



The Kaleidoscope

## Expanding the Scope of Schools.

While on the one hand the mainstream school plays a well defined role in society, preparing students to enter college, to earn a living and contribute to the economy, there are educators in many pockets who have challenged this understanding of education. Over the last few centuries many teacher/philosophers have insisted that schools are not cogs in the economic structure. Schools do not exist to train the work force, bolster existing social institutions, create tractable citizens and maintain the divides in society. Their very purpose is to challenge the status quo, create divergent thinkers, inspire change and transform lives and hence society.

By creating a learning space like Kaleidoscope we are living up to Gandhiji's direction to 'BE the change' we want to see in the world. Not only is the earth bag and bamboo structure lower in cost, kinder to the earth, aesthetically satisfying, cool and comfortable , but it is also a dynamic learning space. It lives the message of our school **Aman Setu**, its structure facilitating equal opportunity to participate.

Kaleidoscope has just the right nurturing energy, suitable for a learning space. We invite you to come and experience it.



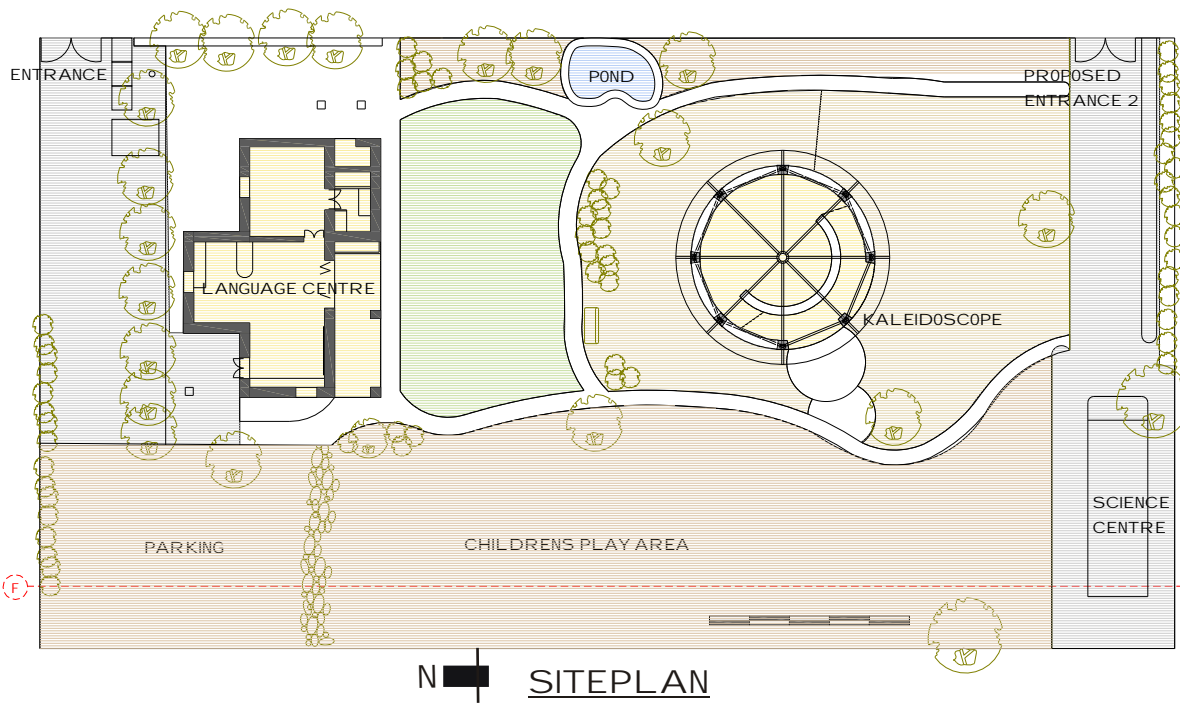
anna

I am proud to announce that the design and execution were initiated by my student Sourabh Phadke and his friend Pooja Joshi. We got the cooperation and full participation of local people without whose wisdom we would have been quite lost. Anna our 'Man of infinite resourcefulness' deserves a special mention and special thanks here.

We are now poised to share our learning experience on the web and will be happy to answer questions and support anyone who wants to create something on similar lines.

MADHAVI KAPUR

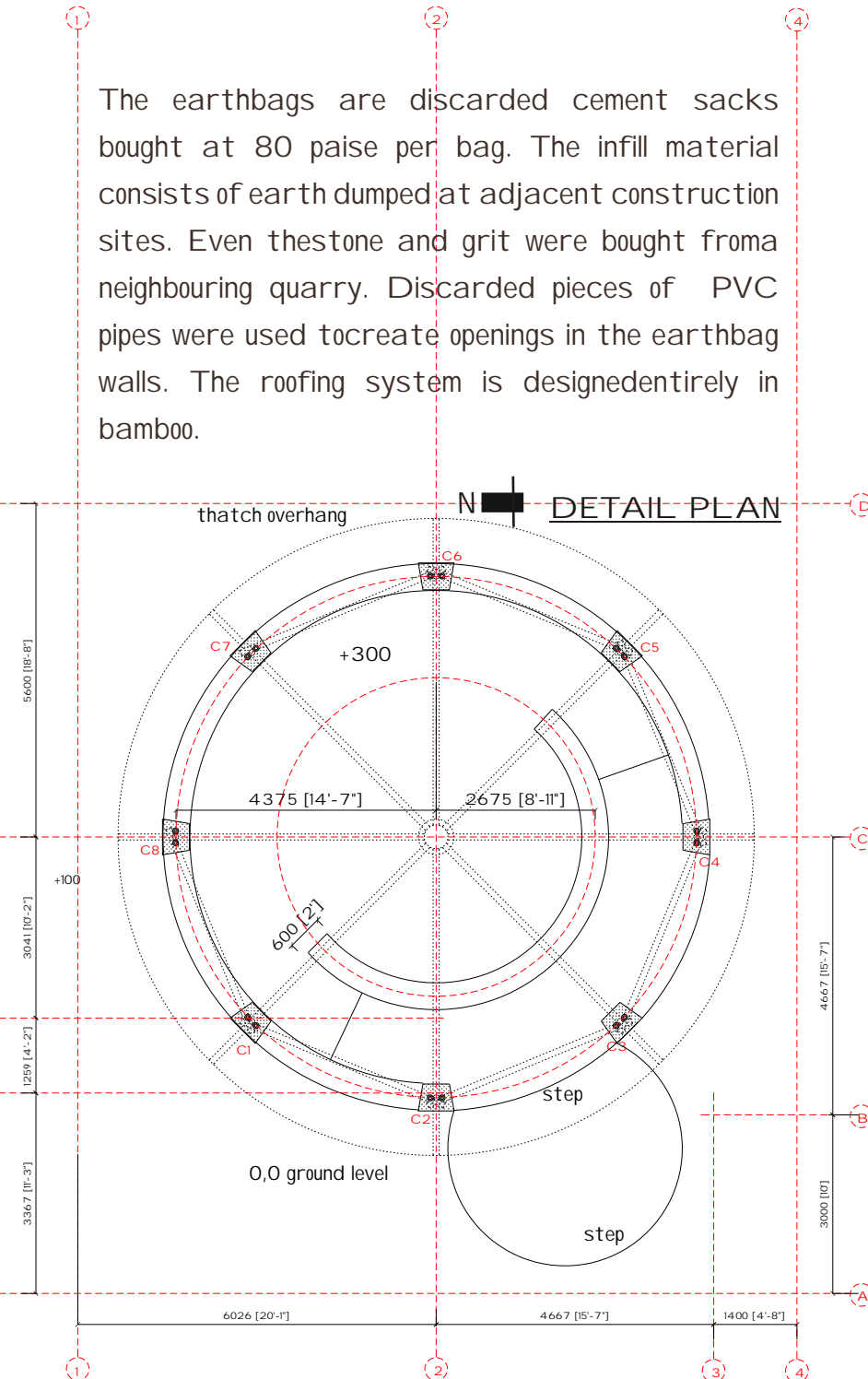




**K**aleidoscope is the creative expressions center on the Aman Setu school campus at Wagholi.

This structure is meant to host activities such as arts, crafts and music for children varying from ages 3 to 8. Thus this 'unstructure' was designed as a playful space which wouldn't define any child's imagination. The Kaleidoscope was designed in order to keep the materialistic embodied energy and hence the carbon footprint low. All materials were procured from the same locality with a conscious effort to reuse discarded material.

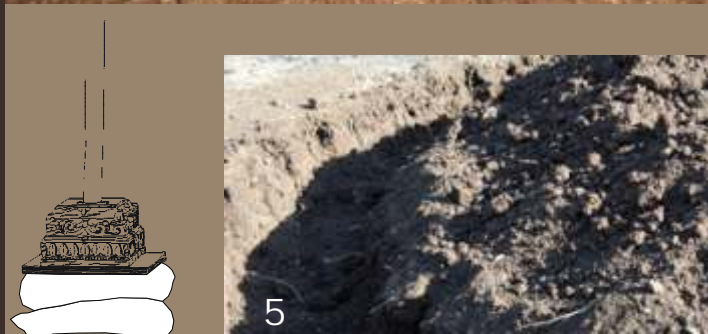
The Kaleidoscope is a simple composition in bamboo and earthbags. Earthbags are discarded cement bags filled with a wet mix of earth, sand, dust and a small amount (5 percent) of cement. These are tamped to attain a shape suitable for construction. The bags are then laid in courses as per conventional masonry techniques. Between each course of earthbags we have two strands of barbed wire which maintain fixity.



The earthbags are discarded cement sacks bought at 80 paise per bag. The infill material consists of earth dumped at adjacent construction sites. Even the stone and grit were bought from a neighbouring quarry. Discarded pieces of PVC pipes were used to create openings in the earthbag walls. The roofing system is designed entirely in bamboo.



## SITE PREPARATION.....



1. Initial picture of the site.

The area was cleared of impediments such as grass and stones to provide a clean surface. The existing bungalow can be seen behind. The light pole visible on the left was removed later.

2. Line out:

Area to be excavated was marked on site with reference to the drawing. The central peg point and other references were marked using a string, soft measuring tape and lime powder ( phakki ). Lime powder is mixed with sand to increase the volume. Lines and angles were marked and cross checked using the triangulation method.

3,4. Excavation

The trenches were dug as per the markings to a depth of 1.5 feet / 450mm . The top soil was segregated and was not used for construction purposes. The rest was retained for using in the earth bags.

A 450mm deep trench suffices for non load bearing walls which rest on the murrum strata beneath. This depth is adequate for bamboo column foundations.

5. Black cotton soil excavated from the trench is prone to extreme contraction and expansion and hence is not suitable for earth construction as is. Only a small proportion of such soil could be added to the earth bags. The mix was balanced by adding sand and murrum soil along with stone dust.





TRIALS & TRIBULATIONS....



We used discarded cement sacks (50kg) from nearby construction sites, procured at a cost of 75p (100p=1 rupee)

8,9. A depo of the prescribed mix is prepared close to the filling area. Every cement sack is filled with 3.5 ghamelas of the specified mix (this fills about 80% of a 50kg sack).

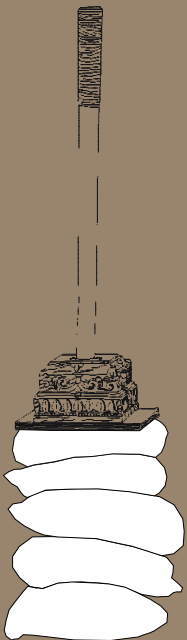
10. The earthbag is then stitched close with a flat plastic thread, the ends of which are looped across the earthbag corners. This creates ears which makes picking the earthbags easier.

11. The bag thus readied can be placed in position for tamping.

Since the mix required for earth bags is more "sandy" than "clayey" the mix filled in the bags was as follows:

- MURRUM: 2 UNITS
- GRIT: 2 UNITS
- SAND: 2 UNITS
- BLACK COTTON: 1 UNIT
- 5% CEMENT

Water was added to attain a moist consistency which doesn't crumble nor does it ooze when pressed.







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## BASE PREPARATION

Short wall: 3/4 inch metal with a layer of grit was laid to prepare a level base to lay the bags on.

Bamboos and the internal wall had a base PCC done.



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13. The stitched bags were laid along the trench leaving space for the bamboo footings. They were then tamped with our home made tamping rod till compacted properly.

14. On completing a course, two strands of barbed wire about 10cm apart were placed on top, weighed down with bricks to hold them in place.

15. Successive courses of earthbags were staggered to break the joints as per conventional masonry. Thus every course alternately began with a half bag. Barbed wire was laid between every two courses.

16. Binding wire was used to hold every course to the ones below in order to increase the stability of the wall. Strands were placed on every alternate sack in any given course and were tied to every third course on top.



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# BAMBOO...

17,18. Bamboo used for the Kaleidoscope was naturally treated using water and fire treatment. The vertical supports were made by joining two bamboos with two spacers in between. The part to be embedded into the footing was treated with coal tar.



19. Space was left between the earthbag walls to cast the column footings. Shahabad tiles served as the temporary formwork.



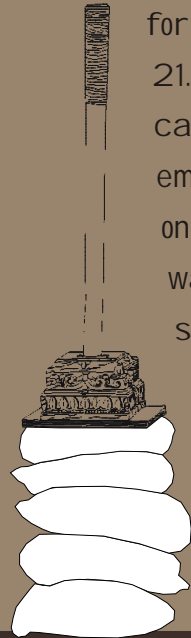
20. The columns were positioned with temporary cross struts for support, and were checked for plumb and level.



21. The first footing was cast. The bamboo was embedded in concrete only up to 300mm. The top was filled with larger stones and lean mortar.



22. The other columns were aligned to the first column and referenced with the center.

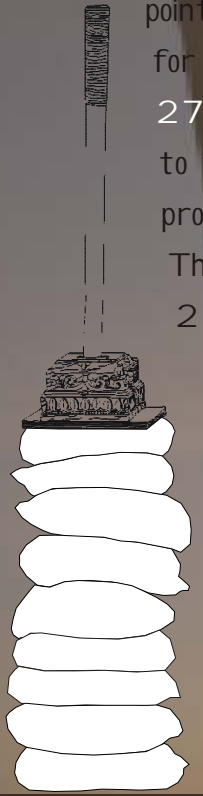


23. Eight built up columns were erected with their spacers in level. 24,25. The central plate was shaped in 1/2 inch ply on which the cross members were fixed. The bamboo ends were loaded with weights to maintain tension and eliminate supports. The tie members of the trusses are made of two members. The lower member runs continuous between opposite columns whereas the upper one breaks at the plate. The inverse happens for the other truss. Machine drills are used on bamboo and fixing is done with nuts and bolts.

26. Similarly the upper plate of the truss was fixed. The position of the central member between the two plates was aligned to serve as the permanent reference point for trusses. Accordingly, the rafters for the bamboo trusses were fixed into position.

27. Temporary bamboo struts were positioned to take the load during the truss assembly process.

The Kaleidoscope has 2 primary trusses and 2 secondary supporting members.







## ROOFING..

As explained earlier in point 27 the bamboo trusses were assembled and the preparation for roofing followed.

28. Once all trusses are up, the supports were removed. A close framework of bamboo slices or thin sticks was made on each of the eight panels. This framework was held together by binding wire.

21,30,31. Straw mats (chatai) panels were fixed on the framework. These mats provided a firm underside to the plastic sheet which would come on top.

32. Large sheets of discarded advertising banners in plastic material, commonly known as flex, was used as waterproof roofing material. This was fixed on the chatai and riveted to the truss members. The plastic was cut to the form of the roof and the joints were sealed with strong glue.





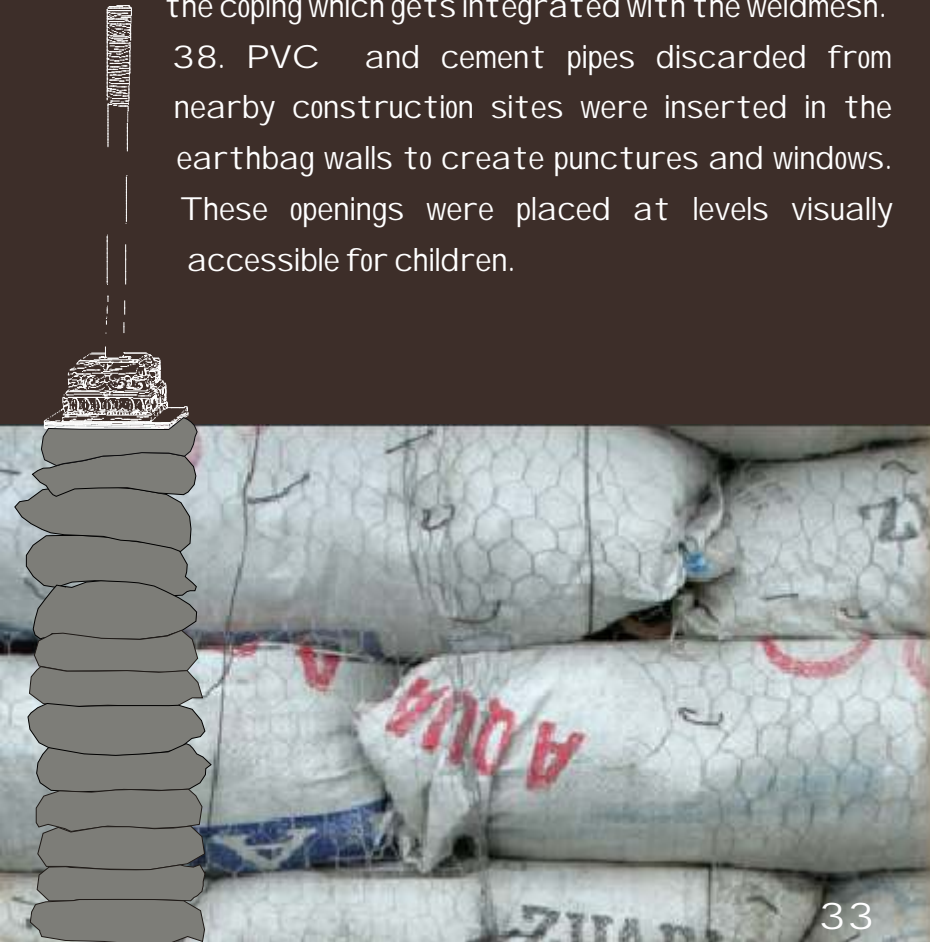
PLASTERING.....

33. After the walls were completed a layer of chicken mesh was stretched over the earth bag profile and held in place with pieces of binding wire. This was done to save on quantity of plaster and accentuate the contours of the wall. Concrete coping reinforced with weldmesh ( 3"x3" ) was laid on top of the wall.

34-35. The wall was plastered in two coats. The first coat was applied by hand, filling in all the gaps where required. The second coat gave a smooth finished surface.

36-37. A coarser mix of concrete is used to make the coping which gets integrated with the weldmesh.

38. PVC and cement pipes discarded from nearby construction sites were inserted in the earthbag walls to create punctures and windows. These openings were placed at levels visually accessible for children.



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FLOOR....



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39. Soling: Random rubble was spread over the floor within the confines of the earthbag walls upto a height as per the plinth level. It was consolidated with murrum soil.  
 40. A mix of 3/4" metal and stone dust was spread over the base and an initial coat of pure cement concrete was given over the surface. The level and slope was fixed with a water tube so as drain any water towards the exit.

IPS FINISH....

41,42. The semicircular stage was finished first with cement slurry and the edge was rounded to prevent chipping and breakage.

43. Red oxide paste( khurmus) is prepared and mixed with the cement slurry . This forms the finished surface and is applied in two coats over the pcc. A vaata / skirting is made along the walls.

44. White cement paint was applied in 2 coats over the walls. The children from school added their own colours later...



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# The Kaleidoscope!



"I like the kaleidoscope because we do painting and hear storys there." Shlok

"I like the kaleidoscope because i can sit on it's cool and nice floor. I love to paint and write on it" Aditya  
We can see the airoplanes from there

"I like the kaleidoscope because i can see through the holes on the wall" Shlok

I like the kaleidoscope because i can climb on it's wall"



"We can play and jump around in the Kaleidoscope" Ayan

"The Kaleidoscope is filled with fresh air. it makes me feel cool" Govind



