ENERGY EFFICIENCY OF A MODERN OFFICE BUILDING

Case Study: The Technopolis Building, Kolkata.

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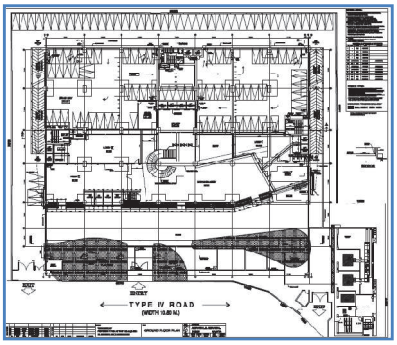
Abstract : Change is inevitable and we no longer see the types of building that used to exist 150 years back – which then defined the skyline of a city like Kolkata. Modern buildings are direct results of people's taste, behavior and requirements under the present context of liberty and limitations. The energy crises, the growing understanding of our limited resources have surely made us aware at the culture of modern buildings. Modern buildings that are consciously designed and the ones which are rated have three understandings at the base level - that our resources are finite and limited, that the impact of our deeds on nature may be irreversible and that we have moral obligations towards our future generations. The paper here is a study of – one such energy efficient modern office buildings in Kolkata, the Technopolis. The paper investigates how the building delivers in saving energy at various levels and explores the role of architectural elements incorporated to achieve thermal and visual comfort conditions.

Key Words – Energy efficiency, modern office buildings, sustainable features.

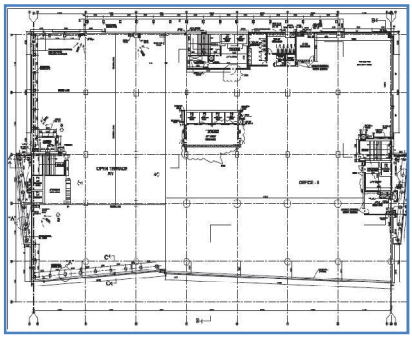
Introduction : Situated in the IT hub of Kolkata - The Sector - V of Salt Lake City, the Technopolis was the first green building to be constructed in Kolkata and one of the first conceived in India. The 14 storey building, functional since 2006, is first IT infrastructure building in India. The building mainly comprises of IT support houses. It was initially designed for 7500 professionals but now it accommodates around 8500 employees with 100 as floating population per day. The building function as a three shift office building and is centrally air conditioned. A typical floor in the Technopolis contains Lobby – Waiting, business centers (office spaces), conference rooms, food courts, reserved dining, kitchen, electrical rooms, toilets and services. Besides, the support services as per calculation includes parking spaces, AHU, battery load rooms, spaces for cooling towers, transformer rooms, ATM, security rooms and stores.

Orientation : The orientation of the building has been so adjusted so as to minimize the solar heat gain. The site is fairly square in shape but the building is oriented with its shorter axis and is laid exactly along the cardinal directions. The shorter axis is at an angle of 180deg from the North in clockwise direction. Thus, the orientation of the building holds good and

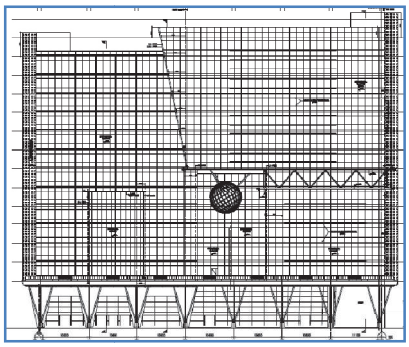
conforms for optimum utilization of the sun's path making it appropriately climatic responsive



GROUND FLOOR & SITE PLAN.
AREA – 5210 SQM.



TYPICAL FLOOR PLAN
AREA – 3750 SQM



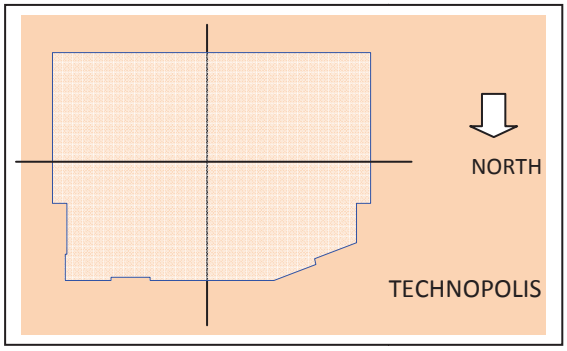
FRONT ELEVATION
NORTH

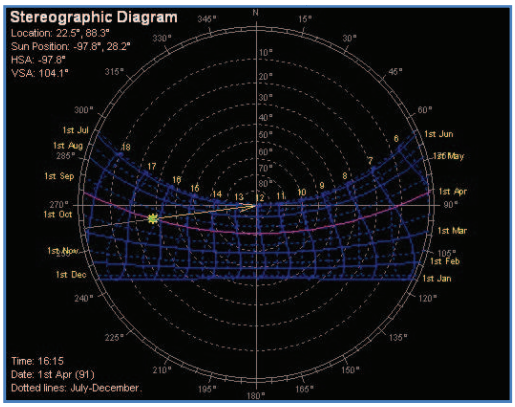
NORTH SIDE

SOUTH SIDE

EAST SIDE

WEST SIDE



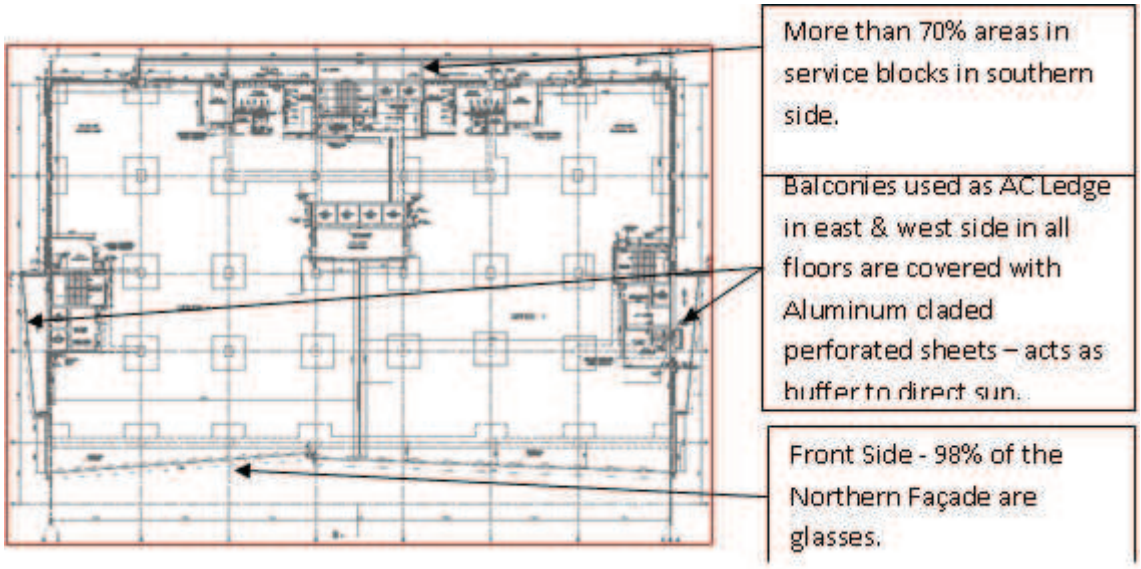


Sl. No.	Facade	Area (In Sqm)	%	Observations
1.	East	3048	19.22	The percentage of north and south exposure of the building is more compared to the east & west exposure.
2.	West	3057	19.27	
3.	North	4910	30.96	
4.	South	4846	30.55	

Façade Exposed –

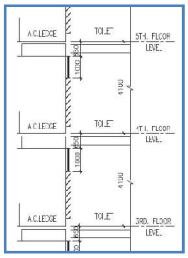
The following is the study of percentage of façade areas exposed in different directions.

The total facade Area of the Technopolis (all sides) = 249.34 x 63.6 = 15858 sqm



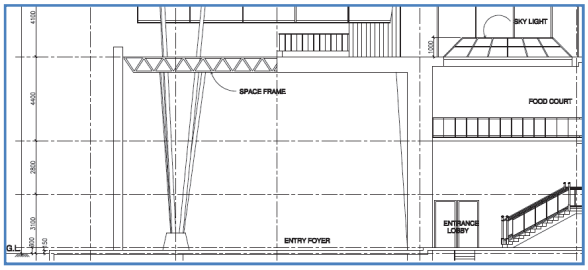
Observations: Architectural Analysis and Climate Responsive Strategies –

1. The figure suggests that the building has considerable north and southern exposure. The north exposure is utilized with the intention to maximize the inlet for diffused natural light which is absolutely necessary for an office building. But the letting in of fresh air or air circulation doesn't hold good for southern facade as the building is centrally air conditioned. Also, due to the positioning of service areas such as toilets, washrooms and staircase in the southern side - ruins the possibility of letting fresh air in. More than 70% of the southern facade has service blocks.
2. Along the western facade, the building is inclined at 5^{0}C to avoid direct sun-rays hitting on its surface. The west & east facade are with less surface area exposed. And the sides also have service spaces, AC ledge, balconies etc, which acts as buffers but still has some continuous glass façade and windows which may create heat gain, causing high HVAC load.
3. Floor Heights – The average floor heights are 4.1m. Additional storing spaces are created in the upper part in most of the office spaces in all the floors and false ceiling embellishments could be seen in all office spaces but the building being centrally air conditioned, the floor heights could not be worked out to be used as energy efficient strategy. The indoor air temperatures though remain at comfortable level for the HVAC systems - pleasant and conducive to support a perfect work environment inside the building.



4. Doubly glazed windows with lower U-Value, SHGC (Solar Heat Gain Coefficient) and LT (Light Transmission) reduce the inlet of heat from the external environment. But the building suffers in terms of optimizing daylight inlet. The entrance foyer at the ground floor is kept double heighted – looks

grand and also there is a provision to capture natural light in the space.



5. The building is centrally air-conditioned and hence the internal illumination is largely dependent on lighting fixtures.

   Normal internal lighting which uses 1.1w/sqft has been replaced by energy efficient lights with illumination 0.6w/sqft – minimizes power consumption.

   Positioning of the skylights in the common areas of ground and first floor ensures that natural lighting has reduced a huge number of electrical fixtures thereby reducing power consumption to a large extent.

6. The roofs also conduct appreciable amount of heat. This issue has been combated by use of over-deck and under-deck insulation in the roof.
7. Strips of jallis used in the east, west and south façade allows air circulation, acts as buffer and prevent sunlight from entering and heating up of the building.

Other Features –

Only 60% area in the building facade is in brick masonry.

More than 30% building materials comprise of either recycled or recyclable products. Use of recycled and recyclable materials helped in reduction of exploitation of natural resources.

Overall water consumption is 20% lesser than standard water consumption calculated for such a building. Fresh water consumption is – 75,000 liters per day - the building draws 3,25,000 liters / day less water from underground thereby saving the ground water hydrology. It is sufficed by the recycled water coming from sewage systems and rain water disposal units.

Water is recycled and is used in fountains and for roof gardening. Roof gardens also collect rain-water which is recycled to be used for landscape and other purposes.

Environmental protection measures taken during construction stage.

A huge service tower to house the various service units.

Motor fans in the basement keep temperature and environment of the basement comfortable. The basement houses car-parking and large number of service rooms.

Alternative fuel vehicles (electrically charged ones) are used for mini transportations.

Colored dustbins are used for quick segregation of waste.

Conclusions – The importance of energy efficient buildings has assumed great urgency today. Change is inevitable and the buildings have to have a new definition every day. A sustainable society restores preserves and enhances nature and culture for the benefit of the present and future generations. And so, the designers need to be more dynamic in their design approach. The study of Technopolis reveals that the building sets some core features supporting sustainable development. The building sets an example that designers with little responsibility and knowhow can make a marked difference in the culture of modern

buildings. They have to understand that our resources are limited, the impact of our deeds may be irreversible and they have moral obligations towards future generations. In the light of fast depleting resources, energy scarcity and increasing environmental pollution, innovative ways to cut down energy consumption is a must.

Lastly, on a different perspective, the study also asks for an answer that in midst of fast growing changes, whether the likes of Technopolis is the only answer to the built forms we have. The role of government in incorporating energy efficient parameters in every new building also holds key. This being mentioned here as the buildings of the past which are functional for as many as 150 years do also function as modern office buildings and are examples of continuous sustainability. Whereas the projected lifespan of a modern building like Technopolis is approximately of 40 years. So, there may be a comparative approach if some intermediate solutions can be reached in recommendation for future buildings

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