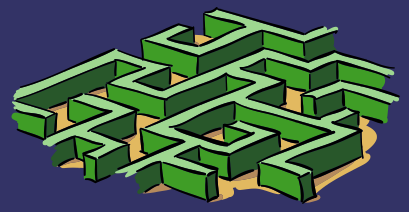
Resource optimization for self sufficiency
in
The New HAREDA Building

A Sustainable Design Approach

Siddhartha Wig & Anant Mann,
The Elements

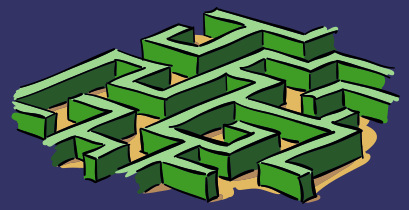


Sustainability

Equity

Consumption

Aspirations



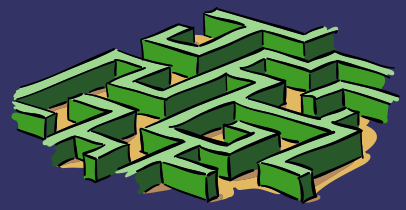
Benchmarking

- To reduce water consumption by 40%
- To achieve complete water sustainability
- To reduce lighting energy consumption by 25%
- Use photovoltaic to completely offset the state grid for energy required lighting, computers and fans.

The forecast for energy consumption in similar buildings was

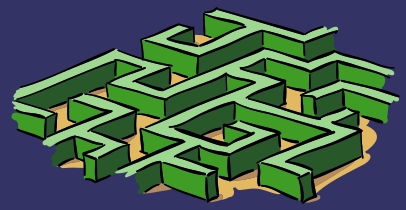
For conditioned buildings – 90kWhr/m2/year (6 days operation per week x 12 month)

For passively or low energy cooled and ventilated buildings – 30 kWhr/m2/year (6 days operation per week x 12 month)



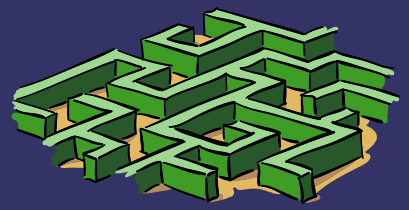
Site and Climatic Data Analysis

- Does the site receive sufficient sunlight and not impact our neighbours?
- Is the site flexible enough to maximize good building orientation?
- Can the prevailing winds be used to maximize the availability and use of natural ventilation?
- Does the site receive consistent rainfall throughout the year to consider collection for re-use?
- Is the site subject to flooding or have any natural water features?
- What is ecological value of site before and after development?
- How can it be improved and linked into overall building performance (e.g. shading, water treatment, etc)



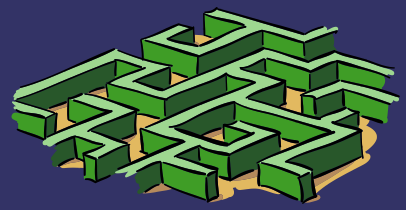
Climate analysis

	9	10	11	12	13	14	15	16	17	18
	18				24					
jan	11.4	13.3	15.5	17.6	19.2	20.2	20.6	20.2	19.3	17.9
feb	13.2	15.3	17.7	19.9	21.6	22.7	23.1	22.7	21.7	20.2
mar	17.7	19.9	22.4	24.7	26.5	27.7	28.1	27.7	26.6	25.0
apr	22.8	25.1	27.7	30.2	32.0	33.2	33.7	33.2	32.2	30.5
may	28.1	30.4	32.9	35.3	37.1	38.3	38.7	38.3	37.2	35.6
jun	29.5	31.4	33.4	35.4	36.9	37.8	38.2	37.8	37.0	35.6
jul	27.9	29.2	30.6	32.0	33.0	33.6	33.9	33.6	33.1	32.1
aug	27.0	28.3	29.7	31.1	32.1	32.7	33.0	32.7	32.2	31.2
sep	25.4	27.1	29.0	30.7	32.1	33.0	33.3	33.0	32.2	31.0
oct	21.3	23.6	26.3	28.7	30.6	31.8	32.3	31.8	30.8	29.0
nov	16.2	18.6	21.4	24.0	26.0	27.3	27.8	27.3	26.2	24.4
dec	12.0	14.2	16.7	19.0	20.8	22.0	22.4	22.0	20.9	19.3



Conclusions

- Set the indoor temperature little higher than the ASHRAE comfort region.
- Use of Scientific methods in orienting the building
- Always air conditioning the building is not solution for comfort
- Provide openings in the building towards the prevailing wind direction,
- Harvest rain



Overall Design Strategy

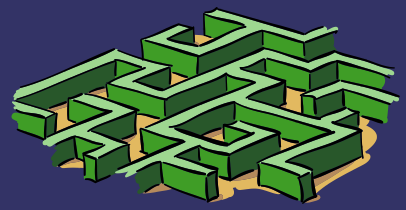
The habitable spaces (excluding courtyard, lobby, corridor, toilets etc.) are about 4200 sqm. Of these,

1400 sqm are deemed apex at 25 ± 1 °C (apex offices and conference room) to be always a/c,

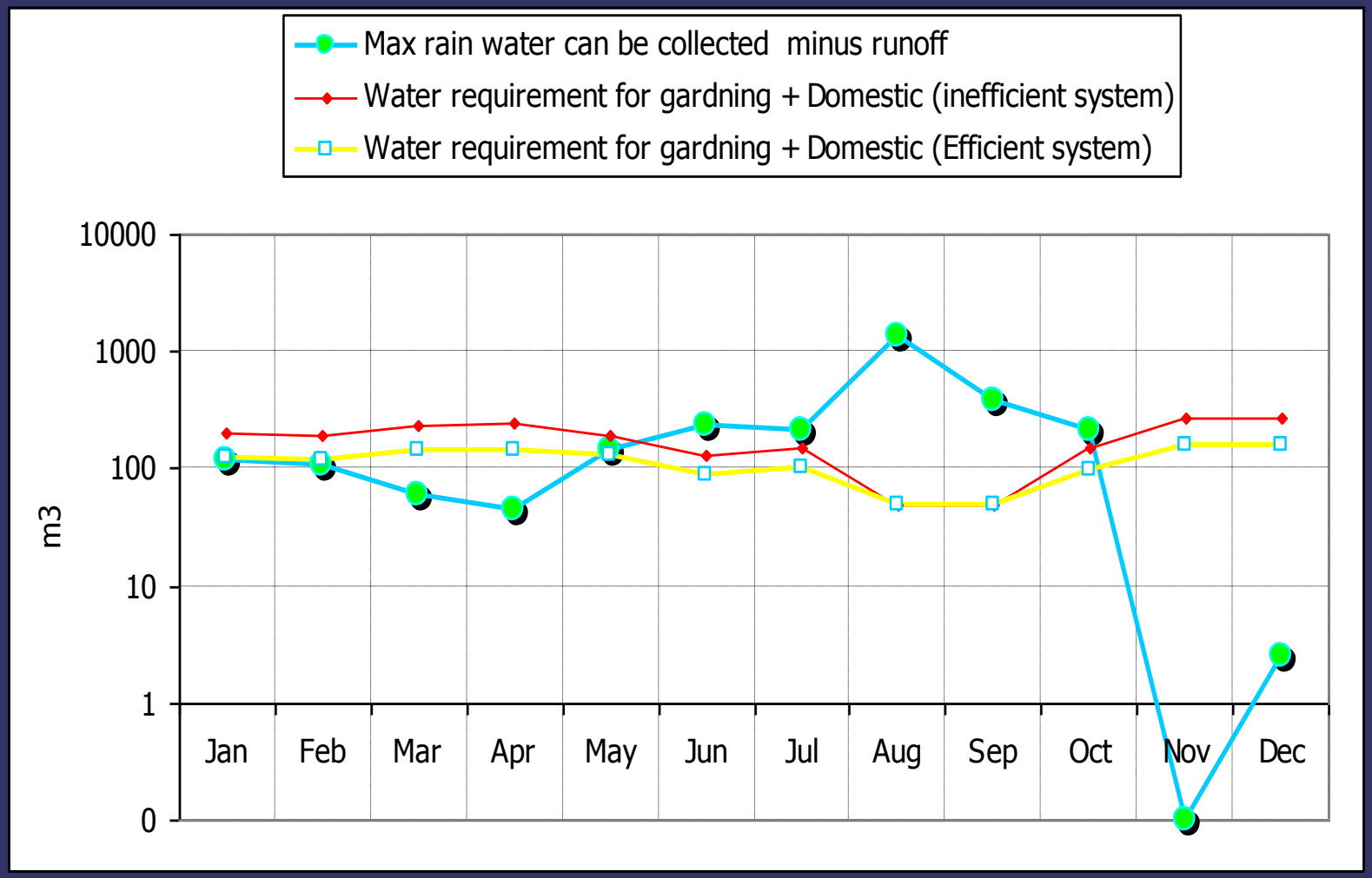
700 sqm are deemed controlled at 25 ± 3 °C (other offices, training room etc.) to be cooled in summer

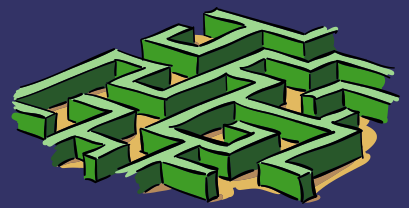
and

2100 sqm are passive 25 ± 5 °C (workshops, exhibition etc.) to be cooled in summer and ventilated in monsoon

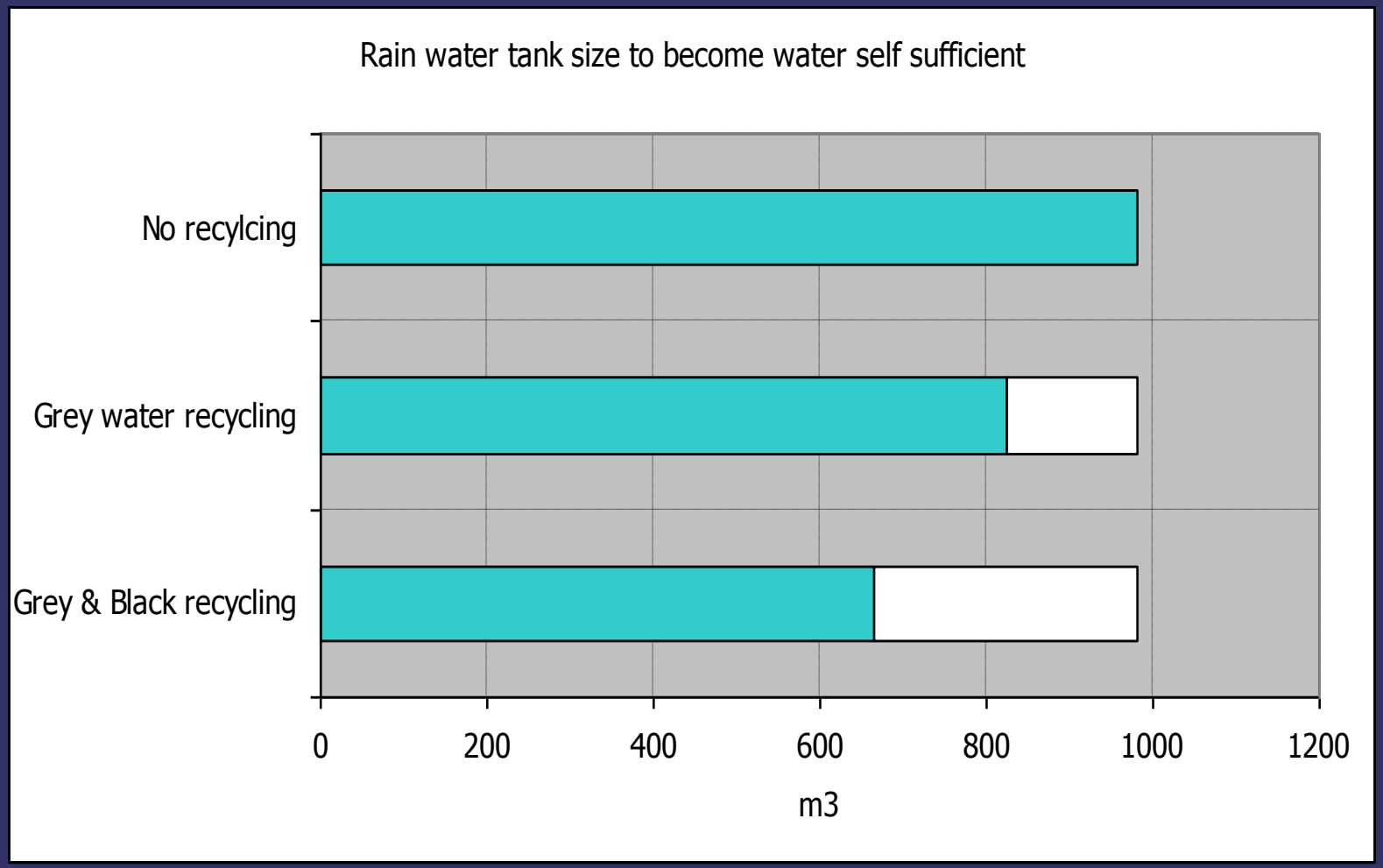


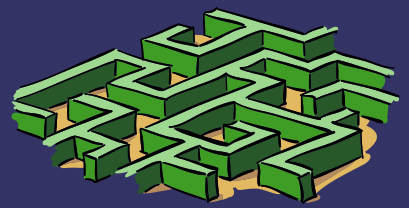
Rain Water Harvesting





Rain Water Tank Optimization

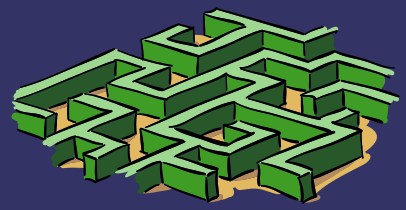




Water Management Strategy

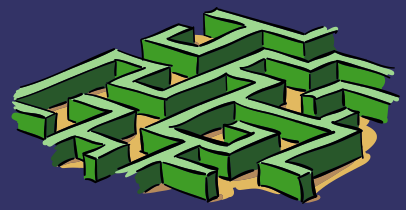
60% reduction in water consumption by having water efficient fixtures.

Completely Water self sufficient building. Achieved by having 6.5 lakhs liters capacity rainwater tank to harvest roof water



Electricity

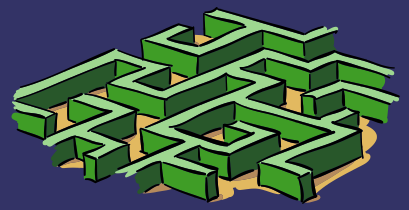
- SPV of about 42.5 kW is proposed on the roof of the north wing and on the courtyard cover
- Grid interaction
- Demand side management
  - Optimization of installed load
  - Optimization of running load
- Choice of devices
- Choice of lighting



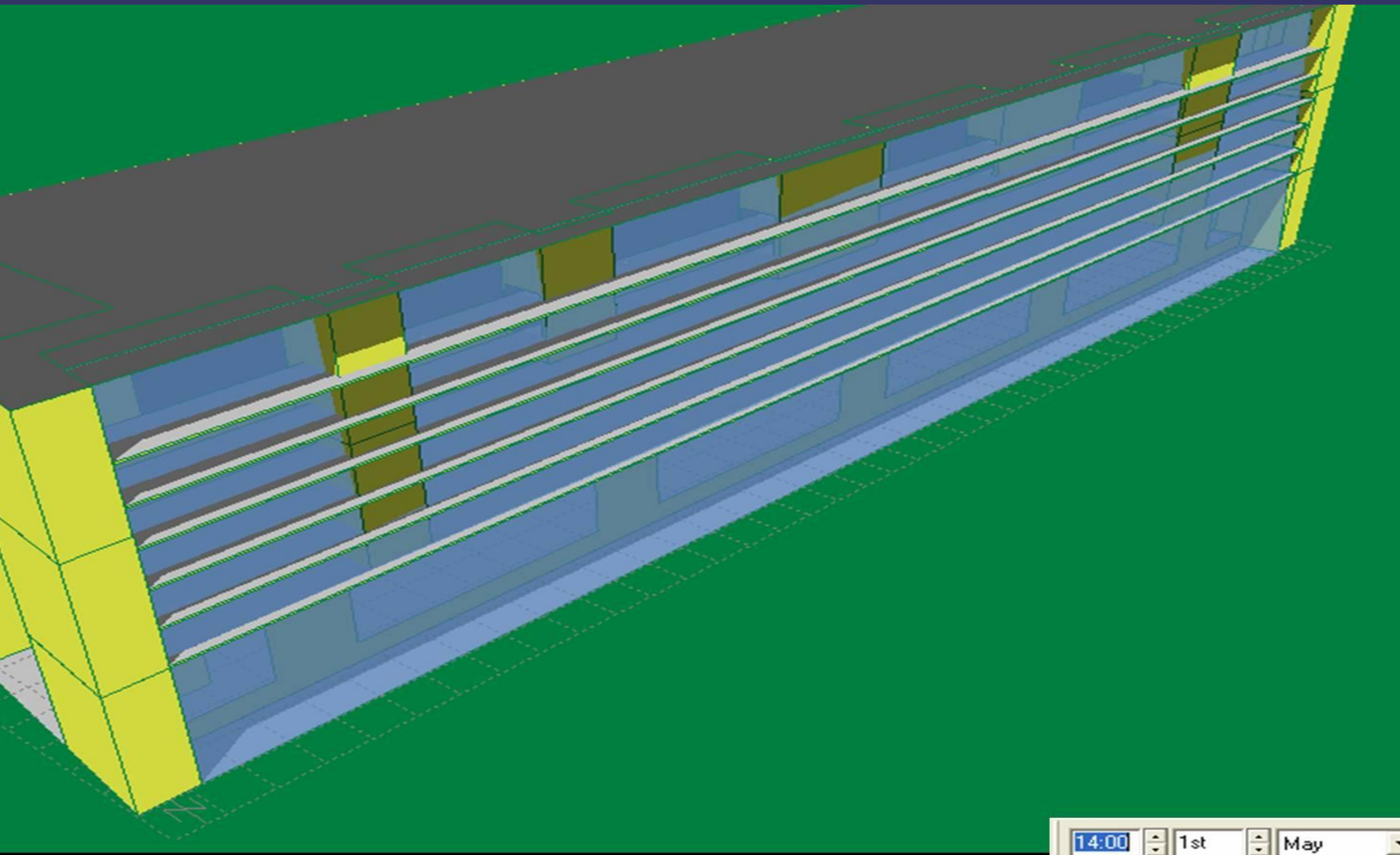
Lighting

45 % reduction in lighting energy by harvesting daylight

All light fittings are of T5, T8 super lite, CFL and LEDs and are controlled through dimmable ballast and photo sensors



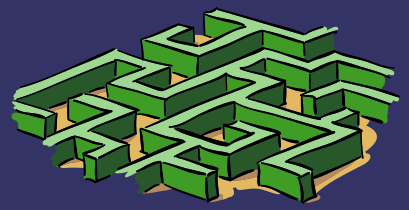
South Face Shade Analysis



North Face Shade Analysis

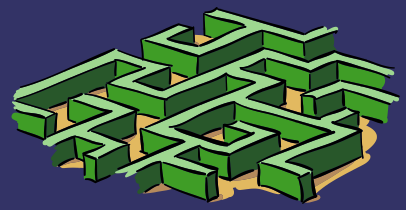
Improving Thermal Performance

- Providing cooling supply devices close to occupants
- Designing small thermal zones
- Providing controls which correspond to interior partitioning
- Planning for the careful admission of direct sunlight
- Using thermal mass to regulate temperature variations
- Better insulation for building to improve thermal quality



Passive Features

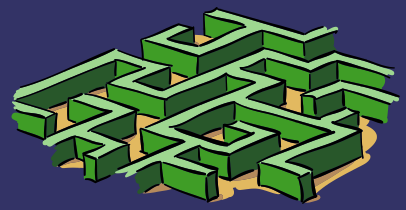
- Well oriented site and building (cardinal directions)
- Glazing coordinated to take advantage of direction
- Horizontally protected south glazing
- Almost no east and west openings
- Reasonable north glazing with vertical protection
- The courtyard is covered with angled louvers that maximize winter sun on the south face of the north wing and shade the atrium in the summer while allowing diffused daylight in
- The south face has solar chimneys to aid ventilation in some of the non a/c spaces (which are mist cooled)
- All workspaces of the building are daylit
- Maximizing use of fly-ash



Comfort Achieved

For Air Conditioned areas an internal temperature of 24 deg C plus minus 1

For non Air Conditoned areas an internal temperature of 28 deg C plus minus 2



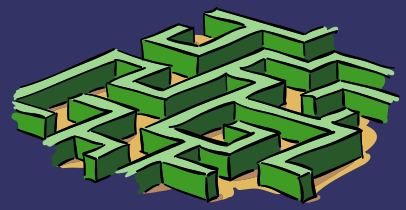
Building Materials

Windows are having double glazed low e glass with UPVC frames.

Walls are insulated, used aerated concrete block

Cavity walls on the east and west with PUF insulation

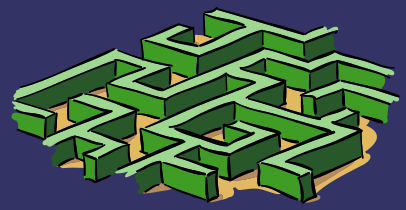
Thermatek roof tiles ensure a 15 deg. C difference at surface



Buildability

- The ease of construction and maintenance with minimum wastage is termed as buildability. Simplicity of design, standardization and clear communication are the main tenets of buildability. The attempt has been to increase buildability in this project.

  - **Construction Details**
  - **Choice of Material**
  - **Operating Modes /Use Guidelines**
  - **Capital cost**




ROAD 32'-9 1/2" WIDE
10'-0" WIDE SERVICE ROAD
SERVICE RAMP
PERGOLA
BALCONY BELOW
DUCT
CUT-OUT
SOLAR CHIMNEY
SPACE FRAME
26'-0"X18'-0"
RISERS 6"
OAT AS/DETAIL
LVL +10"
LVL -8"
LVL -1'-0"
LVL -2'-2"
LVL +50'-9"
SLOPE
ROOF OF TRAINING HALL WITH SOLAR PANEL AS/DETAIL
COURTYARD BELOW
LOUVERS SUPPORTED ON TRUSS BELOW
TERRACE
LVL +3"
PARAPET LEVEL
LVL +49'-2.5"
LVL +47'-9"
PARAPET LEVEL
LVL +40'-9"
LANDSCAPED MOUND
LVL +3'-0"
LVL +38'-3"
RAMP FOR BASEMENT PARKING
PLANTER
PORCH BELOW
LVL +22'-6"
GREEN AREA
RAMP UP
LVL ±0
BUS PARKING
(2 NOS)
12'-0" WIDE ROAD
PARKING
(CAR PARKING 13 NOS)
GATE
GATE
SITE FOR NIRVACHAN SADAN HR
12'-0" WIDE ROAD
ROAD 98'-5" WIDE
ROAD 59'-0" WIDE


SERVICE PARKING
VERANDAH
CAVITY WALL
UP
TOILET
CHOWKIDAR ROOM
KITCHENETTE
W=5'-0" T=10"+.5" nosing R=(20 equal risers)
DN
ACCOUNT'S OFFICER
RECORD ROOM
SOLAR CHIMNEY 6'-0"X3'-0"
PRINTER/FAX STORAGE
CHAIRMAN'S ANTE ROOM
CURTAIN WALL
TOILET 4'-6"X6'-9"
STORE
AHU
W=6'-0" T=10"+.5" nosing R=(24 equal risers)
WORKSHOP
STORAGE
LOW HEIGHT PARTITION
EXTENT OF SLAB
PANTRY
FIRE HOSE
UP
SKYLIGHT FOR BASEMENT
CHAIRPERSON ROOM 25'-0" X 23'-9"
SECTION OFFICER 13'-5.5"X13'-0"
SUPERINTENDENT ROOM 13'-5.5"X13'-0"
GLASS CURTAIN WALL
SOLAR CHIMNEY 6'-0"X3'-0"
2'-9" HIGH RAILING
8'-0" WIDE CORRIDOR
GLASS PARTITION
CHAIRMAN'S PA / VISITOR ROOM 13'-0"X17'-9"
WATER BODY
ENERGY INFORMATION CELL 13'-1.5"X13'-4.5"
LVL +5'-6"
LVL +2'-6"
DRINKING WATER
VENTILATION DUCT AS / SPECIFICATION
LVL +0'-6"
TOILET (HE) 11'-7.5"X9'-4.5"
TOILET (SHE) 13'-0"X7'-11"
DUCT
SLAB AT LINTEL LEVEL
HANDICAP TOILET 8'-0"X5'-6"
janitor's
MEETING ROOM 13'-9"X8'-6"
VISITOR'S WAITING 12'-6"X9'-11.5"
RECEPTION 22'-3"X25'-6"
LIFT PIT SIZE 5'-0"X8'-0"
FIRE HOSE
AHU ROOM
6'-0" CORRIDOR
ADITYA SOLAR SHOP
COUNTER
EXHIBITION SPACE
ROLLING SHUTTER
DRIVER'S ROOM
ATM
ATM
RAMP SUMP
EXTENT OF RAMP
RAMP DN
RAMP UP
T=12" R=6"
LVL +3'-0"
Railing
W=6'-0" T=12" R= 24 eq riser
TOILET (SHE)
TOILET (HE)
ENTRANCE FOR EXHIBITION SPACE
HANDICAP ENTRANCE
DRINKING WATER
ENTRANCE
LVL +0'-0"
CAVITY WALL
A
B
C
6

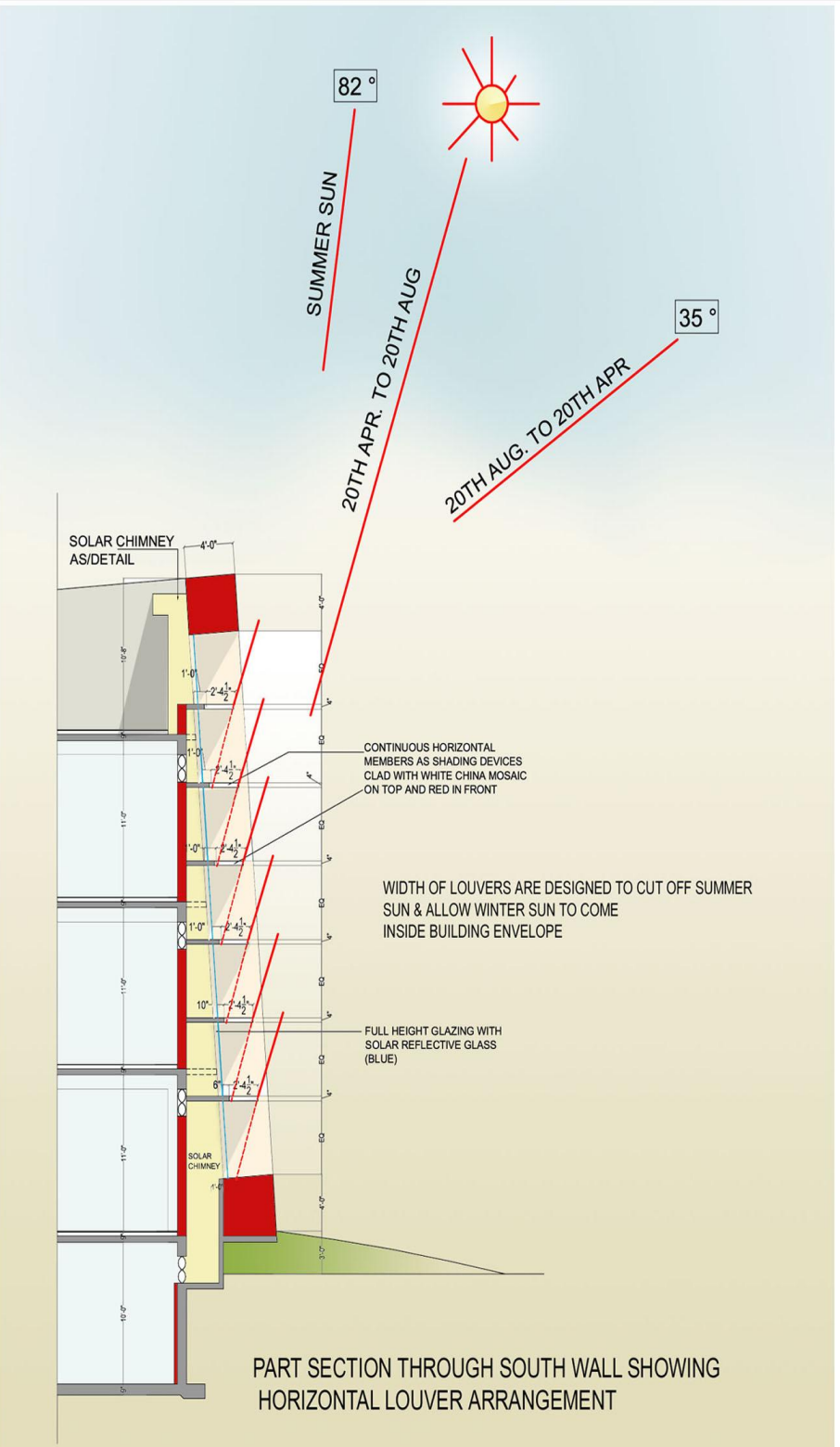
FIRST FLOOR PLAN

Date & Time		notes:	project:	Drawn By:	Dealt by:	Chkd by:	architects:

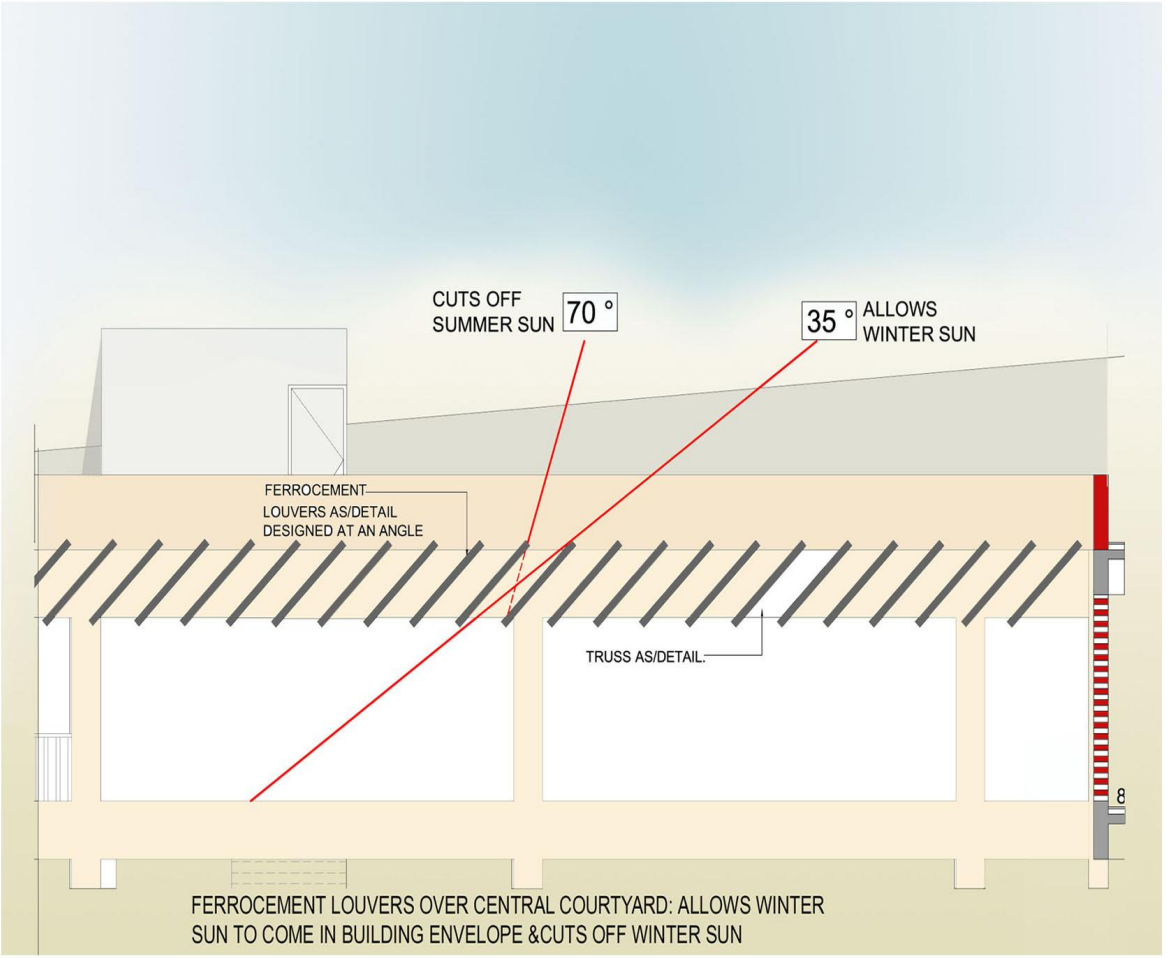

SOLAR SPACE
KITCHEN
BALCONY
LIBRARY
TOILET (SHE
TOILET (HE
BALCONY
STORAGE
EXTENT OF SLAB
RECREATIONAL ROOM
W=6'-0"
T=10"
R=(24 equal risers)
AHU
FIRE HOSE
UP
DN
8'-0" WIDE CORRIDOR
STAFF CANTEEN
GUEST ROOM-1
(23'-10"X12'-6")
COMMON AREA
(11'-0"X12'-6")
TOILET
(11'-9"X5'-0")
BATH
platform
BATH
PANTRY
TOILET
(6'-9"X7'-10.5")
platform
STAGE
TRAINING ROOM
26'-6"X48'-0"
BRICK JALLI WALL
WALL TILL EXTENT OF FLOOR
GUEST ROOM-2
(23'-10"X12'-6")
SOLAR CHIMNEY
6'-0"X3'-0"
8'-0" WIDE CORRIDOR
TRUSS ABOVE
8'-0" WIDE CORRIDOR
TRUSS ABOVE
DORMITORY-1
23'-10"X15'-9"
WC
PANTRY
BATH
BATH
WC
SLAB AT LINTEL LEVEL
8'-0" WIDE CORRIDOR
BOARD ROOM
(25'-0"x17'-8")
JANITOR
LIFT
PIT SIZE
6'-0"X6'-0"
FIRE HOSE
AHU
FUTURE EXPANSION
DORMITORY-2
STORAGE
TOILET (HE)
6'-1.5"X12'-0"
TOILET (SHE)
6'-1"X 12'-0"
6'-0" CORRIDOR
UP
DN
DOUBLE HEIGHT SPACE
GLAZING
PANTRY
STORE
W=6'-0"
T=12"
R= 24 eq riser
PORCH BELOW
DUCT
A
C
1
2
3
4

BASEMENT FLOOR PLAN

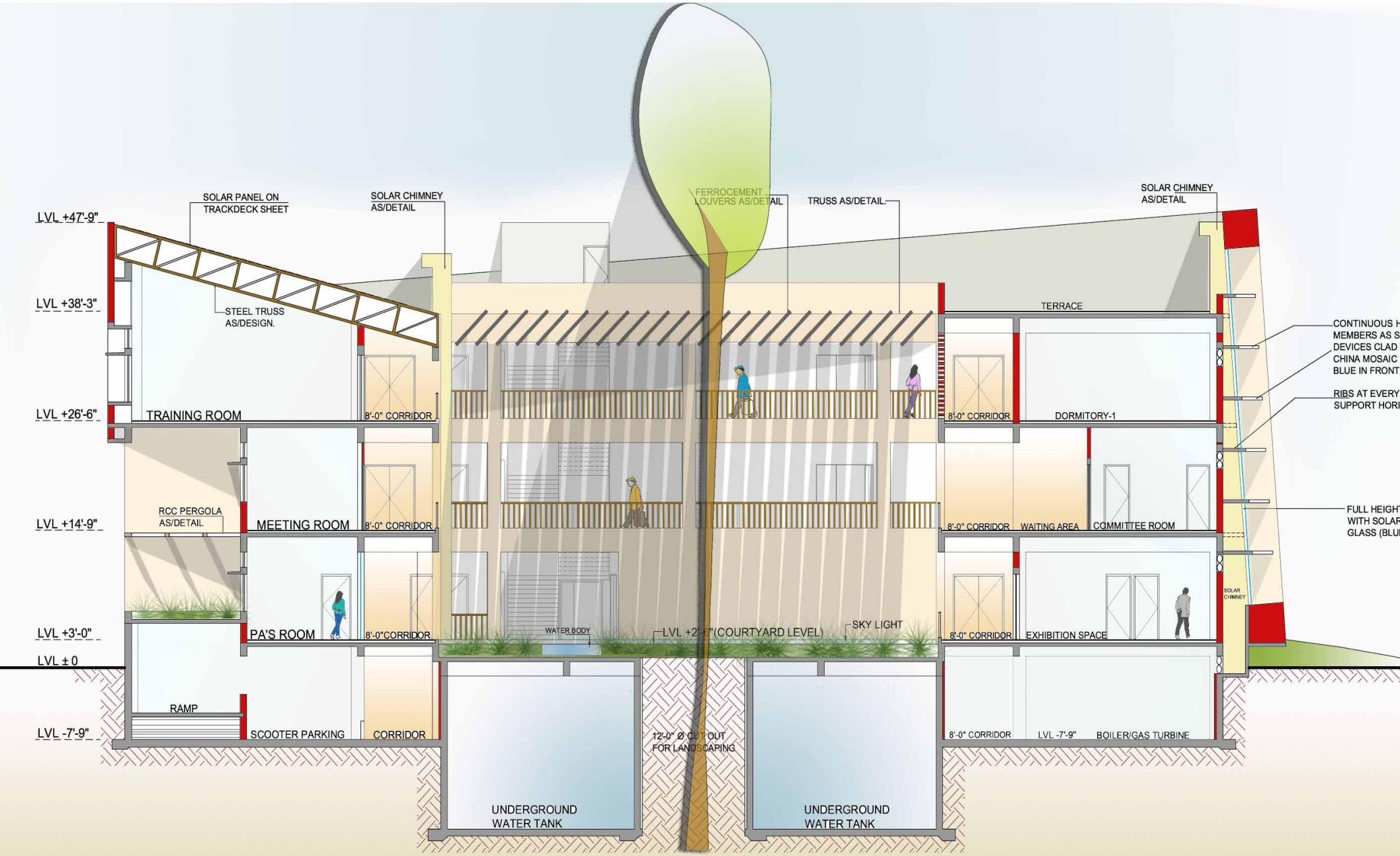
Date & Time	notes:	project:	Drawn By:	Dealt by:	Chkd by:	architects:



PART SECTION THROUGH SOUTH WALL SHOWING HORIZONTAL LOUVER ARRANGEMENT

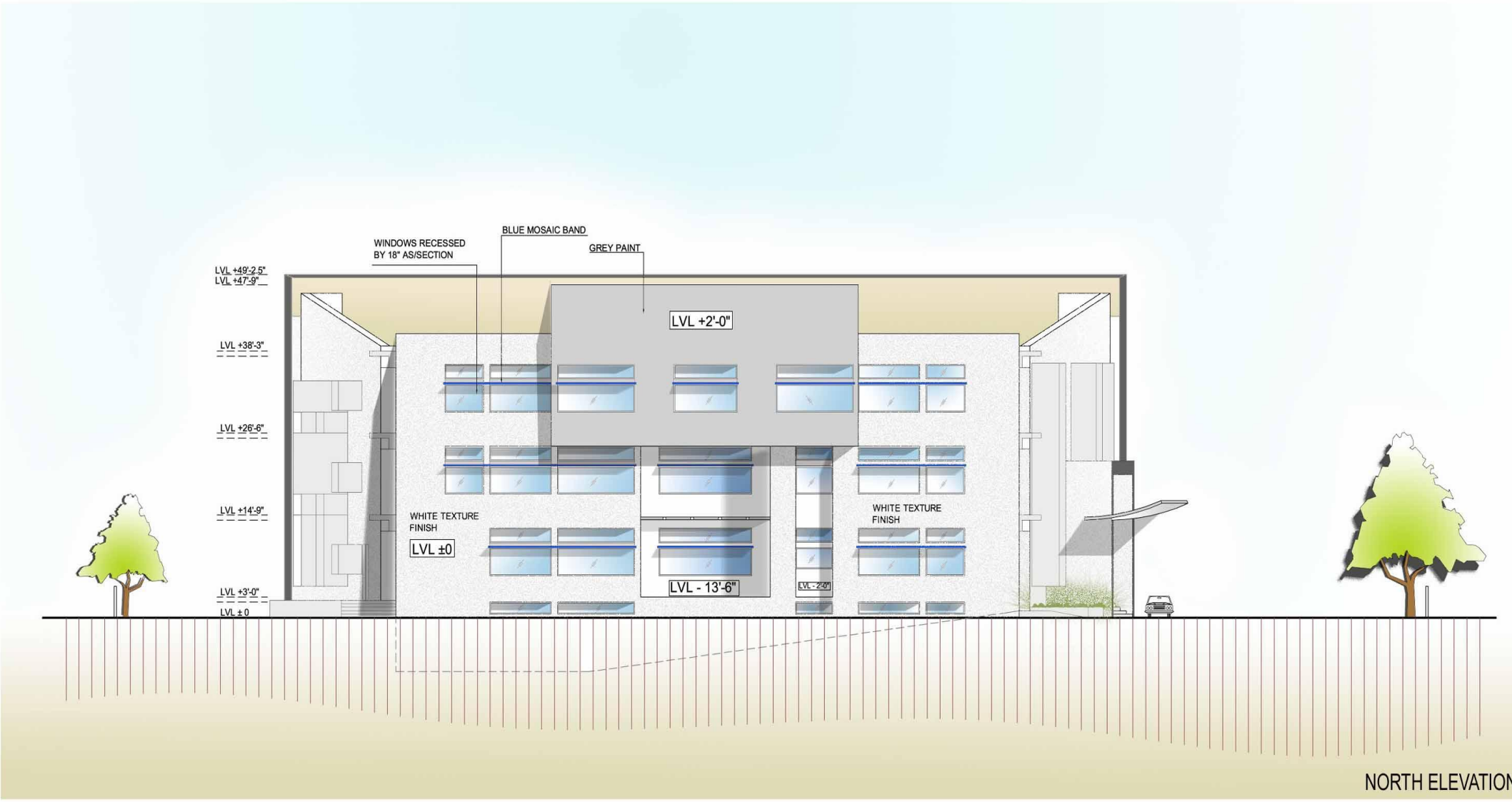


FERROCEMENT LOUVERS OVER CENTRAL COURTYARD: ALLOWS WINTER SUN TO COME IN BUILDING ENVELOPE &CUTS OFF WINTER SUN



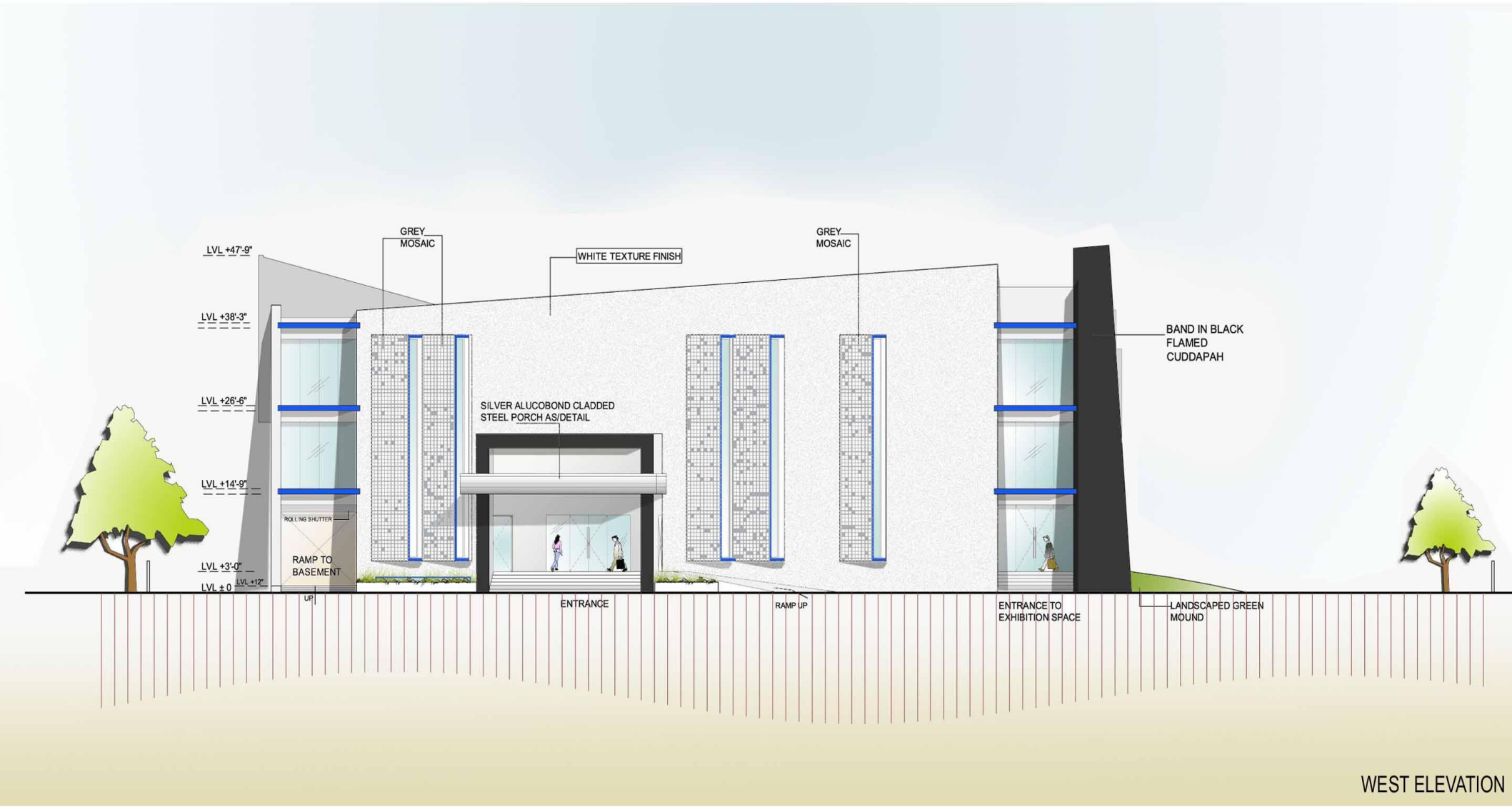
BUILDING CROSS-SECTIO

ons	Note:	Date & Time	notes:	project:	Drawn By:	Dealt by:	Chkd by:	architects:
			1. All dimensions to be read and not scaled					

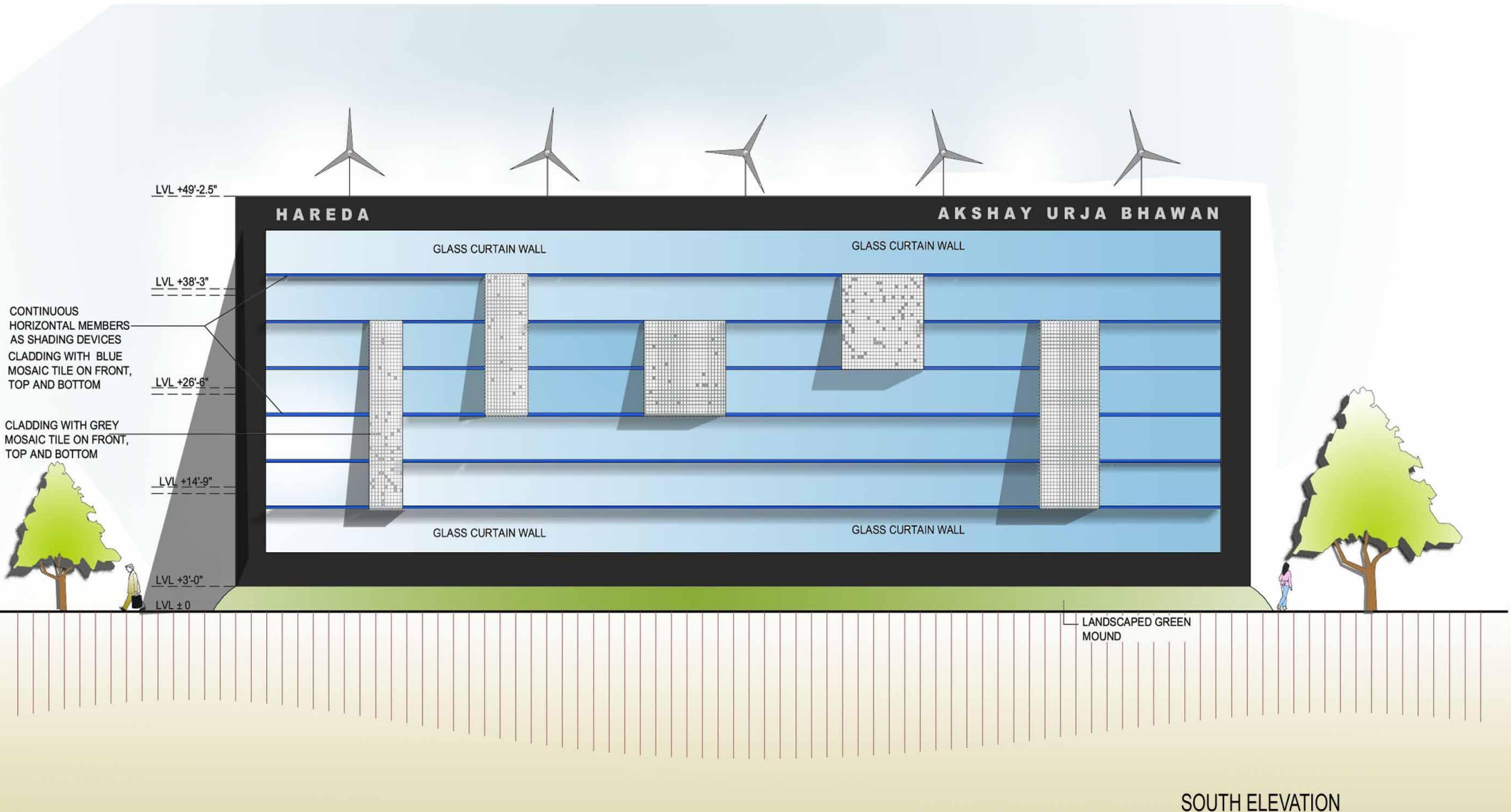


NORTH ELEVATION

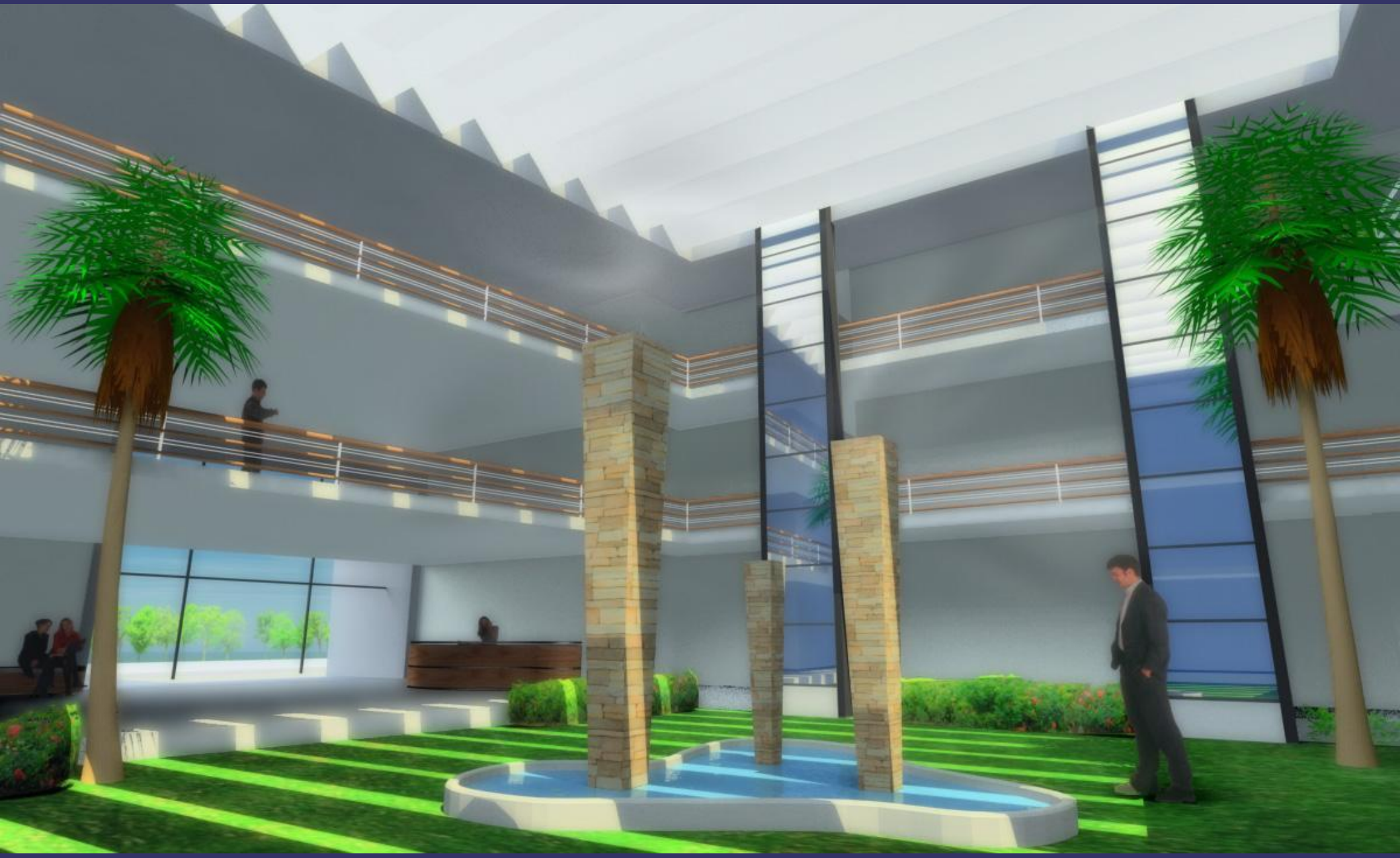
EAST ELEVATION



WEST ELEVATION



SOUTH ELEVATION



View of interior courtyard

ARCHITECTS:

THE ELEMENTS
building with nature
s.c.f.59, first floor, sector-6, panchkula
phone/fax: 580094
e-mail: wigmann@sify.com

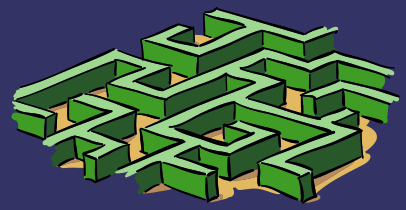
New “GREEN ”office building for HAREDA

Some interesting facts

Building having 55,000 sqft built up area is connected with 70 kW electricity load which amounts to 1.75 W/sqft.

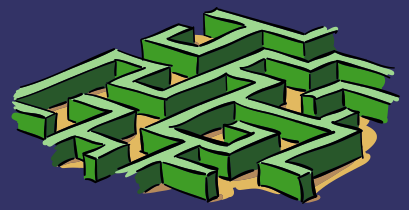
The total simulated energy consumption in the building is 13.5 kWhr/m2/year compared to a conventional building of 140 kWhr/m2/year.

41 kWp Photovoltaic cells (PV) to cater the energy demand which amount to 100% of the yearly energy



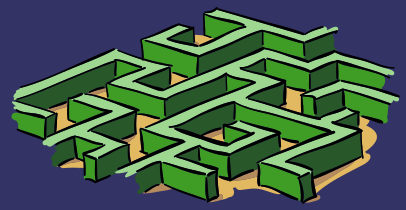
The comparison matrix

	EPI (kWh/m2/yr)	CO2 PRODUCED(Tonnes)
HAREDA	15	-5
GRIHA Limit for HAREDA project	53	215
Conventional Building by having 25% AC area and 75% non AC area	71	306
Conventional Building with Complete AC	150	630



Some additional facts

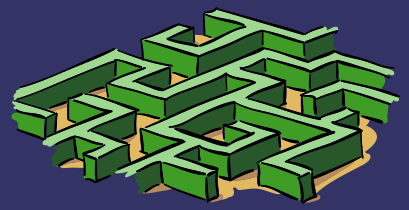
Hareda energy consumption	15 kwhr/m2/year
Energy Required by HAREDA	62415 kwhr
Energy Production from solar PV	67343 kwhr
Excess Energy Produced	4928 kwhr
CO2 Credits	308 Tonnes/year



Cost Comparison

- TERI Retreat = Rs. 1,000.00 /sft without SPV or systems
- CII HQ = Rs 1,500.00 /sft without systems
- AGILENT Systems = Rs 1,500.00 /sft without SPV

- New HAREDA Building = Rs. 2,000 with complete systems and furniture



Troubling Questions

R E D U C E vs reuse/recycle ?

Real intention behind going 'green' ?

Availability of 'green' materials ?

Standard benchmarking figures ?

Need for per capita rating