exquisite manner. The execution in cut and dress brickwork is so neat and perfect as it appears that work has been executed in plaster work. The vertical bands on the either side of gavaksa niches end with amalakas capitals over which the horizontal band rests. Amalakas is a most common feature of temples architecture and found in the Salt Range temples of Kafir Kot north and south, Mari and Kallar temples. The treatment of brick as a medium for decoration, the juxtaposition of intensely decorated elements and the play on light and shade through such alternation of architectonic elements, are all found in existing examples of Kallar in Attock district and Pattan Minara near Rahim Yar Khan.

Triangular motives form an important decorative element in early Ghurid period tombs (Figure 21). The independent

Figure-21: East façade of Tomb of Ahmad Kabir.

triangular motives below the horizontal frieze and as part of top frieze is a prominent visual feature of the tomb and used extensively for the first time in this monument. This motif has also been used in the tomb of Saddan Shahid where it forms a part of the horizontal friezes having vine scrolls. These motives became an important feature of sultanate period tombs constructed in fair face brickwork particularly in the tomb of Ala ud Din Mauj Darya at Pakpattan built in 1330AD (Chughtai M. Abdullah, 1968). This feature is found only in lower Punjab in Hindu temples as no such feature exist in the temples of Koh–e-Jud built between 7^{th} and 10^{th} century AD. A frieze of triangular motif in much smaller size is found in the temple of Pattan Minara in Rahim Yar Khan.

Although decorative friezes existed in Hindu temples but the frames and borders came to subcontinent with the arrival of Muslims in the subcontinent. In particular such frames and borders are found on the monuments of eastern Iran, Afghanistan and Central Asia. These borders and frames are inscribed with floral arabesque, geometric patterns or inscription or calligraphy taken from Holy Quran. These borders became very frequent in the early architecture of Khurasan. The most important monument in this regards are Madrassa Shah-e Mashad, and Ghurid mausolea at Chisht(Casimir, Michael J and Glatzer Bernt 1971). These features became important elements of Sultanate architecture of sub-continent. These frames used to define all kinds of openings, defining the edges of the buildings, mihrabs and niches. These frames and borders break the monotony of bare facades, define various and accentuate architectural elements, create rhythms and architectural interest within the buildings.

The gavaksa niches are crowned with trefoils which is common feature in all Hindu Shahiya temples of Salt Range. In particular the temples of Amb, Mari and Kafir Kot are crowned with trefoil arches. Generally in the Hindu religious tradition of the region an image of the deity is placed under the trefoil where as in the early sultanate period tomb the name of Allah is inscribed in its place. In particular the temple of Amb Sharif located near Quaid Abad and Kafir Kot north contained image of a deity in the trefoils. The word Allah is inscribed in the tomb of Ahmad Kabir and later in Daulat Khan Lodi's tomb in Dipalpur. Considering this fact it is obvious that very basic concept of the two religions remained the same but mode of presentation has changed. It is deity of Krishna or Shiva which is supreme to Hindus but Allah is supreme to Muslims.

Both the tomb of Ahmad Kabir and Saddan Shahid are contemporary and have similar design concept. The decoration on the tomb of Ahmad Kabir shows new beginning of the treatment of façade of a Muslim saint of Indian subcontinent. The tomb of Ala ud Din and Daulat Khan Lodi, built during Tughlaq and Lodi dynasty, are a result of the continuity of this tradition but in a simpler form. The decorative friezes of floral arabesques just above the plinth level (around 7-8 feet) are common in both the tombs. Vines motives found their origin in early Hindu temple sources.

CONCLUSION

The Indus Valley forms a not too constant dividing line between the Indian and Persian world (this include Iran and western Afghanistan). Partly it remained under the Ghaznavids and Ghurids rule and partly it was ruled by the local kings. However, when the Turkish tribes from south Russia swept across Persia and Anatolia, Pakistan was absorbed into the newly formed Turko-Persian cultural network in the eleventh and twelfth centuries. The similarities of the climate and materials of construction of Pakistan and its western neighbors as well as their ethnological and frequent political associations, gave the dry steppe, and desert region of Iran, Afghanistan and Pakistan a common cultural identity (Mumtaz K.K, 1985). In the beginning of the thirteenth century Multan region became a part of the Ghurid Empire with capital at Ghor in Afghanistan. With this the main trade route to Delhi remained via Gomal Pass which resulted in Khorasani influence on architecture of Multan region. The Central Indus valley (Punjab and Sind) shared with Khorasan the enthusiasm for brick as primary medium of architectural expression. The influence came from Afghanistan, assimilated and absorbed in local Indus valley resulting into a new vocabulary of architectural design based upon both Hindu and Khurasani origin. The tomb of Ahmad Kabir is one of the finest examples of this interaction.

The tomb of Ahmad Kabir is one of the best examples where both Hindu and Islamic themes come together in the form design vocabulary to pay tribute to the saint. The tomb seems to have been one of the earliest, if not the earliest after Khaliq Walid in Kabir Wala District, found in the same region. The tomb of Khaliq Walid was built under the patronage of Ali Karmakh, governor of Multan during Ghurid period. It is a plane bare with highly stylistic decorative epigraphy in the soffit of the mihrab. This tomb seems to have been built by the Khorasani master craftsman. However the tomb of Ahmad Kabir presumably built by the both local Hindu and Muslim craftsmen. The tomb of Saddan seems to have been last of the series which shows the perfection of the art developed in the tombs mentioned earlier. There

is a lot of similarity and parallel exist between the two tombs mentioned above. The verses from holy Quran, different forms of calligraphy, both kufic and naskh and variety of borders and form of domed mausoleum all came from Eastern Iran and Afghanistan, while profile of friezes, wine scrolls and animal motives and gawaska niches came from local Indian tradition. The existence of animal figure shows the reverence of the Hindu tradition for a Muslim saint and this is the way of paying tribute by people of two different religions. Finally the tomb finds close analogies in the brick architecture of contemporary Herat, suggesting that they represent a collaborative endeavor between local artisans and those who migrated eastward in the wake of Ghurid conquest.

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REFERENCES

Adle, Chahryar and Assadullah Souren Melikian-Chirvani, (1972): "Les monuments du Xle siecle du Damqan," Studia Iranica 1.2 255; Sourdel-Thomine, Laskkari Bazzar, 10,13-15,32,55-57

Ali Taj, "Tomb of Shaikh Saddan (1993), Its Decoration," Peshawar, Ancient Pakistan 8: 133-38;

Ali, Taj, (1991) "The Mehrab-Inscription of the so-called Tomb of Khalid Walid near Kabirwala (Khanewal District)," Ancient Pakistan No.7:39-46;

Allen, Margaret Prosser Allen,(1991) Ornament in Indian Architecture, Newark, University of Delaware Press.

Asad, Muhammad. Trans. (1984): The Message of Quran,Gibraltar, Dar –al Andalus, p.743

Ashkan, Maryam, AhmadYahaya.(November 2009) Persian Domes: History, Morphologies and Typologies. IJAR Vol.3 issue 3 pp.98-115.

Beveridg H, trans. (1986) The Tarikh-i- Mubarak Shahi of Yahiya bin Ahmad bin Abdullah Sirhindi (rpt. Delhi: Durga Publications, 5-6.

Brown, Percy, (1965). Indian Architecture, Hindu and Buddhist (Bombay: Taraporevala, , p. 94, pl. LXXI, fig. 2.

Brown, Percy, (1942). Indian Architecture: The Islamic Period. Bombay, Taraporevala's House of Books, pp.11-13.

Bunce, Fredrick W. A (1997) Dictionary of Hindu and Buddhist Iconography. New Delhi, D.K. Printworld,

Chirvani, Assadullah Souren Malikian, "Baba Hatem: Un chef d'oeuvre4 inconnu d'Epoque ghaznavide en Afghanistan," The Memorial Volume of the Vth international Congress of Iranian Art and Archaeology 11th – 18th April 1968 (Tehran: Ministry of Culture and Arts, 1972), 2: 108-9, fig. 1.

Chirvani, Melikian, Assadullah Souren Melikian. Baba Hatem. (1972): Un Chef d'oeuvreinconnud'epoque ghaznevide en Afghanistan, the Memorial Volume of the Vth International congress of Iranian Art and Archaeology 11th-18 April 1968. Tehran. Ministry of Culture and Arts. 2-108-109.

Chaghatai M. Abdulla, (1975) "The Ancient Temple at Multan," Journal of the Research Society of Pakistan 12 :13-21

Chughtai M. Abdullah, (1968) Pakpattan and Baba Farid Ganj-i-Shakar. Lahore, Kitab Khana Nauras,

Cohn-Wiener, Ernst. (1939) "A Turanic Monument of the Twelfth Century A.D.," Ars Islamica 6: 89

Cousens, Henry, (1929)The Antiquities of Sind, Archaeological Survery of India , Imperial Series 46 (Calcutta: Government of India Central Publication Branch, 126-127

Dani, Ahmad Hasan, Helmut Humbach, and Robert Gobl, (1964) “Tochi Valley Inscriptions in the Peshawar Museum,” Ancient Pakistan 1: 125-30.

Daryabadi, Maulana Abdul Majid. (1991) Tafsir ul Quran: Translation and Commentary of The Holy Quran vol. IV, Karachi, Darul Ishaat,. P.540

Edward, Holly, 1991, The Rabat of Ali bin Karmakh, Iran. 29:85-94 and (1990) The Genesis of Islamic Architecture in the Indus Valley. D. Phil. Thesis, New York University,

Farooq, Abdul Aziz, (1988) “Mosque or Khalid Walid’s Tomb (A Ghurid Monument, Khanewal District),” Journal of the Pakistan Historical Society No.36: 243-54;

Flood, Finbarr Bary. (2009) Objects of Translation: Material Culture and Medieval “Hindu Muslim” Encounter, Princeton, Princeton University Press

Flood, Finbarr B. (2001) Ghurid Architecture in the Indus Valley: The Tomb of Shaykh Sadan . Ars Orientalis, 36:129-66.

George S.A. Ranking, trans. (1898), Muntakhabu-Tawarikh by Abdul Qadir ibn-i-Muluk Shah Known as AL-Badaoni, Calcutta: Asiatic Society of Bengal, 66;

Ghafur, M.A. (1960) The Ghurid, History, Culture and Administration, Ph.D Dissertation (Hamburg, University of Hamburg.

Gollings, J., John M. Fritz and George Michell, (1991) City of Victory, Vijayanagara: The Medieval Capital of South India, New York, Aperture,

Grover, Satish. (1996) Islamic Architecture in India, New Delhi: Galgotia Publishing Company pp.6-10

Habibi, Abdul Hai (1954) The Oldest Muslim Inscription in Middle Asia, ”The Museums Journal 6.1-2: 70-75; idem, “Peshawar Museum Inscription No. 7

Hamid, Muhammad, (1925-26) “A Kufic Inscription from the Sarada Museum,” Epigraphia Indica Arabic and Persian Supplement: 27-28

Hasan, Brig. (Rtd.) M. Usman, (1991) Terracotta Plaque Decorated Tombs of Baluchistan. Sultanate Period Architecture in Pakistan, Lahore, Anjuman Mimaran

Hillenbrand, Carole (1959 “Summary Report on the Italian Archaeological Mission in Afghanistan II: The Two Excavation Campaigns at Ghazni,” East and West, n.s. 10

Hillenbrand, Robert. (1974) The development of Seljuq Mausolea in Iran, in The Art of Iran and Anatolia from the 11th to 13 century A.D., ed. William Watson, Colloquies in Art and Architecture in Asia no.4.London: Percival David Foundation of Chinese Art,

Hillenbrand, Robert. (1992) Turco-Iranian Elements in the Medieval Architecture of Pakistan: The Case Study of The Tomb of Rukn-I Alam at Multan, Muqarnas IX (Leiden, E. J. Brill, pp.148-174.

Hillenbrand, Robert, “The Architecture of the Ghaznavids and Ghurids, in The Sultan’s Turret: Studies in Honour of Clifford Edmunnd Bosworth, vol.2: Studies in Persian and Turkish Culture, ed.

Hussain, Talib. (1987) A Magnificent Monument of the Balban Period, in “Pakistan Times, 5 June

Javid, Ali and Javeed, Tabbasum (2008). World Heritage Monuments and related edifices in India. New York, Algora Publishing.

Joshi, M.C., (1972) “Some Nagari Inscriptions on the Qutub Minar,” Medieval India: A Miscellany 2 (New York: Asia Publishing House, 307.

Kervran, Monique, (1996) “Entre I’Inde et I’Asie Centrale: Les mousolees islamiques du Sind et du sud Penjab,” Cahiers d’Asie Centrale 1-2: 143-49

Khan Ahmad Nabi, (1990) Islamic Architecture of Pakistan: An Analytical Exposition (Islamabad: National Hijra Council, 75-77.

Khan, Ahmad Nabi, (1989) "The Musallah-Mehrabs of Thirteenth-Fourteenth Centuries at Kabirwala and Pakpattan," Pakistan Archaeology 24: 239-45;

Khan, Ahmad Nabi, (1978) The Mausoleum of Shah Rukn-e-Alam, Islamabad, Journal of Central Asia 2.2, 1-19

Khan, Ahmad Nabi, (1987) Mausoleum of Sheikh Baha al Din Zakariya at Multan and Introduction of Central Asian Art Tradition in South Asian Subcontinent,(Rome: Revista Degli Studi Orientali 59. p.276

Khan, Ahmad Nabi, (1987-88) "Naked Brick Architecture of Early [Sic] Islamic period of Pakistan: An Analytical Study," Pakistan Archaeology 23: 307-11.

Khan, Ahmad Nabi. (1983) Multan: History and Architecture. Islamabad: Institute of History, Culture and Civilization, p. 280

Khan, Muhammad Nazir, (1985) "A Ghaznavid Historical Inscription from Udegram, Swat," East and West, n.s. 35: 153-66

Kramrisch, Stella, (1965) The Art of India thorough the Ages (London: Phaidon, pl. 47.

Longhurst, A. H. (1995) Hampi Ruins: Described and Illustrated, reprint, New Delhi Asian Educational Services.

Lundkhore, Ali Muhammad (1988), Visit to the tomb of Shaikh Sa'adan Shahid," Archaeology 1.1: 60-61

Maury, Curt, (1969) Folk Origins of Indian Art. New York: Columbia University Press, p. 78, figs.78-81

Meister Michael. (1999), "Temples along the Indus"; idem, "Temples of the Salt Range," in Religion, Ritual and Royalty, ed.N.K. Singhi and rajendra Joshi (Jaipur: Rawat, 132-39; idem, (2000) "Discovery of a New Temple on the Indus," Expedition 42

Meister, Michael W. (1972) "The 'Two-and-a-Half-Day' Mosque," Oriental Art 18.1: 62; 70.

Michael, J. and Glatzer Bernt, (1971) Sah-i-Mashad: A Recently discovered Madrasah of the Ghurid Period in Gargistan (Afghanistan).East and West no.21.53-67

Michell, George and Phillip B. Wagoner, (2002).
Vijayanagara: Architectural Inventory of the Sacred Centre, 3 volumes, New Delhi, Manohar,

Mirchandani, B.D, (1968) "Sun-Temple of Multan," Journal of Indian History 46: 209-16

Mumtaz, Kamil Khan. (1985) Architecture in Pakistan. Singapore, Concept Media p.38

O' Kane, Bernard,(1984) "The Minaret of Vebkent," in the Art of Saljuqs in Iran and Anatobia: Proceedings of a Symposium Held in Edinburgh in 1982, ed. Robert Hillenbrand, Mazda: Malibu, 47-48.

Oney, Gonul. Ceramic Tiles in Islamic Architeccture, (Istanbul, ADA Press, Istanbul, 1987)

Parihar, Subhash. (Summer 1991) Summer 1991 "Sarai Nurmahal", Oriental Art, vol. 37, no. 2, pp. 90-91, figs. 17-18.

Pinder-Wilson, Ralph, (1980) "Le mihrab decoree de Darra-i-Shaikh / Gorzivan," Studia Iranica 9.1 : 92,

Pinder-Wilson, Ralph, (1985) "The Minatet of Masud III at Ghazni," in idem, Studies in Islamic Art London: Pindar Press,), 92.

Prasad Pushpa, (1984) "Hindu Craftsmen in the Delhi Sultanate: An Epigraphic Study." Indica 21: 11-15.

Punja, Shobita (1999). Khujaraho: The first Thousand years, Delhi, Viking Penguin Books India.

Rahman, Abdur, (1979). The Last Two Dynasties of the Sahis: An Analysis of Their History, Architecture, Coinage and

Palaeography, Islamabad: Centre for the Study of the Civilizations of Central Asia, Quaid-i- Azam University

Rehman Abdul, (1990) "Hindu Shahiya Temples of the Salt Range: A Preliminary Analysis," in Temples of the Kohe-e-fud and Thar: Proceedings of the Seminar on Hindu Shahiya Temples of the Salt Range Held in Lahore, Pakistan, June 1989 (Lahore, Anjuman Mimaran, 39-40.

Rehman, Abdul. (1991) Sultanate Architecture in Punjab: A Preliminary Analysis. Sultanate Architecture in Punjab, Lahore, Anjuman Mimaran pp.40-41

Reichstein, Steve. (2006) The Love Temple of Khajuraho: A Memoir of Love, Lust and Exotic Places, Delhi, Universal Incorporated.

Raverty, Major H.G., Trans., (1970) Tabakat-i-Nasiri: A General History of the Muhammadan Dynasties of Asia Including Hindustan (rpt. New Delhi: Oriental Books Reprint Corp, 1:449;

Rempel, L. (1936) "The Mausoleum of Ismail the Samanid," Buletin of the American Institute for Persian Art and Architecture 4.4: 203.

Rowland, Benjamin, (1953) The Art and Architecture of India: Buddhist, Hindu, Jain; reprint, Harmondsworth: Penguin, pl. 254.

Schlumberger D. (1966) La Palais Ghaznavide de Laskkari Bazar. (Syria XXIX 1952) pp. 251-70. Alession Bombaci, The Kufic Inscriptions in Persian in the Court of the Royal Palace of Masud III at Ghazni (Rome: Instituto Italiano per il Medio ed Estremo Oriente, 8-9, 67.

Shakur, M.A., (1946) A Handbook to the Inscriptions Gallery in the Peshawar Museum (Peshawar, , nos. 7,49, pp. 9-11, 43-45.

Sivaramamurti.C. (1974) Birds and Animals in Indian Sculpture. New Delhi, National Museum.

Stutley, Margret. (1985). The Illustrated Dictionary of Hindu Iconography, London, Routledge and Kegan Paul.

Subramanian V. K. (2003) Art Shrines of Ancient India. New Delhi: Abhinav Publications. p.76-77, London Phaidon

Tadgell, Christopher.(1994) The History of Architecture in India from Dawn of Civilization to the End of the Raj.

Talbot, W.S. (1903): "Ancient Hindu Temple in the Panjab," Journal of the Royal Asiatic Society, 335-38.

Vats, Madhu Sarup. (1927) Pattan Munara, Calcutta. Archaeological survey of India Annual Reports.1926-27

Wiet, Gaston, (1959) "Les coupoles de Tshista," in A. Maricq and G. Wiet, Le Minaret de Djam La Decouverte de la captile des sultans ghurides (XIIe-XIIIe siecles), Memoires de la Delegation archeologique francais en Afghanistan 16 (Paris: C. Klincksieck, , 69-70, Pl. VIII2-3;

Wilkinson, Charles K., (1986), Nishapur: Some Early Islamic Buildings and Their Decoration. New York: Metropolitan Museum of Art.108-10

USER COMFORT AND ENERGY EFFICIENCY IN PUBLIC BUILDINGS OF HOT COMPOSITE CLIMATE OF MULTAN, PAKISTAN

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ABSTRACT

The close connection between energy use in buildings and environmental damage arises because energy – intensive solutions sought to construct a building and meet its demands for heating, cooling, ventilation and lighting, cause severe depletion of invaluable environmental resources. Buildings designed with efficient use of energy with low operating cost as well as comfortable for users can contribute to the successful environment friendly design. The paper is an attempt to investigate and evaluate the thermal and energy efficiency of public buildings with reference to its user comfort level. To study the passive design elements of energy efficiency, twelve public buildings have been selected as case studies from colonial and contemporary period in which at least one of the energy efficient means has been used. Paper reviews the data collected for the four hottest months from summer season, of monitoring the buildings located in the hot composite climate of Multan, Pakistan and analyzed against mean temperature and relative humidity values for this season. A questionnaire survey is also conducted from the users to know the desired comfort level of these buildings.

Key words: Energy Efficiency, Environmental Design, User Comfort, Public Buildings

1. INTRODUCTION

Buildings, as they are designed and used today, contribute to serious environmental problems because of excessive consumption of energy and other natural resources. However, buildings can be designed to meet the occupant's need for thermal and visual comfort at reduced levels of energy and resource consumption (Saade and Ramadan, 2008). Therefore, an energy efficient building balances all aspects of energy use in a building-lighting, space-conditioning and ventilation – by providing an optimized mix of passive design strategies, energy efficient equipment and renewable sources of energy. Use of materials with low embodied energy also firms a major component in energy efficient building designs (Okeil, 2010). Climate has a major effect on building performance and energy consumption. The objective of any climatic design is to reduce energy cost of a building and to provide comfortable and healthy environment for its users (Yilmaz, 2007).

In Pakistan, most of the areas come under hot composite climate zone in which hot season dominates with the variation in climate. Nicol and others (1999) concluded that as a result of over heating, there is usually a diurnal temperature variation. Multan, located in Southern Punjab, features an arid climate with very hot summers and mild winters, represents hot composite climate zone. The building construction practices in Multan are an amalgam of building methods and design solutions that range from traditional techniques, materials and spatial patterns to advanced industrial materials and hybrid new building forms. Traditional use of masonry architectural construction in local materials were experienced and they proved to be the reliable solutions to basic building design, construction methods and techniques. But due to colonial construction practices and post colonial socio-economic realities, this tradition has been disintegrated.

The objective of the study is to evaluate architectural design elements of energy efficiency and investigate user perception of comfort in public buildings of hot composite climate of Multan. The study will help the building professionals, authorities, policy makers and concerned citizens to understand the appropriate building design approach with reference to thermal and user comfort.

2. ENERGY EFFICIENCY IN BUILDINGS

The building with minimum negative environmental impact and lowest running energy cost is an energy efficient building. According to Majumdar (2001) energy efficiency in buildings can be achieved through an approach involving adoption of bio climatic architectural principles responsive to the climate of the particular location; use of materials with low embodied energy, reduction of transportation energy, incorporation of efficient structural design, implementation of energy efficient

building systems and effective utilization of renewable energy sources to power the building. Energy efficiency in buildings broadly implies three aspects (Agarwal, 2004):

1. Minimize energy waste due to unwanted and non judicious use of electrically operated gadgets.

2. Development of energy efficient appliances.

3. Optimum utilization of non conventional sources of energy through judicious planning and building design.

Ralegaonkar and Gupta (2010) explained about passive techniques with the context of cooling of buildings in hot-dry and warm-humid climates, which aim towards reduction in heat penetration through building envelope and provision of inducing desired natural ventilation indoors. Designing and enveloping new buildings based on sound concepts of sustainability and applying suitable options to existing buildings could substantially improve the energy use efficiency in the building sector. An 'integrated approach' to building design which involves judicious use and application of:

- Efficient materials and construction practices.
- Bio-climatic/Solar-passive architectural principles.
- Efficient systems and equipments.
- Renewable sources of energy.
- Efficient waste and water management practices.

I incorporating above features in a holistic manner in any building, would impose a minimal impact on the environment along with enhancing user comfort and productivity (Figure 1) (Majumdar: 2001).

3. CLIMATE RESPONSIVE DESIGN

The immense increase in built environment has added the concept of climate responsive design. Krishan et al (2001) defined the climate responsive design as an approach to building design that uses the building architecture to minimize energy consumption and improve thermal comfort (Figure 2). Buildings affect the climate by their presence, process of construction and use. Orientation is necessary to avoid direct exposure to solar radiation of maximum building surface. Provision of courtyard or open space inside the building prevents exposure of walls from direct sun. The

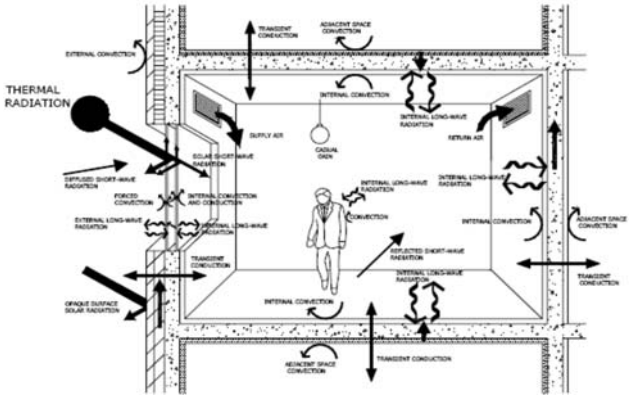

Figure-1: Heat Transfer and Thermal Energy Balance In A Space (Source: Abaza, H. (2002) An Integrated Design And Control Strategy For Energy Efficient Buildings, Virginia Polytechnic Institute and State University, Ph.D. Thesis, Blacksburg, Virginia)

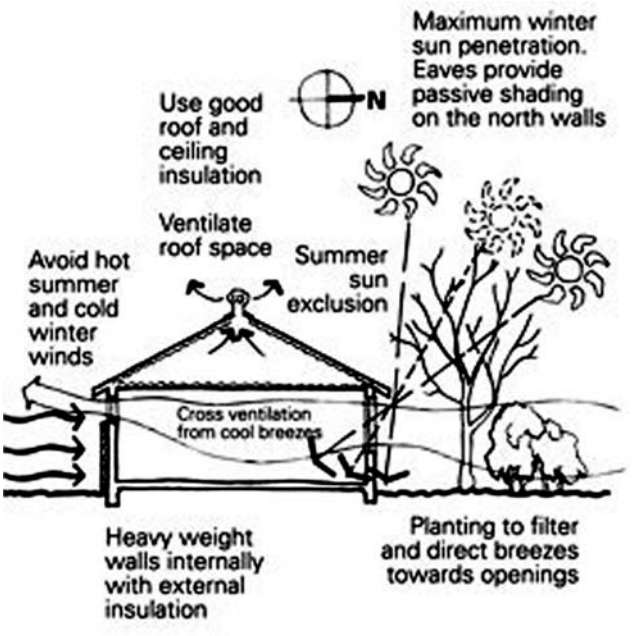

Figure-2: : Climate Responsive Design Solution for Warm Humid Climate with High Diurnal Range
(Source:) http://www.youhome.gov.au)

movement of sun and wind helps to keep the building comparatively cool during the day and to receive cool air in the night from above.

Location and optimum thickness of insulation on walls and roof can reduce the space-conditioning load by about 15 – 20% (Sozer, 2010). In hot climates, insulation facing exterior of the walls is recommended. Proper roof treatment depends upon the climatic needs. Roof insulation is imperative to prevent heat gain into buildings especially in hot climates and is achieved by using materials with low conductivity

which reduces almost 70% of heat gain. Use of hollow brick constructed roofs and double roofs are effective as thermal barriers (Devgan, et al. 2010). Mathur and Chand (2003) suggested that an appropriate thermal insulation and air cavities in walls reduce heat transmission into the building, especially in hot regions.

By using sun shades and screens the effect of solar radiation can be reduced. Vertical shades are most effective to protect from direct sun on west and east directions. Verandahs located on south provide necessary protection from the hot summer sun and provide suitable sunny space in winters. Traditional use of wooden screens allows a cross air flow and has low thermal co-efficient (Devgan, et al 2010). Effective size of openings also prevents solar penetration into interior spaces of building. Louvers, overhangs or awning with optimum dimensions lined on windows help to control direct sun entry into the building especially during summer (Schiavon, et al 2010).

The choice of materials also helps to reduce the energy contents of buildings and maximize indoor comfort. Use of building material with low embodied energy i.e. energy used in the manufacture of the building material help in reducing energy cost as well as green house gases created by manufacturing processes; for example straw fired brick kilns are more environment friendly as compared to coal fired kilns (Lombard, Ortiz and Pout, 2008). Use of local materials reduces transportation energy consumption levels, reducing environmental degradation.

4. Significance of Daylight:

Sustainable architecture makes an efficient use of lighting through control mechanisms and appropriate design and layout by maximum use of natural daylight in the buildings (Okeil, 2010).

According to Mahdavi and Doppelbauer (2010), Day lighting design approaches include four concepts:

- Penetration: collecting natural light inside the building.
- Distribution: homogenous spreading of light into the spaces.
- Protection: reduction of direct penetration of sun into the building, by shading.
- Control: controlling light penetration to avoid visual discomfort

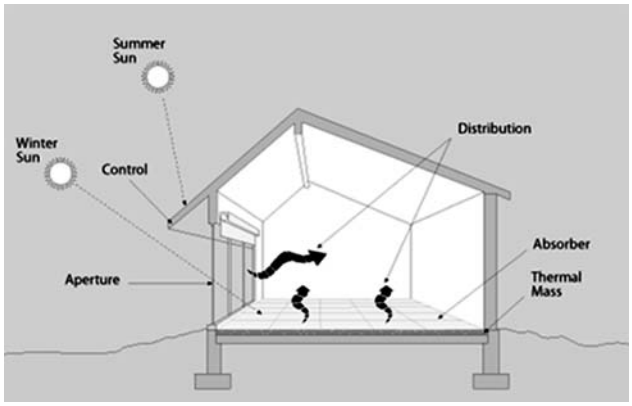

Figure-3: Elements of Passive Solar Design.
(Source: Givoni, B. (1994) Passive And Low Energy Cooling Of Buildings, Van Nostrand Reinhold, New York)

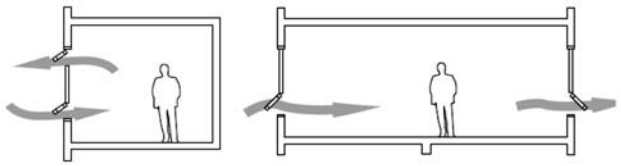

Figure-4: Single Sided and Cross Ventilation
(Source: Mikler, V. and others (2008) City of Vancouver: Passive Design Toolkit – Best Practices, LEED ® AP, Canada)

Passive solar designs (Figure 3) reduce energy consumption and are managed effectively after occupancy (Ralegaonkar and Gupta, 2010).

5. SIGNIFICANCE OF VENTILATION

Dissipation of accumulated heat in buildings can be achieved by introducing cool air flow through proper ventilation (Figure 4). Buildings with mechanical systems to supplement natural ventilation and reduce environmental impact by providing comfortable conditions for occupants, create thermally comfortable indoor environment. By optimizing window size and location, energy can be conserved in most effective way (Givoni, 1994). Ventilators also help to reduce air motion as hot air rises and flows through the ventilators. Schiavon et al (2010) discussed about the openings in the roof which help to induce air movement devoid of windows. Tall shafts with opening on the top help in sucking up the hot air during day and catch cool night air. Wind towers can also be used to control wind in a bio climate house and very effective in hot and dry climate where diurnal variation is high.

6. THERMAL COMFORT

According to ASHRAE[1], "thermal comfort is the condition of mind which expresses satisfaction with the thermal environment". Thermal comfort is a series of conditions in which given population neither feel very hot nor very cold. Comfortable conditions in mechanically ventilated buildings depend on six variables: air temperature, radiant temperature, relative humidity, air velocity, occupant's activity level and occupant's clothing insulation (Figure 5). All conditions effect bodily heat gain by convection and heat loss by evaporation. ASHRAE defines a comfort zone based on these variables where the majority of occupants feel comfortable (ASHRAE, 2004).

There are several models to measure thermal comfort in which two most relevant models are the Fanger Model and Adaptive Models based on ASHRAE Standards. The Fanger Model is most commonly used for typical buildings and defines comfort in terms of air temperature and humidity because these parameters are easy to measure and control. Mikler et al (2008) described the Adaptive Model to measure thermal comfort as function of the building is to provide the occupant with the means to make them comfortable. The current research is based on these two models to assess the thermal comfort in terms of temperature and humidity of buildings and energy efficiency by its function with reference to the provision of comfortable means given in the buildings.

7. PASSIVE COOLING

Passive cooling is a low energy-intensive method of keeping a building cool by relying on architectural design. Passive cooling system often utilize the same building materials found in conventional structures that operate with little or no mechanical assistance and are very unlikely to malfunction. Other key aspects of passive cooling technology described by Givoni (1994) shown in (Figure 6) include the use of insulating materials that retard heat flow, air infiltration, radiant heat transfer barriers under the roof, window design, desiccants for moisture reduction and new types of high performance glass. There is a variety of passive ventilation techniques such as solar chimneys, trombe walls, wind towers and roof vents. Domed roofs resist solar gain and improve ventilation (Chan et al 2010).

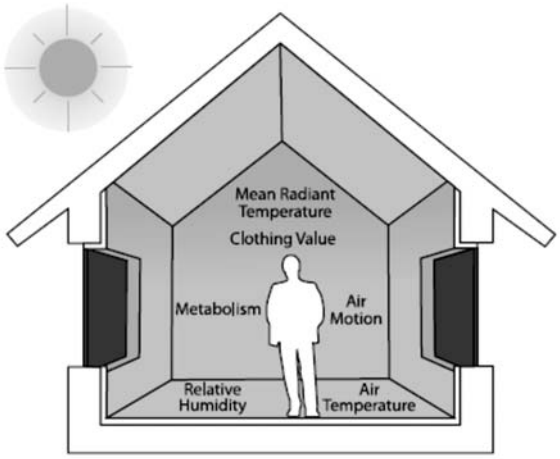

Figure-5: Key Thermal Comfort Parameters
(Source: Mikler, V. and others (2008) City of Vancouver: Passive Design Toolkit – Best Practices, LEED ® AP, Canada)

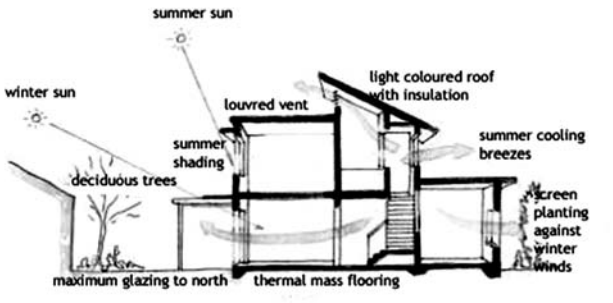

Figure-6: Key Elements of Passive Heating and Cooling
(Source: http://www.smarterhomes.org.nz)

8. CLIMATE OF MULTAN

Generally, climate has been classified into six major zones: cold and sunny; cold and cloudy; warm and humid; hot and dry; composite and moderate. The climatic elements are the variables which affect the building performance. The variables which directly affect thermal comfort are temperature, humidity, solar radiation and air movement.

- Air temperature, measured in degree Celsius, determining the requirement of heating or cooling and varied by other climatic parameters of wind speed and directions.

- Air humidity, usually termed as Relative Humidity is a measure of the amount of moisture present in the air and it is expressed as;

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers.

$$RH = \frac{\text{Absolute Humidity (AH)}}{\text{Saturation Point Humidity (SH)}} \text{ X } 100\%$$

Where,

AH is amount of moisture actually present in unit volume of air, in terms of g/kg or g/m3.

SH is the maximum amount of moisture that a unit volume of air can hold at that temperature.

- Solar radiation, which falls upon the area during each season and determines the temperature.

- Wind speed, measured in m/s by anemometer while the wind direction is measured by a wind vane.

The climate of Southern Punjab has been classified as 'warm composite climate' in which hot dry, hot humid and cold prevail (SABDSP, 2005). Meteorological Department Lahore (2008) observed the maximum (hot) /peak temperature of Multan in June – July and minimum in Dec – Jan (Figure 7), the relative humidity is lowest during May – June and highest in Dec – Jan (Figure 8) and the normal wind velocity is 3.5 to 5.2 km/h.; also wind storms are frequent during March to August generally from west to south or north to east (Figure 9). The interior comfort level recommended for interior environment has been determined as 28°C for higher limits and 20°C for lower limit. The relative humidity limit ranges from 20% to 80%.

9. CASE STUDIES

Generally in Multan, traditional buildings had evolved an architecture that minimized heat gain by maximum insulation and provided controlled ventilation of interior. Massive walls with mud mortar and plaster, thick mud insulating roofing, limber shutters of doors and windows and use of cross ventilation and stalk effect with the use of 'Mang'[2] contributed to creating a cool interior environment.

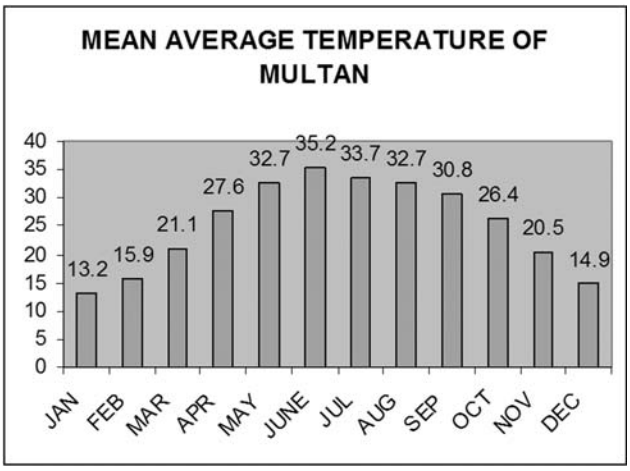

Figure-7: Average Minimum and Maximum Temperatuers in Multan, Pakistan.
(Source: Meterological Station, Lahore)

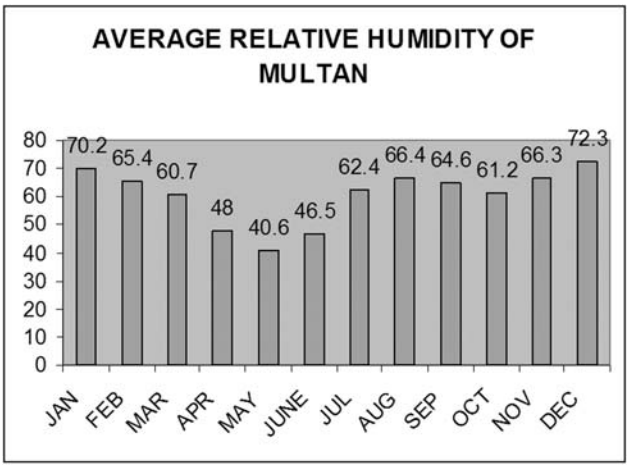

Figure-8: Average Relative Humidity of Multan, Pakistan
(Source: Meterological Station, Lahore)

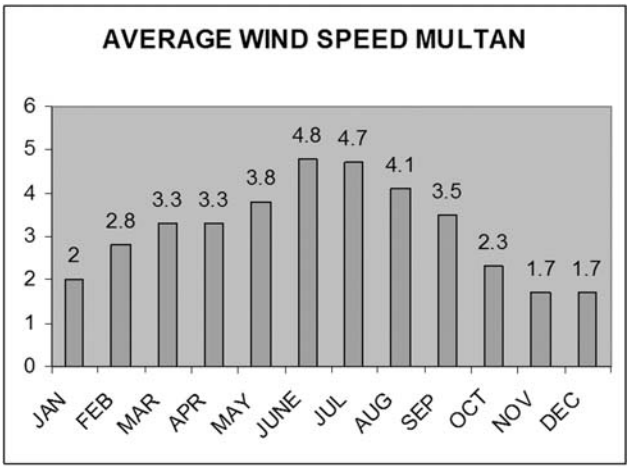

Figure-9: Average Wind Velocity of Multan, Pakistan
(Source: Meterological Station, Lahore)

2 Mang (Mungh) is a traditional term used for an opening made in the roof at the center of the room for air flow stack effect. (Ref: Glossary of Traditional terms for Residential spaces from A Handbook ofÊAppropriateÊBuilding Design forÊSouthernÊPunjab: published by CRC, 6-Temple road Lahore, June 2004.)

9.1 Contemporary Period

Contemporary architecture is applied to a range of styles of recently built structures and space which are optimized for current use. Table 1 shows the selected buildings under contemporary period (Figure 10).

Allama Iqbal Open University, Multan Campus.


Civil Engineering, Department, Bahauddin Zakariya University (BZU), Mutlan.


Punjab College of Information Technoogy, Multan.


Punjab College for Women, Multan.


Institute of Languages, BZU, Multan.


Institute of Management Sciences, BZU, Multan.

Figure-10: Selected Case Studies from Contemporary Period (Photographs by Author)

Building Name	Building Type	Design Features
Allama Iqbal Open University, Mutlan Campus (AIOU)	- Office Building - Education and Examination centre for AIOU, Multan Regional Office.	- Hollow Cement Sand blocks used for thermal insulation on roof - Provision of courtyard and verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Open spaces with sufficient plantation - Provision of sun shades
Civil Engineering Dept., UCET, BZU University, Multan	- North facing engineering education building inside the premises of BZU, Multan	- Vaulted high roofs are used to increase air space inside the building - Provision of courtyard and verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation
Punjab College of Information Technology, Multan (PCI)	- North facing double storey education building	- Large open spaces with sufficient plantation - Provision of verandahs and central courtyard - No windows provided on east and west side to minimize heat gain during summer - Roof insulation provided with mud filling
Punjab College for Women, Multan (PCW)	- Triple storey east facing education building	- Provision of courtyard and verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation - Roof insulation provided with mud filling Provision of sun shades
Institute of Languages, BZU, Multan (IOL)	- Triple storey east facing education building in the premises of BZU University, Multan	- Provision of two courtyards and verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation - Roof insulation provided with mud filling No windows provided towards east and west side to minimize heat gain during summers
Institute of Management Sciences, BZU, Multan (IMS)	- Double storey west facing education building in the premises of BZU University, Multan	- Provision of two courtyards and verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation - Roof insulation provided with mud filling Provision of water bodies and sun shades

Table-1: Selected Buildings of Conemporary Period.

9.2 Colonial Period

The Colonial age has predominantly buildings in Indo-European style i.e. the mixture of European and Indian-Islamic components. Most of the colonial buildings are still in use today. Multan, being a historic city has many colonial structures from which the following have been selected as the case studies shown in table 2 (Figure 11):

Muslim High School, Multan.

Public Library Langey Khan, Multan.

Civil Hospital, Multan.

District Nazim Office, Multan.

Raza Hall, Multan.

Town Hall, Multan.

Figure-11: Selected Case Studies from Colonial Period. (Photographs by Author)

Building Name	Building Type	Design Features
Muslim HIgh School, Multan (MHS)	- North facing education building	- Provision of two courtyards and large verandahs inside building create cool environment during summer to increase thermal comfort and energy efficiency - Open spaces with sufficient plantation - Roof insulation provided with mud filling - High roofs are used throughout in the building to increase air space inside building. - Provision of water bodies and sun shades
Public Library Langey Khan, Multan (PLL)	- South facing public library adjacent to Bagh Langey Khan, Multan	- Provision of verandah outside building to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation - Provision of double roof for insulation - Provision of courtyard - High roofs are used to increase air space inside building.
Civil Hospital, Multan (CHM)	- South facing hospital building	- Provision of two courtyards inside building and large verandahs inside and outside the building create cool environment during summer to increase thermal comfort and energy efficiency - Large open spaces with sufficient plantation - Roof insulation provided with mud filling - High roofs are used throughout to increase air space inside building - Provision of water bodies
District Nazim Office, Multan (DNO)	- South facing administrative office adjacent to district courts, Multan	- Provision of large verandahs outside building create cool environment during summer to increase thermal comfort and energy efficiency - Provision of courtyard - Large open spaces with sufficient plantation - Provision of double roof for insulation - High roofs are used throughout in the building to increase air space inside the building.
Raza Hall, Multan (RHM)	- West facing public gathering space	- Provision of large verandahs outside building create cool environment during summer to increase thermal comfort and energy efficiency - High roofs are used in the building to increase air space inside building - Provision of double roof and mud filling for insulation
Town Hall, Multan (THM)	- South facing administrative office	- Provision of courtyard inside the building and large verandahs outside the building create cool environment during summer to increase thermal comfort and energy efficiency - Provision of double roof for insulation - High roofs are used throughout the building to increase air space inside the building

Table-2: Selected Buildings of Colonial Period.

10. DATA ANALYSIS

Examples selected from Multan are based on general impression and professional judgment regarding the use of energy efficient means for achieving thermal comfort. Climatic conditions of summer season are studied in order to evaluate the user comfort level in public buildings of hot composite climate. Metrological Department Data of outdoor temperature of the region was used to determine comfort standards during summer months and further explained with results. Internal temperatures and humidity of rooms and verandahs have been measured by taking 24 readings from selected buildings during peak hot hours of summer in the afternoon time. Questionnaire survey is conducted from 10 randomly selected users of each building to measure the response about the comfort and usage of the building.

To measure the final score of user comfort and energy efficiency in public buildings of the hot composite climate of Multan, structured design and material aspects of buildings are observed on technical basis and weights are assigned to different components. Weighted average is calculated as final score. Final score is further converted into standard scores to find out the important factors and comparison of different aspects.

Comparisons are made from building to building and further between colonial and contemporary periods with respect to measure use of energy efficiency and user comfort achieved through these measures. Finally the colonial and contemporary buildings are compared for their energy efficiency and user comfort score.

10.1 Energy Efficiency of Building

Buildings are studied for use of energy efficient means and analyzed in two groups of contemporary and colonial buildings. Parameters of study with their respective weight-age are identified, in table 3 and corresponding data is collected from every building through field surveys and questionnaire surveys (table 4). Weight-age of each parameter is identified based on professional understanding.

Four broad parameters are taken comprising passive means for energy efficiency, ventilation, exterior of building and visibility (detailed in table 3). Weighted scores of energy efficiency of individual buildings are identified and applied to all buildings (detailed in table 5). After applying Weightage, Standard score for energy efficiency of each building is identified to be used in further comparison with user comfort applying the following formula:

$$\textit{Standard Scores} = \frac{\textit{Weighted Score} - \textit{Mean of Scores}}{\textit{Standard Deviation}}$$

After studying the individual building, a comparison of energy efficient means of buildings had been developed (Table 6). Therefore, from this comparison, it is indentified that colonial buildings are more energy efficient than contemporary buildings as additional means of energy efficiency are used in these buildings (Figure 12 & 13).

Proportion of Weightage of Energy efficiency of Buildings

Passive Means for Energy Efficiency		50
Orientation	10	
Courtyard	8	
Verandahs	8	
Wall Thickness	8	
Room Height	8	
Insulation	8	
Ventilation		18
Opening	6	
Wall Window Ratio	6	
Sun Shades	6	
Exterior of Building		24
Finish	4	
Vegetation	8	
Open Spaces	8	
Water Bodies	4	
Visibility		8
Natural Light	8	
		100

Table-3: Weightage for use of different engery efficient means in buildings.

S.No.	Building	Orientation	Courtyard	Verandah	Wall thickness	Room Ht.	Insulation	openings	Wall win ratio	Sun shades	Exterior finish	Vegetation	Open spaces	Waterbodies	Natural light
1.	AIOU	2.5	8	6	4	4	5.25	6	6	6	4	8	8		8
2.	CED	7.5	8	6	4	4	2.75	6	6	6	2	4	8		8
3.	PCI	7.5		4	4	4	2.75	3	6	6	4	2	4		8
4.	PCW	7.5		4	4	4	2.75	3	6	6	4	2	4		8
5.	IOL	5	8	8	4	4	2.75	4.5	4	6	2	4	8		8
6.	IMS	2.5	8	8	4	4	2.75	6	4	6	2	4	8		8
7.	MHS	2.5	8	6	6	6	2.75	6	6		4	6	8	4	8
8.	PLL	10	8	4	8	8	8	3	6	6	4	4	6		8
9.	CHM	10	8	8	6	6	2.75	4.5	4	6	4	2	6	4	8
10.	DNO	10		6	8	8	8	6	6	6	4	4	8		8
11.	RHM	10		6	6	8	8	4.5	6	6	4	4	6		8
12.	THM	10	8	8	8	8	8	6	6	6	2		8		8

Table-4: Shows usage of means of energy efficiency in the buildings (based on field survey).

S.No.	Building	Passive Means: 50	Ventilation: 18	Exterior: 24	Visibility: 8	Total	Scores	Std. Scores
1.	AIOU	11	8	10	1	30	75.84	0.2964
2.	CED	12	8	7	1	28	72.17	-0.0818
3.	PCI	10	6	5	1	22	55.17	-1.8339
4.	PCW	11	5	5	1	22	57.17	-1.6278
5.	IOL	12	6	7	1	26	68.17	-0.4941
6.	IMS	11	7	7	1	26	67.17	-0.5972
7.	MHS	12	7	10	1	30	73.17	0.0212
8.	PLL	18	6	7	1	32	83.01	1.0353
9.	CHM	16	6	7	1	30	79.17	0.6396
10.	DNO	18	8	8	1	35	82.01	0.9323
11.	RHM	17	7	7	1	32	76.51	0.3654
12.	THM	20	8	5	1	34	86.01	1.3445
Mean: 72.96417 Standard Deviation: 9.702918								

Table-5: Energy efficiency of selected buildings, standard scores from data collection after applying weightage.

Comparison of Scores

	Contemporary		Colonial	
Passive Means for Energy Efficiency		29.20		40.98
Orientation	5.42		8.75	
Courtyard	6.67		5.33	
Verandahs	6.00		6.33	
Wall Thickness	4.00		7.00	
Room Height	4.00		7.33	
Insulation	3.12		6.23	
Ventilation		15.08		15.67
Opening	4.75		5.00	
Wall Window Ratio	5.33		5.67	
Sun Shades	5.00		5.00	
Exterior of Building		13.67		15.33
Finish	3.00		3.67	
Vegetation	4.00		3.33	
Open Spaces	6.67		7.00	
Water Bodies	0.00		1.33	
Visibility		8.00		8.00
Natural Light	8.00		8.00	
		65.95		79.98

Table-6: Mean weighted scores of different energy efficient means in contemporary vs colonial.

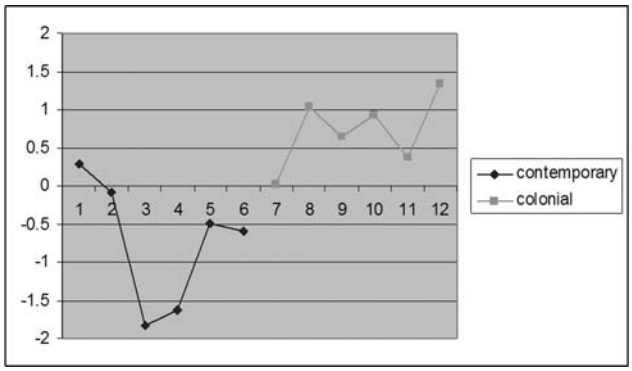

Figure-12: Energy efficiency of Contemporary vs Colonial (Based on Standard Scores).

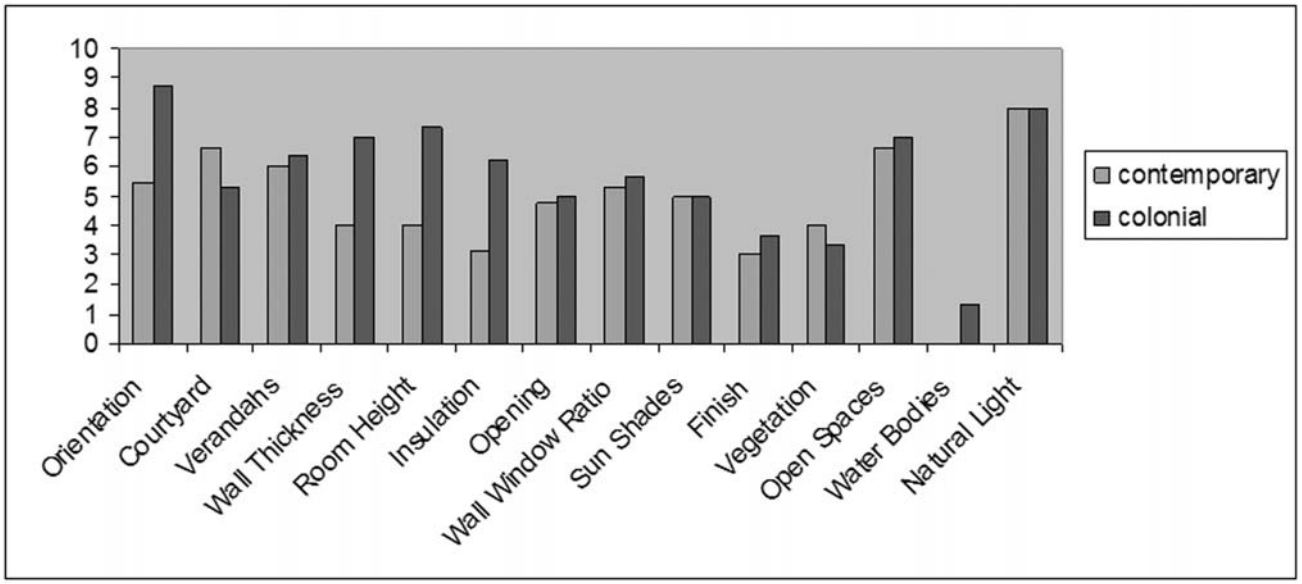

Figure-13: Comparison of means of energy efficiency between contemporary and colonial.

10.2 Climatic Studies of Buildings

From the case studies, verandah had been observed as a constant architectural element. Therefore, Temperature and Humidity are measured from rooms and verandahs of buildings to calculate the difference between outside and inside temperature and humidity twice a day in afternoon from May to August 2008 shown in (Table 7). Digital Hygro-Thermometer[3] has been used to measure the air temperature and relative humidity. This temperature is further compared with standard temperature derived through Adaptive Mean Vote (AMV)[4] to know the actual discomfort level (Table 8). Data of Temperature and Humidity levels of buildings is compared with the Standard Comfort levels. Standard scores are also calculated for further comparisons (Table 9). Therefore, it is found that both the temperature

		Temperature			Humidity		
S.No.	Building	Verandah	Room	Difference	Verandah	Room	Difference
1.	AIOU	35.20	34.50	0.70	49.04	47.21	1.83
2.	CED	35.33	34.70	0.63	52.67	48.21	4.46
3.	PCI	35.26	34.61	0.65	46.92	47.50	-0.58
4.	PCW	35.18	34.54	0.64	47.50	47.54	-0.04
5.	IOL	34.79	34.65	0.15	51.38	47.96	3.42
6.	IMS	34.73	34.44	0.29	51.96	48.50	3.46
7.	MHS	34.97	34.30	0.67	48.50	47.25	1.25
8.	PLL	354.42	34.50	0.92	48.25	46.79	1.46
9.	CHM	35.29	34.44	0.85	47.04	46.50	0.54
10.	DNO	35.75	34.45	1.31	46.75	45.71	1.04
11.	RHM	34.92	34.34	0.58	46.08	46.08	0.00
12.	THM	35.52	34.34	1.18	46.04	46.83	1.21

Table-7: Shows average of temperature and humidity from rooms and verandahs of selected buildings.

3 Hygro-Thermometer meets the GLOBE Protocols for air temperature, relative humidity, soil temperature and maximum-minimum and current temperatures.

4 AMV is calculated from Mean Temperature of the city measured by Meteorological Department Office, Multan

Months	Max T °C	Min T °C	Mean T °C	AMV °C
May	40.16	26.4	33.28	31.47
June	39.39	29.56	34.48	32.12
July	37.97	28.79	33.38	31.53
August	36.15	27.46	31.81	30.68
Mean	38.42	28.05	33.24	31.45

Table-8: Mean temperatures AMV of summer months for Mutlan.
(Source: Metrological Office, Multan).

Average Outdoor Temp. 33.24 Humidity Outdoor 39.73% AMV 31.45						
Buildings	Room Temperatyure	AMV Room	Standard Scores	Humidity Room	50-HR	Standard Scores
AIOU	34.50	-3.05	-0.05	47.21	2.79	0.02
CED	34.70	-3.25	-1.63	48.21	1.79	-1.20
PCI	34.61	-3.16	-0.94	47.50	2.50	-0.34
PCW	34.54	-3.09	-0.41	47.54	2.46	-0.39
IOL	34.65	-3.20	-1.24	47.96	2.04	-0.89
IMS	34.44	-2.99	0.41	48.50	1.50	-1.55
	34.57	-3.12		47.82	2.18	
MHC	34.30	-2.85	1.47	47.25	2.75	-0.03
PLL	34.50	-3.05	-0.05	46.79	3.21	0.52
CHM	34.44	-2.99	0.38	46.50	3.50	0.88
DNO	34.45	-3.00	0.35	45.71	4.29	1.84
RHM	34.34	-2.89	1.17	46.08	3.92	1.38
THM	34.34	-2.89	1.17	46.83	3.17	0.47
	34.40	-2.95		46.53	3.47	
Mean	34.49	-3.04		47.22	2.78	
Standard Deviation		0.1263			0.823153	

Table-9: Difference from comfortable temperature and humidity of buildings.

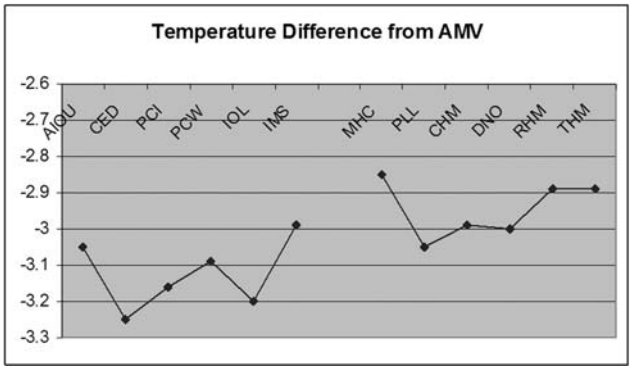

Figure-14: Comparison of temperature and AMV of buildings.

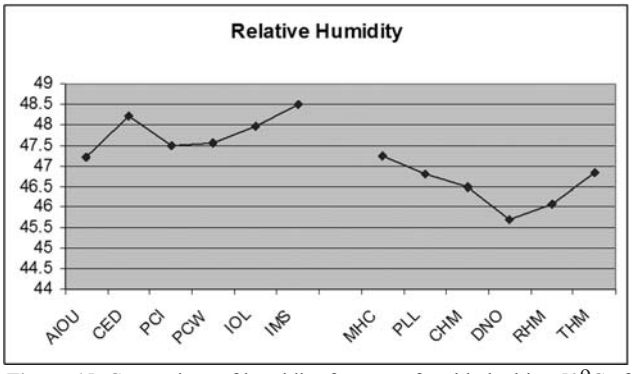

Figure-15: Comparison of humidity from comfortable lvel i.e. 50^{O}C of buildings.

and humidity of colonial buildings are more close to comfortable standards as compared to contemporary buildings (Figure 14 & 15).

10.3 Comfort Levels of Buildings

As this research is designed on a case study approach, ten users (employees) from each building between the age group 25-55 have been randomly selected for the questionnaire survey to assess their personal experience of comfort in reference to the selected buildings (Table 10), using respective form placed in (Figure 16). The user comfort components are assigned weights and weighted average scores of buildings are computed with results. Weight-age of each parameter is identified based on professional understanding (Table 11). Weighted scores of user's comfort of individuals are identified by applying the scores in the data collected from surveys (Table 12). Standard score for user comfort of each building is identified to be used in further comparison with energy efficiency applying the following formula:

$$\text{Standard Scores} = \frac{\text{Weighted Score} - \text{Mean of Scores}}{\text{Standard Deviation}}$$

S.No.	Building	Temperature	Humidity	Air Mvve	Air Quality	Bldg Space	Interior	Visibility	Color	Acoustic	Furniture	Access	Space R	Wind Flow	Score
1.	AIOU	6	1	4	4.5	1.5	0.5	1.75	1.25	9	1	0.25	0.75	1.5	33
2.	CED	-2	1.5	0	-1	1	-0.75	0	1	-2.5	-0.25	0.75	-0.75	-1	-4
3.	PCI	-1	1	1.5	0.5	-1.25	1.75	1.25	-2.5	2	3.25	-1	-0.75	-0.5	4
4.	PCW	-4	-1.5	-6	-5.5	1	2	1.25	3	2	4.25	2.5	2.25	2.5	4
5.	IOL	-1	-2	1.5	1	1	-0.75	0.75	-1.25	0	-2	-1.5	-0.5	0	-5
6.	IMS	-7	-1.5	-1	-0.5	0	-0.25	0	1	-1	-2	-1.75	-0.25	0.25	-14
7.	MHS	6	2	4	2.5	3	-1.5	-0.25	-2	4	-2	0.5	1	1.25	19
8.	PLL	-2	0	3.5	1	2.25	2	0.25	-0.75	-1	2.25	0.5	1	1.75	11
9.	CHM	1	0.5	-0.5	-1.5	0.75	-1.25	0.75	0.25	4	-0.5	1.25	1.5	1.5	8
10.	DNO	-1	1	3.5	1.5	4.25	2	2	1.75	4	2.75	2.25	2.5	3	30
11.	RHM	-2	0	-0.5	5.5	0.25	-0.75	2.75	0.75	2.5	-1.75	-0.75	-0.25	1.75	8
12.	THM	6	2	4	2	2	-1.75	0	-1.25	0	0.25	0	0	0.75	14

Table-10: User's Comfort Level of Selected Buildings (Through Questionnaire Survey).

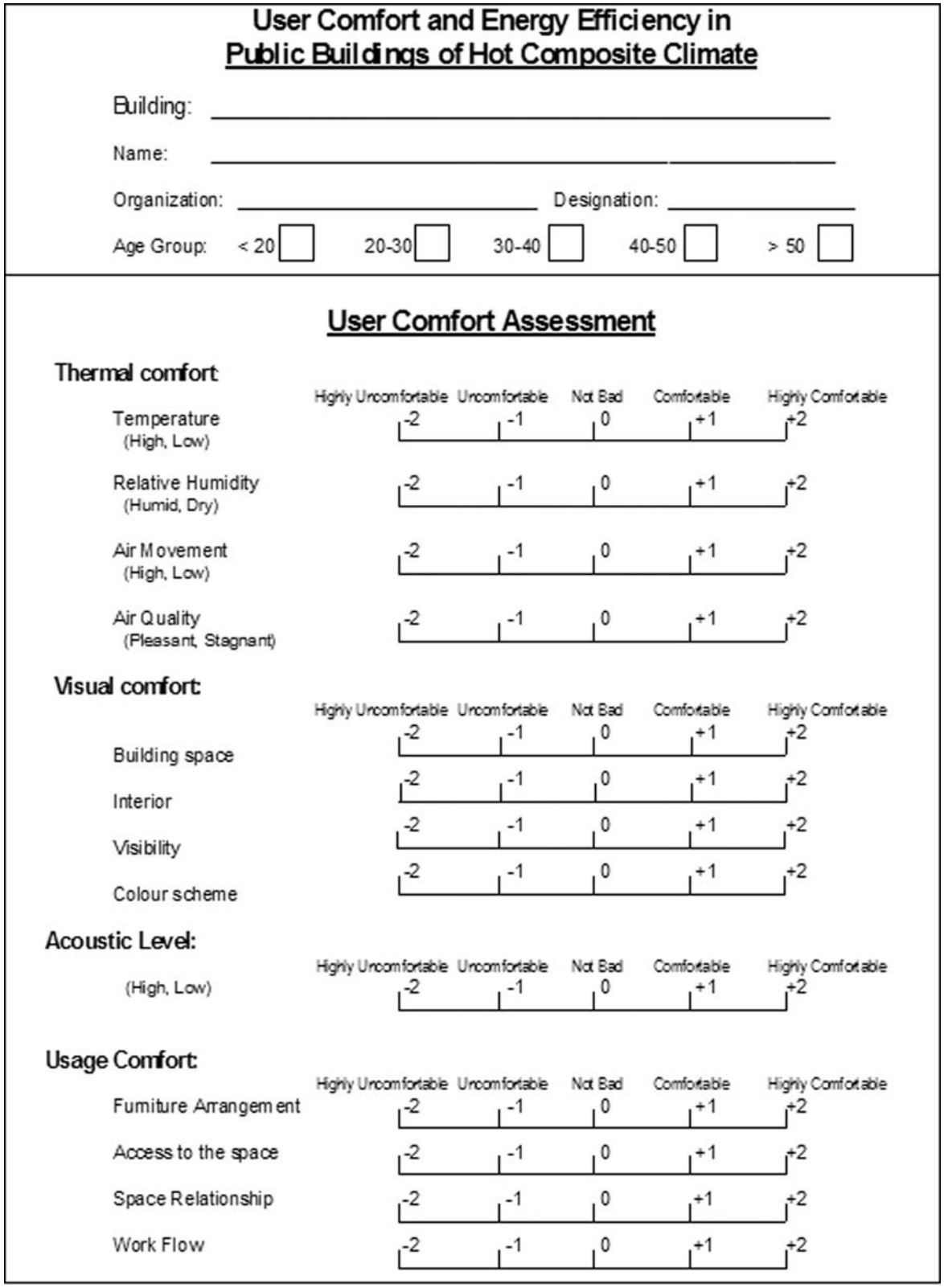

Figure-16: Sample of Questionnaire.

Proportion of Weightage of User Comfort of Buildings

Thermal Comfort		50
Temperature	20	
Humidity	10	
Air Movement	10	
Air Quality	10	
Visual Comfort		20
Building Space	5	
Interior	5	
Visibility	5	
Color Scheme	5	
Acoustic Level	10	10
Usage Comfort		20
Furniture Arrangement	5	
Access to the Space	5	
Space Relationship	5	
Work Flow	5	
		100

Table-11: Weightage for user comfort parameters in the buildings under study.

S.No.	Building	Thermal Comfort	Visual Comfort	Acoustic Level	Usage Comfort	User's Comfort
1.	AIOU	25	20	18	14	77
2.	CED	-1	5	-5	-5	-6
3.	PCI	5	-3	4	4	10
4.	PCW	-30	29	4	46	49
5.	IOL	0	-1	0	-16	-17
6.	IMS	-13	3	-2	-15	-27
7.	MHS	23	-3	8	3	31
8.	PLL	7	15	-2	22	42
9.	CHM	-2	2	8	15	23
10.	DNO	11	40	8	42	101
11.	RHM	8	12	5	-4	21
12.	THM	22	-4	0	4	22

Table-12: User comfort level of buildings under study (Through Questionnaire Survey).

After studying individual buildings, a comparison of user comfort in buildings had been developed (Table 13). Therefore, from comparison, it is found that colonial buildings are more comfortable than contemporary buildings as more users of these buildings mentioned their satisfaction in the questionnaire survey (Figure 17).

10.4 Comparison of Energy Efficiency and User Comfort

Energy efficiency, temperature, humidity and user comfort of buildings are calculated through scores from data collected and converted into Standard score for comparison with comfort levels for hot composite climate. Individual scores are identified by field survey and questionnaire survey (Table 14).

$$\text{Mean Score} = X = \frac{\varepsilon X}{n} = \frac{\text{Sum of Scores}}{\text{Number of Scores}}$$

Standard Scores are derived through Standard deviation and mean values from scores (Table 15).

$$\text{Standard Score} = \frac{\text{Weighted Score} - \text{Mean Score}}{\text{Standard Deviation}}$$

By comparison of standard scores, it is found that all three factors studied are directly proportional and support each other. The buildings using more energy efficient means are more comfortable; study further asserts that colonial buildings are more energy efficient and comfortable than contemporary buildings (Figure 18).

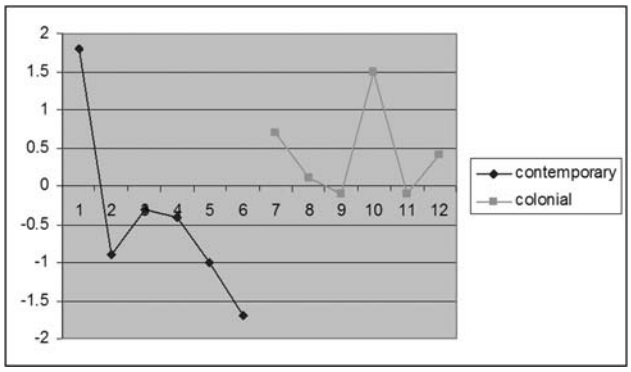

Figure-17: User comfort of contemporary vs colonial (based on standard scores).

11. CONCLUSIONS

1. The design, optics, building materials and construction techniques of public buildings reflect the measure of advancement of a society or a nation. There is a need to recognize that public buildings influence broader cross-section of community and make lasting contributions to enhance our quality of life.

2. Global warming appears to be apparent in the climatic

S.No.	Building	Thermal Comfort	Visual Comfort	Acoustic Level	Usage Comfort	User's Comfort	Standard Scores
1.	AIOU	15.5	5	9	3.5	33	1.8
2.	CED	-1.5	1.25	-2.5	-1.25	-4	-0.9
3.	PCI	2	-0.75	2	1	4.25	-0.3
4.	PCW	-17	7.25	2	11.5	3.75	-0.4
5.	IOL	-0.5	-0.25	0	-4	-4.75	-1.0
6.	IMS	-10	0.75	-1	-3.75	-14	-1.7
7.	MHS	14.5	-0.75	4	0.75	18.5	0.7
8.	PLL	2.5	3.75	-1	5.5	10.75	0.1
9.	CHM	-0.5	0.5	4	3.75	7.75	-0.1
10.	DNO	5	10	4	10.5	29.5	1.5
11.	RHM	3	3	2.5	-1	7.5	-0.1
12.	THM	14	-1	0	1	14	0.4
Mean: 8.9 Standard Deviation: 13.66917							

Table-13: Comparison of user comforts in buildings after applying weightage.

S.No.	Building	Energy Efficiency	Temperature	Humidity	User Comfort
1.	AIOU	75.84	0.06	2.79	33.00
2.	CED	72.17	-0.14	1.79	-4.00
3.	PCI	55.17	-0.05	2.50	4.25
4.	PCW	57.17	0.02	2.46	3.75
5.	IOL	68.17	-0.09	2.04	-4.75
6.	IMS	67.17	0.12	1.50	-14.00
7.	MHS	73.17	0.26	2.75	18.50
8.	PLL	83.01	0.06	3.21	10.75
9.	CHM	79.17	0.12	3.50	7.75
10.	DNO	82.01	0.11	4.29	29.50
11.	RHM	76.51	0.22	3.92	7.50
12.	THM	86.01	0.22	3.17	14.00

Table-14: Comparison of Raw scores for energy efficiency and user comfort.

S.No.	Building	Energy Efficiency	Temperature	Humidity	User Comfort
1.	AIOU	0.30	-0.10	-0.04	1.77
2.	CED	-0.08	-1.64	-1.23	-0.94
3.	PCI	-1.83	-0.97	-0.39	-0.34
4.	PCW	-1.63	-0.45	-0.44	-0.37
5.	IOL	-0.49	-1.26	-0.94	-1.00
6.	IMS	-0.60	0.35	-1.58	-1.67
7.	MHS	0.02	1.38	-0.09	0.71
8.	PLL	1.04	-0.10	0.46	0.14
9.	CHM	0.64	0.32	0.80	-0.08
10.	DNO	0.93	0.29	1.75	1.51
11.	RHM	0.37	1.09	1.30	-0.10
12.	THM	1.34	1.09	0.41	0.38

Table-15: Comparison of standard scores for energy efficiency and user comfort (calculated from data collected through surveys).

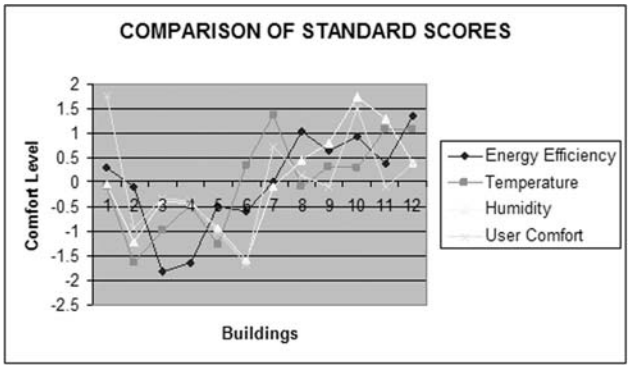

Figure-17: User comfort of contemporary vs colonial (based on standard scores).

cycle of Pakistan. Due to very hot summers in Pakistan, buildings especially public buildings tend to produce internal temperatures close to or exceeding the upper limit of comfort.

3. By adopting some simple passive features like most climatically favorable orientation, adequate shading of windows, reflective coatings on exterior surfaces, greenery cover over the building, roof and wall insulation, energy efficient window system, judicious provision of windows for ample natural ventilation etc results in significant saving in the energy consumed while creating comfortable environment indoors.

4. Energy efficiency measures for buildings are approaches through which the energy consumption of a building can be reduced while maintaining or improving the level of comfort in the building. They can typically be categorized into:

- Reducing heating and cooling demand;
- Reducing energy requirements for ventilation, lighting and heating water;
- Reducing electricity consumption of equipment and appliances;.

5. Buildings surveyed from colonial period are equipped with more energy efficient elements and are more comfortable than the buildings from contemporary period.

6. Buildings in which no passive elements had been used were made comfortable through active means of thermal comfort by excessive energy use.

7. Issues of thermal evaluation regarding energy optimization are not fully considered during the design, in most cases. These issues rely on the holistic understanding of building thermal behavior, which depends on the interaction of building elements with outside and inside variable conditions.

8. In subjective approach of research it is found that human body tends to adjust with the local climate by using adaptive mechanism to achieve their desired comfort conditions much earlier than the logical calculated physiological comfort values. This point is further supported by Adaptive Mean Vote (AMV) of this area.

9. In objective approach of thermal comfort, AMV[5] is closer to the required comfort levels, as compared to standards of Predictive Mean Vote (PMV)[6], confirmed through questionnaire survey.

10. Field studies clarify that results from local climatic setup are different from generalized standards and are more economical and acceptable by users.

12. RECOMMENDATIONS

1. Thermal standards for buildings that can promote use of some simple passive energy efficient elements should be formulated. If buildings are designed and built to incorporate the right mix of these characteristics, the occupants will be able to make themselves comfortable in these buildings using minimum energy.

2. The governmental department should improve the legislative system, mechanism and legal system of energy efficiency in the buildings.

3. Establish and improve the technology on energy efficiency in building through research on energy saving technology and new materials combined with the local climatic characteristics.

4. Use of local resources and materials should be optimized to design buildings based on the principles of thermal comfort.

5. Monitoring and evaluating the energy efficiency in newly-built buildings.

6. Promoting the energy efficiency measures in large public buildings.

7. Enhance research to develop energy saving strategies in buildings and disseminate its application.

8. Building designers should estimate the indoor temperature that building occupants find comfortable and creative ideas should be applied to provide comfortable indoor environments with minimal energy usage.

9. Further studies can be performed considering other aspects of user comfort and energy efficiency considering different energy efficient elements separately.

5 Demonstrates that people are more tolerant of temperature changes than laboratory studies suggest.
6 Based on ASHRAE standards and derived from studies of individuals in tightly controlled conditions.

REFERENCES

Agarwal, K. N. (2004) Thermal Data of Building Fabrics and its Application in Building Design, Building Digest, No. 52, Roorkee, India, Central Building Research Institute.

ASHRAE, (2004) ASHRAE Fundamentals Handbook, ANSI/ASHRAE Standard-55-2004, Thermal Environmental Conditions for Human Occupancy, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta.

Chan, H.; Riffat, S. B.; Zhu, J. (2010) Review of passive solar heating and cooling technologies, Renewable and Sustainable energy Reviews, Volume 14, Issue 2, February 2010, Pages 781-789.

Climatic Data of Hot Composite Climate from Meteorological Department Lahore, 2008.

Devgan, S.; Jain, A. K.; Bhattacharjee, B. (2010) Predetermined Overall Thermal Transfer Value Coefficients for Composite, Hot-Dry and Warm Humid Climates, Energy and Buildings, Volume 42, Issue 10, October 2010, Pages 1841-1861.

Givoni, B. (1994) Passive and Low Energy Cooling of Buildings, Van Nostrand Reinhold, New York.

Krishan, A. and others (2001) Climate Responsive Architecture: A Design Handbook of Energy Efficient Buildings, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Mahdavi, A.; Doppelbauer, E. (2010) A Performance Comparison of passive and low-energy buildings, Energy and Buildings, Volume 42, Issue 8, August 2010, Pages 1314-1319.

Majumdar, M. ed. (2001) Energy Efficiency of Buildings: An Overview of Design Concepts and Architectural Interventions; Energy-Efficient Buildings in India, Ministry of Non-Conventional Energy Sources and Tata Energy Resource Institute, © Ministry of Non-conventional Energy Sources and Tata Energy Resource Institute, Thomson Press. New Delhi, ISBN: 81-85419-82-5

Mathur, V. K.; Chand, I. (2003) Climatic Design for Energy Efficiency in Buildings, IE (I) Journal – AR, Vol. 84, October 2003.

Mikler, V. and others (2008) City of Vancouver: Passive Design Toolkit – Best Practices, LEED® AP, Canada.

Nicol, F. J. and others (1999) Climatic variations in comfortable temperatures: the Pakistan projects, Energy and Buildings, Vol. 30, Issue 3, August 1999, Pages 261-279.

Okeil, A. (2010) A holistic approach to energy efficient building forms, Energy and Buildings, Volume 42, Issue 9, September 2010, Pages 1437-1444.

Perez-Lombard, L.; Ortiz, J.; Pout, C. (2008) A review on buildings energy consumption information, Energy and Buildings, Volume 40, Issue 3, January 2008, Pages 394-398.

Ralegaonkar, R. V.; Gupta, R. (2010) Review of Intelligent Building Construction: A Passive Solar architecture Approach, Renewable and Sustainable Energy Reviews, Volume 14, Issue 8, October 2010, Pages 2238-2242.

Saade, J. J.; Ramadan, A. H. (2008) Control of Thermal-Visual Comfort and Air Quality in Indoor Environments trough a Fuzzy Inference-Based Approach, International Journal of Mathematical Models and Methods in applied Sciences, Issue 2, Vol. 2, 2008, Pages 213-221.

Schiavon, S.; Melikov, A. K.; Sekhar, C. (2010) Energy Analysis of the Personalized Ventilation System in Hot and Humid Climates, Energy and Buildings, Volume 42, Issue 5, May 2010, Pages 699-707.

Sozer, H. (2010) Improving energy efficiency through the design of the building envelope, Building and Environment, Volume 45, Issue 12, December 2010, Pages 2581-2593.

Standards for Appropriate Building Design for Southern Punjab (SABDSP), 2005.

Yilmaz, Z. (2007) Evaluation of Energy Efficient Design Strategies for Different Climatic Zones: Comparison of Thermal Performance of Buildings in Temperate-Humid and Hot-Dry Climate, Energy and Buildings, Volume 39, Issue 3, March 2007, Pages 306-316.

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