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# EVALUATION OF DEVELOPMENT ALTERNATIVE WORLD HEADQUARTERS, NEW DELHI AS A SUSTAINABLE BUILDING

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## ABSTRACT

*Development Headquarters in New Delhi is a sustainable building or an experimental project based on principle of environmental and social sustainability. The structure of the building responds to different seasons giving priority to low embodied energy materials, passive means for reducing operational energy, construction methods based on local or regional capabilities and resources, requiring low processing energy and local capital. It is a low cost model for building in context of urban India. In this paper the author has examined that how the architect has refused to avail best technologies for building air-conditioning system instead along with experts he opt for hybrid system estimated to be at least thirty percent more efficient than any anything in the market. The various elements of this building are evaluated on the basis of their suitability to the climate and redefing of old methods in the contemporary context instead of reviving traditions. Architect of the Development Headquarters is Ashok.B.Lall who is specialized in designing sustainable buildings. He was born in Delhi on 12 Jan1948.He has done his B.A (Arts and Fine Arts) from Cambridge University, UK. Ashok.B.Lall draws attention on industrialization and commercialization as building traditions which has been neglected. The study opens field on the research of how to make a building sustainable by using hybrid and redefine old construction methods in contemporary context in future.*

**Key words:** Ecofriendly, Grey energy, Hybrid system, Redefine old construction methods, Sustainable building, Vernacularism

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# I. INTRODUCTION

Now a days Architects are running behind new technologies to make buildings sustainable but at the same time the CO2 emission is emitting by transporting materials on the site if they are available at a distance from it. Air-conditioning also leads to global warming in such cases. This is an experimental project to find a prototypical solution for the urban workplace built on the principle of environmental and social sustainability. It is a spacial structure that responds to seasons and connects to the forest(Figures-1 and 2 ).

The things that make Development Headquarters, New Delhi an outstanding building in terms of sustainability are:-

1. Locally available materials at shortest distance and local labor.
2. Consultative and collaborative design process
3. Ecological quality and energy conservation
4. Low grey energy
5. Passive cooling
6. Innovative air-conditioning

## About the Building:-

LAND 3100 sqm
BUILT AREA 3100 sqm above ground
1550 sqm basement
POPULATION 250 persons

FUNCTIONS Conference ,Offices, Resource Centre
Recreation, Guest Hostel, Parking

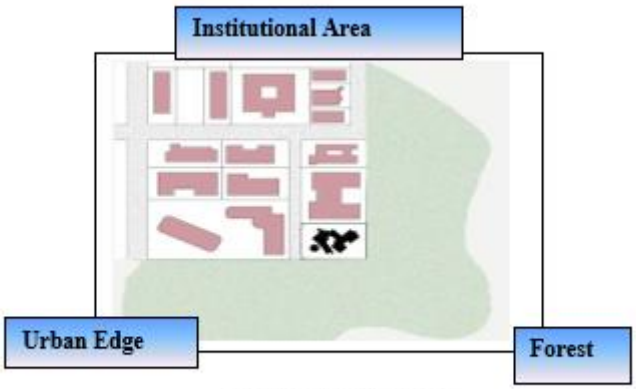



**Figure-1 Site Plan**

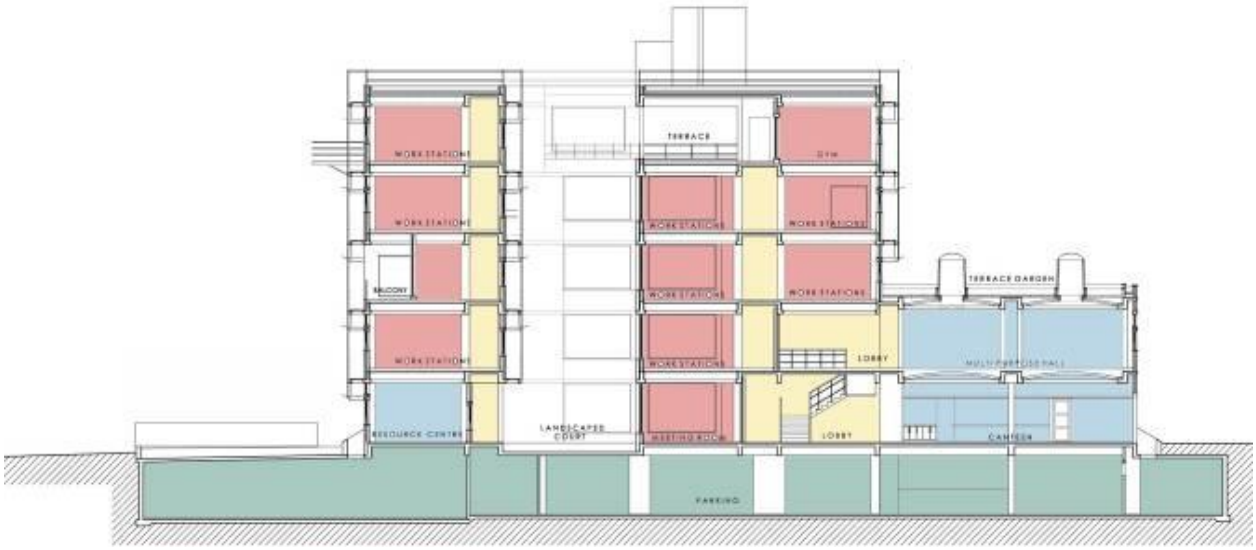
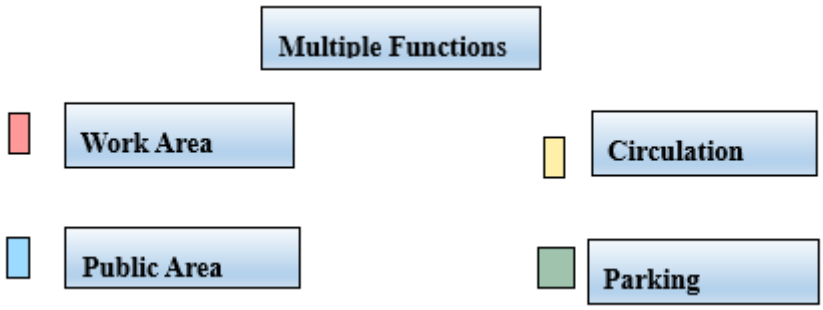


**Figure-2** Different areas in sectional elevation




## Climate Type: Composite

In summer

Day time temperature is 32 to 45 degree Celsius

In night time 27 to 32

In winters

Day time 10 to 25

Night time 4 to 10

Monsoon

Strong winds from north east and south east

**Microclimate Control:-**The microclimate is going to be controlled in DA is done by providing a courtyard with a water body in center of the building. All the other spaces are arranged around the courtyard giving natural light and proper ventilation inside the building cutting out the cost of mechanical ventilation. Other thing given for environment control is the vegetation on roof, window, terraces and facade which reduces the internal and external heat gain of a building.

Apart from above measures the orientation of the site is kept in such a way to get maximum advantage of natural resources during summer and winters.

## Space, form, and material:

The building of Development Headquarters was made by demolishing the old building standing on the same site ,tilted at 45 degree angle with original earthen blocks reclaim to make new blocks. The client wanted that new building should carry the spirit of old one having those of the old domed lobby, vaulted ceilings, central courtyard as the form and shape of new one along with old seminar room, circular, sunken, and covered with a prominent dome (Figure 3).


**Figure 3:-** Old and new building

The new buiding has 4500sq ft of usable area with six stories at place of old building which had 1000 sqft with one and a half story utilizing maximum permissible area of the site. The building is aligned with the street, which ends in a cul-de-sac at the site which is almost flat raising gently 1.2 m towards the forest.

Most users of the building arrive by bus; about a quarter arrive by car, motorcycle, or bicycle. After entering the building lobby the first thing we encounter is a courtyard with the pool of water with trickling sound which opens onto an amphitheater and garden.


**Figure:4** Plan of DA

Everything including meeting rooms, offices, corridors, stairs, terraces gathers around the courtyard which acts as a city square(Figure 4). The interplay of curvilinear and rectilinear surfaces and forms in both vertical and horizontal planes gives the building visual and spatial diversity. The building reflects the play of light through out the day and respond to climate receiving sunlight in winters and cutting down in summers capturing monsoon breeze. The shading grills on the north and south side protect the building from summer sun. Most materials are hand-wrought by skilled craftspeople. A baouli with sitting space is also provided at DA entered from a basement(Figures 5,6 and 7).


**Figure: 5** West side elevation


**Figure:6** East side elevation


**Figure :8** North Facade

## Low grey energy:-

The architect tried to meet the requirement of conserving gray energy by providing recycled or rapidly renewable materials at first preference and natural, locally sourced materials at second requiring little processing energy. Ninety percent of the interior and exterior walls are made of cement-stabilized compressed-earth blocks or cement-stabilized fly-ash lime-gypsum blocks. The earth removed by demolishing the old building was used into compressed earth block for masonry. Exterior masonry cavity walls are anchored with PVC ties.

Five-meter spacing between columns covered with vaulted domes are used for office space. The vaulted elements were precast on site and are bridged from crown to crown with four-centimeter-thick sandstone slabs. Vines climb the pergolas on east and west walls ,shading grills and daylight reflectors on the north and south sides moderate the summer sun. Waste from factory yard was used as tiles in random mosaic pattern on the roof terrace.

The curtain walls are made in glass of thickness five-millimeter as reduction of gray energy corresponds roughly to the reduction of glass thickness(Figure-9)

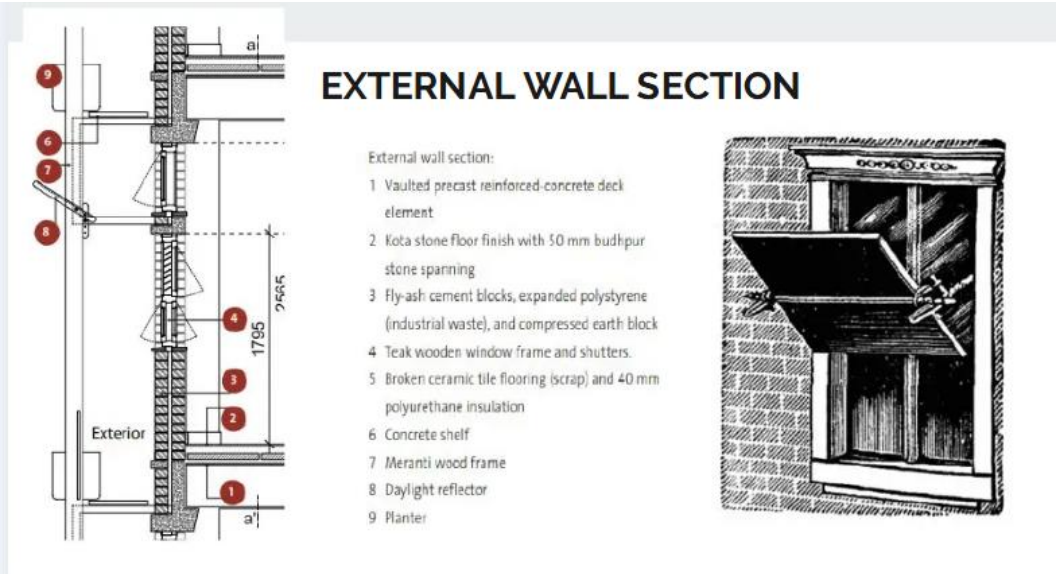



**Figure: 9** External wall section

**Passive Cooling and Innovative Air-conditioning:-**More than seventy percent of electricity is consumed in new offices. The best way to get rid of this problem is through Passive design which reduce the electricity consumption by reducing cooling load on the building and to use efficient cooling systems modifying micro climate(Figure-10). The architect has made building envelop opaque with only twenty five percent glazing along with light, vent and view taking idea from Vernacular architecture. Windows are shaded during warm seasons. Three types of glazing are used in the building: (1) fixed insulating glass panels with a 16mm air space, (2) operable windows with insulating glass with a 16mm air space, and (3) windows consisting of a fixed single-pane outer panel and an operable inner sash, with an adjustable venetian blind in between. Double-glazed panels are provided with a vacuum or argon gas. The glass used in windows is plain with no E-coating, the reason behind that is that the architect has reduced the area of glass on one side in glazing and reduced conduction by providing second later of it which makes it ten percent effective than E-coated glass and half the cost of it. Entire building envelope is moderately insulated. Exterior walls are designed for optimal passive thermal performance. The coolness in the building is achieved by providing greenery and the three-story trickle fountain in the courtyard which moderates the air temperature and comfort.

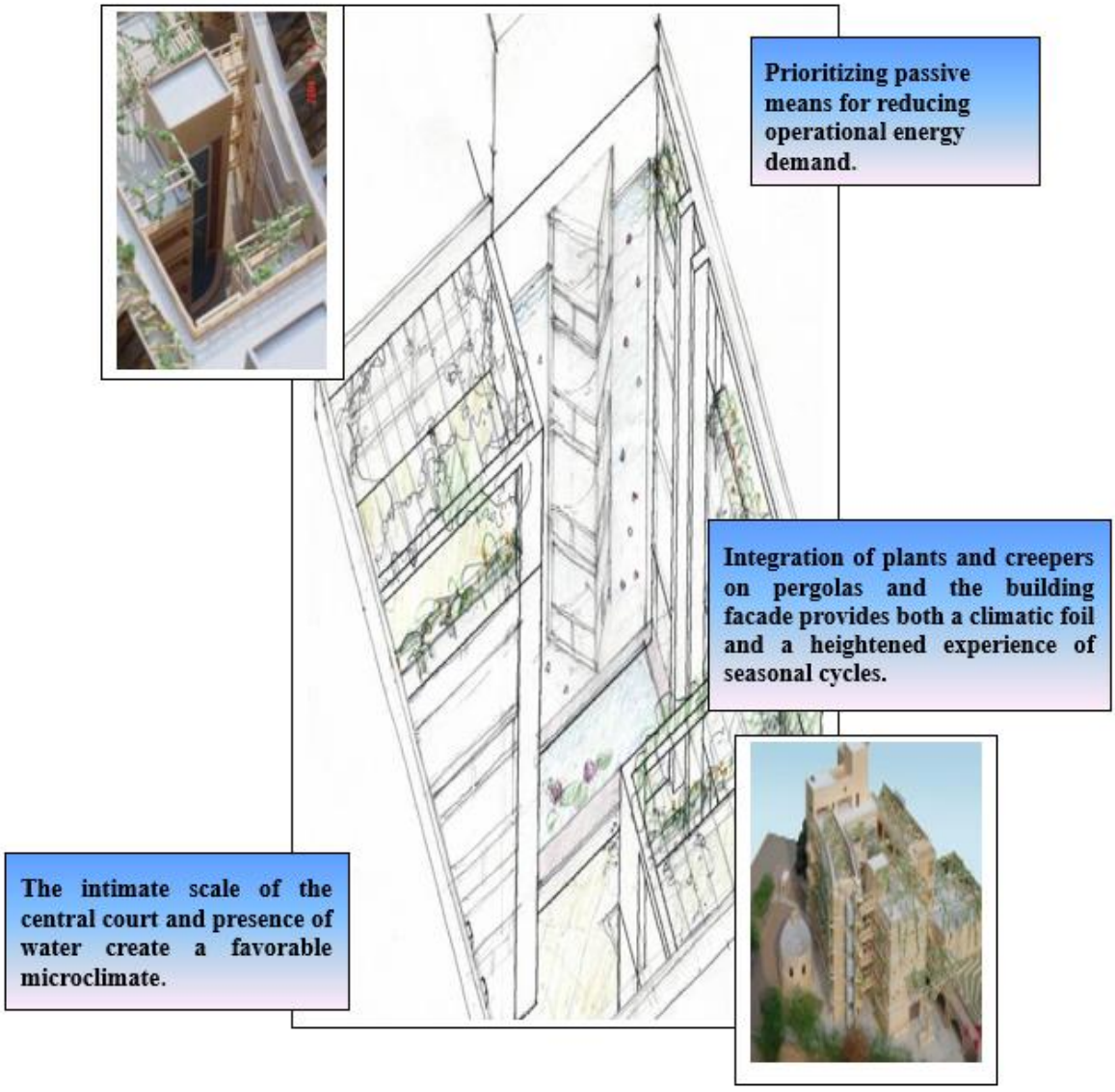



**Figure:10** Measures for Modifying Microclimate

Once the load is minimized by opting passive means less mechanical cooling is needed. Lall has used hybrid system(Figures-11) instead of conventional system of cooling in which cool air is introduced at the floor and return air is collected at the ceiling – reduces energy consumption on two counts. In the hot dry season the system would use direct and indirect evaporative cooling, and in the humid season refrigerant cooling. This system was not available in Indian market so the architect generated it with the help of air-conditioning consultants.

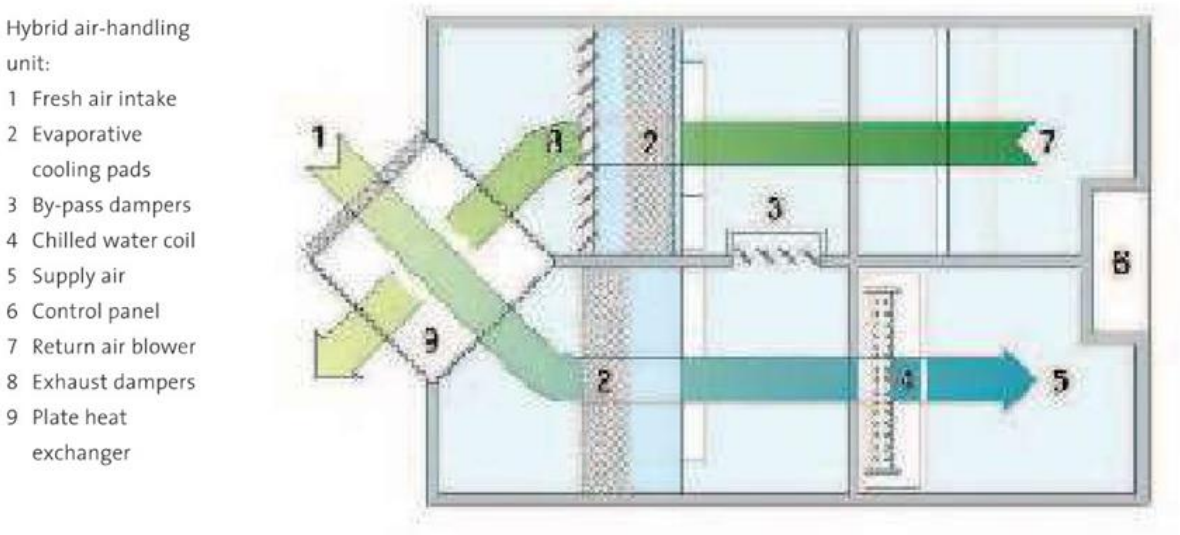



**Figure:-11** Hybrid System

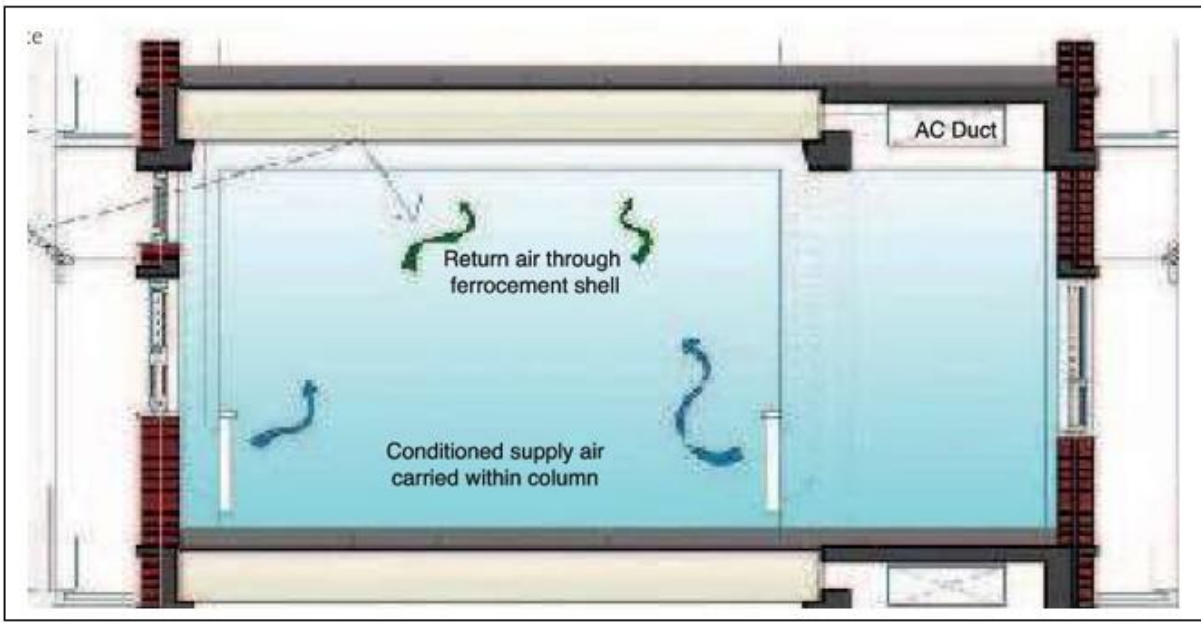



**Figure:12** U-shaped concrete columns housing the vertical ducts.

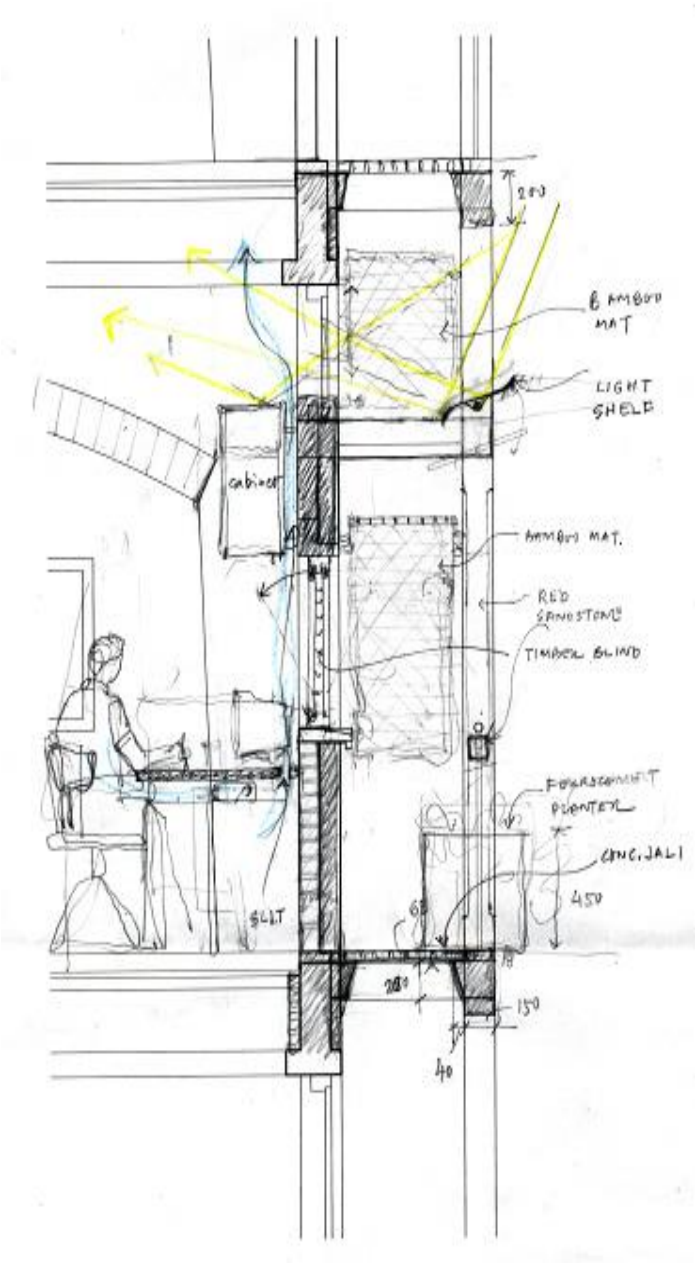



**Figure:13** Daylight Reflector

## Construction Techniques and Structural System:-

Following construction techniques are used in DA building

1. Efficiency and reliability with low investment.
2. Technologies to create wealth and knowledge locally.
3. Ferro cement
4. Shallow masonary dome.
5. Precast concrete screen
6. Stabilized mud block
7. Stabilized Fal-G block
8. Terracotta screen
9. woodwork for doors and windows

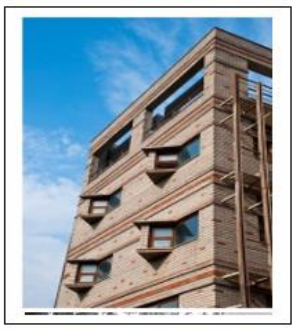


**Figure:-13**

## Structural System:

1.Floor spans: Ferro-cement channel, masonry dome. 30 % embodied energy saving compared to R C C slab.

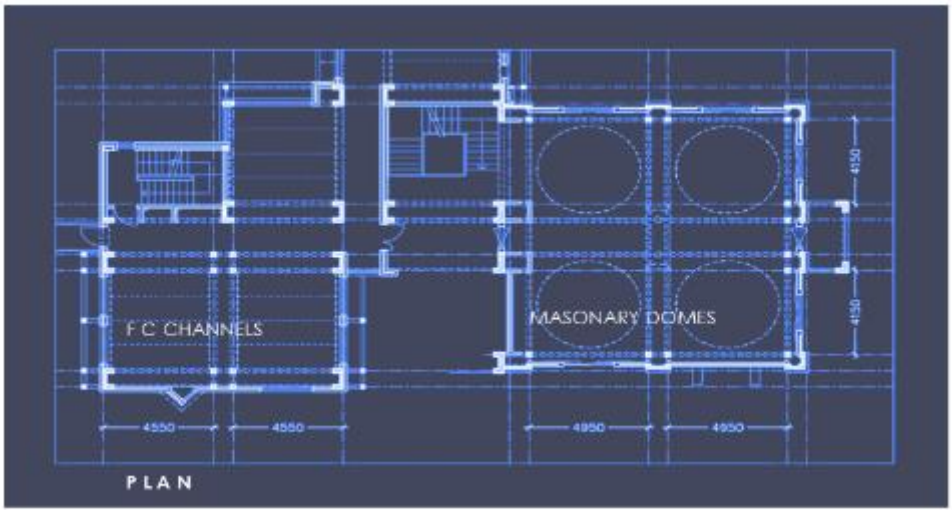



**Figure:14** Plan of DA building

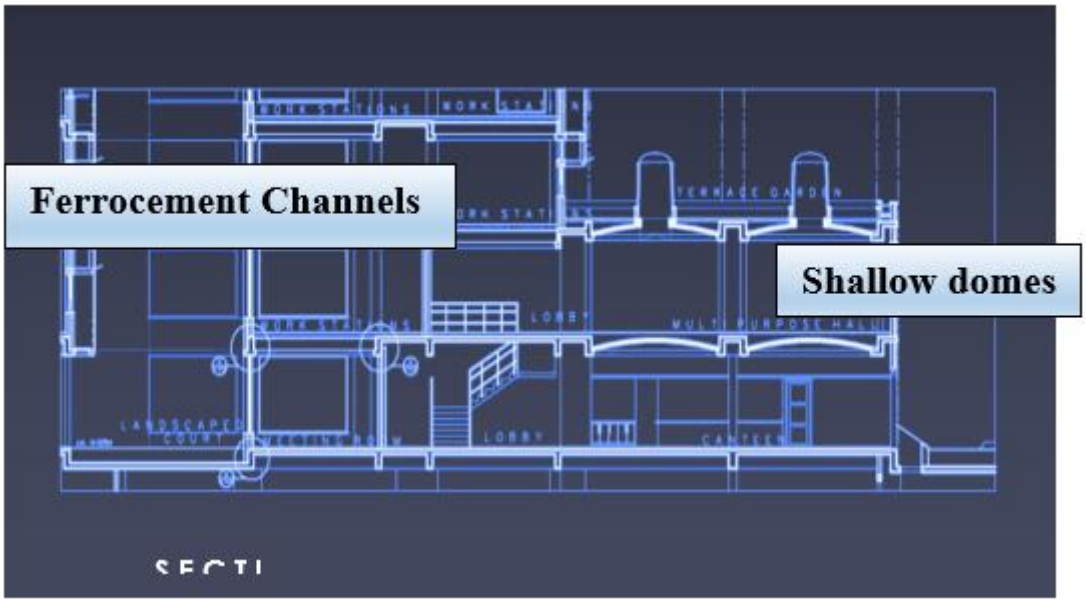



**Figure:15** Section of DA building

2.Short span R C C frame reduces reinforcement steel requirement.

**Figure:16** Short span R.C.C frame

**Water conservation:-** Clean water is a limited source ,so it should be recycled and used sparingly. In DA building the drinking water is supplied by municipal system and an on-site well serves as backup. All water is purified in a low-cost bio-sand, multi-layer gravity filter designed for rural application. Energy efficient fixtures like Low-flow faucets which close automatically after ten seconds, urinals with automatic electronic flushing etc are used inside the building.

The wastewater is treated on site in an aerobic-anaerobic digestion tank .This treated water is filtered and used in toilet flushing along with plant irrigation by drip irrigation system. The hybrid system of air-conditioning used on site has cut down the consumption of water about 45 percent than conventional system.

## Eco-Architecture applied to achieve following milestones:-

Responsibility towards use of scarce natural resources:-

a) all wood work and furniture uses timber from certified managed plantations

b) all rainwater at the site will be collected for recharging the ground aquifer

Recognition and promotion of local crafts in various building elements, e.g.

a) terracotta elements for fenestration

b) artisan based carpentry works

Promotion of an inclusive approach in design in

a) enabling persons with disability to reach all points with ease

b) enabling persons from all strata of society to feel welcome

Promotion of the principle of equal opportunities employment by providing:

a) child care facilities for parents, especially working mothers

b) security systems for women employee

## II. CONCLUSION

The work has examined various passive cooling techniques and locally available materials in Development Headquarters, New Delhi. The building is evaluated in various aspects as on the basis of their suitability to the climate, cheap and locally available materials, innovative air-conditioning by adopting hybrid method, reduction in embodied energy by using appropriate building materials for masonry and windows, water conservation by traditional method, economical and social adaptability etc. The building of DA fulfills two concepts of Architect Mies Van Der Rohe "Form Follows Function" and "Less is more".

The findings from this study suggest further research to explore guidelines for designing energy efficient buildings for sustainable development in the present era and future world.

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