PROTIBESH

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Corrigendum (see pages 39-52)
The paper titled
School design and economy
has been written by
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Editorial

This issue was due in 1990. Due to reasons beyond our control this publication has been delayed by a few months. From the time of publication of our last issue till the present one two very major world events have taken place. Though these are not directly linked with Architecture, we cannot but reflect on the consequences of the Gulf War and the overthrow of the autocratic government of Bangladesh by mass public uprising. The down fall of the ruling autocratic government and subsequent holding of peaceful and impartial elections is a milestone in the history of the country. Now we can expect the onset of consultative-democracy in the country which will change the system of decision making in all spheres. In case of architectural projects, we hope, selections will be made in a non-biased impartial manner based more on the quality of the project or the ability of the designer than on other considerations. A democratic government with stable economy is congenial for the growth of good architecture. We aspire for a bright future of architecture in Bangladesh in the years to come.

Gulf War besides its other political dimensions was a war for the control of oil, the most common source of energy. Some believe lower price of oil will slowdon the quest for alternate sources of energy and will also dampen the energy saving inovation in buildings by Architects. We will be keen to observe what impact this useless war might have on building forms of the future.

Meer Mobashsher Ali
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Protibesh

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ACOUSTICAL PROBLEMS OF BAITUL MUKARRAM MOSQUE

NIZAMUDDIN AHMED *

Baitul Mukarram mosque in Dhaka is the largest mosque in Bangladesh. The six-storied place of worship, raised on a eleven-foot high podium and veiled behind four massive walls, evolving in a cube is reminiscent of the form of Holy "Kaaba". It includes a mezzanine platform between the First and Second floors, and it can provide covered prayer space for about 15000 devotees. The eastern court or "shahan" is abutted on the North and South by roofed ablution facilities catering to 162 Muslims simultaneously. This court is exposed to the elements of the weather but it can accommodate another approximately 8000 respondents to the call of prayer. Because it can be extremely hot in summer and can be wet by rain, the "shahan" is protected by colourful flowing "shamianas" during important festivities and occasions calling for large gatherings.

The main approach from the south, previously overlooking a paved plaza and the scene of many a historical public meeting has been considerably redesigned one understands to prevent political gatherings. It now consists of a linearly laid out water body, sprinkled by fountains and juxtaposed with pretty gardens, climaxing at a 27-step entry portico under a tri-arched gateway. The approach from the north is similarly disposed *sans* the water body, fountains and gardens. The eastern approach ushering in "musallis" along a brick-paved walkway meets a plaza punched with a fountain before ascending up to the stepped podium. Both the latter approaches are lesser only in architectural hierarchy but are functionally as important as the

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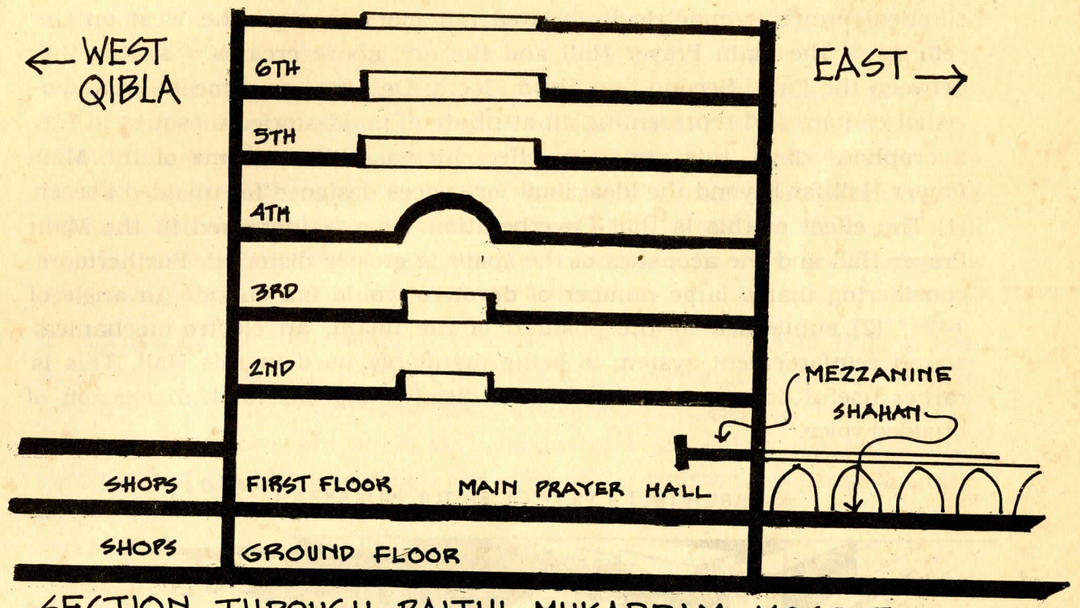
principal approach because the mosque is physically dominant over a busy urbanscape. The entire complex is guarded by high boundary walls pierced with arches latticed in concrete.

The mosque-in-the bazaar legacy is given credence by about 350 shops teeming with shoppers at any time of the day, extending along the Ground Floor and partly on the First of the West Block. There is so much of religious overtones at Baitul Mukarram that one hardly notices that this mosque has no minarets, This is hardly a folly but the failure of the designers to provide a congenial acoustical environment inside the mosque is a blunder of grave concern and consequences.

One of the primary functions of a mosque is to provide auditory communication between the Imam and the "Musallis". This vital transportation of the Imam's utterances to the avid audience is severely affected by the irritable and extremely poor acoustical conditions inside the mosque.

The top five floors, 2nd to 6th floors, and the open-to-sky eastern courtyard are occupied only during large congregations for Eid and Jumma prayers, the nights of Lailat-ul-Q'adr and Shab-e-Baraat, and on very special occasions. The lower three floors of the mosque, Ist to 3rd, are connected visually by a punch which is the central feature of the 4th floor, rather like a hump on the flat floor.



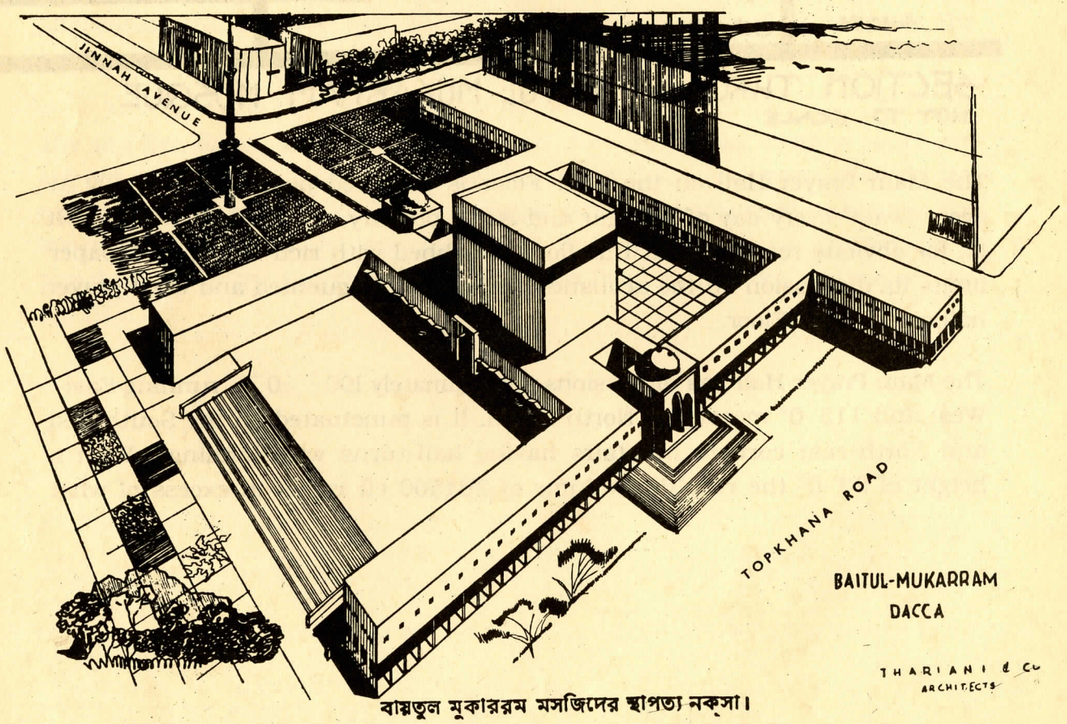
SECTION THROUGH BAITUL MUKARRAM MOSQUE
NOT TO SCALE

The Main Prayer Hall on the First Floor is occupied partially or wholly at every "waqt" every day of the year and is the primary centre of all activities. It is, for obvious reasons, that this floor is dabbed with rich decor. This paper limits its discussion on the acoustics of the most frequented and used prayer hall on the First Floor.

The Main Prayer Hall has dimensions approximately 100 ′ - 0 ′′ running East-West and 115'-0" measuring North-South. It is punctuated on the South-east and North-east corners by stairs having half-turns with landings. With a height of 23'-0" the resulting volume of 264500 cft is not in excess of what

would be the ideal size for design with unaided voice. However, a 580 sft. elliptical punch symmetrically located but more towards the West on the ceilings of the Main Prayer Hall and the one above creates a spatial link between the First, Second and Third Floors. Designed as a means of audio-visual contact and representing an attribute of multi-storied mosques in pre-microphone days, this punch in effect increases the volume of the Main Prayer Hall far beyond the ideal limit for spaces designed for unaided speech. (1) The effect of this is that Reverberation Time is increased in the Main Prayer Hall and the acoustics of the space is grossly distorted. Furthermore, considering that a large number of devotees would fall outside an angle of 140 ° (2) subtended at the position of the Imam, an electro-mechanical sound reinforcement system is being justifiably used in this Hall. This is rather useful because the flat floor is disadvantageous for transmission of unaided voice.

AN ARCHITECT'S VIEW OF BAITUL MUKARRAM (1960's)

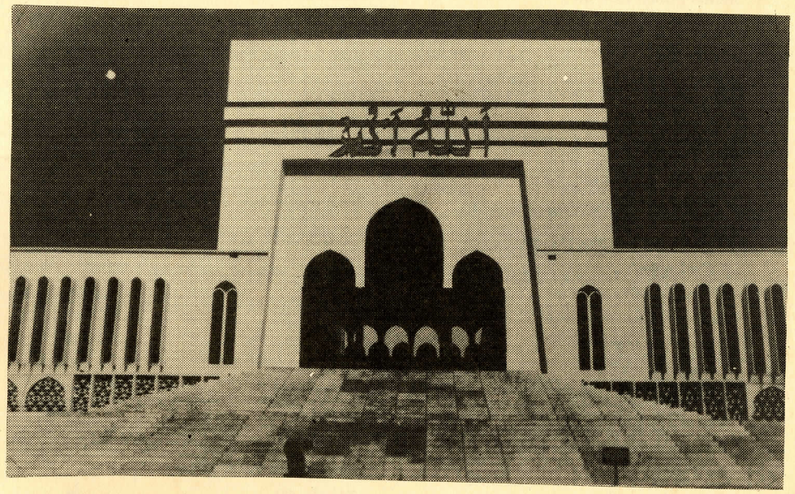


বায়তুল মুকাররম মসজিদের স্থাপত্য নক্সা।

Another factor responsible for increase in reverberation is the highly reflecting bounding surfaces. The floor of the Main Prayer Hall is finished in terrazzo. The West, North and South wall finishes are of marble. The ceiling and the columns are plastered concrete while the East wall is plastered brick. Very little absorption takes place in this space. The maximum possible absorption occurs when the doors and windows are open, and when the floor is fully occupied. There will be partial absorption through open windows and doors on the side walls, open doors on the East wall and the elliptical punch on the ceiling. The East wall on the mezzanine floor is predominantly reflective.

In calculating the Reverberation Time (RT) for the Main Prayer Hall, it has been assumed that 25% of the side walls and a similar fraction of the East wall below the mezzanine floor have absorption coefficient of I.O when the doors and windows are open. On account of being voids, the absorption coefficient of the elliptical punch and 25% of the stairway openings has also been assumed as I.O. A quarter of the West wall is glass; the rest is marble except two 11' X 5' wooden cabinets.

People absorb half as much as an open window at middle frequencies and at full occupancy this cumulates to be a major means of absorption. With absorption coefficients between. .02 to .05 very little is absorbed by the marble faced walls and the plastered surfaces. Although of negligible proportion, absorption by air has also been considered. (3)



Thus, the amounts of absorption in the space are as follows : (fractions ignored)

			Sabines
a.	North and South walls		
	100' X 23' X 2 walls	: 4600 sft	
	25% of above	: 1150 sft	
	Absorption (open)	: 1150 X 1	: 1150
	75% of above (marble)	: 3450 sft	
	Absorption	: 3450 X .02	: 69
b.	East wall 81' X 23'	: 1863 sft	
	Mezzanine is half	: 932 sft	
	Absorption (plaster)	: 932 X .05	: 47
	Ground floor is half	: 932	
	50% of this wall	: 466 sft	
	Absorption (open)	: 466 sft X 1	: 466
	50% of this wall	: 466 sft	
	Absorption (plaster)	: 466 X .05	: 23
c.	Staircases 15' X 23' x2	: 690 sft	
	33% of staircases	: 230 sft	
	Absorption (open)	: 230 X 1	: 230
	66% of staircases	: 460 sft	
	Absorption (plaster)	: 460 X .05	: 23
d.	West wall 115' X 23'	: 2645 sft	
	25% of above	: 661 sft	
	Absorption (glass)	: 661 X .05	: 33
	75% of above less wood	: 1666 sft	
	Absorption (marble)	: 1666 X .02	: 33
	Wooden surface	: 318 sft	
	Absorption (wood)	: 318 X .1	: 32
e.	Elliptical punch	: 580 sft	
	Absorption (open)	: 580 X 1	: 580
f.	Ceiling 84' X 115'	: 9660 sft	
	Minus punch (580 sft)	: 9080 sft	
	Absorption (plaster)	: 9080 X .05	: 454
	Ceiling below and above mezzanine floor		
	16' X 81' X 2	: 2592 sft	
	Absorption (plaster)	: 2592 X .05	: 130
g.	People		
	Total seating area	: 12252 sft	
	6 sft per person	: 2042 persons	
	Absorption (people)	: 2042 X .4	: 817
h.	Carpet area •	: 12252 sft	
	Assuming 50% remain exposed at full occupancy		
	Absorption (carpet)	: 6126 X .3	: 1838
i.	Terrazzo floor ••	: 12252 sft	
	Assuming 50% remain exposed at full occupancy	: 6126 sft	
	Absorption (terrazzo)	: 6126 X .02	: 123
j.	Air Volume	: 264500 cft (7406 m^3)	
	Absorption (air)	: 7406 X .02	: 148

• Used only during the Winter

•• The floor situation in Summer

The total absorption of the Main Prayer Hall is obtained by summing up the above absorptions, The values for summer and winter will vary (see h. and i. above) Carpet is used only in the winter.

Absorption for summer	:	4358
Absorption for winter	:	6073

Therefore, at full occupancy, the reverberation time, RT is given by

RT= .05 V/A, where A is room volume
and B is total absorption

For summer, RT =.05 (264500/4358)
= 3 .03 seconds

For winter, RT =.05 (264500/6073)
= 2 .18 seconds

Knudsen and Harris recommends just over 1.0 sec for a space volume as large as the Main Prayer Hall of the Baitul Mukarram mosque. (4) The values of RT obtained for both Summer and Winter are grossly over the mark. The RT will further increase at partial occupancies which is usually the case as mentioned earlier. The excessive RT in the Hall is a major acoustical problem of the space being considered.

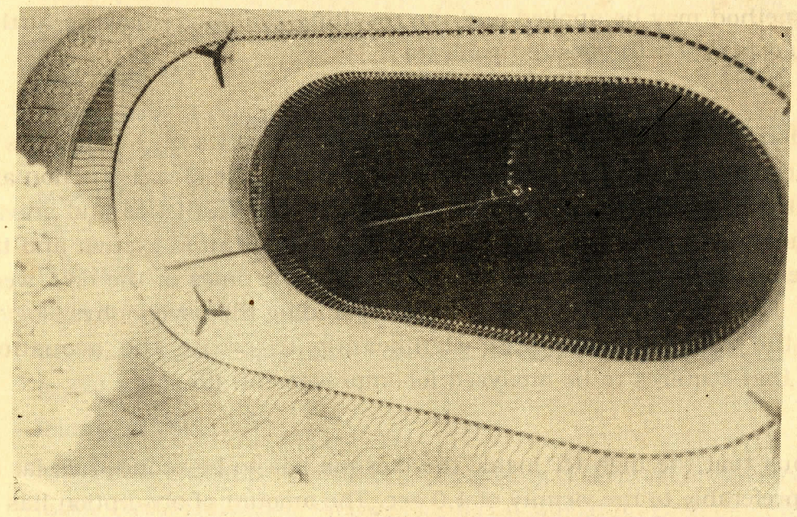
The high RT, echoes travelling more than 110'-0", multiple reflections from the hard surfaces, poorly disposed sound amplicication system, etc all culminate to produce a garble of words, totally unintelligible and barely comprehensible as speech. One can for reasons of familiarity and ritual comprehend *Allahu Akbar, Sura Fateha,* etc. However, *Khutba,* sermons, or any unfamiliar verse from the Holy Quran are not understood at all. This only comfirms Knudsen's view in 1929 that speech intelligibility suffers proportionately with the increase in reverberation time. (5)

Another factor contributing to the problem is that the columns and walls, reflective surfaces as they are, cannot possibly be equidistant from the listener and this obviously gives rise to echoes and delayed echoes, resulting in unintelligible sound. Flutter echoes may also be occuring between opposite parralel reflective surfaces, particularly between the mezzanine floor and the ceiling and also below the mezzanine floor.

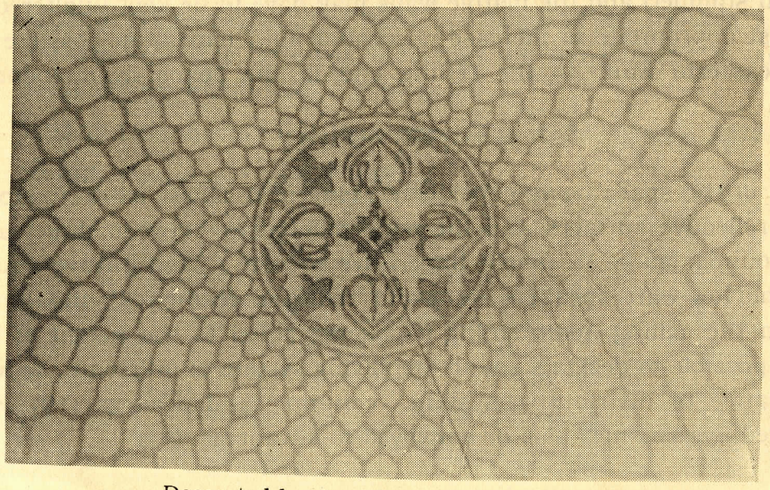
While designing for good acoustics inside a mosque it has to be borne in mind that the Imam Shaheb actually faces two directions in the course of his actions: he faces towards the direction of the Holy "Kaaba" (West in the case of Dhaka) while leading the prayer but he turns 180° to face the audience while reciting the *Khutba* or while addressing the assembly of devotees. It has already been discussed earlier why it is necessary for the Imam Shaheb to use an amplification system inside the Main Prayer Hall at the Baitul Mukarram.

In using a sound reinforcement system, the present distribution of speakers both laterally and vertically is inappropriate and inadequate. The sound cones of the two speakers mounted approximately 15'-0" high do not cover the entire gathering. "Box-type speakers mounted 10'-0" high on the columns are neither properly located, nor spaced. High frequency horns or "tweeters" and Low frequency boxes or "woofers" are being used separately. For best results, speakers should be placed above the audience when the height of the space is about 20'-0" and the distance between the speakers should be equal to the height for maximum coverage. (6) Also, clusters of woofers and tweeters should be used if central distributive system is opted for. The central system, if properly designed, may be marginally successful in the Main Prayer Hall because the height is just above the recommended limit of 20'-0". Under existing situation at the Baitul Mukarram it may be advisable to use a distributive system. (7)

It goes without saying that the existing situation in the Baitul Mukarram mosque is typical of large spaces with high reflectance of the bounding surfaces. Because the building is already constructed and in use, it cannot incorporate significant changes in size and shape. Moreover, the choice of major changes in the interior surface finish is also restricted. Considering



The punch in the ceiling of the Main Hall



Decorated hard surface of the ceiling.

the complexity of acoustics and the uncontrollable variables in this mosque, it is expected that the solution will not be a straight-forward one; rather a trial and test method may be applied and the resulting conditions may be further investigated to reach the desired goal. (8)

The solution of the problems associated with the acoustics of the Hall has to take into consideration the size and shape of the hall, use of construction and finish materials and their methods of application, the aesthetics and gravity of the space as a prayer hall, the use of sound amplification system and the use of the space at different occupancies at different times of the day, week and year. Each of the above factors, notwithstanding the psychophysiological state of the receiver, contribute significantly to create the acoustical condition that requires to be analysed for improvement. (9)

It is obvious that the high RT inside the mosque has to be reduced as far as possible, preferably to the vicinity of 1.0 sec. The amount of absorption has to be increased as adjusting the space volume is not feasible. Considering that the floor (in summer) and the marble walls may have to be kept unaltered, it will be most appropriate to increase absorption to a maximum possible on the rear (eastern) wall, on the ceiling and in the space by suspended absorbents.

The height of the space being considered being near about 23'-0", coupled with high reflective surfaces and the wide differences between direct and reflected sounds, make it almost imperative to use a disrtibutuve sound system. The low-watt speakers (to avoid reflected feed-back) should be installed in the ceiling, maintaining a spacing equal to the height of the room. It is possible to design s sound amplifying system to overcome the long RT. Alternative to distributive system, "column" loudspeakers (10) with Time-Delayed System, may also be employed to advantage. (11)

From the above discussion it will be clear that the solution to the severe acoustical problems of Baitul Mukarram is not a simple proposition. It is a complex task requiring high levels of technical and artistic skills that needs to be undertaken with a spirit of religious zeal.

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CONFLICTS AND COMPROMISES IN WINDOW DESIGN

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ABSTRACT :

The nature of the problem faced during the process of window design is such that it is not possible to specify any absolute values as solutions. The problem is further aggravated when one is faced with climates with seasons having contrary demands. Bangladesh falls in a climatic zone called "Composite or Monsoon" in which we are faced with three distinct seasons--hot-dry, warm-humid and cool-dry. Whereas design solutions for the two dry seasons often coincide, it is very difficult to find compromises when the third, warm-humid season has to be considered. (1). During the course of a research conducted in Sheffield, UK (2), a wide range of variables were studied, relative to building-climate interaction and their effect on window design. The objective of this paper is to bring to light the contradictions faced and compromises arrived at, when attempting to co-ordinate the wide range of varied aspects involved in window design.

CONTROLS FOR ACHIEVING COMFORT :

The 'comfort status' of a space is defined as the expected physical response in terms of thermal sensation of the occupants in a space. The aim of the designer is to produce comfortable interiors, and therfore any change in the comfort status should be towards the 'comfortable'. As situations diverge from the desirable 'comfortable' condition, different controls come into operation.

The first control and probably the most important one from the designer's point of view, is termed 'planning control'. This deals with proper

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window orientation; to catch the breeze in humid climates or the sun in cold climates or to avoid the sun when overheating could result. This control comes into play during the design stage of a building and should make best use of available climatic resources, such as the cooling of breezes, warmth of the sun, and adequate daylighting where and when desired.

The second form of control takes account of the occupier's instinctive response to uncomfortable situations and is termed 'human adjustments'. Thus, the occupant would, in case of 'hot' discomfort, open windows, reduce clothing layers and activity and finally when temperatures outside reach levels higher than that of the skin, would close windows, perhaps try to humidify the surrounding surfaces and induce evaporative cooling and so on. In case of 'cold' discomfort, the occupant would respond in an opposite manner and try to wear more clothing, shut windows, increase activities and so on. Thus, the designer must take into account that when the 'comfortable' condition deviates, people try to do their utmost to bring it back to the desired mean.

Even control by 'human adjustment' has its limits and when the environmental parameters conspire against each other to such an extent that indoor conditions become intolerably 'hot' or 'cold', mechanical controls have to be adopted. The point at which mechanical controls will start to be put to use in a particular situation will depend on the occupants' economical status and the costs and suitability of the various mechanical systems available.

Air-conditioning and heating both belong to this category of control. Table 1 indicates the controls for achieving comfort.

mechanical control	Air conditioning as last resort
HOT human adjustment	Close windows as air temperature rises above skin temperature
	Supplement air movement to countecact still conditions
	Reduce activity level
	Reduce clothing content
	Open windows as wide as possible
planning control	Reduce solar insolation by proper window orientation and shading
	Orientating window for maximum breeze
	COMFORTABLE
planning control	Increased solar insolation by proper window orientation
	Use of heat absorbent surfaces where likely to receive direct solar radiation
COLD human adjustment	Closed windows to reduce air movement
	Increase activity levels
	Increase clothing content
mechanical control	Heating as last resort

Table 1. Controls for achieving comfort

THE FUNCTIONS OF A WINDOW :

Not only should the window contribute to the thermal comfort in a space, but it should also allow daylight to enter, and the occupant to have a pleasant view. The window should exclude rain and dust totally, noise as much as possible, and not work against the privacy requirements of the occupants. The fuctions of a window are shown in Table 2. The relative importance of each of these functions depend partly on climatic demands and also to a certain extent on social and cultural needs.

Daylight is undoubtedly, one of the desirable influences that a window should allow, within limits, to be filtered into an enclosure. Studies show that light has specific influences on the human body, other than that normally associated with vision (3). A window can convey the changing effects of daylight, every hour of the day, and so provides the inmate mental relief. Daylight design therefore, has the responsibility of providing enough light to enable efficient visual performance, while at the same time attaining the psychological and physiological goals.

Ventilation is also one of the prime functions of a window, and its aim is three-fold (4), health ventilation, ventilation for structural cooling nd comfort ventilation, when air movement is needed to induce comfort to the occupants of a space.

Table 2 Functions of a window

Function	To achieve	To avoid
Ventilation	● comfort ● health ● structural cooling	● too much breeze when a, cold b) air temperature is warmer than skin temperature.
Daylighting	● Efficient visual performance ● psychological satisfaction ● physiological needs.	● too much light, as this causes a) glare b) overheating in warm/hot climates.
Solar Penetration	● heat during cold ● Psychological effects ● Physiological needs	● overheating
View	● information content ● aesthetic needs	● undesirable views ● distracting views

A window by its orientation can allow solar penetration in interiors at certain times of the year, a function which becomes particularly important during cold winters. Not only does this raise interior temperatures appreciably, but even when the heat is allowed to escape by ventilating the space, the psychological effects created by solar penetration are considerable. However, overheating at all costs must be avoided.

From the user's point of view, another prime function of the window is the provision of a view. The view should be adequate enough to sustain aesthetic demands and should be balanced with respect to information content. Distracting or undesirable views should be avoided.

The window, being an important architectural element of the three-dimensional expression of a space, must reflect the function, characteristic and aesthetics of that space. Climatic considerations will almost never be the only deciding factor in window design and this is perfectly acceptable, as there are no calculations that can dictate the right size, shape or orientation of a window in any space. Moreover, the demands are so conflicting that compromises are inevitable, but these can be logically derived from the analysis of different variables.

CONFLICTING SOLUTIONS TO THE FUNCTIONS

The various functions of the window are served in differing ways in response to the different climatic regions. The investigations revealed that even in a particular climatic region, the different functions demand conflicting solutions in window design. A brief discussion is required of the conflicts in the different seasons: cool dry, warm humid (when air temperature remains below skin temperature). and hot dry (when air temperature starts to rise above skin temperature). Here each of the functions of a window and their solutions as to size and orientation are examined against the other functions in turn, for the three seasonal conditions and found to either contradict each other or be compatible (as the need dictates). Table 3 sums up this comparison at the end of this section.

Ventilation and daylighting

When cold, the exterior light is insufficient and daylighting solutions would point to large windows. Ventilation requirements however, would dictate the

need for small, sealed windows with only minimum ventilation provision for health. Thus, the two requirements conflict.

In warm climates, with air temperatures usually below skin temperatures, ventilation requirements dictate the need for very large open windows with maximum provision for breeze penetration. Daylight requirements on the other hand, may in most cases indicate the need for smaller windows, as light is abundant and too much light entering would contribute to heat build-up in the interior resulting in unwelcome raised internal temperatures. When hot, air temperatures rise above that of skin and most often outdoor light is in abundant supply and both daylighting and ventilation requirements indicate the need for windows as small as possible.

Ventilation and Solar Penetration Requirements :

When cold, the criterion for solar penetration would suggest properly orientated windows, large enough to allow adequate solar insolation. Ventilation needs indicate small windows and conflict with those for solar radiation.

In warm climates, ventilation demands large windows properly orientated to catch the prevailing breeze; solar radiation requirements indicate small and properly shaded windows facing away from the sun. When the directions coincide, the requirements conflict.

When hot, both these functions are best served with small windows and thus, the solutions to these requirements are compatible.

Ventilation and View :

View requirements in all climates indicate the need for large windows, provided the view outside the window is worth looking at or is pleasant. Thus, in cold and hot climates, where ventilation requires small windows, the functions provide contradictory solutions. In warm climates, where ventilation requirements demand large openings, the two functions are complementary.

Ventilation and the need for privacy, Noise, Rain and Dust Exclusion.

In all climates the need for privacy and that for the exclusion of pollution and the elements would indicate preferences for small windows. Where ventilation requirements also indicate small windows as solutions, as in cold and hot climates, these requirements are compatible. In warm climates, as the ventilation criterion dictates the provision of large windows, these requirements conflict.

Daylighting and Solar penetration :

In cold climates, daylighting and solar penetration requirements both demand large windows and hence do not conflict with each other.

In warm and hot climates again, the needs are compatible, as both criteria indicate the use of small windows, because of the abundance of daylight and its accompanying heat load.

Daylighting and View :

The view criterion is independent of seasonal variations and it is usually desirable to have large windows when exterior view is pleasant. Daylighting design indicates the use of large windows in cold conditions, as the lighting level may be considerably low. This makes the two requirements compatible.

In warm and hot seasons though, the requirements conflict, as daylighting demands small windows to avoid excessive glare and overheating.

Daylighting and Privacy :

In cold climates, where large windows are necessary to provide adequate internal lighting, these needs conflict with that for privacy, which advocate smaller windows.

In warm and hot climates where daylight is in abundant supply, the needs do not conflict, as both are benefitted by small windows.

Solar Penetration and View :

These requirements are compatible in cold climates, as both demand large windows, as long as external view is pleasant.

In warm and hot climates, solar penetration requirments indicate the need for small windows, properly orientated with respect to the sun. View, being independent of seasonal variations, would demand large windows for pleasing views, thus making the requirements conflict, specially when the direction of view and solar position in 'overheated' periods coincide.

Solar Penetration and Privacy;

Privacy requirements, irrespective of seasonal variations and climatic characteristics, demand small windows. In cold climates, large windows are required for adequate solar penetration, thus making the two requirements conflict.

In warm and hot seasons, where much smaller windows would serve the solar penetration requirements, these donot conflict.

Solar peneration criterion, almost always in cold climates, conflicts with the need to preserve the internal environment and a balance has to be struck between the heat gained by solar insolation and that lost through glazing.

View and Ventilation;

View requirements, being independent of weather conditions, demand large windows as long as external view is pleasing to the occupant. Ventilation requirements in cold and hot conditions demand small, sealed windows, and this conflicts with view requirements.
In warm climates the solutions to these needs are compatible, both indicating the use of large windows.

View and Privacy :

These two requirements conflict in all climatic types, as they are independent of seasons and thermal comfort conditions. Privacy requirements demand small windows and view requirements large ones.

View requirements also conflict with the need to preserve the internal environment in cold and hot climates, where small windows are best suited to serve this purpose. In warm climates where internal and external environments are very close because of large, open windows, there is no 'internal' environment as such, needing to be preserved.

Teble-3 Conflicts in Design Decision

Function	conflicts with	in season.
Ventilation	Daylighting	cold/warm
	Solar Penetration	warm
	View	cold/hot
	Privacy	warm
	Rain, Dust, Noise exclusion	warm
Daylighting	Ventilation	cold/warm
	Solar Penetration	-
	View	warm/hot
	Privacy	cold
	Preservation of internal environment	cold
Solar Penetration	Ventilation	warm
	Daylighting	-
	View	warm/hot
	Privacy	cold
	Preservation of internal environment	cold
View	Ventilation	cold/hot
	Daylighting	warm/hot
	Solar Penetration	warm/hot
	Privacy	all
	Preservation of internal environment	cold/hot

Results of the investigation;

To adequately serve all the functions of a window the designer is faced with effecting a series of compromises and the setting up of priorities. The results of the investigation carried out in this research are summarized here to aid in design decisions involving these compromises. With the lack of detailed climatic data, assumptions and prediction techniques had to be relied on to provide some basic data, especially with regard to solar intensity levels and prevailing wind speeds and directions.

The model of a test house built for experimentation in an available boundary layer wind tunnel (6) revealed the following results; (for Bangladesh)

a) Air movement induced by natural means was not enough to ensure comfort for most afternoons of the year.

b) Air change rate in the same rooms was found to be extremely high. This may be advantageous when considering odour removal, but will be associated with penetration of outdoor pollutants, dust and grease.

Three kinds of inlet-outlet combinations were examined for indoor airmovement. These were;

1) Single-sided ventilation

2) Windows on adjacent walls

3) Windows on opposite walls.

It was found that single-sided ventilation is definitely the worst situation possible for windows in Bangladesh. For the second group, in rooms having one window on the south, the performance was markedly better than when the south was blocked. For the third group, it was found that rooms with windows facing north and south had better air movement than those with east and west openings.

Tested for daylighting (7), using the BRE protractor and nomograms, it was found that the minimum lighting levels in the rooms of the test house were above the minimum recommended daylight factors for residences. This indicates that overheating may result. Keeping the same opening area, the daylight factor can be reduced by shading the higher altitudes of the visible sky vault and by lowering the window, measures which may also serve the room better in terms of air movement and solar radiation exclusion.

Shading design (8) revealed the proportions and dimensions of shading devices for different window orientations in Bangladesh. The best orientation

from the shading point of view was found to be North. Western windows were found to look directly into the sun during 'overheated' periods and hence not possible to shade without blocking the opening. South-western windows were also found to be difficult to shade adequately and adjacent spaces should be planned to provide some measure of shading to these windows. It was also found that for south and south leaning orientations, a balcony should be placed outside the window to provide shading.

SEASONAL RESPONSES TO WINDOW DESIGN

The climate in Bangladesh, classed as' sub-tropical' monsoon or 'composite' makes it diffiicult for the designer to properly design openings, as many conficting solutions arise and compromises have to be effected. A seasonal calendar (Table 4) shows the response and conflicts faced by the designer in the attempt to solve problems arising from satisfying various criteria for window design in Bangladesh.

Table 4 Seasonal Calendar for Window Design

Month	Thermal condition	Requirements
December	cool-dry	Air movement: small windows
January		Solar Insolation encouraged largewindows
February		Daylighting; large windows
		as light from blue skies
mid-March	hot - dry	Air movement: small windows
April		Solar insolation discouragd
May		small windows
		Daylghting: very bright exterior
		lighting levels, small windows
June	warm - humid	Air movement: large windows
July		Solar insolation discouraged
August		small windows
September		Daylighting: very bright exterior
October		lighting levels, small wlndows
November		

Privacy demands throughout the year..... small windows
View demands throughout the year ..... large windows.

A 'SEASONAL WINDOW'

A window, were it to face one season only, could cope with the problems associated with that particular season only. Such a hypothetical window could be termed a 'seasonal window'.

An examination of the cold - dry season in Bangladesh shows that the requirements for ventilation and privacy conflict with those for daylighting, solar penetration and view (Table 4). Obviously for proper window design, a compromise would have to be sought; and the designer, realising that large openings could be closed to serve the reduced ventilation criterion and that privacy could be attained by proper planning of spaces, would probably opt for larger windows for this season alone.

In the hot - dry season, lasting approximately for two to two - and - a - half months, window design would have to cope with a completely different thermal situation.The designer, however, in this season, is not faced with as many conflicts as in the other seasons and here all the climatic factors point to small windows. When faced with the conflicting view demands of large windows, the designer almost always will sacrifice this lone requirement in favour of the combined solution of small windows to all the other requirements.

In the rainy season, which is warm and humid, again the designer would be faced with a series of compromises in attempting to meet the various needs served by a window. Ventilation and view requeirements on the one hand would be in favour of large openings; solar penetration, daylighting and privacy needs on the other hand would point to small windows. Fortunately, solar penetration and too much daylighting with its accompanying glare can be avoided by proper orientation and shading. Thus, were a window desigmed for this season only, despite conflicting demands, large windows would be the chosen solution.

The 'seasonal window' described above, cannot cope with all seasons, and a window will undoubtedly have to face all the seasons. A compromise between the large window for the winter and the rainy seasons, and the small window for the hot - dry summer will have to be effected. There is no single simple solution to the problem as each window, being an integral part of a building, will, like the building itself, have to function for the prevalent situation.

It may well be that the present study has led to a solution resembling the vernacular approach to window design, which takes into account traditional building skills and their relationship to the culture and climate of a region. However, vernacular designing is largely carried out without conscious thought, the design evolving from traditions and established practices.

Designers unfamiliar with these traditions are faced with a lack of published material enabling a systematic design to proceed. This work assembles the multiplicity of variables, examines their importance and significance and considers the implications of coordination in a way which will be of assistance to such designers.

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ARCHITECHURAL CONSERVATION :
A responsive approach to development

SHAHEDA RAHMAN IMAM *

ABSTRACT :

The significance of preserving architectural heritage for the benifit of posterity has led to an apparent and increasing restoration and architectural conservation activities all over the world. Bangladesh while heir to a rich architectural heritage, reminiscence of the great civilizations that flourished in this region for the past 2000 years and the magnificence of the building art of the indigenous craftsmen under the mighty rulers of the Hindus, the Muslims and the British Raj, is yet to define its stand and policy on the issues of conservation, It is unfortunate much of the country's building heritage is lost and the remaine face the same. Increment weather, serious resource constraints, absence of necessary policy and legislative apparatus, vandalism etc has been slowly crumbling the countrys culturally and historically important buildings over the years.

In the wake of energetic endeavours to discover, to define one's; past to construe one's future that characterises the present time this paper attempts to understand the nature, the scope and viability of architectural conservation in Bangladesh a country with extreme resource constraints striving to save the past and build for the future while struggling to meet to-day's need for basic shelter, food, health and education.

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INTRODUCTION :

Buildings are representation of high points of human achievements and some buildings and environment cannot be destroyed without incalculable loss to all men both present and future, anymore than great paintings, or any great works of art can be effaced (1). Hence the bid to establish architectural continuum, which today is both a national and a global quest. The search for identity and permanence is said to be induced by the rapidity of change in present time that increases the psychological need for permanence. (2) It is also a reaction to the failure to respect the experience of human living in our present day environment which is not infrequently insensitive to a community's and thereby a country's historical, social, cultural and evnironmental need. In the developing world, particularly in the muslim countries, the desire for architectural continuum is partially an attempt to impress or reexert their national and cultural identity and or supirioity. The concern for architectural conservation is also rooted in the contemporary trend that seriously threatens and are destroying historical sites and edifices in the name of progress, modernization and exploitation of rising land value particularly in the urban centres. The present economic crisis has also made it clear that we cannot afford to destroy old buildings that still have plenty of life in them.

HISTORICAL PERSPECTIVE.

The concept of architectural conservation first crystallized during the early Romans who recognized the need to preserve Greek ruins as a cultural necessity. Fibonacci (of the Fibonacci series fame) established rules for conservation in Italy as early as 8C AD, The practice, however, was not effectively institutionalized by law in European countries until the middle of the 19c (3) which was linked with the transformation that followed the Industrial Revolution that resulted not only in the destruction of existing landscape and historical monuments on an unprecedented scale but with the discovery of steel framework changed the whole concept of design and material. The post-world war developments, focussing on economic standard solutions added a new dimension to this concept. The preservation of material cultural heritage or patrimony became a part of political ideology in the struggle to recapture the cultural identity lost as a result of industrialization and ravages of war.

In recent times the issue of architectural conservation has become truly an international concern impelled by the realization that natural and cultural resources, of which architecture represents an irreplaceable resource, are limited and are dwindling at an alarming rate. Today conservation is regarded as both a moral obligation and a matter of necessity. As a response the World Heritage Council has been formed and UNESCO has declared 1988-97 as the "World Decade for Cultural Development"

In the Indian subcontinent though conservation ethics is not entirely new the record of its parctice is not so well documented as to allow a clear reading of its evolutionary process. There has been always isolated examples born out of individual penchant and vision since ancient times. For example, in the begining of the christian era, Rudradaman had ordered the renovation of the historical dam that was falling to ruins and during the Sultanate period Feroze Shah Tughlaq had set highest priority to repair of ancient monuments, However by and large it is reasonable to infer that until the begining of the colonial rule in the mid-nineteenth century preservation of monuments was used as a means of legitimizing the existing ruling dynasty (4). The practice of conservation per se was introduced with the consolidation of the Archeological Survey of India (ASI) by lord Curzon in 1902 with John Marshall as the director general. The conservation policy thus formulated was made statutory with the enactment of the Ancient Monument Preservation Act 1904 by John Marshall. The policies were given a mature form in a resolution in 1915 and the principles further eloborated and published in a book entitled 'Conservation Manual". Marshall clearly stated in his book that the aim of conservation is not to reproduce what has been defaced or destroyed but to save what is left from further injury or decay and to preserve it as a national heirloom (5). Today, however, architectural conservation as an issue of wider public and professional concern is still nascent in the subcontinent particularly in Bangladesh. In India it is just begining to be addressed as a real issue in the economic and social development and of urban and regional planning. At this point perhaps it could be of interest to glean the ideological transformation that has taken place in the conservation movement in the West as both values and practices here have been derived largely from western attitudes and expirience (6).

ESSENCE AND ATTITUDES

The rationale and approaches to architectural conservation has undergone a great deal of ideological transformation both in technique and attitude since its inception. William Morris, the father of the conservation movement in England, considered any thing " which can be looked on as artistic, picturesque, historical, antique or substantial, any work in short, over which educated artistic people would think worthwhile to argue at all " worthy of protection and restoration. John Ruskin, another guru, held a diametrically opposite view to restoration. In his opinion a building or painting after restoration loses authenticity and it becomes a copy or counterfiet (7).

"It is ..... no question of expediency or feeling whether we shall preserve the building of past time or not. We have no right what ever to touch them. They are not ours they belong partly to those who built them and partly to all the generations of mankind who are to follow us". "The seven lamps of Architecture", 1849 (8). Between the rationale for restoration and the extreme notion of non-interference or non-intervention also known as 'scrape' and anti-scrape' other attitudes ememrged in Europe. The English attitude, however, always expressed a pre-occupation for authenticity. The 'Historic Monuments Protection Act" of 1882 institutionalizing conservation in England shows bias to Ruskin's philosophy that "when care will preserve it no longer, let it perish inch by inch rather than retouch it". This bias was consequently introduced by Lord Curzon in 1902 and absorbed as the philosophy of ASI. (9).

France on the other hand practised a more liberal policy in architectural conservation. It was argued that what could be skillfully substituted would in turn weather and become picturesque to later generations. An alternative preferable to the total obiliteration of the form and design of the original (10). Viollet-le-Duc, George Gilbert Scott and a good majority of other 19 century restorers who advocated 'stylistic restoration 'instead of 'scientific restoration' always strove to express the original intention of the builder of a historic monument in their work in terms of use form, material and construction techniques. Viollet-le-Duc for one always considered surviving details sufficient indication of the intent of the original builder to guide contemporary restoration.

The attitude of modern restorers towards conservation range over an entire spectrum. The ' archeological' attitude emphasizes scientific conservation in which everything new is set off as distinctly as possible from everything original. It is exemplified especially in the work of archeological restorers in Italy. The 'romantic sentimental' attitude frequently shows ignorance of traditional techniques and of the buildings original appearance. The 'practical architectural' approach stresses the practical knowledge of a modern architect, engineer or building technician and frequently suffers from the same kind of ignorance as the `romantic' approach. The 'poetic' attitude values the patina of age, a quality difficult to preserve in many materials, especially if a building needs conservation to prevent serious deterioration or collapse. The ``cautious' undogmatic approach emphasizes humility to work of men of other ages, responsibility to the past and future and not just the present. To put more simply it takes the possible view-points into consideration and attempts to adopt the most logical of it all. (11)

Before deliberating further it is important to understand the contemporary philosophy of architectural conservation. Once preservation, restoration and architectural consevation, were synonymous its bias succintly contained in the advice that " it is better to consolidate than to rebuild, better to rebuild than to embellish; in no case must anything be added, and above all nothing should be removed " The nature and intent of architectural conservation today shows a distinct departure from this philosophy. As practised to-day in restoration and preservation work the buildings are restored to their former glory and function, while adaptive re-use and historical preservation fall within the wider connotation of architectural conservation. The contemporary issue of architectural conservation is not the preservation of historical evidence per se but the intrinsic value of areas, environment, and edifices as representation of highpoints in human achievments with more concern for living buildings and living communities (12). It could be said to be the act or process of keeping something in being, of keeping something alive, a single building to a whole city quater. In the effort to infuse new life it does not exclude demolition or new construction. Architectural conservation augments adaptive re-use i.e. finding new and contemporary use for old historical buildings retaining or preserving as much

as of its original character as possible. (13). It thus allows for slow change linking the past with present as distinct from restoration or preservation which merely preserves or restores a building as close to its original state as far as possible maintaining the same use or which in most cases turns the building at best into a museum. Over the years there has been also a variation in scale and dimension shifting concern from preservation of individual buildings to whole areas in cities, and from buildings to lesser elements of environment like the street furniture, and the surrounding landscape and environment in which the buildings exist.

THE BANGLADESH CONTEXT:

If viewed from the wider context of architectural conservation that is adaptive re-use and historial preservation most of the conservation work in Bangladesh have been in fact historical restoratiori. Whatever ltlle work at that has been done has been on the in'tiative of the Government. These has been either the undertakings of the Ministy of Culture, or the Department of Architecture under Ministry of Works. There have been isloated examples of conservation of ancient buildings by private firms e.g the conservation of ' Bardhawan House' 19 C for Bangla Acadamy by Shahidullah Associates, and conservation of " "Ishaan school" 1910 in Faridpur. by Sthapati Sangsad for Medical Assistant Hostel etc. These do not in any way establish that conservation is a wider professional concern in the private sector.

In Bangladesh the responsibility of protection and preservation of listed monuments, excavation, survey, control of traffic in movable antiquities, regulating foreign excavation missions and establishing museums are entrusted by law to the Department of Archeology and Museums of the Government. The Department has to protect and preserve 229 protected monuments and old sites with a budget allocation of one million taka per annum. It has on its staff a regular engineering branch with engineers trained from the ICCROM Centre at Rome. (14). The monuments on the protection list of the Archeology Department are varied and many. However 90% of the protected monuments are of religious character-mosques, tombs, temples etc, most of which are live monuments daily in use. The Historic City of

Bagerhat and the ruins of Buddhist Vihara at Paharpur protected by the Department have been entered by Bangladesh to be listed on the World Heritage List. Constrained by extreme resource scarcity the Department of Archeology is making valiant effort, to protect the historically important edifices of Bangladesh. Some of the important monuments restored by the Archeology Department are Lalbagh Fort of Dhaka (1679) Kutia temples, Rajshahi (18C-19C); Bagha Mosque, Rajshahi (1523AD); Rajbibi Mosque, Gaur (15C); Goaldi Masjid, Sonargao (16C); Gorar Masjid, Baro Bazar, Jessore (16C), Shahjadpur Kacharibari Shirajganj (19C); Mainamati Buddha Vihar, Comilla; Idgah Mosque, Sat-Masjid Road, Dhaka (17C); Dhakcshwari Temple, Dhaka etc.

The architectural conservation activities of the Department of Architecture, Ministry of Works Bangladesh is more a denouement of individual initiative rather than effectuation of a policy frame-work. It reflects the enligtencd view of an administhrator rather than a general policy. The activities of the department although very recent, begining only in the 80's are appreciable. It encompasses a wide variety of building types both religious and secular dating from the early Mughal to the British period. Some of the works are pure historic preservation while others are historic restoration and a degree of modification of the orignal structure to accommodate the need for expansion of the building's contemporary use as examplified by the Collectorate Building in Jessore. The Jessore Collectorate Building marked the debut of the Department of Architecture's (Ministry of Works) architectural conservation pursuits in 1980. Since then a number of projects have been under taken by the Department of Architecture as follws (15).

1) The Jessore Collectorate Building (1880-1920) Jessore,

2) The Chummery House (1911). Dhaka

3) The Old High Court Building, (1905) Dhaka

4) The Mahanager Pathager, Dhaka (although built in 1952 it represents the vernacular Colonial style of the 1905-12 period)

5) Tara Masjid in Armanitola (early 18c) Dhaka.

6) Ahsan Manjil, (1872) the palace of the Nawab of Dhaka on the north bank of River Buriganga in old Dhaka.

In general as can be adduced from the previous discussion architectural conservation activities in Bangladesh have been focused upon monuments and group of monuments which have historical and cultural significance. For most part these are institution (religious and social) rarely the more utilitarian and less public and commercial structures. Today there are many recognised areas which warrant conservation efforts but are yet to be explored in Bangladesh. The traditional city quaters in the older parts of Dhaka, for example, representative of a distinct regional and cultural syntax are yet to recieve the desired necessary attention and focus in conservation activities of the country. The older city quaters abandoned for the progress of the new city are often in a sad state of neglect. These areas have become the locus of inexpensive housing and with the resulting doubling and tripling of original population densities the physical fabric of these environments is continually deteriorating and some are on brink of total destruction. In other words area conservation is a dimension in architectural conservation that is yet to be explored in Bangladesh.

Architectural Conservation problems in Bangladesh are multi-dimensional. The very object of conservation i.e. the buildings and edifices to be conserved present a unique problem on account of the fragile nature of the building materials used. The pre-mughal buildings were generally made of indigenous perishable materials like mud, bamboo, reed and wood which on exposure to extreme heat, high humidity and torrential monsoon rainfall experienced in these parts easily perished and are nonexistent today. The more permanent structure of the later periods were invariably burnt brick constructions laid in mud-mortar. Brick, which has remained the chief building material in Bangladesh even today, is suceptible to sulphate attack, dampness and rank vegetable growth in the subtropical humid climate of the region. The flat topography with high water-table compounded by water logging from seasonal innundation causes general dampness and severe dampness to the brick foundations. The rising damp and the resultant heavy sulphate attack, pernicious lichens, moss and banayan growth disfigures and disintegrates the masonry work of unattended ancient buildings with surprisng speed. Other dimensions of problem in architectural conservation in Bangladesh are legistation, public awareness and financial inducement, above all the absence

of healthy professionalism i.e conservation not being a wider professional concern.

Presently legislations relating to building and use controls in Bangladesh exist in the form of East Bengal Building Construction Act (EBBC) 1952, the Pourashava Act 1977, the Building Construction Regulation 1984, and Town Improvement Act (TIA) 1953 for different cities and towns as for Dhaka, Chittagong, Khulna and Rajshahi ect. These legislations have no reference what so ever to the problem of architectural conservation. There are also a number of legal provisions and codes for archeological preservation like the Antiquities Act of 1964, the Manuals of Conservation of 1922 etc. (16). These acts are more or less in the pattern of what is followed in India, Pakistan and Srilanka introduced by the British about a hundred years ago.

None of the legislations mentioned effectively deal or serve the present need and cause of conservation. For example, the most recent legislation enacted is the Antiquities Ordinance 1976 (17) which is merely an amendment of the Antiquities Act, 1964 of the then Pakistan period. The ordinance was primarily introduced with the objective to make,

(I) Terminological changes deemed necessary with the change in the political status of the country i.e. the emergence of the sovereign state of Bangladesh in 1971.

(II) Correction of typing/printing errors in the 1964 Act.

(III) Minor omissions, inclusion, or eloboration of the clauses in the 1964 Act.

The Antiquities Act 1964 is an act to consolidate and amend the law relating to the. preservation and protection of Antiquities. Antiquities as defined by the law means "(i) any product of human activity_____ reflective of any aspect of civilization; (ii) any ancient object or site of historic, ethnographic, anthropological, military or scientific interest; (iii) any other ancient object _____ declared_____ by notification _____ to be an antiquity, where ancient means, "belonging or relating to any period prior to May 1857" The period was later redefined in the 1976 ordinance as ~The Preceeding hundred years.

"The 1964 Act merely empowers the Archeology Department, Ministry of Culture to declare any building or site as an ancient monument to be preserved by law if more then hundred years old, and the right to acquire the property under the Land Acquisition Act of 1894 (I of 1894) as for a public purpose. (18). The 1964 Act to be precise merely defines what is to be protected, who has to protect but the hows are not well stipulated so far as buildings and monuments are concerned, nor is there any reference to the issues of architectural conservation. For instance, there is no clause or sub-clause in the Act to control the land-use and physical development in the area around historical sites and buildings which is a matter of necessity for their conservation. The ineffective existing legislation is primarily a consequent of inadequate knowledge and experties in the concerned bodies compounded by the absence of an appropiate adminstrative apparatus. (19).

Never the less legislation alone cannot preserve or conserve a heritage. It needs the support of an enlightened public and financial assistance for restoration work. (20). Vandalism has been a serious threat to preservation of historic mounuments. Rising building costs has led to dismantling of many ancient edifices to provide building material, particularly brick, for new construction. In the rural scene the constant pressure for arable land has claimed and destroyed many historical sites. The misguided zeal of ignorant public has been a considerable threat in the recent past (21). In attempts to restore and renovate ugly old buildings they have been given a face - lift with the so called modern look and thus permanently destroyed of their historical value.

Resource constraints of Bangladesh need no elaboration. The funds available for archiectural conservation is grossly inadequate. The Department of Archeology is allocated one million taka (US $ 30,000 approx) annually to protect 229 monuments all over the country which in Expert's opinion is extremely low. The Department of Architecture under Ministry of Works, the other oganization concerned with architectural conservation, has no budget allocation for conservation work. Funds are made available on project basis by different sponsoring agencies who in most part are also the prospective client and user of the building to be conserved. This indeed poses an insurmountable obstacle as no clear and effective policy can be formulated. In

expert's opinion at present more funds for architectural conservation are not likely to be available nor can be justified given the enormous, competing demands of broader context of national economic and social development needs for basic shelter, food, health and education that are now faced in Bangladesh. (22).

Recognising that the responsibility of preserving and conserving our heritage cannot be borne by the Public Authority alone a workshop on 'Architectural Conservation' the first of its kind in the country was held in Dhaka recently to deliberate and to acquaint the professional and non-professional communities to the scope of architectural conservation in Bangladesh.The workshop undoubtedly was instrumental in defining to an extent the theoritical, technical and practical aspect of architectural conservation in Bangladesh.

CONCLUSION

A coherent policy of architectural conservation is a sine qua non if substance is to be given to our built environment, of present and of future, and to the intangible ethos of our cultural identity. The questions to be adressed are how in Bangladesh the concern for architectural conservation can be developed and what should be the matrix of decision making and what line of action could be pursued.

Contextual research is perhaps the first necessary precondition to build any effective programme of conservation in Bangladesh. Since to preserve everything of value however desirable is not possible one would have to be selective. The selection process necessarily pre-supposes the definition ;of what is important and also classification of buildings and areas deserving coservation efforts.The objective is to ensure that what is most valuable historically and is culturally significant and truly representative may recieve the priority they deserve. To accomplish this task professionals need to be trained to be sufficiently knowledgeable and skillful to make the critical judgement and act on the critical issues.

Conservaation involves legistation, public education and money. Without all three a successful programime cannot exist. Legislation alone cannot preserve or conserve a heritage, nor can ample funds without the publics belief in the need to preserve and conserve. Similarly an enlightened public unsupported by effective legislation will fail and without adequate funds no work is possible. Therefore all three elements must have a pragmatic basis to make any conservation policy a reality in Bangladesh.

In this country arousing public awareness and interest is necessary not only to prevent present vandalism and misguided efforts but because it is necessary to initiate and mobilize private finance to the cause of conservation. It is recongnised that the shoe-string public budget can only protect a very limited number of historic monuments effectively. It may be mentioned further that significant public sector budget are not likly to be available or even to be expected in Bangladesh for conservation works. Other sources of finance must be sought. Foundations, major private sector enterprises etc need to be explored as possible sponsors of specific projects, It is also not considered to be ideal to have the goverment in the role of the sole custodian of a nations heritage, a task for the community at large, (23). Therefore a 'heritage council' is needed through which the community can participate in decision making.

There is also a great need to develop an awareness among all development institutions on the issues of conservation for often irrepairable damages are made in the name of progress. To achieve this it is needed to ensure that the scope of work for the major development projects, both sectoral and spatial, include a specific task to assess the architectural conservation need of the particular area.

Ironic as it may be the very fact that Bangladesh is yet to address the problem of conservation could be a blessing in disguise. What has emerged in this vacuum is the option to reasses our development ideology and to deliberate and define the role of architectural conservation in our development and planning, whether it should be a marginal technical activity

central to our material reality and key to the definition of identity. It further offers Bangladesh the oppurtunity to profitably glean experience from others in comparable situation and seek appropiate solutions in the local context.

In the deranged order of happenings in the country there is an inherent danger of trying to telescope overnight the process that took generations else-where to evolve and inviting the obvious pitfalls. However in the face of the alternative of losing our historic built environment and associated cultural heritage by default makes it a lesser evil. Whatever ;be the action matrix it calls for the initiative and committment of architects and other professionals in the field to formulate it and make it a practical reality.

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SCHOOL DESIGN AND ECONOMY

FARUQUSE A.U. KHAN *

1. ABSTRACT:

Economy in school building design and construction is a subject of great practical importance, particularly in the developing country like Bangladesh, as most of the school committees face the problem of construction of their school projects, due to the shortage of fund. The school designers, all over the world are searching for economic design and construction system of school buildings. The economy in school design can be achieved in many ways. The author did some survey and studied in 1989 in the department of architecture, B.U.E.T. on construction materials and their relative cost. Impact of the system of construction and management techniques on the overall cost of the building was also observed. It was found that choice of a particular system of construction and better management in both layout ad details of construction might significantly influence the cost.

This paper represents an attempt to elaborate on the subjective term 'economy' and the objective term 'cost' on school building design and construction. The author also attempts to focus on the need, ways and means of achieving eonomy in school.

2. INTRODUCTION:

Any satisfactory school design must have three primary attributes. It must (1) be simple, flexible an functional, (2) be cost effective and economical, and (3) have an adequate service life. The spaces, both indoors and outdoors should create an environment conginical for the propagation of knowledge and proper development of human minds keeping in view the affordability of the community for which the educational facility is being designed.

The communities in Bangladesh have strict financial limtations; it is more true in rural communities. It is extremely difficult for rural communities to provide the surplus resources necessary to finance the

essential facilities like education, recreation etc. Out of 9, 132 secondary schools only 172 are totally financed by the government [(i)], the rest are only partially helped by the government. Bulk of the resources have to be generated by the community it self. Moreover education is not considered a direcly productive sector. Though the running cost of the educational facilities can somehow be maintained by the help of the government and active participation of the members of the community, the capital cost or the initial cost of construction is difficult to come by. A minimum capital cost is almost a precondition for educational facilities to take off. It is vitally important that architects, make use of all the tools in their hands to keep the capital cost at bare minimum. A through knowledge of the available methods of construction their relative cost can serve as a good starting point for the designers.

The choice of certain economic design principles help to formulate the eriteria for economic school design. Economic school design principles depend very much upon the type of educational planning, occupational time, flexibility and space standards of the schools.

3 DESIGN PRINCIPLES FOR ECONOMY:

An economic educational system can considerably be achieved by followong proper principles of planning and space standards developed by different national and international organisations associated with educational fcilities design. Here the tern 'economy' is not only used as 'low unit cost' but is considered as a planning factor that refers to the management of the means and resources of a particular community spent for educational, religious and recreational purposes.

3:1 COMPREHENSIVE EDUCATIONAL PLANNING:

In most of the rural communities, besides the regular schooling various other educational, recreational and religious institutions like local libraries, madrashas, clubs, women sewing centres, mosques and play fields etc. are homogeneously distributed within the catchment area of a secondary school. Within a perimeter of three miles from a secondary school, two local libries, and four play fields are found [(2)]. The local people bear the expenses of these institutions seperately. A compehensive education planing and unification of these institution in a place preferabley within the secondary school could save considerable expenses for the society. Space sharing can be very effectively done within the school campus.

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* *(1) SFYP, Draft copy, Government of Bangladesh*

* (2) *p-369, Dr Mazharul Haque, Opcit*

3:2 OCCUPATIONAL TIME:

The occupancy rate of the secondary school campuses are very low. With one shift of classes only, in most cases the secodary school buildings are underused and the occupancy rate is only twentyfive percent or six hours in a day. By using multiple shifts and adding more community programmes,there is a scope for increasing the occupancy rate by about seventy five percent or eighteen hours in a day, thus minimise the wastage incurred by duplication of structures.

3:3 FLEXIBILITY:

The change in curriculum and technique of education, demands the change of the internald and external spaces of the school buidings. This chanse of space or expansion of school structure may be difficult and expensive if it is not considered at the time of designing. A flexible type of structure is suitable for growth, change and improvement and is economic in course of time.

3:4 SPACE STANDARD:

Many dimensions of the indices can be identified for saving the cost of the school project. Space standerd is one of the indices to minimise the school project cost. The amount of space required for(a) a pupil or an user (b) a group of pupils or for a school community, (c) number of pupils per class, (d) quality of materials and finishing provided in school. are some form of units of meaurement of space standerds. A more rational allocation of available money and building resources is possible by following the minimum space standards [(3)]. Minimum space standards should be followed in our under developed communities where resource is scared. This minimum space standard could be followed as the means of control over the irrationally used school land and materials, as well as this is the only means for achieving community's minimum eductional needs and aspirations.

4 ELEMENTS OF ECONOMY:

The shortage of money required for the construetion of the school buildings in our communities requeres the search for inexpensive construction of school buildings. In order to make the school structure inexpensive for both long term economy as well as immediate capital

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* *(3) P-121 ARISBR, School building Design. and*

P-21, EB reprt-5, Xantharid virochsiri, Design Guide for secondary school in Asia, 1977.

outlay, the school designers should know the elements of school economy. In the context of school design, the cost for running the facilities may be devided into two types fo elements 'initial cost' and 'maintenance cost.'

4:1 INITIAL COST :

The initial cost may become an important element of total school cost in a number of ways. The land cost, building cost, service cost and furniture cist etc. comprises the initial cost of the school project.

The initial cost of a school project varies from cimmunity to community and also with a given time. In most of the communities the school site is donated by the effluent donars of the community. If the location of donar's land is not suitable for the school site this may be exchanged by mutual agreement with any other suitable site.

The choice of suitable material, simple structural system and the efficient construction managemnt play a considerable part in balancing the construction budget. The installation of manually operated services involving less technology, can save the initial cost.

4:2 MAINTENANCE COST:

While considering the initial cost of a school building the additional cost on account of its maintenace must be considered. Some times due to improper choice of materials the total maintenance cost during the life time of the building might prove uneconomic in he long run. Specially choice of less durable material in moving parts of the building might necessiate recurrent changes. The careful and logical selection of the building materials, finish materials, furniture materials and educational materials etc. can save the initial cost as well as the frequency of maintenance. Cost of educational materials, repair, cleaning, painting etc. are considered as the maintenance cost of the school.

4:3 ELEMENT INTERRELATIONS:

A schoof site found free from a donar may not be suitable from the locational point of view, might requir the change of site for the ideal location with respect of its commuity. In the same way, the use of cheaper and unstable materials might reduce the initial construction cost, would require the replacement much sooner than the permanent materials. Therfore, both the elements (cheapness and permanency or

cheapness and ideal use etc.) should be considered simltenously for an economic school.

5 CRITERIA FOR ECONOMIC SCHOOL DESIGN:

There are some architectural elements which do not influence the educational process. Architects have relative freedom to work with those elements in reducing the cost of construction. The local community people always try to save money and want to go for less expensive construction. Design criteria and space standards could be formulated to achieve the reasonable econmy of the planning, designing and construction of the school in the context of prevailing ecnomic and cultural conditions of the community. The degee of such economy depands on the scale of achievement of design criteria. regarding conprehensive educational planning, occupational time, flexibility, space standard, initial and maintenance costs etc.

5:1 SCHOOL LAYOUT AND PLANNING:

Educational architecture, in our country, is primarily shaped by economy. Considering that, the simple elongated rectangular layout having verandah at one side facing the court or play ground is the most common plan for school buildings in Bangladesh and rightly so the class rooms arranged against a straight corridor seem to be a rational arrangement. The layout of the school should be compact, leading it self to optimum economy. In the conventional teacher- centric teaching system, the square or rectangular shape class rooms have been proving more economical than any other shape of class rooms.

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*(4) p-172, Faruque A.U. Khan, Opcit.

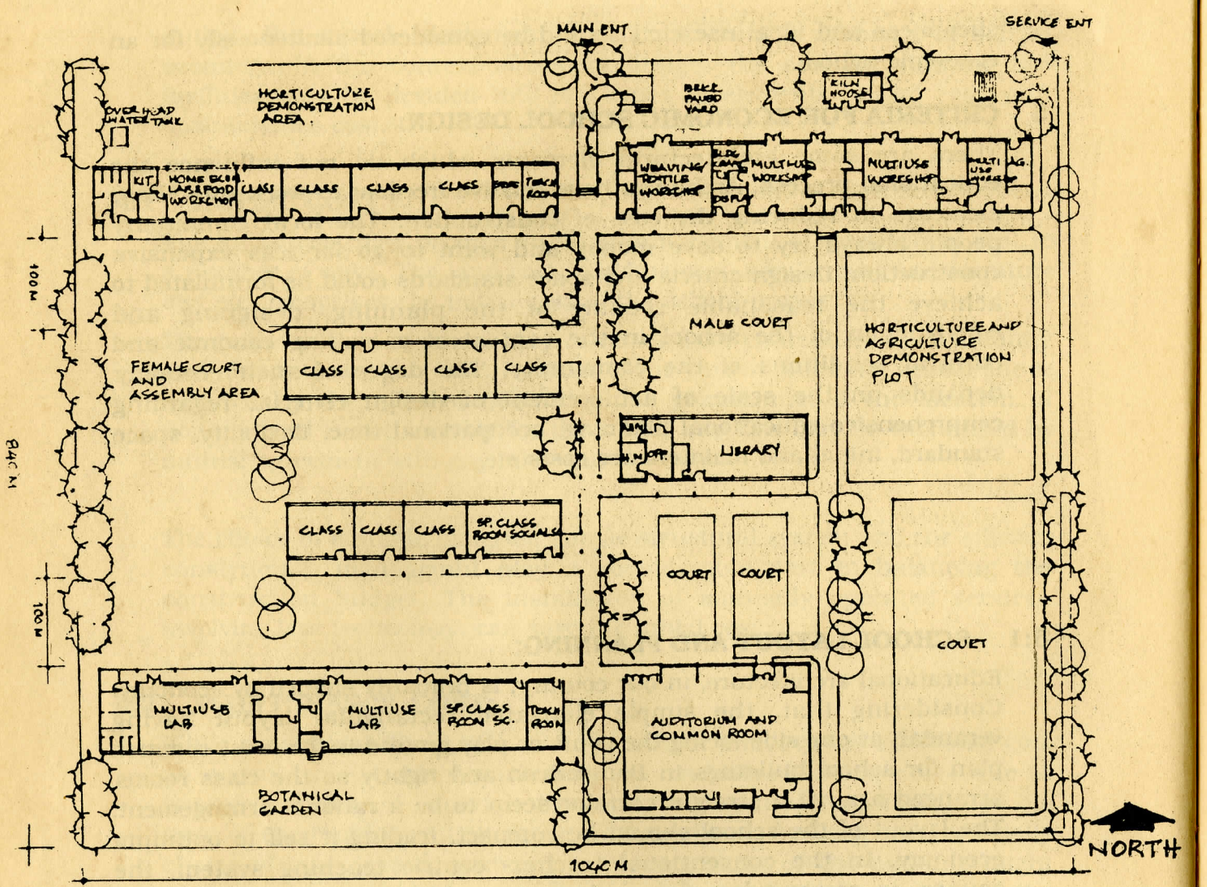

FIG-1 ECONOMIC LAYOUT AND PLANNING OF SCHOOL CAMPUS.

A class room like 26'-8" x 30'-0(8'00m x 9'00m) is sufficient for 48 number of places in the secndary level. And 346'-0" x 280'-0" measuring 10,764 sq. yard is sufficient for a scondary school camous. [4]

5:2 SCHOOL GEOMETRY AND FORM:

There is a definite relationship between geometry and construction cost. As for example, let us consider two secondary schools, one BUET school and other is the Udayan school in Dhaka, having different types of layout. Although both the schools have exactly the same area (for example,as per fig-2), the BUET school has only approximately 60 percent as much outside wall area as the Udayan school, yet it has exactly the same area. If each of these schools has similar type of construcion, there is a possibility that Udayan school might be more expensive.

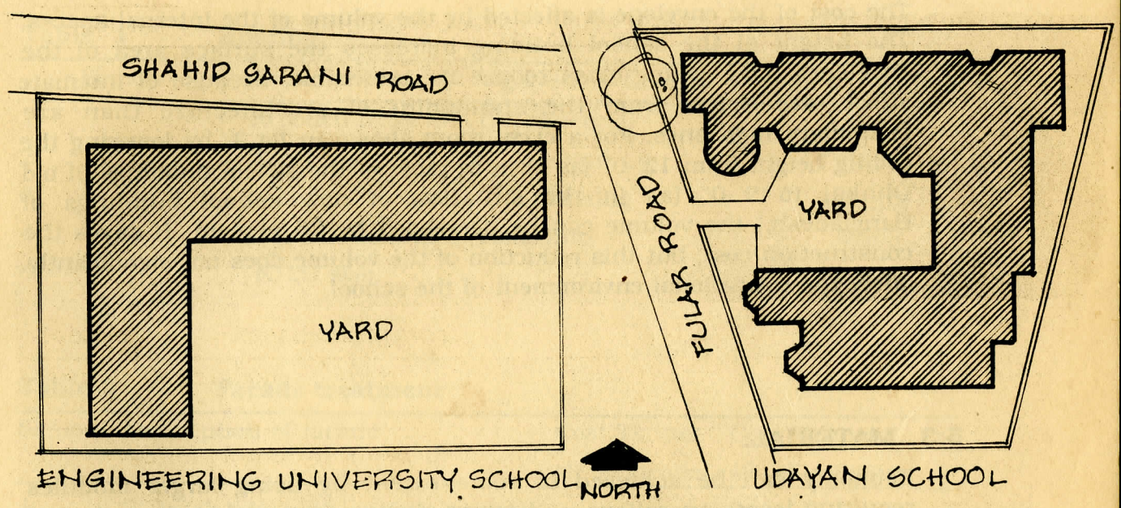

FIG-2 DIFFERENT TYPE OF SCHOOL GEOMETRY.

Again, greater the outside wall, greater is the possibility of water penetration, hence greater is the maintenance cost. The economical school building will be rougly rectanglar and straight with a minimum number of breaks and corners in plan. the simple geomery is one of the way to the cut cost.

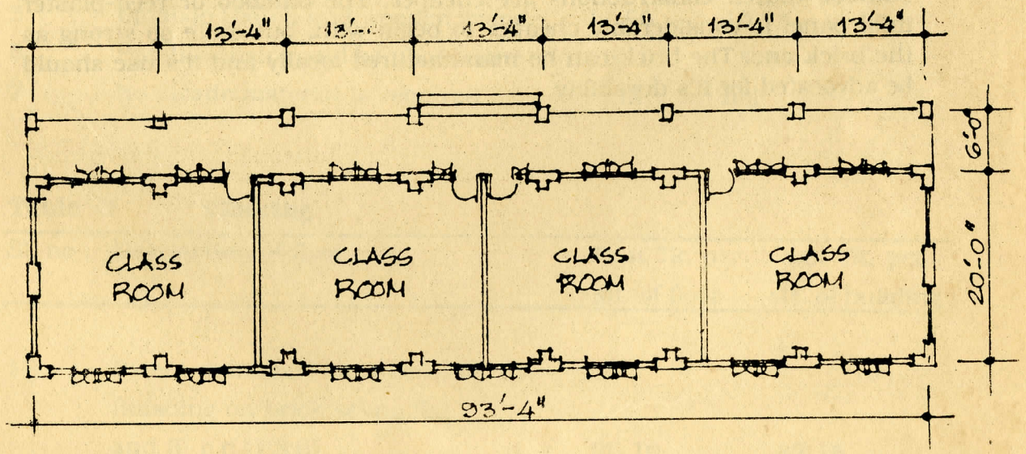

FIG-3. PLAN OF A SCHOOL BLOCK

The breaks in the silhauettee of the roofs of school building add some construction cost. Any break in the roof mass or in parapet wall make the school building expensive. The school buildings with simplified roof lines prove more economical at the time of construction as well as throughout the life of the buildings.

The cost of the envelope is affected by the volume of the internal spaces. The height of the school building increàses the surface area of the envelopes. Low ceiling class rooms are preferable, because of intemate effect, are better from the standpoint of arechitecture than are customary high ones. For a class room shown in fig 3, by lowering the ceiling height from 12'-0" (as seen in most of the school buildings of old Dhaka) to 9'-0" (as in the situation of new school buildings of Bangladesh,) the volume can be decreased by 25 percent. It saves the construction cost, but this reduction of the volume does not significantly. affect the educational environment of the school.

5:3 MATERIAL:

Economy can be achieved to some extent by using larger modules requiring lesser operations and joints. Certain materials are costly and others are relatively cheaper. Usually the heavy and permanent materials are costly and temporary materials are cheap. The use of cheaper and unstable materials might trduce the initial construction costs. This would require the replacement much sooner than would the permanent and stable materials. concrete, stone, and ceramic bricks are costlier, ordinary brick construction takes medium cost, where as C. I. sheet and bamboo thatcn constructions are cheaper. The bamboo or reed-plaster infill panel is considerably cheaper to begin with, but quite so strong as the brick one. The brick can be manufactured locally and it's use should be advocated for it's durability.

Table -1 Roofing

Sl. no.	Description of roofing system	Cost Tk. per sft. of building
1	Wooden truss and C.I. sheeting	33.47
2	Steel truss and C.I. sheeting	5823
3	Woodon truss and C.A. sheeting	51.32
4	Steel truss and C.A sheeting	7608
5	R.C.C. slab	38.86

Table-2 Facade treatment

Sl. no.	Description of facade	Cost Tk. per sft. of facade	Cost Tk. per sft. of building
1	5" brick wall with outside pointing and inside plaster	31.80	28.83
2	5" brick wall with inside and outside plaster	33.34	30.23
3	C.I. sheet and wooden frame	27.35	24.80
4	C.A. sheet and wooden frame	34.44	31.22
5	Bamboo thatch and wooden frame	11.86	10.75
6	Bamboo thatch and bamboo frame	5.79	5.25
7	No facade material is required	nill	nill

Table -3 Flooring

Sl. no	Description of floor	Cost Tk. per sft. of floor	cost Tk. per stt. of building
1	Patent stone and neat cement finishing on brick soling flat and 3" c.c (1:3:6)	36.10	32.15
2	Brick flooringflat on 5" bricks on edges	23.95	21.33
3	Terrazzo flooring on brick soling and 3" c.c(1:3:6)	66.18	58.94

Table -4 **Door and window**

Sl.no.	Description of door and window	Cost Tk. per sft. of door and window	Cost Tk. per sft. of building
1	Wooden (frame: Silkarai, shutter: Gammar) door and uindow, 3mm. clear glass	131.52	20.55
2	Steel frame, wooden (gammar) door shutter, steel window shutter and 3mm. clear glass	78.22	12.22
3	Anodized aluminium frame, aluminium door and 5mm. clear glass	520.09	84.43

5:4 LOCAL TECHNOLOGY AND CONSTRUCTION SYSTEM:

The use of simple structural system and local technology, help in balancing the constructon bugdet of the rural schools. The underdeveloped rural building technology and the shortage of construction bugdet have a strong influence upon both the planning and facade treatment of school buildings. In fact the construction bugdet has been almost a controlling element in secondary school building form snd it's architecture.

Table-5 **Foundation**

Sl. no.	Description of foundation	Cost Tk.per rft. of foundation	Cost Tk. per sft. of building
1a	Brick spread stepped foumdation on brick soling and 3" c.c(1:3:6)	175.00	22.99
1b	Brick spread stepped foundarion on p.v.c. sheet	143.31	18.82
2	R.C.C. footing and brickwork upto plinth	203.50	26.73
3	R.C.C column footing, grade beam, and brick wall upto plinth	234.53	30.81
4	wooden post and brick work upto plinth	104.22	13.69

Table-6: **structural system**

SL. no.	Description of structural system	cost Tk. per sft. of builoing
1.	2'-6"x 1'-8" T-shape 10" thick brick columns in building and 1'-8"x 10" brick columns at varenda, continuous lintel, D.P.C. pointing outside and plaster inside etc.	18.68
2	10" load bearing internal and external walls and 1'-8" x 10" brick columns at varenda, Lintal over door and windoows, pointing outside and plaster inside, D.P. C. etc.	44.42
3a	12" x 12" R.C.C. columns for building, 10" x10" R.C.C. columns at varenda and R.C.C. beams	43.92
3b	12" x 12" R.C.C. columns for building, 10" x10" R.C.C. columns at varenda and wooden tie beams	19.31
4	wooden posts and wooden tie beams	5.26

The R.C.C.structure is permanent but more expensive for many reasons. More over the method of R.C.C. contruction is not familiar to the local masons. Wooden post, wooden truss , C.I. sheet and bamboo mat facades,C.I.sheet roofing etc. are more popular to the local craftsman and even the community people can contribute their free or cheap labour in the construction.

6 DISCUSSION AND CONCLUSION:

The professtional school designers are always compelled to take descision concerning the choice of economic method of consruction.

The development of an appropriate method and finally its refinement and standardisation is considered assential for economic school design. This will be supplimented by designers personal experience and preferences. In order to select the appropriate method for construction, the ultimate aim should be the development of criteria for economic school design.

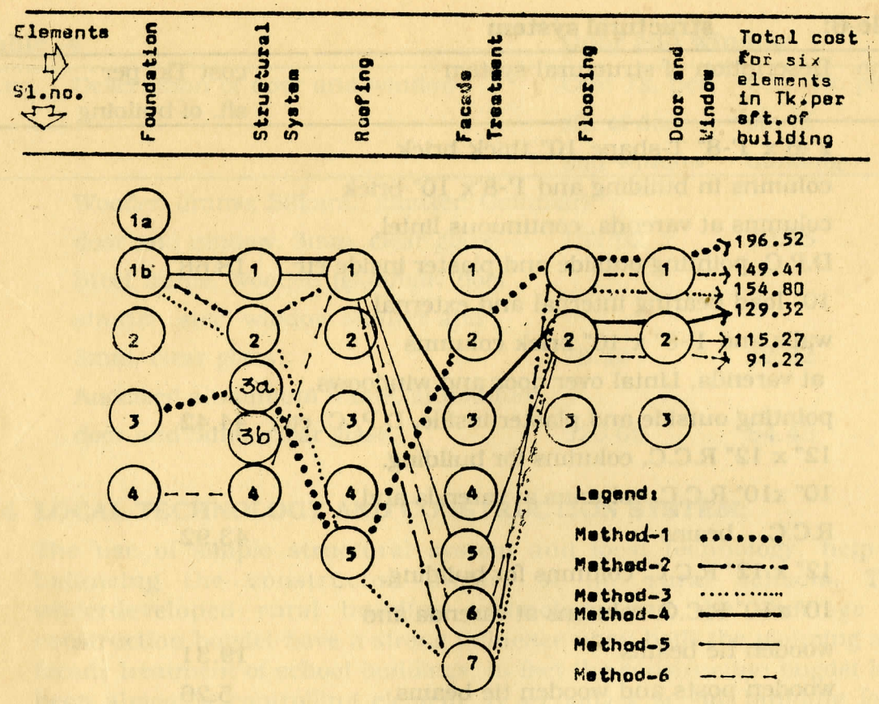

FIG-4. COST OF ELEMENTS.

R.C.C. as a building meterial is found to be expensive both in foundation and in structural system. The use of brick or timber in structural system is cheaper than R.C.C. Inroofing, wooden truss and C,I, sheeting is cheaper than R.C.C. slab.

The local materials are always cheeper than imported materials. The only exception found in the costing of doors and windows construction. The doors and window with sheet rame frame, wooden door shulters and steel window shutters are found to bc cheaper than doors and windows of wooden frame and wooden shutters (table- 4). Doors and windows with atuminium framing are over whelmingly costly than other type of doors and windows.

Certain elements and materials are not always necessary in foundation, if the soil condition is good. As for example, brick soling and cement concrete layer in foundation are not always essential and could be replaced by simple P.V.C sheet. Brick masonry works in foundation could be constructed directly on the P.V.C. sheet. This reduces much the foundation cost.

From the market survey, the unit cost for six elements of a small school block (fig.3) of a secondary school building are tabulated. Multiple number of construction methods could be developed from the cost information tables. These cost information tables are the means of obtaining the appropriate method of economic school design.Six different construction msthods were identified considering the permanancy of construction. The method no.4 is found to be quite satisfactory and reasonable for our rural school construction.

There may be certain restriction on the use of very temporary building materials, like mud in wall or straw/ reeds on roofing system. However, as all the school authorities are not equal in their solvency for construction budget, it is possible to construct relatively inexpensive school building at the beginning which can be progressively improved in stages, when more funds are available.

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POURASHAVAS AND URBAN DEVELOPMENT

KHALEDA RASHID *

INTRODUCTION

The Pourashava is a corporate body that oversees the welfare and development of urban areas within its jurisdiction. At present in Bangladesh there are 91 Pourashava towns (Municipal towns) with 1981 population varying between 8,400 in Mohespur to as high as 405,600 in Narayanganj. The total 1981 Pourashava population was approximately 4.7 million, while the median pourashava population in 1981 was 36,400.

The overall population in the country has been increasing rapidly. The basis of population projections in Bangladesh are the national censuses. The most recent 1981 Bangladesh census indicated a total population of 89.9 millon (corrected for under enumeration). Using the 1981 results, national population projections have been developed by various organisations. The middle projection assumes a 1990 population of 113 million rising to 147 million by the year 2000. (1) And it must be noted that much of the future growth will be urban.

Half ot the 1974-81 population increase was in the urban areas. In 1981 the population in urban areas stood at 13.5 million--- 15% of the national total. Nearly 6 million--- about 41% of the total urban population lived in four major cities namely Dhaka, Chittagong, Khulna and Rajshahi which are administered through individual Municipal Corporations. In 86 Pourashava towns 35% lived while the remaining urban population were in nonmunicipal urban areas. It seems, that the distribution of future urban population among different urban places is not likily to be much diferent from that of 1981. (Table-1)

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Table -1 : Expected Urban Population Distribution in Bangladesh.

	Urban Centres	Population 1981 (in million)	Projected Population 1990	2000
a)	Dhaka, Chittagong, Khulna & Rajshahi (Municipal Corporations)	5.7	10.5	18.5
b)	86 Pourashavas (Municipal towns)	4.7	8.8	15.4
c)	Non Municipal	3.1	5.8	10.1
TOTAL		13.5	25.1	44.0

INSTITUTIONAL SETUP, SERVICE DELIVERY MECHANISMS AND SOURCE OF FUNDING OF POURASHAVA.

The Municipal Corporations and Pourashavas in Bangladesh have vital role to play in the development of urban areas. In matters of municipal functions there is little differnce between the Municipal Corporations and Pourashavas, though the responsibilities and revenue income of Municipal Corporations are much larger and are governed by their respective ordinances.

Under the pourashava Ordinance 1977, Pourashavas are empowered to undertake:

a) all or any of the functions so given which may be undertaken by a pourashava and

b) such other functions as administered by Pourashava generally or by any particular Pourashava

The functions of the Pourashava broadly relate to:

a) Town Planning and Building Control

b) Public Health Care and Prevention

c) Water Supply, Sanitation and Solid Waste Disposal

d) Provision & maintenance of streets, roads, bridges and culverts.

The Municipalities in Bangladesh vary greatly not only in size but also in manpower available. The Pourashava Chairman and Committee of Ward Commissioners are elected. The Secretary is the senior executive who heads the general administration and looks after inter-departmental co-ordination in the Pourashava, except in large pourashavas which have Chief Executive officer in addition to Secretary. Information collected from 43 pourashavas shows that, the post of the Secretary, though important, is presently vacant in 16% of the Pourashavas. Pourashava manpower ranges from as lowas 5 in Mohespur to as high as 370 in Chandpur. About 40% of the Pourashavas has staff strength of over 100, 42% over 50 and 16% below 20. (2)

The largest single source of Municipal funding is the central government devolopment grants. Property based taxes are potentially the most productive form of mobilisation of local resources. But the revenue base of the Municipal organisation is both weak and underutilized. Holding of property taxes do not respond to the population increase or economic acivities due to current deficiencies in property assessment practices. Nonrealisation from central government development grant are common. The municipal governments have acquired for themselves an image of a 'taxing institutions' that render little or no service. The Urban Government Management Paper 1985 has reviewed management, resource mobilisation and national policies including an intergovernmental grant system. Inefficient management and inadequate pricing of urban services are constraints that relate to all municipal services in general. Services cannot be provided without funds while people cannot be motivated to pay their taxes unless their participation is encouraged and adequate services are provided. But given the perseverance, initiative and political will it is possible to break this mould and improve mobilisation of local resources. Choumohoni, a small Pourashava, has over the period 1985-88 increased its revenue from Tk. 5.7 million to Tk. 24.6 million. (3)

As is already evident, the pourashavas are the Local Government Institutions, which are responsible for the overall development of the areas within their urban limits. In view of the Government's recent decentralization of power through the upazila system, pourashavas have acquired renewed importance in the administration, development and maintenance of physical and social services in urban areas of Bangladesh. That the Pourashavas should be the major participants in bringing about development and creating viable environment in urban areas, is a logical outcome of recent government policy.

However, it is beyond the scope of this short paper to discuss all aspects of pourashava functions. The paper will focus on the controls pourashavas exercise or are expected to exercise in the erection or re-erection of buildings and small scale improvemnts in the poura areas.

BUILDING CONTROL

It is important at the outset to define the term building. The pourashava ordinance 1977 defines "building" in the following terms:

> "building" includes any shop, house, hut, out-house, shed, stable or enclosure built of any material and used for any purpose, and also includes a wall, well, verandah, platform, plinth and steps.

The definition clearly indicates that the control over building set-backs, volume, height, as operationally understood but shall also include the regulation and control of the use to which the building is put, i.e. the building control shall also include landuse. Section 98 of the pourashava ordinance lays down that erection or re-erection of buildings within the physical limits of the pourashava shall require the approval by the pourashava or an authority prescribed by government. But unfortunately this is hardly the case in practice. Buildings are being built indiscriminately, without reference to any authority or legislation. Except for major cities like Dhaka, Chittagong, Khulna and perhaps to some extent Rajshahi, building activities are free from encumbrances' of any controls or regulations, Most pourashava do not have even a rudimentary framework of building rules and regulations. There has been little or no attempts to operationalise the provisions of different legislations pertaining to the control of building construction and landuse. But despite the absence of controls and attitudes, the question of effective control of buildings and therir uses is critical for the preservation and promotion of a viable physical and social environment in every urban centre of Bangladesh. In the absence of development agencies such as RAJUK, CDA, KDA & RDA, the pourashavas will have to rise to the occasion and shoulder this responsibility.

IMPORTANCE OF BUILDING CONTROL

Urban areas are in a continuous process of growth and change. With or without pourashava interventions changes in use, renovation, erection and re-cerction will take place. The owner at opportune moment undertakes the action himself. This is the case everywhere. The trend, however, presents a paradox. It is both encouraging and unfortunate. It is encouraging in the sense that private capital and initiative are being used for physical development, but unfrotunate because:

> There is little evience in the history of development..... that the private decision maker, left to his own devices, can be trusted to act in the public interest! (4)

Orderly planning of services and utilities is difficult where direction of development depends on decisions taken by numerous individuals separately on the basis of immediate needs without reference to a plan or what others are doing. The urban form that evolves in the absence of landuse and building conrtrols, does not respect environment, public health or safety which are the expressed intent of the Pourashava Ordinance. Such practices erode open spaces, neglect community needs, destroy historic environment, disrupt traditional, functional and physical linkages, not to mention the exacerbation of existing problems. Bangladesh, a land hungry nation, cannot afford the luxury of considering property owners' freedom to build as being innate and inviolable. The right to build is designated and not inalienable.

Without control over landuse, intensity of developmemt, building height, bulk and inter-relationship of functions, deterioration of urban areas will continue unabated. The physical and social conditions in most pourashava towns are only a premonition of a bleak future. Inadequate physical and social provisions are a rule.

Existing legislation relating to building and landuse control exists in form of the East Bengal Building Consrruction Act 1952 (EBBC), the Pourashava Ordinance 1977 (PO) and the recently formulated Building Construction Regulations (BCR) 1984. The EBBC 1952 empowers the pourashavas and other development agencies to formulate by-laws to regulate and control the erection and reerection of buildings, excavation of tanks and cutting of hills.

Except for a handful of Municipal Corporations no other pourashavas have framed any bye-laws under the provision of the EBBC Act. The BCR 1984 was formulated by the Ministry of Works under the powers vested by the EBBC Act 1952. The BCR, 1984 outlines the procedure of obtaining approval for construction of buildings, excavation of tanks or cutting of hills. It prescribes

set-back regulations for differnt plot sizes and uses, specifies a maximum of 75% site coverage for residential construction and mandates parking provisions for both residential and commercial facilities. Though much remains to be desired, the BCR 1984 is a model that may be improved and built on. While the regulations on building coverage and set-back requirements may be adopted in most pourashavas with or without modifications, parking requirements are too high even for major cities such as Dhaka, Chittagong and Khulna.

TOWN PLANNIG AND RELATED URBAN SERVICES

In addition to more specific powers such as construction of drains, streets, markets, the pourashavas have the power to prepare master plans and site development schemes with control taking the form of a ban on construction without permission unless it conforms to such plans or schemes. Another provision authorises the adoption to development plans to identify projects, sources of funds and institutions capable of carrying them out.

However, the powers of planning and control have seldom been used by the pourashavas partly because of lack of trained personnel and partly because adoption of such plans will require all construction to conform to such a plan- a thing which pourashavas are presently ill-equipped to enforce. Control of landuse and building constructon is an integral part of adoption of a planning frame work. Without a planning frame work it is difficult to justify the landuse controls. Though Master Plans for some pourashavas exist (prepared by Urban Development Directorate), they have not been adopted for reasons cited above. Neither is there a physical planning legislation to give legal sanction to the plans prepared.

It may not be too optimistic to expect appropriate urban landuse legislation to become operational in the not too distant future. Certainly actions are needed to curb rising land prices, discourage land speculation, control unsuitable uses and arrange land to be available for development at the right time, price and place. The draft Physical Planning (land use) and Development Control Ordinance 1985 is being considered by the government. The ordinance seeks co-ordination and collaboration amongst government agencies in the use of power influencing planning and to provide

a flexible formula for assigning to public agency at any level of government, for any area of jurisdiction such planning responsibility or controlling power as seen desirable. In the long term, all pourashavas are likely to be designated as such agencies with greater powers for controlling building and landuse.

In view of the present condition, the urban areas of Bangladesh are not expected to change for better in the immediate future. While the new and small urban centers on the verge of rural-urban transformation are unlikely to feel the pinch of such changes, the deterioration of infrastructure and services in the larger towns will continue unabated. Though there has been improvements in infrastructure and services, but such improvements have failed to keep pace with the demographic changes. Moreover, the improvements have been in bits and pieces without reference to the community needs or a plan. The problem of co-ordinating development is urgent. In the absence. Of effective planning intervention conditions are likely to worsen of the expected population increase a significonf portion will consist of immigrants most of whom will be poor and without skills. It is most likely that they will be employed/under employed in insecure marginal occupations at very low wages. Being on subsistence level these people will contribute little to the municipal revenue, but will nevertheless increase pressure on the existing services. Housing, basic services, social provisions and above all jobs will be needed. Old areas will densify and new areas will have to be developed.

RECOMMENDATIONS

Lack of trained manpower, dearth of financial resources and poor capability of pourashavas are subject of lengthy discourse. In the words of Micheal Cohan :

> the combined strains created by the pace of urban growth in the Third World and a lack of resources for maintenance of infrastructure could rapidly lead to the breakdown of a generation of urban investment in many places. (5)

This is indeed a pessimistic scenario but it is not an ordained fate. It is true that conditions are not expected to change overnight. But development and environmental improvement cannot await the evolution of an ideal institutional system. An optimist, a believer in the ingenuity and resilience of people, in their ability to survive, the worst must rely on different institutiions to cope with the enormous problems. Development programme must consider the existing limitations with possible improvement in modus operandi. There is a need for change -- -- a change in approach to planning and development. Planners, urban designers or architects may bemoan the lack of building regulations or the inability of the pourashavas in enforcing existing legislations. But experts really cannot blame the community for not enforcing controls or responding to programme which the community did not help formulate. The involvement of the local community, so vital for success of building controls or development programmes, is virtually non-existent. The positive impact of UNICEF assisted and Local Government Engineering Bureau (LGEB) administered Slum Improvement Project (SIP) in Bangladesh and the success of Kampung Improvement Project (KIP) in Indonesia speak of the strength and efficacy of involvement of communities in improving their environment and lives. In both these programmes there were neither building controls nor master plans imposed on the community. The community was the master of its fate--the decision maker, the controlling agency and the planner. The local development agency with its engineers, planners and administrators was the 'enabler' that advised the community, provided it with information and choice.

While it is true that efficiency, management and staffing of pourashavas have to be improved, it is equally true that a mechanism to effectively involve the community in identifying problems, articulating priorities, devising solutions and implementing programmes has to be found. Top-down administration must successfully interface with bottom-up community involvement. Administrations that enjoy the confidence of the administered find roots in the community and enjoy a higher chance of success. It is the sense of belonging to a programme that builds confidence and provides momentum to development programmes. Community involvement in decisions affecting their lives is an effevtive way of promoting this sense of belonging and confidence. Instead of imposiong a programme on a community, authorities should help people help themselves.

But the apparent simplicity of such participatory programme belies the real complexity. They present some of the most difficult and challenging problems for urban govenments, especially in an environment where authorities are conceived of as 'entities' apart from and above the community. Furthermore a contract between officials and the urban community to improve environment can neither be precisely defined nor tightly scheduled in advance. Progress depends largely on the willingness of the authorities to allocate resources which make community consultation and involvement possible.

CONCLUSION

There should be no doubt on the importance of the role of pourashavas in controlling building activities and landuse. Without effective control of building and landuse, pourashava will not be able to fulfill its objectives of providing orderly physical and social infrastructure to its inhabitants. To operationalise and rationalise the control mechanism, a planning framework has to be adopted and rules and regulations suitable to local conditions and in consultation with local community have to be formulated and enforced. But above all a commitment to preserving and developing a wholesome environment has to be made. Concept of 'wholesome' enviroment should not be based on a 'preconceived' notion of adequacy, but on a thorough understanding of socio-ceonomic conditions and community resources available--human, financial and institutional-- and its willingness to commit them to the improvement of the environment.

Be it urban design, planning, building conrrols or provisions of physical and social services, it is only through the involvement of the community that social justice and development relevant to the context can be achieved. The process may be slow but achievements will have lasting value. Participatory approach is often criticized for its apparent lack of efficiency, But is efficiency and efficacy synonymous ? Let us pause to think.

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THE HIDDEN DIMENSIONS:

An analysis of Hindu temple-complexes.*

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ABSTRACT:

Through ages Hindu temples or temple complexes have acted as prime generator of social norms and behaviour for the people of this region. Because, this temple-architecture had been a product of religious consciousness and belief of the people with the deeper understandings of the Hindu-builders about the region and religion. Hence, most of these temples and temple-complexes steeped in profound spiritual and religious ambience, with which they exist even after hundreds of years. This script is devoted to understand these temple-complexes and their hidden dimensions of extreme profoundity.

KEY WORDS:

Temple architecture; cosmology; mode of Architectural expression; Built-form versus open space; modulation of masses; organization of spaces; construe of structure; Iconography; symbology.

INTRODUCTION:

Religious building is an ennobling expression of human soul where Architecture goes beyond physical demands and comes out as a statement or, expression of profound insight into the faith.

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* *All the photographs & figures ore taken from 'Living Architecture: Indian, by Andreas volwahsen, unless mentioned. other-wise*

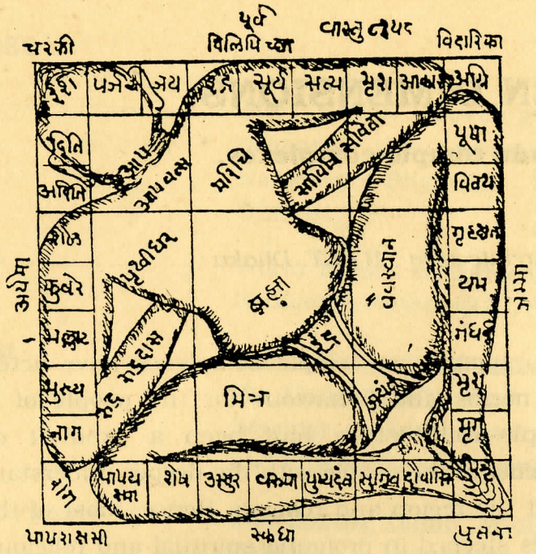

FIG-1. Vastu-Purusha-Mandala: The divine chart which was the basis of the constructional principles of the Hindu Builders.

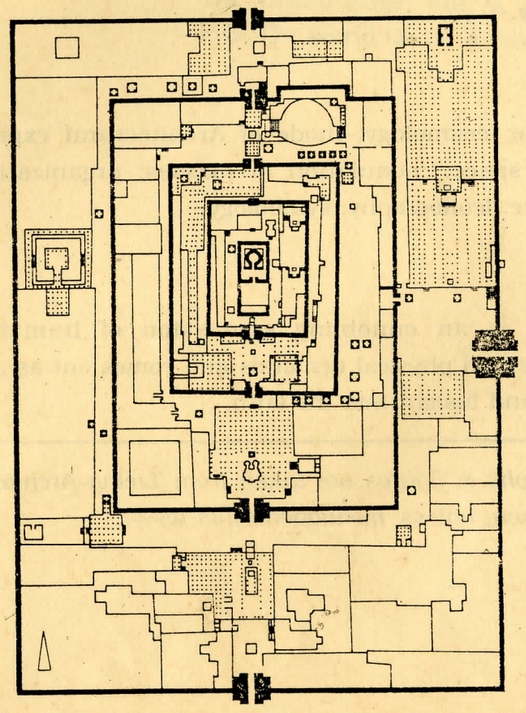

fig-2. The south Indian temple city of Srirangam: An image of the worlds situated in concentriic rings around the center 'Brahman'. The rings also singify specific uses. The Further the layer form the centre, less sacred the use of the space.

The Hindu temples or mandir, the emblem of religious tribute of the Hindus to their gods, is the veritable manifestation of their belif and faith. Through ages, in India, these temple or temple complexes or temple-cities have influenced and nourished the community environment and society as a whole. Because these religious institutions could provide the community with cultural stability, security, occupation and guidance in behavioural patterns. They helped establishing value systems and strong conviction about the validity of these systems. (1)

Nevertheless, it was not the Hinduism alone but the physical environment and architectural expressions of those temple-complexes or temple-cities together contributed significantly towards this achievement. Because they could work as catalysts to result required transformation within the participators. In order to attain that the Hindu-builders had to device some universal means of communication to establish a unique dialogue between the buildings and their users, some of which are identified here. These were also the devices which gave these institutions not only their functional expression but also their philosophical and metaphysical dimensions. Only realization of such axioms or devices in the temple architecture could produce the 'Spiritual Indian Architecture' as claimed by Percy Brown. (2)

COSMOLOGY AND TEMPLE ARCHITECTURE:

The Hindu temple-complexes represent cosmic relationship in their forms, volume and space-articulation. The Hindu builders used the divine chart Vastu-Purusha-Mandala as the basis of their constructional principle to establish such relationship (Fig: 1). To them, Vastu-Purusha-Mandala was an image of laws governing the cosmos. The diagram Vastu-Purusha-Mandala emphasises that when Vastu (environment), Purusha (energy) and Mandala (astrological chart) are brought together in a balanced manner in the architectural solutions, it implicitly becomes contextual relating to the place, people and period. (3) The Hindu builders selected square as the basis of this divine chart-because it could best symbolize the divine or the absolute. To them "The temples were meant to be permanent abode for their otherwise heavenly and

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(1) *Doshi, B.V; Between notion and Reality; Architecture+Design, jan-Feb; 1989.*

(2) *Brown, percy; Indian Architecture (Hindu & Buddhist Period) 1976 (page-1)*

(3) *Doshi, B. V; Opcit.*

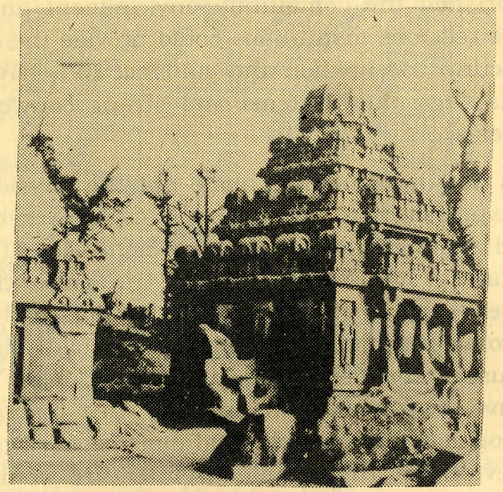

Fig-3,4. The Dharma Raja Ratha of Mahaballipuram: One of the most successful effort of Hindu builders to do justice to all formal, cosmologcal and ritual requiremnts involved in construction of a temple.

elusive gods. Their images had to be installed in shaped symbolizing stability rather than mobility. The square fulfilled these aims far more appropriately" [4] If we were to look at the Bharmesvara temple at Bhubaneswara from air. we would see how the 10th century Hindu 'Sthapatis' (builders or architects), with consumate skill, were able to translate in their own idioms the doctrines of Mandala. According to Percy Brown" the Mandala, if faithfully followed, would make failure impossible" [5]

Similarly, the conception of cosmic centre has taken many forms in the Hindu temples and temple-complexes. In the South Indian temple-city of Srirangam, it is found that the cosmos is represented as an image of the worlds situated in concentric rings around the centre Brahma (Fig:2). Again, the pyramidal arrangement of miniature temples (aedicules) on the temple mass reflects the ancient myth of mount Meru, the centre of cosmos. Dharmaraja Ratha of Mahaballipuram is one of the most successful effort to do justice to all formal, cosmological and ritual requirements involved in construction of a temple. [6] Here in the outer limit of the tiered roofs and of the octagonal domes contained a central Brahma-Sthana and the rings of deities, human and demons. It is an integral diagram transposed into spatial mandala (Fig: 3, 4).

MODE OF ARCHITECTURAL EXPRESSIONS:

The Architectural expressions for the Hindu temple complexes or cities are, for most of the time, indefinite and amorphous rather than finite. Hence, the Hindu temple complexes often donot hold a high place as an architectural entity. Usually they donot follow conscious plans in their arrangements; there exists no decisive preliminary conception; they gradually evolved from small nucleus in the form of shrine until in the course of time they spread out into the indeterminate and in some respects, unsystematic complexes as most of them now present. Such an approach often established dual or even multiple ordering systems in the same complex and influenced the 'Sthapatis' (builders) to conceive complex designs. But one can hardly fail to be impressed by the profoundly religious atmosphere, emotional and often

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(4) Grover, Satish; The Architecture of India (Buddhist & Hindu period); 1980.

(5) Brown, Percy; Opcit.

(6). Volwahsen, Andreas; Living Architecture: Indian; 1969 (p-138)

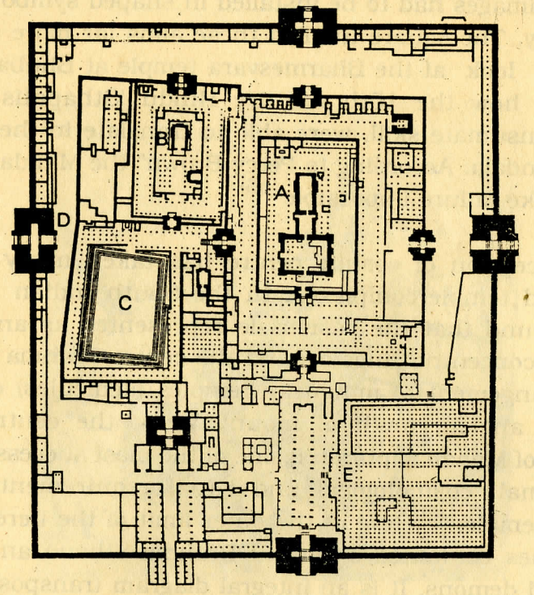

Fig-5. The temple city of Madurai: A vast composite Symbol of essential Hinduism.

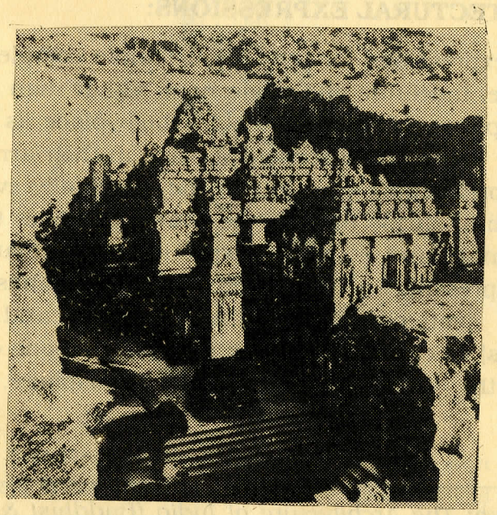

Fig-6. The temple of Kailasa at Ellora: 'An amazing artistic statement by the Hindu builders amidst rough and barren out-crop.

intellectual content, in which many of these temple complexes are steeped, making them a vast composite symbol of essential Hinduism [7] . The temple cities at Madurai, or Srirangam may best exemplify this (Fig: 5). This spirituality might have been the outcome of the uncompromising attitude of the builders to recreate microcosm or, to manifest the microcosm in the temple-complex.

Yet another mode of expression was the juxtaposition of perfection and imperfection. This is a quality or principle that temple architecture exhibits with great strength and this occupied a major place in the aesthetic sensibility of the Hindu-builders. In fact this had been an effective means to evoke sympathetic relationship with the viewer and the architecture itself. The seemingly disorderliness introduced by such juxtaposition often contributes liveliness to the scheme and results a better public response. [8] Thus, it is not surprising for a Hindu complex that delicately curved columns can be viewed against left-over rough surfaces or, an amazing artistic statement like the temple of Kailasa at Ellora amidst rough and barren outcrop (Fig: 6).

BUILTFORM VERSUS OPEN SPACE:

"The Hindu temple complexes are experienced not only as a collection of gopurams or shrines but also as a pedestrian path through sacred spaces." (Charles Correa). [9] The deities in a Hindu temple is envisaged in two capacities; a spiritual and a temporal. In its spiritual capacity the deity remains enshrined within the darkened mystery of the cella, where passively he receives homage of the devout (Fig:7). To provide for such a condition there is, therefore, the inner portion of the temple, strictly reserved and secluded as the sacred habitation of the god. On the other hand, on certain prescribed occasions this divinity personifies a less abstract embodiment and emerges form his retreat in his temporal capacity, assuming a physical form. [10] Thus it is seen that, to conform to these two contrasting attitudes or appearances, the temple resolves itself into two manifestations- an inner, covered and most sacred part, and an outer, open, more public and less sanctified part. These outer part of the temple area is generally formed of concentric rings or, series of couryard called prakamas or pradaskhina patha, enclosed with high walls but open to sky. These prakamas also provided ample space for buildings connected with more secular aspect of the caremonials (Fig: 8).

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(7) Brown Percy; opcit; (p-96).

(8) Doshi, B.V; opcit.

(9) Correa, Charles (Monograph); Ed. Hassan Uddin Khan; 1987

(10) Brown, Percy ; opcit; (p-95)

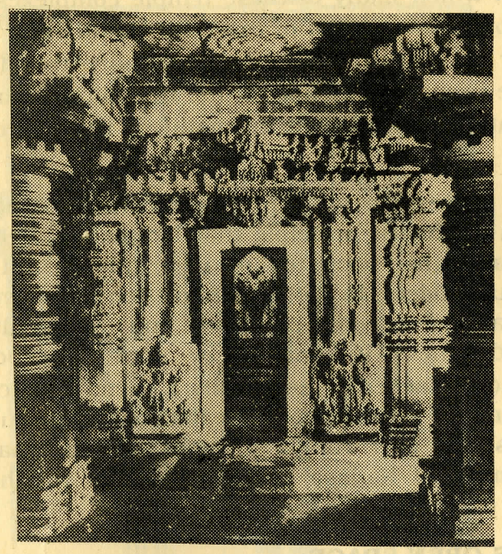

Fig-7. The Image of god enshrind in the darkened cella with its spiritual capacity.

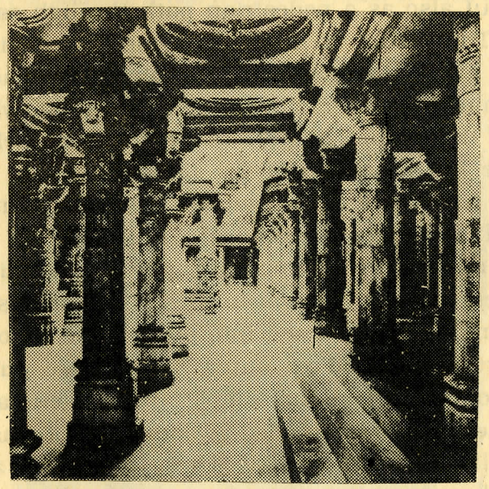

Fig-8. Parkama in a temple complex.

MODULATION OF MASSES AND SOLID-VOID RELATIONSHIP:

Like the Summerian Ziggurat or the Buddhist Stupa, to the Hindus the temples are also the microcosm - its vertical axis is the axis of the universe and the relationship between the centre and the periphery, here, is the symbol of relationship of God to the World. This relationship has traditionally been thought of as dynamic by the Hindus as a process more than static. (11) The interrelationship of forms on the temple exterior expresses this dynamism. So we find that the greatest energy of the Hindu builders were concentrated on the orchestration of the external volumes of the temple (Fig: 9). For the interior space also, the solid-void relationship had always been an important aspect to the Hindu-builders. In the early Hindu-temples, the interior, aesthetically speaking, generally singnified a space where solid masses of columns obtruded into the void and pondorously asserted their presence in it. But in the later period, the interior came to mean the void itself intruding into the solidity of the ordered columnar files, not only by corroding their evenness, but also by boring crevices in their masses, with the consolidated blocks of columns themselves bursting out of their simple geometrical compactness and branching out into the void. Though the basic uniformity of the colonnade was maintained in principle, but the evenness of the shapes of the columns were consistently fragmented in the Hindu-temples of later period as in Vijayanagar or in Madurai (Fig: 10. Thus the regularity, symmetricity or, the continuity of the prospect in the interior was rendered visually ambiguous and the sharp division of solid and empty spaces in the interior are exchanged for an ambivalent and energized interaction between them. (12) This ambivalence or the ambiguity in the interior spaces of the Hindu-temples even now being a pivotal element for tranforming an individual when he is with in a temple or temple-complex.

ATTITUDE TOWARDS SPACE & ORGANIZATION OF SPACES:

'Layering of spaces and interiority of spaces had been fundamental to the organizational attitude towards space of the Hindu-builders. Because these support the behavioural norms, societal values.' (13) This layering of the spaces is also a climatic

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(11) Hardy, Adam; Pattern of thought & form in Hindu temple Architecture; Architecture + Design; September-October, 1989; November-December, 1989.

(12) pereira, Jose; Elements of Indian Architecure; 1987 (p-42)

(13) Doshi, B.V opcit;

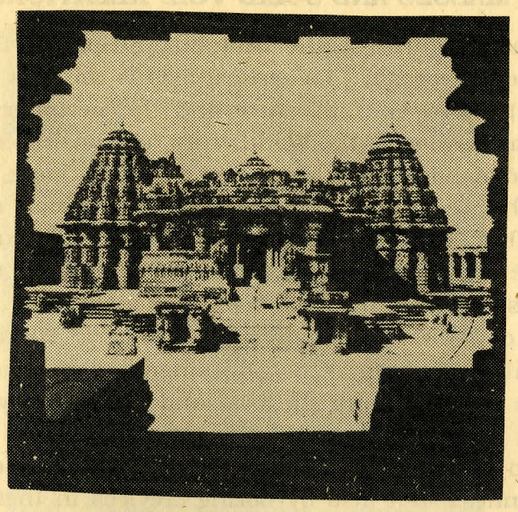

Fig-9. The Kashava temple at Somnathpur- The orchestration of the external volumes of the temple expresses the traditional belief of dynamic interrelationship between the God and the World.

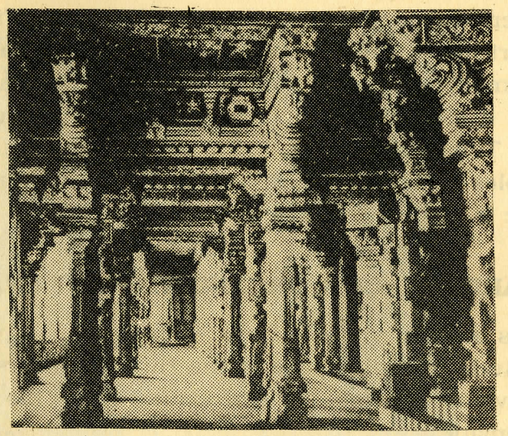

Fig-10 A columnar hall in the temple-city of Madurai where the evanness of the columnar files are consistently fragmented for an energized interaction between the solid masses of columns and the space which contains them.

necessity Which helps to filter out the hostile climatic alements. This specific attitude of the Hindu-builders construe or interpret the multiple elements they invest in a temple complex. For example, in the temple-city of madurai there are multiple elements and multiple centres, each with separate meaning-- but all these relatively separate elements are unified by layers of spaces defined by high enclosure walls. Again, in the city of Srirangam, there are layers of space -- the inner most layer is bordered on either side by ancillary shrines and prayer halls; the second layer is for the dwelling of the priests and for a number of stalls where flowers and fruits are sold for puja sacrifices and the further the layer from the centre less the importance or sacred its use. (see, Fig:2) The layering of spaces and interiority of spaces often stimulate the individual instinct by reaffirming the individual's existence and significance with respect to the surrounding. This also vibrates with life because of the multivalent relationship of the elements, or, the ' unity in diversity' with in a temple-complex.

SPACES AND STRUCTURE:

Use of multiple structural element to characterize spaces- this notion of the Hindu-builders worked as a complement to the concept of layering of spaces. Because, they used the structural elements to define and modulate the spaces so as to generate different reactions and emotions amongst the onlookers. Thus, to them structure was a live element or instrument -- sometimes they are perfectly geometric, sometimes they are highly sculptured, sometimes they are dispersed in the dimness of the interior or, sometimes their protean arabesqye contours are high lighted and coruscated by controlled illumination, keeping with the ambience of the spaces (Fig: 11). This is evident in the temple-complex of Madurai, where at least four major groups of columns can be identified wih different types of spaces, like the square moulded and patterned type, the rampant dragon type, the type with the portrait of the donor and, the types with the figures of deities. (14)

ICONOGRAPHY AS A DEVICE FOR COMMUNICATION:

Use of iconography or treatment of wallsurfaces with plastic form had been unique means used by the Hindu-builders to establish communication between the inert material of the temples and the visitors. The Curvings and the Icons, with which the Hindu-builders used to modulate the surface of the temples, depicted invariably all glorious gods of age-old mythology (Fig: 12). And it was also not infrequent that the

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(14) Brown, Percy ; opcit (p-91-94)

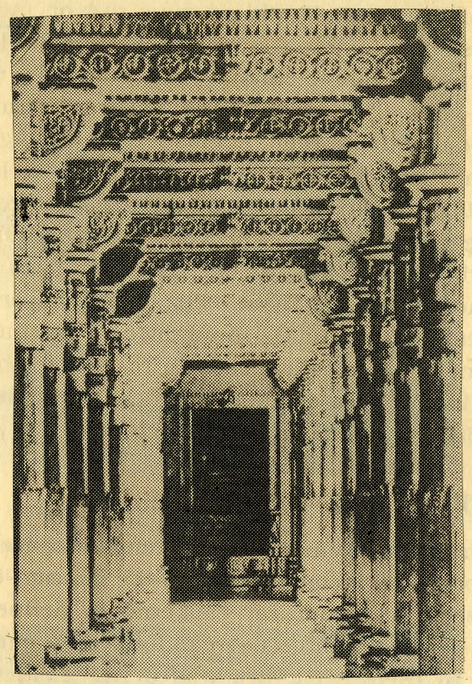

Fig-11. This similarly patterned colonnade defines an ambutatory space in a Hindu temple complex-reflects the notion of the Hindu-builders to define spaces with similar structural elements.

Fig-12. Relief scenes, from the epics of the Ramayana and Mahabharata, on the walls of the lower storey of the kailasa temple at Ellora.

builders used elements like erotic, intoxicated, abberative dancers or, events of great historical importance or, domestic scenes of great humour or, such like these. But whatever may be the subject, these undoubtedly act as an important link between the on-lookers and the architecture. Their participation and presence within the temple complex becomes exilarating through these transfigural and kaleidoscopic depictation of their gods and glorious eventful past. So, they feel the urge for searching the root of their origin and existence.

SYMBOLOGY IN TEMPLE ARCHITECTURE:

Investments of symbols is another essential element of the Hindu temples and templex complexes. The temple is a house of god. It is the link between the god and man, actual and ideal, earthly and divine. People go to the temples for Darshana i.e. to see the gods, The temple is not merely a shelter but a concrete object of devotion which is full with the presence of god. One text says "the concrete form (murti) of Shiva is called the house of god (Develaya). So one should contemplate and worship it first". [15] Hence, the temple is got to be symbolic.

The Hindu-builders were the adroit exploiters of symbology. For example, they identified different parts of the temple and temple complexes with the different parts of the body of the god-- both vertically and horizontally. Horizontally (i.e. in plan), the garbhagriha (womb house) is the head of the god and gopurams are the feet of the god and other parts of the building complex are identified with other parts of the body. While vertically, the garbhagriha represents the neck, the shikhara the head, the kalasa (finial) the tuft of hair and so on (Fig: 13).

A Hindu temple is also analogous to both human body and human psyche. The names of some parts of temple reflect this association with temple and human being-like the jangha (thigh), griva (neck) etc. More singnificant is that it also represents the subtle body with seven psychic centre or chakras. The first three chakras are located below the ground, the fourth one is the garbhagriha, the fifth and sixth are in the Shikhara area and the seventh is located in the topmost part of the kalasa. [16]

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(15) Hardy, Adam; Opcit.

(16) Swami Harshananda; All about Hindu Temples; 1988.

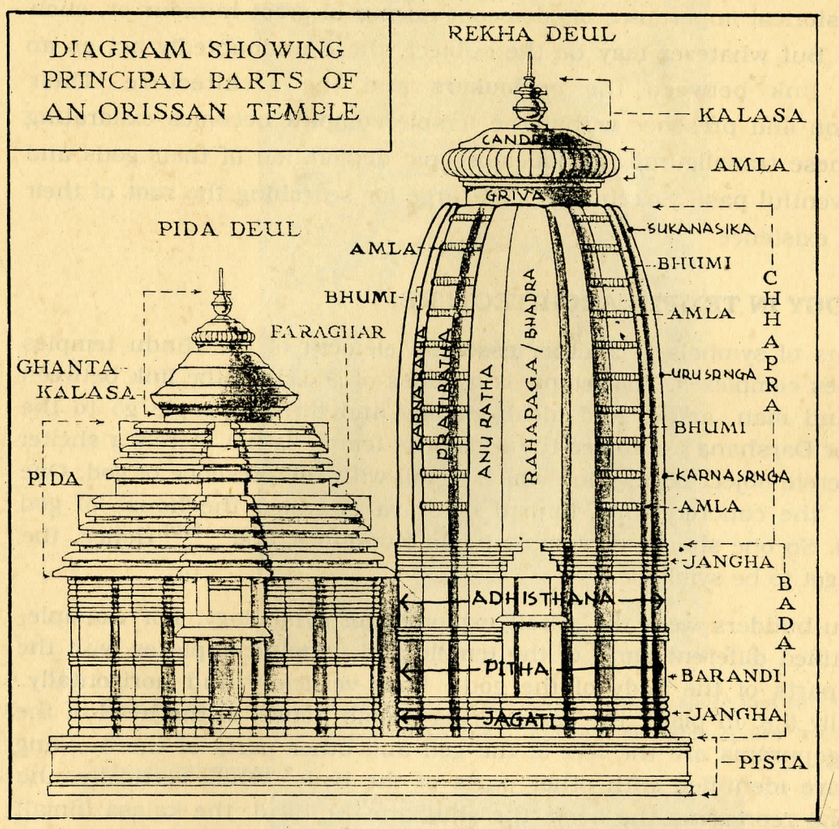

Fig-13. Principal parts of an Orissan temple-shows its relation to different parts of the humanbody in its nomenclature (source: Indian Architecture, percy Brown; 1976)

LIGHTING THE INTERIOR SPACES:

Intuitive to the Hindu-builders was the understanding of the nature of light and its nuances. Controlled disposition of illumination on the surfaces of the interior spaces of the temples and temple-complexes had been an unavoidable tool for them to create necessary ambience which is evident in south Indian temple-cities and temple-complexes. In these temple-complexes, the sculpted columns form a continum of ambiguously multiform shapes that melt into the surrounding darkness when at some significant points this shadowy continum is allowed to be broken by shafts of light which transfigure some of those columns into profile of luminous arabesque; at other times, the light is permitted to stream down from an opening in the roof and thus produce an unearthly glow as it flickers over the protean contours of many bracketed pillars dispersed through the dimness. (17) There, thus, arouses a sense of impermanence in the vistas of the broken contoured shafts with its variform capitals and arching brackets-- especially when the reflected light flashes vibrantly on the mouldings of the columns as in the interior of the Chanekesava temple at Belur, or coruscating on the prodigious assemblage of animals, dwarfs and deities, clustered with colonnattes as in the Vitthalaswami temple of Vijayanagar (Fig: 14).

CONCLUSION:

However, it is true that all these aspects of architecure could not be engaged simultaneously in all the Hindu-temple complexes built by the Hindu builders. But it is evident that throughout the history, the Hindu temple-architectre showed very little changes and variations in its form and idea. This testifies that the intention and the purpose of the temple architecture were never dissimilar to the Hindu builders. To them the fundamental purpose of building art was to represent and to support the religious belief and consciousness of the people. So, instead of showing structural inventiveness or any special attempt to solve structural problems, they had been much more clinging to theological discipline which ultimately could steep in the spirituality of absorbing awe and reverence with which the temple complexes exist even after hundreds of years.

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(17) Pereira, Jose; Opcit; (p-43)

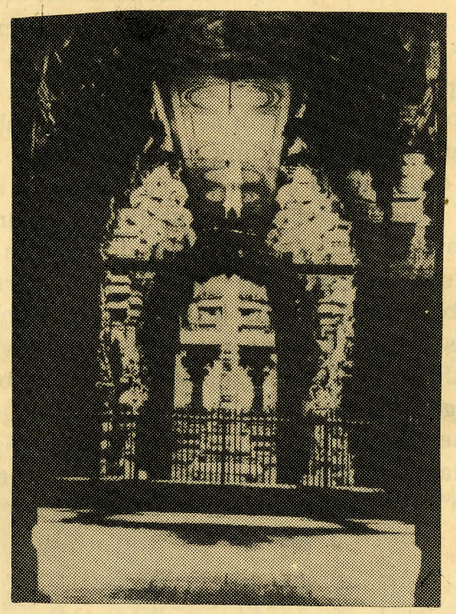

Fig-14. Only at a few places does day light enter the dark vestibule leading to the sanctum a Hindu temple.

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JOURNAL; HUQ; A. B. C. Architecture in Bangladesh, Journal of Architecture, vol. 1. No. 1., January, 1989
PAPER : HUQ., A. B. C., Architecture in Bangladesh, World Architecture, p. Q. R. AMIN (ED.) XYZ publishers, Dhaka, 1989.

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