

HOTEL CUM SHOPPING MALL

(ENERGY EFFICIENT BUILDING)

A THESIS

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

By

N. VINAY KUMAR REDDY
(39210052)



DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND ENVIRONMENT

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY) Accredited

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BONAFIDE CERTIFICATE

This is to certify that Thesis Report is the bonafide work of **N. VINAY KUMAR REDDY (39210052)** who carried out the Thesis entitled "**HOTEL CUM SHOPPING MALL**" under our supervision from December 2023 to May 2024.

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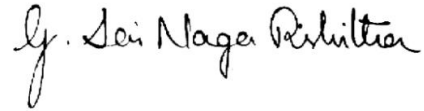
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DECLARATION

I, **GRANDHE SAI NAGA RISHITHA** hereby declare that the Thesis Report entitled “Model School with AMCM (Alternative Materials and Construction Methods)” done by me under the guidance of **Ar.Surya Rajkumar** (Internal Guide), **Ar.Sanghavi.V.V** (Internal Review Member) and **Ar.Hariesh K. Sankaran** (External Guide) Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Architecture Degree.

DATE: 06-12-2021

PLACE: Chennai



SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **Sathyabama Institute of Science and Technology** for their kind encouragement in doing this Thesis and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr.Devyani Gangopadhyay**, Dean and Head of the Department, School of Building and Environment, Our Design Chair **Dr.Suresh Kuppaswamy**, Thesis Coordinator **Ar.Surya Rajkumar** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Thesis Internal guide **Ar.Surya Rajkumar**, Internal Review member **Ar.Sanghavi.V.V** and External Guide **Ar.Hariesh K. Sankaran** their guidance, suggestions and constant encouragement which paved the way for the successful completion of my Thesis work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Architecture**, all my family members and also juniors Dinesh and Anushree helpful in many ways for completion of the Thesis.

GRANDHE SAI NAGA RISHITHA

THESIS SYNOPSIS

Andhra Pradesh government has taken up GNSS (Galeru Nagari Sujala Sravanthi) project. It is one of the projects in Y.S.R kadapa district for facilitating water to the dry lands of the Pulivendula. Due to this storage of water 26 surrounding villages were droned. Villagers of this 26 villages were allotted plots in the respective rehabilitation in the nearby areas giving all sorts of compensation.

Talla Proddatur is also one of the rehabilitated villages. In Talla Proddatur village there is proposal for the government high school. Designing a high school with all required and convenient infrastructure facilities with reused and recycled materials and passive design strategies in Talla Proddatur village Admin, Library, Pri primary, Primary, High school blocks, Kitchen and dining area and Play ground all these are the spatial requirements planned in school.

For construction locally available materials (kadapa stone pieces, granite waste pieces) are used for wall and roof materials. Recycled and reused waste materials can be used as construction materials. Building with these types of materials are sustainable, eco friendly and can reduce the cost of construction.

TABLE OF CONTENTS

CHAPTER No.	TITLE	PAGE No.
	THESIS SYNOPSIS	v
	LIST OF FIGURES	viii
	LIST OF PLATES	x
1	INTRODUCTION	1
1.1	INTRODUCTION	1
1.2	NEED OF THE PROJECT	1
1.3	AIM AND OBJECTIVE	1
1.4	METHODOLOGY	2
2	LITERATURE CASE STUDIES	3
2.1	ATELIER SCHOOL – BANGALORE	3
2.2	SUSTAINABLE PUBLIC SCHOOL – ARGENTINA	7
2.3	MANAVSADHNA ACTIVITY CENTER – AHMADABAD	12
2.4	KADAPA PUBLIC SCHOOL - KADAPA	16
3	DATA COLLECTION AND STANDARDS	20
4	SITE STUDY AND ANALYSIS	26
4.1	SITE SELECTION	26
4.2	SITE JUSTIFICATION	26
4.3	SITE ANALYSIS	27

5	ARCHITECTURAL DESIGN	31
5.1	SPATIAL REQUIREMENTS	31
5.2	CONCEPT	31
5.3	DETAILED DRAWINGS	39
5.4	MODEL	47
6	REFERENCES	48

LIST OF FIGURES

FIGURE No.	TITLE	PAGE No.
2.1	Plan of Atelier school	3
2.2	Structural plan of Atelier school	4
2.3	Column detail	4
2.4	Plan of Sustainable public school	7
2.5	View of Sustainable public school	8
2.6	Wall detailing of Sustainable public school	8
2.7	construction of Sustainable public school	9
2.8	Section and elevation of Sustainable public school	9
2.9	Plan of Manavsadhna activity center	12
2.10	Waste materials used in Manavsadhna activity center	13
2.11	Climate analysis of Manavsadhna activity center	13
2.12	Plan of Kadapa public school	17
3.1	Andhra Pradesh building rules, 2017	22
3.2	Staircase standards and Parking area percentage	22
3.3	Minimum setback standards	23
3.4	Primary and Secondary class room standard layout	24
3.5	Physics and Chemistry lab standard layout	25
3.6	Sanitary fittings for school	25
4.1	Andhra Pradesh state map	26
4.1	Talla Proddatur village map	26
4.2	Site view	26
4.3	Talla Proddatur village satellite map	27
4.4	Site neighborhood view	28
4.5	Site analysis plan, section and elevation	29
4.6	Climatic data of Andhra Pradesh	30
5.1	Area requirements	31

5.2	Site view	32
5.3	View of mutual shading of buildings	32
5.4	View of walkway and greenery	33
5.5	Passive air conditioning system	33
5.6	Green roofing system	34
5.7	Passive down draft evaporative cooling	34
5.8	Outdoor sitting at the dinning	34
5.8	Gathering spaces	35
5.9	Concepts used in site	35
5.10	Construction of wall system	36
5.11	Construction of flooring system	36
5.12	Construction of roof system	37
5.13	Foundation materials	38
5.14	Construction of cupboards	38
5.15	Material detailing	38
5.16	Site plan and section	39
5.17	Pedestrian entrance to the site	40
5.18	OAT and notice board wall	40
5.19	Play ground and Multipurpose hall	40
5.20	Parking area beside the administration office	40
5.21	Block – 1 (Pri primary school)	42
5.22	Sand play area and Green roofing system	42
5.23	View of high school block	42
5.24	View of the block 2 from the walk way	42
5.25	View of the corridor to the walk way	45
5.26	walk way and courtyard view from the corridor	45
5.27	View of the admini block and service road	45
5.28	Play area and top view of pri primary and high school buildings	45
5.29	OAT at dinning and gathering space in the walkway	46

LIST OF PLATES

PLATE No.	TITLE	PAGE No.
2.1	Atelier school	5
2.2	Atelier school	6
2.3	Sustainable public school	10
2.4	Sustainable public school	11
2.5	Manavsadhna activity center	14
2.6	Manavsadhna activity center	15
2.7	Kadapa public school	18
2.8	Kadapa public school	19
3.1	Material study	20
3.2	Material study	21
5.1	Block – 1 (Pri primary school)	41
5.2	Block – 2 (Primary school)	43
5.3	Block – 3 (High school)	44
5.4	Library, Admin, Kitchen and Dinning blocks	46

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Andhra Pradesh government has taken up many irrigation projects for providing water to the dry lands of drought areas. GNSS (Galeru Nagari Sujala Sravanthi) project is one among them situated in Y.S.R kadapa district for facilitating water to the dry lands of the Pulivendula. Area with a storage capacity of 26tmc of water and built a reservoir accordingly. Due to this storage of water 26 surrounding villages were droned.

Villagers of this 26 villages were allotted plots in the respective rehabilitation in the nearby areas giving all sorts of compensation. Hence the villagers started constructing new houses in the allotted rehabilitation areas. Talla Proddatur is also one of the rehabilitated villages. In Talla Proddatur village there is proposal for the government high school

1.2 NEED OF THE PROJECT

Education is the foundation of any society. It is responsible for the social, economical, and development of society. Schools play an important role in molding a nation's future by facilitating all round development of its future citizens.

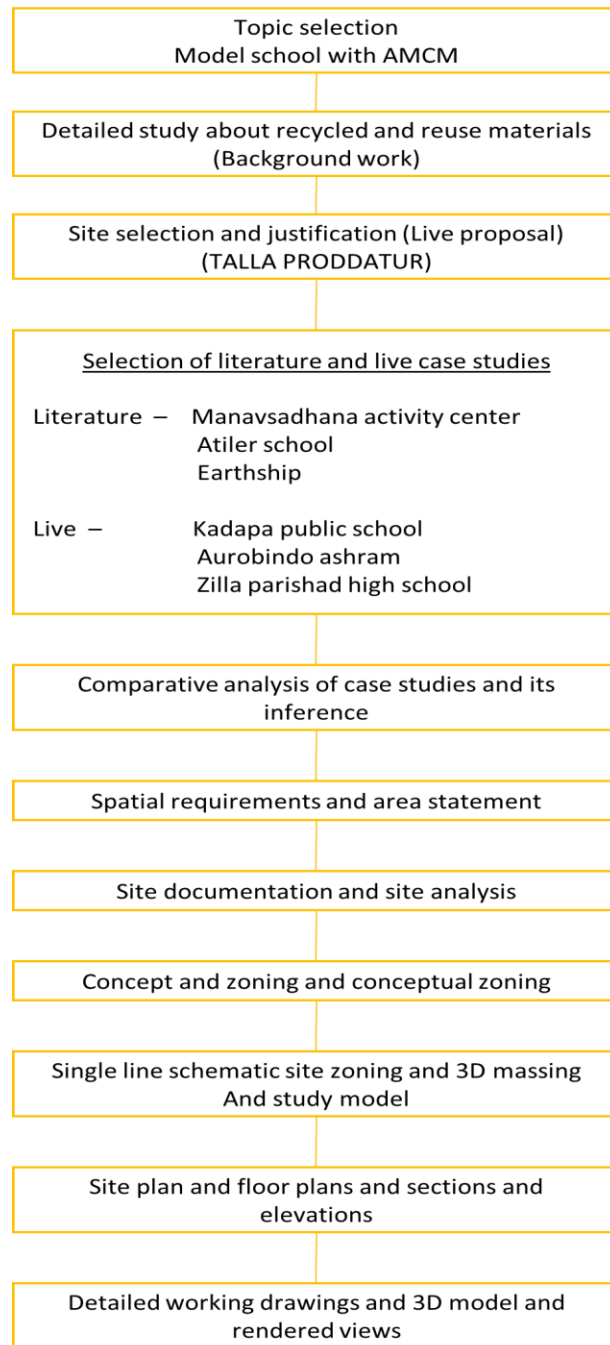
1.3 AIM AND OBJECTIVE

(a) To design a high school with all required and convenient infrastructure facilities with reused and recycled materials and passive design strategies in Talla Proddatur village.

(b) Constructions using alternative materials like reused and recycled materials

(c) Incorporating passive design strategies

1.4 METHODOLOGY



CHAPTER 2

LITERATURE CASE STUDIES

2.1 ATELIER SCHOOL – BANGALORE

Location - Bangalore, India

Architect- Chitra Viswanath

Building type- Play School

completion – 2016

2.1.1 SPACIAL ANALYSIS:

The school building contains classrooms, studio, and a childhood simulation center around a central piazza, with filter spaces allowing transition between the class rooms and the piazza. All the spaces like class rooms, center piazza are interconnected with each other. It makes the space convenient to the children to play and study as well

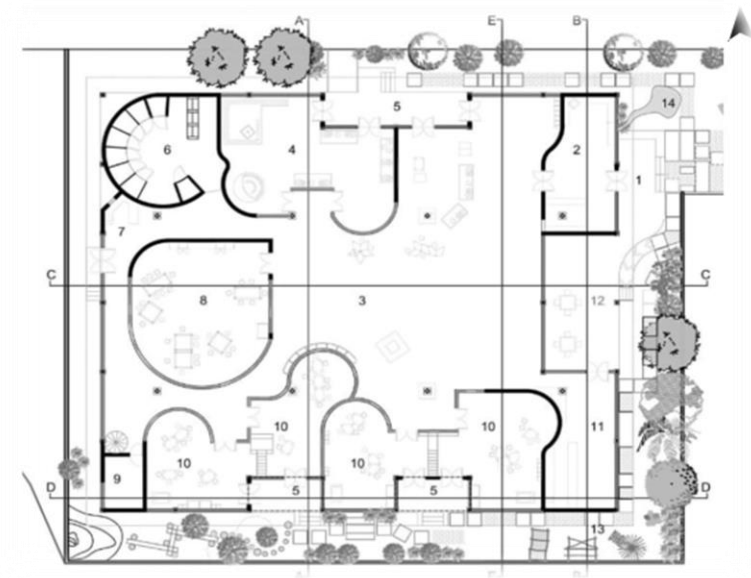


Fig 2.1: Plan of Atelier school

There are totally 8 columns which support the whole building as a single roof. Each column looks like tree with branches. This tree form, will be a structural element, allows the roof to be perceived from a height that where children can relate to.

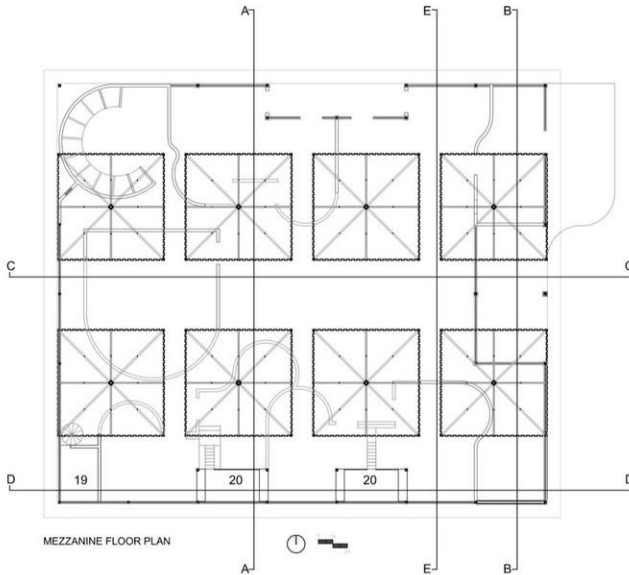


Fig 2.2: Structural pain of atelier school

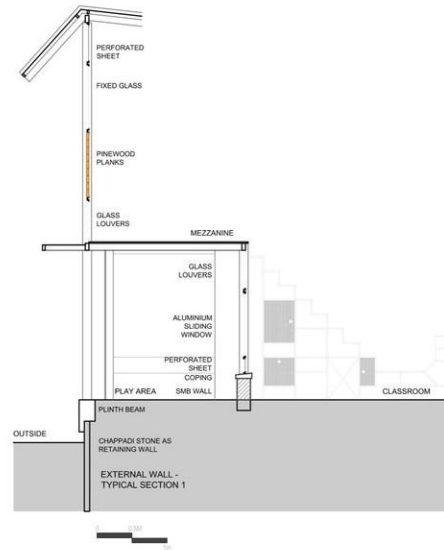


Fig 2.3(a): Column detailing

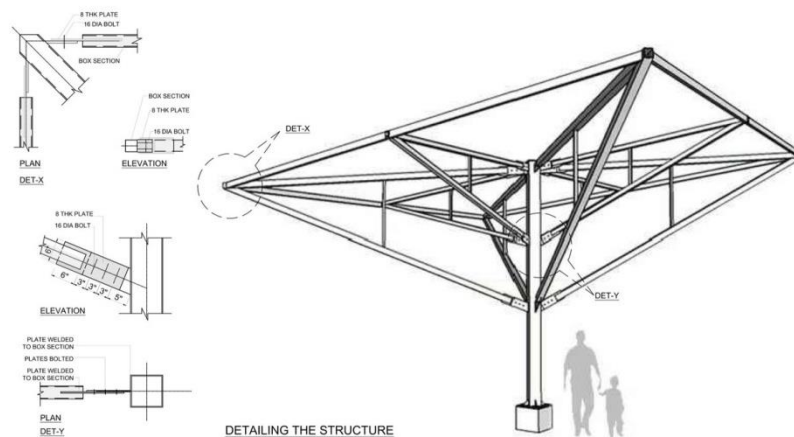


Fig 2.3(b): Column detailing

2.1.2 MATERIAL ANALYSIS:

Whole interiors are done with paper tubes. Paper tubes are supported by brick wall of height 0.2m from the floor level. And top of the brick wall 2 inch concrete coping is done and on that paper tubes are placed and screwed with iron rod inside the paper tube for stability to with stand. Each paper tube is of 100mm thick and each paper tube is screwed with another paper tube for the stability of the wall. Paper tube wall does not take any structural load. Paper tubes are used only for the interiors partition walls

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

ATELIER SCHOOL - BANGALORE

*Location - Bangalore, India

*Architect- ChitraViswanth

*Building type- Play School

*completion - 2016



plaza space for kids to play and study



studio with paper tube partition



Roof is supported on eight columns in the form of a branching tree.



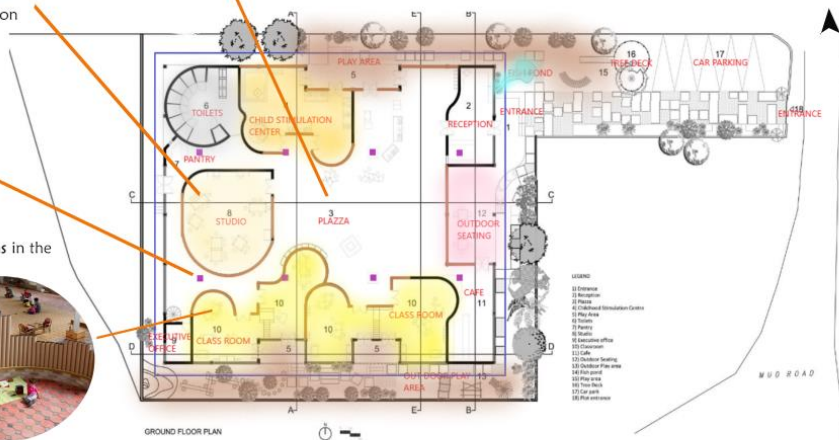
class room partition with paper tube

SPECIAL ANALYSIS:

*The building consists of classrooms, studio, and a childhood simulation center around a central piazza, with filter spaces allowing transition between the rooms and the piazza.

*All the spaces are inter connected with each other. It makes the space convenient to the children to play and study as well

*This tree form, while being a structural element, allows the roof to be perceived from a height that children can relate to.



CASE STUDY - ATELIER SCHOOL

<https://architectureivive.in/the-atelier-school-bangalore-biome-environmental/>

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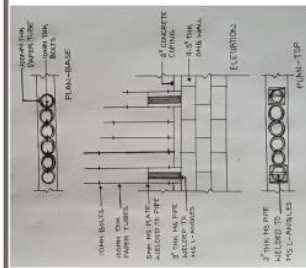


Plate 2.1: Study of atiler school

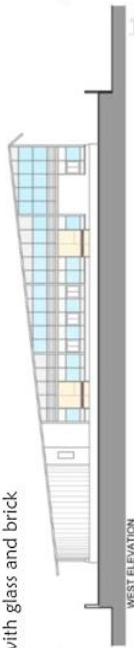
MATERIAL ANALYSIS:

MATERIAL ANALYSIS:

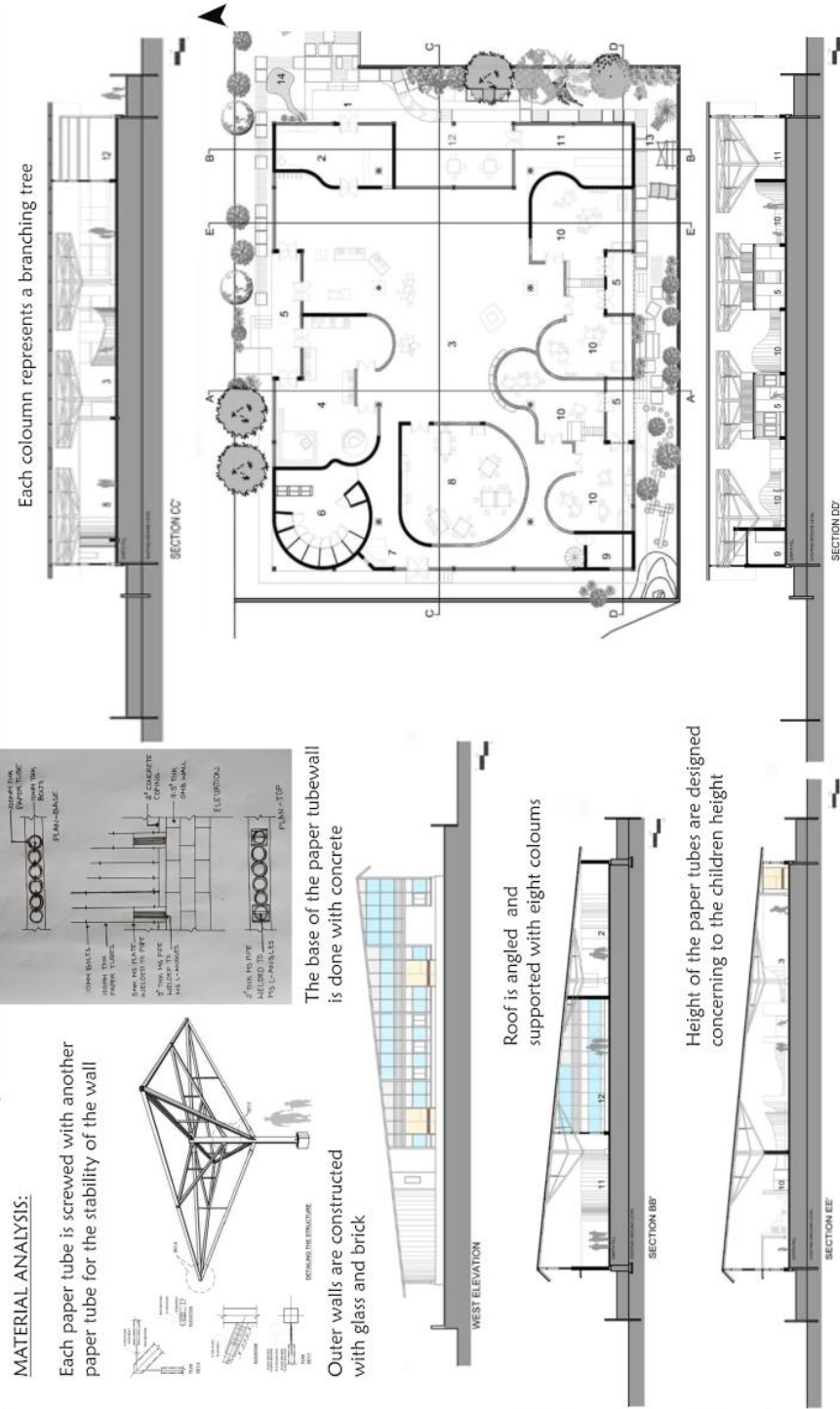
Each paper tube is screwed with another paper tube for the stability of the wall



Outer walls are constructed with glass and brick



Height of the paper tubes are designed concerning to the children height



This tree form, while being a structural element, allows the roof to be perceived from a height that

These paper tubes does not take any structural load

Paper tubes are used only for the interiors partition walls

2.2 SUSTAINABLE PUBLIC SCHOOL – ARGENTINA

Location - Argentina, India

Architect - Michael Reynolds

Building type - School

Year of construction - 2016

Area - 270sq.mts

Construction Time - 7 weeks (January – March 2016)

2.2.1 SPACIAL ANALYSIS:

The Earth ship, as Reynolds calls it, seeks to make the most of the energy of the sun, water, wind, and earth. The surroundings are sensitive to the orientations, opening to the north to make the most of light and solar energy through a wide glass corridor that acts as a distributor of the three classrooms and two wings of the school.

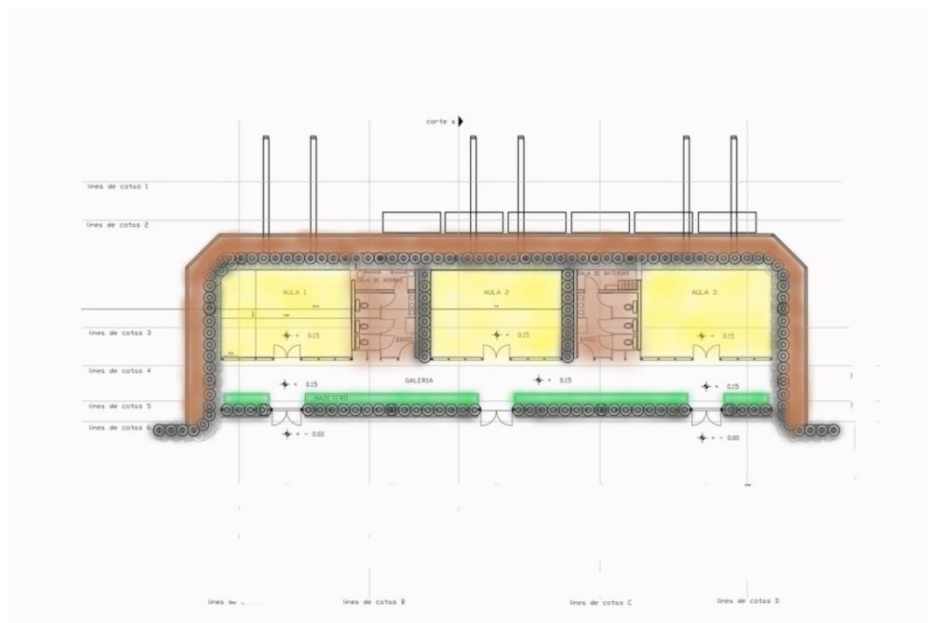


Fig 2.4: Plan of Sustainable public school

Seven principles of sustainability on which the building will be built:

1. The use of recycled materials
2. Treatment of gray and black water
3. Thermal conditioning
4. Application of renewable energy sources
5. Collection and purification of rainwater
6. Organic food production, and
7. The human factor



Fig 2.5(a),(b): Views of Sustainable public school

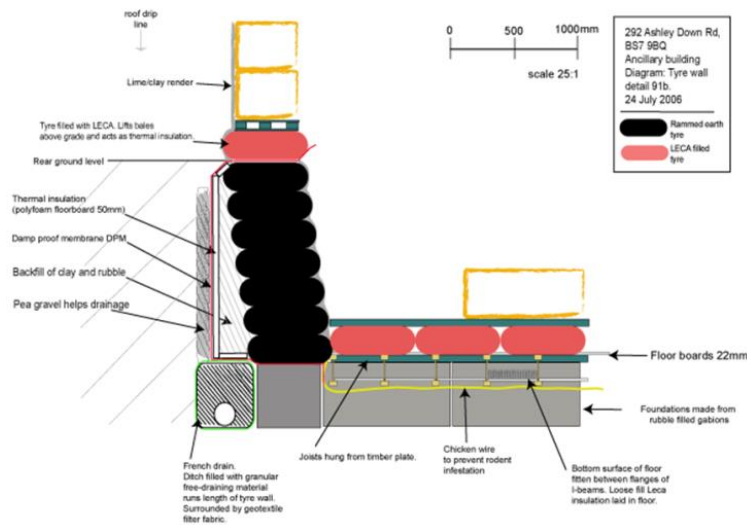


Fig 2.6: Wall detailing of Sustainable public school

The south side building is enclosed with a thick retaining wall made of roofs filled with sand and compacted gravel containing the sand and earth slope at the back of the building. The

north corridor, in turn, enables the production of food through an interior garden. projecting to the exterior a simple and forceful facade dominated by glass and wood.

2.2.2 MATERIAL ANALYSIS:

Its construction is made up of approximately 60% recycled materials (covered with plastic and glass bottles, cans, cardboard) and 40% of traditional materials. The school also counts on a process of treatment of black water which includes a septic tank also created with recycled materials (in this case tractor coverings) and a wet zone on the exterior of the building.

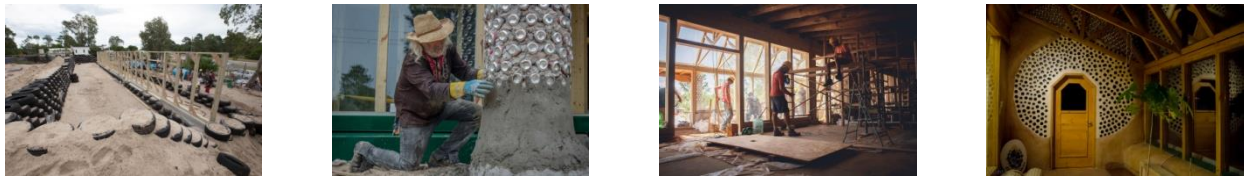


Fig 2.7(a),(b),(c),(d): construction of Sustainable public school

The sustainable school uses rainwater for human consumption in the sinks, irrigation of the vegetable gardens and finally to the cisterns. It will generate cross circulation of fresh air in the summer through the classroom. Electrical energy is generated from photovoltaic panels and central energy storage.

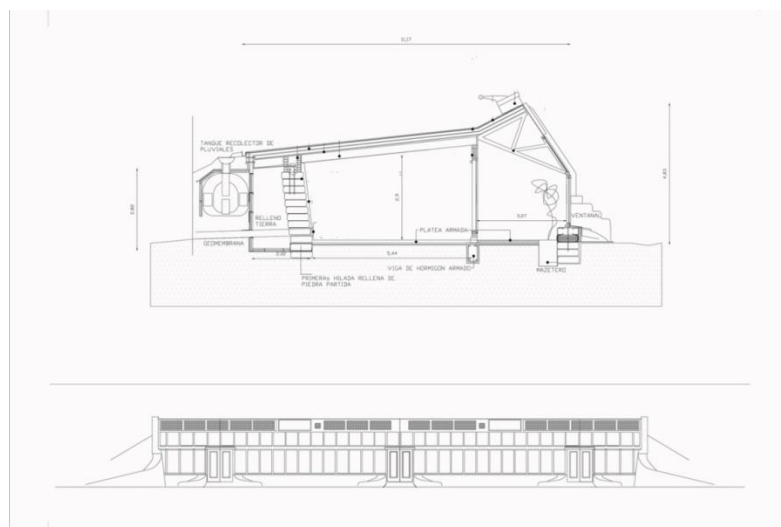


Fig 2.8: Section and elevation of Sustainable public school

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

SUSTAINABLE PUBLIC SCHOOL - ARGENTINA

*Location - Argentina, India

*Architect - Michael Reynolds

*Building type - School

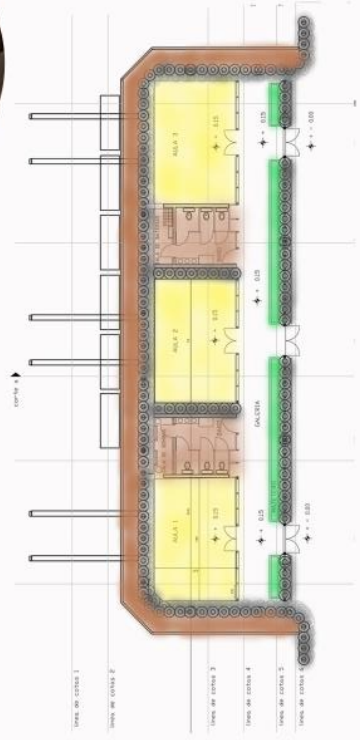
*Year of construction - 2016

*Area - 270 sq.mts

*Construction Time - 7 weeks (January – March 2016)

SPECIAL ANALYSIS:

*The Earthship, as Reynolds calls it, seeks to make the most of the energy of the sun, water, wind, and earth.



*The surroundings are sensitive to the orientations, opening to the north to make the most of light and solar energy through a wide glass corridor that acts as a distributor of the three classrooms and two wings of the school.

- *7 Principles of sustainability on which the building will be built:
1. The use of recycled materials
 2. Treatment of gray and black water
 3. Thermal conditioning
 4. Application of renewable energy sources
 5. Collection and purification of rainwater
 6. Organic food production, and
 7. The human factor



*To the south, the building is enclosed with a thick retaining wall made of roofs filled with sand and compacted gravel containing the sand and earth slope at the back of the building



*The north corridor, in turn, enables the production of food through an interior garden, projecting to the exterior a simple and forceful facade dominated by glass and wood.



CASE STUDY - SUSTAINABLE PUBLIC SCHOOL

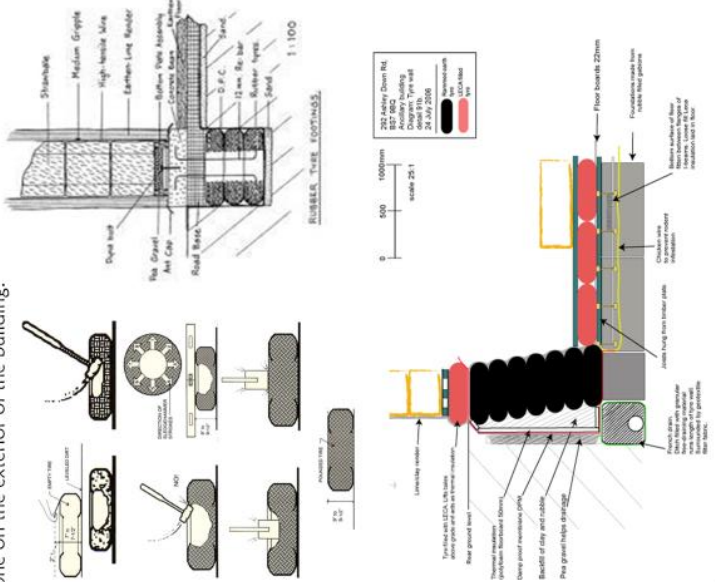
Plate 2.3: Study of sustainable public school

MODEL SCHOOL WITH AMCM

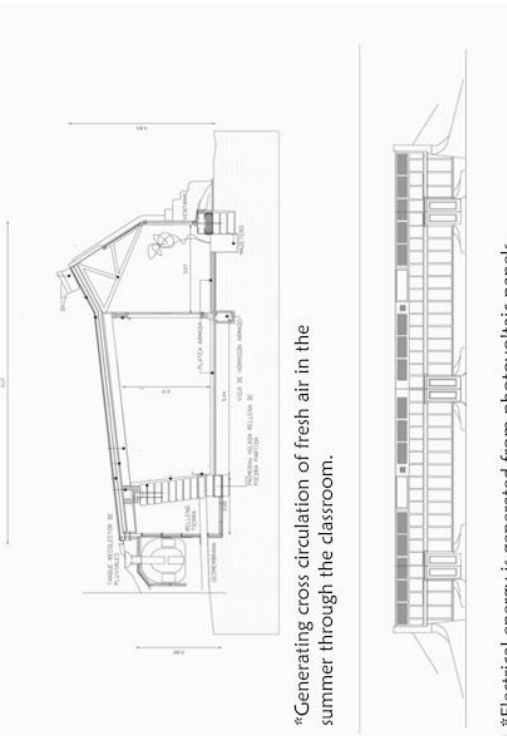
(Alternative materials and construction methods)

*Its construction is made up of approximately 60% recycled materials (covered with plastic and glass bottles, cans, cardboard) and 40% of traditional materials.

*The school also counts on a process of treatment of black water which includes a septic tank also created with recycled materials (in this case tractor coverings) and a wet zone on the exterior of the building.



*The sustainable school uses rainwater for human consumption in the sinks, irrigation of the vegetable gardens and finally to the cisterns.



*Generating cross circulation of fresh air in the summer through the classroom.

*Electrical energy is generated from photovoltaic panels and a central energy storage.

Plate 2.4: Study of sustainable public school

2.3 MANAVSADHNA ACTIVITY CENTER – AHMADABAD

Location - Ahmadabad

Architect - Yatin Pandya

Year - 2006

Area - 1100 sq.mts

Construction Time - one year (2005 – 2006)

2.3.1 SPACIAL ANALYSIS:

Manavsadhna has radial organization. Here all the spaces are tend to open at the central court. The courtyard acts as a multipurpose space where children dance and play various outdoor games and also cultural programmers will be conducted. Ahmadabad is a kind of hot and dry climate. All the spaces are oriented towards the windward direction facing the open court for the cross ventilation.

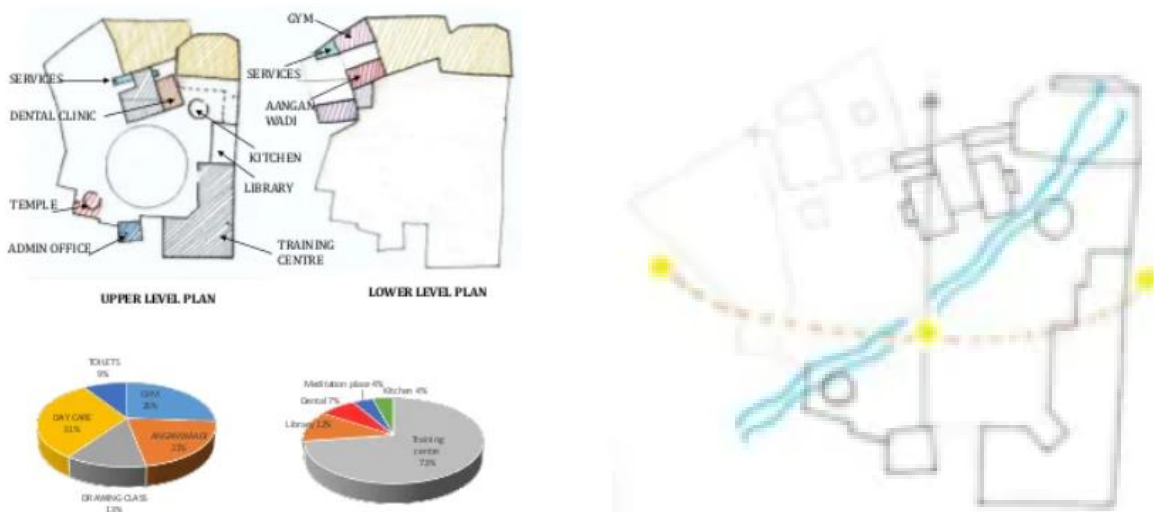


Fig 2.9(a),(b): Plan of Manavsadhna activity center

2.3.2 MATERIAL ANALYSIS:

Manavsadhna is constructed as a live demonstration for the application of recycled waste as affordable, aesthetically pleasing and efficient building components. Materials are of municipal/domestic waste and prepared with simple hand operated tools by the local people

These recycle materials include –

- cement bonded fly ash bricks,
- mold compressed bricks made from landfill site waste residue,
- Stabilized soil block,
- glass bottles,
- Plastic bottles filled with ash and waste residue,
- vegetable crate wood paneling in the inner
- partition walls

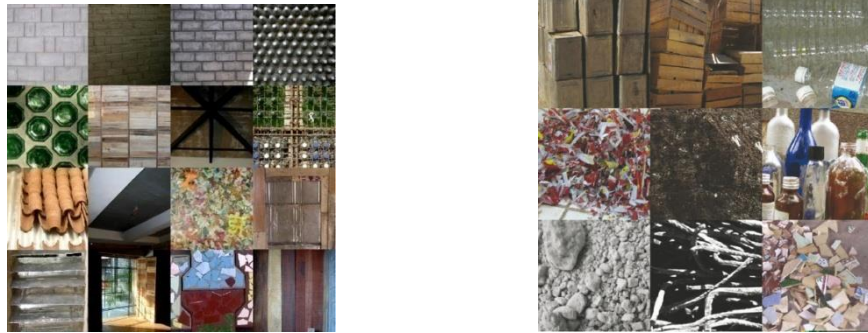


Fig 2.10(a),(b): Waste materials used in Manavsadhna activity center

For reinforcement coated paper waste and for door panels uses shredded packaging wrapper. Vegetable wood crates as frames for the interior partition walls and oil containers as blades make the ventilation louvers in the toilet.

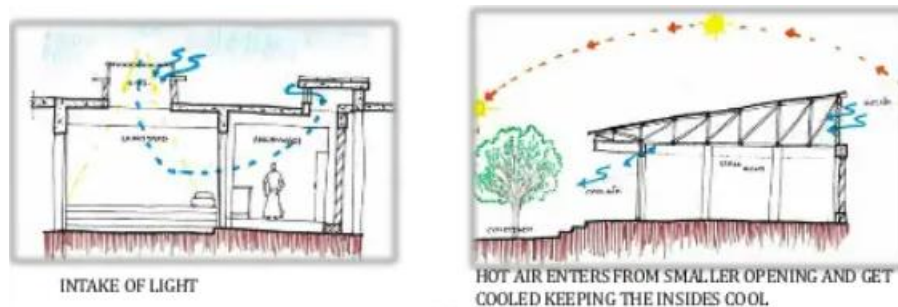


Fig 2.11: Climate analysis of Manavsadhna activity center

There are different types of waste materials and construction techniques used in making walls, and the roof and floor slabs are -

- Filler slab with glass bottles,
- Plastic bottles
- fly ash Bricks
- Stone slab
- Cement bonded particle clay tile cover
- Light conduit pipe truss with G.I. Sheet with clay tile roof

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

MANAVSADHNA ACTIVITY CENTER - AHMADABAD

*Location - Ahmadabad

*Architect - Yatin Pandya

*Year - 2006

*Area - 1100 sq.mts

*Construction Time - one year (2005 – 2006)

MATERIAL ANALYSIS:

*Manavsadhna is built as a live demonstration for the application of recycled waste as affordable, aesthetically pleasing and efficient building components

*Materials are municipal/domestic waste and prepared with simple hand operated tools

*These include –

- cement bonded fly ash bricks,
- mold compressed bricks made from landfill site waste residue,
- Stabilized soil block,
- glass bottles,
- Plastic bottles filled with ash and waste residue,
- vegetable crate wood paneling in the inner
- partition walls

*Door panels uses shredded packaging wrapper and coated paper waste as reinforcement.

*Vegetable wood crates as frames and oil containers as blades make the ventilation louvers in the toilet



Filler slab with glass bottles,



fly ash bricks



cd's



filler slab



plastic bottles



Vegetable wood crates as frames



*There are six types of waste materials and construction techniques used in making walls. The roof and floor slabs are includes

- Filler slab with glass bottles,
- Plastic bottles
- fly ash Bricks
- Stone slab
- Cement bonded particle clay tile cover
- Light conduit pipe truss with G.I. Sheet with clay tile roof



CASE STUDY - MANAVSADHNA ACTIVITY CENTER

<https://worldarchitecture.org/architecture-projects/ezmc/manavsadhna-activity-centre-project-pages.html>

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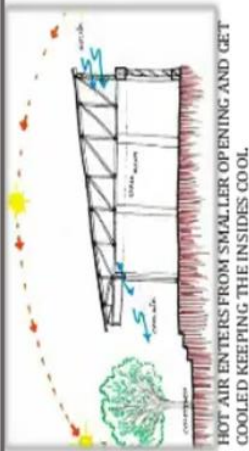
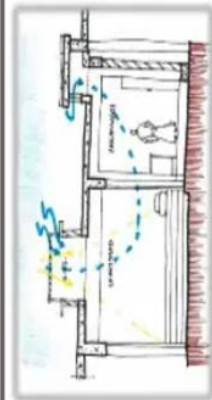


Plate 2.5: Study of manavsadhna activity center

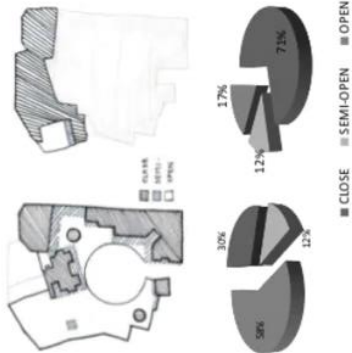
MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

Climate :

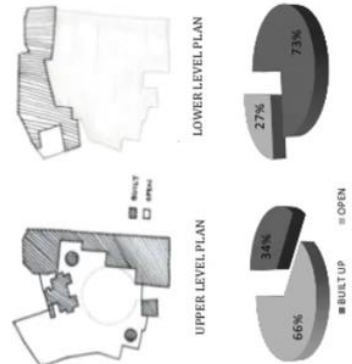
- *Ahmadabad has hot and dry climate
- *All the spaces are oriented towards the windward direction facing the open court for the cross ventilation



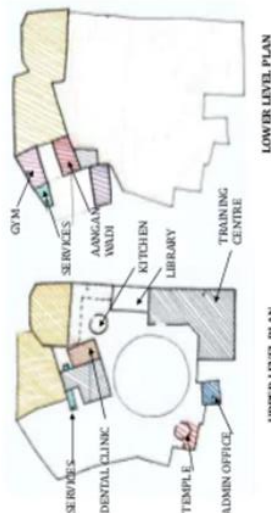
Built up space and open space :



Open, semi-open and closed spaces :



Design Programme :



Spatial organization :

- *Manavsadhna has radial organization
- *Here all the spaces are tend to open at the central court
- *The courtyard acts as a multipurpose space where children dance and play various outdoor games and also cultural programmes will be conducted



CASE STUDY - MANAVSADHNA ACTIVITY CENTER

Plate 2.6: Study of manavsadhna activity center

2.4 KADAPA PUBLIC SCHOOL – KADAPA

Location - Kadapa, India

Total site - 7562.75sq.m

Built up area - 1762.41sq.m

Building type- High School

completion – 2016

kadapa public school is located in T.Rama chandrapuram in kadapa town. The surroundings of the school are very calm with farming lands on the south and housing colony on the north. There are two existing roads on the west and south side of the site. There is only one internal road which divides the site into two parts. The school building is located at south and play ground is located on the north of the site In the front there is a fish pond and play area and toilets on the south west for primary class children and in the south east corner of the site for the higher class students

2.4.1 SPACIAL ANALYSIS:

They have separate play area for the preprimary, primary and secondary class students. In addition they have language lab, audio and visual lab and robotics lab for the students. There is a central courtyard which plays a major role in lighting and ventilation for the spaces of the building. The central courtyard is open to sky. It acts as a multipurpose space like indoor play area gatherings and also it has basket ball and tennis court for the students

Spaces in the ground floor are – Reception, waiting lounge, principal room, wise-principal room, admin office, preprimary class and primary class rooms, language lab, and math's lab, computer lab, audio and visual room, robotics lab, staff room, meeting hall, accounts room, girls toilets, boys toilets, staff toilets

*In they have separate play area for and secondary class students

*In addition they have language lab, audio and visual lab and robotics lab for the students

*The central courtyard is open to sky. It acts as a multipurpose space like indoor play area gatherings and also it has basketball and tennis court for the students

computer lab
audio and visual room
robotics lab
staff room
meeting hall
accounts room
girls toilets
boys toilets
staff toilets

Audio and visual room meetings and lectures will happen for all the students

Robotics lab students will play and learn with electronic items

vice principal room

Reception

18

MODEL SCHOOL WITH AMCM

(Alternative materials and construction methods)

*In first floor there is a physics lab, chemistry lab with all the facilities for the students for better understanding of the subject

*There is a mess hall for all the students. All students can have their lunch in the d

*Including pri-primary and primary class children will have their lunch here only

*There is no toilet facility in the first floor.

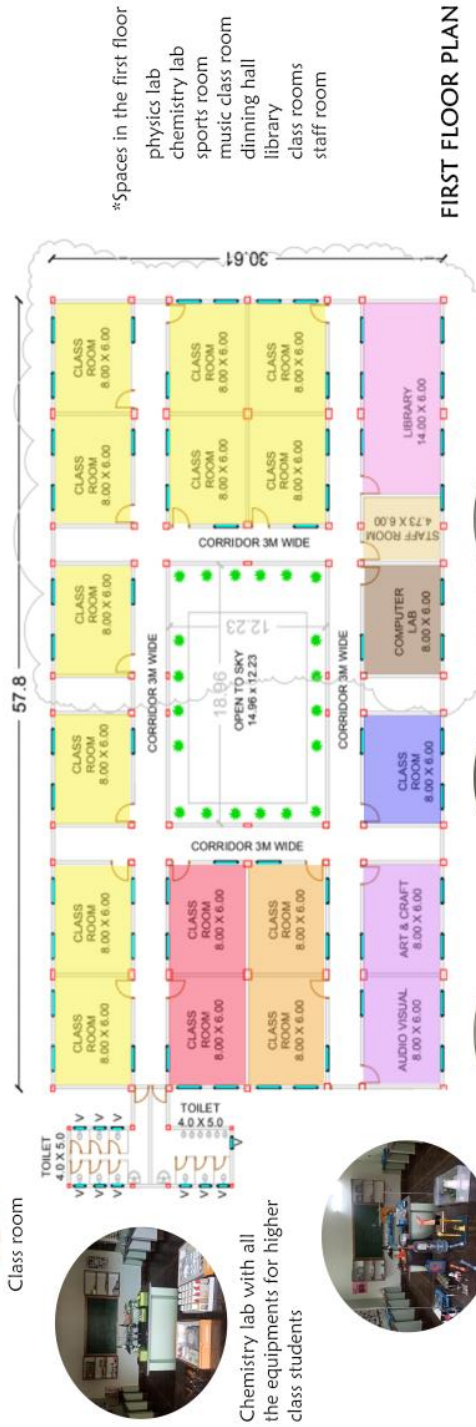
*The corridor width is 2.5m

*Staircase is located in the two opposite sides of the courtyard

*Electrical boards are located under the staircase

*Each class room has a projector

*Sports room also acts as a medical room as well



Physics lab higher class students

^aIn the first floor the south side is constructed newly in the plan of increasing class room as there is an increase in the students strength

Dinning hall

Sports room

Music class room

Plate 2.8: Study of kadapa public school

CHAPTER 3

DATA COLLECTION AND STANDARDS

3.1 REUSABLE MATERIALS NEAR THE SITE:

Waste materials like glass bottles, pet bottles, tires, and paper tubes can be used for construction. There are different types of construction techniques to use these materials in the construction.

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

MATERIALS

GLASS BOTTLES:

*Glass bottles can be reused after the primary use

*Glass bottles can be used in many ways.



PET BOTTLES:

*Pet bottles are plastic waste

*Pet bottles can be used for walls and other elements



Building a bottle wall

Bottles

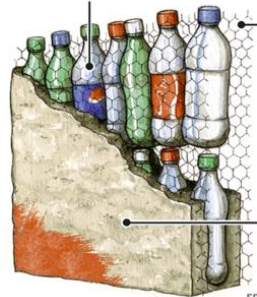
Students and volunteers stuff the plastic bottles with plastic bags and other insulating trash. More bags fill in the gaps between bottles.

Chicken wire

The bottles were bound between layers of chicken wire, which are attached to a metal frame.

Concrete

Up to three layers of cement mixed with sand were applied to the outside of the bottles, with orange paint adding the finishing touch.



ERIC BAKER/THE OREGONIAN

Pet bottle wall construction:

The empty plastic bottles are filled with dry sand or construction waste

The filled plastic bottles are placed like a row of block or brick

Gaps in between the bottles are filled with rubble and cement to form a solid wall

The bottles are aligned in straight or curve lines with the help of a twin tied around the neck of the bottles when laid



MATERIAL STUDY

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2017-2022 (THESIS)

11



Plate 3.1: Study of materials

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

LOCALLY AVAILABLE WASTE MATERIALS

Kadappa stone (cut pieces) -

- * Kadappa black stone is hugely popular for its optimum quality. It is available in large quantities and at pocket friendly prices. It is available in both Polished as well as Natural form.
- * Natural Kadappa Black stone are used for flooring and foundation purposes as the stone is more resistant than most other sedimentary rocks.
- * Kadappa black lime stone is a flooring stone available in different sizes and finishes
- * Black Kadappa Polished Stone, 25-40 Mm. ₹ 18 / Square Feet and Thickness: 20-60mm. ₹ 45 / Square Feet
- * Kadappa stone pieces are the highest waste generated in this tadipathri area. Tadipathri is the hub for the stone and granite production. There are nearly 500 granatine factories in tadipathri
- * Kadappa stone can be used for foundation, compound walls, exterior walls, flooring, road walk ways cupboards, exterior sitting spaces, sewage tank



*Every week there will be around 5 tractor load of waste will be generated
*In that there will be approximately 60% of small pieces and 40% will be of big pieces



compound wall
Roads and walk ways

Granite stone -

- *This granite stones are the left over piece which can not be cut further
- *These pieces can be used for the foundation
- *Can break into small pieces and use for the construction of sewage tank



Tati Tirtu / Tati Dantalu -

- * Tati tirtu are from palm tree. The palm tree is cut and used for roofs
- * Palm trees are regularly used as constructive building material for house walls, rafters and roofing.
- * palms are easiest and best material to work with.
- * Palm tree wood is used in several small scale areas, where palm trees are common and the infrastructure for small scale mass production is available.



MATERIAL STUDY

Plate 3.2: Study of materials

3.2 STANDARDS:

Municipal Administration and Urban Development Department - Model Building Bye-Laws 2016 of GoI – Andhra Pradesh Building Rules, 2017 – Orders – Issued.	
For non-residential plots above 3000 sqm	
For institutional buildings above 750sq.m, 5% to be developed as open space	
For buildings beyond 300sq.m, 1m planting strip on peripheries must be maintained	
In case of plots above 750sq.m, it is permitted to transfer up to 2m of setback from any one side to any other side without exceeding overall permissible plinth area, subject to maintaining of a minimum 2.5m setback on other side and a minimum building line. The transfer of setback from front setback is not allowed.	
Main entrance to the premises shall be of adequate width to allow easy access to the fire tender and in no case it shall measure less than 6m	
For buildings with above 15m in height (excluding stilt floor) the minimum dimension of the internal courtyard shall be with an area of not less than 25sq.m and no side shall be less than 3m in width	
No portion of a room shall be assumed to be lighted if it is more than 7.50m from the opening assumed for lighting that portion	
Size of ventilation shaft 4sq.m with of 1.5m	
Watch and ward cabins of area not more than 45sq.m at the entry point	

Fig 3.1: Andhra Pradesh building rules, 2017

Minimum Width Provisions for Stairways		
S. No.	Type of Building	Minimum width for each stairway (m)
(A)	(B)	(C)
1	Residential Non High Rise Buildings	1.00
2	Other Residential Buildings e.g. Apartments, Hostels, Group Housing, Guest Houses, etc.	1.25
3	Educational Buildings like Schools, Colleges	1.50
4	All other buildings including Hotels, Nursing Homes etc.	1.50
5	Institutional Buildings like Hospitals etc.	2.00
6	Assembly Buildings like Auditoria, Theatres and Cinemas	2.00

Parking Area to be provided in All Buildings			
Sl. No.	Category of building/activity	Parking area to be provided as percentage of total built up area	
		Municipal Corporations & Selection Grade, Special Grade Municipalities	First Grade, Second Grade Municipalities, Nagar Panchayats and Gram Panchayats in Master Plan areas and in Development Authority Areas
(A)	(B)	(C)	(D)
1	Multiplexes	60	50
2	Information Technology Enabling Services Complexes, Shopping Malls (above 4000sq. m).	50	40
3	Business buildings, Cinema halls, Hotels, Kalyana Mandapams, Lodges, Offices, Other Commercial buildings, Restaurants & High-Rise Buildings / Complexes of Non Residential Category	30	25
4	Colleges, Godowns, Hospitals, Industrial buildings, Institutional buildings, Residential Apartment Complexes, Schools, Educational Buildings & Other Buildings	20	20

Fig – 3.2(a),(b): Staircase and Parking area percentage

Sl. No.	Plot Size (in Sqm) Above – Up to	Parking provision	Height (in m) Permissible Up to	Building Line or Minimum Front Setback to be left (in m)					Minimum setbacks on remaining sides (in m)
				Abutting Road Width					
				Up to 12 m	Above 12m & up to 18m	Above 18m & up to 24 m	Above 24m & up to 30m	Above 30m	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
11	Above 2500	Stilt + 2 or more Cellar floors	7	3	4	5	6	7.5	5.0
			15	3	4	5	6	7.5	6.0
			18**	3	4	5	6	7.5	7.0

Fig 3.3: Minimum setback standards

3.3 Ramps:

(a) Ramps shall not be allowed in the mandatory setbacks including building line, however ramps may be permitted in the side and rear setbacks after leaving minimum 7m of setback for movement of the fire-fighting vehicles.

(b) The ramps to basement and parking floors shall be with at least two ramps each with a minimum of 3.6m wide or one ramp with a minimum of 5.4m wide, provided with gradient of 1:8 for cars and 1:15 for heavy vehicles. At curved portions of the ramp the slope should not be more than 1:12.

3.4 Corridors:

(a) Exit corridors and passageways shall be of width not less than the aggregate required width of exit doorways leading from them in the direction of travel to the exterior.

(b) The minimum width of a corridor in a residential building shall be 1.2m for single loaded and 2.0m for double loaded and in all other buildings shall be 1.5m.

(c) Where stairways discharge through corridors and passageways, the height of corridors and passageways shall be not less than 2.4m.

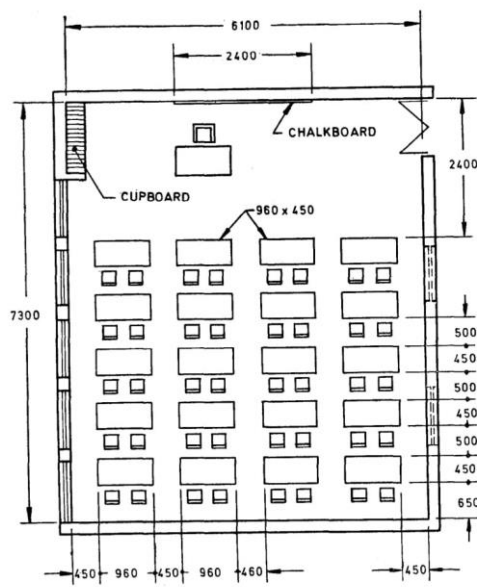
3.5 Pathways:

(a) Public walks should be at least 1200mm wide and should have a gradient not greater than 1 in 20

(b) A walk shall have a level platform at the top which is at least 1500mm long, if a door swings out onto the platform or towards the walk. This platform shall extend at least 300mm beyond each side of the doorway.

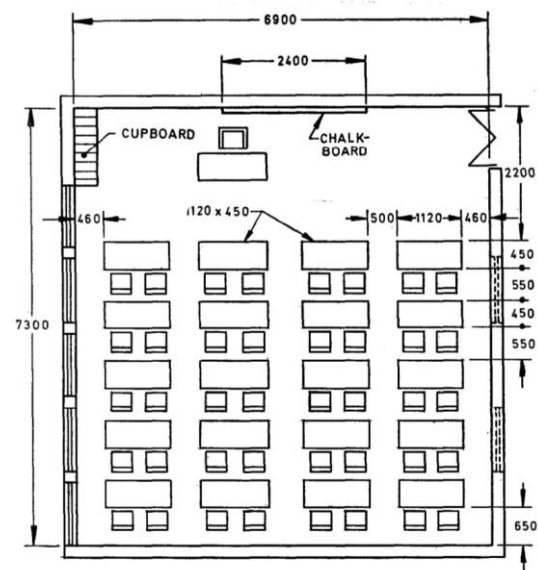
(c) A walk shall have a level platform at least 900 mm deep, if the door does not swing onto the platform or towards the walk. This platform shall extend at least 300 mm beyond each side of the doorway.

3.6 Class room:



All dimensions in millimetres.

FIG. 1 TYPICAL ILLUSTRATION OF A PRIMARY CLASSROOM



All dimensions in millimetres.

FIG. 2 TYPICAL ILLUSTRATION OF A SECONDARY/HIGHER SECONDARY CLASSROOM

Fig 3.4(a),(b): Primary and Secondary class room standard layout

3.7 Laboratories:

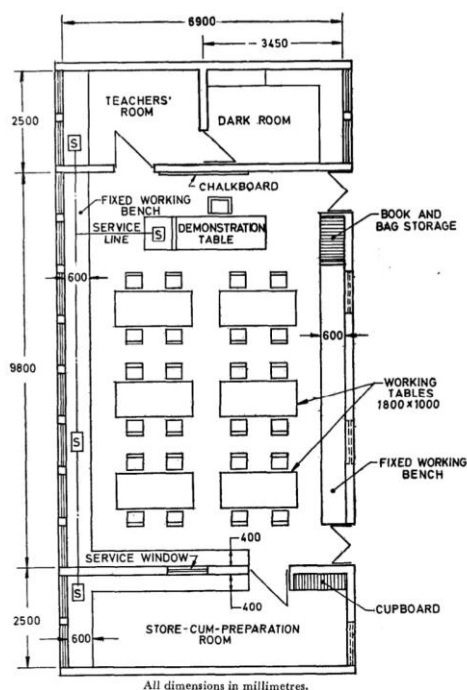


FIG. 6 TYPICAL ILLUSTRATION OF A PHYSICS LABORATORY

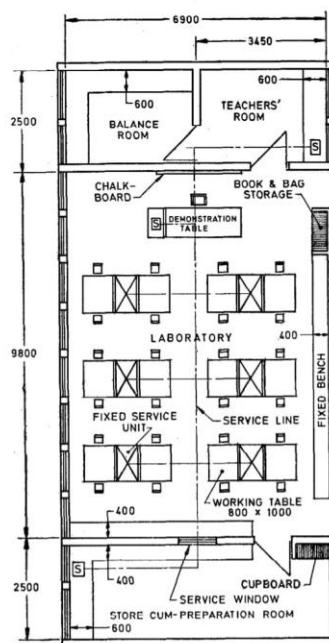


FIG. 7 TYPICAL ILLUSTRATION OF A CHEMISTRY LABORATORY

Fig 3.5(a),(b): Physics and Chemistry lab standard layout

3.8 Sanitary fittings:

TABLE 9 SANITARY FITTINGS FOR SCHOOLS				
(Clause 16.2)				
Sl. No.	FITMENTS	PRE-SCHOOLS	SCHOOLS OTHER THAN PRE-SCHOOLS	
			For Boys	For Girls
(1)	(2)	(3)	(4)	(5)
1.	Water-closets	1 per 15 pupils or part thereof	1 per 40 pupils or part thereof	1 per 40 pupils or part thereof
2.	Ablution taps	1 in each water-closet 1 water tap with draining arrangements shall be provided for every 50 pupils or part thereof in the vicinity of water-closets and urinals	1 per 30 members of staff or part thereof	1 in each water-closet
3.	Urinals	—	1 per 20 pupils or part thereof	Squatting plate urinals 1 per 20 pupils or part thereof
4.	Wash basins	1 per 15 pupils or part thereof	1 per 40 pupils or part thereof	1 per 40 pupils or part thereof
5.	Baths	1 bath-sink per 40 pupils or part thereof	1 per 30 members of staff or part thereof	—
6.	Drinking water fountains	—	1 for every 50 pupils or part thereof	—
7.	Cleaner's sink	—	1 per floor, Min	—

Fig 3.6: Sanitary fittings for school

CHAPTER 4

SITE STUDY AND ANALYSIS

4.1 SITE STUDY:

Site is located in a village Talla Proddaturu. Site is in the center of the village on the highway road. Total site is 33,081sq.m

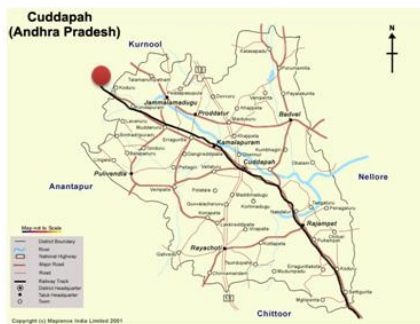


Fig 4.1(a): Andhra Pradesh state map



Fig 4.1(b): Talla Proddatur village map

4.2 SITE JUSTIFICATION AND FEASIBILITY:

Site is located in the center of the village on the main road so it will be easy for other village students to come to school. The surroundings of the site is residential area. There is a bus stop opposite to the site.



Fig 4.2(a),(b): Site view

4.3 SITE ANALYSIS:

4.3.1 Neighborhood Context:

Site has three side road axes. One is main highway road and other two are street roads. There is a healthcare center to the west at a distance of 200 meters. Opposite to the site there are some commercial shops. In the east there are electrical lines throughout the street road

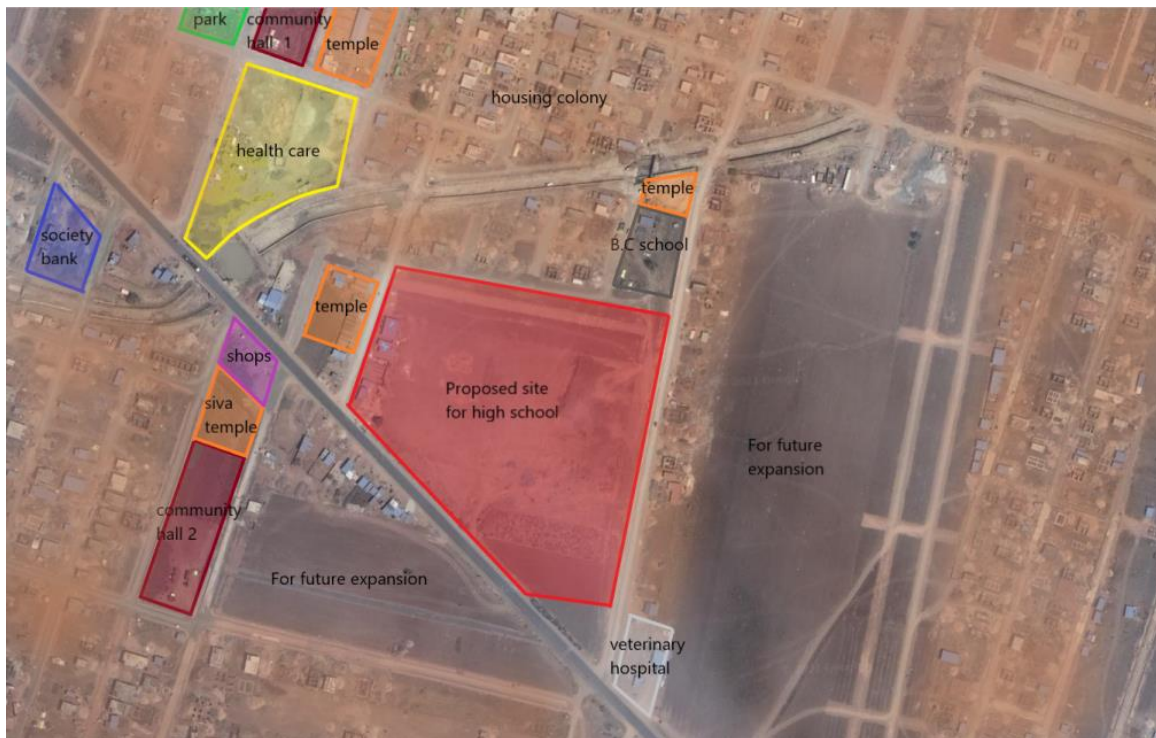


Fig 4.3: Talla Proddatur village satellite map

4.3.2 Site and Zoning:

Setbacks – South (Front) - 3m
East - 6m
West - 6m
North - 6m

Height restriction - 15m

Parking - 20% of the site
- 1,654.05sq.m

4.3.3 Circulation:

Site has three sides road access. Bus stop is opposite to the site at a distance of 14m. Service trucks can be accessed from the main road. The nearest railway stations are Kondapuram at a distance of 14km (21min) and Tadipathri at a distance of 19.8km (32min)



Fig 4.4(a),(b): Site neighborhood view

4.3.4 Man Made Features:

There are no man made features in the site. Power poles are throughout the road in the east side. There are residential buildings in the east and north and there is a health care in the west side



Fig 4.4(c),(d): Site neighborhood view

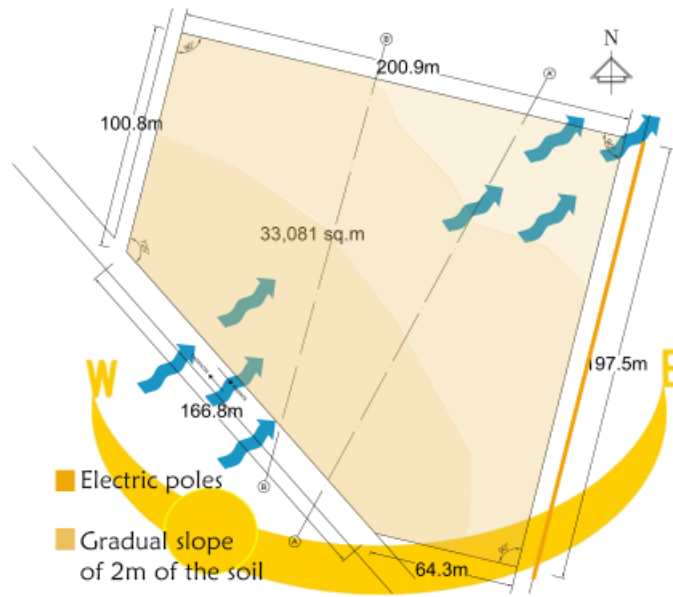


Fig 4.5(a): Site analysis plan and section

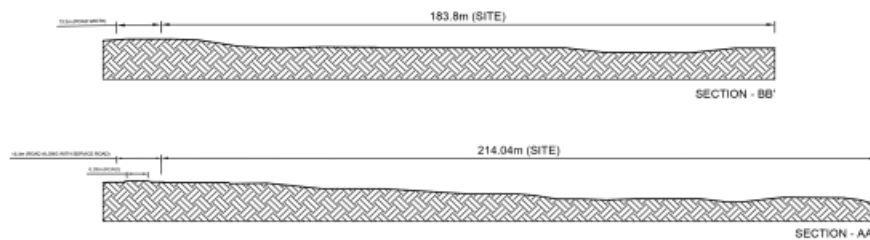


Fig 4.5(b): Site analysis plan and section

4.3.5 Natural Physical Features:

Site has a natural slope of 2m for the distance of 214.04m. Drainage pattern follows the slope to the east side of the site. Soil type is Black cotton soil

4.3.6 Climate of Andhra Pradesh:

Climate of Andhra Pradesh falls under warm and humid. My site is located in Rayalaseema region here the temperature is more and humidity will be less

Climate

*Average Rainfall - 94.2mm
minimum - 3mm
maximum - 133mm

*Rainy days minimum - 1day
maximum - 13days

*Average Humidity - 67%
lowest - 36%
highest - 70%

*Average Wind speed - 13km/h

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	24.6 °C (76.3) °F	27 °C (80.6) °F	30.3 °C (86.5) °F	32.7 °C (90.9) °F	33.1 °C (91.6) °F	29.2 °C (84.6) °F	27.5 °C (81.5) °F	26.9 °C (80.4) °F	26.9 °C (80.5) °F	26.6 °C (79.9) °F	25.5 °C (77.9) °F	24.3 °C (75.8) °F
Min. Temperature °C (°F)	18.4 °C (65.2) °F	20.3 °C (68.6) °F	23.5 °C (74.2) °F	26.5 °C (79.6) °F	27.7 °C (81.9) °F	25.4 °C (77.8) °F	24.4 °C (75.8) °F	23.9 °C (75) °F	23.6 °C (74.4) °F	22.4 °C (72.3) °F	20.3 °C (68.6) °F	18.5 °C (65.4) °F
Max. Temperature °C (°F)	31 °C (87.8) °F	33.8 °C (92.9) °F	37 °C (96.6) °F	39 °C (102.2) °F	38.9 °C (102.1) °F	34 °C (93.1) °F	31.6 °C (88.9) °F	30.6 °C (87.2) °F	30.9 °C (87.7) °F	31.2 °C (88.2) °F	30.8 °C (87.5) °F	30.4 °C (86.6) °F
Precipitation / Rainfall mm (in)	5 (0.2)	3 (0.1)	9 (0.4)	12 (0.5)	38 (1.5)	103 (4.1)	122 (4.8)	133 (5.2)	126 (5)	120 (4.7)	33 (1.3)	9 (0.4)
Humidity(%)	49%	41%	36%	37%	40%	60%	66%	69%	70%	67%	59%	54%
Rainy days (d)	1	0	1	2	5	11	13	12	11	9	4	1
avg. Sun hours (hours)	9.4	10.5	10.6	11.1	11.3	9.4	8.4	8.0	8.1	8.8	8.6	8.8

*Average Temperature - 29°C
lowest - 18.4°C
highest - 39°C

*Average sun hours - 8.8hours
lowest - 8.0hours
highest - 11.3hours

Fig 4.6: Climatic data of Andhra Pradesh

CHAPTER 5

ARCHITECTURAL DESIGN

5.1 SPATIAL REQUIREMENTS

ADMINISTRATION	NUMBERS	TOTAL AREA	PRIMARY SCHOOL	NUMBERS	TOTAL AREA	SECONDARY SCHOOL	NUMBERS	TOTAL AREA
entrance lounge/reception	1	22.7	nursery class room	2	162	class 6,7	4	324
waiting area	2	137.8	play area	2	60	class 8,9,10	6	486
admission room	1	20	class 1,2	4	324	staff room	2	120
incharge room	1	20.5	class 3,4,5	6	486	library	1	272
accounts room	1	20.5	EVS laboratory	1	81	EVS laboratory	2	200
Examination cell	1	37.5	staff room	2	120	maths laboratory	2	120
vice-principal office	1	25	girls rest room	2	60	physics laboratory	2	240
principal office	1	30	boys rest room	2	60	chemistry laboratory	2	240
board room	1	20	total		1353	computer laboratory	2	250
service room	1	20				biology laboratory	2	200
staff lounge	1	37.5	OTHERS	NUMBERS	TOTAL AREA	locker room	1	60
lecture room	1	96	indoor games	1	300	workshop space	4	81
gents rest room	1	20	art room	2	120	sports room	1	135
ladies rest room	1	20	music room	2	120	medical room	1	81
Multipurpose hall	1	230	home science	1	60	stationary room	1	40
total		807.5	language room	1	75	activities room	1	81
			audio and visual room	2	60	girls rest room	2	60
OTHERS	NUMBERS	TOTAL AREA	club activities room	1	150	boys rest room	2	60
kitchen	1	400	total		1185	total		3050

Fig 5.1: Area requirements

5.2 CONCEPT

5.2.1 Strategies can be followed at site level:

(a) Orientation -

The built forms longer facades can be oriented facing the east and west directions. The east and north side orientations can have the larger window open it helps in avoiding the direct exposure to sunlight and also allows the interior to receive ample amounts of indirect natural light and help preventing solar heat gain

(b) Built form -

More scattered open and closed volumes can be planned and more open courtyards and buffer spaces can be created. The organic and curved building forms of the building leads to reduced surface volume ratios towards the East and West directions and thereby reduces the solar heat gain



Fig 5.2: Site view

(c) Mutual shading -

Mutual shading by placing and planning the building such that they share each other from the her son can help in reducing the heat gain



Fig 5.3: View of mutual shading of buildings

(d) Vegetation -

Vegetation and landscaping can play a major role in changing the microclimate of a site and can lower the temperature vegetation can also be used to prevent and protect INS the undesirable winds and solar radiation

(e) Wind channeling and buffer spaces -

Buffer spaces open gardens and courtyards can be provided to channel and bring in good Breeze and wind into the building



Fig 5.4: View of walkway and greenery

5.2.2 Passive design strategies:

(a) Courtyard effect –

Courtyard can be microclimate modifier and controller it helps in evaporative cooling and increase of heat loss through ventilation. Usually open to the sky. The heat transfer that takes place within a courtyard is affected greatly by - the Airflow, thermal mass, solar radiation. Due to the incident solar radiation in the courtyard the air in it becomes warmer and rises up to replace it cool air from the ground level floors the rough the louvered openings of the room the producing the air flow

(b) Passive air conditioning system –

Allowing natural ventilation and day lighting through proper implementation can help in achieving passive air conditioning. Techniques stack ventilation can also be implemented to avoid the use and consumption of mechanical air conditioning system

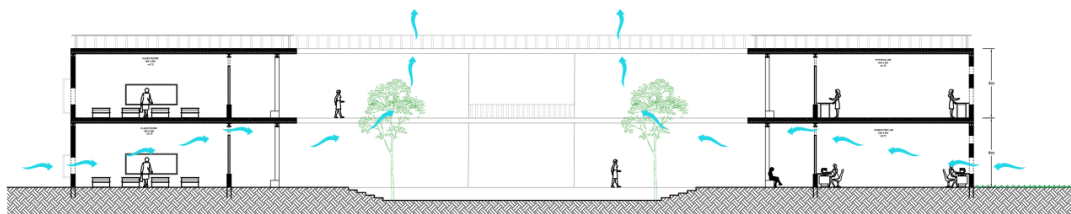


Fig 5.5: Passive air conditioning system

(c) Green roofing systems –

These are roofs covered with vegetation and soil and also functions by providing shading, insulation, evapotranspiration, and acts as thermal mass

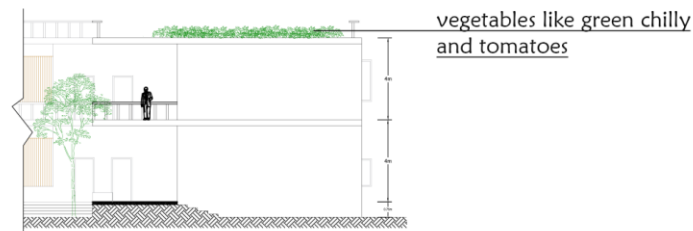


Fig 5.6: Green roofing system

(d) Passive downdraft evaporative cooling –

These systems catch the wind present at higher levels and cool the air down using the evaporative devices and direct the cooler air into the space

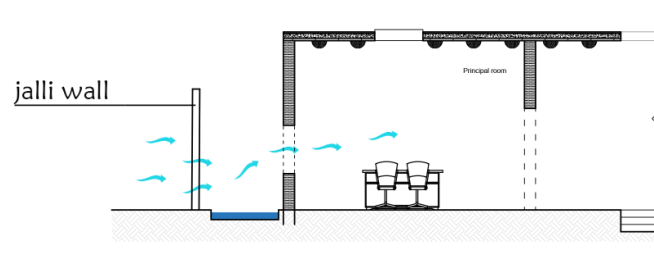


Fig 5.7: Passive down draft evaporative cooling

5.2.3 Concepts at site level:

For the primary school children, have designed a sand play area with a tire wall for play time

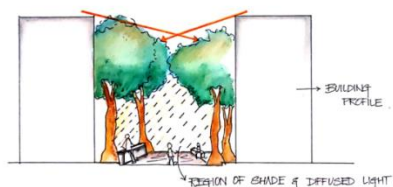


Fig 5.8(a): Mutual shading by trees



Fig 5.8(b): Sand play area

At the dinning area outdoor dinning is also designed in such a way that the children can have their lunch and watch the game from any direction



Fig 5.8(c): Outdoor sitting at the dinning

Each and every block is connected with a common gathering space which place a major role in the school



Fig 5.8(d): Gathering spaces

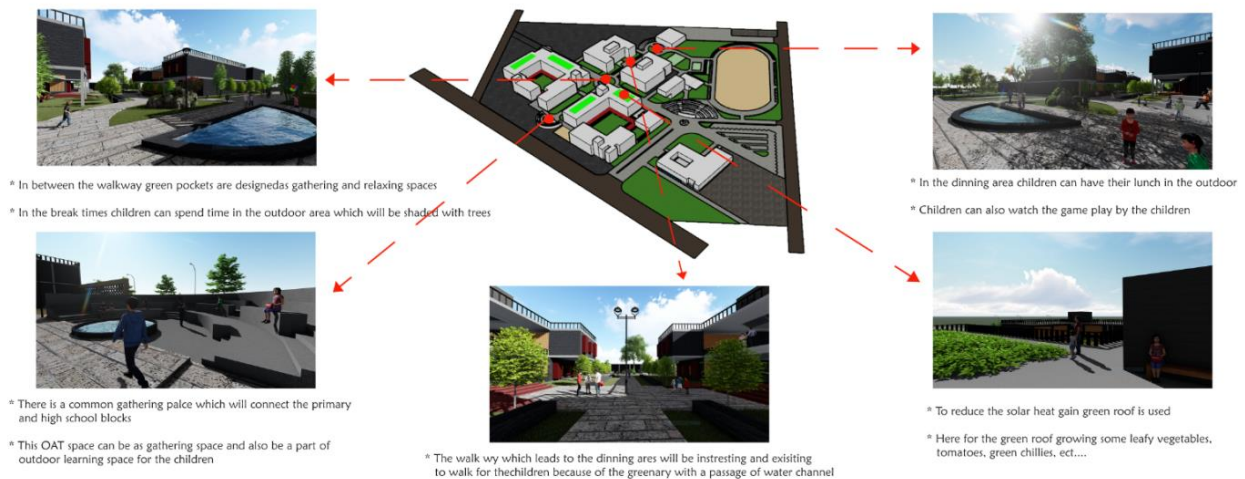


Fig 5.9: Concepts used in site

5.2.4 Materials and construction techniques:

(a) Wall system -

For exterior wall the construction is with kadapa stone and for interior wall have used combination of kadapa stone and paper tube. Paper tubes are of 100mm thick and filled with lime motor. For joints in Kadapa stone wall lime motor is used. Lime motor is a combination of lime + kadukai jagari.

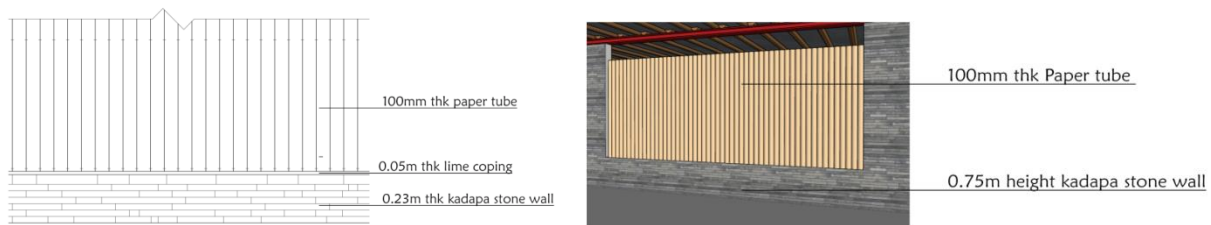


Fig 5.10(a),(b): Construction of wall system

(b) Flooring system -

For flooring have gone for red oxide flooring which will reduce the structural load and will be more economical and astatically pleasing

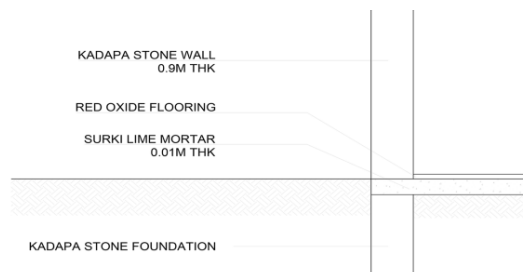


Fig 5.11: Construction of flooring system

(c) Roof system –

This roof is a combination of palm tree rafters, kadapa stone, surki lime motor. Palm tree rafters are supported on I - section beams, on top of that 20mm kadapa stones are laid and filled with surki lime motor (kadapa stone pieces + lime + sand)

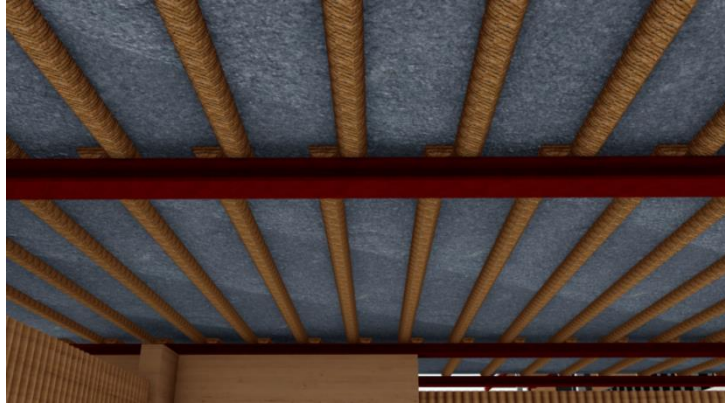


Fig 5.12(a): Construction of roof system

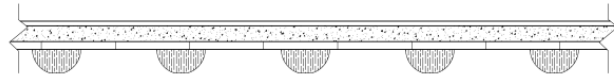
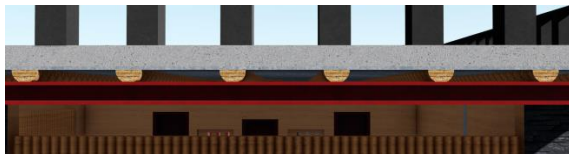


Fig – 5.12(b),(C): Construction of roof system

Surki lime mortar ratio - 1 : 1/2 : 3
lime : sand : surki

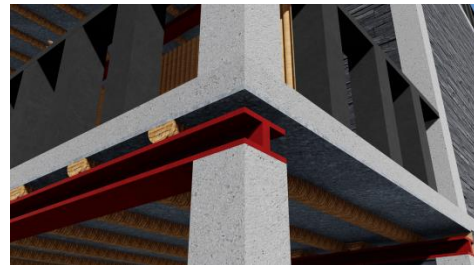
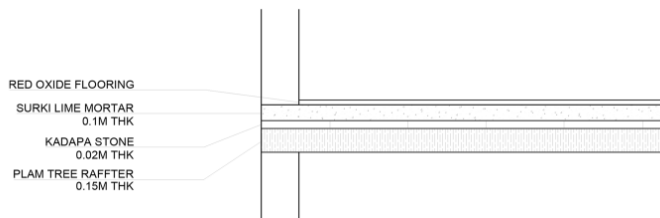


Fig 5.12(d),(e): Construction of roof system

(d) Foundation –

For foundation waste granite and kadapa stone pieces can be used. The wastage is generated from the cutting of granite and kadapa stone



Fig 5.13(a),(b),(c): Foundation materials

(e) Cupboards –

For cup boards ferro cement was used.

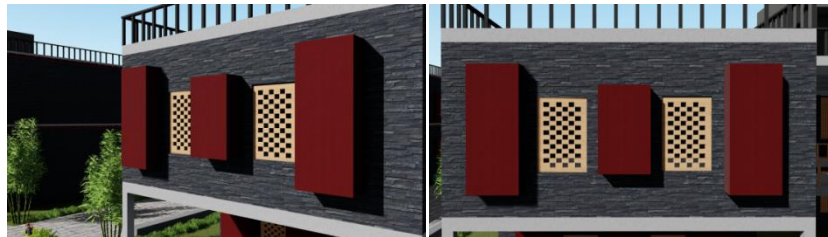


Fig 5.14: Construction of cupboards

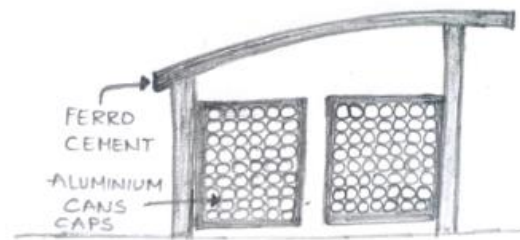
In rest rooms wash basins can be used tires and for doors FRP (fiber reinforced plastic) can be used.



Fig 5.15(a): Material detailing



Play wall for pri-primary and primary children at their play area



Entrance gate with aluminium can caps and ferro cement

Fig 5.15(b),(c): Material detailing

5.3 DETAILED DRAWINGS

5.3.1 Site plan:



Fig 5.16: Site plan, section and elevation



Fig 5.17(a),(b): Pedestrian entrance to the site



Fig 5.18(a),(b): OAT and notice board wall

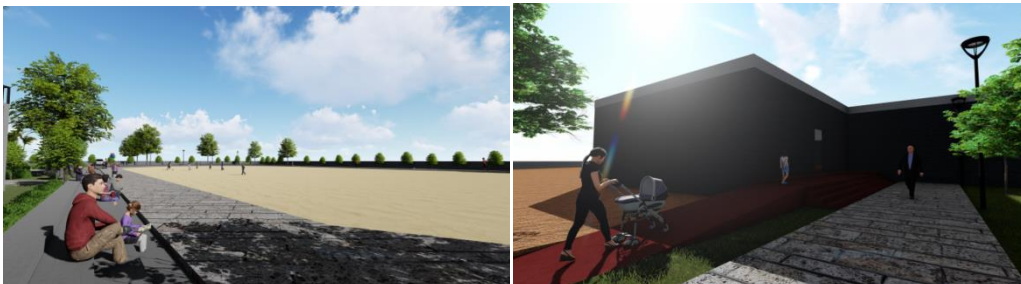
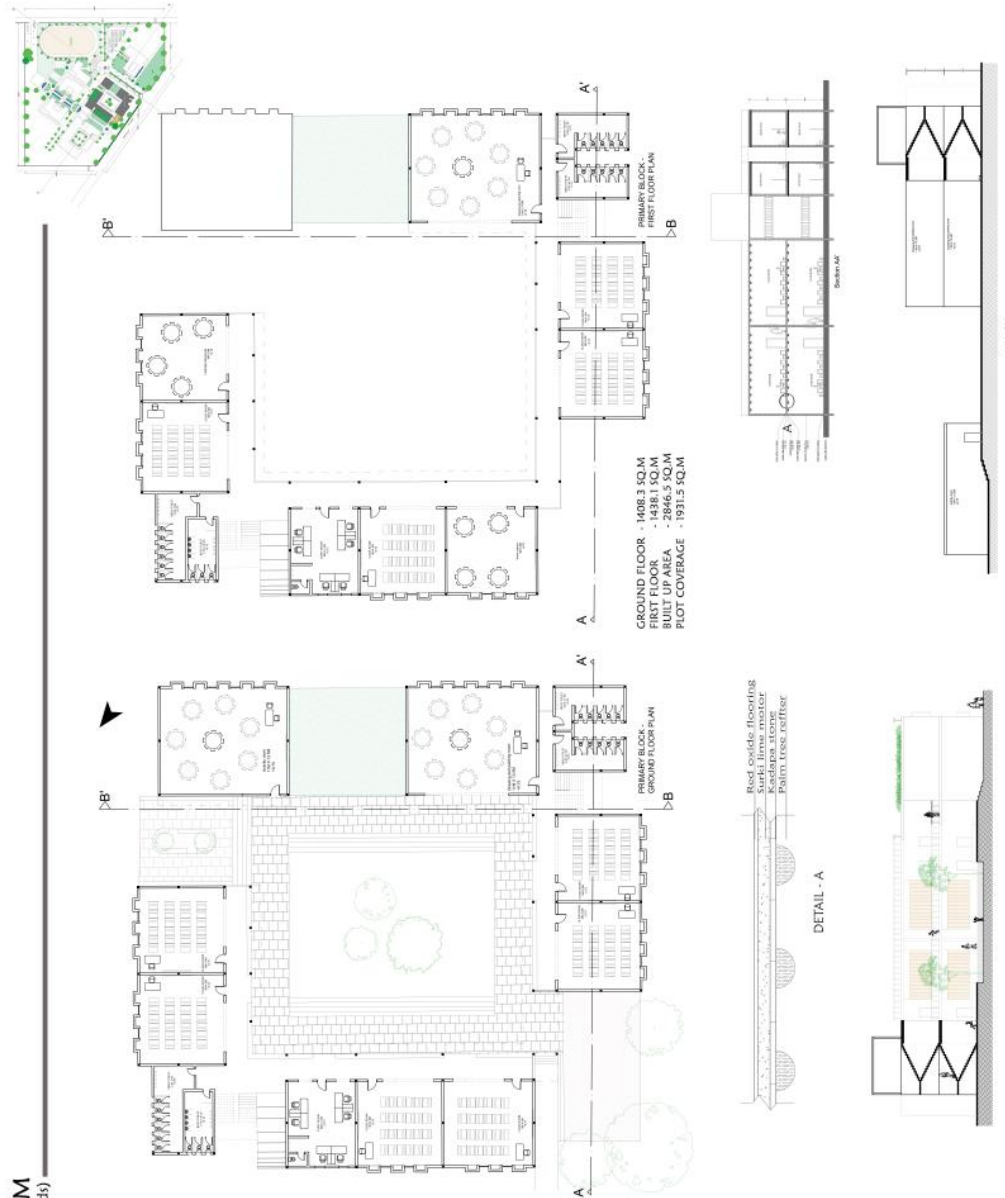
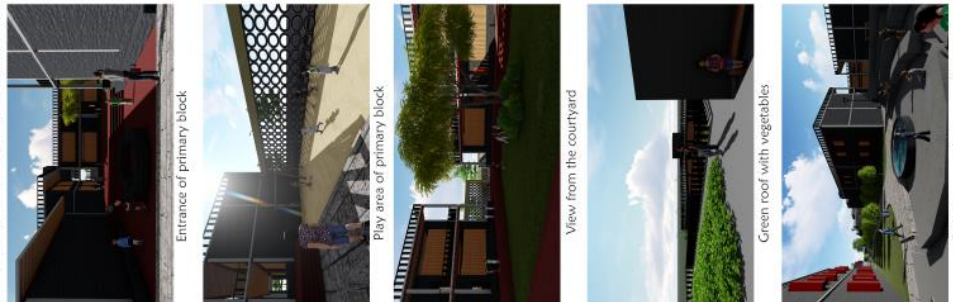


Fig 5.19(a),(b): Play ground and Multipurpose hall



Fig 5.20(a),(b): Parking area beside the administration office

MODEL SCHOOL WITH AMCM
(Alternative materials and construction methods)



SCALE - 1:100

GRANDHE SAI NAGA RISHITHA
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2017-2022 (THESIS)

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ARCHITECTURAL DRAWING - BLOCK 1 (PRI - PRIMARY SCHOOL)



Plate 5.1: Pri primary school



Fig 5.21(a),(b): Block – 1 (Pri primary school)

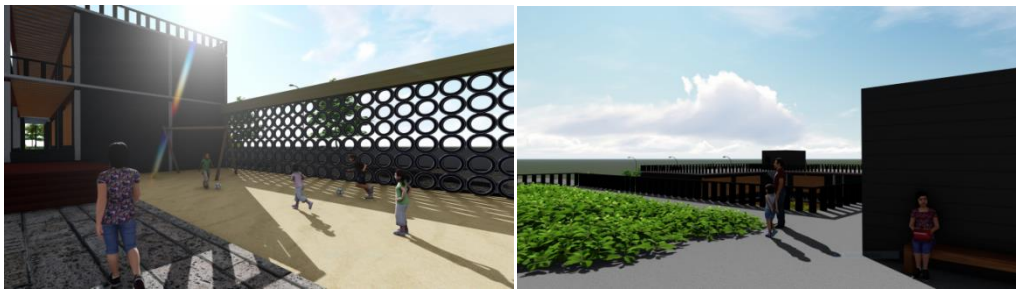


Fig 5.22(a),(b): Sand play area and Green roofing system

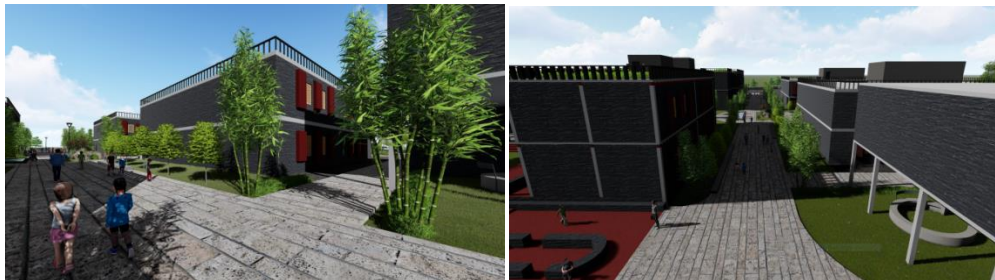


Fig 5.23(a),(b): View of the high school block from the pri primary block

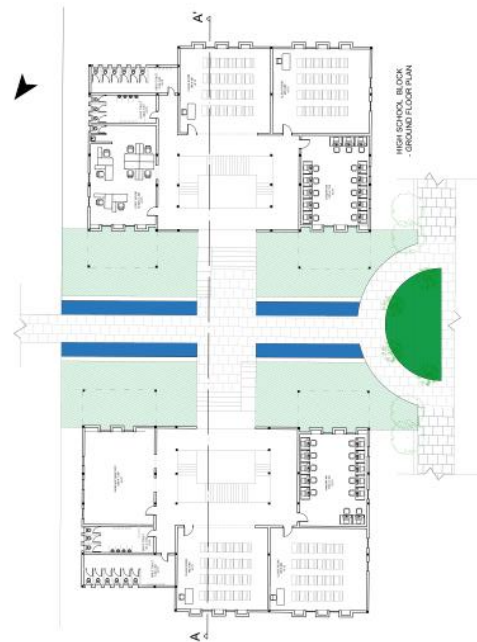


Fig 5.24(a),(b): View of the block 2 from the walk way

MODEL SCHOOL WITH AMCM

Alternative materials and construction methods

The architectural drawings include a site plan at the top left showing the school's location within a larger campus. The main floor plan is a detailed cross-section showing various rooms such as classrooms, a library, a cafeteria, and administrative offices. It also includes a north arrow and a scale bar. To the right of the floor plan are two elevations: the 'WEST ELEVATION' and the 'EAST ELEVATION'. The west elevation shows a long, low building with a series of windows and a central entrance. The east elevation shows a similar building with a different facade. The drawings are rendered in a clean, professional style with a color palette of blue, green, and grey.



The floor plan shows a symmetrical layout. On the left side, there is a large room with several circular tables and chairs, and a smaller room with a wavy pattern. On the right side, there is a large room with several circular tables and chairs, and a smaller room with a wavy pattern. In the center, there is a large open area with a staircase and a central column. At the bottom, there are two long rows of rectangular tables and chairs, and a central area with a staircase and a central column. The plan is labeled 'A' at the bottom center.

SCALE - 1:100



Walkway leads to dining in between the buildings



View of the building from the gathering space



Front elevation of the building



View from the opposite building



View of the building from the primary block

MODEL SCHOOL WITH AMCM (Alternative materials and construction methods)

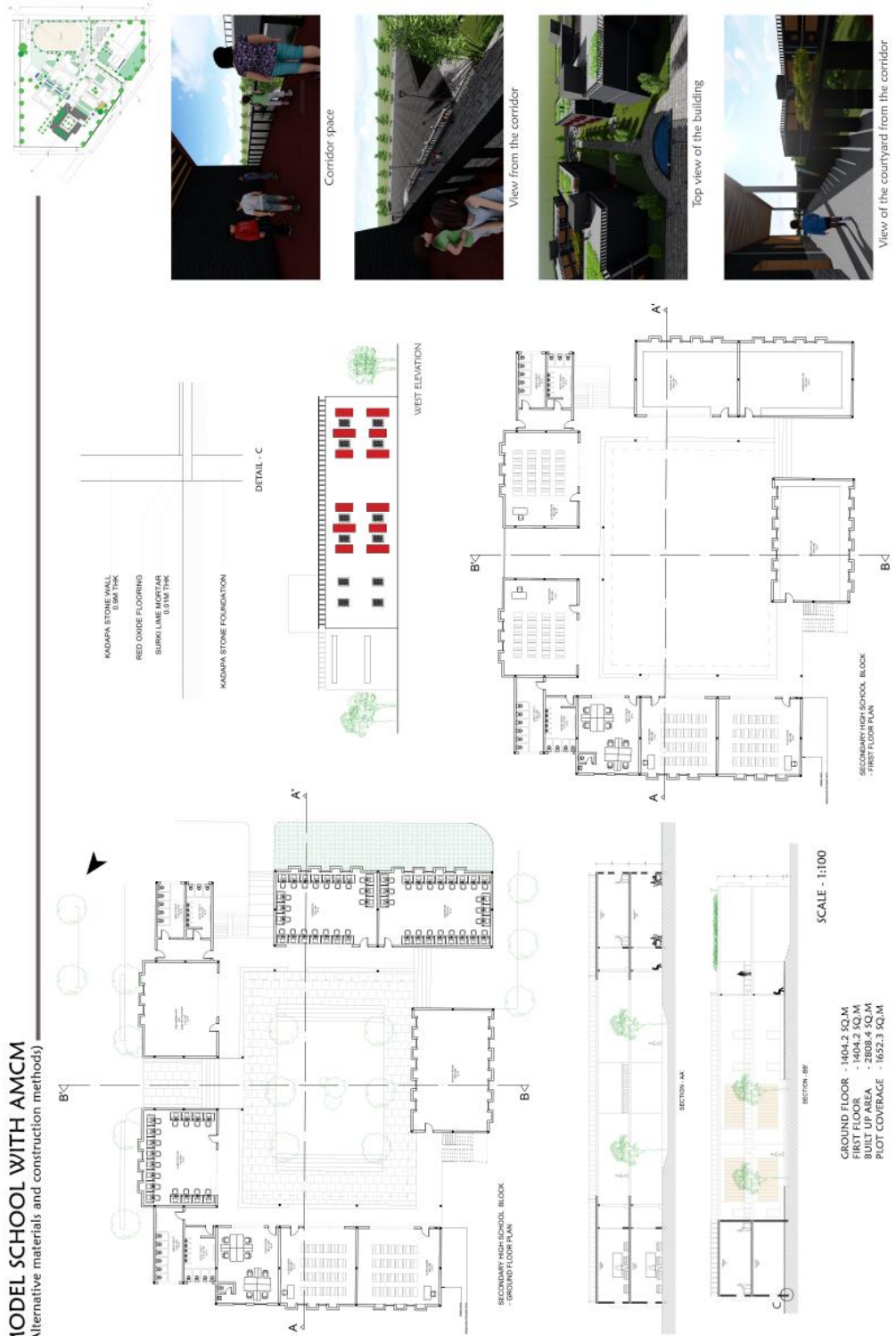


Plate 5.3: High school



Fig 5.25(a),(b): View of the corridor to the walk way



Fig 5.26(a),(b): walk way and courtyard view from the corridor

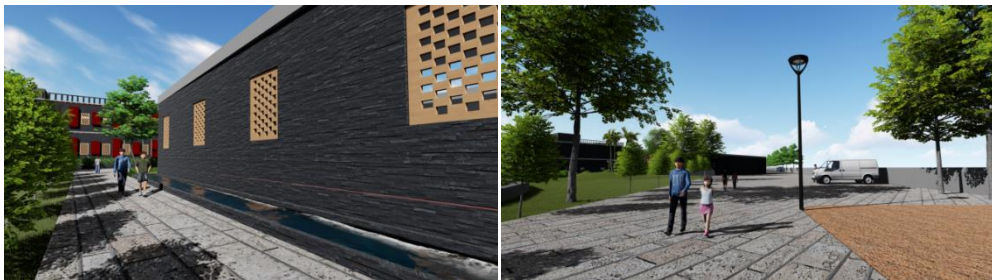


Fig 5.27(a),(b): View of the admini block and service road



Fig 5.28(a),(b): Play area and top view of pri primary and high school buildings



Fig 5.29(a),(b): OAT at dinning and gathering space in the walkway

[illegible]

5.4 MODEL:



Fig 5.30: Over all site view from the top

CHAPTER 6

REFERENCES

6.1 Journals:

1. R.Arulmalar, Dr.N.Jothilakshmy (2017) The vocabulary of post-consumer packaging waste in built environment: a qualitative study.
2. R.Arulmalar, Dr.N.Jothilakshmy (2017) Post consumer waste materials in architecture
3. Lucy Wang (2017) Amazing building made from 1.5 million plastic bottles withstands fires and earthquakes
<https://inhabitat.com/amazing-plastic-bottle-architecture-withstands-earthquakes-in-taipei/>
4. Launceston, Tasmania, (10–12 November 2004) The issues of using recycled materials in architecture
http://anzasca.net/wp-content/uploads/2014/08/ANZAScA2004_Munn.pdf
5. IOP Publishing G Suharjanto, K A Salim, Y Mariana, S Wijaksono (2020) Perforated metal made from recycled material in the application of building façade
<https://iopscience.iop.org/article/10.1088/1755-1315/426/1/012091/pdf>
6. Deane Madsen (*March 23, 2014*) Paper Log House India
<https://www.architectmagazine.com/project-gallery/paper-log-house-india>
7. Aga Khan Paper Log house
https://archnet.org/sites/5102/media_contents/46685
8. Lucy Lau (*May 15th, 2018*) Shigeru Ban's Paper Log House built on humanitarian principles
<https://www.straight.com/arts/1076071/shigeru-bans-paper-log-house-built>
9. Biome Environmental Solutions (march 28, 2017) The Atelier-School, Bangalore, Biome Environmental Solutions
<https://architecturelive.in/the-atelier-school-bangalore-biome-environmental/>

10. Vivek Muthuramalingam (July 6, 2020) An Elementary School that can be dismantled and repurposed – The Atelier Bangalore
<https://www.greenv4.com/2020/07/06/an-elementary-school-that-can-be-dismantled-and-repurposed-the-atelier-bangalore/>
11. Vivek Muthuramalingam (September 14, 2016) The Atelier / Biome Environmental Solutions
12. Daniel flahiff (2009) POLLI Bricks: Build a House with Recycled Bottles
<https://inhabitat.com/polli-bricks-by-miniwig/>
13. Chu chia ning (April 2013) The implementation of polli-bricks in Malaysian construction industry
<http://eprints.utar.edu.my/877/1/QS-2013-0905772-1.pdf>
14. Planet (20 January 2011) Exotic formula: plastic bricks
<https://plastics-themag.com/Polli-brick-a-revolutionary-high-tech-process>
15. Yatin Pandya (Apr 7, 2009) Manavsadhna Activity Centre
<https://worldarchitecture.org/architecture-projects/ezmc/manavsadhna-activity-centre-project-pages.html>
16. Pascal Faucompré (May 2, 2017) Earthship and Geonef, advantages and disadvantages
<https://www.build-green.fr/earthship-et-geonef-avantages-et-inconvenients/>
17. Tim Lynch (JUN2013) Mike Reynolds Architect/Builder 'Earthship' Dwellings & The Garbage Warrior
<https://www.ourplanet.org/greenplanetfm/mike-reynolds-architect-builder-earthships-the-garbage-warrior>
18. Wendy Jewell (2017) Michael Reynolds, Garbage Warrior
https://myhero.com/Michael_Reynolds_2008
19. Sven und Sig (21. Feb 2019) Innovative and self-sufficient: living in an Earthship
<https://www.otto.de/reblog/earthships-2299/>

20. Surfaces reporter (08 Aug 2018) Architect Yatin Pandya Recycling Domestic Waste into Building Components

<https://www.surfacesreporter.com/articles/20900/architect-yatin-pandya-recycling-domestic-waste-into-building-components>

6.2 Websites:

1. <https://dme.ap.nic.in/nodaldme/dist/Cuddapah.html>
2. <https://architecturelive.in/the-atelier-school-bangalore-biome-environmental/>
3. <https://www.archdaily.com/795183/the-atelier-biome-environmental-solutions/57d76759e58ece897b000179-the->
4. <https://www.archdaily.com/795183/the-atelier-biome-environmental-solutions/57d76759e58ece897b000179-the-atelier-biome-environmental-solutions-photo>
5. <https://www.archdaily.com/tag/michael-reynolds>
6. <https://inhabitat.com/earthship-pioneer-michael-reynolds-is-building-the-first-sustainable-school-in-argentina/>
7. <https://www.archdaily.com/632487/michael-reynolds-to-build-a-sustainable-public-school-in-uruguay>
8. <https://www.archdaily.com/888713/michael-reynolds-to-build-sustainable-public-school-in-argentina>
9. <https://www.re-thinkingthefuture.com/architecture/housing/manav-sadhna-by-yatin-pandya/>
10. https://www.zingyhomes.com/project-detail/yatin-pandya_208/manav-sadhna-activity-centre/
11. <https://worldarchitecture.org/architecture-projects/ezmc/manavsadhna-activity-centre-project-pages.html>
12. <https://www.surfacesreporter.com/articles/20900/architect-yatin-pandya-recycling-domestic-waste-into-building-components>



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BONAFIDE CERTIFICATE

This is to certify that Thesis Report is the bonafide work of N. VINAY KUMAR REDDY (39210052) who carried out the Thesis entitled "HOTEL CUM SHOPPING MALL" under our supervision from December 2023 to May 2024.


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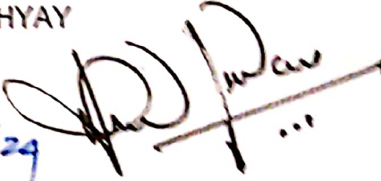

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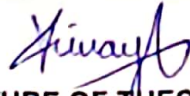

External Examiner

DECLARATION

I, **N.VINAY KUMAR REDDY** hereby declare that the Thesis Report entitled "Model School with AMCM (Alternative Materials and Construction Methods)" done by me under the guidance of **Ar.Ramesh Kumar** (Internal Guide), **Ar.Mohana Gopiraj** (Internal Review Member) and **Ar.Maheshwaran** (External Guide) Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Architecture Degree.

DATE: 23/5/24

PLACE: Chennai



SIGNATURE OF THE CANDIDATE