SUSTAINABLE APPROACH TO LEARNING CENTRE IN URBAN FABRIC

By

MANALI BHATTACHARYA

A REPORT

Submitted in partial fulfillment of the requirements for the degree of
Bachelor of Architecture.

University of Mumbai

2018

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AKNOWLEDGEMENT

As I present this dissertation, I would always remain grateful to the people who have helped me in the different stages of this project.

I would like to express my gratitude to **Ar. Sandeepkumar Prajapati** who was my guide and mentor, and helped me conceptualize my thoughts into spaces and provided encouragement at all times.

I would like to thank my **family** and friends for always supporting me ,believing in me and helping me in all the ways they could.

I'm thankful to my Dean, **Ar.Swapna Joshi** for the year round support and guidance.

Also thankful for the college facilities like the college library and computer laboratory.

Sincere thanks to **Ar Poonam Mahatre** and **Ar Abhishek Kadam** for their immense help and guidance throughout the academic year.

Finally thankful to authorities of the case studies visited for their extended help.

1. ABSTRACT

Education is humanity's only hope. But we often forget education is nothing without its practical implementation and logical utilization. We might be getting educated but are we getting wise?

A person spends 1/3rd his life getting educated at an institute we call ' school'. His childhood school experiences at such learning centres forms a major fragment of his personality and temperament. As we see in today's youth – not only are they confused but also impulsive and impatient. The chief cause of this is the environment they thrive in. The space a person spends most of his time it has the maximum impact on his mental health and composure. When this space asks you to sit at one place for 8 hours straight and not make you wonder or ask question, this prolonged effects are corrupt.

As a designer of space, architect's role will be to understand the psyche of the child and design space accordingly which will not only trigger curiosity in him but will also make him positive and happy in the environment that he spends most of his day in.

Designing of learning centre spaces are hence very crucial, and is a direct reflection of how a child will turn out in the future. therefore, ***learning spaces should be designed and treated as practical laboratory*** where lessons are based on experimental knowledge and understanding while also ***considering nature as an integral part of the whole system.*** A closed loop like a schooling system must not forget the current demands of climate change and the adverse effects we are causing to the environment we blossom in. Hence with ***innovative spaces, sustainability comes hand in hand.***

If we start imparting seeds of self sustaining ecosystems right from childhood, its impact would be much fruitful. Right from theoretical studies to hands on practical knowledge will help a child understand the urgent need and ways contribute to a sustainable living.

This paper focuses on methods and techniques architects can explore to **enhance the policy of sustainability in schools via means of planning, learning spaces, and overall consideration of the environmental impact at an urban context.** A modular design will propose how well designed spaces at institutional level will add up in magnitude at an urban scale, which can be further repeated with consideration to site context.

If the built fabric the students are surrounded in imparts the importance and the urgent need of sustainably in all aspects of the society, they are automatically wired to maintain a healthy relationship with the environment while having a sustainable lifestyle.

One needs to realise that with changing times and climate, just like the design, the importance and utility of a space changes. We have reached a time where sustainability is not just an option anymore but the need for the future generation to incorporate sustainable habits in their lifestyle so as to experience a holistic change in the times to come.

Sustainability includes a lot of factors, some of which this dissertation will focus on with respect to schools are :

- Wind energy harvesting
- Solar energy harvesting
- Sustainable construction in terms of material use
- School food production and catering services
- Harvesting and effective use of water
- Reduce carbon footprint
- Design of adequate green spaces

Overall design of creativity triggering spaces at school level will be explored. ***Interactive spaces for students to learn through practical approach so as to tackle problems and take correct decisions as future responsible citizens. Learning spaces will henceforth be addressed as practical laboratory where lessons are more experimental based and which embody eco friendly initiatives that reduce negative environmental impact which will result in a much greener and climatically stable future.***

2.1. INTRODUCTION

With changing times, it is very important that the spaces we thrive in or spend most of the day acts as an incubator and helps us grow into a better human being. Most importantly it should enhance our overall personality and mental health. Just like we upgrade our gadgets with newer version, it is time we upgrade our very roots of personality development space i.e the built form of imparting knowledge we call a 'school'.

Studies show that the kind of spaces a students experiences daily has a huge impact on his character and temperament. But what we see is a 4^{th} grade student and a 9^{th} grade student both sitting in a classroom of four walls studying different topics in the same manner. Something doesn't add up here !

It is as simple as understanding, when a person takes a vacation he prefers going somewhere to disconnect from the civilians preferably some lush green countryside or any other abode of nature but we fail to realise the deep rooted reason behind it is **- humans were wired to adapt to nature and natural surroundings and hence they seek nature when they are mentally exhausted.** Just by looking at a picture of a secluded beach or a lush green trek gives a momentarily peace of mind. This is the impact of a space on humans, and as architects – the fabricator of spaces we must realise how important each space we design is in a person's daily routine.

School is a person's second home they say. Students spend most of their day time in school. When we say school, we think about a secure campus where students are gaining knowledge and building character. But it is not always about learning through textbooks and flash cards. Children learn more through experiences and that's why in Montessori they are made to play with colour and blocks but what about the cube they are paced in?

Any space with an intention of parting knowledge has to show characteristics of it – it cannot just be another room which can later be converted into just any other room. **Spaces especially school spaces should be an incubator for kid's to think outside the box but ironically enough they cannot do so while being enclosed in one such box.**

A child's mind until the age of 25 is eager and enthusiastic and schooling spaces should use that to their advantage to make them more creative thinkers , problem solvers and a responsible citizen of the nation.

Therefore, it calls for an **urgent need to rethink our learning centres while keeping in mind the need to maintain harmony and balance with nature**. A learning centre which imparts education but also portrays the current world environment situation and not only makes them aware of the issue but actually teaches them via different mediums how they can be a part of the change both at school campus level and at individual level and the benefits of it at a global scale would be something architecture and planners must focus on. One such module in an urban fabric if repeated will create a huge impact of the carbon footprint of the individual campus and the adjoining neighbourhood. When this module works at an educational institute level, it can be further redesigned for other typologies of the society, ultimately causing global change.

2.1.1 BACKGROUND STUDY

To understand the timeline of educational spaces , it is important to refer the Indian traditional learning hubs and how it has evolved to present day classroom systems.

Gurukul System

Dating back system to the Gurukul of learning- palm leaves formed the writing pads and more focus was given to oral learning rather than in the form of tests for valuation. This discarded the feeling of competition or comparison amongst students which helped the focus on themselves. Religious knowledge based on Upnishads were the main subject of learning. Major importance was given to discipline, routine and behaviour of an individual.Most relevant aspect of this kid of system was the teacher – student boarding type. All time availability of teacher as well as campus being home to the student played a major role in the all round personality development. Along with religion, medicine was also the core subjects. Memory enhancement through recitation of verses. More logical and reasoning to situations. This type of teaching mostly happened out in the open which lead to a close relationship to nature and a sense of harmony. One day classes could be conducted under a tree the other day in an agricultural filed. Students were aware of their surrounding and were always alert which helped increase concentration. Nature was not a part of learning – as the became a part of nature.

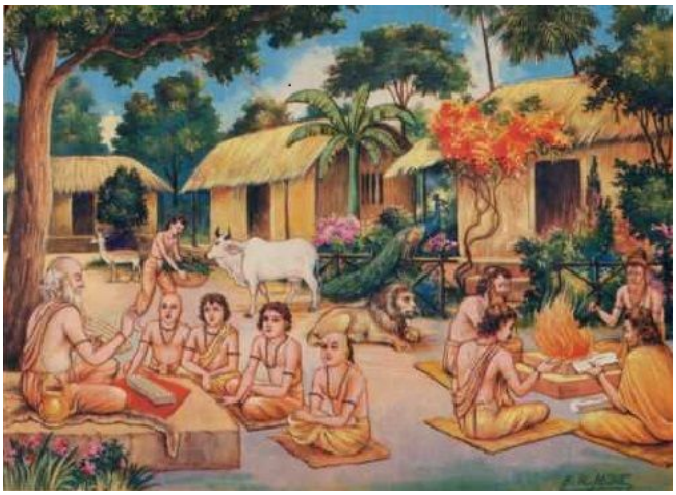


Fig. 1 : gurukul system – spaces which imparts wisdom

One would realise that even if there are no classes or lectures on a particular day, the campus provides so many opportunities and freedom at an individual level to roam about and learn from observation.

Education in Medieval India

The beginning of the first millenium and some years preceding saw the starting of universities like the Takshashila University, Nalanda University, Vikramshila University and Ujjain. Concrete subjects of study came into being like Astronomy, Grammar, Logic, Philosophy, Literature, Law, Medicine, Hinduism, Buddhism and Arthashastra (Politics and Economics), Mathematics and Logic. Each of the university specialized in a subject, with Takshashila focusing on medicine, the university in Ujjain on astronomy, whereas, Nalanda dealt with almost all the branches of study. Education was widely spread with the availability of schools in most of the villages in India, during the 18th century. Medieval times also saw the establishment of Madrasas and setting up of libraries and literary societies.This is the time where sense of competition came into picture.All the listed subjects lead to using different aspects of logical reasoning, critical thinking and practical approach to life. A sense of enclosure was observed with the built campus. Even with enclosure , the spaces were strongly connected to the nature and were interactive in character.

Fig 2. Nalanda University

Even with the buitform , there was no sense of seizure. The buitform complemented the semi open and open sapces.

Existing educational status

A campus with multinational facilities like swimming pool,high tech computer laboratories, auditoriums, interactive spaces, sports grounds, list of extra curriculum activities and confining classrooms back to back. More number of subject with periodic tests but less understanding. More books to refer from and never ending knowledge pit - google but no logical reasoning. Students are trained to become rot learners to pass tests. Extra coaching classes after school hours. No sense of belonging to the builtform. More pressure due to high level of competition and more number of suicide cases due to lack of self worth. Lot of scope of opportunities but not in the right direction.

Fig 3. International schools – concrete blocks

One would feel with all the advancement in technologies, the graph of students should be ever roaring but that is not the case. **Being connected to the nature and natural environment plays a very important in a child's growth and mental health. Due to rapid urbanization, most of the schools have also started growing vertically, which further reduces natural interactive spaces. In the long run, it has immense adverse effects on the child's psyche and health.**

Hence, it high time we start using technology to our benefit and bring **back harmony of built to nature.** As the current architectural fabric is highly emphasising on 'greens' and eco friendliness, it is about time our very first knowledge centres become sustainable campuses. Classrooms be no longer confining spaces but rather spaces to trigger logical reasoning and critical thinking. Teaching techniques be more experimental oriented rather than textual and overall campus should provide the student a sense of belonging and harmony with the environment both built and natural.

Once the design of spaces starts from the point of sustainability, the spaces automatically start becoming more interactive and inquisitive. To achieve that one must know what all factors are related to sustainability in architecture and how to design those so as **it does not simply look like an installation but the very starting point of the design.**

Architecture has the power to trigger nay kind of emotion into the user of the space – when a person design in accordance to nature, the deign ultimately calms the user i.e the students. When the mind is calm it focuses better and leads a person to think and ask critical questions and makes him observe his surroundings. These kind of healthy mind exercises are necessary to keep the mind fit and apt.

Once the mind gets trained to be calm, it becomes a habit and ultimately a person's innate nature to behave and react to situations with patience and perseverance. As soon as the mind is healthy, it reflects on his body and temperament. When a person is lifted mentally , his intellectual level automatically rises making him more confident and knowledge hungry.

But with urbanization at its peak and rapid growth of world population, more natural resources are being consumed than replenished. Industrialization, globalisation, economic restructuring has lead to environmental and hence life threatening impacts like : air pollution , depletion in groundwater table and contamination of water sources, uncontrolled use of fossil fuels, soil degradation etc. All these factors are co related which on a global scale, result to an unmanageable climatic drift.

According to a recent UN report " The world's cities occupy just 3 per cent of the Earth's land, but account for 60-80 per cent of energy consumption and 75 per cent of carbon emissions." And "As of 2016, 90% of urban dwellers have been breathing unsafe air, resulting in 4.2 million deaths due to ambient air pollution. More than half of the global urban population were exposed to air pollution levels at least 2.5 times higher than the safety standard."

These facts call out for an immediate action for the human race to take serious steps towards self-sustaining ecosystems.
Cities being the hotspot of degrading environmental factors – they should be the epicentre for sustainable development. Starting from spreading awareness to utilizing sustainable methods of energy conservation , there are many pockets which could act as an excellent module for so.
One of them being an educational institute.

There are many NGOS like Green School, Eco schools, etc which are working towards sustainability in schools. Since they are not aided with architectural space knowledge, all they do is install sustainable plugins into already existing school buildings which works good too but its effect will be more enhanced **if the learning spaces itself are designed as a part of the sustainable system.**

2.1.2 WHAT IS SUSTAINABILITY IN ARCHITECTURE ?

Sustainability in Architecture has no concrete definition. It is a state of flux which changes with time and environmental conditions. The terms has certain evolution from words like 'environmental design' in 1970s, 'green design' in 1980s, 'ecological design' in late 1980s and 'sustainable design' in 1990s.

"**sustainability**" is the study of how natural systems function, remain diverse and produce everything it needs for the ecology to remain in balance. It also acknowledges that human civilisation takes resources to sustain our modern way of life.

In simpler words, **to sustain, and hence to keep a balance between produce and usage.** Humans currently have more than exceeded the rate of usage to the rate of replenishment.

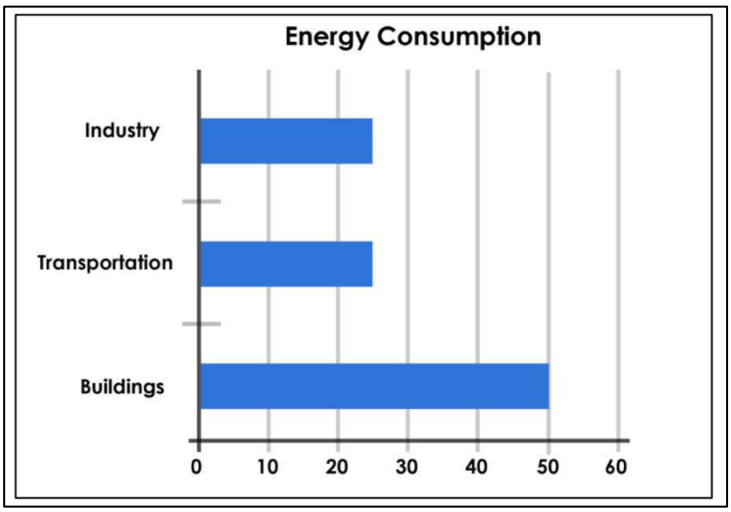


Fig 4. Energy conspumtion by building (Cebeci, 2005).

Sustainable architecture is architecture that seeks to minimize the negative environmental impact of buildings by efficiency and moderation in the use of materials, energy, and development space and the ecosystem at large. Sustainable architecture uses a conscious approach to energy and ecological conservation in the design of the built environment.

The idea of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations.

Source: Wikipedia.org

The attributes of Sustainability are :

1. **Environment**

   The method employed is to change the way schools are designed and how students are

- being educated about the real-world impacts. Therefore, the role of Architecture is emphasized and forced to push its envelope in providing a design solution where Schools will be the primary Teachers. This initiative will offset the Environmental impacts by

thousand folds as the future generations are taught to make sustainability as their way of life.

2. **Social**

   The active and interactive nature of design based on sustainability principles are expressed and become an integral part of the architecture itself enhancing the social dialogue around sustainability. By retrofitting and redesigning, the school becomes a way of giving itself back to the society and its community.

The thesis anticipates concentrating on its primary (students) and secondary end users who are the future generation to graduate with a full understanding of sustainability and evolve their lives on its principles which would in turn affect the society at large in the future towards its shift for a *sustainable future* thus encompassing the main intent of this thesis.

2.1.3
INTRODUCTION TO SUSTAINABLE SCHOOLS

A sustainable school adopts a "whole-school" approach; one that extends beyond the curriculum and addresses the entire planning, operation and management of the school facility. School sustainability policies can reinforce what is taught about sustainability in the classroom, improve the school's own carbon footprint and strengthen public relations with the surrounding community.

Educating for a Sustainable Future: Clarifying the Concept

Education is the primary agent of transformation towards sustainable development, increasing people's capacities to transform their visions for society into reality. Long gone are the days when 'environmental studies' was just another subject within the four walls with a 2hr written examination at the end of the term. The present day condition of the environment demands classroom to spill out of the walls for the users to get a reality check on the circumstances. Teaching children to understand and appreciate their world will make them more responsible about their environment. The good news is that today's children are in a position to be better educated as environmental awareness is increased and is incorporated throughout daily activities. And while many children may be taught about environmental responsibilities at home, schools are in a spotlight position to further this kind of awareness and understanding (Clemson.edu, 2012).

US Former president Bill Clinton has also spoken to our responsibility to the environment, and specifically directs his comments to schools: "*I think that we should begin in elementary schools teaching people about sustainability... we know that children's instincts always direct them to be more green... We should give every young person the means to maximize the environment of their schools. They're all in school somewhere—public or private. We should be right now engaged in retrofitting every school in America*."

A lot of factors like urbanization, industrialization, economic growth amidst the immense population growth in India, challenges its need to rely on the natural resources.. The ultimate drivers of environmental degradation are population growth, inappropriate technology and consumption choices, and poverty, leading to changes in relations between people and ecosystems, and development activities such as intensive agriculture, polluting industry, and unplanned urbanisation.

For addressing the various environmental problems, Environmental Education for Sustainable Development (EESD) is emerging as an essential tool to change student's commitment, motivation, stewardship, behaviour and attitudes (UNESCO, 2011). To achieve the goals EESD, the active teaching learning approach is widely recommended by several earlier workers.Field based education is one component of active environmental education. There is a strong agreement that fieldwork is advantageous for learning in the biosciences (Davenport, 1998; Baggott and Rayne., 2007), and nature studies has traditionally had strong connections with fieldwork, dating back to early naturalists such as Gilbert White, Charles Darwin and Wallace (Davenport, 1998; Baggott and Rayne., 2007). ***However, in practice, field work in the environmental studies at school level is limited or negligible and there is a very little research on the experiential learning at school level in India.***

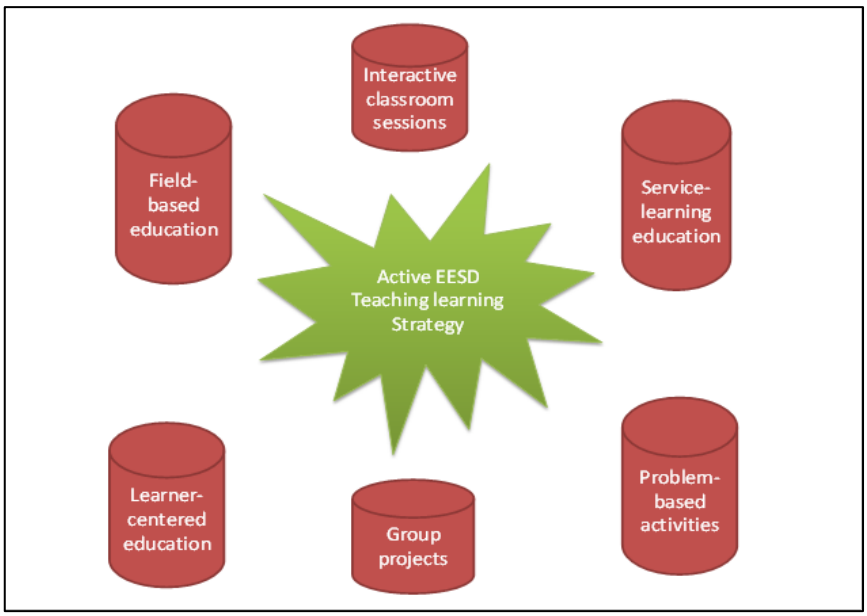


Figure.5 Basic components of active environmental education

Active teaching learning methods involve students in the learning process such as ***discussions, writing, asking and answering questions and engaging in their own learning.*** These activities in turn require students to use critical thinking skills such as analysis and evaluation (TIEE, 2006).

Many a times the above said field work also fails when the students visit say a vermi compost pit at some sanctuary and come back to school campus.This is due to the failure of understanding that nature is ***not a by product but a process***. To get the in depth understanding of any phenomena one has to be critically noting the entire process rather than just the end result.For students to understand and hence ***practice sustainability, they need to sow the seeds and witness the growth of the process so that they themselves can practice it in the future. Hence sustainability should start at campus level.***

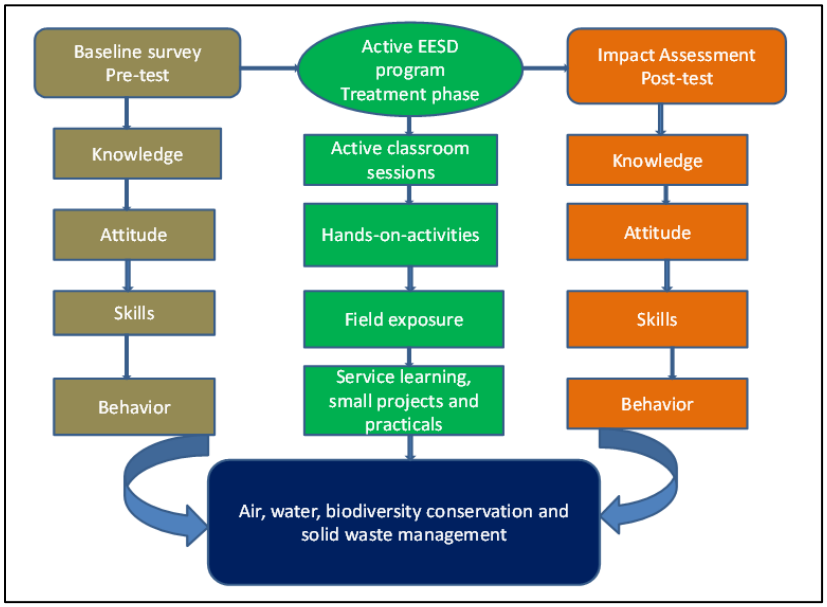


Figure 6. A schematic diagram of pre and post test design for EESD modules.

The present scenario of Architecture focuses on green buildings, bio facades and 'sustainable ecosystems'. For architecture to intersect education, designing in harmony of the environment becomes the base plate to start from. This means the architect must provide different configurations for learning environments, more **flexibility, adaptability, movable**

components and future conversion to other uses. Conservation or harvesting any form of energy goes hand in hand while designing spaces.

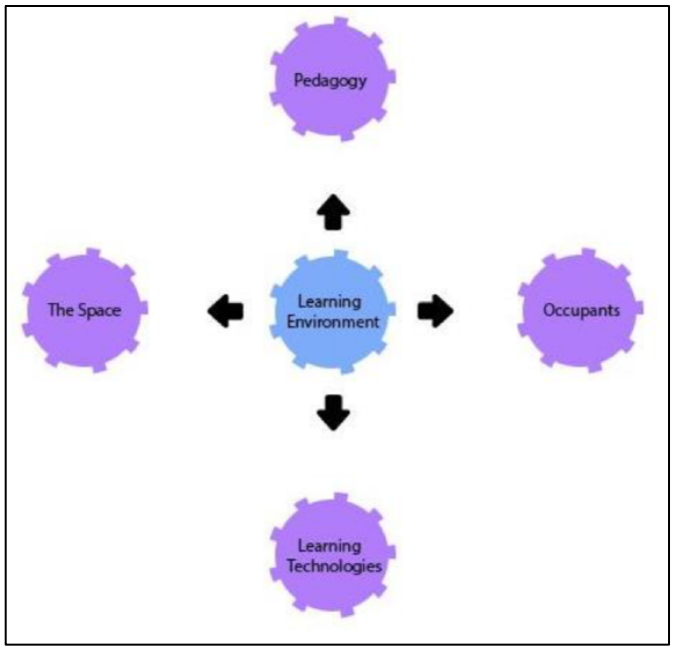


Figure 7. Old learning frameworks in schools

Old Design Model' showing linear approach to designing space , its contents, and its users.

Each aspect of design worked well but the amalgamation of these spaces was not thought of hence no scope for experimentation and future expansion in terms of ideology and teaching techniques

Source: 'Guidelines for the design of Sustainable Learning Laboratories that teach through *Architecture' by Jim Jones*

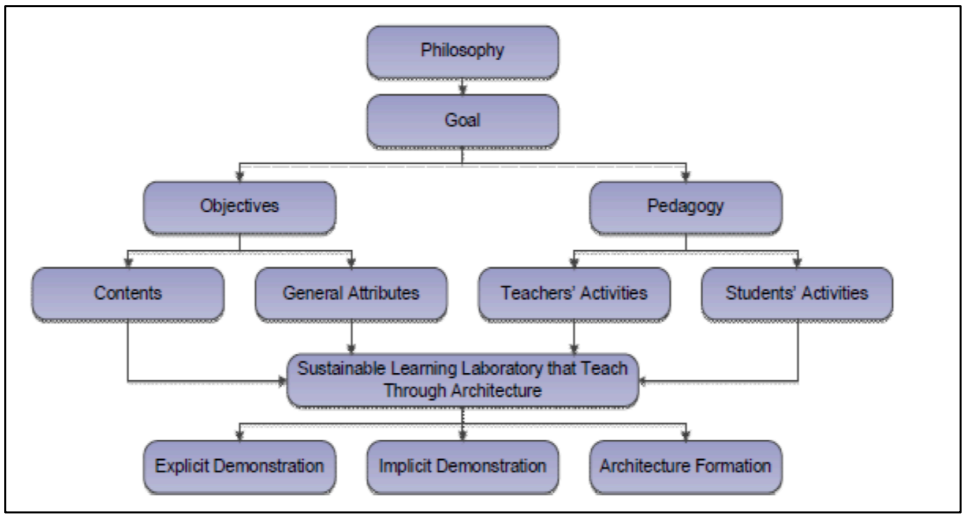


Figure 8. A new framework for designing buildings that teach

A new framework is suggested in the for designing buildings that teach, which involves combining a School's philosophy and goals of sustainability with a Pedagogical system. This model looks at placing teachers at the centre of learning as conductors where the orchestrated learning provides opportunities for students to learn from both new material and old knowledge.

Since **children learn from the entire context they need to have a sense of safety to indulge in free learning, which makes it important to put extra care in designing the environment.** The third component identified is 'active processing' or the process of learning such as reflection, analysis, contemplation, questions, personal analogies and so on.

The research stresses that for a sustainable learning centre, environmental factors can be important inputs to architecture and form and proposes a framework intended to bring together academia and architecture to form a sustainable future.

Below are the study results conducted by ***Green Schools*** on sustainable school campus and their effects on different scales :

STUDENTS	SCHOOLS	PLANET
98% of studies conducted by Stanford University revealed a positive impact as a result of environmental education.	Sustainable schools use 33% less energy and 32% less water than conventionally constructed schools.	Sustainable schools are designed to act as living laboratories to teach and embody eco-friendly initiatives that reduce our environmental impact.
Sustainable schools with natural light sources reported significant increases in test scores, and progression in reading and math.	Sustainable schools save, on average, $100,000 per year on operational costs.	Sustainable school buildings are constructed with eco-friendly materials that decrease the reliance on fossil fuels, thus reducing carbon emissions.
Studies reported students were able to equally engage in environmental education regardless of where they fell on the intellectual spectrum.	Sustainable schools reduce absenteeism, improve health of students and staff, and increase indoor air quality. One study reported a 38.5% reduction in asthma, the number one reason for student absences in the United States.	Green roofs last 30-50 years longer than typical roofs, reducing the amount of waste produced from more frequent replacement.
Studies reported increased student participation and engagement in class.	Sustainable schools receive direct and indirect savings from increased efficiency, higher teacher retention, and lower health costs, saving about $70 per square foot, 20 times higher than the initial "greening" costs.	Sustainable schools offer more opportunities for outdoor and hands-on learning, which inspire the next generation of environmental stewards.

Fig 9 : effects of sustainable approaches in school campus

INFERENCES :

- Provides the youth with a sense of responsibility towards environmental at a very early stage with good knowledge of sustainable implementation in the lifestyle
- On campus related activities will keep the students engaged and become reasons they are looking forward to attending schools
- School campus can act as a hotspot for other such sustainable seminars and workshops which encourage other classes of society for their participation in enhancing environmental and reducing carbon footprint – students can be the conductors of these programs as they'll be having good learning experience on their campus
- Due to such greens in campus and other on going activities, students can always learn something new not necessarily in the classrooms – will boost their mental health and confidence.
- Such interactive campus give opportunities for critical thinking and logical reasoning along with triggering curiosity and boosting creativity.
- Students themselves will understand the importance of space as they see how spaces can directly affect behaviour.
- Overall campus will have a much lower carbon footprint and will help enhance the micro climate of the neighbourhood.

2.1.4 PRACTICES OF EDUCATIONAL CAMPUS SUSTAINABILITY :

The overall goal is to produce buildings that take less from the earth and give more to people"

— A Primer on Sustainable Building, The Rocky Mountain Institute (1995)

A sustainable school prepares young people for a lifetime of sustainable living through its teaching and day-to-day practices.
A sustainable school adopts an integrated approach across the campus, curriculum and community. It hence explores sustainable development through:

- Its campus planning and buitform planning – relation of built to environment.
- How designers amalgamate sustainability in the design – not merely adding the plugins
- Its teaching and learning provision, i.e. its curriculum,
- Its values, ethos and operation; by focusing on the environment and campus, and
- Its engagement of local people and partners which comprise the community.
- Improve student learning
- On campus organic food production and utilization in cafeteria.
- Save operating and maintenance expenses–at little or no additional
- construction cost
- Increase student, faculty and staff productivity
- Contribute to meeting the Greenhouse Gas Action Plan emissions reduction
- Reduce fossil fuel dependence, energy consumption and air pollutants
- Increase campus energy security and reliability
- Create healthier indoor and outdoor environments
- Support markets for non-toxic and sustainable building materials and supplies
- Educate students about green design, environmental impacts, and sustainability

Examples on how schools follow one/more of the below techniques as an approach to achieve sustainability :

- Recycling waste/ waste management
- Harvesting sunlight, water
- Producing on campus food
- Maintaining adequate quantity of greens in campus
- Maintain thermal comfort
- Using sustainable materials

1. ***WASTE MANAGEMENT***: students are taught theoretical bifurcations of waste generation and its segregation in the classrooms – the on filed (in campus) they are made to manually segregate their week's waste production and collect them under different waste treatment categories like :
    - waste produced in the form of recyclable paper , paper bags, wrapping materials, cardboard, newspapers, magazines, etc.
    - glass, plastic , metals and cartons are recycled separately
    - landfill waste like pens, plastic bags, markers, Styrofoam, non compostable food containers, paper cups, lids, etc

    COMPOST PIT : the kitchen waste produced including other compostable materials are processed in the compost pit on site and utilised later as fertilizers for plants as it contains many nutritional values.

    Architect's eye : the main role of a designer is during the planning stage , the location, the materials, the sizes of the equipment's, how it is to be segregated , how to get it transported with ease, how biodegradable waste is to be treated on campus, its orientation and ease of services on campus will have to be highly thoughtful. What age group of students will participate hence its space proximity chart , also incorporate design principles to minimize waste generation on campus and prevent students from littering. To calculate which waste treatment plan will workout for the campus according to its location and footfall.

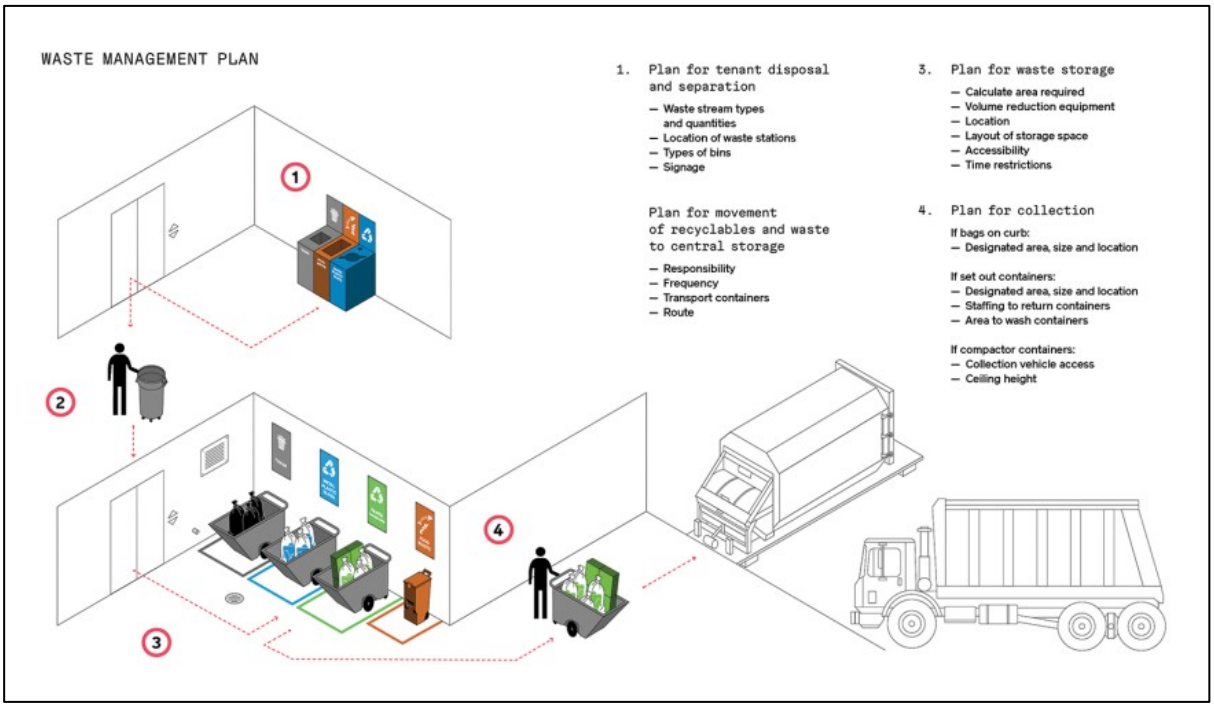


Fig. 10 waste segregation and design considerations

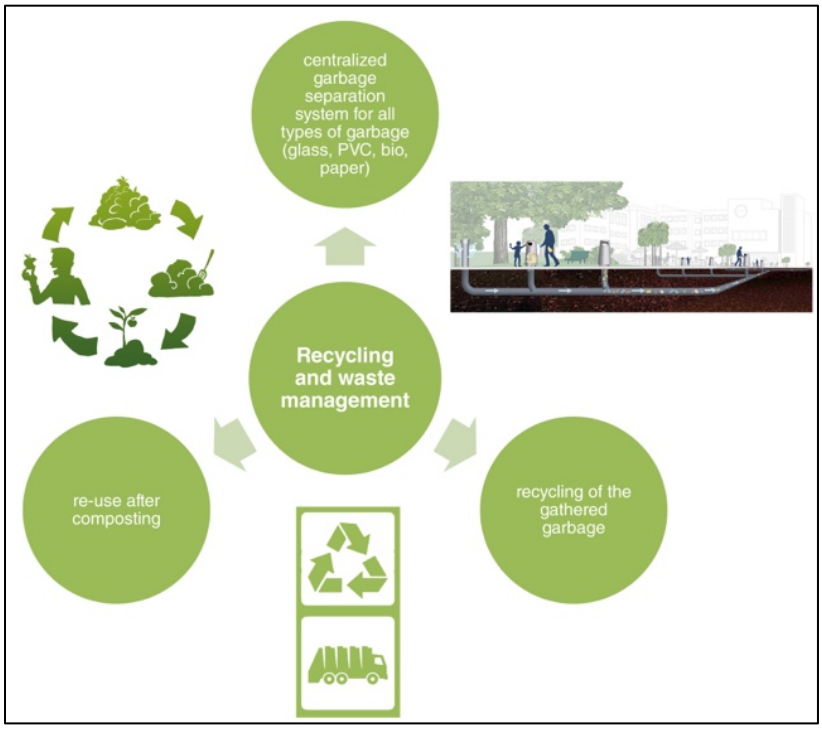


Fig. 11. Principles of waste reuse and recycling.

2. ***HARVESTING SUNLIGHT*** : **Natural light is considered the best source for studying and has proven to also raise the levels of melatonin, a happy hormone secreted by the brain when it gets the required about of natural sunlight. It is believed to keep depression at bay and makes a person active , exactly what learning spaces should be delivering.**

Architect's eye: the major part in harvesting the natural sunlight is the planning and orientation of the building block according to site context. The treatment of façade always plays a vital role.The planning of the spaces of a school, especially classrooms should be made in such a way that maximum usage of daylight is made either in the form of skylights or dimmable tubelights which adjust according to the irradiance in the room. Harvesting daylight offers a multitude of benefits beyond energy savings. It is the highest-quality light source available for interior environments, it is flicker-free, and it provides excellent colour rendering and colour balance. Skylights and daylighting tubular devices reduce cooling costs because less reliance on electric lights means less heat is generated. And daylighting is one of the fastest greenhouse gas-reducing paybacks schools can buy, because it shrinks both energy bills and re-lamping maintenance costs. Introducing daylight into buildings provides energy savings, excellent lighting quality and more beautiful interior spaces.

Fig.12. harvesting sunlight through façade development

Fig.13. utilising sunlight in the corridors spaces via skylights

Fig.14. harvesting sunlight via other calculated fitting devices.

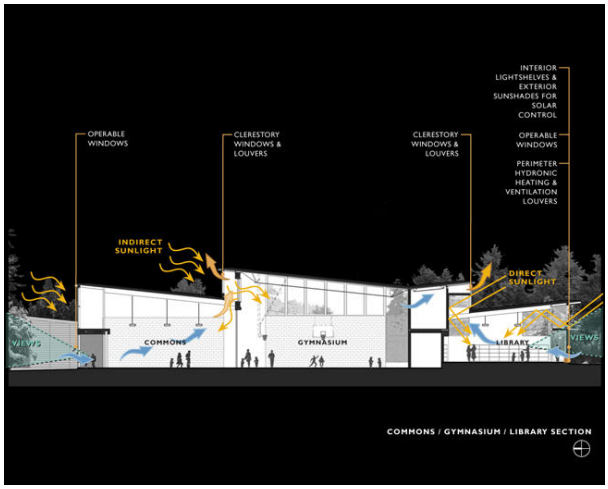


Fig.15. installation of skylights based on sun path diagrams

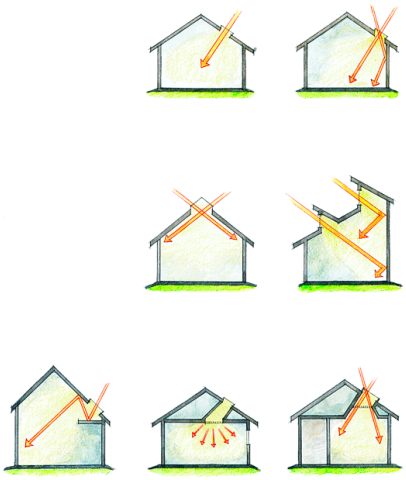


Fig.16. types of skylights and diffused lights incidences

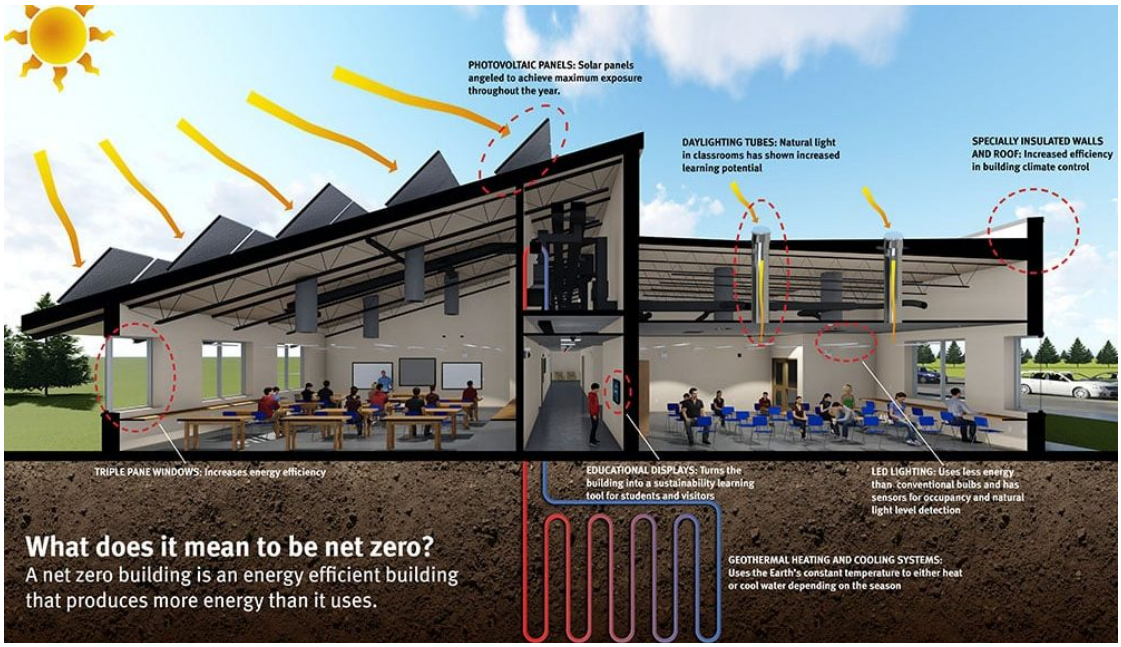
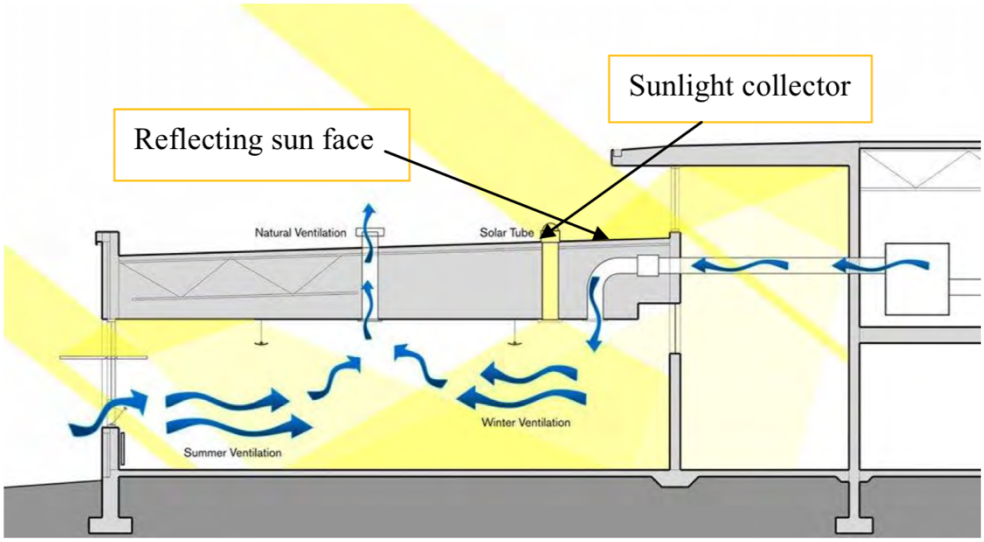


Fig.17. fort totten public school



passive solar energy system is easy to design and allow heating, cooling and lighting to all be addressed in the initial stages of planning.Clackamas school. —Sustainable school book".[1]

3. ***HARVESTING WATER*** : rainwater is harvested on school campuses for minimizing the load on the natural resources. Along with harvesting , other systems are used to make efficient use of water like using drip irrigation for watering plants, using recycled water wherever possible, using aerators for taps, etc. Overall monitored usage of water as per needs is prioritized.

Architect's eye:

1. **Native plants** are indigenous to a specific region. They benefit the environment because they require little to no supplemental water or fertilizer to remain healthy since they are adapted to local soils and climate. Native plants provide food and natural habitat for wildlife, including important pollinator species (insects, birds,

bats), and promote wildlife habitats that support ecotourism, recreational uses and environmental education.

- Non-invasive are adaptive species that tolerate regional soils and climate. The planting design respects the establishment period (the first growing season). After which, the trees, shrubs, grasses and groundcover would no longer require supplemental irrigation, so harvested rainwater can be completely allocated to the open lawn.

Fig.18. non invasive plants at ben franklin elementary school

2. Pervious paving

- Conventional impervious paving causes water to quickly sheet flow over the surface and into gutters and storm drains, often causing flooding during a heavy rain event. Urban runoff contains pollutants like heavy metals, oil and other hydrocarbons, which are conveyed to natural waterways, damaging ecosystems. Pervious paving allows water to move vertically through the paving material to slowly infiltrate and recharge groundwater. Water flows through the joints between pavers, filters through the gravel subbase, percolates into the native subgrade and ultimately recharges the groundwater. Naturally-occurring oil-degrading microbes within the subbase break down contaminants into less harmful forms before the water reaches the water table. Pervious paving can be designed to detain or convey water.

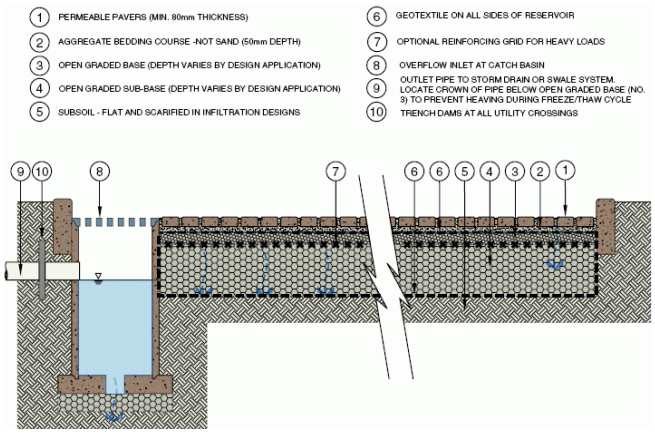


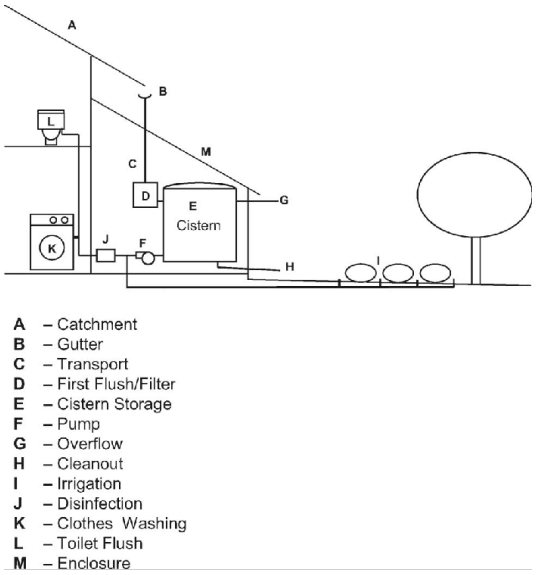
Fig.19. pervious paving

Fig.20. pervious paving

3. ROOF WATER COLLECTION

- Utilizing existing gutter and downspout systems, rainwater can be re-routed to rain barrels and cisterns. These components allow the reuse of water that would otherwise flow into storm drains, polluting natural waterways and preventing groundwater recharge.

- A **rain barrel** interrupts the discharge of roof water. Designed to retrofit downspouts, a typical rain barrel consists of an above-ground, opaque tank (to prevent algae), a screened inlet (to prevent mosquito breeding), a hose or spigot to reuse water, and a means of overflow relief.



• **Underground cisterns** are waterproof tanks that provide rainwater storage for reuse and distribution on site. Each cistern has one outfall with the opportunity for multiple inlet sources. Using cisterns for rainwater harvesting makes it possible to eliminate the reliance on potable water.

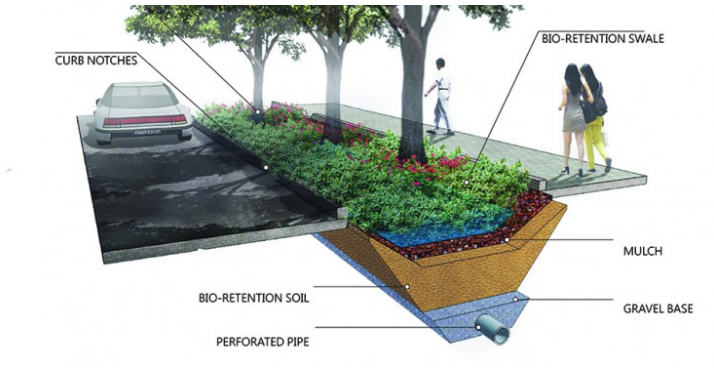
Fig.21. cistern system for water harvesting

- Saving water. A grey water system at Howard Norman Elementary School with the goal to conserve resources and educate students and the community about sustainable practices. A corrugated galvalume cistern was used to collect rain and condensate from roof top equipment for irrigation. After 16 months of usage, the landscape is thriving, the maintenance staff are happy, and less potable water is being used for irrigation

Fig.22. grey water system at howard norman elementary school

4. RAIN GARDEN + BIOSWALE

A **rain garden** is a shallow planting bed depressed six to eight inches that collects water runoff from impervious surfaces like sidewalks, roads, compacted lawns and roof downspouts. The water is filtered, retained for a short time, and released slowly through the amended soil into the native subgrade, recharging groundwater. Rain gardens capture water that would otherwise flow into storm drains, polluting our natural waterways and preventing groundwater recharge.



Similar in function to a rain garden, a **bioswale** is a wide, shallow, landscaped channel with a slight gradient. It captures surface water during a rain event, and allows the water to flow slowly and infiltrate the enriched soil into the native subgrade. It is used as an alternative to traditional gutters and storm drains. Like rain gardens, bioswales recharge groundwater supplies and filter pollutants from water before it reaches natural waterways. A perforated drain pipe may be incorporated to convey excess water due to oversaturated soil.

Fig.23. bioswale at parking spaces

5. RAINWATER IRRIGATION PUMP

Conventional irrigation systems source their water from municipal or other potable water sources, wasting the cost and effort of bringing that water to human-consumption standards. Instead, rainwater collected on site can bestow a naturally replenishing source of irrigation water.

4. ***MAINTAINING GREENS*** :**A study shows that a classroom with a green view can improve the mood and concentration power of students as compared to a concrete view.** This is because green , according to colour therapy is a soothing colour to the eye, it clams the nerves and helps the student's mind to relax and focus. A campus with a good interactive landscape will benefit its students and teachers not only physically but will also improve their mental health and reduce stress levels. Interactive landscapes can provide opportunities for the classrooms to spill outside the built if designed accordingly, this will make the lectures more interesting and more bilateral.

Fig.24. green roof and landscape merging at farming kindergarten, Vietnam

5. ***ORGANIC FOOD PRODUCTION ON CAMPUS :*** When we talk about increasing greens on site, why not make them greens more useful then just for adding aesthetic and climatic values ? Hence the idea of producing on **campus organic** food not only enhances environmental impact but also adds as an allied subject to a sustainable approach while the produce goes to the school cafeteria. Both traditional and modern farming techniques are used to produce food and techniques like hydroponics, aquaponics etc are taught by professionals in seminars not only for students but also for tertiary campus users like parents, organic food enthusiasts, activists, etc. This will teach the kids modern day farming which can begin from home level and also uplift the micro climate of the campus. Vertical green skins can act as fenestration for buffering hot air and will also add up to aesthetic c value. Students will now be familiar with what they eat and how it is produced without the use of chemical fertilizers and harming the soil and nature.

- **Organic food** : organic is when the food is grown without the use of harmful chemical fertilizers and pesticides. These food have high nutritional value and taste similar to inorganic food. They not only help the environment but are also sustainable to water and soil as they do not over use these resources. Organic farming indulges in crop rotation and changing the type of crops produced on the same land to ensure the soil doesn't not get saturated and lose its nutritional value.

- **Hydroponically grown food** : Hydroponic vegetables are grown suspended in a liquid solution containing the minerals the plant needs to thrive. In most cases, a hydroponics farm is enclosed within a greenhouse, but hydroponics systems can also be set up outdoors. The water used in hydroponic farming can be recycled through the system. Because there is no exposure to the outdoors, hydroponic vegetables may not need the same levels of pesticides to protect the plants against insects or pathogens. Some hydroponics growers do not use pesticides, and they employ organic farming methods, which allows them to meet the standards required to be labelled as organic produce. Hydroponic farming appeals to some people because of environmental concerns, since it uses less water and requires fewer pesticides or fertilizers than traditional farming techniques.

Fig.25. hydroponically grown crops in polyhouses in goa

Fig.26. organic farming at farming kindergarten, Vietnam

Benefits of farming in school campus are as follows :

- Consumption of fruits and vegetables
- Knowledge about sustainable agriculture and growing cycles
- Ability to identify local produce and seasonality
- Participation in school meal programs increased by an average of 9.3%
- Attitudes about healthy eating
- Awareness of recommendations for fruit and vegetable consumption by 30%
- Ability to select healthy foods at the supermarket

In addition to the positive impacts on children, there are several other stakeholders that can benefit from on campus farming :

- Teachers reported buying school lunch more often and being more conscious of dietary behaviours.
- Foodservice staff in some districts found farm-to-school programs as an opportunity to develop innovative seasonal recipes and new uses for local foods.
- Parents reported healthy changes in shopping, cooking and talking about healthy eating.

- Parents also reported believing farm-to-school initiatives would improve students' long term, food choices.
- Farmers reported viewing farm-to-school programs as promotional opportunities for their business as well as a way to build cooperation between schools, farms and the community.

- Architect's eye: in this case, the architect cannot simply take the food producing installations and install upon the campus – he has to design these food producing installations in such a say what it is an amalgamation with the school design – i.e the both are dependent on one another in a way that food production is an integral part of the campus and the system and vice versa . The designer has to come up with design strategies to amalgamate and invent new joineries and details so that both can co function.

6. ***SUSTAINABLE BUILDING MATERIALS :*** sustainability in terms of building materials will cater the following points :

- Its abundance near/around the site (local material)
- Its eco friendliness and apt use
- Its advantages to certain space / design element construction i.e the entire building cannot be made up of one material
- Its durability
- Its impact on environment and the users
- Its maintenance and cost effectiveness
- Skill labour set for erection
- The material flexibility and composition
- Material joinery details and easement
- If the material would work better as a composite with another material

Fig.27. use of contextual and vernacular materials at METI SCHOOL, BANGALADESH

INFERENCES : with the above mentioned information on elements of sustainable approach and an architect's design point of view towards each of them , this dissertation will focus on how these elements can merger together to try to achieve a sustainable school campus and its impact on the user. Along with environmental and mental

benefits, how the design of spaces for the students and according to their psych will be a major study and research zone.

INFERENCES RELATING TO ELEMEMNTS OF SUSTAINABILITY :

- ALONG WITH OPTIMUM USE OF NATURAL SUNLIGHT AND RAINWATER HARVESTING – AFTER INNOVATION IN SPACES, THE CAMPU'S NEXT IMPORTANT GOAL WILL BE PRODUCING ON CAMPUS FOOD.
- THE FOOD WILL BE PRODUCED BOTH TRADITIONALLY AND WITH THE HELP OF NEW MODERN TECHNIQUES USING HYDROPONICS
- THE CAMPUS WILL BE LENT OUT TO ENTHUSIATIS AND PROFESSIONAL FOR SEMINARS AND WORKSHOPS IN HYDROPONICS AND THEIR USGAE.
- THERE WILL ALSO BE AN ALLIED PROGRAM TO INCORPORATE LOCAL FARMERS AND HELP THEM BY THE MEANS OF PROGRAMME
- INNOVATION AND EXPERIMENTATION IN DESIGNING HYDROPONIC SYSTEM THAT MERGERS WITH THE SCHOOL FACILITIES WILL BE MADE SO AS TO NOT WASTE RESOURCES.
- THE PRODUCTION OF ON CAMPUS FOOD WILL ENHANCE THE CAMPUS GREENS ALONG WITH MAKING THE FAÇADE ASETHETIC AND ADD TO ADDITIONAL BENEFITS OF THE CAMPUS MICROCLIMATE.
- STUDENTS WILL LEARN HOW THE FOOD THE ARE SERVED IS CULTIVATED WHICH WILL INCULCATE VALUES OF NOT WASTING THEM AT THE SAME TIME INNOVATION IN SUCH A FIELD WILL TRIGGER TEHIR INTEREST IN THE SUBJECT.
- AN EXPERIMENTATION LAB WILL BE PROVIDED FOR REVENUE GENERATION WHICH CAN BE USED BY STUDENTS TO INNOVATEMODERN FARMING TECHNIQUES FURTHER.
- THE PRESENCE OF NURSERY ON THE CAMPUS WILL NOT ONLY ADD TO THE GRENERY BUT ALSO HELP A LOT IN REDCUING THE CARBON FOOTPRINT OF THE SYSTEMWHILE TAKING A STEP FURTHER TO MAKING THE CAMPUS A NET ZERO ENERGY USABLE CAMPUS.

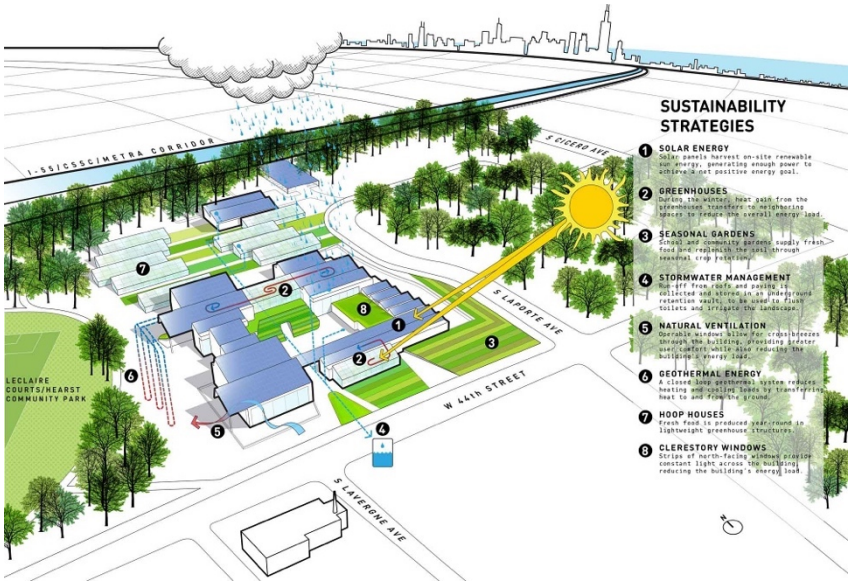


Fig.28. Use of sustainable strategies at campus level

Fig.29. Example of vertical green skins farming and asethtics at school façade in france

SOME EXAMPLES OF INNOVATIONS IN LEARNING CENTRES :

Fig.30. who wouldn't like to relax in a mud cave

Fig.31. learning the ripple effect

Fig.32. recess time racing in the courtyard

Fig.33. innovation in interior space for intellectuals at google

Fig.34. history lessons out in the open

Fig.35. furniture fun

Fig.36. story telling made fun

Fig.37. interactive classrooms

Fig.38. interactive spaces

As it is evident, most of the above innovation in spaces are within a close proximity to nature because that's where kids feel the most energetic and enjoy a sense of belonging. Being around natural elements with vibrant colours and shapes is a child's natural instinct. Ever wonder why kids run to catch butterflies?

GENERAL CONSIDERATIONS FOR DESIGNING A SCHOOL / EDUCATIONAL INSTITUTE

Accessibility

Design spaces to meet the specific needs of students, teachers, and administrative staff with disabilities.
Design for future flexibility, which enables spaces to be easily modified.

Aesthetics

The importance of the physical appearance of a public school should not be minimized. A school building that is attractive and responds to and is consistent with the design and context of the neighbourhood, builds a sense of pride and ownership among students, teachers, and the community. The exterior should complement the neighbourhood and reflect the community's values. The interior should enhance the learning process.

- Provide an interior environment that is visually comfortable and stimulating by integrating natural and artificial lighting, eliminating glare, and incorporating colors that stimulate or soothe, depending on the space function.
- Design for diffuse, uniform daylight throughout classrooms.
- Avoid direct-beam sunlight.
- Use a daylighting analysis tool to integrate lighting systems, controls, and materials that reflect or absorb light.

Cost-effective

- Apply cost effective principals in the planning, design, construction, and operation of school facilities.
- Select building elements on the basis of life cycle cost analysis.
- Consider the recyclability of materials.
- Specify materials and products that are easy to maintain.
- Utilize life-cycle cost analysis tools.
- Integrate day lighting systems, high-performance HVAC, energy-efficient building shell, and high-performance electric lighting.

Functional

- Cluster classrooms around common areas.
- Connect spaces visually with colors and patterns, particularly for primary school children.
- Provide platform spaces for gathering, sitting, and presenting and alcoves for quiet play, reflection, and reading.
- Decentralize administrative spaces to encourage active leadership and maximize interaction with students.

- Provide a "home base" for each student and teacher.
- Productivity Elementary schools should enhance the health and productivity of students, teachers, and staff. Secure and Safe
- Maximize visual access to corridors and school grounds.
- Increase occupants' sense of ownership and "territoriality" by providing comfortable, not institutional, rooms and by clearly defining the school boundaries.
- Control access to the building and grounds by individuals and vehicles.
- Accommodate safe egress from the building in case of emergency.
- Use Durable non toxic building materials.
    -
- Adding an additional allied programme of farming on campus will act as a fun activity students will be looking forward to. With increasing age groups students will get familiarised with newer and modern farming techniques to not only grow food but also flowering plants, medicinal herbs, etc which will further enrich their touch with nature and the knowledge they will gain from this will help them throughout their life.

2.1.2 AIM :

Amalgamation of innovative school spaces with sustainable campus

2.1.3 OBJECTIVE:

- Redesigning learning centres as creativity triggering spaces amalgamated with nature to bring about all round development of its users
- An attempt to achieving a sustainable campus and reducing carbon footprint
- Addition of on campus farming to reduce load on resources while also incorporating the food in the school cafeteria – providing a tiffin service can add to employment of LIG women
- To create a prototype which could be re adjusted according to site context and further enhanced to user needs
- Creating such a closed loop sustainable system is most vital in the urban fabric
- To experiment in innovative spaces for maximum interaction and apt use of resources
- To enhance the microclimate of the neighbourhood fabric
- To create a platform for knowledge exchange from various sectors
- To induce logical reasoning by experimental learning
- To break the pattern of sustainable schools being located at the outskirts of cities or suburban areas

2.1.4 SCOPE :

- The centre will focus on redefining the concept of ‘classrooms’ and experiment with innovative spaces
- It will inculcate a sense of belonging to the user with respect to built and environment
- It will act an example for other institutional campus to retrofit or redesign their campus to be sustainable
- If the yield from the farming eventually increases in future – it can be merged with the local farmers to help them will aiding the campus resources
- The campus will be used for other allied activities on weekends to different spectrum of professions to spread awareness about sustainability and means to achieve it
- The campus will provide employment to different categories of people for its on campus allied activities like farming, recycling, maintaining landscapes, etc.

- The site will be chosen within a close proximity of other educational institutes in an urban fabric for easy remodelling of the design strategies

2.1.5 LIMITATIONS :

- To understand student psychology in terms of creativity triggering spaces which will be in respect to the age and interest
- Trial basis so may not be able to achieve all sustainable approaches
- The site and its context with respect to materials and type of sustainability strategy to be used.

2.1.6 RESEARCH METHODOLOGY :

- Existing case studies in understanding innovation in learning spaces
- Understanding space dynamics which trigger creativity and curiosity in children
- Effectiveness of campus planning in terms of visual connections and connections between spaces and allied activities
- Learning about sustainable aspects to incorporate architecturally in space planning and design
- Knowledge about allied activities and ways to operate them
- Understanding the modularity of designing and which aspects could be further enhance according to site context
- Case studies on such pre existing techniques

2.1.7 HYPOTHESIS :

When we understand why schooling of a person is important as it truly moulds the person and develops his character and persona – we must also realise what aspect of schooling are we focusing on? Is it the knowledge ? the extra curriculum ? or just the sake of getting a degree and a job with good package. The minute we realize how spaces affects a person mentally and intellectually , we notice how gravely important is designing spaces for educational purposes.

A person spends one third of his life in educational institute, so to inculcate present day vital values and practises, it makes sense to start from where he begins learning, the very basic roots of his education. **Innovation in spaces around him, will bring about innovation in the thinking process** and knowledge hungry attitude along with an **enhanced mental and intellectual health.** Sustainability is nothing new. Infact it is a very ancient practice which keeps getting modified according to present day needs. The current times demands that all individual built fabric is sustainable in itself as a unit so as to be sustainable in a holistic picture. To induce the values and practices of sustainability , no better platform then an educational institute comes into mind as the designer not only **gets to highlight the importance of space quality in the learning centre but also gets an opportunity to illustrate that sustainable approaches need not act as individual plugins to the programme but is an integral part of the design and both are go hand in hand.**

This paper will research on the architectural intervention of a sustainable module of school and it effects on the urban fabric. The experiences of the user is the chief priority and their behaviour to the built spaces will be catered. Enhancement of the microclimate along with reducing carbon footprint of the system will be a synchronised design aspect.

Once the modular system is designed and its evaluation is positive, this can be repeated at different urban sites to ultimately aid to act as a base for innovation in learning spaces and support minimize the urban island heat phenomena.

2.2 LITERATURE REVIEW :

2.2.1 DEFINATIONS AND DESCRIPTIONS

- **THE PSYCHOLOGY OF THE ENVIRONMENT**

The psychology of the environment has been come up since 1960s in 20th century. This field of psychology is about territorial behaviours, density and crowds and environmental stress makers. It is a branch with close relation to architecture, perspective architecture and urban design (Luc, et al,2002). The psychology of the environment can be assumed as a scientific interdisciplinarity branch studying the mutual relationships between physical environment and human's behaviours. Considering the mutual relationship between the two elements (environment/ behaviour) is driven from Winston Churchill's the popular speech expressing " we construct buildings and after the buildings we are built".

Fig.39. Child friendly architecture

- **CHILD DEFINITION**

Child is a mature and human's son or daughter who has not been fully grown and is an independent creature from individual features point of view put in the growth and development trend in which they have not reached to a level to be called matured but they are originally and naturally dynamic and potentially to be developed.

- **OBJECTIVITY AND SUBJECTIVITY IN CHILDREN ARCHITECTURE**

Today, the most important issue in architecture is the identity of architecture space and understanding it by users. To achieve this goal defining and re-introducing the environment and receiving its messages are needed. To do this there are different ways including experiencing the

space by which objectivities can be achieved and compare them with primary thoughts and form them.

- **CHILD'S SPATIAL PERCEPTIONS**

To put simply, child's spatial perceptions is how a child see the world and understand it. The purpose of recognizing the perceptions is to find a way to strengthen child's feeling perceptions and

improve the quality of the space and environment to grow and develop the child. Child's spaces should be a creative one.

- **CHILD'S SENSES AND PERCEPTIONS GROWTH IN THE ENVIRONMENT**

In a child's room, all cases including lighting, temperature, colour, safety and hygiene should be regulated and controlled. Thus creating a favourable environment in terms of health and environmental monitoring, is necessary. Most children make contact with the environment through the senses. In the first years of growing, two main tools of the child's cognitive change into visual and tactile senses.

How to use it in spaces	Specifications	Color
Using it in the environments of game, show and sport	warm color and stimulating Passion and love, sincerity	Red
For Educational spaces in elementary school – due to the prevention of drowsiness and lethargy in children ... lively, invigorating, warm peace of the children	Energizing and stimulating color	Orange
Its combination with other colors and use it in the space of rest	indicating Love and romance	Pink
It is better to use the color with combination with other colors inclasses and educational spaces	Expresses the sense of relief - represents peace, security and order-expresses the feeling of sorrow, introspection and isolation in some people	Blue
To make interior decoration happy and bright	Warm and happy color- stimulating thought- making eyes bored more than other colors	Yellow
For decorating studying rooms, educational spaces and a place needs consentration.	Cool color and a symbol of nature - represents peace, happiness, health and jealousy, gaining the ability to read	Green
Pale violet spectrum in space and educational environment, gives peace and happiness. as a result it can be used practical and craft classes .	The most spiritual color represents harmony between reason and emotion and border between spirituality and materialism	Purple

TABLE 1 .General Psychology of colours and how to use them in spaces

The place of use	Excited emotions	Form
Child's play space	Imaginery-creative imagination	Irregular forms
Entrance	Caller	Concave form
emphasis points and pausing space	Innovation and complexity	Static form
	Suggests the status of rejecting	Convex form
Children love the spaces	Softness and comfort	Soft and arched form
Passage	Comfort and mobility	horizontally Expanded form
	Hard	Angular and broken forms

TABLE 2.General Psychology of forms and how to use them in spaces

- **SUSTAINABLE SCHOOL**

A sustainable school adopts a "whole-school" approach; one that extends beyond the curriculum and addresses the entire planning, operation and management of the school facility. School sustainability policies can reinforce what is taught about sustainability in the classroom, improve the school's own carbon footprint and strengthen public relations with the surrounding community.

Goals of sustainable schools _ by http://www.cpas-egypt.com/

- Result from a well understood, and organization-wide, proactive commitment to engage in sustainable development as a positive social and economic driver.
- Meets the functional needs of the school and integrates with the wider community through consideration of shared and communal facilities and mixed-use development.
- Recognizes people as the most important assets of a school
- Enhances the teaching and learning environments through healthy and vibrant internal environments including excellent levels of natural light and ventilation and quality external environments that facilitate outdoor activities
- Does not endanger the health of the occupants, or any other parties, through exposure to pollutants, the use of toxic materials or providing host environments to harmful organisms
- Is responsive to local community needs, requirements and aspirations,
- Enhances biodiversity locally by landscaping based on best practice guidance and globally by not using materials from threatened species or environments.
- Does not cause unnecessary waste of energy, water or materials due to short life, poor design, inefficiency or poor construction and manufacturing procedures
- Uses materials that are environmentally benign in manufacture, use and disposal
- Is affordable to run and simple to manage and maintain in a benign manner.
- Does not consume a disproportionate amount of resources, including land during construction, use or disposal
- Uses renewable and recycled and recyclable resources wherever possible

- Has a green travel plan at inception to create minimum dependence on polluting forms of transport and encourage access to, and the development of, safe, non- polluting and sustainable forms of transport.
- Is flexible to facilitate changes in demographics and technology and allows expansion or contraction in the future, where appropriate.
- Has on campus food production committee and farming as allied subject

Fig.40. child friendly healthy green campus

- **LEED**

In 2000, USGBC established the LEED rating system as a way to define and measure ―green & Sustainable buildings.LEED is an internationally recognized green building certification system, providing third-party verification that measures how well a building or community performs across all the metrics that matter most: energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. The suite of LEED rating systems are designed to address the complete lifecycle of buildings.

Each rating system provides a concise framework for identifying and implementing practical and **measurable green building solutions. LEED points** are awarded on a 100-point scale, and credits are weighted to reflect their potential environmental impacts. A project must satisfy specific prerequisites and earn a minimum number of points to be certified. Certification levels, based on the number of points, include: Certified, Silver, Gold, and Platinum.

- **LEED FOR SCHOOLS**

The LEED for Schools Rating System recognizes the unique nature of the design and construction of K-12 schools. Based on LEED for New Construction, it addresses issues such as classroom acoustics, master planning, mould prevention, and environmental site assessment.

By addressing the uniqueness of school spaces and children‘s health issues, LEED for Schools provides a unique, comprehensive tool for schools that wish to build green, with measurable results. LEED for Schools is the recognized third-party standard for high performance schools that is healthy for students, comfortable for teachers, and cost-effective.

- **THE SCHOOL AS A TEACHING TOOL**

Teachers at green schools can use the building as the basis for innovative curricula. The school can serve as a tool for hands-on lessons, such as math students tracking and charting utility cost savings, science students analysing the environmental impact of traditional cleaning products compared to eco-friendly ones, and students designing their dream sustainable homes using the types of systems and innovations used to green their school. Exercises like these help students connect to their environment and understand the effect that buildings have on land, natural resources, and their communities.

- **GREEN SCHOOLS AT THE INTERSECTION OF ―BIG THREE‖: ENERGY, EDUCATION, AND HEALTH**

Green schools are at the very intersection as healthy environments conducive to learning while saving energy and money.

Education: With reduced operating costs, green schools can put the money saved directly back into the classroom. Innovative design strategies provide students and teachers with a wealth of hands-on learning opportunities that they can take beyond the classroom and into their homes and communities. Young people are at the forefront of the fight against climate change, and they understand what is at stake if significant efforts are not made to rethink the way America produces and uses energy. We must recognize the need to meet the demands of this new generation of sustainability natives, and to prepare them for the emerging green jobs market.

When it comes to educating for sustainability, teachers are seeking interdisciplinary, active models of student engagement that are easily applied to their classrooms. The approach must be both informational and interactive: learned and experienced. Utilizing the built environment as the context for learning promotes student achievement in math, science, and literacy skills through hands-on explorations. Envision students engaged with a new type of laboratory – their immediate surroundings – exploring concepts and developing new understandings.

- **GREEN BUILDINGS AS TEACHING TOOLS**

The combination of green school design, a green organizational culture, and curriculum aligned with green practices and methodologies sets the stage for a school to utilize their facilities and grounds as a teaching tool. When educational principles are built into the learning environment, the environment transforms itself into a teaching tool.

As Anne Taylor observes in the book "***linking architecture and education - Sustainable design for learning environments", "architects must integrate many aspects of design to create a whole and wholesome learning environment by not addressing merely a numerical program***, however important size and cost, but also a deeper program responding to the needs of the user, the community, and the Earth" (Taylor & Enggass, 2009).

- **CARBON FOOTPRINT**

A carbon footprint is defined as: the total amount of greenhouse gases that are produced (directly and indirectly) to support human activities. It is usually expressed in equivalent tons of carbon dioxide (CO2). For example:

• When you drive a car, the engine burns fuel and emits a certain amount of CO2, depending on its fuel consumption and the driving distance.

• When you use electricity that is being fuelled by fossil based fuels, a certain amount of CO2 is produced.

• When you buy stuff (food, goods, etc.), their production and transportation also emits CO2.

Your carbon footprint is the sum of all emissions of CO2, as a result of your activities in a given time frame. Usually a carbon footprint is calculated for a year.

DID YOU KNOW?

As per the World Resources Institute's analyses of country-wise greenhouse gas emissions (2015), India contributes to almost 7% of the global GHGs and is currently the fourth largest carbon emitter in the world.

- **URBAN HEAT ISLAND**

The Urban Heat Island (UHI) effect is the term given to localised higher temperatures that are experienced in urban environments compared with the temperatures of surrounding green spaces.

The Urban Heat Island effect is primarily caused by the replacement of natural surfaces with hard impervious surfaces that are generally dark and absorb large amounts of solar radiation. Urban hard surfaces are significant in the built environment in the form of roads, paved areas, and roof tops (Getter, Rowe et al. 2007).

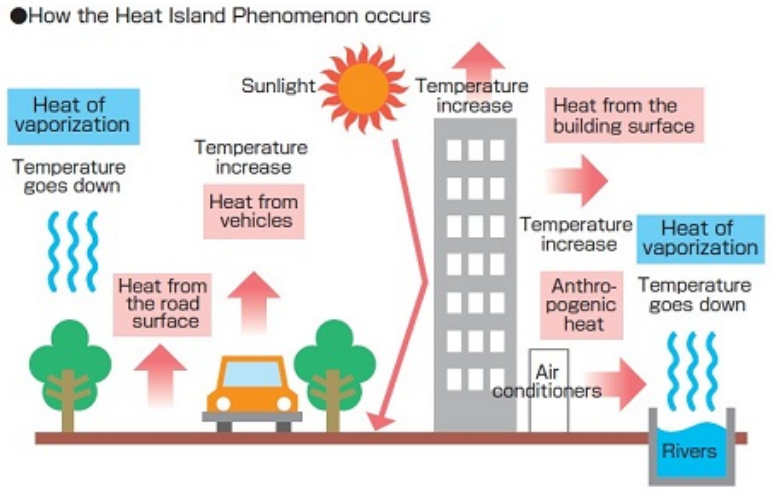


Fig.41. heat island phenomena

- **ECO SCHOOLS**

Eco Schools introduces the concept of sustainable development into the heart of our everyday activities in school. The scheme is rooted in a genuine desire to help children become more effective citizens by encouraging them to take responsibility for the future of their own environment. It is not about environmental excellence, it is about our school starting to look at how it impacts upon the environment and how this is decided upon and can be managed.

Pupil involment is a key part of the Eco Schools programme. We hope that having pupils engaged in the whole process, including monitoring, action planning and decision making, will lead to genuine ownership of the programme and an increase in their sense of responsibility for the school environment and local area.

The scheme looks at nine key areas of school activity:

- ***Litter***
- ***Energy Conservation***
- ***Waste Recycling***
- ***Water***
- ***School Grounds***
- ***Biodiversity***
- ***Transport***
- ***Healthy Living***
- ***Global Perspective***

Fig.42. eco schools programme by UNICEF

- **PASSIVE COOLING TECHNIQUES**

Passive cooling is a building design approach that focuses on heat gain control and heat dissipation in a building in order to improve the indoor thermal comfort with low or no energy consumption. This approach works either by preventing heat from entering the interior (heat gain prevention) or by removing heat from the building (natural cooling). Natural cooling utilizes on-site energy, available from the natural environment, combined with the architectural design of building components (e.g. building envelope), rather than mechanical systems to dissipate heat. Therefore, natural cooling depends not only on the architectural design of the building but on how the site's natural resources are used as heat sinks (i.e. everything that absorbs or dissipates heat). Examples

of on-site heat sinks are the upper atmosphere (night sky), the outdoor air (wind), and the earth/soil.

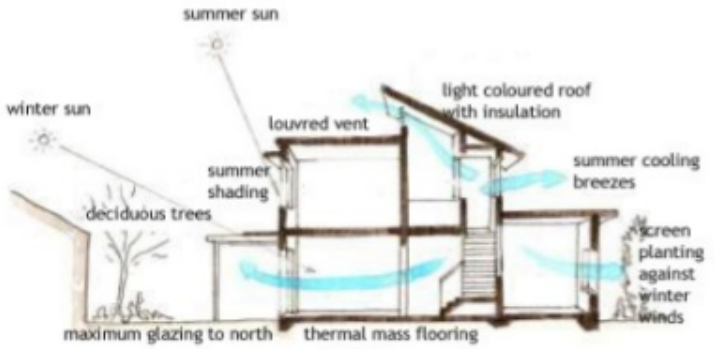


Fig.43. passive cooling techniques

- EVAPORATIVE COOLING

This design relies on the evaporative process of water to cool the incoming air while simultaneously increasing the relative humidity. A saturated filter is placed at the supply inlet so the natural process of evaporation can cool the supply air. Apart from the energy to drive the fans, water is the only other resource required to provide conditioning to indoor spaces. The effectiveness of evaporative cooling is largely dependent on the humidity of the outside air; dryer air produces more cooling. A study of field performance results in Kuwait revealed that power requirements for an evaporative cooler are approximately 75% less than the power requirements for a conventional packaged unit air-conditioner. As for interior comfort, a study found that evaporative cooling reduced inside air temperature by 9.6 °C compared to outdoor temperature. An innovative passive system uses evaporating water to cool the roof so that major portion of solar heat does not come inside.

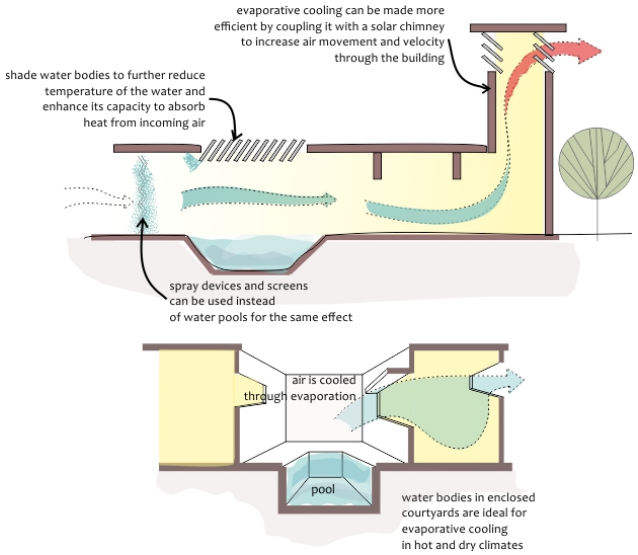


Fig.44. evaporative cooling

- **HYDROPONICS**

Hydroponics is a subset of which is a method of growing plants without soil by using mineral nutrient solutions in a water solvent. Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel.

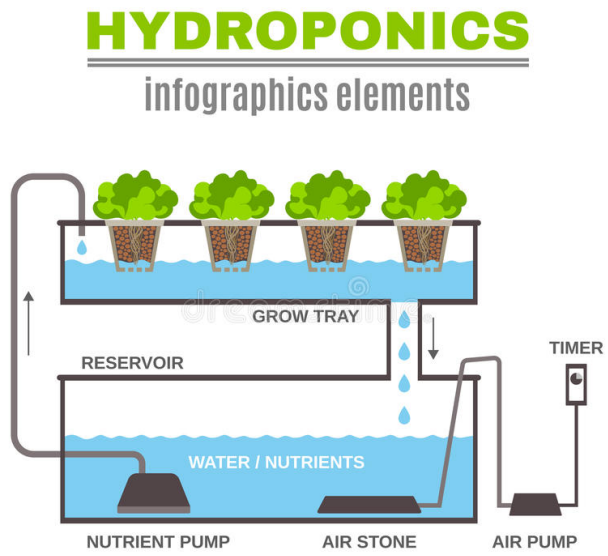


Fig.45. hydroponics infographics

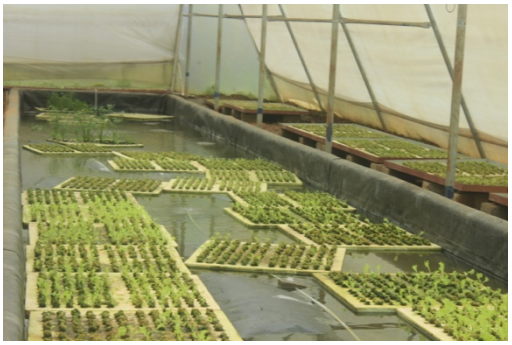
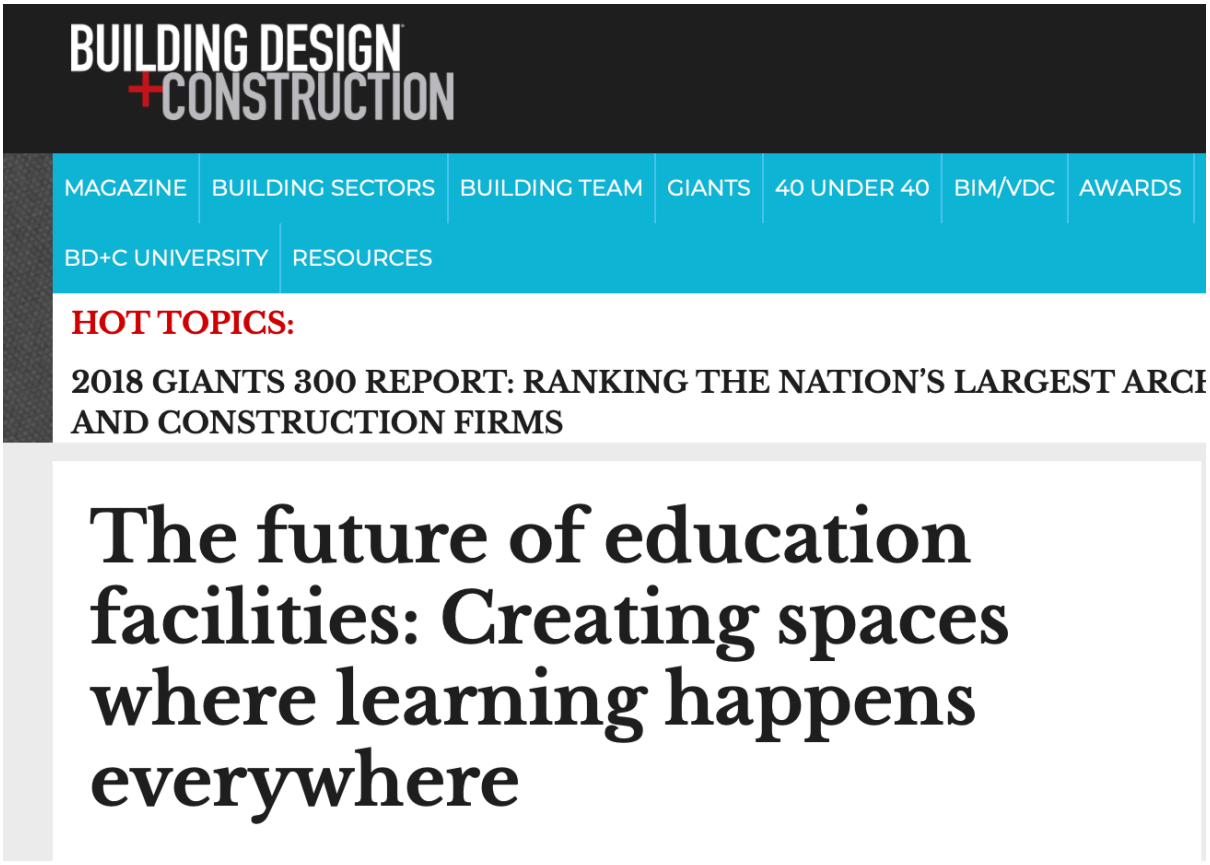


Fig.46-49. Hydroponically grown vegetation in polyhouses in GOA

2.2.2 ARTICLES AND INTERVIEWS

1.



The future of learning environments starts with the teacher. They are the facilitators to their students' education, the curators of learning, and they play a crucial role in the next generation's growth. Teachers are at the front line of education innovation, and they are well aware that the physical environment can make or break creativity and innovation. So how are we, as architects, using the physical learning spaces—formal and informal—to assist our teachers' creative development as instructors? How can the educational environment further strengthen our children's growth and learning?

Initially, educators and designers believed that learning occurred inside the classroom with the teacher being the carrier of knowledge. Today, the idea that education happens only in the confined walls of a classroom has become outdated. The understanding that learning happens everywhere is driving the future of education and the facilities we are designing.[1]

Knowing this, the art of designing schools lies not in just understanding what makes a functional classroom, but in how successful we are in creating a wide array of educational options for teachers and students within the school environment. A variety of spatial opportunities, indoors and outdoors, provides teachers the literal and figurative space to explore, experiment, and tailor lessons to the needs of the students and the curriculum.

LEARNING HAPPENS EVERYWHERE

'Education must shift from instruction to discovery — to probing and exploration ...' — Marshall McLuhan, educator and communications theorist

Learning linked with meaningful experiences has been shown to significantly improve retention.[2]Providing meaningful educational opportunities in a wide variety of settings helps teachers make sure that learning can happen anywhere. For example:

A Terrain of Learning. Weaving the natural environment of the site into the school building can provide learning opportunities that engage students through exploration and play. At Riverview Elementary classroom neighborhoods face the wetland that claims a large portion of the campus. A winding trail carves a path through and around the wetland where botanical signage identifies native plants and lookouts provide places for pause and observation. A timeline of the site's geological history is embedded in the porous concrete pathway around the playfields, chronicling ancient periods of local glaciation.

Educational Wayfinding. At Playa Vista Elementary a treasure hunt of sustainable initiatives on campus was created to teach students about native vegetation, sustainable practices, and environmental stewardship. A large etched brass panel describes 20 different sustainable strategies implemented throughout the school and directs students to areas on campus where they can see the strategies in action.

Learning in the Garden. At Cherry Crest Elementary, raised planter beds on the roof garden provide an opportunity for students to grow fruits and vegetables, while studying the science of nutrition, horticulture, and the importance of soil, effects of erosion and the water cycle.[3]

Tracking Energy Use. As a sustainable prototype for the Renton School District, the Secondary Learning Center utilizes LED accent lighting throughout the school to track energy and water use. The lights change color to reflect the level of resources being used in different sections of the building in real time, encouraging both staff and students to be engaged in sustainable practices.

Trigger the Senses. Using color, light, and materials incorporated throughout the school facility, and simultaneously encouraging hands-on learning, can play a powerful role in a student's growth. At Summit Sierra, the use of vibrant colors, large wayfinding graphics, glass garage doors and flexible shared spaces support the student-centered, self-directed learning approach. The physical space supports inquiry-based education where students are enabled to drive their own learning. Environments rich in sensory experiences—sound, smell, taste, touch, and movement—helps students retain and retrieve what they learn.[4]

Science as a Way of Life. North Central High School infuses STEM education throughout the daily experience of students, both inside and outside the classroom. The building promotes a truly immersive learning environment, with students "becoming" scientists as they trade their backpacks for lab coats when they enter class. The students consider themselves scientists because they do genuine research in biogenetics, in an inspiring architectural environment that celebrates their passion for learning and discovery. This reinforces the program's belief that the more students can visualize themselves in a research role, the more likely they will be to step into the role in the future.

In part two we will look at the idea of the "third teacher" and what we as designers can do to help teachers take full advantage of the opportunities we've created for them in and with their school building.

INFERENCES : students, parents as well as educationalists have started realizing how our vertical school stacking system is not going to work anymore and why we need to break the monotony. Any new innovation in school spaces is now going hand in hand with sustainability because it is the need of the hour.

2. Settling into new learning spaces LONG READS

Rebecca Vukovic (/authors/rebecca-vukovic)

01 November 2017

When the students at Harbord Public School walk into their classrooms and take their seats, those seats could take many di!erent forms and positions in the room.

They could be large, round ottomans, individual ottomans, giant cushions or a stool on wheels, or a wobble balance stool. They could be 'Gen-ga' block cushions, or a couch, or a daybed by the window. The students could opt for traditional school chairs, or they could choose a half hemisphere mound to sit or lean against.

'This furniture is all out in the common area as well so we can move them in between the classroom and the common area as needed,' Assistant Principal and Year 5 teacher Amber Fuller says.

At the beginning of the 2017 school year, the New South Wales school opened its brand new three-storey innovative learning environment to teachers and students.

'There are 18 classrooms in total, with six classrooms on each level, as well as a two-storey library, and currently Year 3, 5 and 6 are the grades that are in the building,' Fuller explains.

'So on each floor there are six, home base classrooms, as well as two practical activity spaces or wet areas that are designed for art and science, and also a large common area that runs across the middle of each floor. Each floor has a colour theme – orange, yellow or green – and the classrooms have ample space for an average size class but then of course we can open up the glass doors and use the common area outside each classroom as well. So each classroom is separated by glass sliding doors that can be opened to create large teaching spaces.'

When the students first arrived for the new school year, they were thrilled with their new learning environment. ‘Of course it was very exciting at first and they all came in full of energy, but we began straight away by encouraging the students to respect the new furniture and to choose carefully and sensibly about where they work best and what places are best for them to work in,’ Fuller shares. ‘Term 1 was quite busy with teachers adjusting and getting used to where everything went and how everything works, but we’ve all settled in pretty well.’

When designing this new building, flexibility was key, so every classroom can be modified to suit the lesson taking place. Now well into Term 4, the students and teachers are continuing to work out how to best use the space to its full potential.

‘The teachers and students regularly change how the classroom and common areas are set up, which is great, because the flexible nature of the furniture, being able to move it around to di!erent types of seating to suit the lesson, is really good for a nice change,’ Fuller says. ‘So the students really enjoy that, and [they] are very good at resetting too – so, each a"ernoon we put all the furniture back where it started that morning so we can find everything again. Students like being able to choose where they can sit to work and the ability to go and work in small groups in other areas of the common spaces.’

Fuller says that as the year has progressed, the teachers have become much more confident using the space and the furniture in innovative and creative ways. ‘We weren’t sure how strict or regimented we would need to be with using the common areas or timetabling in those spaces, but it’s worked really well. If the teachers just have good

communication, it’s led to using the spaces quite flexibly and being able to change our minds and adapt the lesson and share the spaces just as when needed really.

‘Overall, I think sta! really enjoy teaching in the new building and it will only get easier the more we are given opportunity to teach like this. I’m not sure I could go back to a traditional classroom now!’

Given everything is made to be flexible and moved around, the teachers have also had to get used to a new storage system in their classrooms. ‘There’s no teacher desk as such, just a table for a computer and just to put our things on. There is one large storage cupboard in the classroom with sliding doors that double as our whiteboard surface for us to write on and there’s also a common grade storage room on each floor.

‘So, when we moved in the teachers were a little concerned about the amount of storage space but it’s actually worked out really well. We’re learning to minimise a little bit and keep all of our stu! in the whiteboard cupboard.’

The new building has also allowed the teachers to adapt the way they deliver their lessons. ‘Teachers have the ability to team teach much more easily now because those glass doors can be opened up or classes can gather together in the common spaces and conduct lessons together, which is really good,’ Fuller says.

‘Not having a teacher’s desk as such means that teachers are up and walking amongst the students more. And the furniture is so comfy for us too, that we can mingle with the students more easily than say in a traditional classroom where there’s a desk and a chair for each student. So, that makes it a lot easier for us to interact with them.’

According to Fuller, the types of lessons that take place have changed a little too. ‘Having laptops and iPads have allowed for some really good and creative open-ended tasks and having the wet areas or the practical spaces right outside our classrooms has meant that lessons can easily flow between the home base and the wet area to allow for di!erentiation or for di!erent tasks to happen at the same time.

‘The access to technology has been really good and also having all the grade resources in one space on one floor, classrooms aren’t spread across the school ...’

Fuller adds the sharing of resources has become a whole lot easier, for students and teachers. ‘We do have things like shared stationary now, so instead of the students having their own storage tub or their own pencil cases, its shared resources. So, getting the students to be really respectful of the class items is important, as I mentioned about when they first came in, we

were trying to get them to really respect the furniture and understand how they work best in this space.'

And, while the teachers have always had high expectations of the students when it comes to behaviour, the new classrooms allow the students to be more autonomous with their own learning. 'I think we give them more autonomy now and mostly they do meet our high expectations and students have really thrived in this environment because the teachers have been willing to allow students that choice and freedom of where and how to work,' Fuller shares.

The new learning space has also allowed sta! to collaborate with each other on a professional and social level. 'I think the team aspect among the teachers has been a really positive change,' Fuller says. 'We're all able to chat before and a"er school and have our grade meetings in the common areas and I guess it just feels a bit more

https://www.teachermagazine.com.au/articles/settling-into-new-learning-spaces

natural – that social side for the teachers has been really nice. I find it easier to keep in touch with the teachers in my team and what they're doing because we're working so closely in the same space together.'

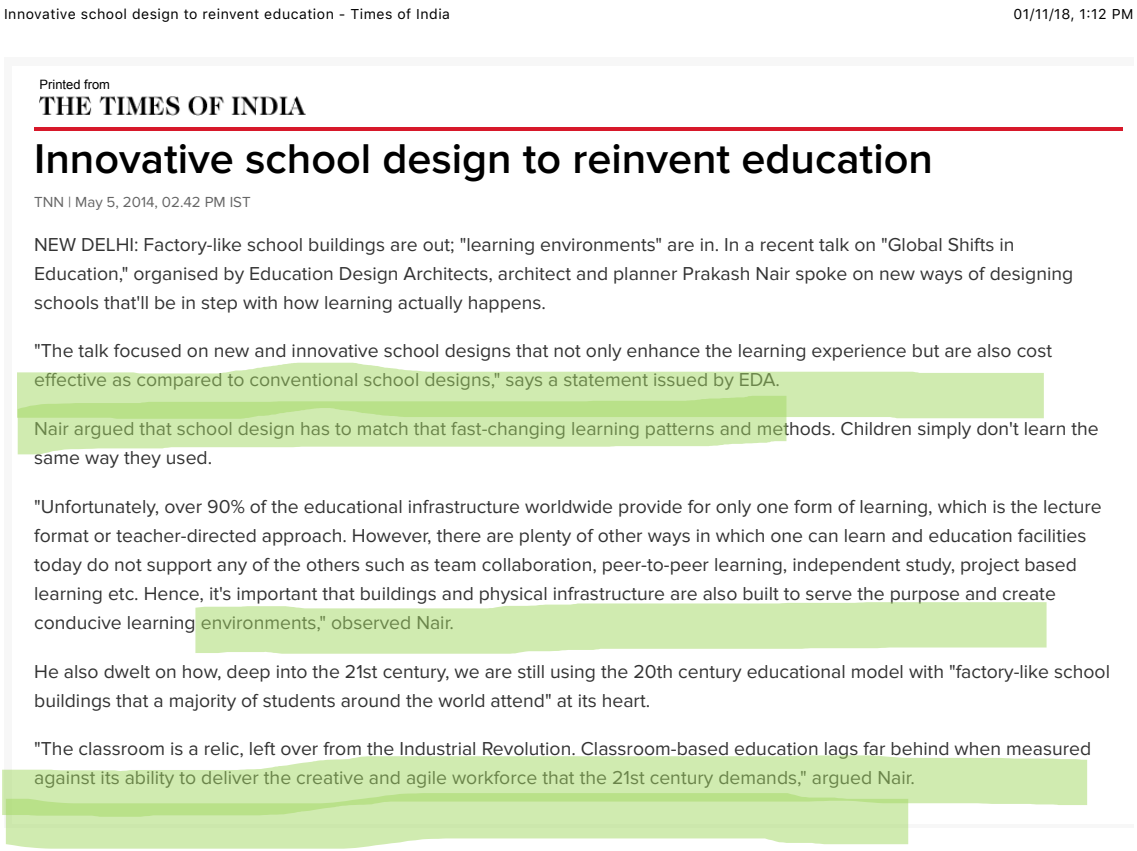
A key feature of the new building at Harbord Public School is its flexibility. In your own classroom, do you move or rearrange furniture according to the lesson you're working on? How does this impact the way students engage in these lessons?

Amber Fuller says the new classroom environment allows students to be more autonomous. Do you allow your students the freedom to choose their own seating or position in the classroom? How does this work? What are your challenges?

INFERENCES : at the faculty and school level, wherever re designing school module is not possible faculties are adopting different methods like innovative furniture's and use of interior

vibrant color and shapes. They try to make the classroom more flexible and see opportunities to open it up to a natural element like courtyards.

3.



Innovative school design to reinvent education - Times of India 01/11/18, 1:12 PM

Printed from
THE TIMES OF INDIA

Innovative school design to reinvent education

TNN | May 5, 2014, 02.42 PM IST

NEW DELHI: Factory-like school buildings are out; "learning environments" are in. In a recent talk on "Global Shifts in Education," organised by Education Design Architects, architect and planner Prakash Nair spoke on new ways of designing schools that'll be in step with how learning actually happens.

"The talk focused on new and innovative school designs that not only enhance the learning experience but are also cost effective as compared to conventional school designs," says a statement issued by EDA.

Nair argued that school design has to match that fast-changing learning patterns and methods. Children simply don't learn the same way they used.

"Unfortunately, over 90% of the educational infrastructure worldwide provide for only one form of learning, which is the lecture format or teacher-directed approach. However, there are plenty of other ways in which one can learn and education facilities today do not support any of the others such as team collaboration, peer-to-peer learning, independent study, project based learning etc. Hence, it's important that buildings and physical infrastructure are also built to serve the purpose and create conducive learning environments," observed Nair.

He also dwelt on how, deep into the 21st century, we are still using the 20th century educational model with "factory-like school buildings that a majority of students around the world attend" at its heart.

"The classroom is a relic, left over from the Industrial Revolution. Classroom-based education lags far behind when measured against its ability to deliver the creative and agile workforce that the 21st century demands," argued Nair.

INFERENCES India is now realizing the worth of space quality and how we have blindly copied the western culture by fitting kids into four walled classroom and ignored our traditional teaching methods of open learning. Innovation in learning space is the key to future critical thinkers and logical reasoners something our country requires now more than ever.

4.

Printed from
THE TIMES OF INDIA

Ten schools from India get CSE's Green Schools Award

TNN | Feb 25, 2016, 06.41 PM IST

KOLKATA: Schools from across India were among the top 10 green schools of India after an extensive audit of the environment-friendly practices followed in these schools. The winners included schools from Noida, Delhi, Sikkim, Rajasthan, Rajasthan, Punjab and Himachal Pradesh. More than 500 schools from India, covering most states and Union Territories are part of the Green Schools Programme and participated in the event.

CSE director general Sunita Narain and theatre and film personality Tom Alter gave away the awards at a ceremony today at New Delhi.

Schools from the National Capital Region - three in Delhi and one in Greater Noida - were among the top 10 green schools in the country. The top prize went to Father Agnel School, Greater Noida, the second prize to Queen's Valley School, Dwarka (Delhi) and the third to the Government Senior Secondary School, Devnagar (Shimla).Two schools from Sikkim made it to the top ten. A few winning schools - from Himachal Pradesh and Punjab - could not receive their awards as connectivity to Delhi has been affected due to the ongoing agitation in Delhi's neighbourhood.

The awards have been given on the basis of a detailed assessment of environment-friendly practices such as rainwater harvesting, proportion of green area in school, waste management, water management and sanitation practices, availability of health-promoting food in the canteen, among other practices.

Awards were also given for criteria such as to a state that reported the highest submissions (Punjab with 122 submissions), for recycling (Salwan Public School, Ghaziabad), water-efficiency (The Shri Ram School, Moulsari, Gurgaon).

Encouraging school children who have led environmental work in their schools, Narain said, "Green practices should be a part of our life not because they get us points, but because they are correct."Congratulating schools for keeping their waste at a minimum - a criterion for the awards - she said this should not increase.

Lamenting that schoolchildren could not follow some environmental practices such as walking or cycling to school, she said, "This is a reality of our cities that if you cycle or walk to school, you may meet with an accident." She hoped it would be possible to rate states on the basis of their policies - whether they were environment-friendly or not.

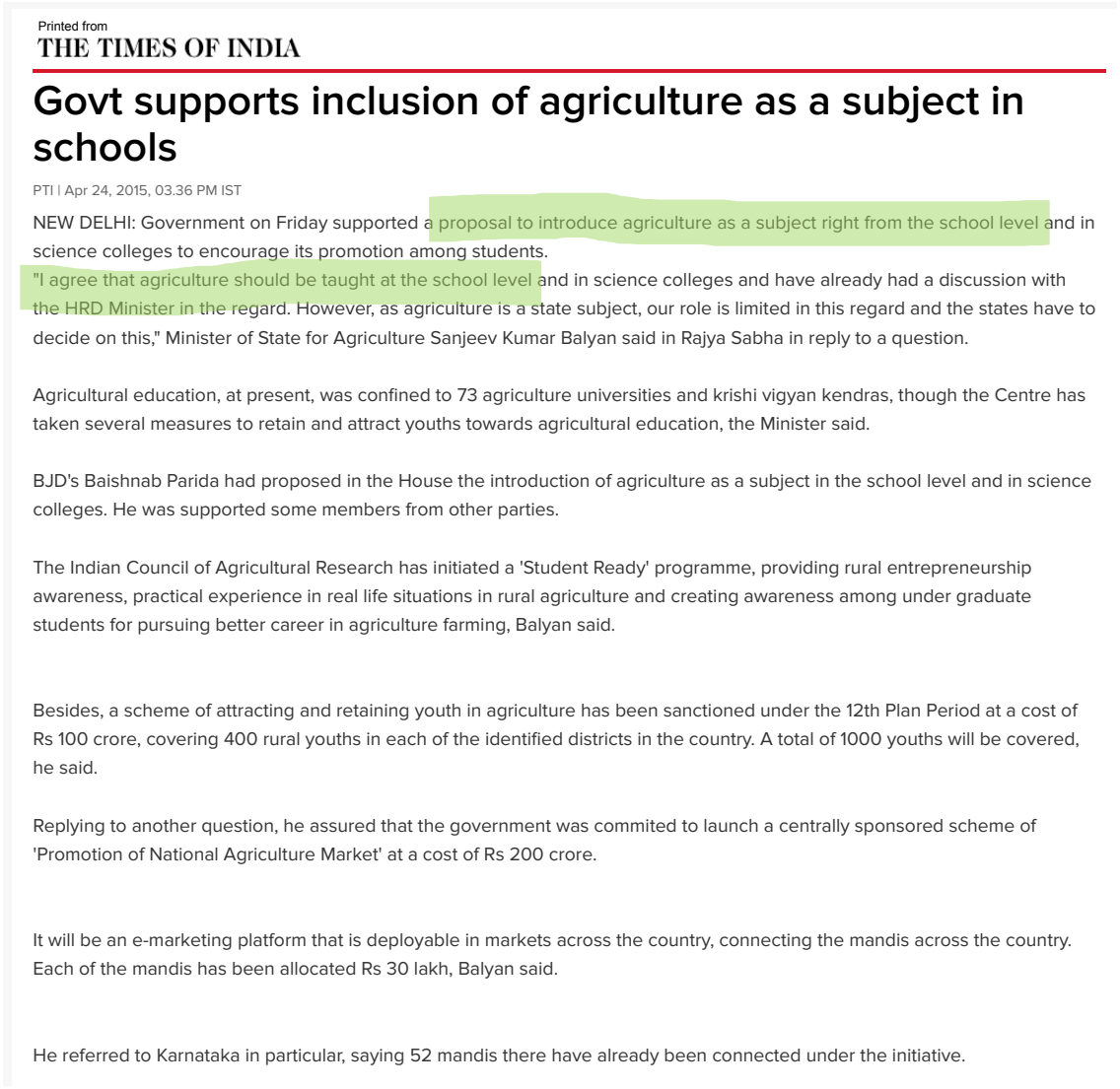
Challenging children to be green warriors, Alter said the path was strewn with difficulties and that it was not easy as they would face opposition. "Telling someone not to litter, or not to waste resources will get you into trouble - like it has got me into trouble several times - but if you take up this challenge, you will do a great service to everyone," he said.

Alter also said it was important to segregate 'progress' the way we segregate waste. Reminiscing about his school - the Woodstock School, Mussoorie-he said it was a green school, being located in hilly forests of Mussoorie. He said the walk from the dormitory to the school building was on a beaten track through a forest. Alter rued wistfully that the path had been converted into a cement path now. "Earlier, you could know the seasons from the way the path felt under your feet, now you cannot because cement is the same in every season," he said.

Speaking about the process followed in selecting the winners, Ranjita Menon, director of CSE's Environment Education Unit that runs the Green Schools Programme, said for this year's awards, an online application system had been followed.

INFERENCES India is not taking step for sustainability and importance of greens in an educational institute – the very roots .Slowly from sustainability being a plugin, it will modify into being the base of design will evolve to cater to innovative school spaces.

5.



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THE TIMES OF INDIA

Govt supports inclusion of agriculture as a subject in schools

PTI | Apr 24, 2015, 03.36 PM IST

NEW DELHI: Government on Friday supported a proposal to introduce agriculture as a subject right from the school level and in science colleges to encourage its promotion among students.

"I agree that agriculture should be taught at the school level and in science colleges and have already had a discussion with the HRD Minister in the regard. However, as agriculture is a state subject, our role is limited in this regard and the states have to decide on this," Minister of State for Agriculture Sanjeev Kumar Balyan said in Rajya Sabha in reply to a question.

Agricultural education, at present, was confined to 73 agriculture universities and krishi vigyan kendras, though the Centre has taken several measures to retain and attract youths towards agricultural education, the Minister said.

BJD's Baishnab Parida had proposed in the House the introduction of agriculture as a subject in the school level and in science colleges. He was supported some members from other parties.

The Indian Council of Agricultural Research has initiated a 'Student Ready' programme, providing rural entrepreneurship awareness, practical experience in real life situations in rural agriculture and creating awareness among under graduate students for pursuing better career in agriculture farming, Balyan said.

Besides, a scheme of attracting and retaining youth in agriculture has been sanctioned under the 12th Plan Period at a cost of Rs 100 crore, covering 400 rural youths in each of the identified districts in the country. A total of 1000 youths will be covered, he said.

Replying to another question, he assured that the government was commited to launch a centrally sponsored scheme of 'Promotion of National Agriculture Market' at a cost of Rs 200 crore.

It will be an e-marketing platform that is deployable in markets across the country, connecting the mandis across the country. Each of the mandis has been allocated Rs 30 lakh, Balyan said.

He referred to Karnataka in particular, saying 52 mandis there have already been connected under the initiative.

INFERENCES : besides the food yield, having on campus farming has other benefits like enhancing micro climate – awareness among kids – seminars and workshops in modern farming techniques which can generate revenue for the campus and ultimately reducing carbon footprint.

6.

Printed from

THE TIMES OF INDIA

Chennai: 100 corporation schools to grow vegetables for noon-meal

TNN | Jul 3, 2018, 08.14 AM IST

CHENNAI: Nearly 100 city corporation schools will soon be equipped with gardens that grow vegetables for their mid-day meal scheme.

A self-help group which acquired expertise in terrace gardening under the National Urban Livelihood Mission will train the corporation teachers and students.

"Members of the SHG will train nearly 40 students who are part of eco clubs and the national green corps. These children will be provided with seeds and pots for 25 plants. They will grow the plants either in pots in terraces of the schools or in a small patch of land available inside the

school premises," said deputy commissioner, education, Mageswari Ravikumar.

Corporation schools will replicate the model of Teresa Women's Complex at Valluvar Kottam , in their gardens

Each school will have a teacher coordinating the entire process. "The idea is to inculcate the importance of farming and responsibility among the children. In several schools, the students even sell their excess harvest. For now, we have only decided to use them in the school kitchens. If we start growing excess, we may even start a student bazaar to help them learn

about the economics and business of farming," said a teacher.

Srirathi, a member of the self-help group, said they have created a terrace garden at Annai Teresa Magalir Vazhagam near Valluvar Kottam and will replicate the same model in these schools.

"We will train the teachers and students on how to maintain the plants," she said.

Officials said the compost that the civic body is generating from the garbage collected by it will be used in these gardens. "We will also try and generate our own compost at the schools once we start generating income from this. We will develop the gardens and make them scientifically equipped over the years," said Mageswari.

Schoolteachers when contacted said the project will mostly involve primary and middle schools. "A few higher secondary schools will also be selected. It all depends on the availability of space. We have started identifying the schools. The work on the gardens will start within a week," said a coordinator.

Officials said they wanted the students to learn about managing garbage and making compost at the young age so that they become responsible. Snehalatha, project officer of National Urban Livelihood Mission said that a lot of women were getting trained in various fields. "We wanted these women to use their training and help the government. When we informed about it to the corporation, they were willing to use their help," she said.

The corporation officials said as part of the eco clubs, the students were already involved in a lot of activities such as planting drives, treks, creating awareness, taking up cleaning drives.

INFERENCES : schools adding farming plugins in their campus to reduce load on resources as well as employment needs.

7.

Printed from
THE TIMES OF INDIA

Medicinal farming on Kharghar hill makes women self-reliant

TNN | Sep 3, 2013, 05.53 AM IST

NAVI MUMBAI: A group of hard working tribal women have transformed a portion of Phanaswadi village atop Kharghar hill into a lush green zone where they grow much needed medicinal herbs and plants.Twelve years back, the NGO Span Mahila Vikas Charitable Trust had planted more than 2000 saplings of medicinal plants on top of the picturesque hill with the aim to nurture Mother Nature.
Over the years, many local tribal women joined in to do specific medicinal farming here, without disturbing the existing flora of the region.

This medicinal plant project is one of the most remarkable projects around the city. Today, we have nearly 12000 plants, medicinal as well fruits, grown here on the vast 25-acre land. Due to the hilly slope, all plantations are done along the line of step-farming ,'' informed Anisa Shaikh, one of the founders of this project.

These plants are mainly used for making alternative medicines or directly utilized as ayurvedic drugs for specific ailments. For instance, Safed Musli (for diabetics), ground Amla (throat infection), Shankha pushpi (gynecological problems), Ashwagandha (for heart ailment), Vekhand (for healing wounds), reetha (skin diseases and hair treatment), Karanja (oil for arthritis) and Aloe vera (for skin and blood circulation), are some of the plants farmed here.

"In the year 1998 when I started this plantation programme, the task was quite challenging. The area was very underdeveloped, without electricity and water supply," recalled Shaikh.

Since chemical manure was not used for ayurvedic plants, the women had to prepare the soil only with cow dung. Rain water was their only source of irrigation.

Many tribal women from this hilly area were employed as regular farm hands. They worked in eight-hour shifts. Later, more workers joined in from outside Navi Mumbai and started living in Kharghar with their families to work here for bread and butter. Sangita Khopre and her husband Balu from Bhoir near Pune, came here last year and have been staying at a nearby hutment.

Interestingly, the founder, Shaikh, who is a resident of Seawoods, used to earlier work as the caretaker of a Khandala based farmhouse of legendary actor, late Ashok Kumar, who was quite passionate about the Indian medicinal sciences.

Besides, she was inspired from her father, an Ayurvedic doctor M A Shaikh. Being an ayurveda scholar herself, she wants to revitalize the ancient Indian medical heritage. "This is fully a profit sharing project. Under our charitable trust, we encourage the rural women to initiate their own project by forming small groups in their respective areas," she added.

INFERENCES : these kind of medicinal knowledge can also be imparted in schools – it was already prevailing in our traditional teaching not its is time to bring it back with more efficiency and experimentation on campus.

8. THE HINDU

MUMBAI

A growing movement: bringing farming to the city

Diipti Jhangiani

MUMBAI:, OCTOBER 09, 2016 00:00 IST

UPDATED: NOVEMBER 01, 2016 23:43 IST

Urban farming is poised to take a big leap with the launch of a forum that will encourage the practice. From just a few, scattered individuals practising terrace gardening, to communities, housing societies and corporations in the Mumbai Metropolitan region setting up terrace farms, going green is gaining mass appeal.

The movement got a big push last week with the inauguration of the Urban Farming Forum, an initiative undertaken by The Energy and Resources Institute (TERI) under the guidance of State

Urban Development Department, and in collaboration with the Navi Mumbai Municipal Corporation (NMMC).

Dr .Anjali Parasnis, associate director, TERI, said, “We will put together courses, knowledge series, awareness programmes and policy initiatives. A Grow Green competition has been scheduled for early next year to encourage

urban farming on a large scale.”

A panel of urban planners, government officials, architects, students and hobbyists attended the inauguration. Citizens across generations shared their success stories and suggestions with the NMMC to promote urban farming.

Matunga resident Anagha Gaikwad, a student of the Green House Management Course, Ruia College, said, “As part of our course, we grow everything from vegetables to herbs. But I wish more of the younger generation was aware that you can actually grow food in the city. May be it should be added as an elective in school curriculums.”

During the launch, Dr. Parasnis presented the carbon baseline survey of Navi Mumbai. She also shared vital statistics on the high pesticide and heavy metal content in commercially-grown fruits and vegetables. She shared the results of a survey by the University of Baroda, showing how commercially-grown fruits and vegetables contain pesticides like Aldrin, Chlordane, Dichlorvos much beyond the when permissible levels were 0.1 mg/kg.

She spoke about how urban farming could help decrease the urban-heat-island effect plaguing the city. Most of the land in the city is either made of concrete or covered with tar, which traps heat onto the land surface. Buildings and school compounds, too, which were earlier grounds of raw earth, are now covered with paver blocks and astroturfs, trapping that much more heat. Urban farming, especially terrace farming, can create green roofs, thereby decreasing the urban-heat-island effect, she said.

A panel discussion chaired by Jayant Kumar Banthia, former State Chief Secretary and chancellor, Narsee Monjee Institute of Management Studies (NMIMS), presented several ideas to incorporate urban farming into the city’s plans. “We spend so much in landscaping road dividers. Instead, we could grow vegetables there,” suggested G.S Gill, former managing director of CIDCO and an advisor to TERI.

The launch highlighted the role that educational institutions can play. Dr. Pramod Pabrekar, Principal ICLES’ Motilal Jhunjhunwala College, said, “We have sown the seed, and provided the knowledge. The millennial generation has the power to propel this idea .”

The forum is expected to provide impetus to the urban farming movement growing gradually in Mumbai. Those who do not have space for terrace farming can also volunteer at many of the urban community farms across the city, from Green Souls in Kharghar, Urban Leaves in Matunga and Andheri, to Pixie Dust Farm in Bandra.

INFERENCES : the government is now recognizing the power of farming in an urban fabric – also it is in procress of being added to educational institute – the challenge now is to merge innovative school spaces with sustainable techniques in the city fabric. Like already mentioned

above, we spent money on landscape, why not that landscape be put to better use then just for aesthetics.

9.

Located at The Sustainable City, Dubai, the school will tailor the IB continuum program to integrate unique sustainable education curriculum

Dubai will inaugurate its first sustainability-focused international school in 2018, founded by Esol Education, an established operator of prestigious international and American schools around the world. Drawing upon Esol Education's 40-year tradition of educational excellence, Fairgreen International School will offer the full International Baccalaureate (IB) continuum of education and will incorporate sustainability as an integral part of its educational program.

Dr. Abdulla Al Karam, Director General of the Knowledge and Human Development Authority (KHDA), said: "Sustainability is often described not just as a state of harmony with the environment around us, but also harmony with ourselves and each other. Fairgreen International School at The Sustainable City will provide a unique education offering to parents in Dubai, and will enrich Dubai's schools landscape. We look forward to working with our friends at Esol Education to add yet another layer of quality to education in Dubai and bring out the best from within our community."

By instilling sustainable values in future generations, Fairgreen International School aims to play a leading role in helping the UAE achieve its sustainable development goals (SDG's) as outlined in the United Nations' 2030 Agenda for Sustainable Development, adopted by the Dubai Plan 2021 and the UAE's National Committee on SDGs. "From the campus and architecture to the curriculum and activities, the entire school will adhere to a 'sustainability first' ethos," shared Esol Education Chairman, Mr. Walid Abushakra, explaining that Fairgreen aims to be one of the world's foremost models of an integrated sustainable school, enabling students to fully envision and tackle the global challenges posed by climate change, the impact of conventional energy sources and food scarcity. "Our graduates will understand the urgency and importance of sustainable living, which will guide their academic and career choices. They will be pioneers of

renewable energy research and urban agriculture, eco-entrepreneurs and public policy change makers," he added.

Part of The Sustainable City, Dubai, Fairgreen's campus has been designed to minimize the school's environmental impact, utilizing solar power for all its energy needs, recycling all its water for agricultural use, and implementing waste separation and wind energy generation. The Pre-K to 12 international school will offer the full International Baccalaureate (IB) continuum of education, comprising the IB Primary Years Programme (PYP), Middle Years Programme (MYP), Diploma Programme (IB DP) and Career-related Programme (IB CP). Fairgreen's curriculum will also integrate sustainability, featuring hands-on project-based learning, innovative teaching methods, technology initiatives and worldwide partnerships with leading experts and organizations in sustainability-related research and practice.

Fairgreen International School will feature technology-enabled classrooms, state of the art labs and maker-spaces, research and food production labs, a library and learning hub, and arts and music labs. The school's athletic complex will include a swimming pool, a large indoor multi-purpose gym and auditorium, outdoor soccer field, courts and playgrounds. Students will also have access to the City's Innovation Centre, Junior Innovation Centre, Equestrian Centre, and biking and jogging tracks. One of The Sustainable City's spacious bio-domes will be dedicated to the school and will serve as its Health, Wellness, and Learning Centre, led by "America's favourite teacher," Mr. Stephen Ritz, and modelled on the innovative and transformational programs he has established in one of New York City's most disadvantaged communities. The Centre will engage Fairgreen's students in project-based learning through urban farming, vertical farming, and other endeavours that promote health, wellness, and sustainability.

Established in 1976, Esol Education currently operates nine schools across five countries, recently establishing American School Hong Kong in 2016, its first school in East Asia. Strongly committed to developing the educational landscape in the UAE, Esol has operated leading international schools here for over 20 years, including the American International School in Abu Dhabi (AISA), the Universal American School in Dubai (UAS), and Deira International School (DIS) in Dubai. Along with Fairgreen International School, Esol has also announced the opening of Dunecrest American School in 2018, a premium American school located near the Al Barari and Living Legends developments in Dubailand.

Fairgreen International School will open with Pre-KG to Grade 9 classes in September 2018, growing to a thriving community of over 1,000 students by 2025. Admissions will open in October 2017

INFERENCES : the phenomena of designing learning centers as sustainable hubs has already started in many countries and at international level. It is time we use our contextual materials and sustainable techniques to evolve our idea of a 'school'.

GENERAL TAKEWAY INFERENCES :

- **The need of innovation in educational spaces is now more than ever- different approaches to it are interior corrections, retrofiting and designing tailor made spaces from scratch**
- **People have started adding sustainability measures to their campuses but as a plugins**
- **To re module this – designing innovation educational spaces from scratch with sustainability as the base layer is vital**
- **Urban schools are often vertical due to lack of space which further cuts down their touch with nature**
- **Most of the sustainable schools are found to be either in rural or sub urban area – the challenge is to bring this to the city where it is most needed**
- **Designing a module for innovation in learning spaces which goes hand in hand with sustainability is the key to crack the design – this module can be re used at different urban pockets with contextual modifications.**

2.2.3 CASE STUDIES

C1.PEARL ACADEMY , JAIPUR (LIVE)

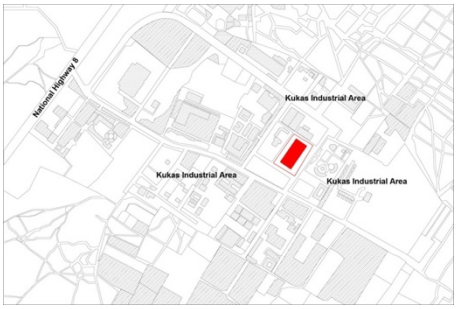
- **Architects :Morphogenesis**
- **Location :Jaipur, Rajasthan, India**
- **Area :11745.0 m2**
- **Project Year :2008**

C1.FIG.1 VIEW OF THE INSTITUTE

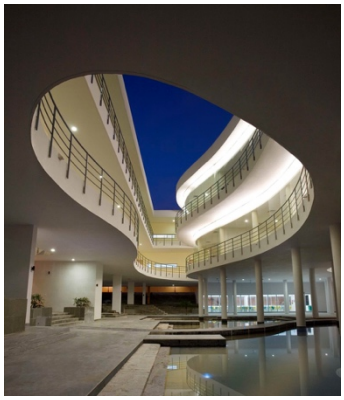
SITECITON CRITERIA :

INTERACTIVE LEARNING SPACES WITH SPILLOVERS AND THERMAL COMFORT THROUGHT TRADITIONAL PASSIVE COOLING

THE PEARL ACADEMY OF FASHION, JAIPUR IS A CAMPUS WHICH BY VIRTUE OF ITS DESIGN IS GEARED TOWARDS CREATING AN ENVIRONMENTALLY RESPONSIVE PASSIVE HABITAT. ***THE INSTITUTE CREATES INTERACTIVE SPACES FOR A HIGHLY CREATIVE STUDENT BODY TO WORK IN MULTIFUNCTIONAL ZONES WHICH BLEND THE INDOORS WITH THE OUTDOORS SEAMLESSLY.*** THE RADICAL ARCHITECTURE OF THE INSTITUTE EMERGES FROM A FUSION OF THE RICH TRADITIONAL BUILDING KNOWLEDGE BANK AND CUTTING EDGE CONTEMPORARY ARCHITECTURE**.**



C1.FIG.2 SITE LOCATION

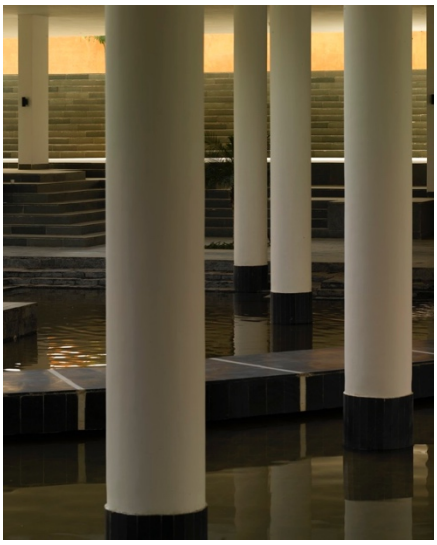


THE INSTITUTE IS LOCATED IN A TYPICAL HOT, DRY, DESERT TYPE CLIMATE ON THE OUTSKIRTS OF JAIPUR IN THE SOULLESS KUKAS INDUSTRIAL AREA, ABOUT 20 KILOMETERS FROM THE FAMOUS WALLED CITY. IT RANKS THIRD IN THE TOP 10 FASHION DESIGN INSTITUTES IN INDIA, AND ITS DESIGN NEEDED TO REPRESENT THE SERIOUSNESS OF ITS ACADEMIC ORIENTATION THROUGH ITS FORMAL GEOMETRY

C1.FIG.3 VIEW OF THE WATER HARVESTING COURTYARD

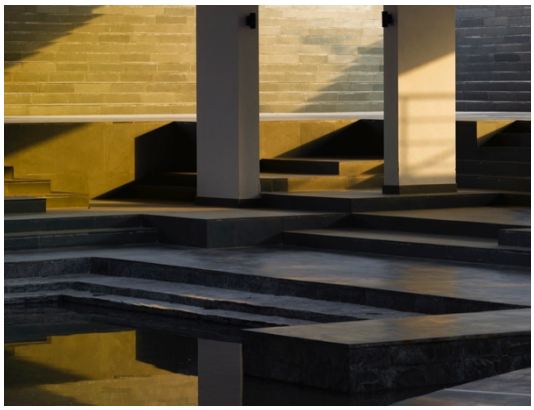
C1.FIG.4 VIEW OF THE WATER HARVESTING COURTYARD

GIVEN THE NATURE OF AN INSTITUTION, BUDGETARY CONSTRAINTS ON THE PROJECT NECESSITATED THE USE OF COST EFFECTIVE DESIGN SOLUTIONS TO KEEP WITHIN THE PRICE POINTS SET BY THE CLIENT AND YET BE ABLE TO ACHIEVE THE DESIRED FUNCTIONALITY AND EFFECT. THE ADVERSE CLIMATE MAKES IT A CHALLENGE TO CONTROL THE MICRO CLIMATE WITHIN THE PROJECT THUS INCORPORATING VARIOUS PASSIVE CLIMATE CONTROL METHODS BECOMES A NECESSITY AND ALSO REDUCES THE DEPENDENCE ON MECHANICAL ENVIRONMENTAL CONTROL MEASURES WHICH ARE RESOURCE HUNGRY.



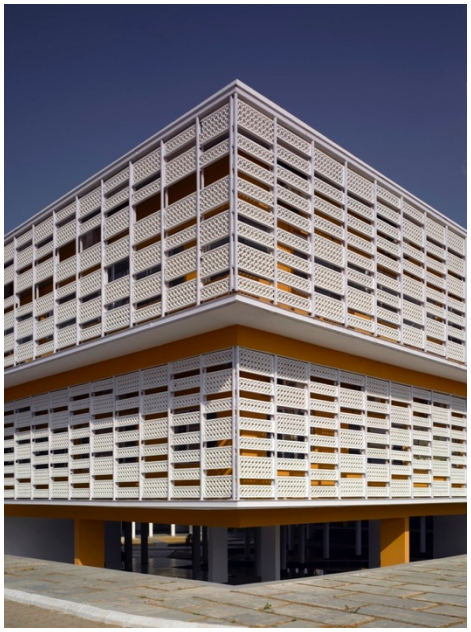
C1.FIG.4 INTERACTIVE SPACE PLAY

THE ARCHITECTURE OF THE ACADEMY NEEDED TO BE A CONFLUENCE OF MODERN ADAPTATIONS OF TRADITIONAL INDO-ISLAMIC ARCHITECTURAL ELEMENTS AND ***PASSIVE COOLING STRATEGIES PREVALENT IN THE HOT-DRY DESERT CLIMATE OF RAJASTHAN SUCH AS OPEN COURTYARDS, WATER BODY, A STEP-WELL OR BAOLI AND JAALIS (PERFORATED STONE SCREEN).***



C1.FIG.5 LIGHT AND SHADOW PLAY ON INTERACTIVE SPACES

ALL THESE ELEMENTS HAVE BEEN DERIVED FROM THEIR HISTORIC USAGES, BUT WILL MANIFEST THEMSELVES THROUGH THE BUILT FORM AND BECOME AN INTRINSIC PART OF THE DAILY LIFE OF THE DESIGN STUDENT.



C1.FIG.6 VIEW OF THE BUILDING

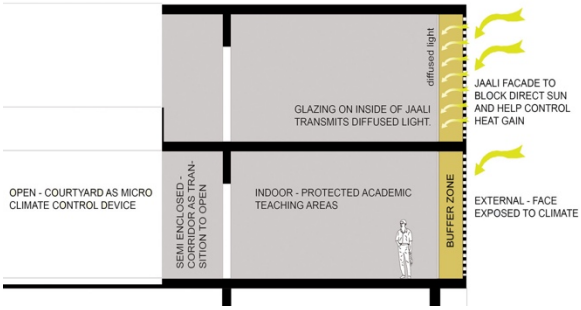
C1.FIG.7 VIEW OF THE BUILDING SKIN AND THE WALL CREATING A BUFFER SPACE FOR THERMAL COMFORT

THE BUILDING IS PROTECTED FROM THE ENVIRONMENT BY A DOUBLE SKIN WHICH IS DERIVED FROM A TRADITIONAL BUILDING ELEMENT CALLED THE 'JAALI' WHICH IS PREVALENT IN RAJASTHANI ARCHITECTURE.

THE DOUBLE SKIN ACTS AS A THERMAL BUFFER BETWEEN THE BUILDING AND THE SURROUNDINGS. THE DENSITY OF THE PERFORATED OUTER SKIN HAS BEEN DERIVED USING COMPUTATIONAL SHADOW ANALYSIS BASED ON ORIENTATION OF THE FAÇADES.

C1.FIG.8 VIEW OF THE BUILDING – ELEVATION PLAY

THE OUTER SKIN SITS 4 FEET AWAY FROM THE BUILDING AND REDUCES THE DIRECT HEAT GAIN THROUGH FENESTRATIONS. DRIP CHANNELS RUNNING ALONG THE INNER FACE

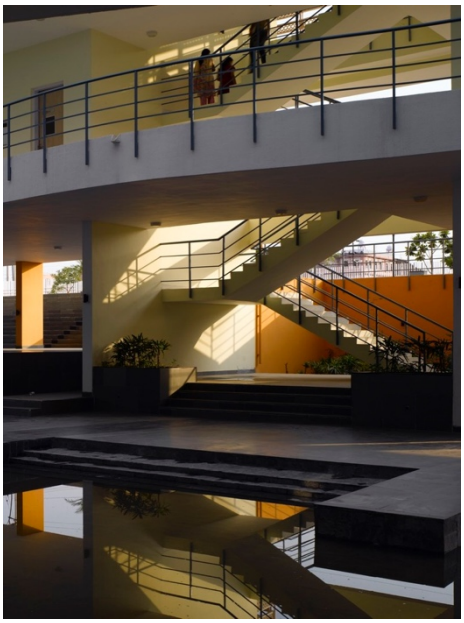


C1.FIG.9 PASSIVE COOLING TECHNIQUES USED

OF THE JAALI ALLOW FOR PASSIVE DOWNDRAFT EVAPORATIVE COOLING, THUS REDUCING THE INCIDENT WIND TEMPERATURE.

THE SCHEME ***RELIES ON SELF SHADING SLIVER COURTS TO CONTROL THE TEMPERATURES OF INTERNAL SPACES AND OPEN STEPPED WELLS WHILE ALLOWING FOR SUFFICIENT DAY LIGHTING INSIDE STUDIOS AND CLASS ROOMS.***

C1.FIG.10 WATER COURTYARD FOR EVAPORATIVE COOLING



C1.FIG.11 STAIRCASE BLOCK NATURALLY LIT

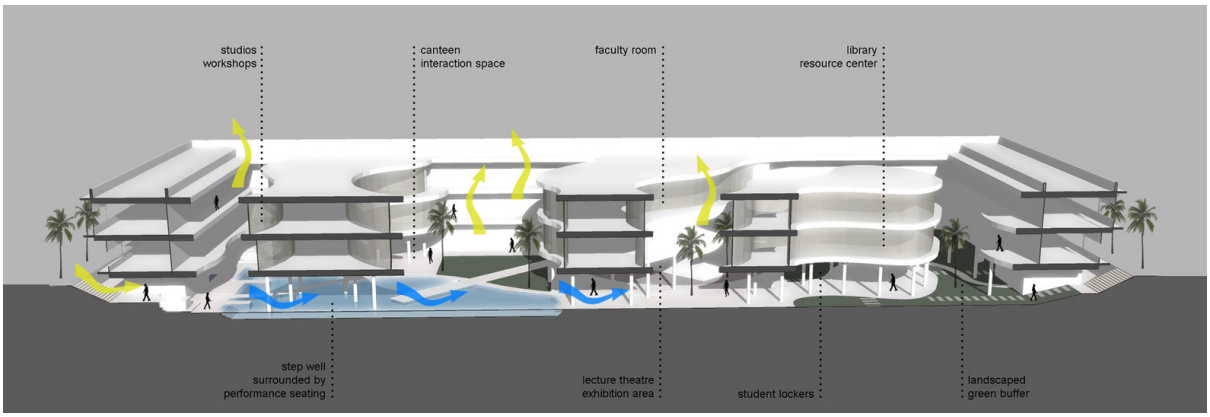
THE ENTIRE BUILDING IS RAISED ABOVE THE GROUND AND A SCOOPED OUT UNDER BELLY FORMS ***A NATURAL THERMAL SINK WHICH IS COOLED BY WATER BODIES THROUGH EVAPORATIVE COOLING. THIS UNDER BELLY WHICH IS THERMALLY BANKED ON ALL SIDES SERVES AS A LARGE STUDENT RECREATION AND EXHIBITION ZONE AND FORMS THE ANCHOR FOR THE ENTIRE PROJECT.***

DURING THE NIGHT WHEN THE DESERT TEMPERATURE DROPS THIS FLOOR SLOWLY DISSIPATES THE HEAT TO THE SURROUNDINGS KEEPING THE AREA THERMALLY COMFORTABLE. THIS TIME LAG SUITS THE STAGGERED FUNCTIONING OF THE INSTITUTE.

C1.FIG.12 GOOD PLAY OF VISUALS

THE MATERIALS USED FOR CONSTRUCTION ***ARE A MIX OF LOCAL STONE, STEEL, GLASS, AND CONCRETE CHOSEN KEEPING IN MIND THE CLIMATIC NEEDS OF THE REGION WHILE RETAINING THE PROGRESSIVE DESIGN INTENT***.

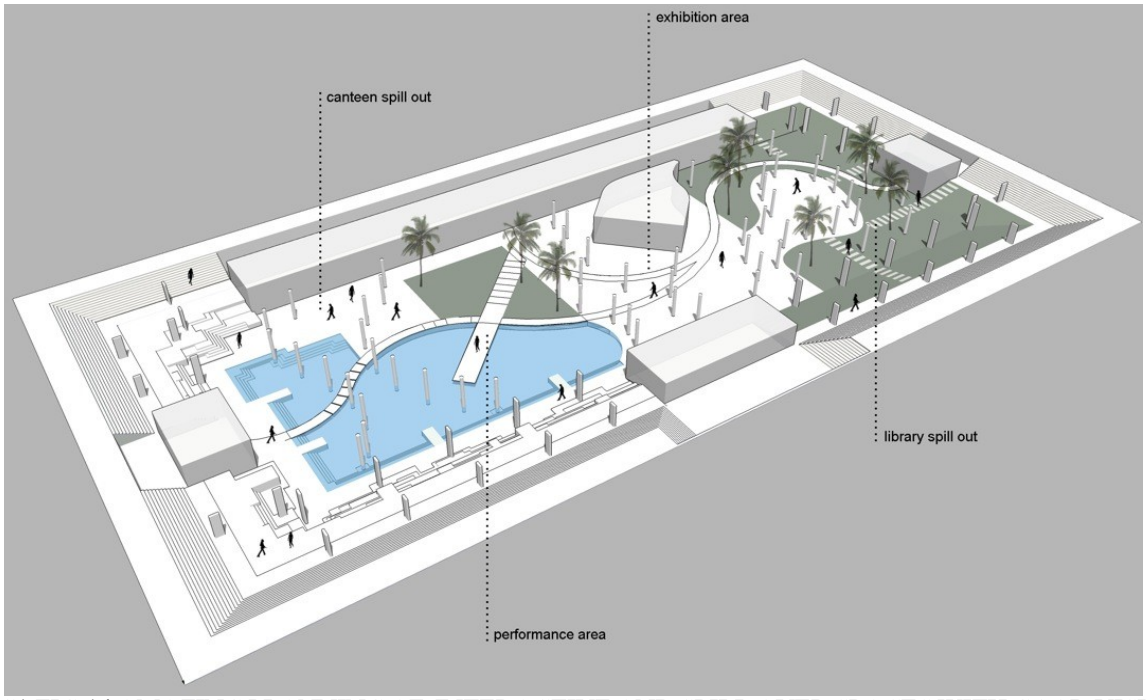
ENERGY EFFICIENCY IS A PRIME CONCERN AND THE INSTITUTE IS 100% SELF SUFFICIENT IN TERMS OF CAPTIVE POWER AND WATER SUPPLY AND PROMOTES RAIN WATER HARVESTING AND WASTE WATER RE-CYCLING THROUGH THE USE OF A SEWAGE TREATMENT PLANT.



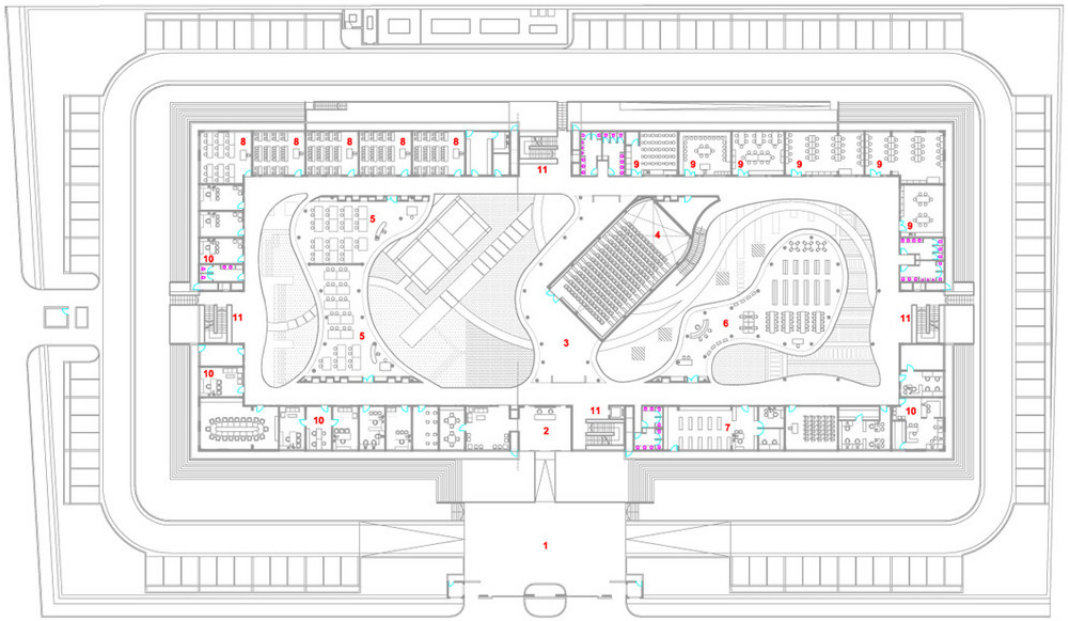
C1.FIG.13 PASSIVE COLLING TECHNIQUES USED – PLAY OF VOIDS FOR VENTILATION

BESIDES HAVING BECOME A VERY SUCCESSFUL MODEL FOR COST EFFECTIVE PASSIVE ARCHITECTURE IN DESERT REGIONS THE DESIGN AND FACILITIES OF THE CAMPUS COMPLEMENT THE IDEOLOGY OF THE PEARL ACADEMY OF FASHION – A CUTTING EDGE DESIGN INSTITUTE WITH A SUSTAINABLE APPROACH.

THE PEARL ACADEMY OF FASHION IS AN EXEMPLAR OF AN INCLUSIVE ARCHITECTURE WHICH INTENDS TO ACCOMMODATE ALL THE HERITAGE VALUES WHILE POSITIONING IT WITHIN THE CONTEMPORARY CULTURAL AND ARCHITECTURAL PARADIGM.

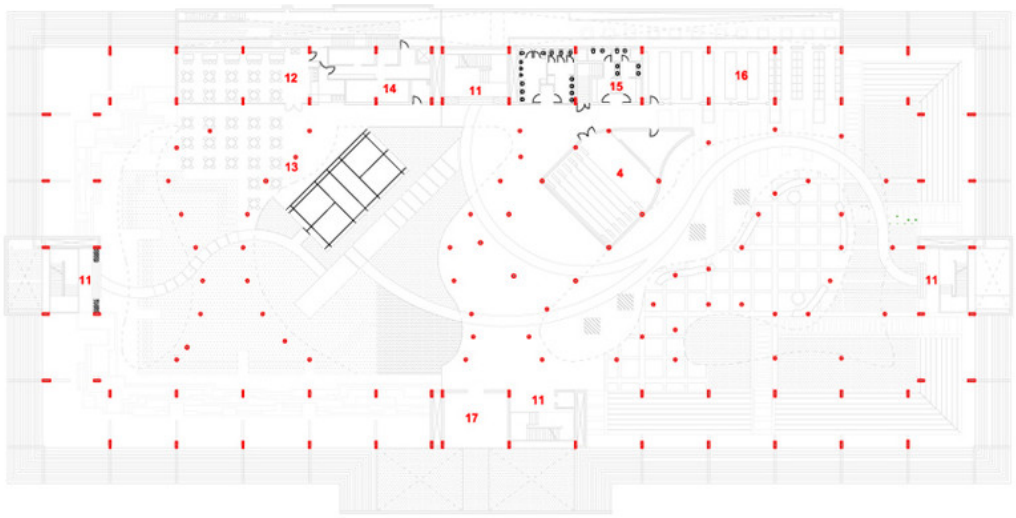


C1.FIG.14 AMAZING PLANNING OF INTERACTIVE AND SPILL OVER SPACES WITH GOOD VISUAL CONNECTIVITY AND THEMALLY COMFORTABLE.



1. main entrance
2. reception
3. exhibition area
4. lecture theater
5. studios
6. library
7. resource center
8. class rooms
9. labs
10. administrative offices
11. staircases
12. canteen
13. outdoor seating
14. kitchen
15. backstage
16. lockers
17. shop

C1.FIG.15 GROUND FLOOR PLAN SHOWING STRUCTURE FUNCTIONS



1. main entrance
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11. staircases
12. canteen
13. outdoor seating
14. kitchen
15. backstage
16. lockers
17. shop

C1.FIG.15 FIRST FLOOR PLAN SHOWING STRUCTURE FUNCTIONS

INFERENCES :

- despite the hardship of the extreme climate, the campus has proven to be effective in terms of micro climate control and in providing creative flexible spaces for the students.
- it has kept its intrinsic values of Rajasthan and infact used the traditional methods in a contemporary form to control the micro climate.
- the characteristics of the spaces thus formed are innovative and efficient in triggering curiosity and creativity.
- the presence of water element not only helps make the structure comfortable but also acts as a design element which enhances the overall fell of that area.
- the central courtyard is utterly flexible in nature and has a good visual connectivity for interactive sessions.

C2.
AXIS PRAMITI / THE PURPLE INK STUDIO

ARCHITECTS : THE PURPLE INK

AREA :14000.0 FT2

PROJECT YEAR : 2017

SELECTION CRITERIA :
INTERACTIVE LARNING SPACES WITH CONTEXTURAL MATERIAL PALLATTE.

C2.FIG 1. SCHOOL ELEVATION

THE PROGRAMMATIC ***VALUES OF THE SCHOOL BELIEVE IN BREAKING AWAY FROM THE STANDARD SCHOLASTIC TEACHING SYSTEM.***

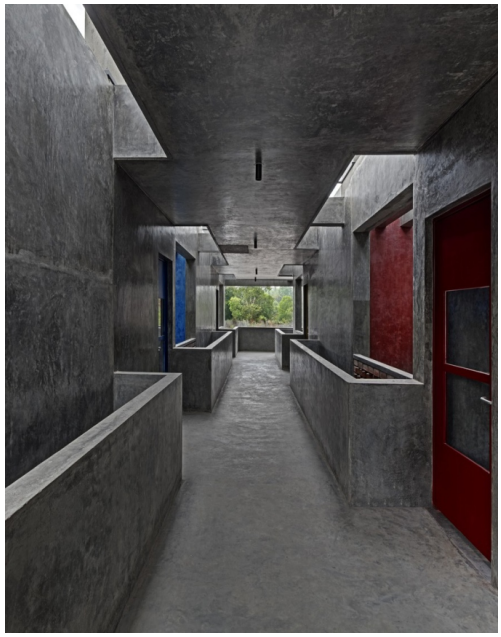
C2.FIG.2 NATURAL LY SUNLIGHT CORRIDORS

THE DESIGN ***EMBRACES THE CREATIVE ENTERPRISE OF 'FLEXIBLE LEARNING' TO CATER TO THE NEEDS OF A HETEROGENEOUS GROUP OF LEARNERS.***

THE SITE IS A LAND WITH STEEP SLOPING NATURAL TOPOGRAPHY AND SEVERAL ***EXISTING TREES MAKING IT AN IDEAL SETTING FOR IMPARTING EDUCATING IN A GREEN ENVIRONMENT***. THE PREMISE IS DESIGNED TO BE ***SAFE AND CLOSE KNIT YET COMPLETELY FLEXIBLE CREATING AN ENCOURAGING AND INTERACTIVE ENVIRONMENT.***

THE ADMINISTRATIVE ***HIERARCHY IS CONVENTIONAL FOR EASE IN FUNCTIONING WHILE, THE LEARNING SPACES AND THE ACTIVITY OR EXTRACURRICULAR AREAS ENCOURAGE INTERPERSONAL CONTACT BETWEEN THE STUDENTS***.

C2.FIG.3 CLASSROOMS OPENING INTO THE COURTYARD



C2. FIG.4 CONVENTIONAL ADMINISTRATION BLOCK

EACH LEARNING SPACE IS ORGANIZED AROUND AN OUTDOOR COURT WHICH ENABLES THE EXTENSION OF THE INDOOR SPACE INTO THE OUTDOORS EITHER FOR ADDITIONAL ACTIVITIES OR TO ACCOMMODATE MORE STUDENTS AT A TIME WITHIN THE SAME SPACE

C2.FIG.5 CLASSROOM VIEW

EACH OF THE CLASSROOMS WHICH ARE OCCUPIED THROUGH MOST PART OF THE DAY IS CLIMATICALLY ORIENTED AND HOUSES A TREE IN THE OUTDOOR COURT MAKING SPACES COMFORTABLE TO INHABIT THROUGH THE YEAR THROUGH PASSIVE VENTILATION.

C2. FIG.6 CORRIDOR VIEW - NATURALLY LIT

C2. FIG.7 CLASSROOM SPILLOVER

THE ENTIRE FEEL IS ORGANIC WITH NATURAL LIGHT WASHING THE EXPOSED WALLS AND CEILINGS WITH A SPECTACULAR PLAY OF LIGHT AND SHADOWS.

C2.FIG.8 ADMIN SPACES

C2 .FIG.9 NATURALLY LIT INTERACTIVE CORRIDORS

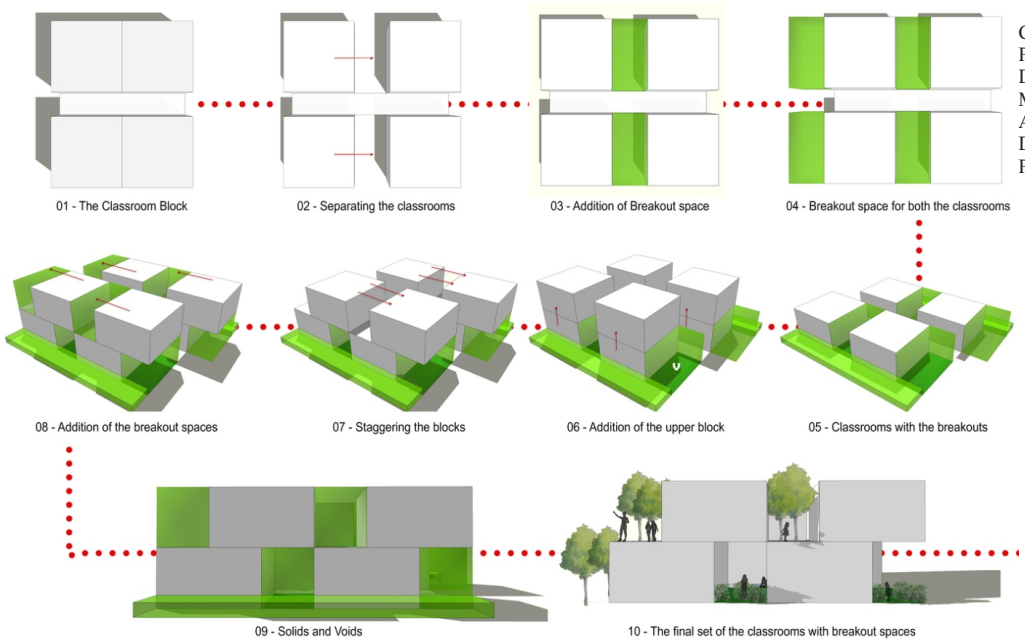
THE SPACES ARE FURTHER ***HELD TOGETHER WITH A STRONG DESIGN LANGUAGE OF EXPOSED CEMENT FINISHES,*** PIGMENTED WALLS AND BRICK JAALI OPENINGS WHICH MERGE THE INTERIOR AND EXTERIORS, QUITE LITERALLY. ***THE FLOORING IN ALL THE MAIN ROOMS IS PLANNED IN KOTA STONES AND THE COMMON CORRIDORS ARE PLANNED WITH IPS.***

C2.FIG.10 STAIRCASE BLOCK

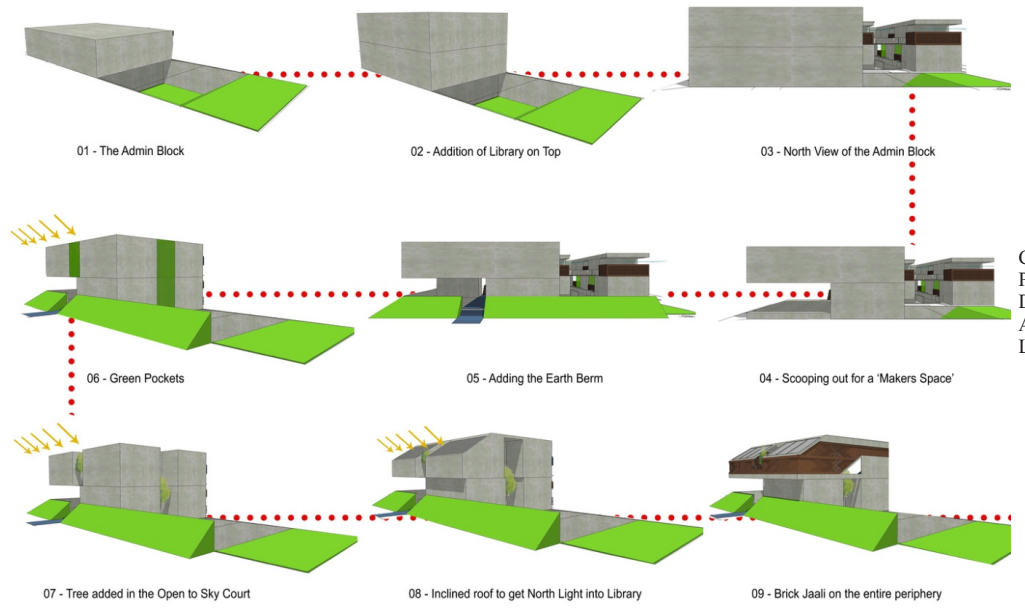
C2.FIG.11 VIEW OF THE MASS

C2. FIG.12 CORRIDOR SPACE

THE LOWER ADMINISTRATIVE FLOORS AND THE FACILITIES FOR ADDITIONAL ACTIVITIES LIKE THE LABORATORIES, AV ROOMS AND ART CLASSES ON THE UPPER FLOORS ARE CONNECTED WITH ***A SERIES OF INNER COURTS THAT ARE EXTENDABLE INTO OUTDOOR LEARNING AREAS, BLEND TO BECOME A GREEN CORRIDOR WHERE THE STUDENTS CAN INTERACT IN A NATURAL ENVIRONMENT.***



C2.FIG.13 PROCESS AND DERIVATION OF MASSING ACCORDING TO DESIGN PRINCIPLES.



C2.FIG.14 PROCESS AND DERIVATION OF ADMIN AND LIBRARY.

THE PROCESS & DESIGN EVOLUTION : **ADMIN + LIBRARY**

THE ***INTERPERSONAL CONTACT BETWEEN THE STUDENTS IS AN IMPORTANT FACTOR IN THE DESIGN,*** WHICH IS ACHIEVED THROUGH ***VARIOUS HIERARCHIES OF INTERACTION SPACES***. **THE PREMISE IS DESIGNED TO BE SAFE AND CLOSE KNIT YET COMPLETELY FLEXIBLE CREATING AN ENCOURAGING AND INTERACTIVE ENVIRONMENT**

C3.
CASE DESIGN + TRANSSOLAR COMPLETE AVASARA ACADEMY FOR GIRLS IN PUNE, INDIA

C3.FIG.1 VIEW OF THE BUILT MASS

LOCATED IN THE RURAL VILLAGE OF LAVALE IN INDIA, ***THE NEW AVASARA ACADEMY SCHOOL BUILDING HAS BEEN REALIZED AS PART OF THE GROWING TOWNSHIP OF KNOWLEDGE CITY.*** ITS ***UNIQUE POSITIONING TAKES ADVANTAGE OF LOCALLY-AVAILABLE RESOURCES,*** AND DESPITE BEING DISTINCTIVE IN COMPARISON TO ANY OTHER BUILDINGS IN THE AREA, ***THE ARCHITECTURE IS RESPECTFUL TO ITS RURAL SURROUNDINGS, ENVIRONMENTALLY FRIENDLY AND SUPPORTS THE DEVELOPMENT OF SPEARDING EDUCATION FOR YOUNG WOMEN IN INDIA***

C3.FIG.2 THE CONCRETE STRUCTURE HAS BEEN LEFT OPEN WITH ONLY BAMBOO SHADING TO PROVIDE A SENSE OF ENCLOSURE

C3.FIG.3 USABLE SPACE IS PLANNED AROUND THE CENTRAL CIRCULATION

A COLLECTION OF SIMPLE STRUCTURES ARRANGED AROUND AN INFORMAL SERIES OF WALKWAYS, COURTYARDS, GARDENS AND TERRACES. THE LARGEST BUILDING HOSTS THE CLASSROOMS AND FACILITIES THAT DRIVE THE LEARNING EXPERIENCE FOR THE STUDENTS. PASTEL COLORS PAINTED ON THE CEILINGS OF EACH FLOOR GIVE THE DETAILED CONCRETE CONSTRUCTION AND STONE BUILDING VIBRANCY, WHILE THE MOSTLY OPEN-FAÇADE IS COVERED IN PANELS OF BAMBOO SHADING.

THE ARCHITECTURAL DESIGN WAS CONCEIVED BY **MUMBAI-BASED FIRM CASE DESIGN**, ***MEANWHILE TRANSSOLARKLIMA ENGINEERING CALCULATED THE SOLUTIONS TO ALLOW THE BUILDING TO ACHIEVE ITS NET-ZERO ENERGY STATUS.*** TOGETHER, **BOTH TEAMS DEVELOPED A RESPONSE FOR THE 4.3 ACRE CAMPUS WHICH GROWS OUT FROM THE HILLSIDE.**

C3.FIG.4 THE SCHOOL IS UNIQUELY POSITIONED TO TAKE ADVANTAGE OF LOCALLY SHARED RESOURCES WHILE ESTABLISHING ITS OWN IDENTITY AS A LEADER IN THE EDUCATION

THE ROOMS HAVE BEEN BASED AROUND **THE PERIMETER OF THE BUILDING, ALLOWING THE CENTRAL CORE TO BE COMPLETELY OPEN AND SERVE SOLELY FOR CIRCULATION PURPOSES**. IN TURN, ***THESE CENTRALLY LOCATED 'EXHAUST CAVITIES' ARE INTEGRATED IN THE STRUCTURAL CORE OF THE BUILDING AND EVENTUALLY EXTENDS OUT AS SOLAR CHIMNEYS ABOVE ROOF LEVEL TO PASSIVELY DRIVE AIR FLOW, AND PROVIDE COOLING, THROUGHOUT***.

C3.FIG.5 THE CEILINGS OF EACH FLOOR HAS BEEN PAINTED IN A DIFFERENT COLOR

C3.FIG.6 SPACES LOOKS OUT TO THE LANDSCAPE BEYOND

C3.FIG.7 OUTSIDE AIR IS DRAWN THROUGH A SERIES OF EARTH DUCTS, WHERE IT IS PASSIVELY PRE-COOLED, BEFORE BEING SUPPLIED INTO THE CLASSROOMS AND LIVING SPACES

C3.FIG.8 BAMBOO PROVIDES SHADING AND ADDS PRIVACY TO THE MOSTLY EXPOSED BUILDING

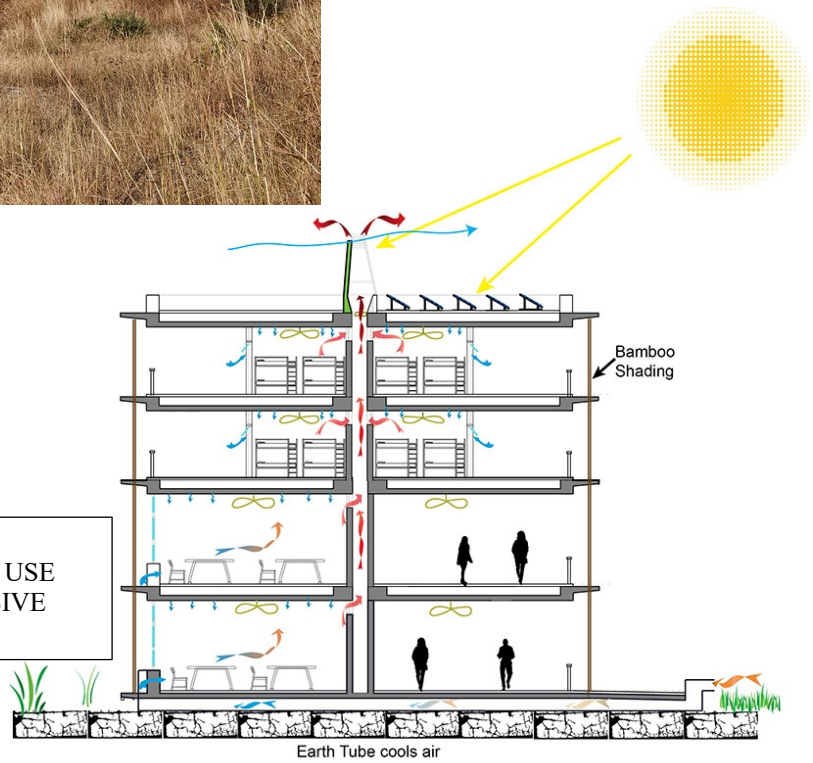
WITH A HIGH AMBITION AND A MODEST BUDGET, THE BUILDING ACHIEVES **A COMFORTABLE INTERNAL CONDITION WITHOUT THE USE OF ANY MECHANICAL SYSTEM DESPITE THE WARM AND HUMID WESTERN CLIMATE OF INDIA**.

TAKING CUES FROM LOCAL AND OTHER EXAMPLES OF ACADEMIC, DOMESTIC, PUBLIC AND SACRED SPACES, THE ARCHITECTURE OF AVASARA ACADEMY RESPONDS TO SITE, PROGRAM AND CLIMATE, ADDRESSING THE NEEDS OF THE COMMUNITY TO PROVIDE A SANCTUARY FOR LEARNING.

ALONG WITH THE CLIMATIC RESPONSIVE MASSING, STRATEGIC PROGRAM PLACEMENT, THE STUDY OF AIR FLOW AND THE USE OF LOCALLY SOURCED BAMBOO SHADES; THESE WERE ALL COMPONENTS THAT ALLOWED THE BUILDING TO USE ARCHITECTURAL AND STRUCTURAL INFRASTRUCTURE FOR A YEAR-ROUND COMFORTABLE LEARNING AND LIVING ENVIRONMENT.

C3.FIG.9 ACRE CAMPUS IS LOCATED 10 KM WEST OF PUNE AND ROUGHLY 145 KM SOUTHEAST OF MUMBAI

SELECTION CRITERIA :
CONTEXTUAL MATERIAL USE WITH TRADITIONAL PASSIVE COOLING TECHNIQUES



C3.FIG.10 SOLAR CHIMNEYS, USES HEAT FROM THE SUN AND ARE DESIGNED TO PASSIVELY DRIVE THE ENTIRE AIR FLOW, AND PROVIDE COOLING

INFERENCES :

- THE USE OF LOCALLY AVAILABLE MATERIAL AND LABOR CUTS DOWN COST
- USING TRADITIONAL COOLING METHODS REDUCES THE LOAD ON ENVIRONMENT AND USE OF MECHANICAL VENTILATION
- GOOD USE OF TRADITIONAL COURTYARD VENTILATION AND ITS MANIFESTATION IN THE DESIGN AS STAIRCASE PIT
- SENSE OF BELONGING AS THE DESIGN SEEMS TO COMPLETELY MERGE WITH THE ADJOINING NATURE.
- USE OF VIBRANT COLOUR AS PER COLOUR THERAPY FOR INTERACTIVE AND CREATIVE SPACES.
- DESIGN GIVES GOOD OPPORTUNITY FOR VISUAL PLAY AND SHADOW PATTERNS DUE TO BAMBOO SHADING.

C4.
FARMING KINDERGARTEN, VIETNAM

LOCATION :BIÊN HÒA, DONG NAI, VIETNAM

AREA :3800.0 SQM

PROJECT YEAR : 2013

C4.FIG.1 ARIEL VIEW OF THE SCHOOL

VIETNAM HISTORICALLY AN AGRICULTURAL COUNTRY IS FACING CHANGES AS IT MOVES TO A MANUFACTURING BASED ECONOMY, TAKING ITS TOLL ON THE ENVIRONMENT. INCREASED DROUGHTS, FLOODS AND SALINIZATION JEOPARDIZE FOOD SUPPLIES, WHILE NUMEROUS MOTORBIKES CAUSE DAILY CONGESTION AND AIR POLLUTION IN THE CITIES. ***RAPID URBANIZATION DEPRIVES VIETNAMESE CHILDREN OF GREEN LANDS AND PLAYGROUNDS, THUS RELATIONSHIP WITH NATURE***

C4.FIG.2 THE BUILDING'S CONTINUOUS GREEN ROOF CONTAINS BENEATH IT ALL OF THE SITE'S DIFFERENT PROGRAMS

FARMING KINDERGARTEN IS A CHALLENGE TO COUNTER THESE ISSUES.

LOCATED NEXT TO A BIG SHOE FACTORY, AND ***DESIGNED FOR 500 CHILDREN OF THE FACTORY'S WORKERS, THE BUILDING IS CONCEIVED AS A CONTINUOUS GREEN ROOF, PROVIDING FOOD AND AGRICULTURE EXPERIENCE TO CHILDREN, AS WELL AS AN EXTENSIVE PLAYGROUND TO THE SKY.***

A ***FULLY ACCESSIBLE GREEN ROOF DRAWN IN A TRIPLE-RING-SHAPE CREATES THREE COURTYARDS ENCLOSED BY THE LOOPING STRUCTURE, PROVIDING SAFE AND SECURE PLAYGROUNDS FOR THE KINDERGARTEN'S OCCUPANTS***.

C4.FIG.3 ACCESSIBLE ROOFS CREATING INTERNAL SAFE COURTYARDS FOR KIDS.

RECENTLY, AN EXPERIMENTAL VEGETABLE GARDEN WAS REALIZED ON ITS TOP. FIVE DIFFERENT VEGETABLES ARE PLANTED IN 200M2 GARDEN FOR AGRICULTURE EDUCATION.

THE FOOD PRODUCED IS USED FOR THEIR DAY MEAL - ITS HEALTHY AND ORGANIC IN NATURE.

C4.FIG.4 FARMING HELPS KIDS UNDERSTAND SUSTAIN ABILITY AND BECOME SENSITIVE TOWARDS NATURE

C4.FIG.5 ENCLOSED COURTYARDS ACT AS SAFE ENVIRONMENT FOR KIDS.

ALL FUNCTIONS ARE ACCOMMODATED UNDER THIS ROOF. AS THE ROOF LOWERS TO THE COURTYARD IT PROVIDES ACCESS TO THE UPPER LEVEL AND VEGETABLE GARDENS ON TOP- THE PLACE WHERE CHILDREN LEARN THE IMPORTANCE OF AGRICULTURE AND RECOVER CONNECTION TO NATURE.

THE DIFFERENT LEVELS AND GRADIENTS CREATED BY THE BUILDING'S SPIRAL FORM OFFER A SERIES OF DISTINCT OUTDOOR LEARNING ENVIRONMENTS, WHERE CHILDREN ARE ABLE TO FORGE A CLOSE RELATIONSHIP WITH THE NATURAL WORLD.

C4.FIG.6 INTERACTIVE VISUAL CONNECTIONS AND LEVEI PLAY.

C4.FIG.7 KIDS ARE ALWAYS MONITORED FRO BELOW SPACES.

AS A RESULT, THE KINDERGARTEN IS OPERATED WITHOUT AIR CONDITIONERS IN THE CLASSROOMS DESPITE BEING LOCATED IN A HARSH TROPICAL CLIMATE. ACCORDING TO POST-OCCUPANCY RECORD ISSUED 10 MONTHS AFTER COMPLETION, THE BUILDING SAVES 25% OF ENERGY AND 40% OF FRESH WATER COMPARED TO BASELINE BUILDING PERFORMANCE, REDUCING ITS RUNNING COST GREATLY.

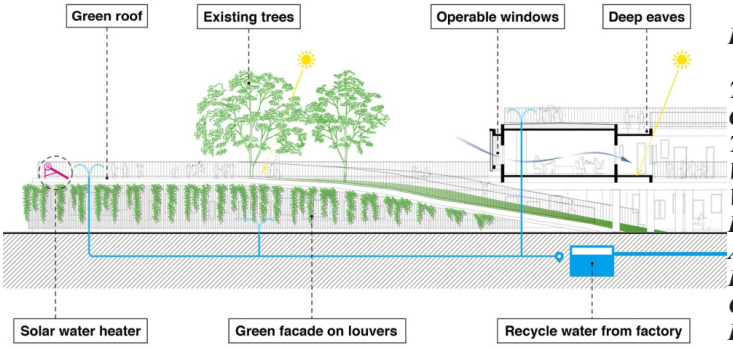
C4.FIG.8 VIEW OF THE COURTYARD SPACE- A SENSE OF PROTECTION IS OFFERED BY THE ENCLOUSRE.

COST-EFFICIENCY

THE BUILDING IS DESIGNED FOR LOW-INCOME FACTORY WORKERS' CHILDREN, THEREFORE CONSTRUCTION BUDGET IS QUITE LIMITED. THEREFORE, THE COMBINATION OF LOCAL MATERIALS (EX. BRICKS, TILES) AND LOW-TECH CONSTRUCTION METHODS ARE APPLIED, WHICH ALSO HELP MINIMIZE THE ENVIRONMENTAL IMPACT AS WELL AS PROMOTE LOCAL INDUSTRY. THANKS TO SIMPLE RIGID FRAME WITH ECONOMICAL MATERIALS, THE CONSTRUCTION COST PER ONE SQUARE METER IS ONLY 500 USD INCLUDING FINISHES AND EQUIPMENT, WHICH IS COMPETITIVELY CHEAP EVEN WITHIN THE VIETNAMESE MARKET

C4.FIG.9 CLASSROOMS

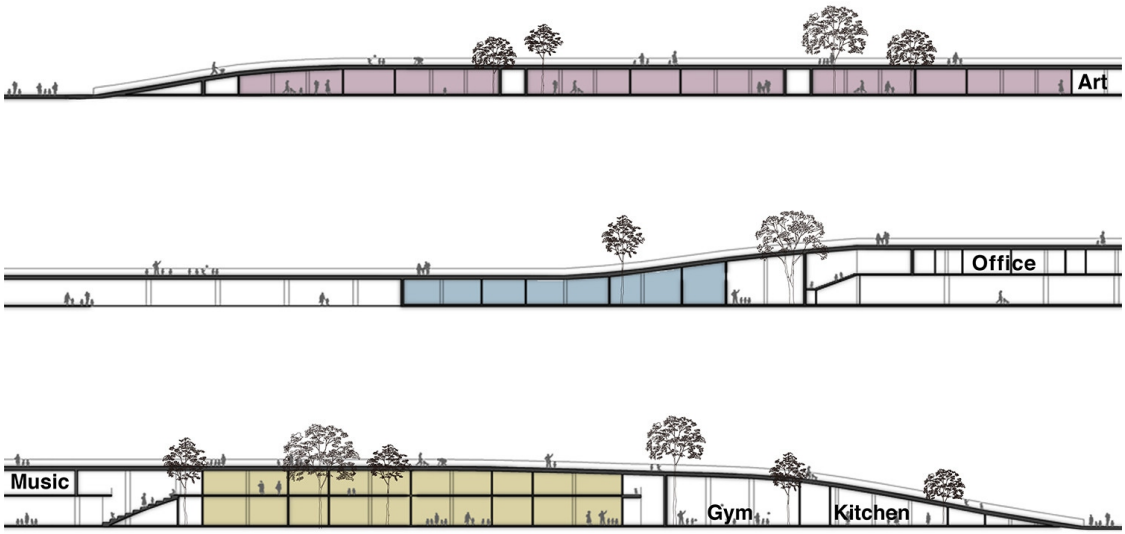
C4.FIG.10 CLASSROOMS SPILLING OUT IN THE GREENS



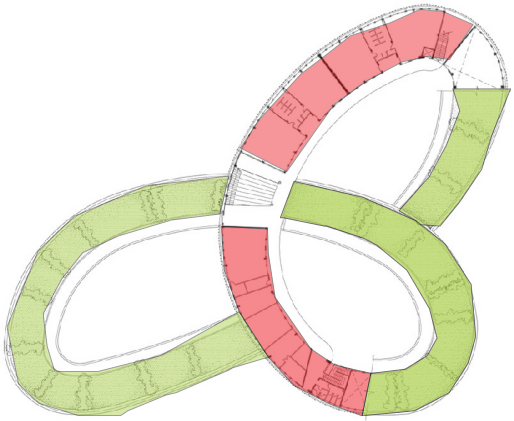
C4.FIG.11 SUSTAINABLE STRATEGICS USED.

ENVIRONMENTAL STRATEGIES

THE BUILDING IS MADE OF A CONTINUOUS NARROW STRIP WITH TWO SIDE OPERABLE WINDOWS WHICH MAXIMIZE THE CROSS VENTILATION AND NATURAL LIGHTING. ADDITIONALLY, ARCHITECTURAL AND MECHANICAL ENERGY-SAVING METHODS ARE COMPREHENSIVELY APPLIED INCLUDING BUT NOT LIMITED TO: GREEN ROOF AS INSULATION, GREEN FACADE AS SHADING AND SOLAR WATER HEATING. THESE DEVICES ARE DESIGNED VISIBLY AND PLAY AN IMPORTANT ROLE IN THE CHILDREN'S SUSTAINABLE EDUCATION. FACTORY WASTEWATER ARE RECYCLED TO IRRIGATE GREENERY AND FLUSH TOILETS.

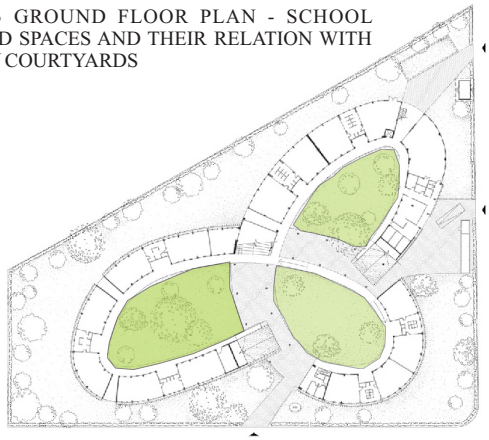


C4.FIG.12 SECTIONAL ELEVATION SHOWING VOLUMETRIC SCALE AND LOCATION OF DIFFERENT SPACES



C4.FIG.14 FIRST FLOOR PLAN - RATIO OF SCHOOL SPACES TO AGRICULTURAL SURFACE.

C4.FIG.13 GROUND FLOOR PLAN - SCHOOL ENCLOSED SPACES AND THEIR RELATION WITH THE OPEN COURTYARDS



SELECTION CRITERIA :
GREEN ROOF – FOOD PRODUCTION ON CAMPUS – COURTYARD SPACES – SUSTAINABLE CAMPUS.

INFERENCES :

- THE USE OF LOCALLY AVAILABLE MATERIAL AND LABOR CUTS DOWN COST
- USING TRADITIONAL COOLING METHODS REDUCES THE LOAD ON ENVIRONMENT AND USE OF MECHANICAL VENTILATION
- SENSE OF BELONGING AS THE DESIGN SEEMS TO COMPLETELY MERGE WITH THE ADJOINING NATURE.
- COURTYARD IS EFFICIENTLY DESIGNED TO KEEP A VISUAL TRACK OF THE KIDS ON THE KIDS AT THE SAME TIME THEY DO NOT FEEL RESTRICTED.
- THE FOOD THAT THEY GET IN SCHOOL IS WHAT THEY HELP IN CULTIVATION SO THEY KNOW THEY FOOD AND HOW IT IS GROWN - VALUE ARE INCULCATED NOT TO WASTE FOOD.
- THE GREEN SKIN ACTS AS A BUFFER TO STRONG SUNLIGHT AND HEAT WHILE ALSO COOLING DOWN VIA EVAPORATIVE COOLING IN SUMMERS.
- EXCELLENT USE OF VOLUMES AS VISION IS NOT HINDERED AT ANY POINT IN THE DESIGN.

C5.
BEN FRANKLIN ELEMENTARY SCHOOL

LOCATION: KIRKLAND WASHINGTON ,UNITED STATES

PROJECT YEAR: AUGUST 2015

AREA: 56,800 SQ.FT

THE BEN FRANKLIN ELEMENTARY SCHOOL SERVES 450 STUDENTS IN KINDERGARTEN THROUGH GRADE SIX. THE STUDENTS ARE DISTRIBUTED WITHIN SMALL LEARNING COMMUNITIES, EACH INCLUDING A CLUSTER OF FOUR NATURALLY VENTILATED AND DAYLIT CLASSROOMS AROUND A MULTIPURPOSE ACTIVITY AREA. STACKED WITHIN TWO-STORY WINGS THAT EXTEND TOWARD THE WOODS, THESE COMMUNITIES ARE INTEGRALLY LINKED WITH VIEWS AND ACCESS TO NATURE BEYOND.

THIS PROJECT WAS CHOSEN AS AN AIA COMMITTEE ON THE ENVIRONMENT TOP TEN GREEN PROJECT FOR 2006.

C5.FIG.1 VIEW OF ONE O F THE SCHOOL CLUSTERS

C5.FIG.2 SITE CONTEXT OF THE SCHOOL

C5.FIG.3 ACTUAL ARIEL VIEW OF THE SITE AND ADJOINING COMMUNITY FIELD

THE SITE, EMBRACING THE WOODS.

COMMUNITY WORKSHOPS WERE USED TO IDENTIFY THE NEEDS AND DESIRES OF THE DISTRICT, CITY, STUDENTS, PARENTS, AND NEIGHBORS. THE FORESTED AREA AT THE NORTHERN PORTION OF THE SITE WAS IDENTIFIED AS A COMMUNITY ASSET. AS A RESULT, THE DESIGN OF THE SCHOOL FOCUSED ON HIGHLIGHTING THE BUILDING'S RELATIONSHIP TO THE FOREST FOR BOTH LEARNING AND RECREATION. CONNECTIONS FROM BOTH THE CLASSROOMS AND PLAY AREAS TO THIS NATURAL ENVIRONMENT ARE MAINTAINED. THE SCHOOL BUILDING WAS SHIFTED TO THE EAST TO ALLOW BOTH VISUAL AND PHYSICAL CONNECTIONS FROM THE PUBLIC STREET TO THE FOREST BEYOND, INVITING THE NEIGHBORHOOD TO UTILIZE ALL OUTDOOR AMENITIES OF THE SITE.

IN ADDITION, THE SITE DESIGN BALANCES THE ACADEMIC NEEDS OF THE SCHOOL WITH THE RECREATIONAL NEEDS OF THE NEIGHBORHOOD. PARTNERING WITH THE CITY PARKS DEPARTMENT ALLOWED FOR PASSIVE RECREATIONAL IMPROVEMENTS WITHIN THE FORESTED AREA AND THE CREATION OF A MULTI-SPORT PLAYFIELD FOR SHARED COMMUNITY USE.

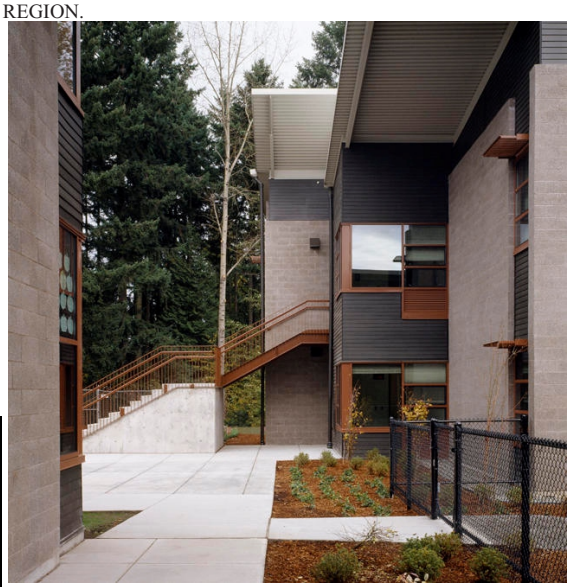
THROUGH COMMUNITY PARTNERSHIPS AND OUTREACH THE FACILITY AND SITE ARE BEING USED WELL AFTER SCHOOL HOURS, DURING WEEKENDS, AND DURING SUMMER MONTHS. INTERIOR SPACES THAT ARE HEAVILY USED BY THE PUBLIC, INCLUDING THE LIBRARY, GYM, AND COMMONS, WERE LOCATED NEAR THE ENTRY FOR EASY AFTER-HOURS USE.

LAND USE AND SITE ECOLOGY :

REALIZING THAT EACH STUDENT HAS THE POTENTIAL TO SHARE HIS OR HER ENVIRONMENTAL ETHIC WITH THE COMMUNITY AT LARGE, THE PROJECT TEAM DESIGNED THE SITE NOT ONLY TO CELEBRATE CURRENT GREEN BUILDING PRACTICES BUT ALSO TO INSPIRE AND EDUCATE GENERATIONS OF STUDENTS ABOUT MORE SUSTAINABLE PATTERNS.

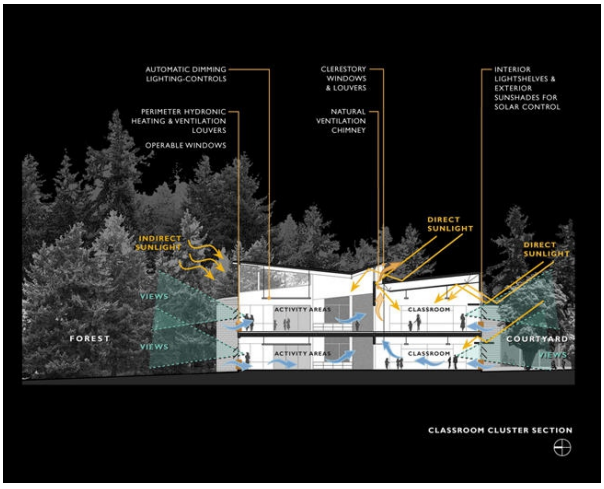
THE TWO CENTRAL COURTYARDS PROVIDE STRUCTURED OUTDOOR LEARNING ENVIRONMENTS, EXPOSING STUDENTS TO ELEMENTS OF THE REGION'S UNIQUE HYDROLOGY AND PROVIDING DIRECT CONNECTIONS TO THE SITE'S NATIVE FORESTED ECOSYSTEM. THE FUNCTIONAL ECOSYSTEM OF THE SOUTHERN COURTYARD MAKES NATURAL PROCESSES VISIBLE ON A DAY-TO-DAY BASIS. THIS OUTDOOR ENVIRONMENT PROVIDES EDUCATORS WITH A THREE-DIMENSIONAL, "HANDS-IN-THE-DIRT" LABORATORY THAT FOSTERS UNDERSTANDING THROUGH OBSERVATION. HIGHLIGHTING SUBTLE ENVIRONMENTAL VARIATIONS IN SUN, WIND, RAIN, AND SHADOWS, THE INTEGRATION OF BUILDING, COURTYARD, AND SCULPTURAL FOCAL POINT PROVIDES A LENS THROUGH WHICH VISITORS OF ALL AGES CAN VIEW THE INTRICATE WORKINGS OF THE ENVIRONMENT IN WHICH THEY LIVE.

C5.FIG.4 THE FUNCTIONAL ECOSYSTEM IN THE SOUTHERN COURTYARD, SHOWN IN THIS PHOTO, IS A STRUCTURED LEARNING ENVIRONMENT CONNECTING THE STUDENTS WITH THE NATURAL PROCESSES OF THE REGION.



C5.FIG.5 COURTYARD VIEW AND ADJOINING BUILT SPACES

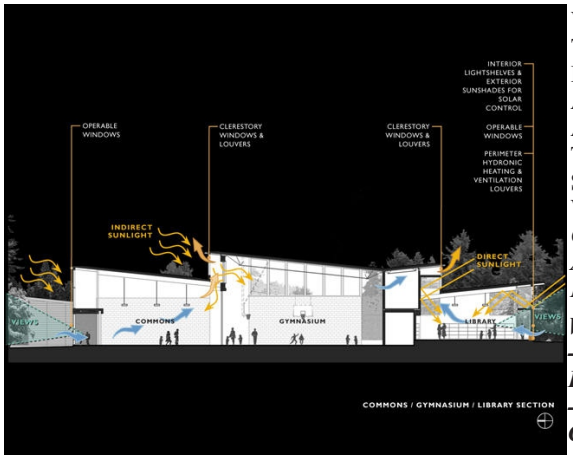
BIOCLIMATIC DESIGN ELEMENTS :



C5.FIG.6 THIS ANNOTATED DRAWING SHOWS THE PATHWAYS OF LIGHT, AIR, HEAT, AND VIEWS THROUGH THE COMMONS, GYMNASIUM, AND LIBRARY SPACES

THE BUILDING'S TWO COURTYARDS INTIMATELY CONNECT STUDENTS AND TEACHERS WITH THE LOCAL ECOSYSTEMS.

DAYLIGHTING DURING THE WINTER SEASON IS RELATIVELY EASY WITH THE PREDOMINANTLY OVERCAST SKY. DIRECT SUN EXISTS PRIMARILY IN THE SUMMER MONTHS, WHEN THE SUN IS HIGH IN THE SKY AND ITS LIGHT IS EASY TO CONTROL. MAJOR GLAZING AND ROOF SLOPES FACE EITHER NORTH OR SOUTH TO MAXIMIZE AND CONTROL NATURAL DAYLIGHT AND VIEWS. TO REDUCE SOLAR HEAT GAIN, SIGNIFICANT OVERHANGS AND SUNSHADES WERE INCORPORATED ON THE SOUTH ELEVATIONS. THE RESULT IS REDUCED GLARE BUT INCREASED DIFFUSE LIGHT IN THE LEARNING AREAS. THE BUILDING'S ARTICULATED FOOTPRINT AND ROOF FORM ALLOW ALL SPACES TO BENEFIT FROM EXPOSURE TO DAYLIGHT AND NATURAL VENTILATION.



C5.FIG.7 THIS ANNOTATED DRAWING SHOWS THE PATHWAYS OF LIGHT, AIR, HEAT, AND VIEWS THROUGH THE COMMONS, GYMNASIUM, AND LIBRARY SPACES

LIGHT & AIR :

C5.FIG.8 THE CLASSROOM AND ACTIVITY AREA SHOWN IN THIS PHOTO EXEMPLIFY THE BUILDING'S CONNECTION TO THE WOODS

WITH MAXIMUM TEMPERATURES RANGING FROM 45 TO 75°F AND MORE THAN 36 INCHES OF RAINFALL EACH YEAR, THE PACIFIC NORTHWEST CLIMATE ALLOWS FOR A RELATIVELY PERMEABLE AND ARTICULATED STRUCTURE. OUTDOOR TEMPERATURE AND HUMIDITY LEVELS FROM LATE SPRING THROUGH EARLY FALL ARE GENERALLY WITHIN THE ***ACCEPTABLE LIMITS OF INDOOR COMFORT CONDITIONS AS PRESCRIBED BY ASHRAE, CREATING AN IDEAL OPPORTUNITY FOR NATURAL VENTILATION AND PASSIVE COOLING.***

VISUAL COMFORT AND THE BUILDING ENVELOPE
-ORIENT THE FLOOR PLAN ON AN EAST-WEST AXIS FOR BEST CONTROL OF DAYLIGHTING
-USE LARGE EXTERIOR WINDOWS AND HIGH CEILINGS TO INCREASE DAYLIGHTING
-USE SKYLIGHTS AND/OR CLERESTORIES FOR DAYLIGHTING

VISUAL COMFORT AND INTERIOR DESIGN
-DESIGN OPEN FLOOR PLANS TO ALLOW EXTERIOR DAYLIGHT TO PENETRATE TO THE INTERIOR

VISUAL COMFORT AND LIGHT SOURCES
-PROVIDE ILLUMINATION SENSORS

VENTILATION AND FILTRATION SYSTEMS
-PROVIDE OCCUPANTS WITH ACCESS TO OPERABLE WINDOWS
-DESIGN FOR OPTIMUM CROSS-VENTILATION THROUGH WINDOW PLACEMENT

ELIMINATION OF INDOOR POLLUTANTS
-USE FINISHES THAT ARE EASY TO CLEAN USING MILD SURFACTANTS AND WATER

REDUCTION OF INDOOR POLLUTANTS
-USE ONLY VERY LOW OR NO-VOC PAINTS

AIR

ALL LEARNING AREAS ARE NATURALLY VENTILATED WITHOUT THE USE OF AIR HANDLING EQUIPMENT OR SUPPLEMENTAL FANS. OPERABLE WINDOWS AND VENTILATION CHIMNEYS IN THE CLASSROOMS GENERATE A NATURAL STACK EFFECT THAT RESULTS IN TEN AIR CHANGES PER HOUR, PROVIDING AN EXEMPLARY INDOOR AIR QUALITY WITHOUT ENERGY CONSUMPTION.

LIGHT

EXTENSIVE GLAZING CONNECTS THE OCCUPANTS WITH THE OUTDOORS. THE SPACES ARE ORIENTED ALONG AN EAST-WEST AXIS, WITH GLAZING FACING NORTH AND SOUTH TO CONTROL AND MAXIMIZE THE NATURAL DAYLIGHT WITHIN THE BUILDING. DAYLIGHT MODELING CONFIRMED THE APPROPRIATE CONFIGURATION OF WINDOWS AND EXTENT OF SHADING DEVICES TO CONTROL GLARE AND MAINTAIN DIFFUSE, BALANCED DAYLIGHT IN ALL LEARNING AREAS WHILE PROVIDING CAREFULLY PLANNED LOWER VIEW WINDOWS.

WATER CYCLE :

LOW-IMPACT DEVELOPMENT "RAIN GARDEN" STRATEGIES WERE USED TO COLLECT STORMWATER ON SITE RATHER THAN PIPING IT AWAY. THE BEN FRANKLIN ELEMENTARY SCHOOL IS THE FIRST PROJECT WITHIN THE CITY TO UTILIZE THIS INNOVATIVE APPROACH. RAINWATER IS COLLECTED FROM THE BUTTERFLY ROOFS AND HELD IN POINT-SOURCE BIO-RETENTION CELLS. THE PLANTED STORMWATER COLLECTION AND MANAGEMENT SYSTEM MINIMIZES DISCHARGE RATES WHILE MAXIMIZING GROUNDWATER RECHARGE, WATER QUALITY FILTRATION, AND EVAPOTRANSPIRATION.

THE TWO LANDSCAPED COURTYARDS SERVE AS OUTDOOR CLASSROOMS AND HIGHLIGHT PUGET SOUND'S UNIQUE HYDROLOGY THROUGH THE USE OF SCULPTURAL ART PIECES AND AN INTERMITTENT STREAM THAT ARE FUELED BY RUNOFF. CLOSE COLLABORATION WITH A LOCAL ARTIST RESULTED IN A SCULPTURAL ART PIECE THAT EXPRESSES THE IMPORTANCE OF RAIN IN THE AREA. THE MULTIFACETED BASALTIC SCULPTURE, IN ONE OF THE COURTYARDS, DEMONSTRATES THE EFFECTS OF RAIN IN A VARIETY OF WAYS; IT INCLUDES A ROOF SCUPPER, A POLISHED DEW-COLLECTING SURFACE, AND THREE FOUNTAINS THAT ARE ACTIVATED BY RAIN LEADERS.

SITE-SPECIFIC, NATIVE, AND DROUGHT-TOLERANT PLANTINGS REQUIRING NO PERMANENT IRRIGATION WERE USED THROUGHOUT THE SITE. THE PLAYFIELD IS OPERATED AND MAINTAINED BY THE CITY PARKS DEPARTMENT. TIGHTLY SPECIFIED CONTROLLER SCHEDULING CONSERVES MORE THAN 1.6 MILLION GALLONS OF WATER PER YEAR COMPARED TO CONVENTIONAL OPERATIONAL PROCEDURES.

PLUMBING FIXTURES ARE LOW-FLOW AND LOW-FLUSH TO CONSERVE POTABLE WATER. WATERFREE URINALS, USED THROUGHOUT THE BUILDING, SAVE AN ESTIMATED 60,000 GALLONS OF POTABLE WATER PER YEAR.

DEVELOPMENT IMPACTS
-LIMIT PARKING AREA

WATERLESS FIXTURES
-SPECIFY WATERLESS URINALS

LANDSCAPE PLANTINGS
-LANDSCAPE WITH INDIGENOUS VEGETATION

LOW-WATER-USE FIXTURES
-USE LOW-FLOW TOILETS

DEMAND FOR IRRIGATION
-SELECT PLANTS FOR DROUGHT TOLERANCE

INTEGRATION WITH SITE RESOURCES
-CELEBRATE AND ENHANCE EXISTING LANDSCAPE FEATURES

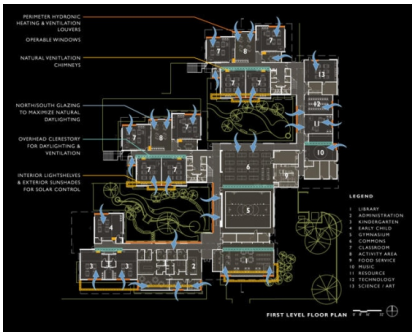
C5.FIG.9 LANDSCAPE WITH INDIGENOUS VEGETATION

ENERGY FUTURE :

OCCUPANCY SENSORS AND AUTOMATIC DIMMING CONTROLS WERE INSTALLED ON LIGHT FIXTURES IN ALL CLASSROOMS. DAYLIGHTING MODELS OF THE CLASSROOMS, ACTIVITY AREAS, LIBRARY, GYM, AND COMMONS WERE ANALYZED TO ENSURE THAT THE SPACES WOULD MEET OPTIMAL DESIGN CRITERIA AND ACHIEVE A 2% OUTSIDE ILLUMINATION BASELINE. AUTOMATIC DIMMING CONTROLS ADJUST LIGHT LEVELS IN THE CLASSROOMS TO MAXIMIZE THE ENERGY EFFICIENCY BENEFIT OF THE DAYLIGHTING. DAYLIGHT HARVESTING IS EXPECTED TO REDUCE LIGHTING ENERGY USAGE BY 25% IN THESE AREAS

C5.FIG.10 THE LIBRARY, WHICH UTILIZES CLERESTORY WINDOWS FOR DIFFUSE DAYLIGHTING.

USING THE CONCEPTS OF THERMAL BUOYANCY AND PRESSURE DIFFERENTIALS, THERMAL CHIMNEYS CREATE A STACK EFFECT IN THE BUILDING, DRAWING FRESH AIR THROUGH LOW-LEVEL PERIMETER WINDOWS AND LOUVERS AND VENTING IT AT HIGH LEVEL. EXTENSIVE COMPUTATIONAL ANALYSIS WAS PERFORMED TO PERFECT THE GEOMETRY OF OPENINGS THROUGH EACH CLASSROOM. WHOLE-BUILDING NATURAL-VENTILATION DESIGN TECHNIQUES, AFFECTING BUILDING ORIENTATION, WINDOWS, SHADING, CONSTRUCTION MATERIALS, DAYLIGHTING, AND VENTILATION OPENINGS, WERE EMPLOYED TO ALLOW FOR PASSIVE COOLING THROUGHOUT THE BUILDING DURING OCCUPIED SEASONS. IN HEATING MODE, THE AIR PASSES OVER FIN-TUBE WATER HEATING ELEMENTS LOCATED AT THE PERIMETER LOUVERS BEFORE IT IS INTRODUCED INTO THE CLASSROOM SPACES.



C5.FIG.11 THIS DRAWING OF THE FIRST-LEVEL FLOOR PLAN SHOWS THE PATH OF AIR ENTERING THE BUILDING THROUGH THE PERIMETER HYDRONIC HEATING AND VENTILATION LOUVERS

MATERIALS AND CONSTRUCTION :

THE PRIMARY SELECTION CRITERIA FOR ANY PUBLIC SCHOOL PROJECT ARE DURABILITY AND MAINTAINABILITY. HOWEVER, THE IMPACT OF THE MATERIALS ON THE INDOOR ENVIRONMENTAL QUALITY FOR CHILDREN IS BECOMING AN EVER MORE SIGNIFICANT PART OF THE SELECTION CRITERIA. DURABLE, NONTOXIC, LOW-IMPACT MATERIALS WERE USED THROUGHOUT THE PROJECT. THESE INCLUDE PAINT WITH LOW EMISSIONS OF VOLATILE ORGANIC COMPOUNDS (VOCS), RUBBER RESILIENT FLOORING, WOOL TACKABLE WALL COVERINGS, GROUND-FACE CONCRETE BLOCK, CEMENT-BOARD SIDING, AND RECYCLED GLASS CULLET. IN MANY CASES THE MATERIALS MEET ALL THREE CRITERIA.

C5.FIG.12 INTERIOR MATERIAL FINISH - SUSTAINABLE AND DURABLE

FOR EXAMPLE, THE RETRO-PLATED CONCRETE FLOOR FINISH PROVIDES THE SCHOOL WITH AN EXTREMELY DURABLE FINISH (THREE TIMES HARDER THAN NORMAL CONCRETE), A SURFACE THAT REQUIRES ONLY HOT-MOPPING FOR CLEANING (ELIMINATING THE NEED FOR CHEMICALS AND HIGH-PH DETERGENTS), AND IMPROVED INDOOR AIR QUALITY (BY AVOIDING APPLIED ADHESIVES AND SURFACES ON WHICH DUST AND MOLD COULD COLLECT).

THE USE OF INTERIOR FINISH MATERIALS WAS LIMITED TO THE ESSENTIAL. MATERIALS WERE CHOSEN THAT COULD CONTRIBUTE TO MULTIPLE FACTORS, SUCH AS ACOUSTIC ABSORPTION, LIGHT REFLECTANCE, DURABILITY, AND COMFORT. THE WOOL WALL COVERING, FOR EXAMPLE, IS A RENEWABLE, WARM, ABUSE-RESISTANT MATERIAL THAT SERVES THE SCHOOL'S NEED FOR BOTH A TACKABLE SURFACE AND AN ACOUSTICALLY ABSORPTIVE SURFACE. APPLIED MATERIALS THAT DID NOT DIRECTLY BENEFIT THE PERFORMANCE OF THE BUILDING WERE AVOIDED.

DIVERSION OF CONSTRUCTION & DEMOLITION WASTE
CONSTRUCTION WASTE WAS SORTED FOR RECYCLING.

PREDESIGN

ANTICIPATING LOCAL, REGIONAL, AND EVENTUALLY NATIONAL MANDATES FOR MORE SUSTAINABLE BUILDINGS, THE LAKE WASHINGTON SCHOOL DISTRICT PROACTIVELY PURSUED GREEN DESIGN TO BETTER UNDERSTAND THE EFFECTS ON SCHOOL BUILDINGS AND DISTRICT-WIDE POLICIES.

RECOGNIZING THE WAYS IN WHICH ACCESS TO NATURAL LIGHT, VIEWS, AND FRESH AIR BENEFIT LEARNING, THE WHOLE TEAM FOCUSED ON ACHIEVING THESE QUALITIES.

SPECIFIC SUSTAINABLE GOALS WERE DETERMINED IN AN ECO-CHARRETTE AT THE BEGINNING OF DESIGN. ALL INDIVIDUALS WHO WOULD BE INVOLVED IN THE DESIGN AND FUTURE MAINTENANCE AND OPERATIONS OF THE BUILDING PARTICIPATED IN AND CONTRIBUTED TO THIS INITIAL EXERCISE. THE RESULTS GUIDED THE DESIGN TEAM AND REINFORCED DECISIONS WITH THE CLIENT GROUP THROUGHOUT THE PROCESS.

DESIGN

EARLY AND CONTINUED DIALOGUE WITH THE JURISDICTION ALLOWED THE DESIGN TEAM TO ARTICULATE AND CLARIFY PROGRESSIVE STORMWATER MANAGEMENT METHODS FOR THE SITE, THEREBY ALLEVIATING CONCERNS AND FACILITATING APPROVAL OF THE PROPOSED LOW-IMPACT DEVELOPMENT STRATEGIES.

NATURAL VENTILATION COMPUTER MODELING GAVE THE DESIGN TEAM CLEAR, PRECISE DATA TO SUPPORT THE DESIGN APPROACH AND TO HELP THE DISTRICT UNDERSTAND THE EXPECTED PERFORMANCE OF THE BUILDING. LARGE-SCALE DAYLIGHTING MODELS WERE TESTED TO REFINE NATURAL DAYLIGHTING STRATEGIES IN THE CLASSROOMS, COMMONS, GYMNASIUM, AND LIBRARY.

CONSTRUCTION

AS THIS WAS A PUBLICLY BID PROJECT, EDUCATION PLAYED A LARGE ROLE IN THE SPECIFICATION AND BIDDING PROCESS. SUSTAINABLE STRATEGIES HAD TO BE CLEARLY EXPLAINED, AS UNCERTAINTY WITH SYSTEMS AND PROCUREMENT CAN LEAD TO HIGHER COSTS AND HIDDEN CONTINGENCIES. DISCUSSIONS OF SUSTAINABLE FEATURES AND SYSTEMS WERE HELD DURING A PREBID CONFERENCE TO ENSURE FOREKNOWLEDGE AND REDUCE SURPRISES.

ENVIRONMENTAL ASPECTS

THE NEW SCHOOL EXPANDS LEARNING BEYOND THE CLASSROOM BY CONNECTING THE DISTRICT'S EDUCATIONAL PEDAGOGY WITH ENVIRONMENTAL SUSTAINABILITY AT EVERY LEVEL.

THE SCHOOL WAS DESIGNED TO PRESERVE AND HARNESS THE ENVIRONMENT AS A LEARNING OPPORTUNITY. THE LARGE WOODED AREA ALONG THE NORTH END OF SCHOOL'S SITE IS VALUED AS A COMMUNITY ASSET. CREATING CONNECTIONS TO THIS RICH NATURAL ENVIRONMENT BECAME A PRIMARY GOAL IN THE DESIGN PROCESS. TWO-STORY CLASSROOM WINGS REACH LIKE FINGERS TOWARD THE WOODS AND VISUALLY CONNECT STUDENTS WITH NATURE. BETWEEN, COURTYARDS LANDSCAPED WITH NATIVE PLANTS AND ENHANCED BY INTEGRATED ARTWORK, SERVE AS OUTDOOR CLASSROOMS AND FEATURE AN INTERMITTENT STREAM FED BY ROOF RUNOFF. GATHERING AREAS FOR OUTDOOR CLASSES ARE LOCATED WITHIN THE LANDSCAPING.

BECAUSE DAYLIGHT AND INDOOR AIR QUALITY PROFOUNDLY IMPACT STUDENT PERFORMANCE, THE SCHOOL WAS DESIGNED TO MAXIMIZE PERFORMANCE IN THESE AREAS. THE CLASSROOM AREAS OF THE SCHOOL ARE ENTIRELY NATURALLY VENTILATED AND DAYLIT. THIS DESIGN ALSO LED TO EXEMPLARY ENERGY PERFORMANCE: THE SCHOOL IS ANTICIPATED TO USE ONLY 16,405 BTU PER FT2 PER YEAR. COMPARING BASELINE DATA FROM THE OLD SCHOOL TO THAT RESULTING FROM A POST-OCCUPANCY EVALUATION PLANNED OVER THE NEXT YEAR SHOULD VALIDATE PERFORMANCE RESULTS.

INFERENCES :

- USING TECHNOLOGY TO AID TO SUSTAINABLE APPROACH TO LEARNING SPACES WHILE AMALGAMATION OF CREATIVE COURTYARD SPACES AND VISUAL PLAY
- SMART AND EFFICIENT USE AND HARVESTING OF NATURAL RESOURCES TO REDUCE LOAD ON THE ENVIRONMENT.
- HELPING IN ENRICHING THE MICROCLIMATE AND ULTIMATELY REDUCING CARBON FOOTPRINT.

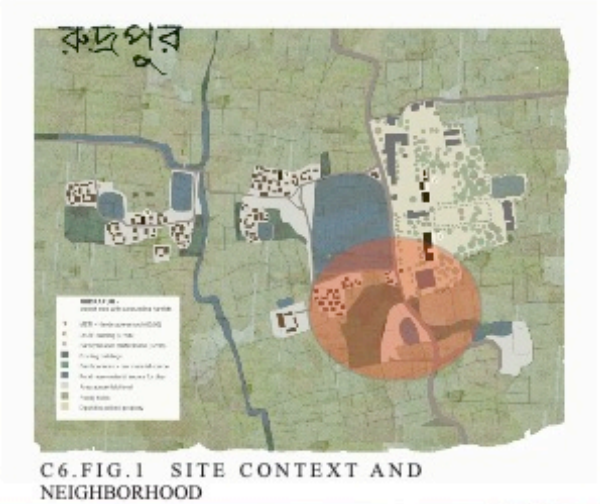
C6.
METI SCHOOL, BANGLADESH

PROJECT NAME: METI SCHOOL
LOCATION: RUDRAPUR, DINAJPUR DISTRICT, BANGLADESH
GROUND FLOOR: 3 CLASSROOMS AND 6 'CAVES',
FOOTPRINT : 275 M

CONSTRUCTION
25 TO 30 LOCAL WORKERS

- WORKERS BY TRADE
- 8 BRICK LAYERS
- 12 – 20 LABOURERS FOR EARTHEN BUILDING
- 8 LABOURERS FOR BAMBOO CONSTRUCTION
- 1 FOREMAN, 2 APPRENTICES, 5 TRAINEES, METI TRAINING WORKSHOP FOR JOINERS
- 5 PLASTERERS (INTERIOR PLASTER)
- 1 LOCAL FOREMAN
- 2 ARCHITECTS, 2 CRAFTS EXPERTS (TEAM FROM GERMANY)
- 4 – 6 VOLUNTEERS, (STUDENTS, TEACHERS, WORKMEN FROM GERMANY AND AUSTRIA)

C6.FIG.3 USE OF VIBRANT COLOURS AND SUSTAINABLE MATERIALS IN THE END WALL DETAIL



C6.FIG.1 SITE CONTEXT AND NEIGHBORHOOD

C6.FIG.2 SCHOOL ELEVATION

CONSTRUCTION PERIOD

- 6 MONTHS (SEPTEMBER TO DECEMBER 2005 AND MARCH, APRIL 2006)

MATERIALS USED

- 83 M3 MASONRY BRICKWORK FOR FOUNDATIONS AND VERANDA
- 270 M3 COB FOR WALLS, CEILINGS IN THE 'CAVES', RAMMED EARTH FLOORS
- 400 TONNES WET EARTHEN MATERIAL
- 2,300 BAMBOO CANES FOR CEILINGS, UPPER STOREY, FACADES
- 12,500 BAMBOO STRIPS FOR UPPER STOREY BAMBOO FACADES

CONSTRUCTION

- FOUNDATIONS: BRICK MASONRY WITH DAMP PROOF COURSE
- WALLS, GROUND FLOOR: LOAD-BEARING COB WALLING (WET EARTH TECHNIQUE, STRAW-EARTH MIXTURE)
- CEILING: BAMBOO CEILING, TRIPLE-LAYER WITH COB FILLS
- UPPER FLOOR: FRAMEWORK OF THICK BAMBOO MEMBERS
- FACADE UPPER FLOOR: TIMBER WINDOW FRAMES WITH BAMBOO CLADDING
- FLAT ROOF, CORRUGATED IRON ROOFING

C6.FIG.4 NIGHT VIEW OF THE SCHOOL - HOW THE COLOUS LIT UP TO GIVE AN AESTHETIC APPEARANCE

C6.FIG.5 USE OF LOCAL LABOR AND MATERIALS

CONCEPT AND DESIGN: METI A***IMS TO PROMOTE INDIVIDUAL ABILITIES AND INTERESTS TAKING INTO ACCOUNT THE DIFFERENT LEARNING SPEEDS OF THE SCHOOLCHIL- DREN AND TRAINEES IN A FREE AND OPEN FORM OF LEARNING.***

IT OFFERS AN ALTERNATIVE TO THE TYPICAL FRONTAL APPROACH TO LESSONS. **THE ARCHITECTURE OF THE NEW SCHOOL REFLECTS THIS PRINCIPLE AND PROVIDES DIFFERENT KINDS OF SPACES AND USES TO SUPPORT THIS APPROACH TO TEACHING AND LEARNING. ON THE GROUND FLOOR WITH ITS THICK EARTH WALLS, THREE CLASSROOMS ARE LOCATED EACH WITH THEIR OWN ACCESS OPENING TO AN ORGANICALLY SHAPED SYSTEM OF 'CAVES' TO THE REAR OF THE CLASSROOM. THE SOFT INTERIORS OF THESES SPACES ARE FOR TOUCHING, FOR NESTLING UP AGAINST, FOR RETREATING INTO FOR EXPLORATION OR CONCENTRATION, ON ONE'S OWN OR IN A GROUP.**

THE UPPER FLOOR IS BY CONTRAST LIGHT AND OPEN, THE OPENINGS IN ITS BAMBOO WALLS OFFERING SWEEPING VIEWS ACROSS THE SUR- ROUNDINGS, ITS LARGE INTERIOR PROVIDING SPACE FOR MOVEMENT. THE VIEW EXPANDS ACROSS THE TREETOPS AND THE VILLAGE POND. LIGHT AND SHADOWS FROM THE BAMBOO STRIPS PLAY ACROSS THE EARTH FLOOR AND CONTRAST WITH THE COLOURFUL MATERIALS OF THE SARIS ON THE CEILING.

EDUCATION PROGRAM:

- METI WORKS WITH THE PHILOSOPHY OF 'LEARNING WITH JOY'. THE STUDENTS ARE ENCOURAGED BY THE TEACHERS TO UNDERSTAND AND DEVELOP THEIR OWN POTENTIAL, UTILIZING IT IN A CONSCIENTIOUS AND CREATIVE WAY.
- THESE PRINCIPALS FORM THE CONCEPT OF THE SCHOOL BUILDING IN TERMS OF ARCHITECTURAL DESIGN, MATERIALS USED AND CONSTRUCTION TECHNIQUES ADOPTED.
- ***ALONG WITH PROVIDING HOLISTIC EDUCATION, THE SCHOOL INTENDS TO ENHANCE THE PREVAILING BUILDING TECHNIQUES, TO CONTRIBUTE TO SUSTAINABILITY BY EMPLOYING THE LOCAL POTENTIAL AND TO BOLSTER THE REGIONAL IDENTITY.***

C6.FIG.6 FIRST FLOOR OPEN SPACE

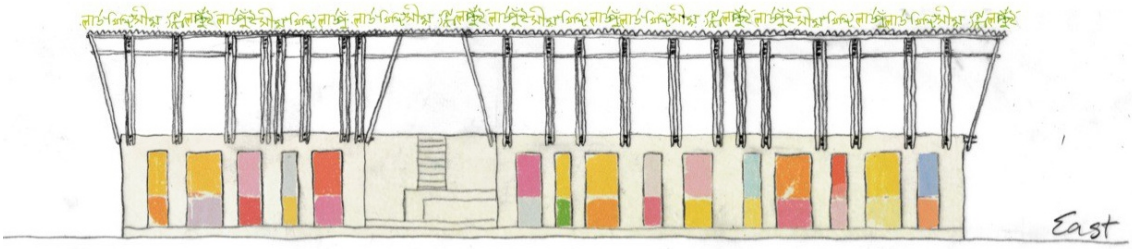
C6.FIG.7 BREAKING CLASSROOM STEREOTYPE

C6.FIG.8
CLASSROOM OPENINGS AND PLAY O F SHADOWS

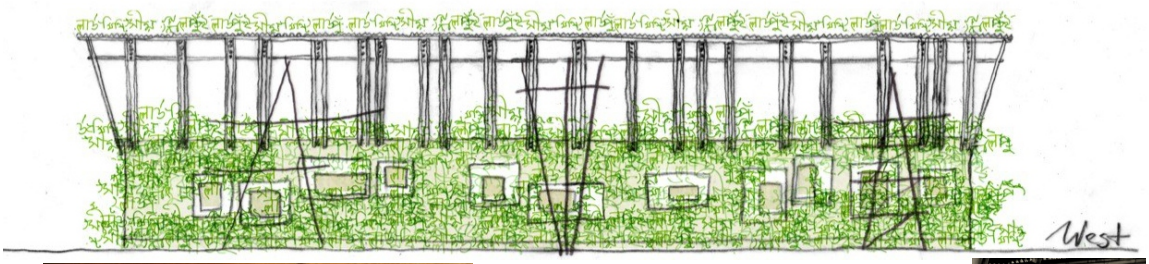
METI, MODERN EDUCATION AND TRAINING INSTITUTE: METI ENABLES CHILDREN AND YOUNG PEOPLE IN THE REGION TO TAKE CLASSES UP TO THE AGE OF 14 AND PROVIDES WORKSHOPS FOR TRADE-ORIENTED PROFESSIONS. THE IDEA IS TO PROVIDE THE RURAL POPULATION WITH ACCESS TO GOOD, HOLISTICALLY-ORIENTED EDUCA- TION. THE CHILDREN AND YOUNG PEOPLE ARE ENCOURAGED TO DEVELOP INTO RESPONSIBLE, MOTIVATED AND CREATIVE PERSONALITIES AND TO USE THEIR SKILLS TO IMPROVE AND DEVELOP THEIR IMMEDIATE RURAL ENVIRONMENT. READING, WRITING AND ARITHMETIC AS WELL AS LANGUAGES ARE OFFERED IN A FREE ENVIRONMENT AND THROUGH OPEN FORMS OF LEARNING. MEDITATION, DANCE AND CREATIVE WRIT- ING ARE PART OF EVERYDAY LEARNING AT THE METI SCHOOL AS ARE DISCUSSIONS, LEARNING AS PART OF A GROUP AND SELF-CRITICAL AND SOCIAL BEHAVIOUR.

C6.FIG.9
CLASSROOM OPENINGS AND PLAY O F SHADOWS

C6.FIG.10
STUDENTS ENJOYING IRREGULAR OPENINGS ACTING AS INTERACTIVE SPACES



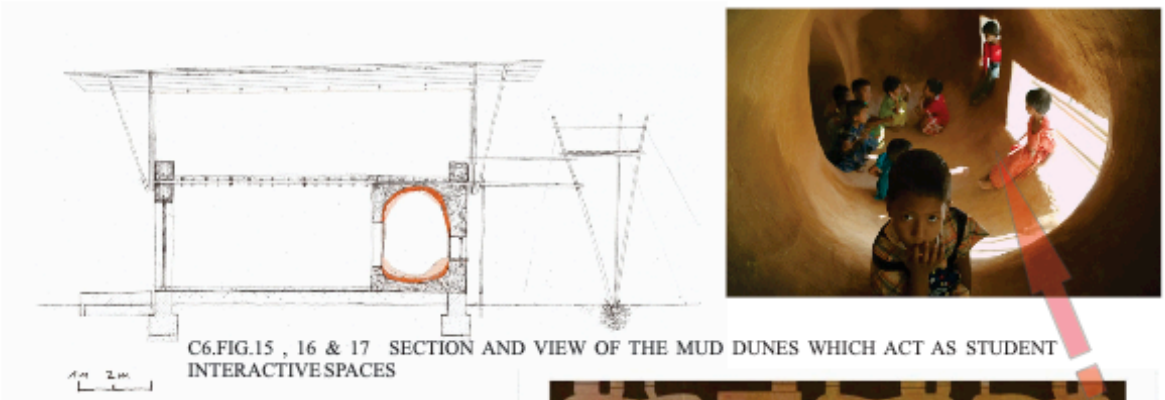
C6.FIG.11 EAST AND WEST SCHOOL FACADES WITH IRREGULAR OPENINGS



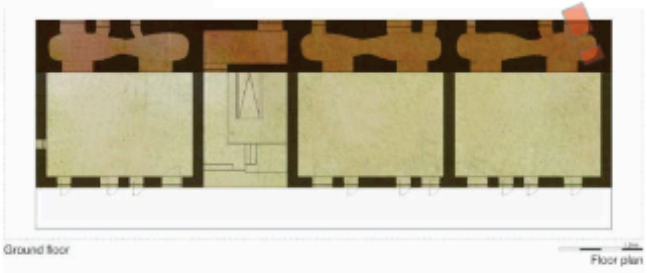
C6.FIG.12 INTERACTIVE MUD DUNES - MORE DISCUSSIONS

C6.FIG.13 NO TYPICAL TABLE CHAIR CLASSROOM INTERIORS

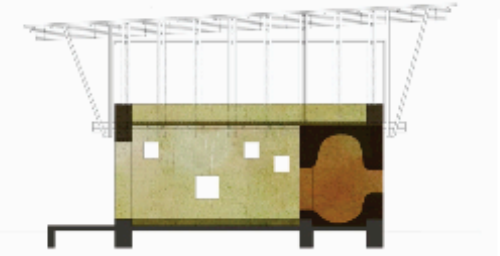
C6.FIG.14 VISUAL CONNECTIVITY

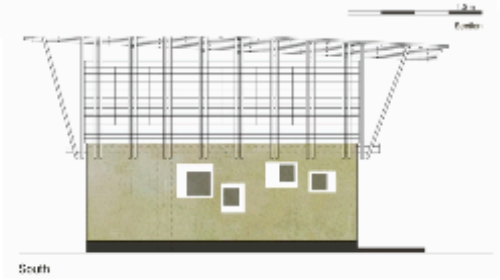


C6.FIG.15 , 16 & 17 SECTION AND VIEW OF THE MUD DUNES WHICH ACT AS STUDENT INTERACTIVE SPACES

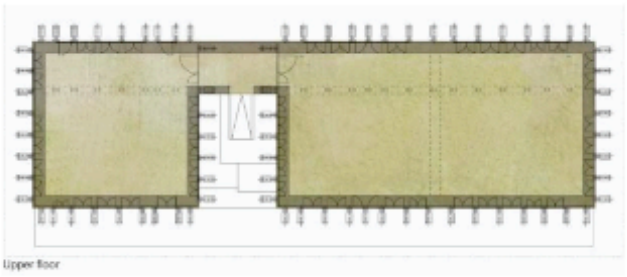


C6.FIG.18 GROUND FLOOR PLAN

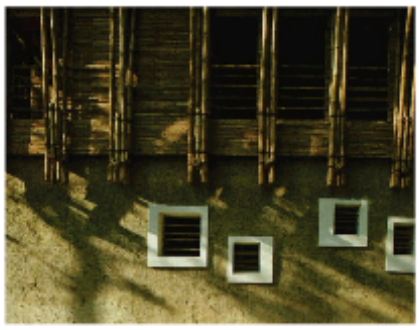




C6.FIG.20 SOUTH ELEVATION



C6.FIG.19 UPPER FLOOR PLAN



C6.FIG.21 EARTHBOUND MATERIALS SUCH AS LOAM AND STRAW ARE COMBINED WITH LIGHTER ELEMENTS LIKE BAMBOO STICKS AND NYLON LASHING TO CREATE A ENVIRONMENTALLY SUSTAINABLE FOUNDATION.

C6.FIG.22 VIEW INTO THE CLASSROOM FROM THE MOLDED CAVESPACES.

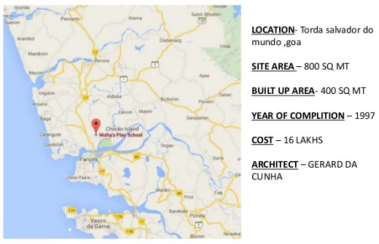
C6.FIG.23 THICK WALLS ASSURE A COMFORTABLE CLIMATE ON THE GROUND FLOOR OF THE BUILDING.

SELECTION CRITERIA : CONTEXTUAL MATERIAL, INTERACTIVE SPACES.

INFERENCES:

- FUNCTIONS AS PER THE ALTERNATIVE SCHOOLING PROGRAM.
- OPEN LEARNING ADAPTED.
- FREE FLOW SPACES CREATES INTERACTION AMONG TEACHERS AND STUDENTS.
- CLOSE PROXIMITY AND ADAPTABILITY TO NATURE AND SUSTAINABLE USE OF RESOURCES
- SENSE OF BELONGING IN THE CAMPUS.
- AWARENESS OF LOCAL MATERIAL AND ITS CONSTRUCTION .

C7.
NISHA'S PLAYSCHOOL , GOA



C7.FIG.1 VIEW OF THE SCHOOL

NISHA'S PLAY SCHOOL IS BUILT ON AN 800SQFT PLOT,THE FLAT AREA WAS RETAINED AS A PLAY GROUND WHILE THE MAIN STRUCTURE WAS BUILT ON SLOPE, BALANCING THE CUT AND FILL

C7.FIG.2 VIEW OF THE SCHOOL

C7.FIG.3 STUDENT FRIENDLY DESIGN ELEMENTS

C7.FIG.4 VIEW OF THE ENTRANCE LOBBY

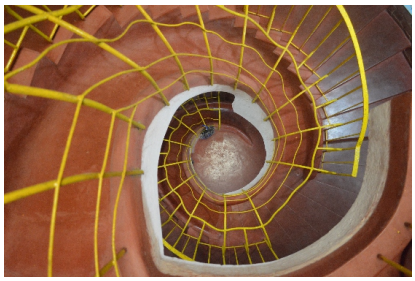
C7.FIG.5 OPENINGS IN DIFFERENT GEOMETRIC SHAPES FOR AMAZEMENT

CONCERNS OF BRINGING IN NATURAL LIGHT, WESTERLY BREEZE AND MAXIMIZING THE USE OF SPACE ALONG WITH SMART CONTOUR PLAY WERE INSTRUMENTAL IN DETERMINING THE EVENTUAL FORM OF THE STRUTCTURE

C7.FIG.6 OPENINGS IN DIFFERENT GEOMETRIC SHAPES FOR AMAZEMENT

GREAT PLAY OF LIGHT AND OPENINGS WERE CREATED. THE ORGANIC NATURE OF THE ELEMENTS DEPICTED THE WAY A CHILD'S MIND WORKS- CHAOTIC AND DISTRACTED IN ALL DIRECTIONS

SERVICE ELEMENTS LIKE STAIRCASE BLOCKS WERE MADE INTERESTING BY ADDING CHILD FRIENDLY ELEMENTS LIKE SPIRAL SLIDE.



C7.FIG.7 SPIRAL STAIRCASE/SLIDE

C7.FIG.8 PLAY AREA VIEW

SCALE OF MOST OF THE SPACES WAS TAILOR MADE JUST FOR THE KIDS

C7.FIG.10 SMALL SCALE TOILET

C7.FIG.9 SMALL SCALE TOILET

GATHERING SPACE AS FOCAL POINTS OF THE STRUCTURE- TRANSITION OF MATERIALS FROM BRICK TO STEEL ROOF FRAMING AND PVC TRANSLUCENT SHEETS FOR NATURAL LIGHT.

C7.FIG.11 VIEW OF THE GATHERING SPACE

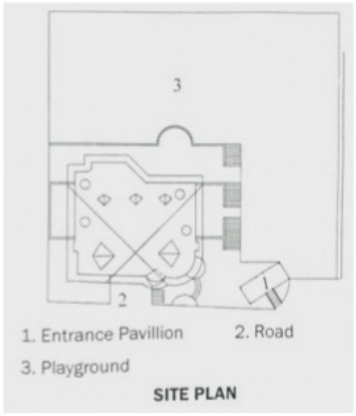
C7.FIG.12 STAIRCASE CONNECTING FLOORS

C7.FIG.13STAIRCASE TO THE GROUNDS

EACH STAIRCASE BLOCK IS DIFFERENT IN TERMS OF ITS UNIQUE SHAPE AND THE PURPOSE OF IT. MULTIPLE USE OF LEVELS ARE MADE FOR TH KID'S PLAYFULNESS.

PLAYFUL OPENINGS, A TOUCH OF FRENCH BALCONIES, PLAY OF LIGHT AND SHADOW IN THE GATHERING SPACES - KEEPS THE STUDENT ENGAGED.

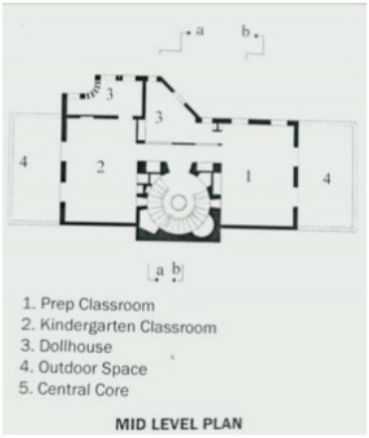
C7.FIG.14 PLAYFUL FENESTRATION

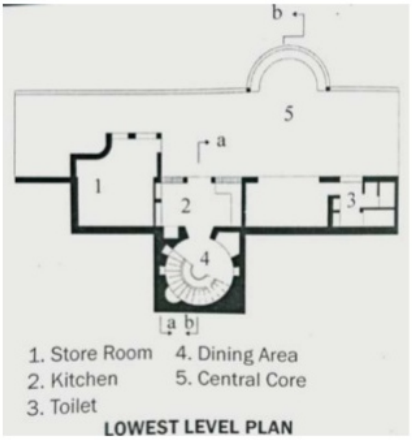


SECTION - BB

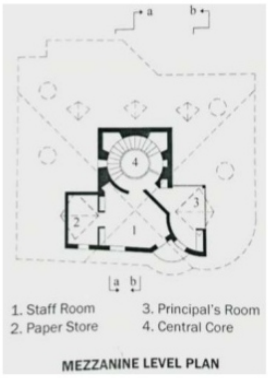
C7.FIG.15 TOWARDS AMPHITHEATER

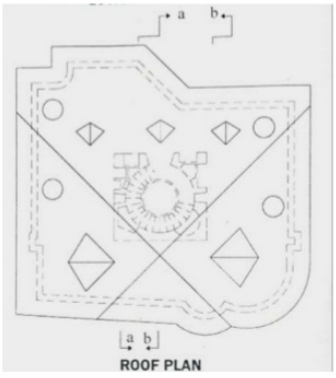
• Some class rooms have entrances dimensions to the anthropometric of a child, adults have to stoop to enter.





C7.FIG.16 NATURE A PART OF THE DESIGN





C7.FIG.17 VIEW OF THE PLAYGROUND

C7.FIG.14 PLANS

INFERENCES :

- **THE SCHOOL IS MADE UP OF SUSTAINABLE MATERIALS**
- **THE SCHOOL SPACES ARE TAILOR MADE W.R.T CHILD PSYCHOLOGY BOTH IN TERMS OF SCALE AND USE OF SHAPES AND COLOURS**
- **GREAT USE OF LEVELS ARE CREATED TO KEEP THE STUDENT ACTIVE AND ENGAGED**

SELECTION CRITERIA :

- **INTERACTIVE CHILD FRIENDLY SPACES**

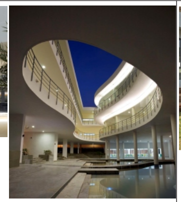
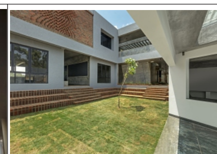
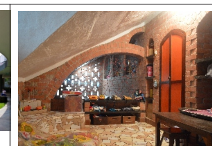
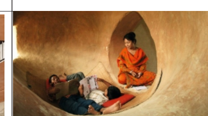
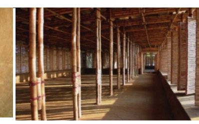
USE OF MATERIALS AND PLAY OF LIGHT, LEVELS AND VISUALS

2.2.4 CASE STUDY INFERENCES

SPACES	PEARL ACADEMY	AXIS PRAMITI	AVASARA ACADEMY	FARMING KINDERGARTEN	BEN FRANKLIN ELEMENTARY SCHOOL	MITI SCHOOL	NISHA'S PLAY SCHOOL
Classrooms	1	1	1	1	1	1	1
Libraries	1	1	1	1	1	0	0
Digital libraries	1	0	0	0	1	0	0
Multifunctional spaces	1	1	1	1	1	1	1
Hands on experience areas/ spill over spaces	1	1	1	1	1	1	1
Workshop spaces	1	1	1	1	1	1	1
Spill overs/courtyards		1	1	1	1	1	1
Lifts	1	1	0	1	1	0	0
Landscape treatment	0	1	0	1	1	0	1
Use of local material and construction techniques	1	1	1	1	1	1	1
Climate responsive in terms of space planning and design	1	1	1	1	1	1	1
On campus food production	0	1	0	1	0	0	0
Waste management on campus	1	0	0	0	1	0	0
Greenhouse/polyhouse	0	0	0	0	0	0	0
Innovation in learning space	1	1	1	1	1	1	1
Other allied activities in terms of environment and sustainability	0	1	0	1	1	1	0

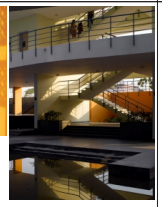
Table 3 : school spaces comparison

Table 4: PERFORMANCE BASED COMPARISION

SPACIAL EXPERIENCES AND ANALYSIS			
PEARL ACADEMY	**AXIS PRAMITI**	**FARMING KINDERGARTEN**	**NISHA'S PLAY SCHOOL**
  SPACES ARE USER FRIENDLY - TRIGGERS CREATIVITY AND A SENSE OF BELONGING - HAS A CONTEXTUAL ATTRIBUTE AT THE SAME TIME IS MATURE ENOUGH TO CATER TO THE USER GROUP OF 17- 24 YEARS YOUNG ADULTS. VIVID AND ACCESSIBLE SPACES WITH PLAY OF VOLUME AND TEXTURES.	  SPACES HAVE A CLOSE CONNECTION WITH OPEN NATURAL SPACES WHICH DIRECTLY AIDS IN A CHILD'S MENTAL GROWTH AND DEVELOPMENT - HENCE USER SPECIFIC DESIGN (PRIMARY CLASS). USE OF COLOURS AND PLAY OF VOLUME ENHANCES THE NATURE OF SCHOOL SPACES. CLASSROOMS ARE FLEXIBLE IN TERMS OF ITS USAGE AND CAN AT ANY GIVEN TIME OPEN UP TO THE COURTYARDS TO INCORPORATE A LARGER NUMBER OF USERS . GREAT VISUAL CONNECTIVITY IS OBSERVED THROUGHOUT THE CAMPUS.	  MULTIPLE COURTYARDS ACTS AS SAFE ENCLOSURE FOR THE KIDS FOR RECREATIONAL SPACE AT THE SAME TIME THEY DO NOT FEEL CAGED WHILE BEING IN THE VISUAL CONNECTIVITY OF THE FACULTY. GOOD USE OF LARGE ROOF SURFACE AREA AS CULTIVATION OF FOOD. ALL THE CLASSROOMS ARE VISUALLY AND PHYSICALLY CONNECTED TO THE OPEN COURTYARDS. FREEDOM IN TERMS OF ACCESSIBILITY WHILE BEING SECURE - GOOD PLANNING.	  MULTIPLE LEVEL PLAY, NATURE IS INTEGRATED WITHIN THE STRUCTURE , AMPLE USE OF VARIED SHAPES , COLOURS AND TEXTURE. SCALE WISE TAILOR MADE STUDENT SPACES. CONTEXTUAL MATERIAL USE. AESTHETICALLY ATTRACTIVE.
BEN FRANKLIN ELEMENTARY SCHOOL	**AVASARA**	**MITI SCHOOL**	***COMMON INFERENCES :***
  SPACE SEGREGATION ON THE BASICS OF CLASS AND AGE GROUP. EACH CLUSTER OF BUILT ONE UP IN THE ADJOINING COURTYARD. USE OF FAMILIAR LOCAL MATERIAL GIVES A SENSE OF BELONGING AND CONTEXT. OPTIMUM USE OF SKYLIGHTS FOR NATURAL LIGHTING ENSURES GOOD MENTAL HEALTH AND ENHANCED FOCUS IN CLASS. SPILL OVER SPACES MAKES ROOM FOR HANDS ON EXPERIENCE AND CRITICAL REASONING WHILE TEACHES STUDENTS TO BE SENSITIVE TO NATURE AND ITS PROS AND CONS.	  BEING LOCATED AT THE RURAL CONTEXT, THE SPACES ARE HIGHLY INSPIRED BY THE LOCAL ARCHITECTURAL SPACES OF COURTYARDS AND SEMI OPEN AREAS. THE CLASSROOMS FLEXIBLE AND APPEAR VISUALLY BIGGER AND BRIGHTER DUE TO GOOD NATURAL LIGHT AND VENTILATION BECAUSE OF BAMBOO SKIN. STAIRCASE BLOCK AT THE INTERNAL COURTYARD MAKES GOOD USE OF SUCH SPACE AS WELL AS ADDS VISUAL PLAY AND CONNECTIVITY. USE OF VIBRANT COLOURS AS PER COLOUR THERAPY ADD TO THE POSITIVENESS OF THE CLASSROOM ENVIRONMENT. THE BUILT MERGES WITH THE ADJOINING ENVIRONMENT.	  STUNNING USE OF LOCAL MATERIALS FROM FOUNDATION LEVEL TO ROOF LEVEL. EXCELLENT INNOVATION IN STUDENT'S SPACE - NO STEREOTYPICAL USE OF FURNITURE - MUD CAVES ARE INTERACTIVE TAILOR MADE FOR THE STUDENTS FOR LEARNING WITH FUN EXPERIENCE. MULTIPLE SCOPE FOR HANDS ON EXPERIENCE AND PRACTICAL KNOWLEDGE. USE OF VIBRANT COLOURS TO ENHANCE FOCUS AND TRIGGER CURIOSITY. GIVES THEM AN IDEA ABOUT HOW THE LOCALLY LYING MATERIALS AROUND THEM CAN BE MADE TO SUCH A BEAUTIFUL USE WITH GOOD KNOWLEDGE AND CONSTRUCTION TECHNIQUES.	IN ALL THE ABOVE CASE STUDIES THE FOLLOWING POINTS WERE COMMON : • USE OF DIFFERENT COLOURS HELP TRIGGER CREATIVITY AND A POSITIVE ENVIRONMENT. • CONTEXTUAL AND LOCAL MATERIAL IMPARTS A SENSE OF BELONGING AND DOESN'T MAKE THE CHILD FEEL ALIEN IN THE BUILT FORM. • NATURE PLAYS A CRUCIAL ROLE IN THE FORM OF RECREATIONAL AND SPILL OUT SPACES - STUDENTS TEND TO GO TO NATURE FOR COMFORT AND EASE. • FORM AND SHAPE OF THE SPACES THEY ARE ENCLOSED IN PLAYS A CRUCIAL ROLE ESPECIALLY IN THE AGE GROUP OF 5- 11 YEARS. • OPEN - SEMI OPEN SPACES INDUCE THE CHANCES OF MORE INTERACTION AND DISCUSSIONS THAN JUST A CLOSED ROOM.

NATURAL LIGHT AND VENTILATION ANALYSIS

PEARL ACADEMY

NATURAL LIGHT IS ADEQUATE DUE TO THE PLANNING AND ORIENTATION OF THE BUILT MASS. THE MODERNIZED JAALI MAKES SURE TO BUFFER/SCRREN THE WARMTH AND LIGHT ENTERING THE SPACES WILE ALSO CREATING INTERESTING LIGHT AND SHADOW PLAY. THE PRESENCE OF WATER ELEMENT IN THE SCOOPED OUT COURTYARD ENHANCES THE REFLECTED LIGHT QUALITY.

AXIS PRAMITI


DUE TO INSTALLATION OF SKYLIGHTS THE CORRIDORS ARE ALWAYS NATURALLY LIGHT. THE ADJOINING CLASSROOMS GET NATURAL LIGHT AND VENTILATION FROM THE COURTYARDS WHILE ACTS AS SPILL OVER / FLEXIBLE CLASSROOMS. THE USE OF KOTA STONE ENHANCES THE NATURAL LIGHT EXPERIENCE ON THE FLOOR.

FARMING KINDERGARTEN


CLASSROOMS ARE NATURALLY LIGHT BY THE ADJOINING COURTYARD SPACES - NO USE OF SKYLIGHTS NEEDED. THE CLASSROOM WINDOWS ARE ON LOOKING THE COURTYARDS LET IN VISUAL GREENS INTO THE CLASSROOM ENVIRONMENT.
THE CORRIDORS ARE SEMI OPEN SPACES ONE SIDE OF WHICH IS OPEN TO / FACING THE COURTYARDS.

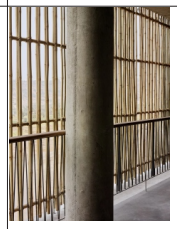
NISHA'S PLAY SCHOOL


MULTIPLE UNIQUE SHAPES AND FENESTRATION MARKS THE GOOD QUALITY NATURAL LIGHT IN DIFFERENT PATTERNS THROUGHOUT THE STRUCTURE. THE STRUCTURE IS ORIENTED IN THE DIRECTION OF PREVAILING WESTERLY BREEZE. BACKYARD GREEN SKIN ACTS AS A BUFFER.

BEN FRANKLIN ELEMENTARY SCHOOL

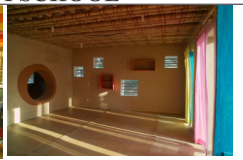

USING SKYLIGHTS IN THE DESIGN PRINCIPLES MOST OF THE INSTITUTIONAL SPACES LIKE CLASSROOMS, LIBRARIES, GYMNASIUM ARE ALWAYS NATURALLY LIT.
THE CLASSROOM WINDOWS OPEN UP TO THE COURTYARD SPACE WHILE ALSO LETTING GREEN VISUALLY INTO THE SPACES AND ENHANCING THE SPACE QUALITY

AVASARA




THE CLASSROOM ARE NATURALLY LIGHT AS THE ONLY BUFFER IS THE BAMBOO SKIN WHICH PARTIALLY SHADES THE CLASSROOM BUT ALSO LETS LIGHT AND AIR FLOW.
THE INTERNAL STAIRCASE COURTYARDS MAKES SURE THE CORRIDOR SPACES ARE WELL LIT AT ALL TIMES DURING THE DAY. FLOORING IS DONE IN A WAY THE REFLECTED LIGHT DOESN'T HIT DIRECTLY IN THE EYE OF THE USER.

MITI SCHOOL

LIGHT IS IN ABUNDANCE IN THE CLASSROOMS.
ALONG WITH LIGHT INTERESTING CLOLOUR AND IRREGULAR SHAPE PLAY IS SEENTO KEEP THE USER ENGAGED INTO THE BUILT FORM.
THE ORIENTATION OF THE BUILDING MAKES SURE OF ITS GOOD VENTILATION.
BUFFERING OF THE DAYLIGHT IS DONE USING BAMBOO SCREENING. MUD WALLS KEEPS THE INTERIOR COOL.

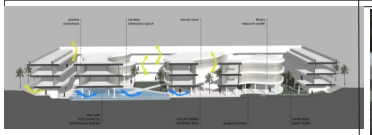
COMMON INFERENCES :

IN ALL THE ABOVE CASE STUDIES THE FOLLOWING POINTS WERE COMMON :

- NATURAL LIGHT PLAYS A VITAL ROLE IN THE CLASSROOM SPACES.
- LIGHT QUALITY IN A ROOM DECIDED A STUDENT'S ATTENTION AND FOCUS IN THE CLASSROOM AS WELL AS AFFECTS HIS MENTAL GROWTH AND DEVELOPMENT.
- MAXIMUM USE OF DAYLIGHT ENSURES SUSTAINABLE APPROACH AND REDUCES NEED FOR ARTIFICIAL LIGHT AND REDUCES WASTAGE OF RESOURCES.
- GOOD AMOUNT OF NATURAL LIGHT QUALITY KEEPS THE STUDENT ATTENTIVE AND ACTIVE IN THE CLASSROOM, INCREASES HIS METABOLISM AND IMPROVES CONCENTRATION.
- LIGHT QUALITY IS ONE OF THE MOST IMPORT DESIGN ASPECT FOR EDUCATIONAL SPACES.

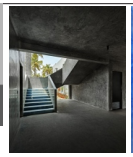
SUSTAINABLE APPROACH ANALYSIS

PEARL ACADEMY



EVAPORATIVE COOLING AND AIR SCREENING ARE THE MAIN DESIGN CRITERIA USED TO MAINTAIN THERMAL COMFORT ALONG WITH USE OF SUSTAINABLE MATERIALS AND PASSIVE COOLING TECHNIQUES.

AXIS PRAMITI

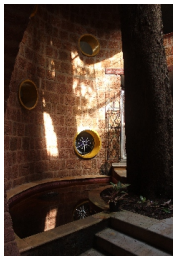


ENSURES AIR FLOW THROUGH DIFFERENT OPENINGS AND THEIR ORIENTATION.
PLANNING OF THE BUILT MASS ENSURE MAXIMUM USAGE OF DAYLIGHT AND VENTILATION HENCE CUTTING DOWN MECHANICAL HVAC. AMPLE AMOUNT OF GREENS IN THE CAMPUS ALONG WITH ORGANIC FOOD PRODUCTION FOR THE CAFETERIA USE. COMPOSTING OF VEGETABLE AND BIODEGRADABLE WASTE.

FARMING KINDERGARTEN

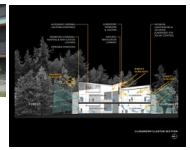
ON CAMPUS FOOD PRODUCTION AND USAGE BY SCHOOL CANTEEN.
AMPLE AMOUNT OF GREENS IN THE CAMPUS.
ORIENTATION OF THE DESIGN MAKES SURE OF GOOD AMOUNT OF SUNLIGHT AND VENTILATION.
WATER IS HARVESTED BY PLANTING NATIVE INDIGENOUS PLANTS HENCE INCREASING GROUNDWATER TABLE LEVEL.

NISHA'S PLAY SCHOOL



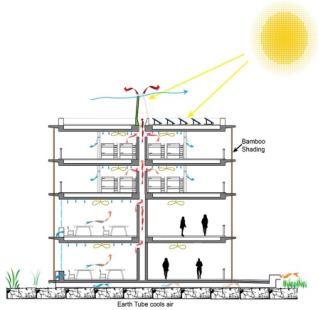
USE OF CONTEXTUAL MATERIALS WHILE LETTING NATURE INTO THE STRUCTURE IS OBSERVED.
BEING A CONTOURED SITE, THE SCOOPED OUT LAND IS USED TO CREATE LEVELS.
LOCALLY AVAILABLE SKILL LABORS AND TECHNIQUES OF CONSTRUCTION USED.

BEN FRANKLIN ELEMENTARY SCHOOL



AMPLE SUNLIGHT IS UTILIZED VIA SKYLIGHT WINDOWS AND PRESENCE OF COURTYARD SPACE ENSURE AIR FLOW THROUGHOUT THE SPACES
ON SITE WATER HARVESTING AND LOCAL MATERIAL ENSURE SUSTAIN ABILITY ALONG WITH PLANTATIONS THAT TRAP WATER AND BISOSWALE

AVASARA



EARTH TUBES ARE USED TO COOL THE ENTIRE BUILDING MASS ALONG WITH BAMBOO SCREENING WHICH HELPS BUFFERING THE DIRECT SUNLIGHT AND HARSH WINDS.
USE OF LOCAL MATERIALS IS ANOTHER STEP TOWARDS SUSTAINABILITY ALONG WITH TRADITIONAL PASSIVE COOLING TECHNIQUES AND COURTYARD SPACE CONCEPTS.

MITI SCHOOL

USE OF RAMMED EARTH AND CONTEXTUAL MATERIALS MAKES GOOD USE OF NATURAL RESOURCES AND KEEPS THE STRUCTURE COOL. THE BAMBOO SCREENING BUFFERS THE DIRECT SUNLIGHT AND HARSH WINDS WHILE ALSO CREATING INTERESTING SHADOW PATTERNS.

COMMON INFERENCES :

IN ALL THE ABOVE CASE STUDIES THE FOLLOWING POINTS WERE COMMON :

- SUSTAIN ABILITY IS THE MOST VITAL STEP SCHOOLS ARE INCORPORATING AFTER THEIR USER TAILORED DESIGNED SPACES
- THE NEXT CHALLENGE IS TO DESIGN SPACES WHICH COMES WITH SUSTINABILITY AND DOES NOT THRIVE WITHOUT IT.
- IT IS NOW MADE A MAJOR PART OF THE ROUTINE AS IT IS THE NEED OF THE HOUR TO REDUCE THE CARBON FOOTPRINT IN THE URBAN FABRIC.
- THE NEXT STEP WOULD TO RATHER THEN HAVING SUSTAINABLE SCHOOLS IN SUB URBAN OR RURAL AREAS, HOW CAN WE INCORPORATE SUSTAINABLE GREEN SCHOOLS IN THE DENSE URBAN FABRIC IS THE DESIGN WE NEED TO CRACK.

2.3 RESEARCH DESIGN

2.3.1 SCHOOL STANDARDS

- This Indian Standard was adopted by the Indian Standards Institution on 27 February 1978, after the draft finalized by the Functional Requirements in Buildings Sectional Committee had been approved by the Civil Engineering Division Council.

- GROUPING OF CLASS LEVELS

For the purpose of this standard, the class-levels have been grouped into five categories as given in

TABLE 1 GROUPING OF CLASS LEVELS

Sl No.	Category	Age Group	Level
(1)	(2)	(3)	(4)
		years	
i)	Pre-school	3-5	Pre-Nursery, Nursery
ii)	Primary/Junior	5-10	I to IV/V
iii)	Secondary/Middle	10-13	V to VII or VIII
iv)	Higher Secondary (Old)	13-16	VIII/IX to XI
v)	Higher Secondary (New) (Ten plus two)		
	Level (i)	13-15	IX and X
	Level (ii)	15-17	XI and XII

Table 5. These categories take into account the age group and the level of education to be imparted.

- CLASSROOMS

The basic unit of a school is classroom. The classroom, apart from satisfying the minimum requirements of space, fittings and furniture, shall be designed to meet the adequate functional and environmental requirements. The size of a classroom shall depend on the following:

a)Anthropometric dimensions of children and their space requirements;
b) Dimensions, arrangements of furniture and equipment and their incidence c) Number of students to be accommodated;

d) Types of activities to be carried out; and e) Diverse seating arrangements essential for these activities.

The number of classrooms in a school‘ and the number of sections per class should depend upon the size and level of school and use efficiency of spaces.

The classroom should be designed for the following number of student places: a) Nw.w~ - 20 to 25 student places
b) Primary/Higher Secondary - 40 student places

TABLE 2 USABLE FLOOR AREA OF CLASSROOMS

(*Clause* 4.3)

Sl No.	Category	No. of Student Places per Classroom	Gross Area of Classroom in m^2 per Student Place, *Min*
(1)	(2)	(3)	(4)
i)	Pre-school	20/25	2·00
ii)	Primary/Junior		
	i) With furniture	40	1·11
	ii) With squatting	40	0·74
iii)	Secondary/Higher Secondary	40	1·26

- Essential Constructional Requirements :

Height of the classroom should not be less than 3.00 m measured at any point from the surface of the floor to the lowest point of the ceiling. The minimum headroom such as under the bottom of beams, fans and lights shall be 2.6 m measured vertically under such beam, fan or light.

The proportion of the breadth (minimum dimension.) to the length (maximum dimension) of the classroom should be not more than 1 : 1.5.

Sill Heights - The sill height for classrooms with furniture arrangement should be not more than 800 mm measured from finished floor level and that for the classrooms with squatting arrangement should be not more than 600 mm.

TABLE 4 TEACHING SPACES OTHER THAN CLASSROOMS

(Clause 5.1)

Sl No.	Rooms	Distribution of Area	Total Area
(1)	(2)	(3)	(4)
		m^2	m^2
i)	*Physics Laboratory*		96
	a) Laboratory	65	
	b) Store-cum-preparation room	15	
	c) Teacher's space/room	8	
	d) Dark room	8	
ii)	*Chemistry Laboratory*		96
	a) Laboratory	65	
	b) Store-cum-preparation room	15	
	c) Teacher's space/room	8	
	d) Balance room	8	
iii)	*Biology Laboratory*		96
	a) Laboratory	65	
	b) Store-cum-preparation room	15	
	c) Teacher's space/room	8	
	d) Museum	8	
iv)	*Domestic Science Laboratory*		89
	a) Laboratory	65	
	b) Store	8	
	c) Teacher's space/room	8	
	d) Museum	8	
v)	*Social Science Room*	65	65
vi)	*Art Room*	65	65
vii)	*Crafts Room*	65	65
viii)	*Activity Room*	65	65
ix)	*Science Theory Room*	50	50

- ADMINISTRATIVE SPACES
  Pre-school and Primary School -An area of about 10 ms may be provided for a room for
- headmistress/headmaster of the school.
- Another area of 10 ms may be provided for general storage. 7.2 Secondary and Higher Secondary Schools - The prevision of areas for the rooms for the Principal, Vice-Principal, general office, etc, shall depend upon the total enrolment in the school. The minimum areas for the various administrative purposes for two categories of enrolment number are given in Table 6 for guidance.
- Principal‘s Xoom - The size of the room for the principal of the school may be governed by the space needed for parents‘ meeting, waiting space and space for toilets.

- Vice-Principals Room - Generally the control of examination and records of the school is looked after by the vice-principal. The space for his room may be decided taking these factors into account. In case there is no vice-principal of the school, the area for the above function may be provided suitably. General Office -Apart from the working space for general oflice staff, it should provide space for fee collection, student‘s contact, parent‘s contact, etc.
- Teaching Staff Area - Staff common room which may contain facilities for lockers for all teachers, office tables and chairs, easy chairs and a separate toilet facility for staff should be provided in all secondary and higher secondary schools.

- STUDENTS’ SPACES
- When designing a school, provision of indoor areas for student activities appropriate to the level of school as given in Table 6 shall be considered.

TABLE 6 RECOMMENDED ADMINISTRATIVE AREAS FOR SECONDARY/HIGHER SECONDARY SCHOOLS

(Clause 7.2)

Sl No.	Enrolment Number	Principal's Room	Vice-Principal's Room	General Office	Storage Area	Teaching Staff Area Including Staff Common Room
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		m^2 *Min*	m^2 *Min*	m^2 *Min*	m^2 *Min*	m^2 *Min*
1.	Up to 960	19	29	29	50	1·8 m^2 per teacher (for 60% of teaching staff)
2.	From 960 to 1 920	19	33	45	65	1·8 m^2 per teacher (for 60% of teaching staff)

- CIRCULATION AREAS
- Circulation areas such as corridors, entrance halls, staircases, ctc, in the school buildings with double loaded and single loaded corridors &all not be more than 18 percent and 24 percent of the total covered area of the building respectively.
- OUTDOOR AREAS
- Outdoor areas for a school such as playgrounds, open air assembly, parking, etc, shall depend upon the following:

The size of the school, and
b) The location of the school, that is: 1) Urban,

2) Suburban, or
3) Rural.
For outdoor spaces under lawns, courtyards, etc, an area of 1 n12 per student should be provided. It is desirable to make a provision for play fields for all categories of schools.

TABLE 7 INDOOR AREAS FOR VARIOUS STUDENTS' ACTIVITIES

(*Clauses* 8.1 *and* 8.2)

Sl No.	Room	Area	Remarks
(1)	(2)	(3) m²	(4)
i)	Common Rooms	0·1 per student (*Min* 25 m², *Max* 100 m²)	Boys common room should contain arrangements for sitting or squatting and it may be combined or be a part of canteen itself. Girls common room should contain in addition a bench or a coach for lying down
ii)	Canteen	0·1 per student (*Min* 25 m²; *Max* 100 m²)	—
iii)	NCC/ACC/Scout/ Guide	One room for each, 11·0 m² area	—
iv)	Medical Inspection Room	20 to 30	It should contain facilities such as a table, a chair, an examination bed, a medicine chest and a wash basin
v)	Book/Stationery Shop	30 to 50	—
vi)	Library	0·1 per student (*Min* 50 m²; *Max* 150 m²)	Regarding primary elements in the design of school library buildings, IS : 8338-1976* may be referred
vii)	Students' Club and House Offices	30 to 50	—
viii)	PET Room (Physical Education and Teaching Room)	45	—
ix)	Toilets	0·2 per student	Regarding provision of various fittings in toilets, Table 9 may be referred.
x)	Multiuse Hall (Optional)	0·65 per student for 50% of the strength (excluding stages)	—
		(*Min*: 14 m × 28 m × 5·5 m)	Without stage
		(*Max*: 18 m × 36 m × 6 m)	

*Recommendations for primary elements in the design of school library buildings.

It should be possible to extend the teaching areas in the open space beyond the classrooms and for this purpose such open spaces should be designed to provide for chalkboards, raised platforms and outside sitting arrangements.

● Parking areas for the following should be provided when designing a school building: a) Cycles At the rate of 1.1 ms per cycle
b) Scooters 3, 3 ms per scooter
c) Cars ,> 25 rns per car

d) Buses >, 60 ms per bus

● OVERALL AREA OF SCHOOL

The built-up area of school and the overall area of the plot should be calculated according to provisions Table (which gives category-wise the various facilities to be provided), and building regulations. However, as a rough guide the following values may be taken when planning a school.

	For Primary School	For Secondary + Higher Secondary School	For Primary + Secondary + Higher Secondary School
a) Built-up area (on all floors) per student place:			
1) For a school having four sections per class	1·80 m²	3·40 m²	2·60 m²
2) For a school having two sections per class	1·80 m²	4·60 m²	3·20 m²
	(The area per student place will decrease when number of sections per class increase and vice-versa)		
b) Plot area other than play fields	2 to 3 times the built-up area (on all floors) depending upon the number of storeys		
c) Play fields	According to provisions in **10.3**		

Set-Back Lines – In the absence of local building byelaws the minimum set-backs of the building from the boundaries shall be as follows:

a) Front set-back 15 metres b) Side set-back 6 metres

- SELECTION OF SITE

While selecting the site of school buildings, the following points should be kept in mind: a) Easy accessibility from residential areas;
b) Site should be away from heavy traffic roads, rivers, ponds, railway tracks, etc;
c) Site should be away from high tension lines;

d) The land should not be of made-up ground unless precautions have been taken for stabilization; e) Site should ensure a good natural drainage; and

f) The site should preferably be at a quiet place away from places generating noise and pollution, such as cinemas, factories and shopping centres.

- EFFECT OF LANDSCAPE ELEMENTS

While planning the school building, the importance of landscape elements such as open areas, to increase the comfort conditions inside the building and also in the surrounding environment, should be kept in mind.

Plants, hedges and shrubs planted immediately outside the classroom windows where such windo\vs are the principal source of natural light and ventilation should not protrude beyond the sill level.

The rows of tall or shady trees should be at right angles to the source of light to the building in order to avoid glare in the rooms. At the same time the tall and shady trees, walls, or any obstruction in front of the classroom windows should be at a distance to ensure adequate amount of lighting and ventilation. This distance may be taken equal to the height of the building.

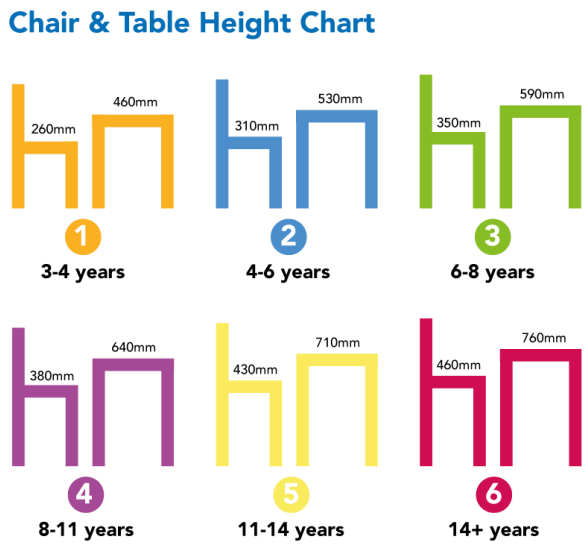


Fig.52 : furniture standard dimensions

2.4 SITE SELECTION & JUSTIFICATION

The primary focus of the design programme are its users – kids from age group 4- 16 years(kindergarten to secondary school goers). Since the programme focuses on educational institute i.e learning centers in an urban fabric the two major aspects of the site should be :

- Site should be located in an urban fabric
- In the vicinity of other educational centers so as to easily cater to the primary users and to judge the feasibility of the module which would later be used at other urban sites

When we think about urban level education and sustainability , the first city that comes to mind in pune due to the following reasons :

- Pune was called "***the oxford of the east***" by jawaharlal nehru, india's first prime minister. Pune attracts students from all over the world.
- ***Pune university has 811 affiliated colleges and 20,160 schools.***

These factors make Pune apt for an experimental learning center – as being in the close vicinity of its primary user the design will easily evolve according to their needs while adding strengths to the programme and reducing weakness from the same.

The second most import factor why Pune should be chosen as the site for innovative sustainable schools is the fact that pune has been seeing a lot of sustainability in its built system like **Suzlon, MIT campus , INFOSYS campus** etc.

Hence we get a base to start and compare the design from and then take a step further according to the user needs.

PUNE STATISTICS :

- POPULATION : 3.13 million
- Pune is ranked the No. 1 city in India in 'ease of living' ranking index
- Research institutes of information technology, education, management and training attract students and professionals from India and overseas. Several colleges in Pune have student-exchange programs with colleges in Europe [increases the changes of special diversity since each student will have its own perception of space and can get more reviews regarding what elements can be added or removed from the design programme and ultimately how to hence the innovative spaces the students will be thriving in]

PUNE CLIMATOLOGY :

Pune stands on the leeward side of the Western Ghats on an altitude of 559m.(1863 ft.). The temperatures are pretty moderate. Avg temp from 19-33 degree Celsius .Climate of Pune also acts as an aid to the allied design element of farming.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	21.3	23.1	26.3	29	29.6	27.3	24.8	24.5	24.8	25.5	23	21.1
Min. Temperature (°C)	12.2	13.5	17	20.7	22.6	23	22	21.5	20.8	19.5	15.3	12.3
Max. Temperature (°C)	30.5	32.7	35.7	37.4	36.7	31.7	27.6	27.5	28.9	31.5	30.7	30
Avg. Temperature (°F)	70.3	73.6	79.3	84.2	85.3	81.1	76.6	76.1	76.6	77.9	73.4	70.0
Min. Temperature (°F)	54.0	56.3	62.6	69.3	72.7	73.4	71.6	70.7	69.4	67.1	59.5	54.1
Max. Temperature (°F)	86.9	90.9	96.3	99.3	98.1	89.1	81.7	81.5	84.0	88.7	87.3	86.0
Precipitation / Rainfall (mm)	0	1	2	13	41	122	211	128	132	82	26	5

The difference in precipitation between the driest month and the wettest month is 211 mm. During the year, the average temperatures vary by 8.5 °C.

Table 3 . meteoblue.com/pune

THE ECONOMIC TIMES

Infosys Pune becomes largest campus to receive LEED Platinum certification

BUREAU | UPDATED: APR 18, 2017, 04.38 PM IST

LEED Platinum is the highest level of green rating for buildings and with this recognition, the Infosys Pune campus becomes the largest in the world to achieve this distinction.

Technology services and consulting firm Infosys today announced that it has been awarded the LEED EBOM (Leadership in Energy and Environmental Design - Existing Building Operation & Maintenance) Platinum certification by the United States Green Building Council (USGBC) for its entire Infosys Pune Phase-2 campus.

LEED Platinum is the highest level of green rating for buildings and with this recognition, the Infosys Pune campus becomes the largest in the world to achieve this distinction.

Spread over 114 acres in Hinjewadi Phase 2, the campus started operations in 2004 and comprises office buildings, residential training facilities, food courts, health and fitness facilities and can accommodate 34,000 people. Infosys has followed a two-pronged strategy to make the campus

sustainable and resource efficient; designing new buildings to meet the highest efficiency standards, and implementing deep retrofits in old buildings to make them efficient.

In the last eight years, there has been a 47% reduction in per capita energy consumption and 38% reduction in water consumption. This year, 77% green power was used to meet the electricity needs of the entire campus.

In new construction category, three buildings in the Infosys Pune Phase–2 campus are certified with LEED Platinum rating. For existing buildings, efficiency improvements were achieved through large-scale retrofit projects in 10 office buildings, three food courts, the employee training center, the guest house and sports complexes across the campus.

Post a Comment

Business Standard

Pune NGO TERRE releases first-ever 'Campus Sustainability Report'

IANS | Pune June 12, 2018 Last Updated at 15:08 IST
The TERRE Policy Centre launched its first-ever Campus Sustainability Report, on the occasion of World

Environment Day recently, an official said here on Tuesday.

The launch of the report, developed by the MIT Group of Institutions, Pune, was hosted by the Maharashtra Institute of Technology-World Peace University (MIT-WPU) Director-General Vishwanath Karad.

"Hitherto, sustainability reports have been the annual records of the corporate world providing in-depth reviews of the actions taken by business corporations on environmentally and socially responsible practices. They gave insight into their company strategies and robust views on how they adjust their policies and practices to address the current sustainability agenda," said TERRE Chairman Rajendra Shende.

However, providing such information by an educational institute and resolving to do so annually is setting a new trend in India, he said.

The latest report highlights the progress achieved by four MIT-WPU campuses over the last one year since the Smart Campus Cloud Network, a global network of educational campuses geared towards Sustainable Development Goals was launched by Human Resource Development Minister Prakash Javadekar in June 2017.

The report includes benchmarking of the sustainability indices for the campus like energy use per square foot of built up area, trees per square foot of open area,

management of e-waste, canteen waste, solid and liquid waste and sustainable transport. The report also unveils the future plan and vision to contribute to SDGs.

"Smart Campus activities like re-processing the waste within the campus could generate tomorrow's business leaders," said Dinkar More, former Director-General of Water Resource Board of Maharashtra, who presided over the event.

Other prominent guests included Milind Pande, J. Gore, Principal Advisor to MIT-WPU and Professor at Purdue University, US, I.K. Bhat Vice Chancellor of MIT-WPU and R. Dod, professor of civil engineering and environment department.

Shende hoped that henceforth other educational campuses under SCCN would also start releasing Campus Annual Sustainability Reports.

INFERENCES : FURTHER THESE SUSTAINABILITY ACTIONS IN PUNE SET A BENCHMARK FOR THE CITY TO TAKE STEPS TO ENRICH OTHER CAMPUS TO BE SUSTAINABLE – SUCH CONSIDTIONS WOULD ***BE IDEAL FOR DESIGNING OF AN INNOVATIVE SUSTAINBELE SCHOOL CAMPUS.***

CITY SELECTION : MAGARPATTA

Distance from pune junction railway station : *33 min* ***(8.3 km) via BG Shirke Rd***

Distance from pune airport : *38 min (10.1 km) via New Airport Rd/Symbiosis Rd*

- For any schooling facility primary element would be its accessibility and ease from residential zone
- Further MAGARPATTA is consist of 30% green zone surrounded by residential and commercial zone. The commercial zone will act as secondary client for the school allied farming and tiffin system

- Spread over 430 acres, Magarpatta City is an award winning and internationally acclaimed model of integrated development and self-sustainability.

- A city within a city, Magarpatta City is home to a commercial zone, residential neighbourhoods, two schools, a multi speciality hospital, a shopping mall, multiple restaurants, a gymkhana and a large 25 acre serene park called Aditi Garden. All this is complemented by a verdant environment and a pollution free ambience - a supreme setting for life and business.

- Through its sustainable development model, Magarpatta City has introduced eco-friendly development and has green spaces that make up for 30 per cent of the area. The implementation of comprehensive waste management and sustainable systems ensures further preservation of the environment.

- It has won accolades at the Sydney World Congress of Metropolis, 2008, and the Maharashtra Economic Development Council lists Magarpatta City among the 'Top 10 success stories of the State'.
- Today, the name Magarpatta City stands for quality in construction, innovation in design and impeccable planning. It is the only fully functional and privately managed township in the country and is regarded as a remarkable reality; a reality born through immaculate vision and brilliant execution.

Magarpatta: building a city with rural-urban partnership How we can and why we must foster such partnerships

Written by Ranesh Nair | Ranesh Nair | Isher Judge Ahluwalia | Updated: May 27 2010, 01:59am hrs

Magarpatta is a shining example of how urban areas can expand to accommodate the needs of urbanisation without hurting the interests of rural landowners through forced or unfair acquisition. Magarpatta is a 430 acre area located on the outskirts of the city of Pune, which itself is spread over an area of 60,000 acres. It has been part of the Pune Municipal Corporation since 1960, even though it was in the agricultural zone***. Magarpatta has been developed over the past 10 years within the Pune metropolitan region as a modern sustainable urban habitat by the original inhabitants who were farming their ancestral land in that area. Today, with its emphasis on environment-friendly development, high quality of urban services, excellent modern facilities for education and health, and state-of-the-art working conditions, this city is home to over 35,000 residents and a working population of 65,000.***

The Magar clan, a community of 120 farmers on the outskirts of Pune, owned agricultural lands that had fragmented through the years. In the 1990s, they saw a surge in activity in the vicinity of their landholdings as the pressure of urbanisation led to widespread construction in the suburban areas of Pune. Building Magarpatta city on their agricultural lands with a view to sharing the gains in the appreciation of land value was the farmers answer to the challenges posed by these developments.

A crucial decision of the

Magar community was to organise themselves to set up the Magarpatta Township Development and Construction Company, which prepared a city plan for Magarpatta. Preparation of such a plan is a precondition for obtaining permission for change of land use, something which is otherwise done by developers after they acquire land from agriculturists. The Magar farmers pooled their land, with each landowner becoming a shareholder in the company in proportion to the value of his/ her land in the total. The land cost was determined as a percentage of sale proceeds as and when accrued. The Master Plan of the proposed township was submitted to the Pune Municipal Corporation and the Government of Maharashtra in 1993 and approvals obtained in 2000.

We were struck by the pollution-free and clean urban environment and impressed with the manner in which meticulous plans for the delivery of urban services were being executed.

Almost 30% of the area of the city has been reserved for greens, and the city is home to Aditi Gardens which is now the largest garden in Pune, covering 25 acres***. The city is designed around the concept of walk to work, walk to shop and walk to school, with a view to making access a central feature and minimising the pressure on urban transportation.***

Satish Magar pointed out that over 240 tonnes of garbage (household and commercial) is separated at source per month. About 170 tonnes of biodegradable waste is used for vermiculture and biocompost. ***A network of sewage treatment plants with capacity ranging from 0.25 to 3 million litres per day caters to the wastewater treatment needs of the township. Rainwater harvesting is done through pipes under the pavements. Over 7,000 solar collectors are deployed to heat approximately 9 lakh litres of water every day, resulting in savings of 1.48 crore electricity units per year.***

The City Council of Magar-patta has 105 elected representatives, of which 35% are women. The Council highlights the concerns of residents, but the decision-making rests with the development company. Mahesh Zagade, Municipal Commissioner, Pune, was happy that the township imposes no burden on the Corporation and rather contributes to the revenue by paying taxes and other charges levied by the Pune Municipal Corporation.

It is not surprising that the state-of-the-art Cybercity Magarpatta IT Park has attracted global IT giants such as Accenture, John Deere, Aviva and Patni to the city. With 6 million square feet of IT space, the city has created direct employment for 60,000 professionals and indirect employment for another 20,000 persons. Magarpatta houses Punes fastest growing Business

Centre spread over an area of 85 acres, and a shopping and commercial complex spread over about 12 acres.

Satish Magar was very appreciative of the role played by Mr BG Deshmukh, former Chief Secretary of Maharashtra and subsequently Cabinet Secretary and former Private Secretary to Prime Minister Rajiv Gandhi.

Mr Deshmukh was the guide and patron for this ambitious endeavour. What he did not point out and we learnt subsequently was the role played by Mr Magar himself in organising the farmers of the area to understand and appreciate the opportunity. The Draft Development Plan prepared in 1982 had showed Magarpatta as a future urbanisable zone, which meant that the government could acquire the land at any time.

After 1987, when the Magarpatta area was re designated, Mr Magar and a few others started the development company, and sought permission to develop the land. The result is what we see today.

LAND USE PLAN

The site is a vacant land adjoining Magarpatta road – easy accessibility to site

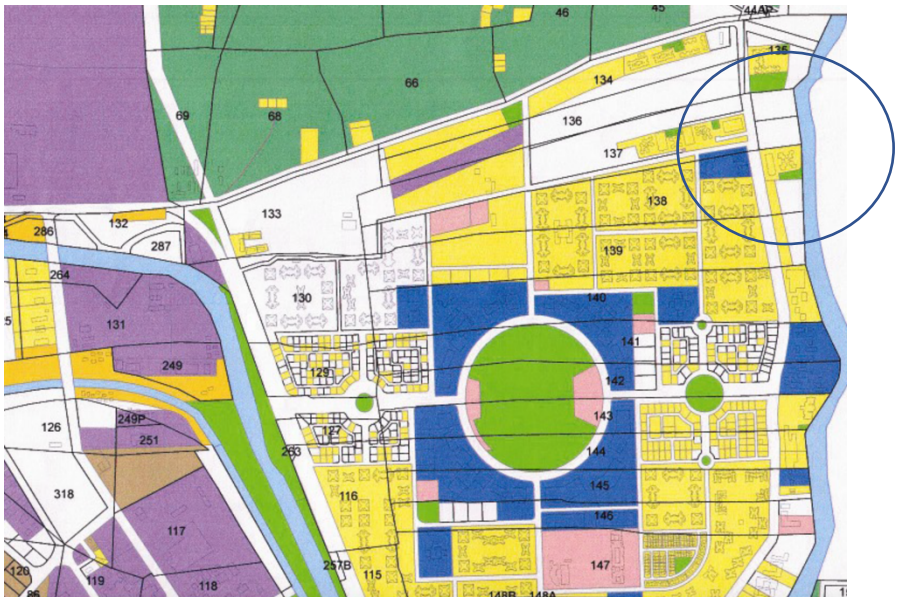


Fig.50. land use plan of Magarpatta, pune

The site currently houses KF BIOPLANTS which is additional benefit to design aid as they can be integrated in the design programme – they have their own florists polyhouses on the site which aids the nursery aspect of the school design.

On the top left of the site is a nana nani park – additional greens to the space design neighborhood.

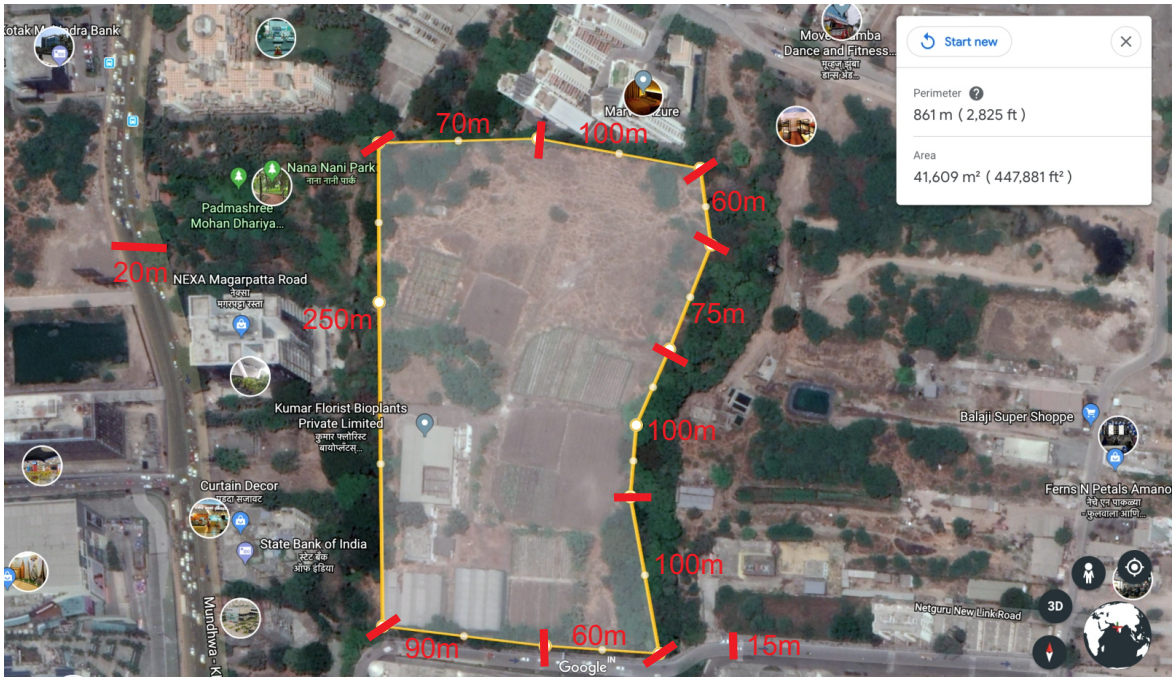


Fig.51 site dimensions and profile

SITE CHARACTERISTICS :

- Distance from pune junction railway station : *33 min* ***(8.3 km) via BG Shirke Rd***
- Distance from pune airport : *38 min (10.1 km) via New Airport Rd/Symbiosis Rd*
- Site area : 41,609 sq.m
- Close proximity to Magarpatta road
- The same locality has 11 other schools
- On site polyhouses which cater to nursery aspect of the design programme
- Close proximity to residential and commercial zones
- Adjacent to nana nani park – acts as extended greens to the site
- Close proximity to seasons mall and amanora mall
- Close proximity to police station

Most of the above public spaces will cater to weekend revenue generating programme and help in full usage of campus facilities to form a sustainable closed loop system.

3.CONCLUSION :

THE PROJECT WILL TRY TO ACHIEVE AS MUCH FLEXIBILITY AND CREATIVITY WHILE DESIGNING STUDENT'S SPACES AS PER THE KNOWLEDGE OF THEIR PSYCHOLOGY AND HUMAN – SPACE BEHAVIOUR. THE PROJECT WILL AIM TO MANIFEST DESIGNS WHICH WILL SPARK CURIOSITY AND EARGNESS IN STUDENTS TOWARDS LEARNING WHILE DESIGNING SPACES THAT PRODUCE OPPOURTUNITY TO LEARNING WITH EXPERIMENTAL AND HANDS ON EXPERIENCE TO GENERATE RATIONALE AND LOGICAL THINKING INTO THE STUDENT'S MIND TO PREPARE THEM TO BECOME BETTER CITIZENS OF THE WORL DNATION. ALSO AN IMPORTANT ASPECT OF THE DESIN WILL BE ITS ABILITY TO AMALGAMTE SPACES IN SUCH A WAY THEY ARE NOT ONLY SUSTAINABLE BUT ALSO HELPS REDUCE CARBON FOOT PRINT OF THE SYSTEM WHICH WILL HELP DEVELOP SENSITIVE ATTITUDE TOWARDS NATURE. SUSTAINABLE APPROACH WILL BE CONSIDERED AS A DESIGN ELEMENT AND NOT JUST MEARLY AS A PLUGIN ON THE DESIN. CAMPUS DEVELOPMENT WILL BE CONSIDERED AN IMPORTANT ASPECT WHILE DESIGNING AND THE EFFECTS OF GREEN CAMPUS AND SUSTAINABLE SCHOOL ON THE MICROCLIMATE OF THE NEIGHBOURHOOD WILL BE EXPLORED.

4.TENTATIVE SPACE PROGRAMME

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
A.	**PRE PRIMARY**	CLASSROOM						
		PLAYGROUP	2	25	70	140	SEMI-OPEN	PRIVATE
		NURSERY	2	25	70	140	SEMI-OPEN	PRIVATE
		KINDERGARTEN	2	25	70	140	CLOSED	PRIVATE
		LIBRARY/ RESOURCE CENTRE	1	20% STUDENTS	100	100	CLOSED	PUBLIC
		READING ROOM	1		50	50	SEMI-OPEN	PUBLIC
		BOOK SECTION	1		15	15	SEMI-OPEN	PUBLIC
		STORY TELLING AREA	1		30	30	OPEN	PUBLIC
		STAFF AREA	1		10	10	CLOSED	PRIVATE
		STORAGE	1		15	15	CLOSED	PRIVATE

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		ARTS AND CRAFTS ROOM	1		50	50	SEMI-OPEN	PUBLIC
		MUSIC ROOM	1		50	50	CLOSED	PUBLIC
		AV ROOM	1		50	50	CLOSED	PUBLIC
		DANCE DRAMA ROOM	1		70	70	SEMI-OPEN	PUBLIC
		SELF SERVING KITCHEN	1		30	30	CLOSED	PUBLIC
						890		
		ADMINISTRATIVE						
		STAFF ROOM+STORE	1		55	55	CLOSED	PRIVATE
		STAFF TOILET	1		12	12	CLOSED	PRIVATE
		COORDIANTOR ROOM	1		20	20	CLOSED	PRIVATE
		MEDICAL ROOM	1		20	20	CLOSED	PRIVATE

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		SUPPORT/ STAFF						
		DORM	3		20	60	CLOSED	PRIVATE
		TOILET	2		37	74	CLOSED	PRIVATE
		TOILET FOR DISABLES	2		3	6	CLOSED	PRIVATE
		JANITOR ROOM	2		1.6	3.2	CLOSED	PRIVATE
		STORE	1		6	6	CLOSED	PRIVATE
		PANTRY	1		6	6	CLOSED	PRIVATE
						262.2		
	TOTAL BUILT UP AREA					1152.2 SQM		
B	**PRIMARY AND MIDDLE**	CLASSROOM						
		1	4	25	60	240	CLOSED/SEMI	PRIVATE
		2	4	25	60	240	CLOSED/SEMI	PRIVATE

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		3	4	25	60	240	CLOSED/SEMI	PRIVATE
		4	4	25	60	240	CLOSED/SEMI	PRIVATE
		5	4	25	60	240	CLOSED/SEMI	PRIVATE
		6	4	25	60	240	CLOSED/SEMI	PRIVATE
		7	4	25	60	240	CLOSED/SEMI	PRIVATE
		8	4	25	60	240	CLOSED/SEMI	PRIVATE
		ARTS ROOM	2		108	216	SEMI-OPEN	PRIVATE
		MATERIAL STORAGE	2		13.5	27	CLOSED	PRIVATE
		MUSIC ROOM	3		70	210	CLOSED	PRIVATE
		DRAMA/DANCE ROOM	1		70	70	SEMI-OPEN	PRIVATE
		SCULPTURE AND MODELLING ROOM	1		100	100	SEMI-OPEN	PRIVATE
		CARPENTRY WORKSHOP	1		70	70	CLOSED	PRIVATE
		PROJECT WORK ROOM	1		70	70	SEMI-OPEN	PRIVATE
						2683SQM		

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		ADMINISTRATIVE						
		STAFF ROOM+STORE	4		40	160	CLOSED	PRIVATE
		STAFF TOILET	4		12	48	CLOSED	PRIVATE
		COORDINATOR ROOM	4		20	80	CLOSED	PRIVATE
		SUPPORT/ STAFF						
		TOILET	8	M-4,F-4	25	200	CLOSED	PRIVATE
		TOILET FOR DISABLES	6		2.6	15.6	CLOSED	PRIVATE
		JANITOR ROOM	3		1.6	4.8	CLOSED	PRIVATE
		STORE	4		6	24	CLOSED	PRIVATE
		PANTRY	4		6	24	CLOSED	PRIVATE
						568 SQM		

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
C	**SECONDARY**	**CLASSROOM**						
		9	4	30	70	210	CLOSED/SEMI	PRIVATE
		10	4	30	70	210	CLOSED/SEMI	PRIVATE
		11	4	30	70	210	CLOSED/SEMI	PRIVATE
		12	4	30	70	210	CLOSED/SEMI	PRIVATE
						840SQM		
		AV ROOM	1		80	80	CLOSED	SEMI-PUBLIC
		PHYSICS LAB	2		160	320	CLOSED	SEMI-PUBLIC
		CHEMISTRY LAB	2		160	320	CLOSED	SEMI-PUBLIC
		BIOLOGY LAB	2		160	320	CLOSED	SEMI-PUBLIC
		HOME SCIENCE LAB	2		160	320	CLOSED	SEMI-PUBLIC
		ARTS ROOM	1		108	108	SEMI-OPEN	SEMI-PUBLIC
		MATERIAL STORAGE	2		22.5	45	CLOSED	SEMI-PUBLIC
		MUSIC ROOM	1		100	100	CLOSED	SEMI-PUBLIC

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		DANCE ROOM	1		100	100	SEMI-OPEN	SEMI-PUBLIC
		WORKSHOP ROOM	1		100	100	SEMI-OPEN	SEMI-PUBLIC
		PROJECT WORK ROOM	1		100	100 1593SQM	CLOSED	SEMI-PUBLIC
		ADMINISTRATIVE						
		STAFF ROOM+STORE	3		40	120	CLOSED	PRIVATE
		STAFF TOILET	3		12	36	CLOSED	PRIVATE
		COORDINATOR ROOM	3		20	60	CLOSED	PRIVATE
		SUPPORT/ STAFF						
		TOILET	4		40	160	CLOSED	PRIVATE
		TOILET FOR DISABLES	1		2.6	2.6	CLOSED	PRIVATE
		JANITOR ROOM	1		1.6	1.6	CLOSED	PRIVATE
		DRINKING FOUNTAIN	2		2.8	5.6	CLOSED	PUBLIC

SR. NO	SPACES	SUB SPACE	NO. OF SUB SPACE	NO. OF USERS	Min. ROOM SIZE	AREA m2	QUALITY OF SPACE	TYPE OF SPACE
		STORE	2		6	12	CLOSED	PRIVATE
		PANTRY	2		6	12	CLOSED	SEMI-PUBLIC
						410SQM		
	SHARED SPACES	ADMINISTRATIVE						
		RECEPTION+ LOBBY	1		100		SEMI-OPEN	PUBLIC
		PRINCIPAL ROOM	1		40		CLOSED	PRIVATE
		VICE PRINCIPAL	1		30		CLOSED	PRIVATE
		DIRECTOR ROOM	1		20		CLOSED	PRIVATE
		OFFICE CUM STORAGE	1		30		CLOSED	PRIVATE

		RECORD+ ATTENDANCE	1		20		CLOSED	PRIVATE
		PANTRY	1		5.4		CLOSED	PRIVATE
		TOILET	2		11.7		CLOSED	PRIVATE
		UNIVERSAL TOILET	1		1.6		CLOSED	PRIVATE
		MEDICAL ROOM	1		20		CLOSED	SEMI-PUBLIC
		STATIONARY	1		45		CLOSED	SEMI-PUBLIC
					323.7			
	MISC.	LIBRARY/RESOURCE	1		510		CLOSED	PUBLIC
		READING ROOM	1		400		SEMI-OPEN	PUBLIC
		BOOK SECTION	1		70		CLOSED	PUBLIC
		STAFF AREA			40		CLOSED	PRIVATE
		AUDITORIUM	1		1000		CLOSED	PRIVATE
		CONFERENCE	1		200		CLOSED	PRIVATE
		LECTURE HALL	1		300		CLOSED	PRIVATE
		PRAYER AREA	1		1550		CLOSED	PRIVATE
		FACULTY CAFETERIA	1		200		CLOSED	SEMI-PUBLIC

		DINING HALL	1		1200		SEMI-OPEN/OPEN	SEMI-PUBLIC
		KITCHEN	1		162		CLOSED	PRIVATE
					4080SQM			
	SPORTS	400 M RACE TRACK	1				OPEN	PUBLIC
		ADVENTURE	10				OPEN	PUBLIC
		GYMNASIUM	1				SEMI-OPEN	PUBLIC
		BADMINTON COURT	4				CLOSED	PUBLIC
		STORE	1				CLOSED	PUBLIC
	CAMPUS FARMING AND RESEARCH ZONE							
	COOKING AREA		10		30		SEMI OPEN	PUBLIC
	SEMINAR AREA		20		50		SEMI OPEN	PUBLIC
	WORKSHOP AREA		20		50		SEMI OPEN	PUBLIC
	STORAGE SPACE		3		20		CLOSD	PRIVATE
	YIELD STORAGE		3		20		CLOSED	PRIVATE
	WASTE MANAGEMENT		5				SEMI OPEN	SEMI PUBLIC

5.DESIGN BRIEF :

WITH CHANGING TIMES, EVRY ASPECT OF THE SOCIETY NEEDS UPGRADATION.THE MOST FUNDADAMENTAL BUILDING WHERE A PERSON SPENDS 1/3RD OF HIS LIFE IS AN EDUCATIONAL INSTSTITUTE AND ITS HIGH TIME WE UPGRADE INSTITUTIONAL SPACES TO NOT JUST MEET THE USER REQUIREMENTS BUT TO MAKE THEM THINK OUTSIDE THE BOX.TO DO SO THE MONOTONY OF THE LEARNING SPACES HAS TO BE BROKEN IN A WAY THAT NOT ONLY IT ACTIVATES CURIOSITY IN ITS USER BUT ALSO IS SUSTINABLE IN NATURE.

THIS THESIS WILL FOCUS ON A MODULAR DESIGN FOR A SUSTAINABLE SCHOOL IN AN URBAN CONTEXT AND TO EXAMINE WHAT ALL APPROACHES CAN BE ACHIVED IN THE DESIGN OF THE SCHOOL SPACES.THE PRIMARY FOCUS WILL BE USER BASED DESIGN OF EACH SPACE ADHERING TO SUSTAINABLE APPROACHES AT THE SAME TIME.SPACE QUALITY THAT SPARKS INTEREST IN STUDENTS WILL BE EXAMINED AND HOW THE QUALITY OF SPACE AFFECTS A STUDENT'S MENTAL GROWTH AND DEVELOPMENT IN THE LONG RUN WILL BE STUDIED.

THE PROGRAMME WILL INCORPORATE THE FOLLOWING SPACES :

- FORMAL LEARNING SPACES / CLASSROOMS
- SPILL OUT ZONES FOR EXPERIEMNTAL BASED LEARNING
- WORKSHOP ZONES
- EXPERIMENTATION LAB
- ON CAMPUS FARMING ZONE
- RAINWATER HARVESTING AND UTILIZATION UNIT
- ORGANIC WASTE COMPOSTING
- EXHIBITION SPACES
- MULTIFUNCTIONAL SPACES

SOME OF THE ABOVE SPACES WILL BE RENT OUT TO GENERATE REVENUE AND SPREAD AWARNESS .THIS PROGRAMME WILL TRY TO ACHIEVE ZERO CARBON FOOTPRINT SYSTEM WHICH CAN BE RE MODULED TO FIT OTHER URBAN

POCKETS AND ULTIMATELY ENHANCE THE MICRO CLIMATE OF THE NEIGHBOURHOOD AND REDUCE URBAN ISLAND HEAT EFFECT.

THE BEST SITE TO EXPERIMENT ON SPACES OF AN EDUCATIONAL INSTITUTE WILL BE THE EDUCATIONAL HUB OF INDIA ITSELF – PUNE. BEING SURROUNDED BY YOUNG ADULTS AND SIMULTANEOUS WORKS OF MAKING IT A SMART CITY, PUNE HAS ALREADY STARTED TAKING STEPS TOWARDS SUSTAINABILITY.

THE PROPOSAL OF INNOVATION IN SCHOOL SPACES WILL GET THE FASTEST RESULT WHEN IT IS IN THE VICINITY OF ITS POTENTIAL USERS AND THEIR BEHAVIOUR TO THE SPACE COULD BE NOTED FOR FURTHER ALTERATIONS TO THE DESIGN.

ADVANTAGES OF SITE BEING IN PUNE ARE AS FOLLOWS :

- MAXIMUM YOUTH CROWD
- SMART CITY PROPOSALS ON- GOING
- SUCESSFUL SUSTAINABLE PROJECTS LIKE SUZLON ALREADY IN PRACTICE
- CLIMATE OF PUNE WILL BE HELPFUL TO SOME OF THE SUSTAINABLE APPROACH DESIGN ELEMENTS LIKE HYDROPONICS FARMING, FAÇADE DESIGN , ETC AMONGST THE OTHERS.

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