Architectural College Building
for
M/s Vellore Institute of Technology, Vellore

Discoy Construction Pvt Ltd


GANDHI BLOCK
SCHOOL OF ARCHITECTURE
GANDHI BLOCK
SCHOOL OF ARCHITECTURE

Project Details

PROJECT DETAILS

1	Name of the Organization :	Discoy Construction Pvt Ltd
2	Name of the Project :	Vsparc – Gandhi Architectural Block
3	Location of the Project :	Vellore
4	Name of the Client :	Vellore Institute Of Technology, Vellore

OTHER INFORMATION

1	Name/s of the Designers/who were involved in the project :	M/s Mindspace Architects, M/s Rays Consulting Engineers.
2	Names of the Contractor who executed the Work :	M/s Discoy Construction Pvt Ltd
3	List of Sub Contractors associated with the execution of the project at site :	M/s Nina Percept Pvt Ltd - Subsidiary of Pedilite Industiries Ltd M/s Freyssinet Menard India Pvt Ltd M/s Pest Control India
4	Names of personnel involved in the execution of the project at site :	Sunil Diwakar, Puttaraju, Gopinathan, Balaji, Jayanna, Sourirajan
5	Project specific requirements for the design :	Place to Inspire, Think big, Encourage Creativity.

1) Salient design concepts which in your opinion had a major bearing on the design:

a) Architectural:

It is important to have a “personalized” space to work (Cave) .When you come back after attending lectures, from canteen or after a game-a space that evokes a feeling of Homecoming. Creativity needs a relaxed mind, openness, and connection with nature. Studios are designed with adequate privacy to concentrate as well as need to interact with others – Group discussions. Classrooms are proposed to be partially buried to have earth insulation and thus reduce AC load. Earth berms not only provide insulation but also scales down the building and provide easy access from studio level to the ground.

b) Structural:

Large span structures with flat soffits & exposed surfaces resulting in the elimination of false ceilings.

To create flat softs slabs, Porotherm blocks have been used as filler blocks resulting in economy and reduction of weight on the structure.

7m wide span central corridor with wind flow from one end to the other.

Composite materials with the usage of MS members and RCC in structural members for bridges, suspenders etc

Double & Triple height for free air circulation.

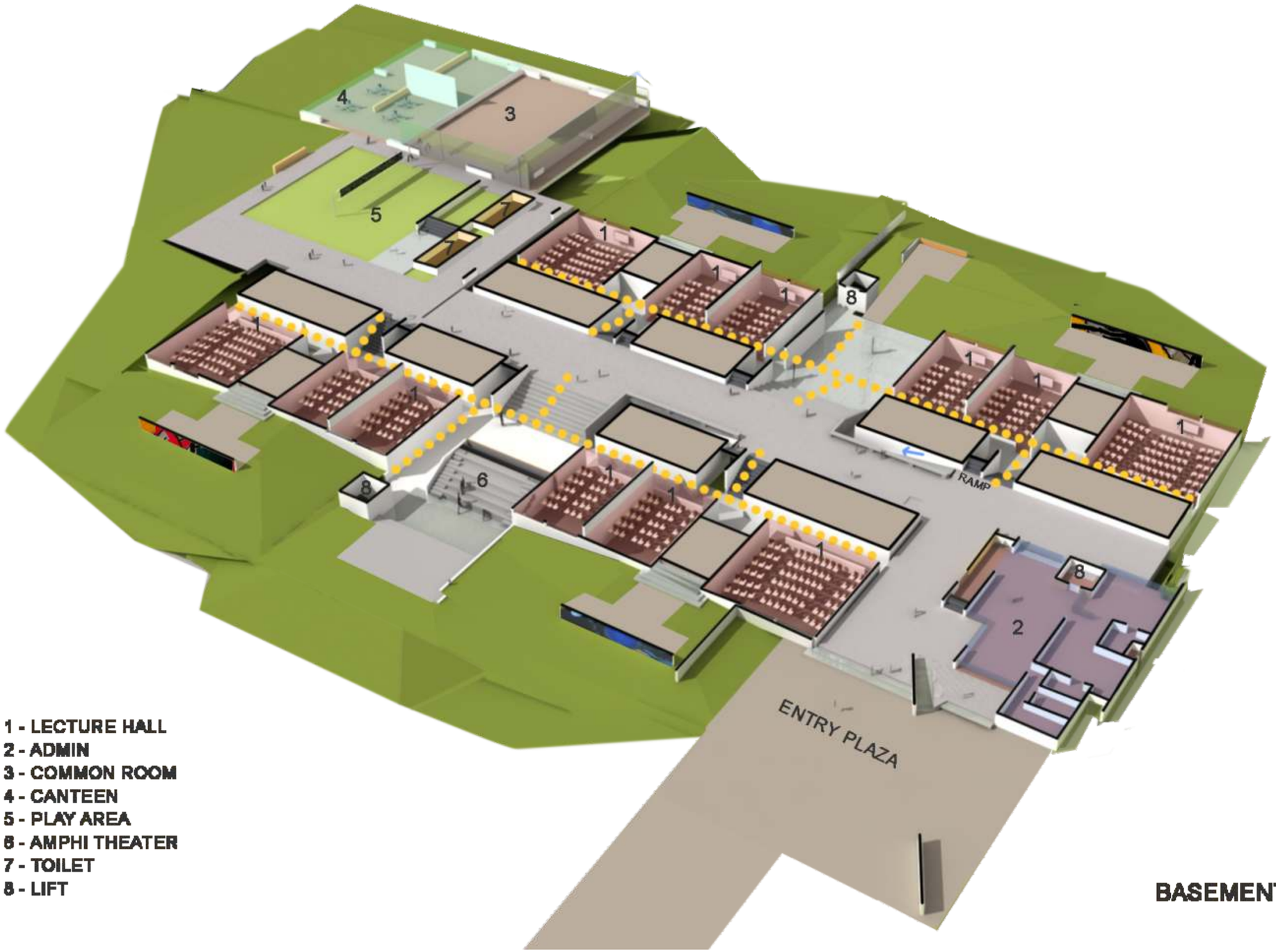
Façade works for architectural appearance as well as to reduce the heat by proposing MS frames with porotherm clay blocks with water sprinklers and A1 mesh for growing creepers.

Post Tensioned beams for large spans.

c) Execution:

The methodology needed to execute the project on the ground systematically was kept in mind by the design team while incorporating exposed concrete walls and slabs with multi-level beam network of regular beams, inverted beams, MS steel beams, post tensioned beams, steel suspender columns, filler slabs filled with porotherm blocks at double and triple heights with slab thicknesses varying from 200 to 300 mm. The design elements that achieved the desired effect were executed at site by the contractor through a collaborative effort with the designers.

SCHOOL OF ARCHITECTURE-V I T



1 - LECTURE HALL
2 - ADMIN
3 - COMMON ROOM
4 - CANTEEN
5 - PLAY AREA
6 - AMPHI THEATER
7 - TOILET
8 - LIFT

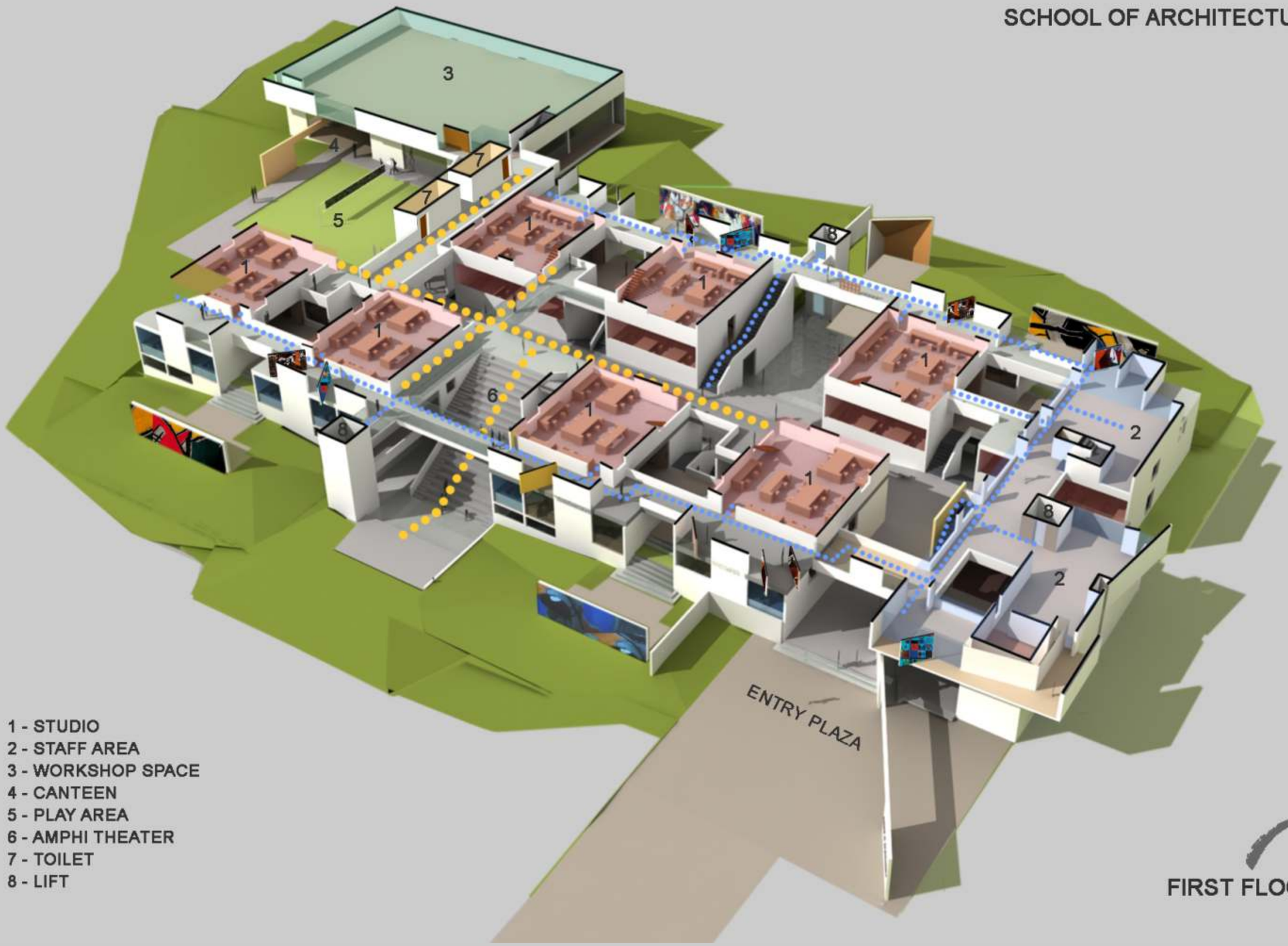
BASEMENT FLOOR VIEW

SCHOOL OF ARCHITECTURE-V I T

1 - STUDIO
2 - ADMIN
3 - COMMON ROOM
4 - CANTEEN
5 - PLAY AREA
6 - AMPHI THEATER
7 - TOILET
8 - LIFT

GROUND FLOOR VIEW

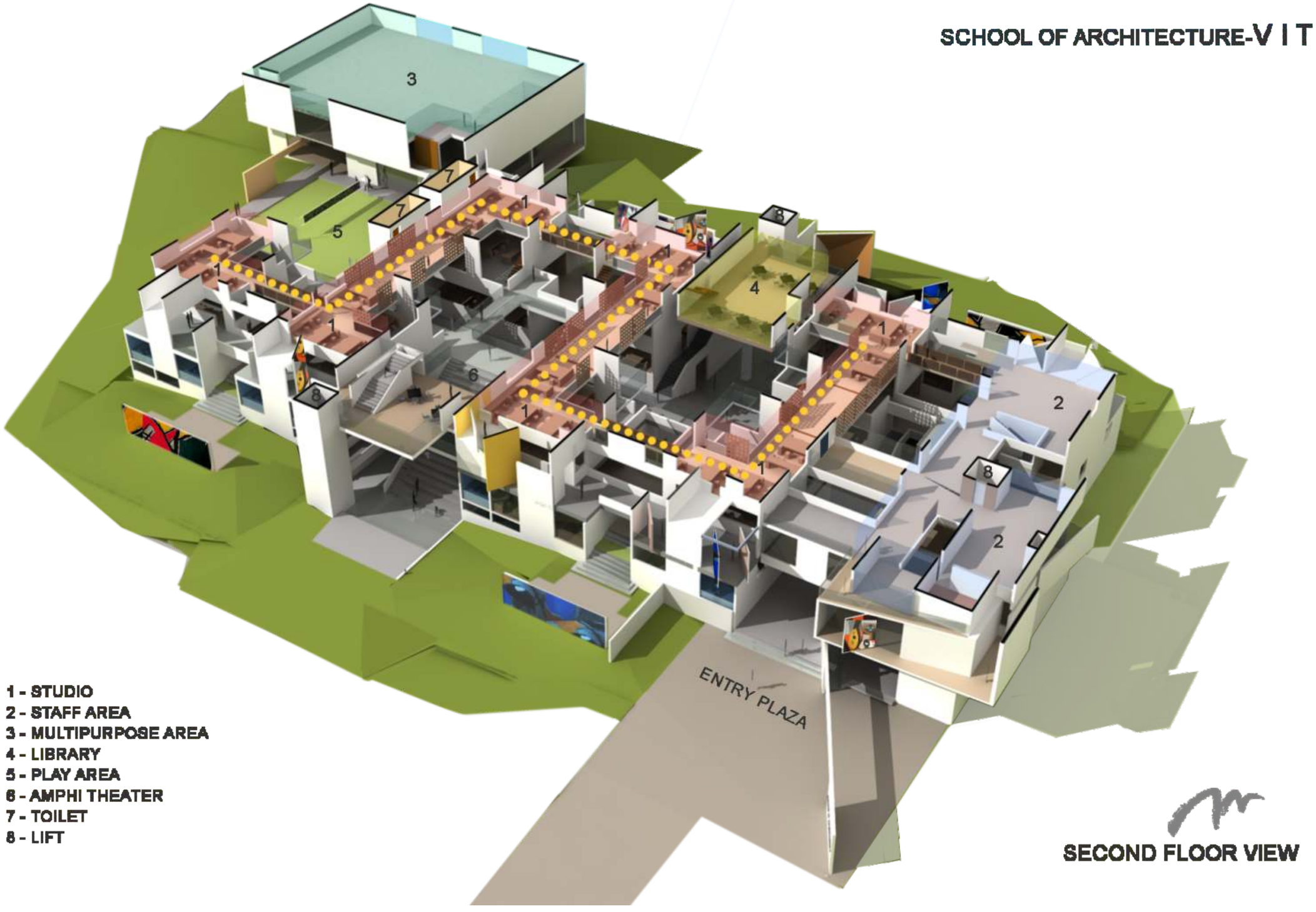
SCHOOL OF ARCHITECTURE-V I T



1 - STUDIO
2 - STAFF AREA
3 - WORKSHOP SPACE
4 - CANTEEN
5 - PLAY AREA
6 - AMPHI THEATER
7 - TOILET
8 - LIFT

FIRST FLOOR VIEW

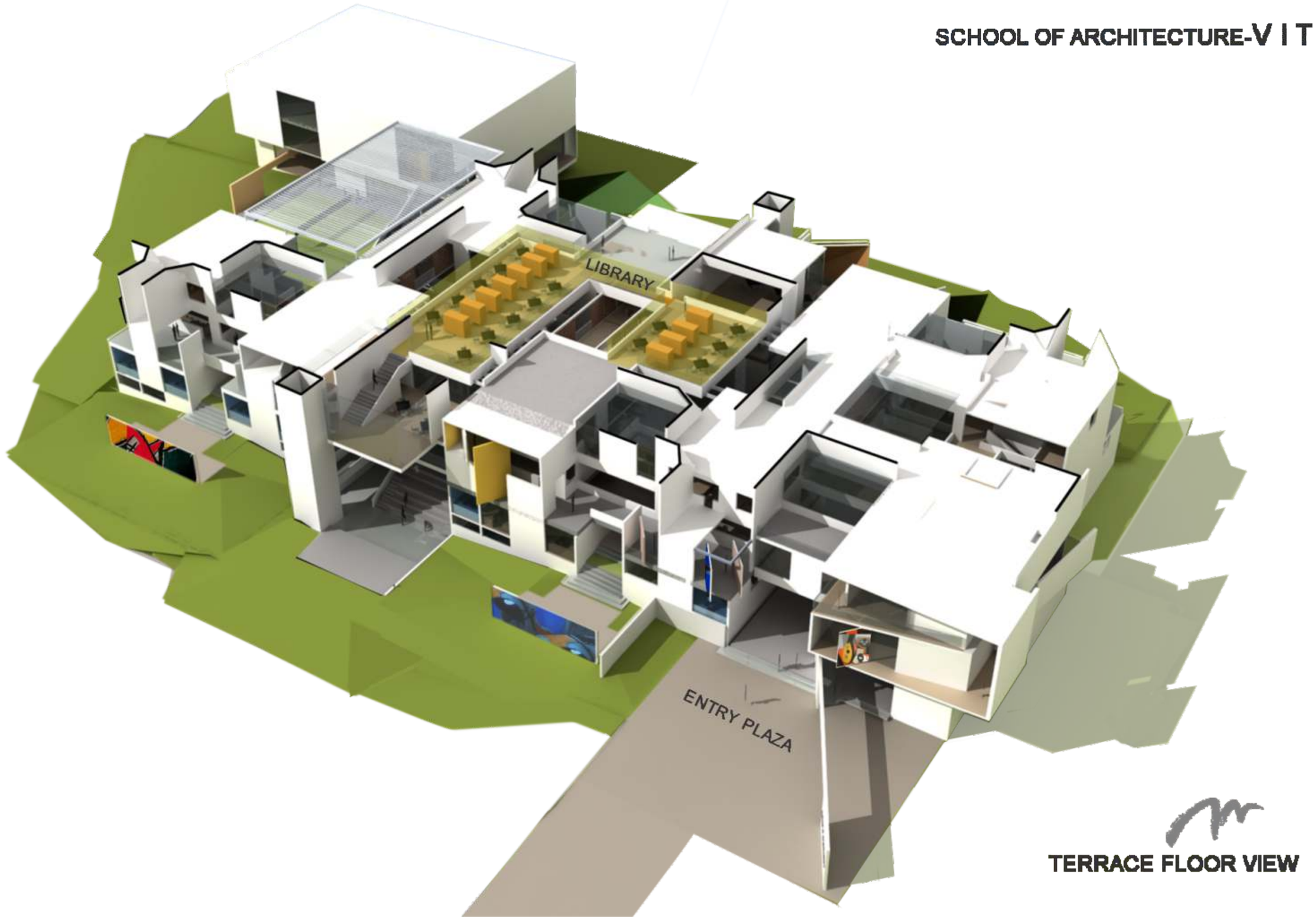
SCHOOL OF ARCHITECTURE-V I T



1 - STUDIO
2 - STAFF AREA
3 - MULTIPURPOSE AREA
4 - LIBRARY
5 - PLAY AREA
6 - AMPHI THEATER
7 - TOILET
8 - LIFT

SECOND FLOOR VIEW

SCHOOL OF ARCHITECTURE-V I T

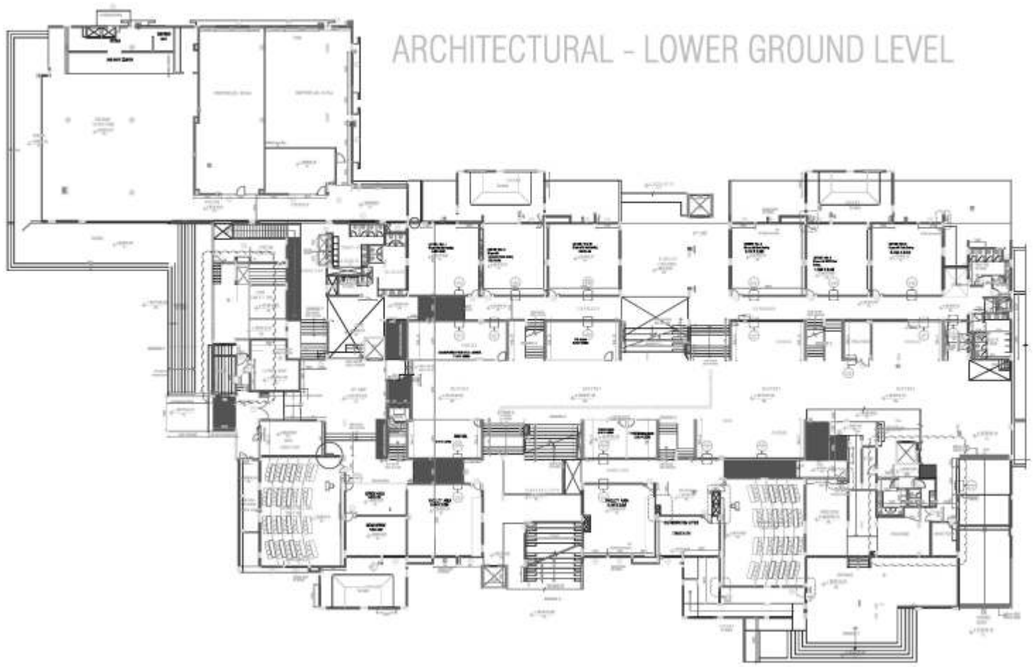


TERRACE FLOOR VIEW

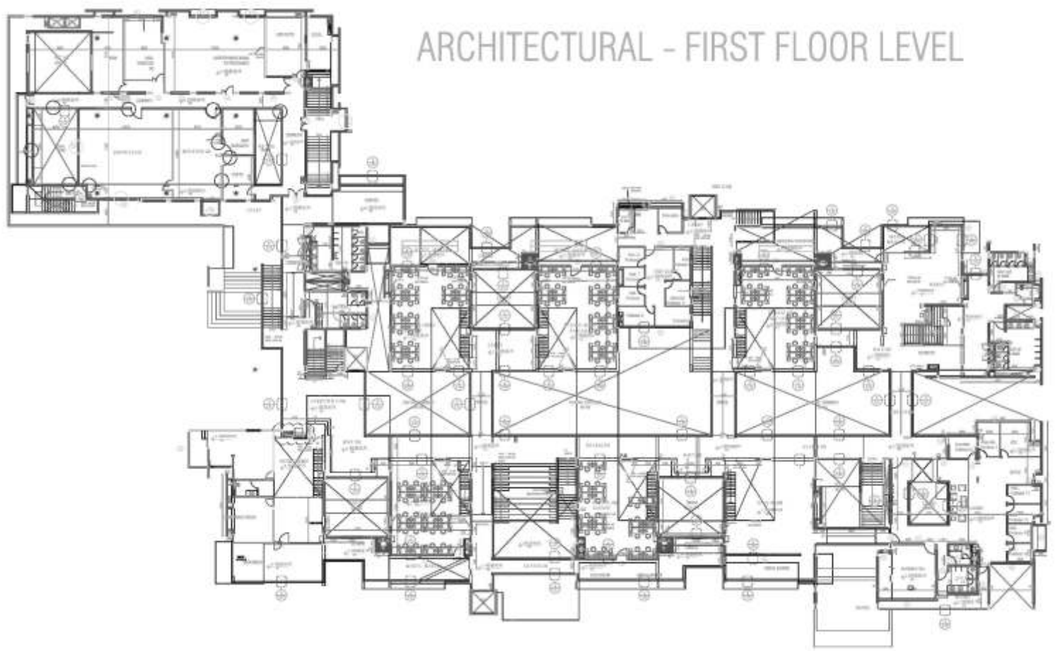

TERRACE
MEZZANINE
MODELMAKING
STUDIO
CENTRAL CORRIDOR
CORRIDOR
TERRACE
MEZZANINE
STUDIO
STUDIO
STUDIO
STUDIO
STUDIO
3200
3000
3500
3600
LECTURE HALL
CORRIDOR
PARKING
DRIVEWAY
PARKING
CORRIDOR
LECTURE HALL

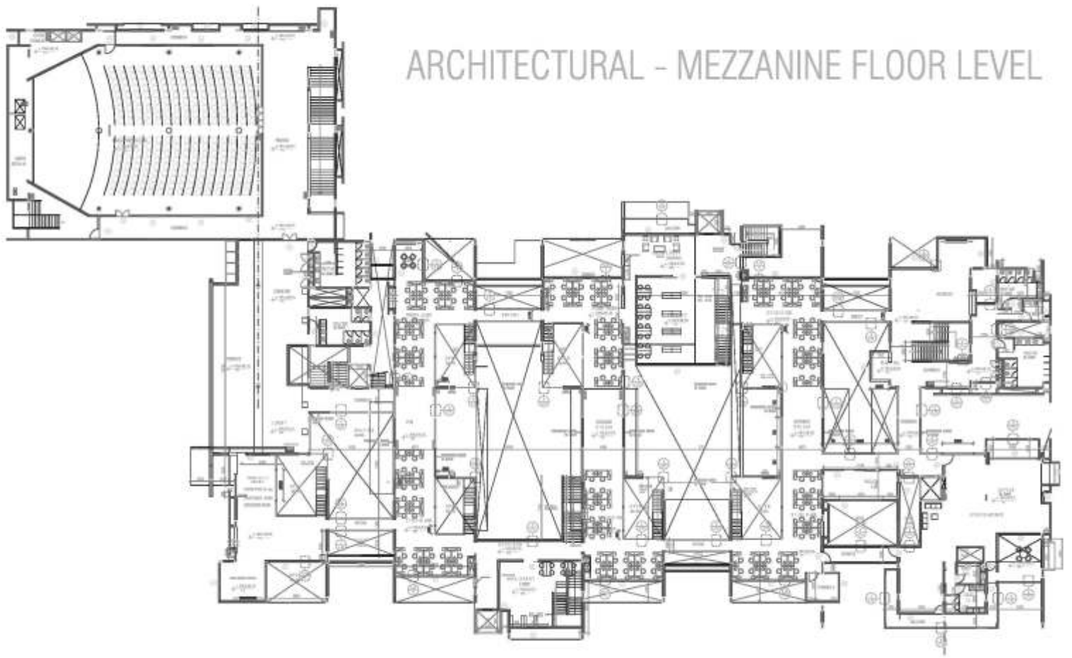

STUDIO
STUDIO
STUDIO
STUDIO
LECTURE HALL
LECTURE HALL

Floor Plans

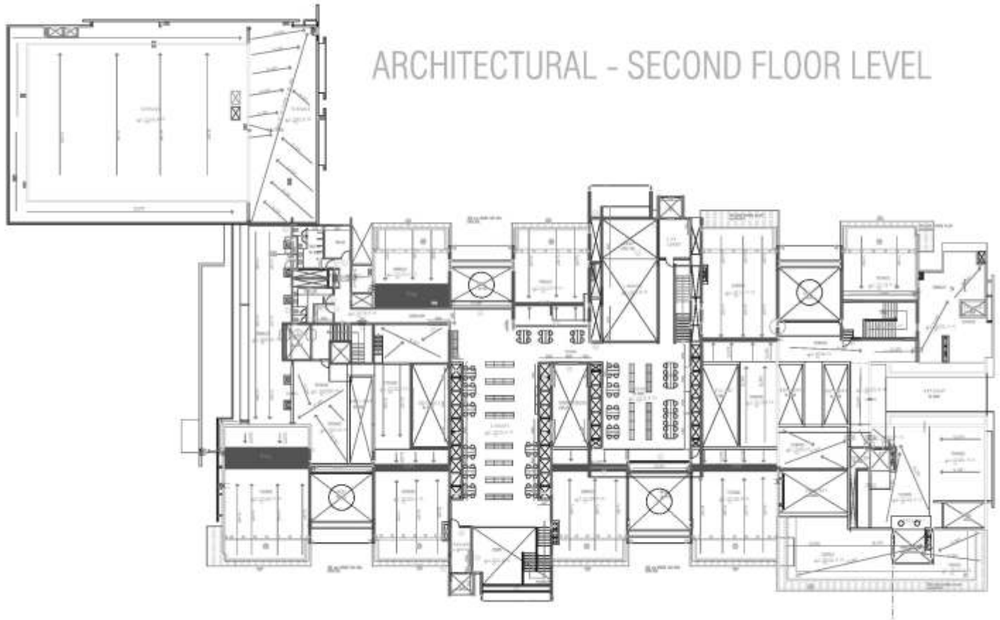

ARCHITECTURAL - LOWER GROUND LEVEL

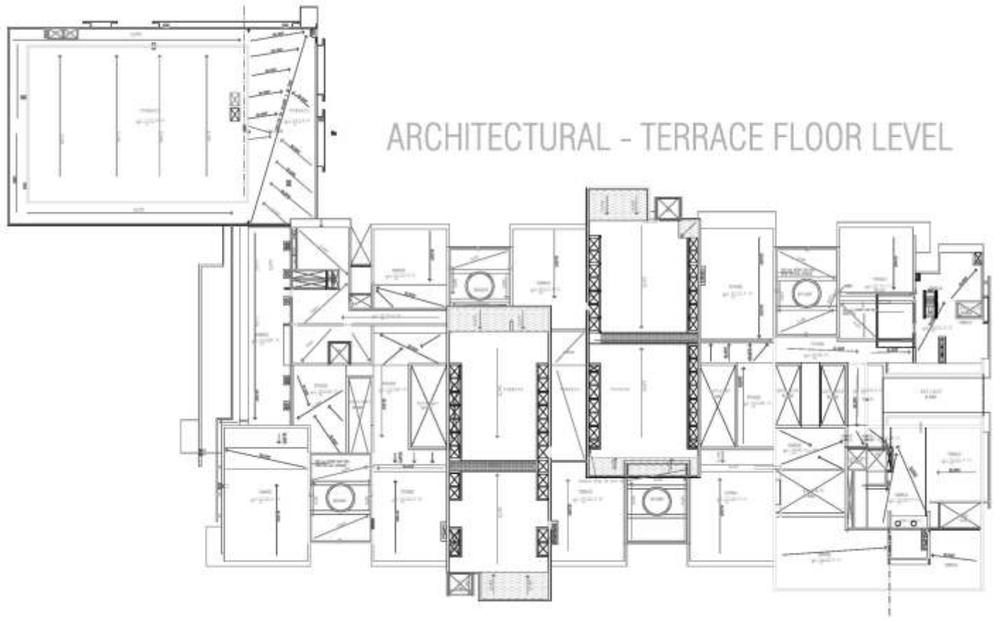

ARCHITECTURAL - UPPER GROUND LEVEL


ARCHITECTURAL - FIRST FLOOR LEVEL

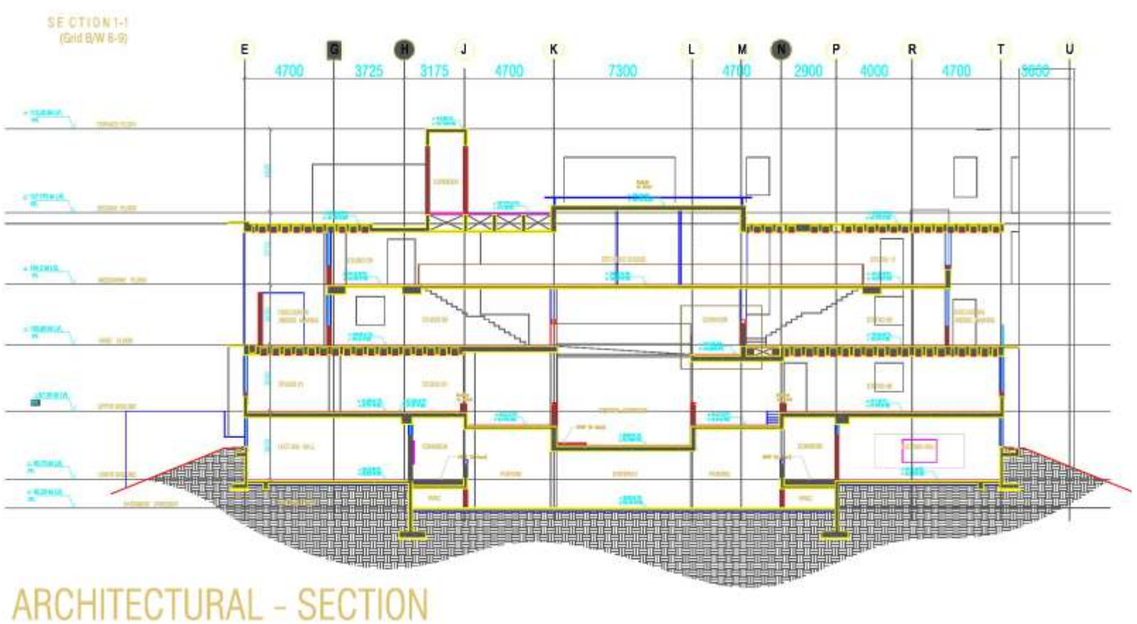

ARCHITECTURAL - MEZZANINE FLOOR LEVEL

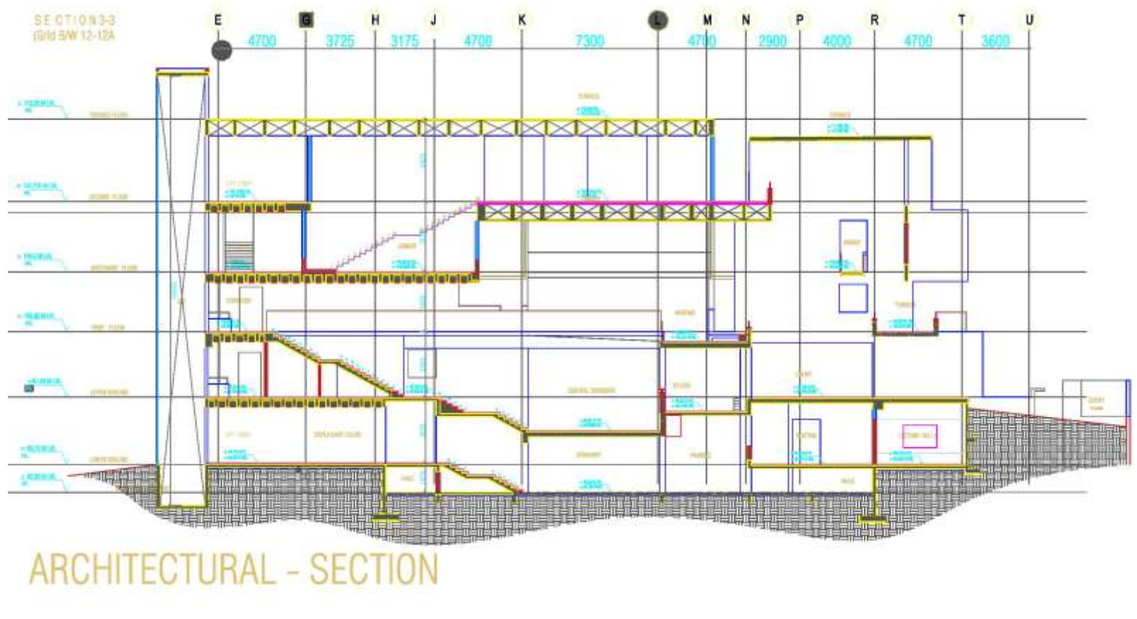
Floor Plans

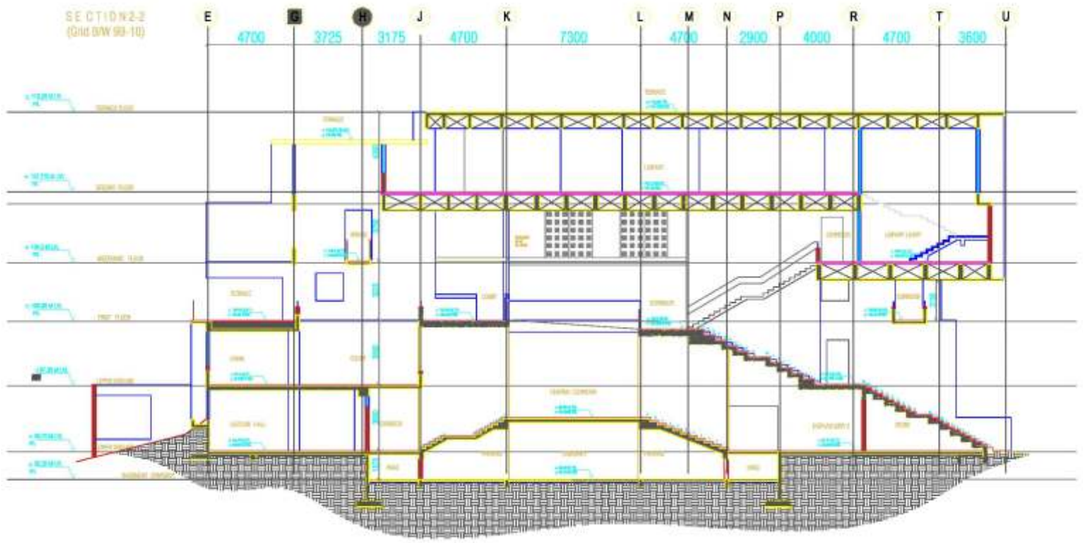




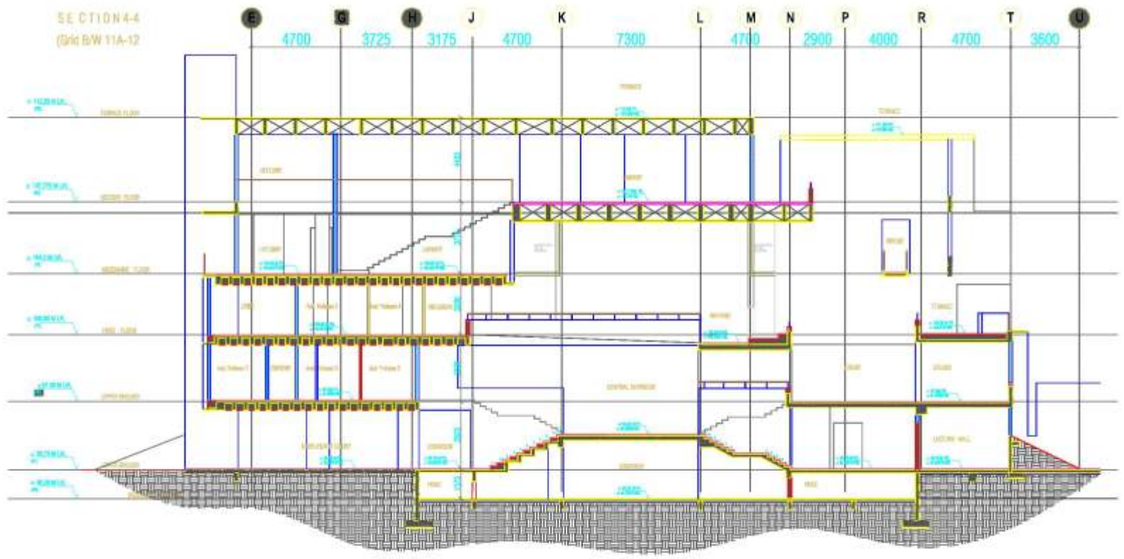
Sections





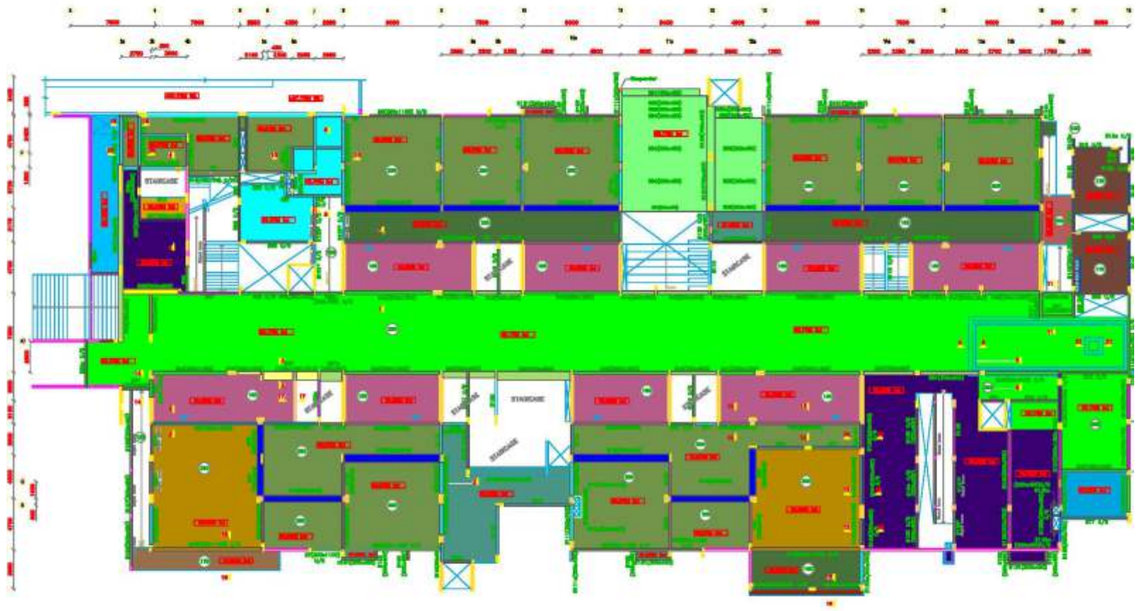


ARCHITECTURAL - SECTION

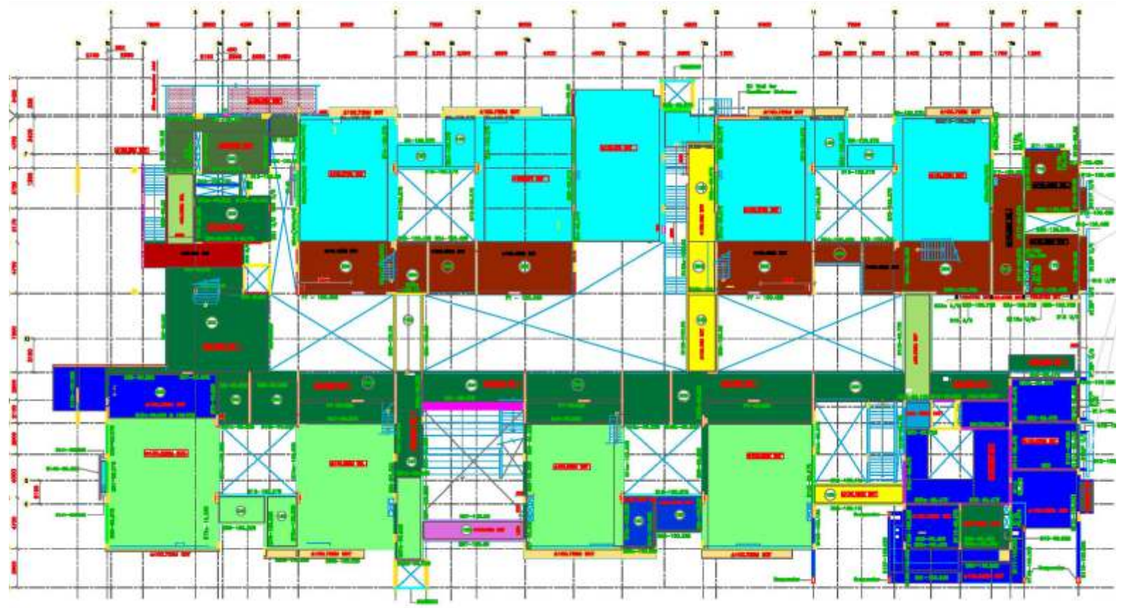


ARCHITECTURAL - SECTION

Complexity of Floor Level Differences - 30 Levels



UPPER GROUND FLOOR – LEVEL DIFF DETAIL

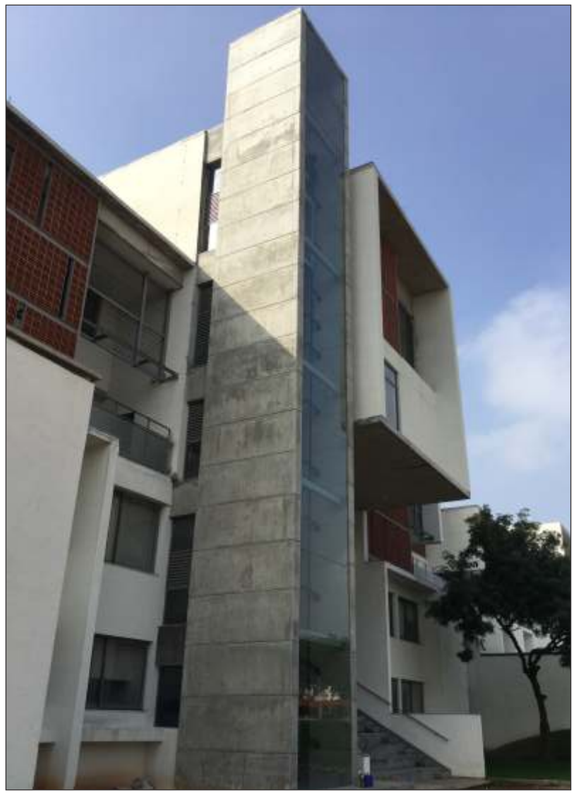


FIRST FLOOR – LEVEL DIFF DETAIL


SCHOOL OF

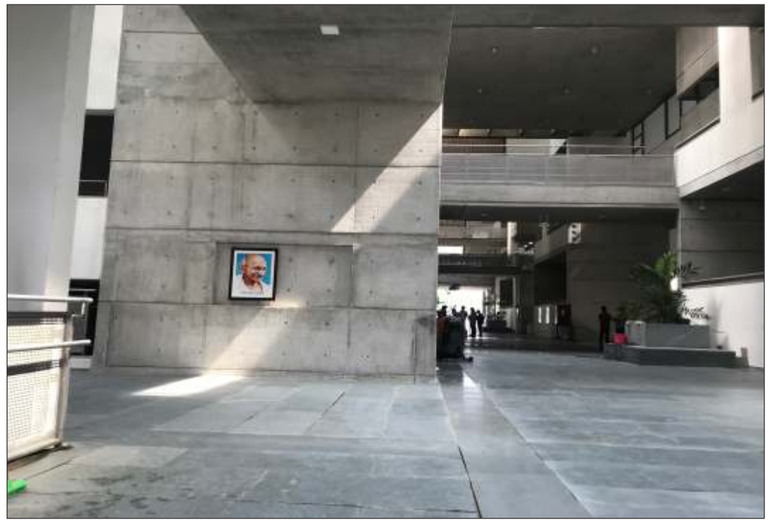


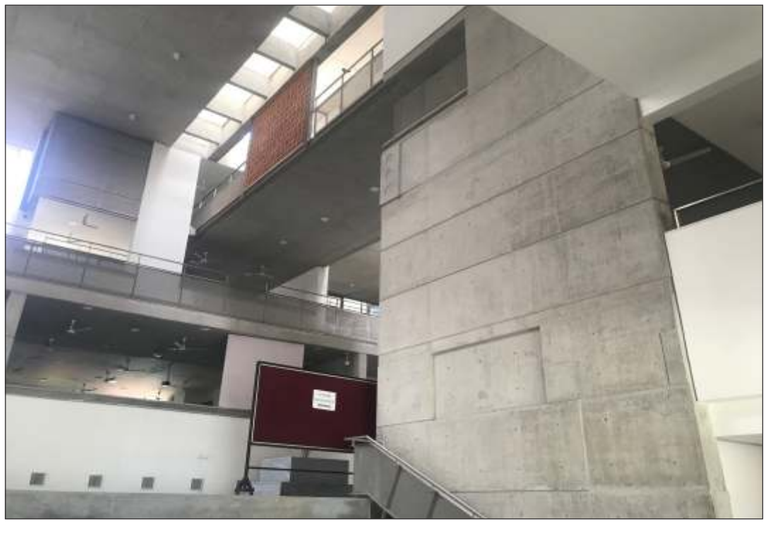


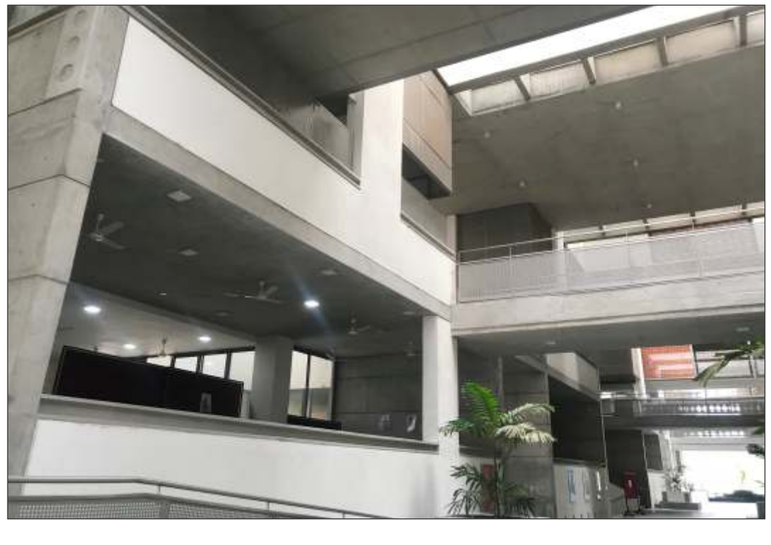








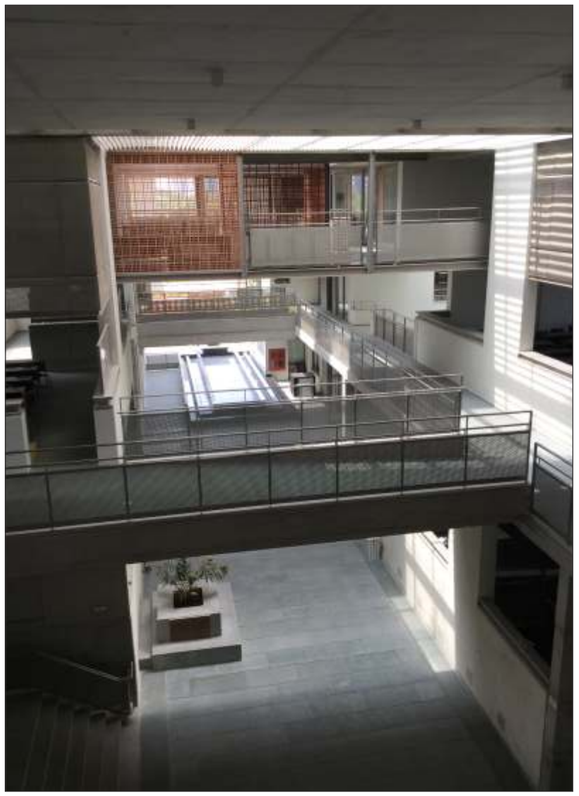
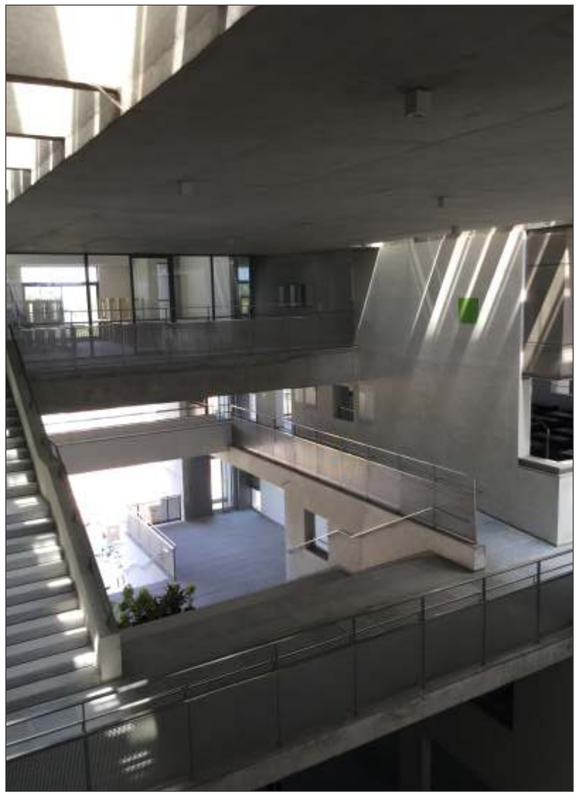
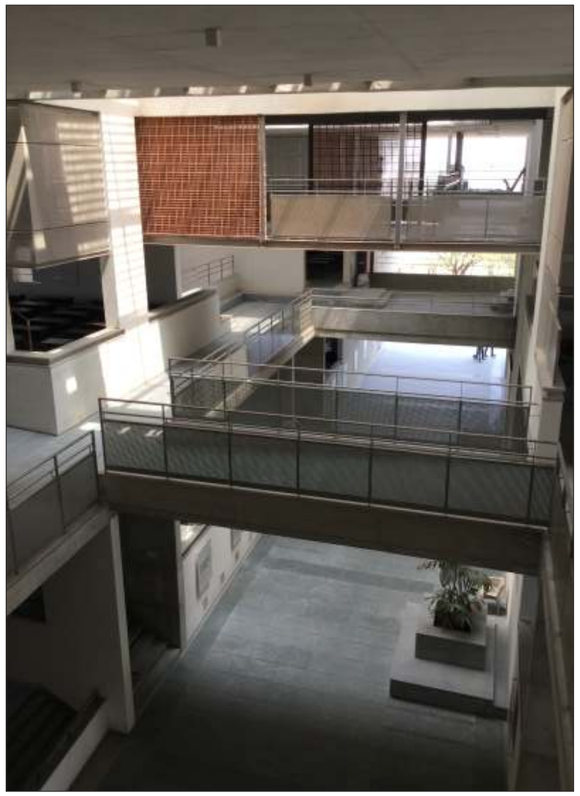
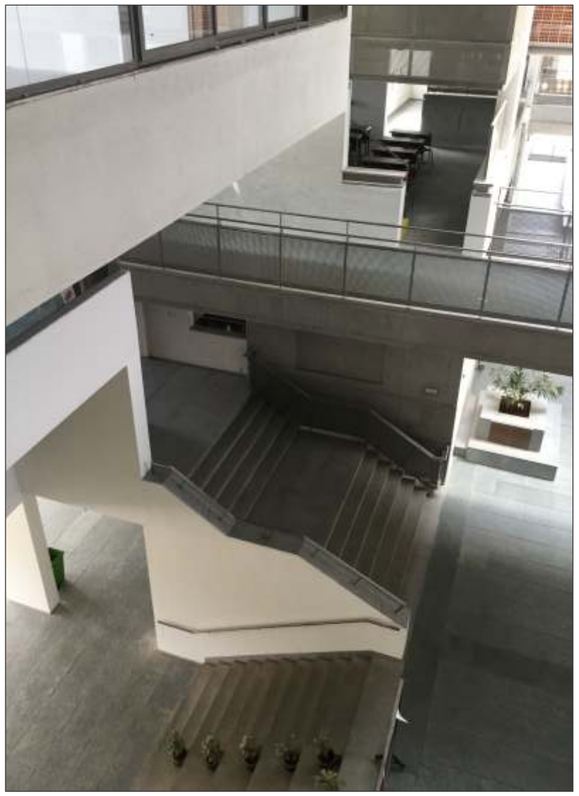


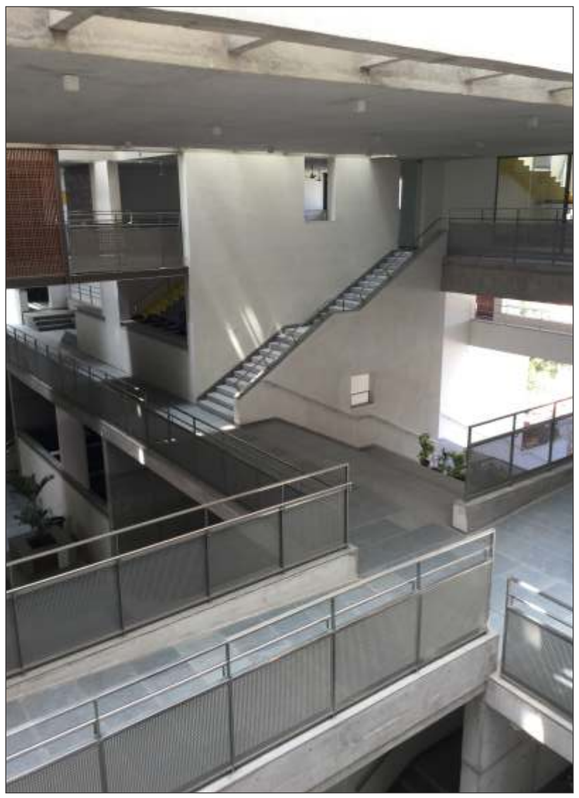
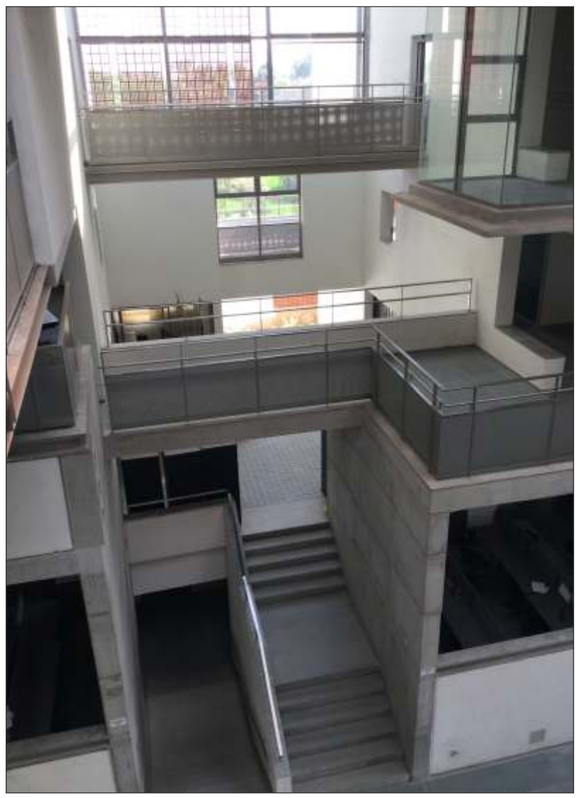
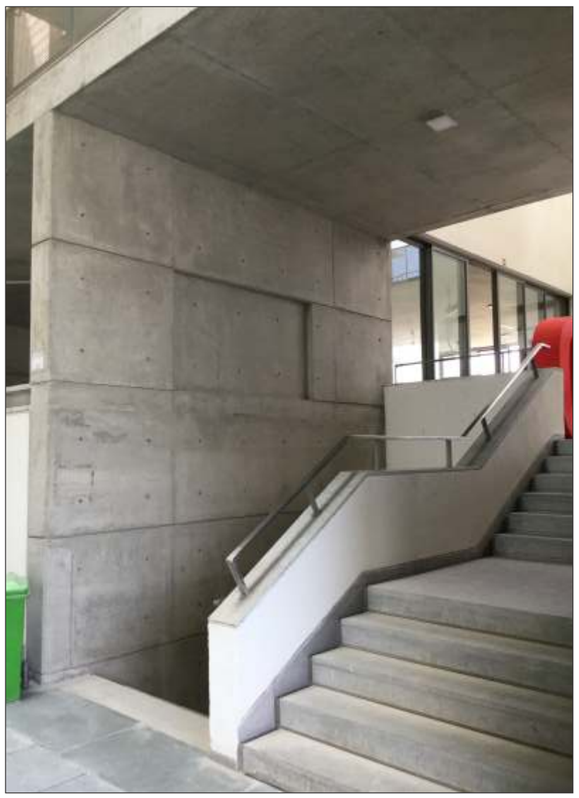


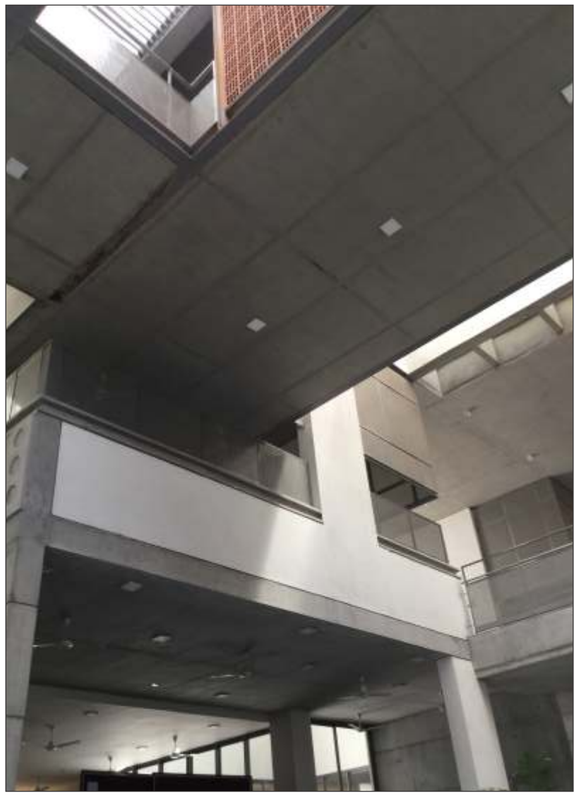









2) Materials used and the need for the choice of the specific material:

Weinerberger Porotherm Filler Blocks:

The desire to achieve flat slabs without beam projections necessitated the design of filler slabs. The space between beams was filled with porotherm clay blocks.

This in turn achieved savings in concrete quantity by bringing down the overall weight of filler material and the steel quantity.
The weinerberger clay bricks are rated by Indian Green building council and GRIHA.

The lower U values of clay blocks assures better thermal insulation thus providing comfortable indoor climate, especially in a place like Vellore where the summer time temperatures touch 40 to 44 degrees.
They are also materials with recycled content thus saving natural resources.

The distance of the factory to site is also less than 400 km and is classified as a regional material.

Kota Stone:

The desire to use natural stone in flooring was reflected in the use of kota for the flooring for all floors.

This was done to achieve the desired cooling of the building as kota is naturally a material that dissipates heat and lowers temperatures indoors.
As there is no installation of air conditioners for all common floor spaces other options such as kota have been used to bring down temperatures and avoid forced ventilat
ion.

Façade porotherm with MS frames and A1 mesh:

External balconies and open space have been erected with MS framework with embedded clay blocks cut to predefined sizes.
Special water spraying pipes have been installed that sprinkle water on the blocks.

This results in hot air passing over these water-cooled clay blocks and entering the building. This in turn lowers internal temperatures.

Radiant Cooling:

Cool water is forced to flow through pipes placed below all floors.

By circulating cooled water through pipes embedded in building's structure, radiant cooling evenly absorbs heat energy from a room, eliminating drafts and hot spots. This system achieves best results when combined with other energy-efficient systems in tight building structures. Radiant cooling may handle the entire cooling load or be used to cover the base loads in traditional cooling applications. Since radiant cooling solutions can improve air quality, they are ideal in buildings such as this project.

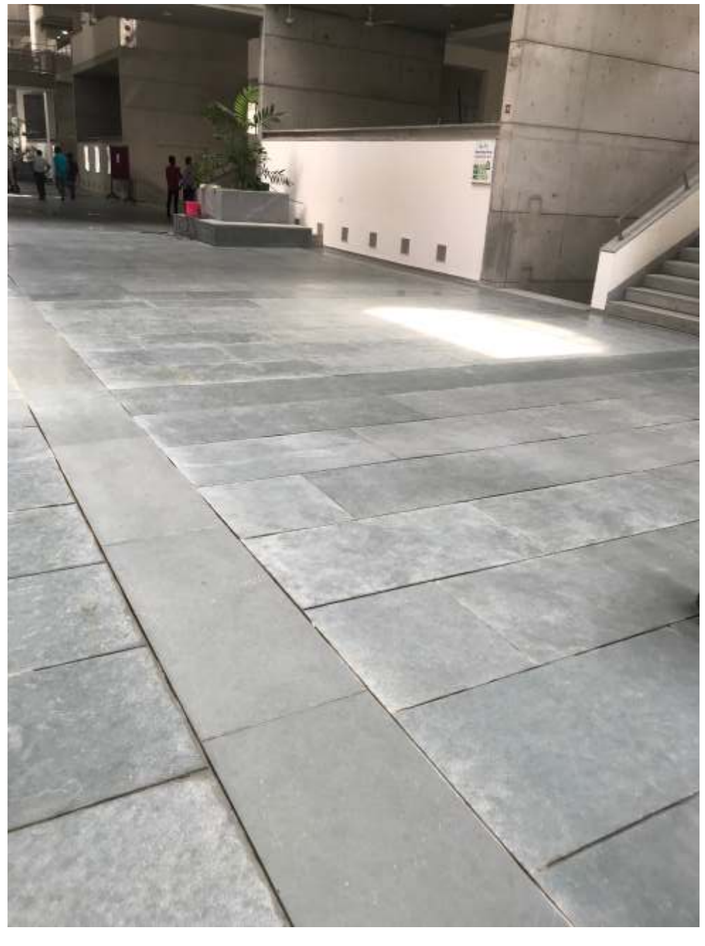
Radiant cooling is an innovative approach to comfortable, high-efficiency cooling. The technology is basically the same as radiant heating. RAUTHERM S pipe is installed in floors and circulates chilled water. Radiant cooling is most effective when used in conjunction with other energy-reducing systems.

Cooling is more evenly distributed and drafts are eliminated.
Pipes are embedded in floors depending upon requirements.
Requires air movement and dehumidification equipment as part of the system. Temperature can be controlled at the individual room level.

Weinerberger Porotherm Filler Blocks:

Weinerberger Porotherm Filler Blocks:

Kota Stone:



Facade Porotherm :

Radiant Cooling:

3) Scaffolding & Formwork Design – Salient points:

1) Exposed concrete: Walls requiring specially designed centering frames mounted with plywood as per architectural requirement in terms of grooves, heights , tie rod holes spacing, interconnecting beams at different levels and recessed portions within exposed walls. Exposed walls starting from footings and going up to the height of 16 m to 20m across multi levels from basement to double and triple heights.

Metal framework had been made in such a way in terms of compactness to achieve slurry leakage free finish. Ply was 19mm thick, proper jointing with sharp edges, so as to obtain surface colour of concrete as pure as cement finish.

Further, to reduce the slurry leakage at joints of boards, offset jointing of ply & MS members was done.

Formwork ply sheet sizes of 1220mm by 2440mm were used and it had been detailed to avoid joints and wastage.

Wall elements required tie-bolts positions and architect shared preferred location of ties. This required a good coordination between the contractor and architect to establish the number required and actual position to be maintained as per the design requirement.

Proper care was taken while making of exposed frames so that there should not be any nail heads nor screws fixed through the face of plyboards. For site team operatives, proper training was given to take care not to damage the surface by scuffing with sharp tools or implements.

De-shuttering of form finished exposed shuttering done within 12-14hours after concreting.

After concreting, maintenance of the exposed finished surface till the end of project, at the highest quality of finish in the environment of de shuttering, block work, plastering and ongoing work of other agencies.

2) Centering Systems: The structural system consisted of 6 levels from basement, upper ground floor, first floor, mezzanine , second floor and terrace floor. The structural system was made up of interconnected regular beams, inverted beams, MS steel beams, post tensioned beams, steel suspender columns, filler slabs filled with porotherm blocks and slabs with thicknesses varying from 200 to 300 mm. There were multi level slabs consisting of single , double and triple heights.

To execute all the above complexity the centering consisted of cup lock system of shuttering interconnected at all levels to ensure stability due to high load of tmt steel, porotherm block and concrete weight that had to borne by the centering.The centering was also braced at many levels with 6m pipes additionally to prevent sway during concreting. At many locations the the centering had to be retained at lower levels until the concrete was completed at higher levels in the case of suspended slabs and beams. Same was the case with post tensioned beams where the centering had to be maintained till the tension was applied to the cables within the beams while the work continued at higher levels above the tensioned beams for slab and beam concrete. The slabs centering was done by film faced ply to obtain exposed finish supported by ply runners resting of the spans between the vertical props. All centering load was ultimately transferred by the top jacks to the vertical pipes of the props and on to the bottom jack to the floor.

Extra care had to be taken with respect to the sequencing of centering along with the concrete pours. Deshuttering was also planned meticulously based on the required setting time and schedule as well as the complexity of the structural design.

All the exposed concrete boards , centering , steel and concrete was lifted into position with a tower crane.

Exposed Wall Shuttering









Exposed Wall Shuttering









Scaffolding & Formwork

Footing

Basement Roof Shuttering

Basement Floor

Scaffolding & Formwork

Basement Roof

Ground Floor Roof Shuttering

Ground Floor
Roof Shuttering

Scaffolding & Formwork

▲ First Floor Roof

Second Floor Roof ▼

Scaffolding & Formwork

Third Floor Roof

Terrace View

Scaffolding & Formwork







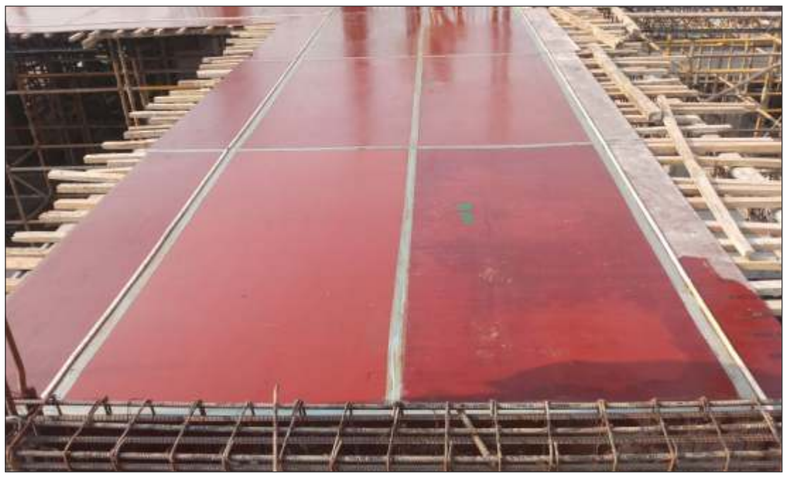


Scaffolding & Formwork









Scaffolding & Formwork









4. Description of the execution, with respect to: Major site constraints:

An old filled up well was found during excavation for raft footing of lift towards north side of building.

Structural consultants inspected the excavated well portion and advised first to remove all the filled up material and next instructed to fill the void with GSB in layers with compaction.

Plate load test was carried out to check the compactness of gsb.

Delay in the project schedule due to the existing well was a major constraint at early stages of project.






5. Details of structural system adapted – its salient feature, construction details, and uniqueness if any:

Salient Features:

1) Large span structures with flat soffits & exposed surfaces – elimination of false ceiling

2) To create flat soffits slabs – Porotherm used as filler blocks (economy & also light in weight)

3) Wide 7m span central corridor with wind flow from one end to the other.

4) Composite materials – Usage of MS members & RCC in structural members for bridges, suspenders etc

5) Double & Triple height for free air circulation.

6) Façade MS works for architectural appearance as well as to reduce the heat by proposing porotherm frames with water sprinklers & A1 mesh for growing creepers.

7) Post Tensioned beams for large spans.

Construction Details.

The structural system consisted of 6 levels from basement, upper ground floor, first floor, mezzanine, second floor and terrace floor. The structural system was made up of interconnected regular beams, inverted beams, MS steel beams, post tensioned beams, steel suspender columns, filler slabs filled with porotherm blocks and slabs with thicknesses varying from 200 to 300 mm. There were multi level slabs consisting of single, double and triple heights.

Uniqueness:

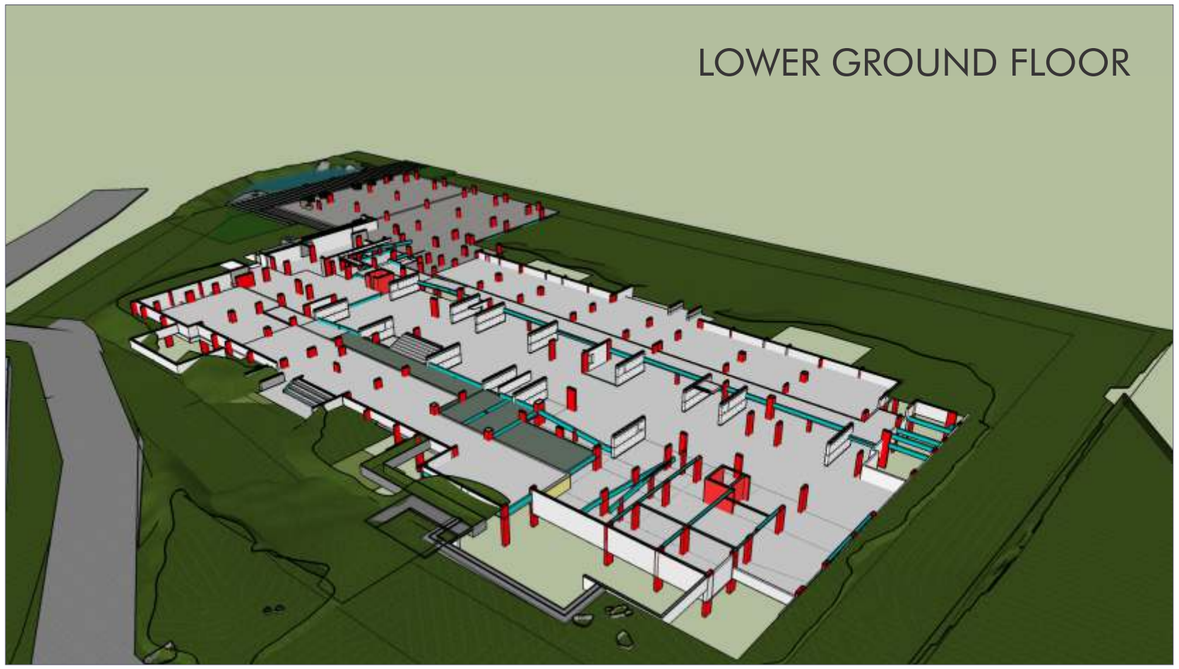
The unique architectural design necessitated a unique structural design. This aspect is clearly perceptible when one enters the building. The integration of architectural aesthetics and the rcc structural elements is so seamless, that the entire structural frame work and its complexity is just not visible to the eye. This has been achieved by individually working out the necessary structural elements, sizes, orientations and thicknesses at a local and micro level instead of having a single approach for the entire structure. Part to whole would define this approach.

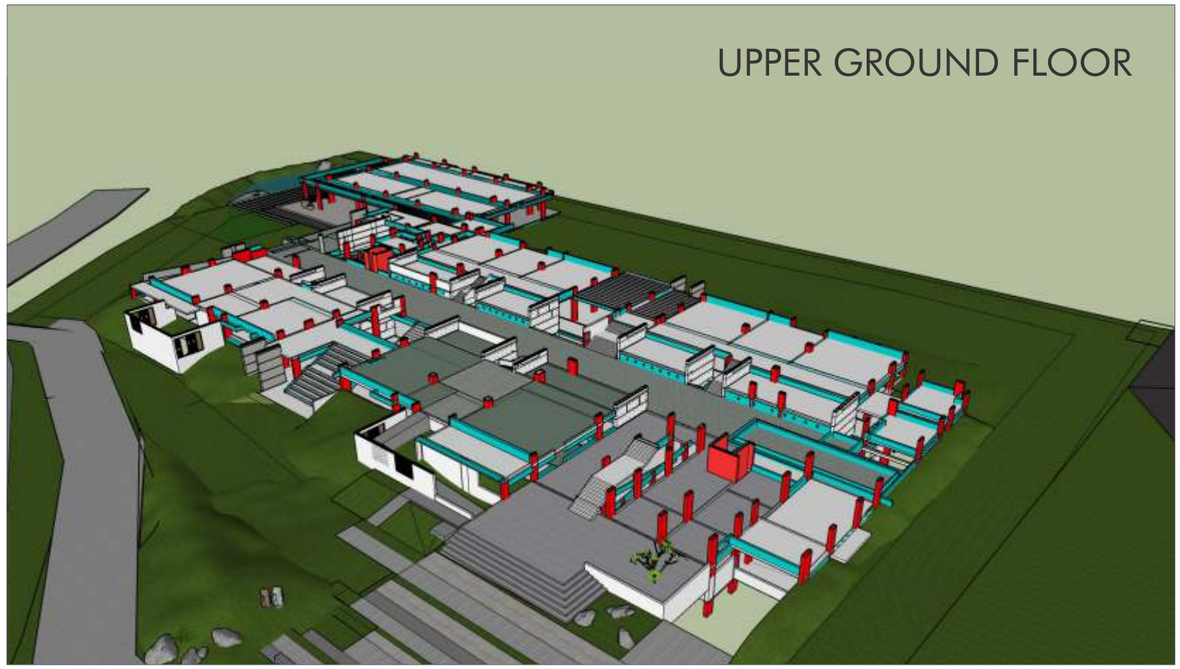
The combination of various aspects rcc design, structural steel design, filler slabs to introduce porotherm blocks, suspended slabs and post tensioned beams to achieve the desired effect complimented by the construction methodology consisting of sequencing of centering and concreting activity to enable the success of the design would stand out as a speciality.

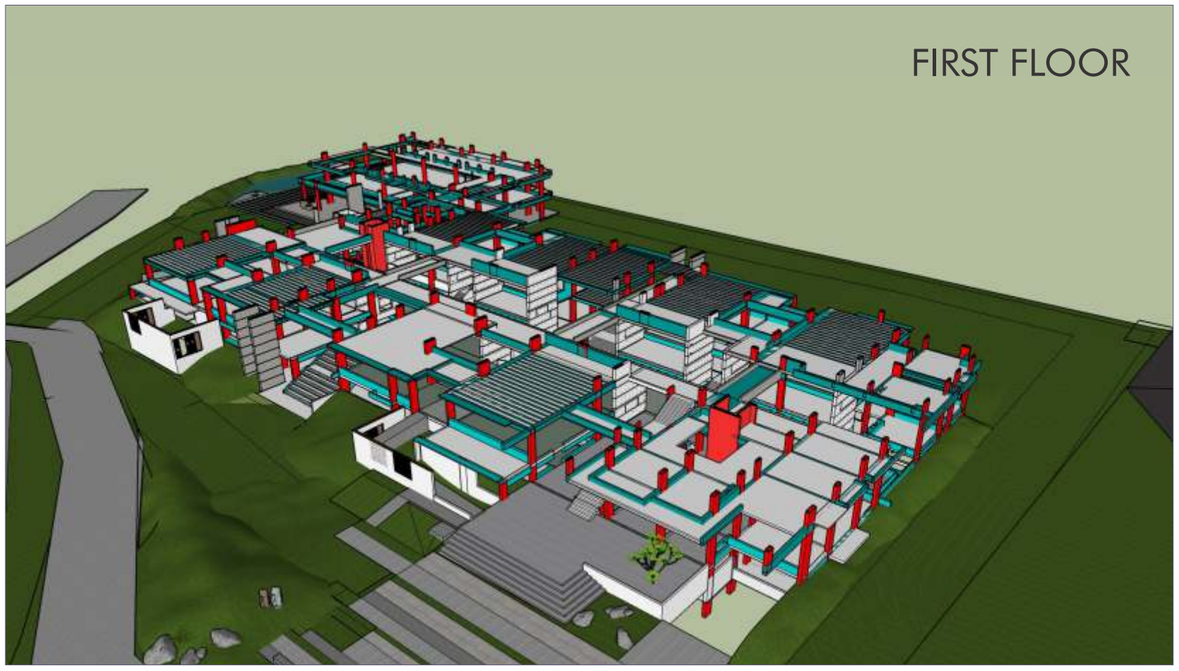
The contribution of the structural design to achieve the larger goal of temperature reduction within the building in the absence of forced ventilation would stand out specifically. The design ensures the free flow of air through out the building creating natural drafts driving hot air out of the building which is significant in a city such as Vellore where temperatures reach between 40 to 44 degrees.

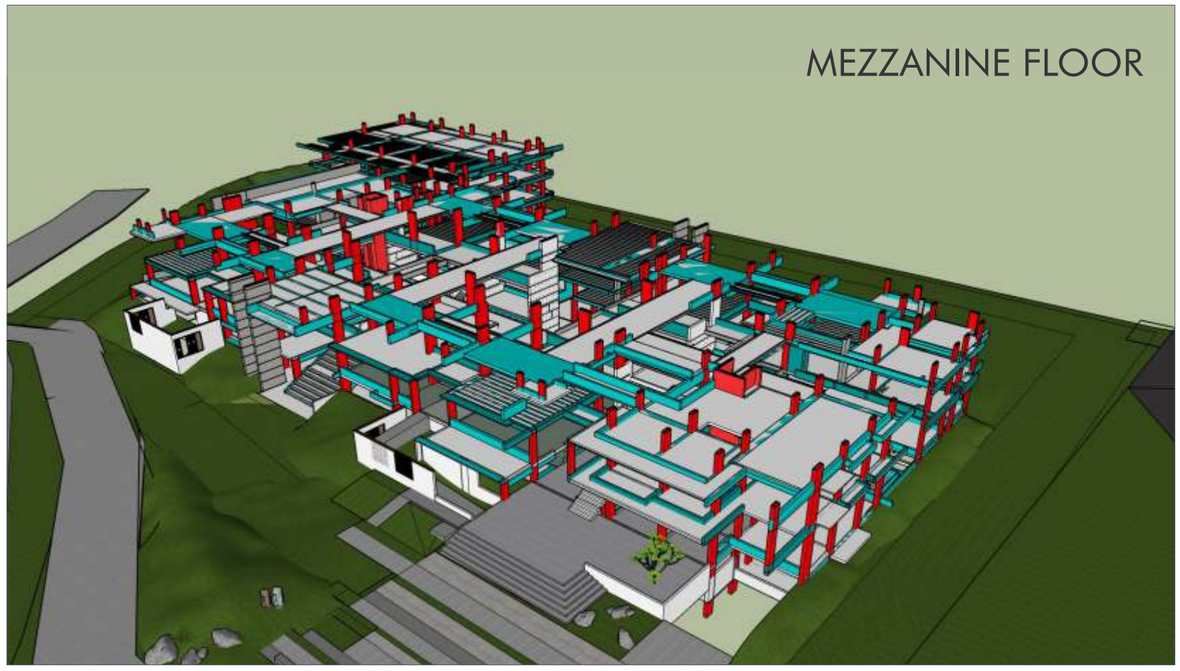
The creation of spaces as envisaged by the architects to encourage a unique learning environment and to stand out as a design experiment for future architects can be credited in part to the unique structural design.

Structural System Adopted - Structural Layout

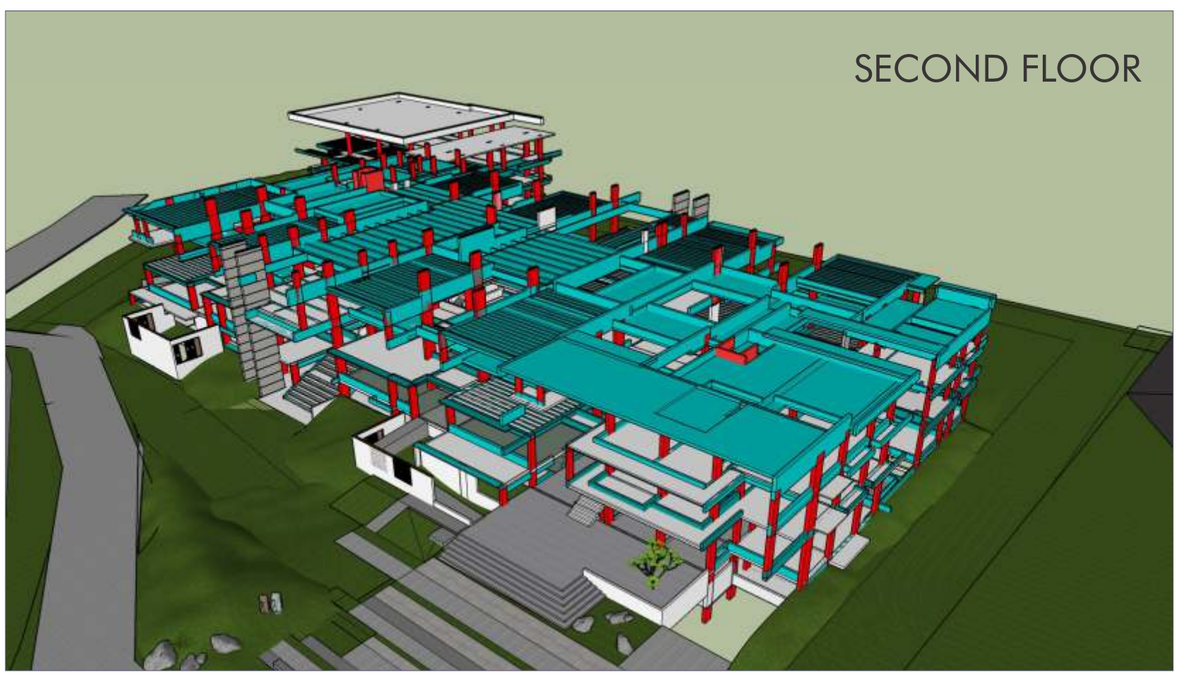


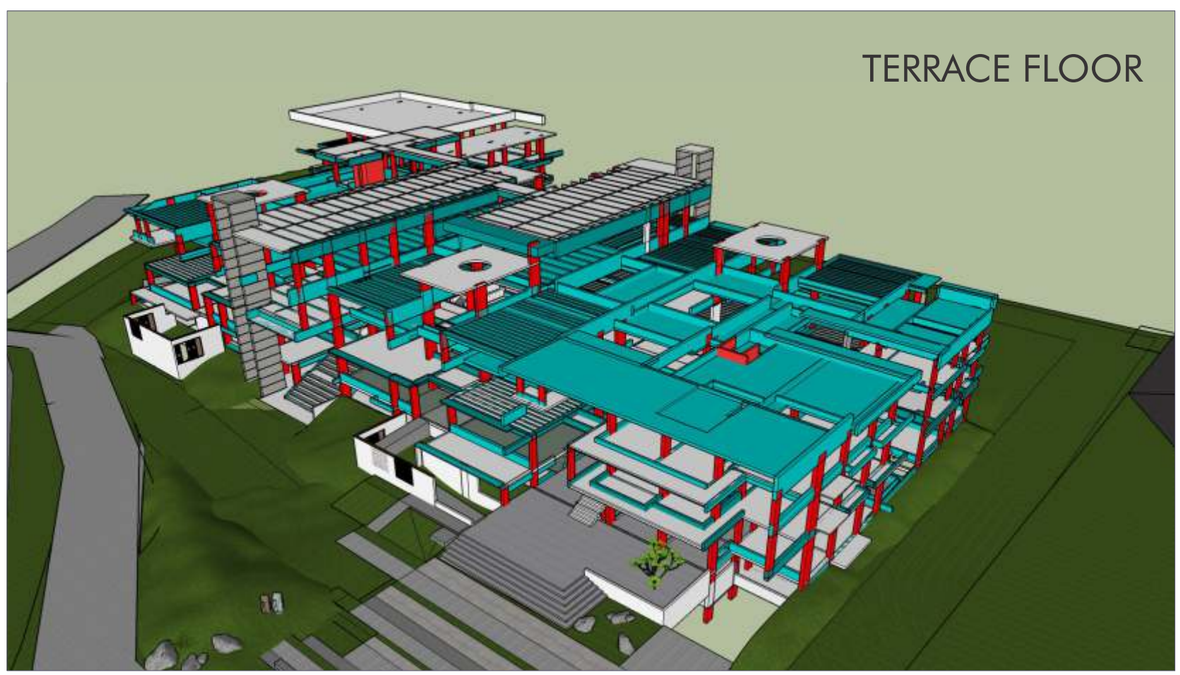




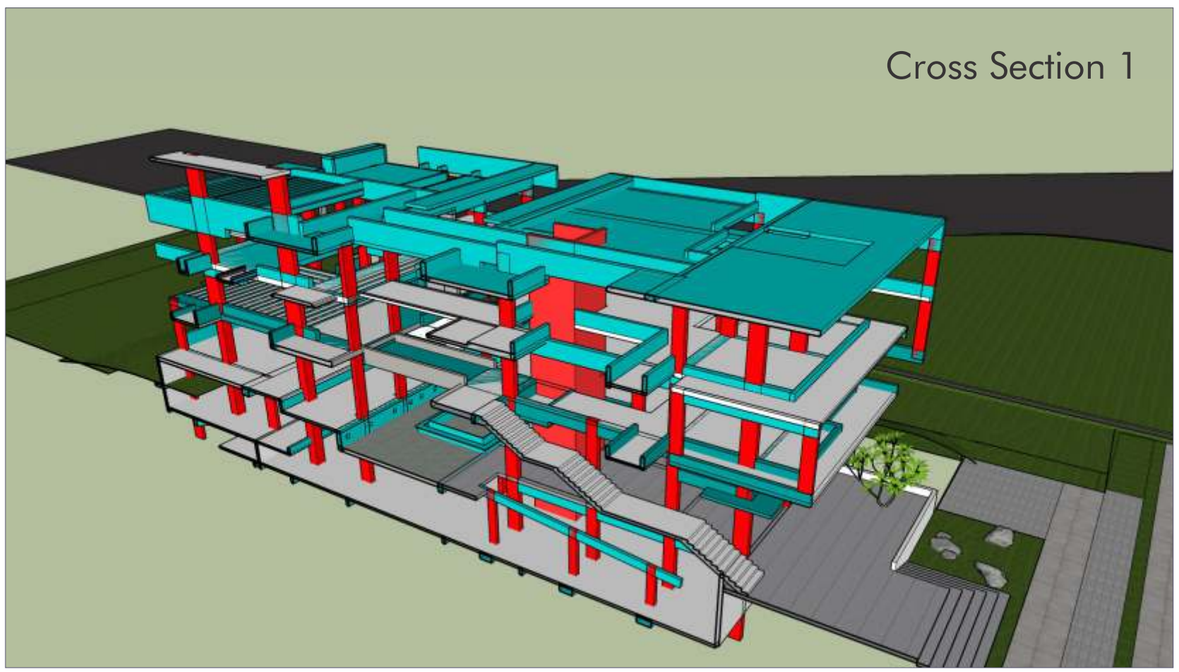


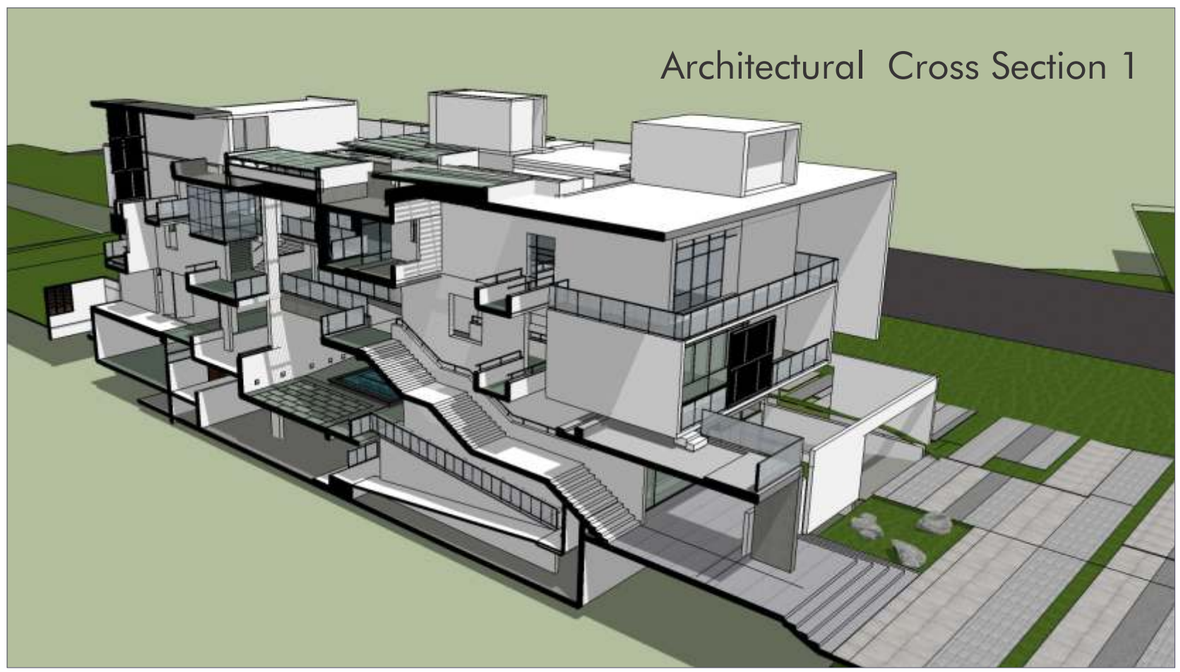
Structural System Adopted - Structural Layout

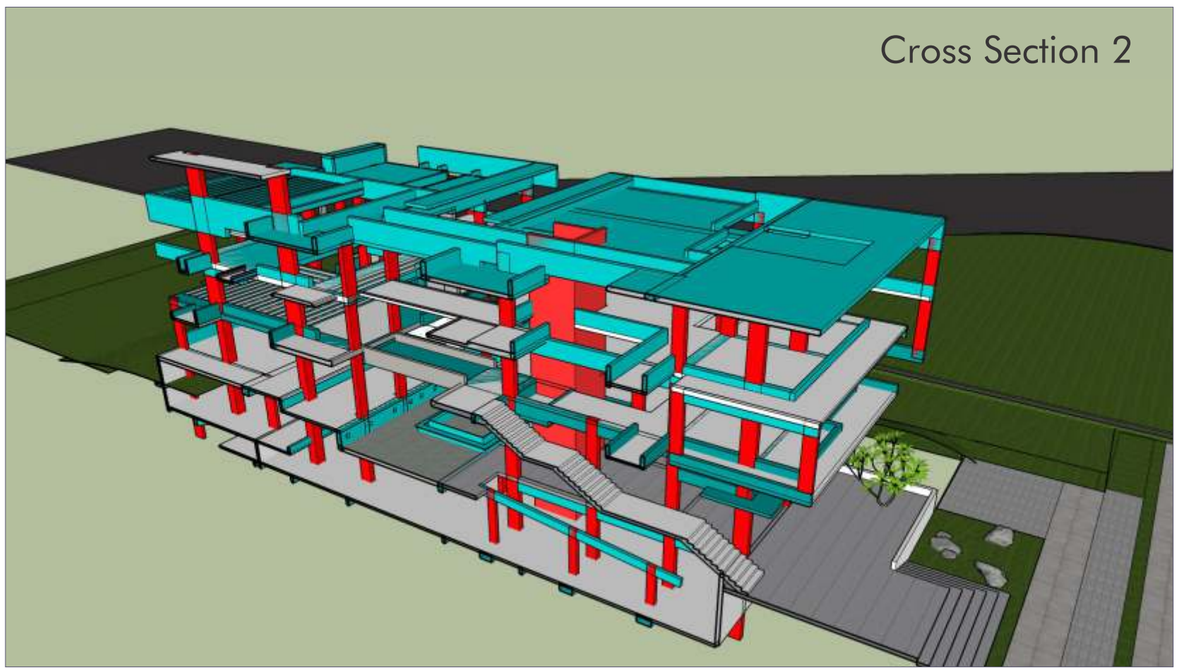


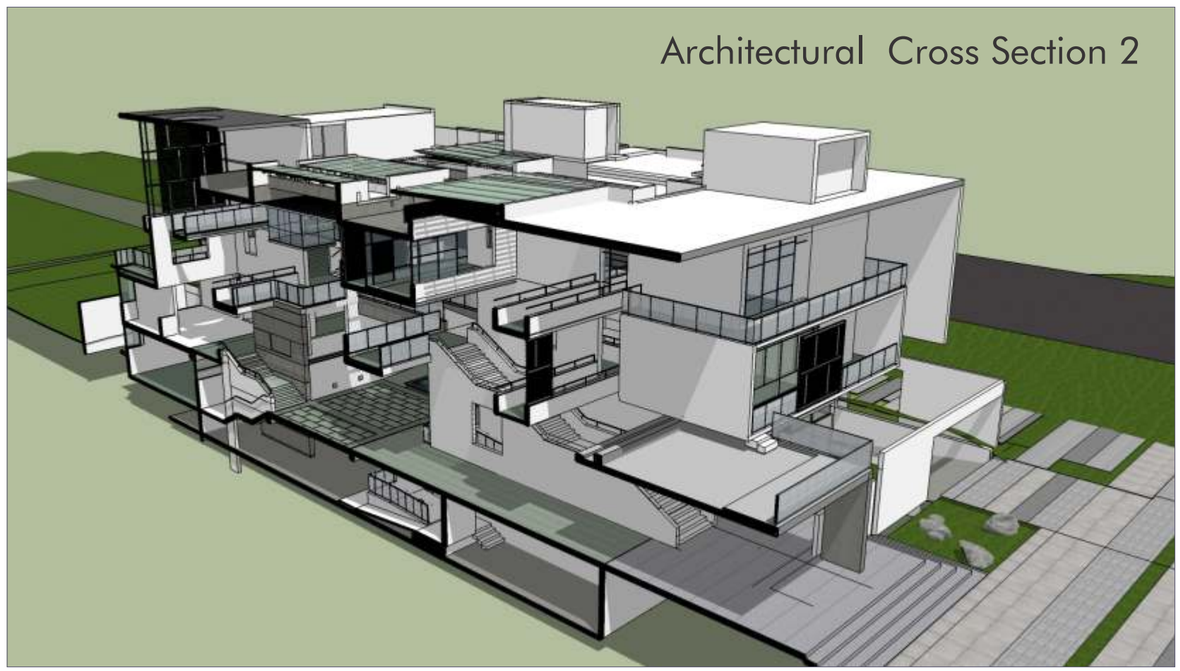


Structural System Adopted - Cross Sections Views - Structural layout v/s Architectual Sections

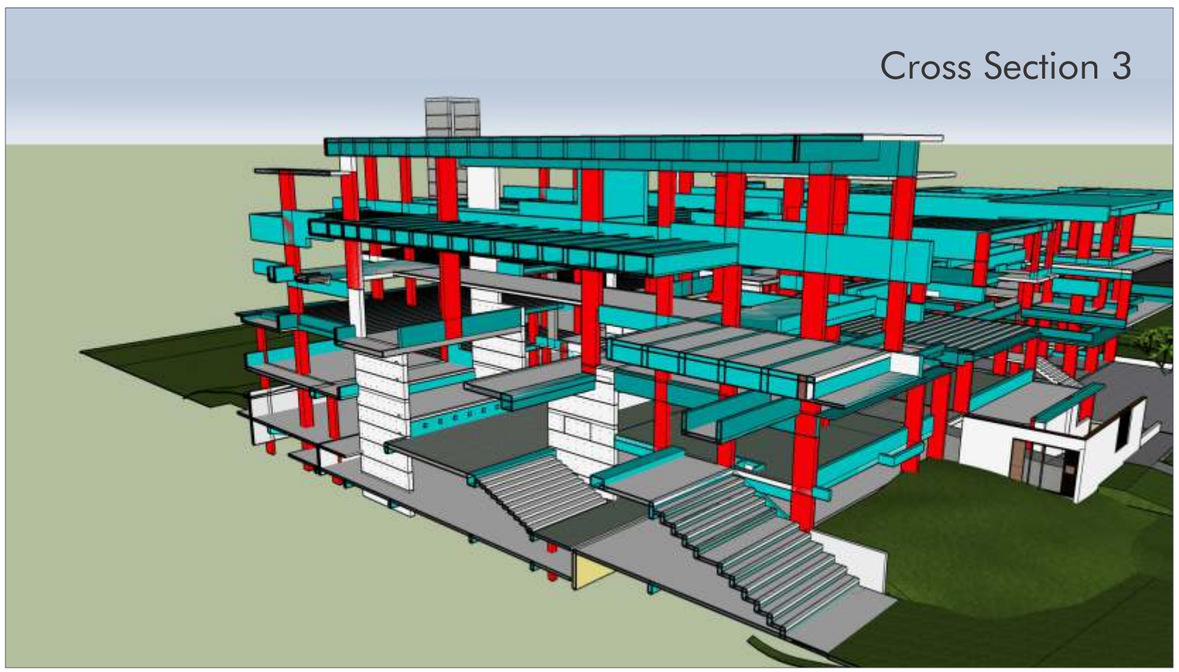


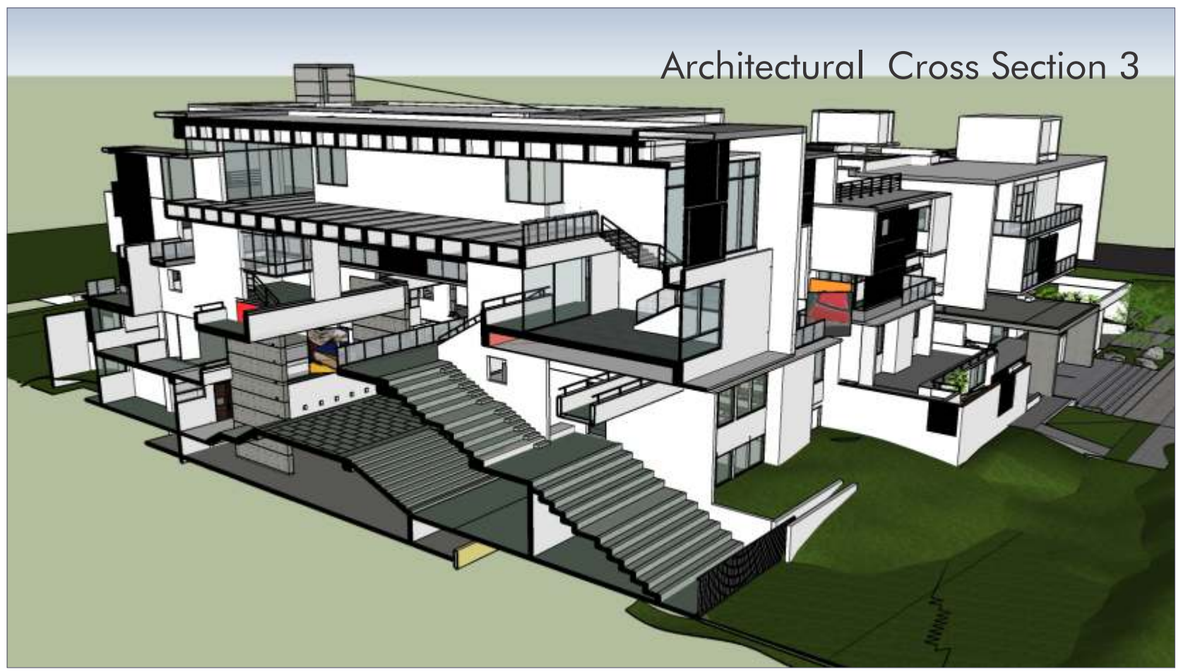


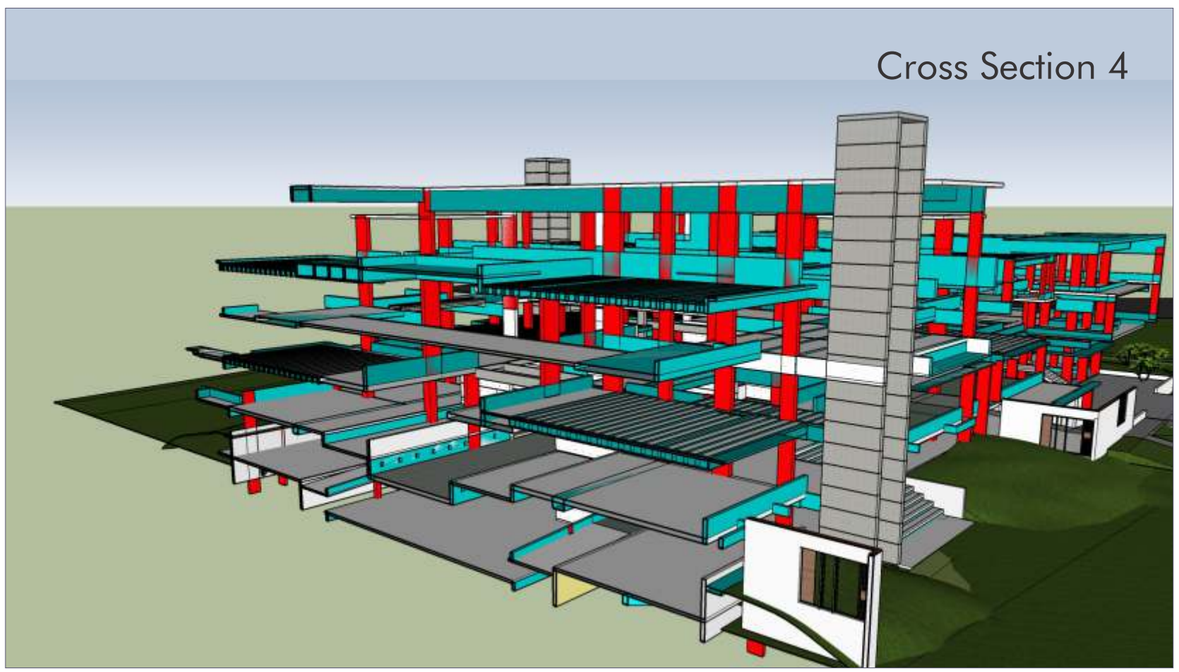




Structural System Adopted - Cross Sections Views - Structural layout v/s Architectual Sections



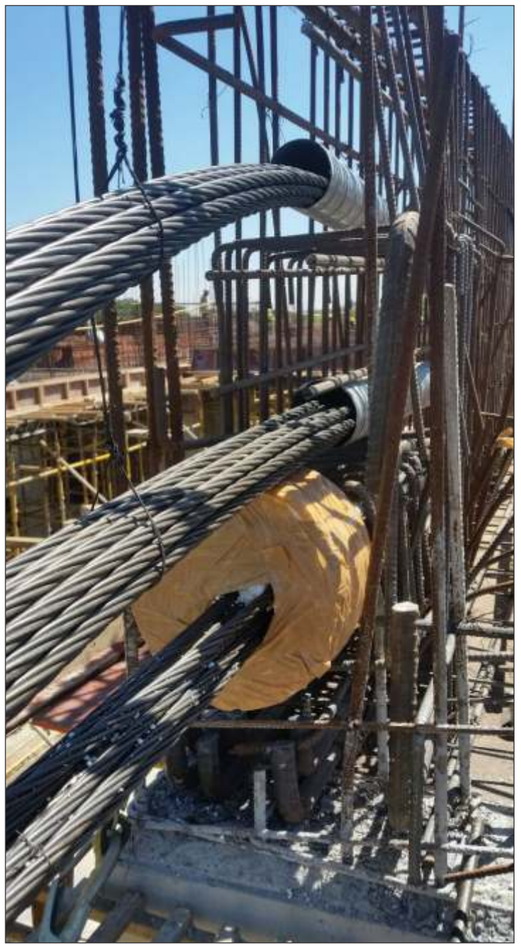




Structural System Adopted - Post Tensioned Beams



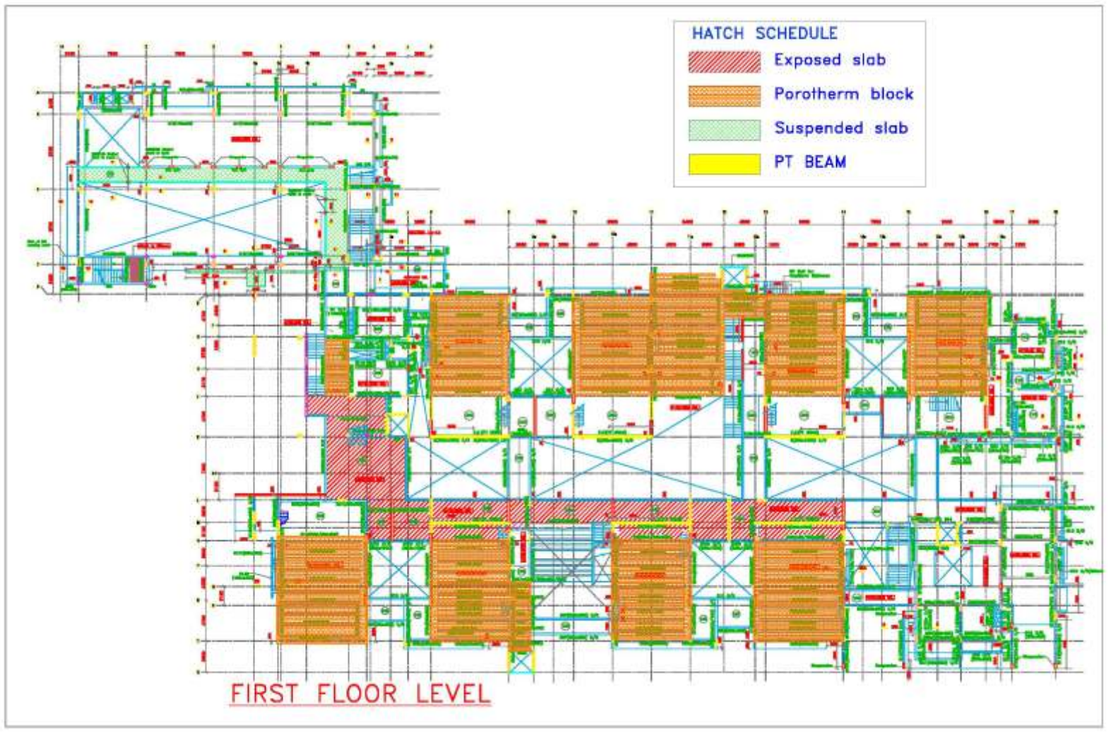


6. Details of design and execution of the roof slab including suspended slabs if any :

The need for double and triple heights as a part of the architectural design clubbed with interconnecting passageways, necessitated the incorporation of suspended slabs held by mild steel structural members. The execution of the same needed the centering to remain in position even after the lower floor was concreted. The centering for the upper slabs in turn was erected further above, to support the upper slab holding the lower level. The construction methodology was further challenged by the presence of such suspended slabs at various levels simultaneously and in different parts of the building.

Location of Suspended Slabs



Suspended Slabs

Suspended Slabs









Suspended Slabs



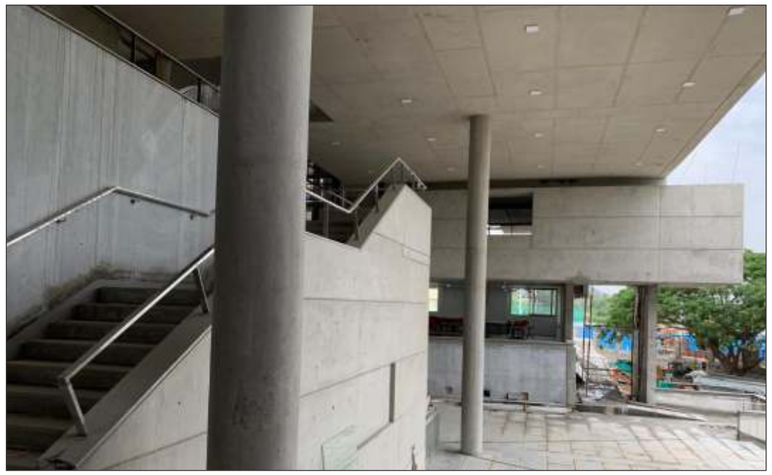




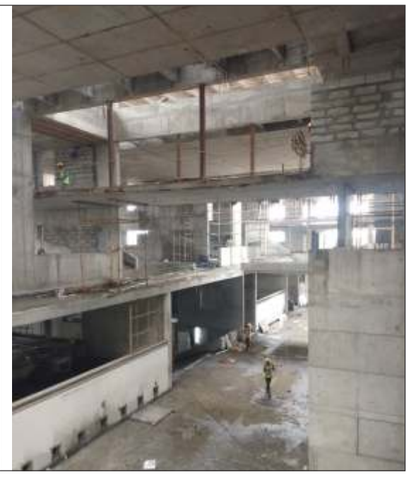


Suspended Slabs







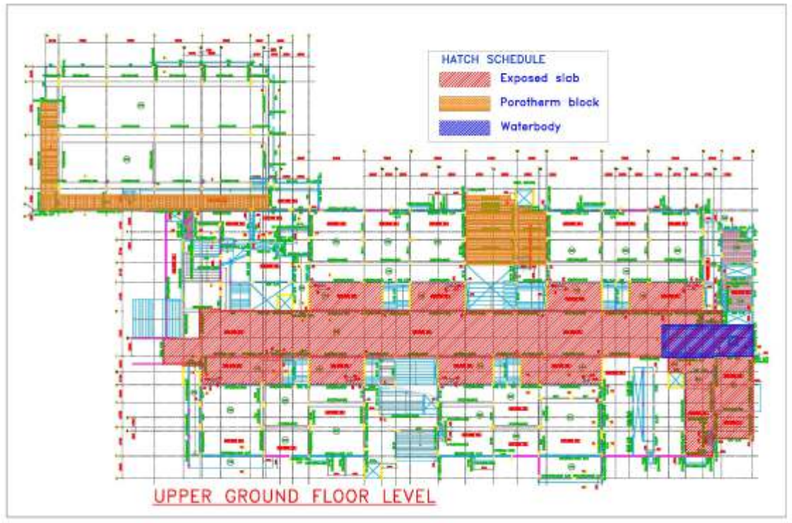


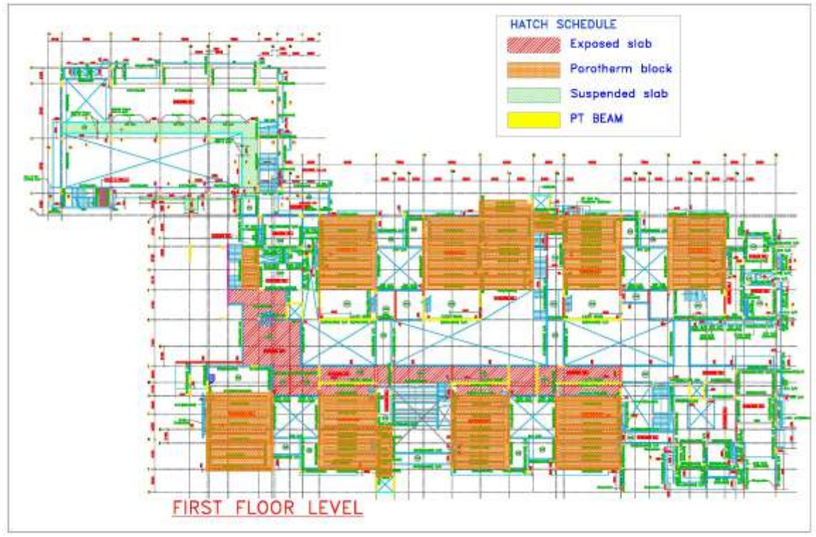


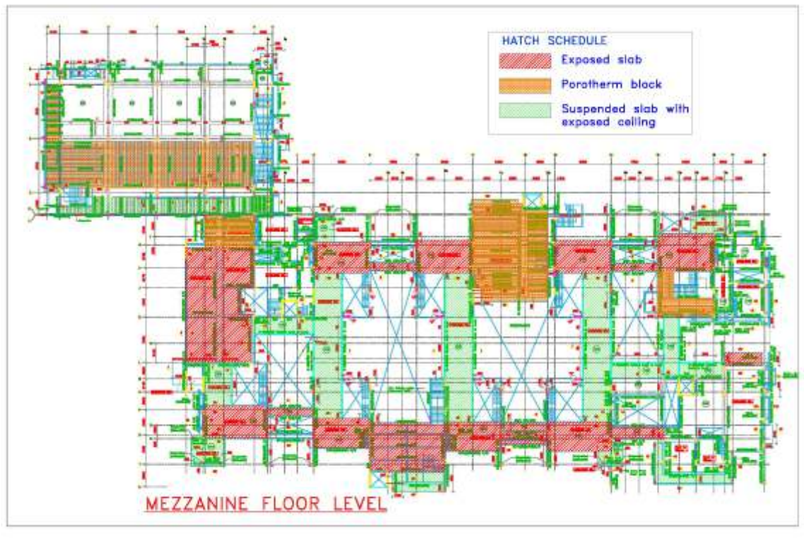
7. Details of any project specific specialized structures constructed as a part of the overall process for the project :

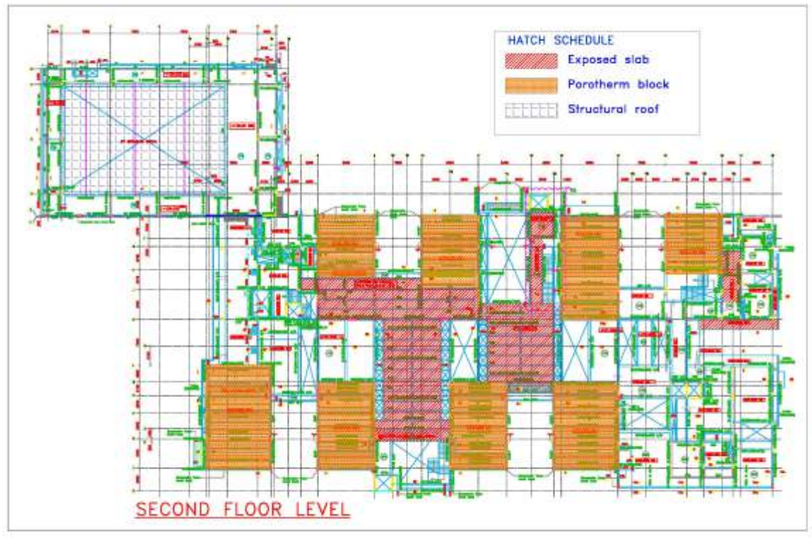
Exposed Concrete Slabs & Walls:

The introduction of shear walls in the form of exposed concrete walls as part of the design thinking has been a major feature of this project. These walls not only act as structural members but also add to the aesthetic thinking when viewed across the imposing double and triple heights. These exposed walls have also been connected to each other by exposed slab finishes.

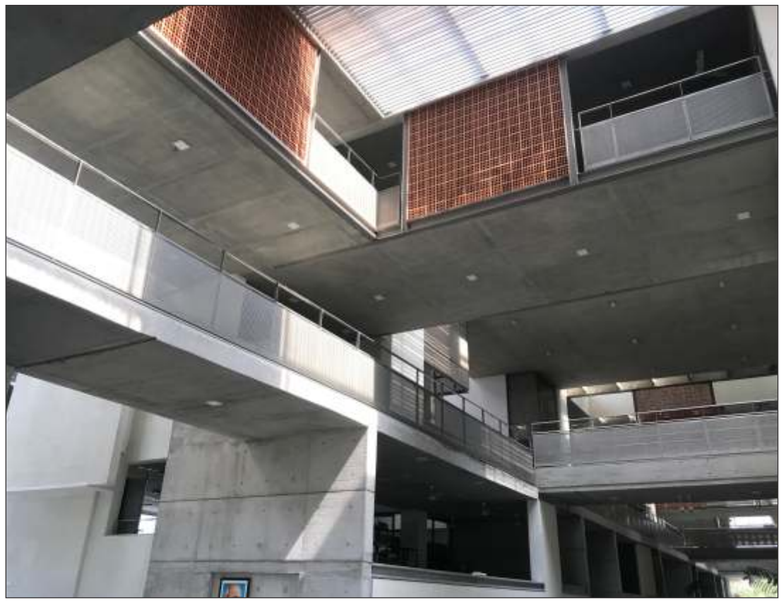






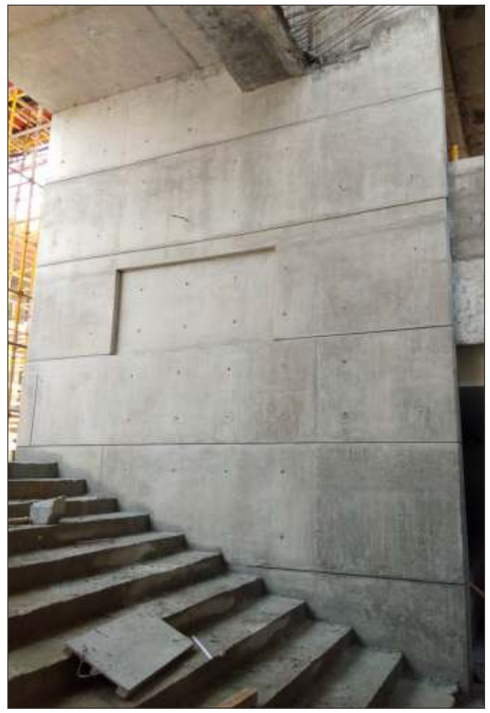


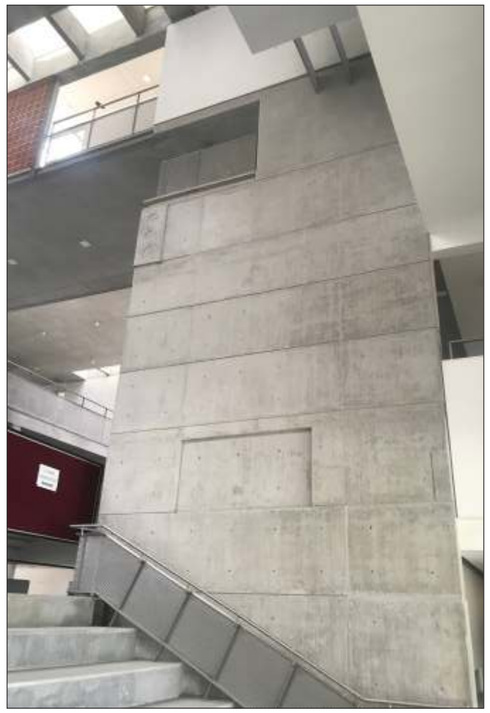
Exposed Concrete Slabs & Walls:

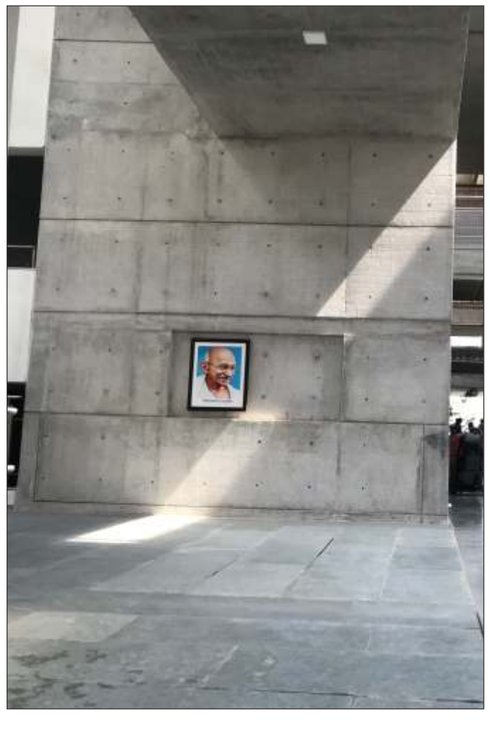


Exposed Concrete Slabs :

Exposed Concrete Walls:



8. Any other relevant feature executed to enhance or supplement the overall performance of the structure :

1) Floor radiant cooling system to reduce heat:

Improved Air Quality, No Drafts, No Hot Spots

By circulating cooled water through pipes embedded in building's flooring, radiant cooling evenly absorbs heat energy from a room, eliminating drafts and hot spots. Radiant cooling solutions improve air quality and are ideal in such buildings where air quality is critical due to high summer temperatures in summer time.

RAUTHERM S pipe is installed in floors and circulates chilled water.

Cooling is more evenly distributed and drafts are eliminated.

Pipes are embedded in floors depending upon requirements.

Temperature can be controlled by individual room.

2) Terrace PU waterproofing - Dr. FIXIT LEC SYSTEM (Waterproofing & Insulation)

The construction of this project in Vellore necessitated that the terrace water proofing be of a specialised nature. Vellore's geographical location meant that it experiences high temperature during summer and heavy rainfall in the rainy season due to its proximity to the coast. The hills surrounding Vellore also play a major part in the movement of hot air in the region.

A specialised system was designed by the architects and the same has been explained below.

Application Procedure

1. Final cleaning of the surface.
2. Providing a cement-sand mortar based angle fillet of 50 X 50mm admixed with Dr Fixit Pidiproof LW+ @ 0.2 litre per 50 kg bag of cement, all around in the side at the floor-wall junction and curing by water as per std practice.
3. All construction joints will be treated with high strength non shrink grout/polymer modified mortar admixed with Dr. Fixit Pidicrete URP.
4. Curing by sprinkling of water for 24 hrs.
5. The surface will be cleaned, to ensure that the substrate is free from dust, laitance, debris, etc.
6. Applying Dr. Fixit Flexi PU 270(I) at the parapet-slab junction for a width of 300mm.
7. After complete drying of Dr. Fixit Flexi PU 270(I), Spray application of Dr. Fixit Foamshield, polyurethane foam of 50 kg / cum. density, at an average thickness of 75 mm. Spraying of PUF will be done only on dry surface.
8. Once the thickness is achieved, apply Dr. Fixit Flexi PU @0.75 kg/Sqm by roller/spray/brush.
9. After the coating, a geo textile membrane of 120 gsm shall be placed.

10. Fibrated concrete (polypropylene/recron fibers 0.9 kg/cum) screed of M20 grade shall be cast into these bays, either from a concrete mixer or, by a RMC pump, maintaining the requisite slope of at least 1 in 100. Groove cutting to be carried out on the screed & to be filled with Dr. Fixit PU Sealant or equivalent.

11. All around on the roof, at the parapet wall junction, an angular fillet of 50 mm X 50 mm shall be applied with concrete screed.

12. Curing of the concrete screed & angle fillet shall be done as per regular concrete curing practices for minimum of 7 days.

13. Final ponding test to be conducted for 24 hrs.

14. Fibre mesh to be placed on the angle fillets followed by priming the surface with Dr. Fixit Primeseal @150 gms/sq-mt & then to be followed with application of Dr. Fixit Newcoat Ezee @1 kg/sq-mt.

3) Ingress Air Cooling System:

Ms fames have been erected in all balconies and large openings. Porotherm clay blocks with openings in them have been fixed into these frames.
A system of water supply pipes have been routed through these frames to sprinkle water on the clay blocks. A set of A1 ms frames have been erected behind the frames above the planter boxes. Creepers are to be grown from the planter boxes to grow upwards and fill up the A1 ms frames.

Water from sprinklers will be sprayed on the frames wetting the clay blocks as well as providing water to the creepers in the planter boxes. In turn, hot air is sucked into the building due to the various double and triple heights and the natural cooling systems designed into the building. This hot air gets cooled during entry through the frames further cooling the building interiors.

4) Cantilever MS staircase:

Cantilever stairs are made to have the entire stairs to appear to be floating in the air without support. To achieve this look the stair risers have been cantilevered from the side wall with a stringer ms plate fixed flush to the plastered surface. The treads have then been filled in by welding creating a homogenous look to the entire stair.

This design has been incorporated into the building to save space and to create visual lightness. These stairs are also meant to be a teaching tool for the students.

5) Water Body at Lower Ground Floor:

Granite water body has been incorporated into the building and located at a point in the western area close to large openings in the structure. From these openings hot air entering the building gets cooled due to the water overflowing into side drains and results in further cooling of the building interiors.

Terrace PU waterproofing - Dr. Fixit LEC System (Waterproofing & Insulation)










Terrace PU waterproofing - Dr. Fixit LEC System (Waterproofing & Insulation)






9. Details of all effective running maintenance cost reduction incorporated into the structure.

The entire emphasis of the design in terms of the following to reduce maintenance costs:

1) Double and Triple heights
2) Kota flooring
3) Radiant Cooling
4) Large openings on all side of the building for air flow.
5) Façade ms frames with water sprinkler system and creepers. Ingress air cooling system.
6) Open classrooms.
7) Water body on the western side.
8) Porotherm blocks embedded into the filler slabs.
9) Specialised waterproofing system at terrace levels
10) Internal use of clay blocks in between suspender for cooling.
11) Skylights with air exhaust openings.

All the above features have been incorporated to reduce entirely the dependence on the use of forced ventilation.

This in turn reduces the daily maintenance cost in terms of use of electricity. This is particularly important in a city such as Vellore where temperatures are high.

10. Any other relevant information or features

1) Unique Architectural Design.

2) Complementary Structural Design to achieve the vision of the architects.

3) Construction Methodology and capability to convert the complex and multi level structural elements in terms of centering and staging, steel fabrication, suspenders and suspended slabs and sequencing of concrete pours including post tensioning items. Completion of structure in time inspite of the complex nature of the structural elements.

4) Energy saving measures including the double and triple heights, floor cooling systems, water body, façade air ingress cooling method, kota flooring, porotherm clay blocks in slabs, clay blocks in interior elements, large openings on all sides of building for air ventilation and skylights for air circulation in roofs.

5) Architecture college in the truest sense for a truly enlightening learning environment featuring all aspects of construction systems within the building itself and visually available for the young students to experience first hand, gaining vital practical knowledge.

6) IGBC Green building norms were followed by Discoy during the execution as mandated by the green building consultants M/s Green Sketch Consultants appointed by the M/s Vellore Institute of Technology. The IGBC mandated GRIHA rating has been applied for by the client and are awaiting the final approval and certification.

IGBC Green building norms followed by Discoy :