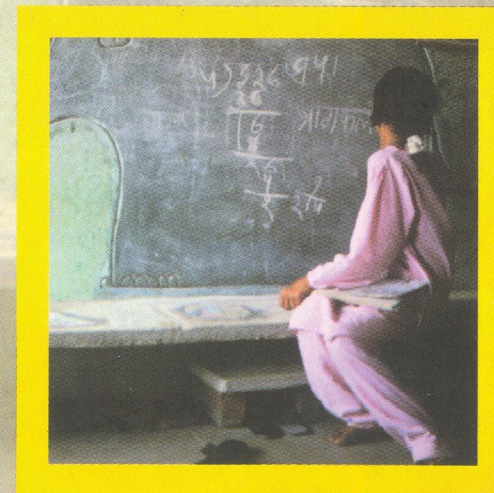


Child-friendly Elements for Rural Primary Schools

an engineer's handbook

District Primary Education Programme



Produced by

Civil Works Unit
DPEP Technical Support Group
Educational Consultants (India) Ltd.

Photographs

Most of the images shown here are from Kaithal district in Haryana, from a demonstration project on Child-friendly elements, done together by TSG, consultants and State Engineers.

* These images are from a documentation by the design firm *Vinyas* for Department for International Development (DFID), of their work in Lok Jumbish, Rajasthan.

** These images are from activity centres constructed by DPEP Madhya Pradesh.

*** These images are from schools constructed under the Bihar Education Project.

Thanks are due to DFID and *Vinyas*, MP DPEP and BEP Bihar for their contributions.

**Comments and
Suggestions**

Comments and suggestions on this handbook would be appreciated. They should be addressed to:

The Civil Works Unit
DPEP Technical Support Group
B-86, Defence Colony
New Delhi - 110 024

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Introduction

Improving school environments is a very important area under DPEP Civil Works. All DPEP states are now using improved designs for construction of new schools - these new designs cater to most of the functional requirements.

However, there is scope for further improvement. Certain issues are yet to be addressed. For example, in many cases, our schools do not have enough learning spaces. Display and storage facilities are often inadequate. Also, we are yet to provide a 'barrier-free environment' for our disabled children.

'Child-friendly' Elements

Certain building elements have been identified to address such issues, and make the school environment more 'child-friendly'. For example, the provision of a simple chabutara (platform) under a tree, with a chalkboard, creates an outdoor space that is usable for teaching. The provision of ramps, handrails etc. encourages children who are physically disabled.

The addition of such small features also makes the school more attractive to the child.

About this document

DPEP engineers in most states are now beginning to incorporate these elements. This document attempts to provide information, which would help them get a clear picture of what to construct.

The handbook consists of the following:

- 1. Descriptions of elements:** Elements that have been successfully tried out are described here. The following details are provided:
 - General description and purpose
 - Photographs of elements in use
 - Hints about where to locate them
 - Typical construction method in brief
 - Technical drawings showing typical heights, widths and other dimensions
 - Item quantities of a 'typical' element. (By applying local rates to these quantities, the engineers should be able to estimate how much this kind of element would cost in their situation.)
- 2. Case Studies:** Child-friendly elements can be easily incorporated into existing designs and buildings. Proposals have already been made for Orissa and Maharashtra.
 - Both states have two kinds of designs -
 - two rectangular classrooms
 - two hexagonal classrooms

(Many other DPEP states have very similar designs.)

It can be seen that these proposals have not resulted in any change to the original designs. In fact, the elements now seem to be a part of them. The proposals are shown here as case studies.

Upon going through this booklet, one can see that these elements are low in cost and are easy to construct. They do not need any special technical know-how, or new materials. Also, they can mostly be incorporated into any existing design or building. With the help of this document, all DPEP engineers will be able to easily design, estimate and implement child-friendly elements into their schools.



Low Cost Student Benches



Students using the benches in different ways - as seating, as worktops, individually and in groups.

Many of our rural primary schools do not possess furniture. Permanent benches provided along the classroom walls are very useful in these situations. Students can use these benches as seating, and also as worktops. The space underneath these benches can be used as storage, and the bench itself can be used to display models and other items.



Here ferrocement benches have been placed all along the classroom walls. Storage spaces are provided underneath.

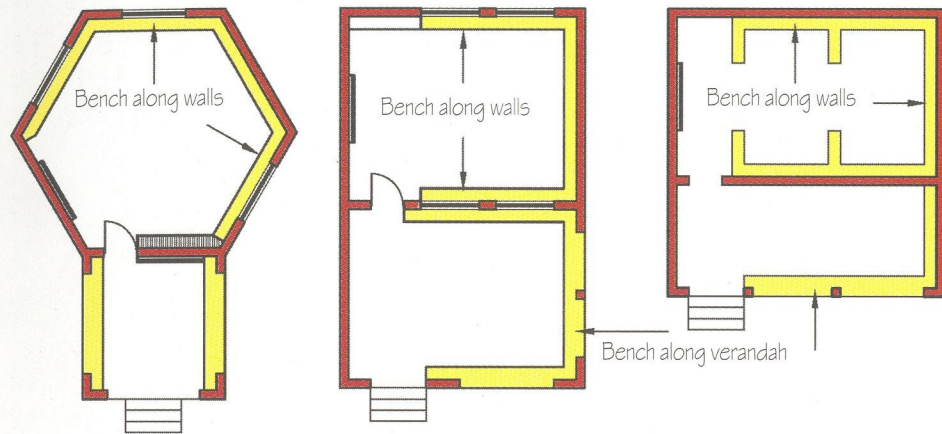


Benches can be provided in the verandahs too.

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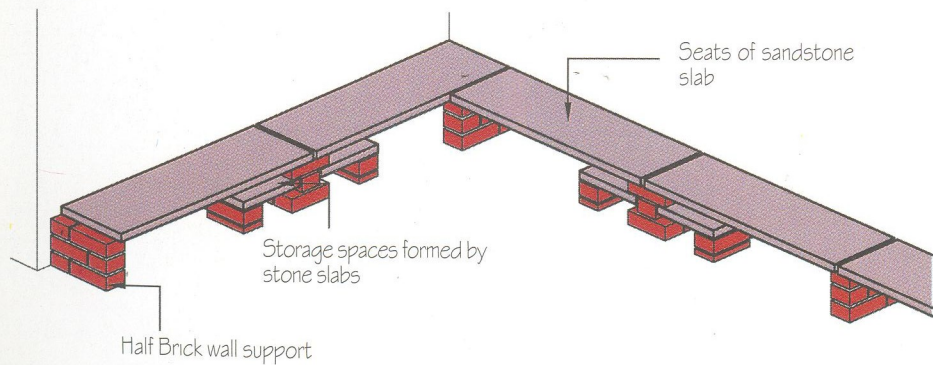
Placement

The benches can typically be placed all around the classroom / verandah, except near the chalkboards and doors.

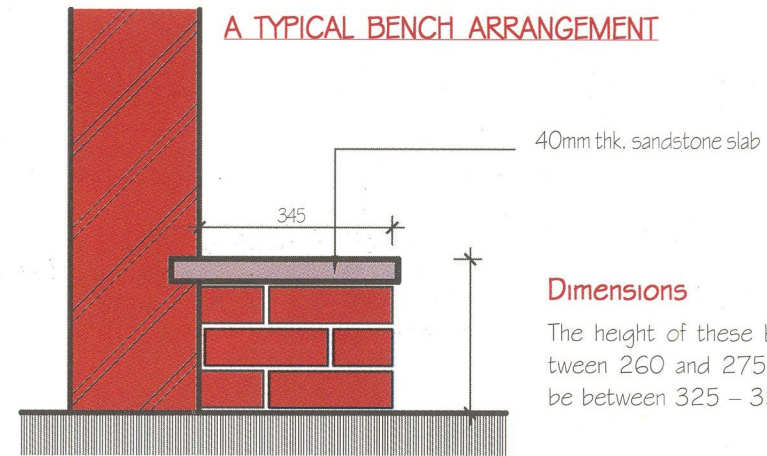


Construction

The bench seats are normally of sandstone, or precast / cast-in-situ ferrocement or Reinforced Concrete. The typical span of these could be between 900-1200 mm. The supports are normally of 115mm thk. brickwork, of three courses so as to get the required height.



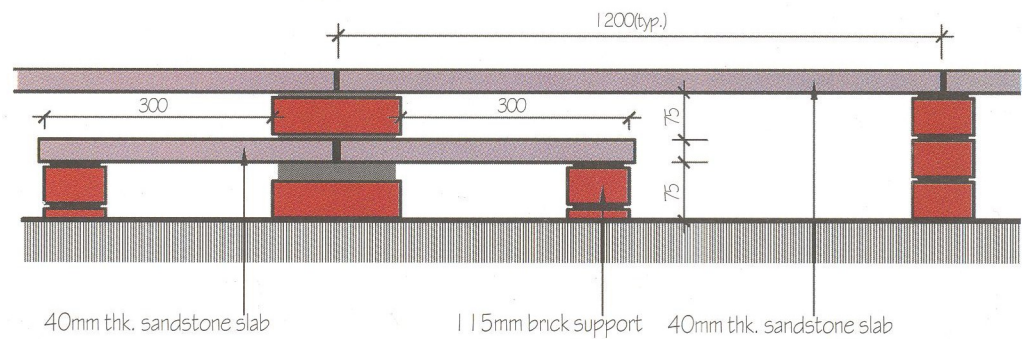
A TYPICAL BENCH ARRANGEMENT



Dimensions

The height of these benches should be between 260 and 275 mm. The width should be between 325 - 350mm.

Section



Elevation

Quantities of a typical bench, per running meter

25mm thk. Ferro-cement Slab/40mm thk. Stone Slab.	0.345	sqm
Brick work in 1:6 mortar.	0.019	cum

Storage and Display

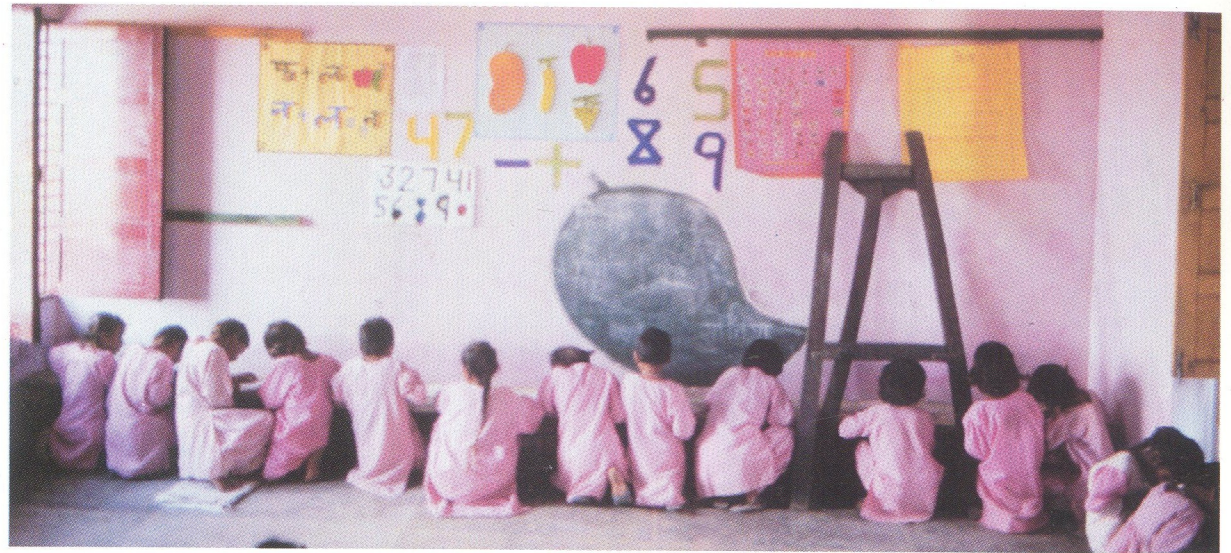
Storage Spaces

At least one regular cupboard must be provided in every classroom. A typical cupboard should have open shelving below, which can be used by students, and lockable storage above, which can be used by the teacher.

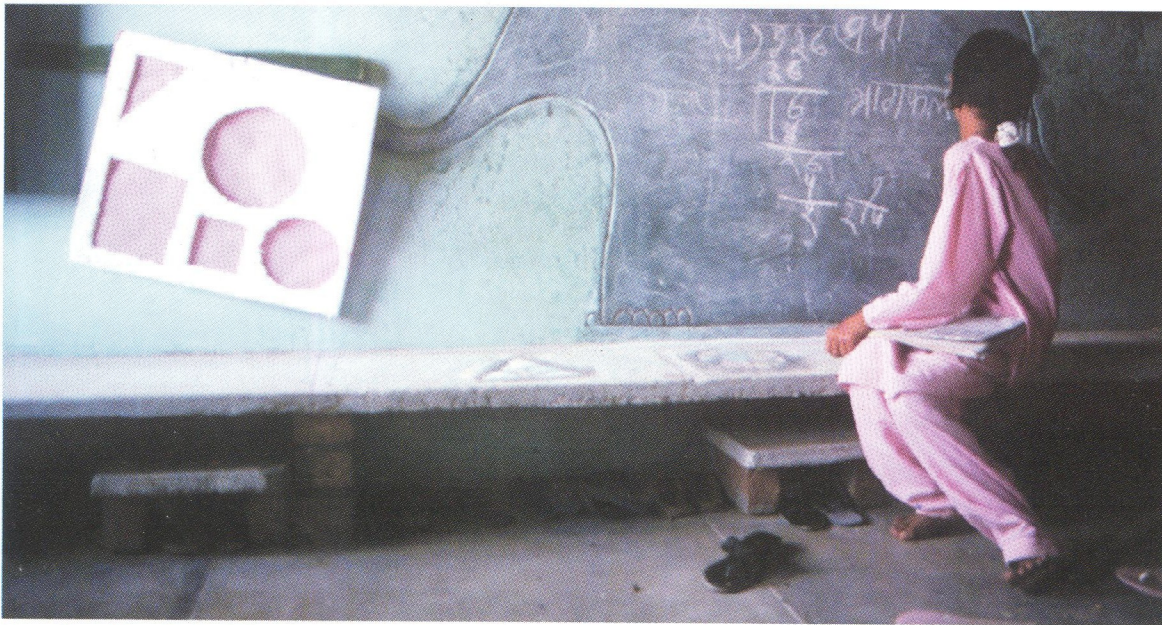
Important: Small storage spaces must also be provided which can be used as *personal storage spaces* by children.

Placement

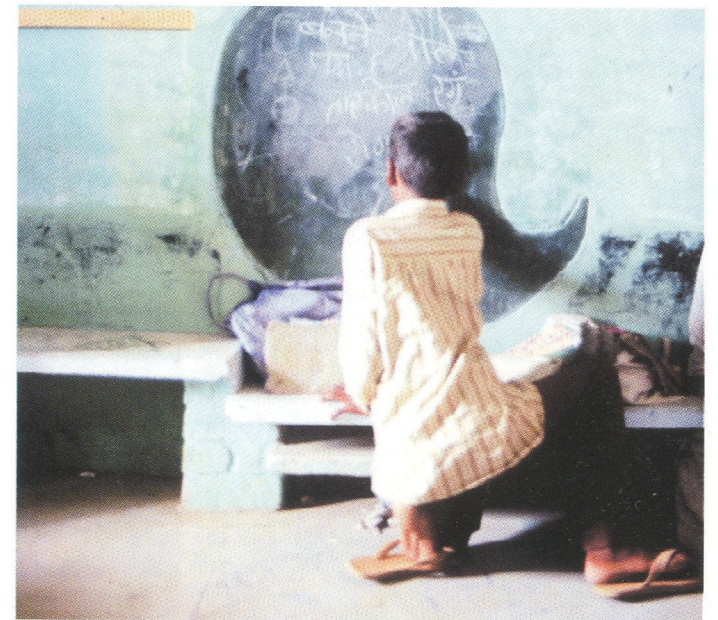
The regular cupboards should be near the teacher's chalkboard. The small storage spaces for children should be provided in all possible nooks and corners in the room. If benches are provided, then the space underneath can be used as students' storage space.



Wooden battens should be provided at various levels for display of educational material.



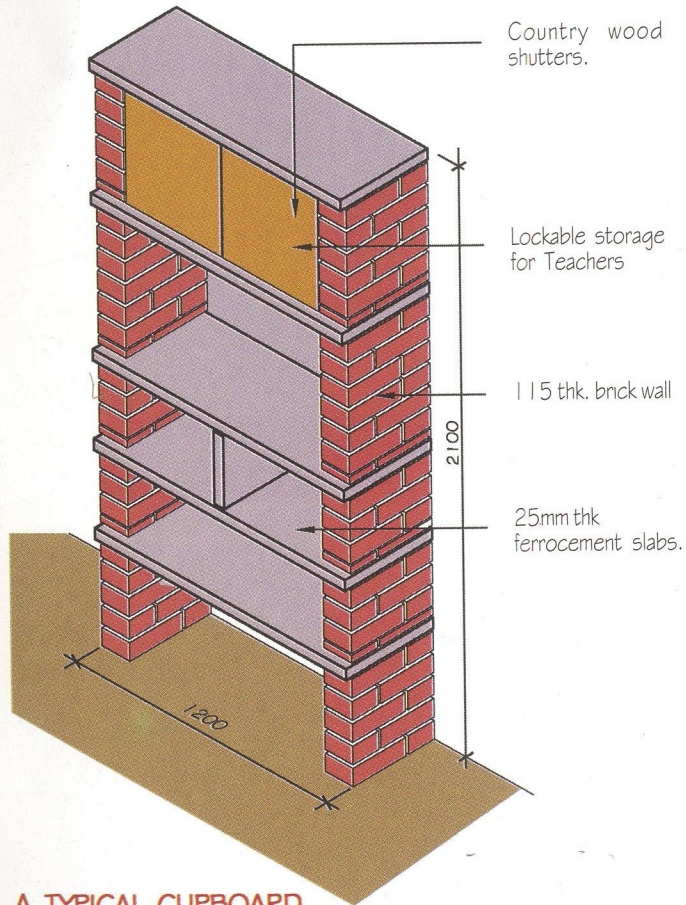
An educational chart has been hung on a wooden batten, which is provided at a lower level. Storage space is available under the benches.



Storage spaces of different heights could be provided under the benches.

Construction

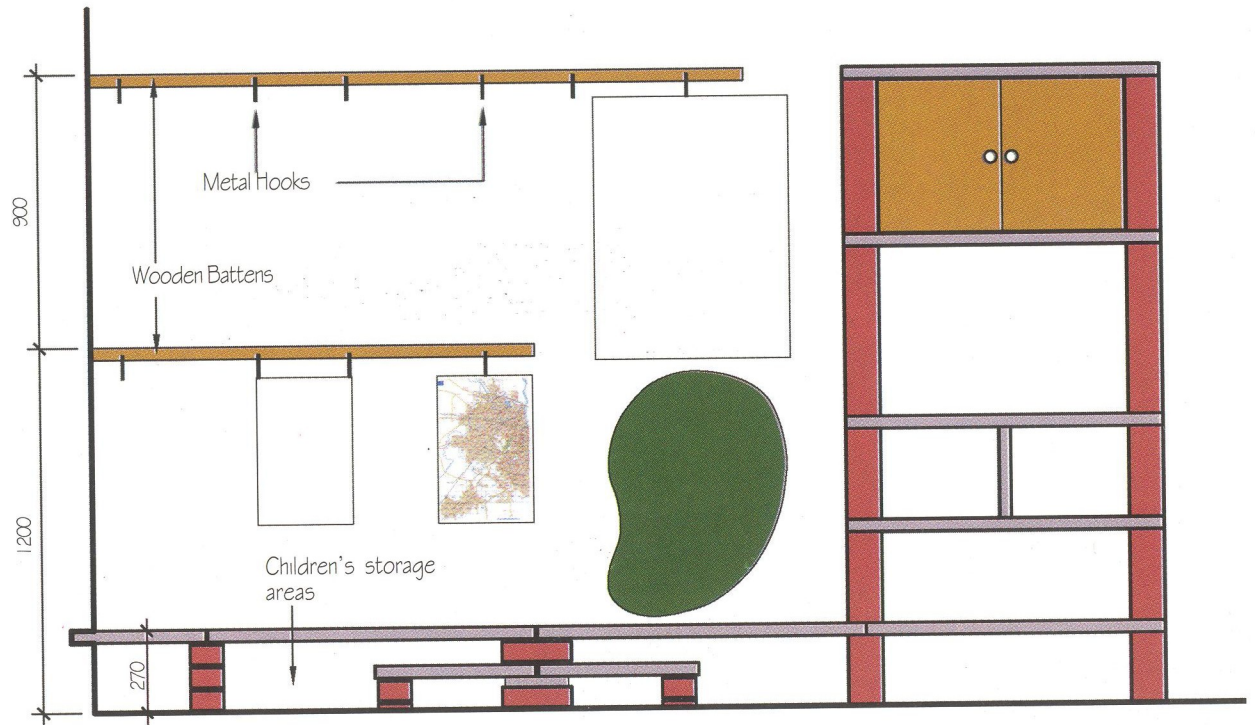
Cupboards can be made of 115 mm brickwork, with stone or precast / cast-in-situ ferrocement or RC shelves.



A TYPICAL CUPBOARD

Quantities of a typical cupboard

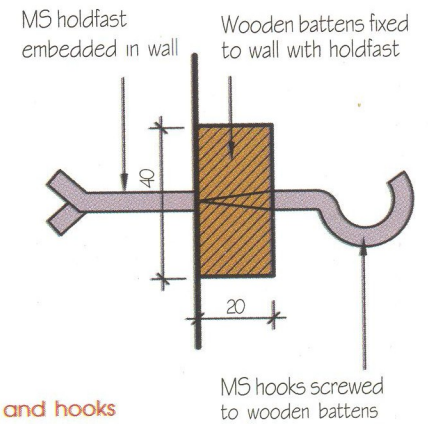
25mm thk. Ferro-cement Slab/40mm thk. Stone Slab.	1.84	sqm
Half brick work in 1:6 mortar.	1.45	sqm
Country board shutters	0.33	sqm



Typical Elevation of a classroom wall with display elements and storage spaces.

Display Elements

Wooden reapers with hooks can be provided at various levels, to allow for exciting display arrangements. Strings tied at differing levels would also work well.



Fixing Details for batters and hooks

Lower cost Learning Spaces

In many cases, we do not have the funds to provide rooms for all classes. Here, we can provide low-cost spaces, where classes can be held. A verandah costs about 80% of the cost of a similar-sized classroom. A pavilion, which is basically a classroom sized platform with a roof, would cost only around 60%, and a platform would cost around 20%.

Later, when funds are available, these elements can be constructed upon. A pavilion can be converted to form a classroom, and a platform can be constructed upon to form a pavilion or a classroom.

Placement

Since they can be converted into rooms, platforms and pavilions must always be located in a place which is appropriate for an additional classroom. They should be easily accessible from existing rooms, and should ideally share a plinth with them. *Where possible, they can be between two existing rooms, so that two walls are saved, and the space feels more enclosed.*

Construction

These elements should always be designed for future expansion. It should be kept in mind that they will later be converted to full-fledged classrooms. Therefore, the foundations must be provided accordingly. It is preferable to provide permanent roofing in pavilions.



*** A platform provided between two existing classrooms. The chalkboard is placed on an existing wall. In future, this platform can be easily built upon, and two walls will be saved.

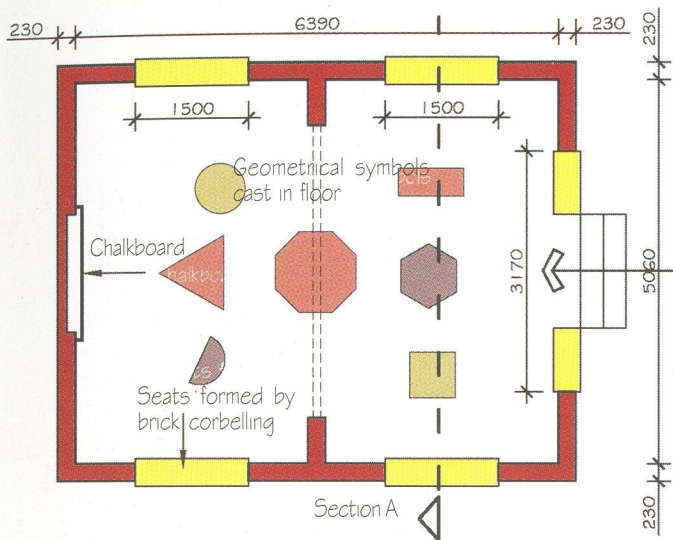


A pavilion, which costs about 60% of a classroom.

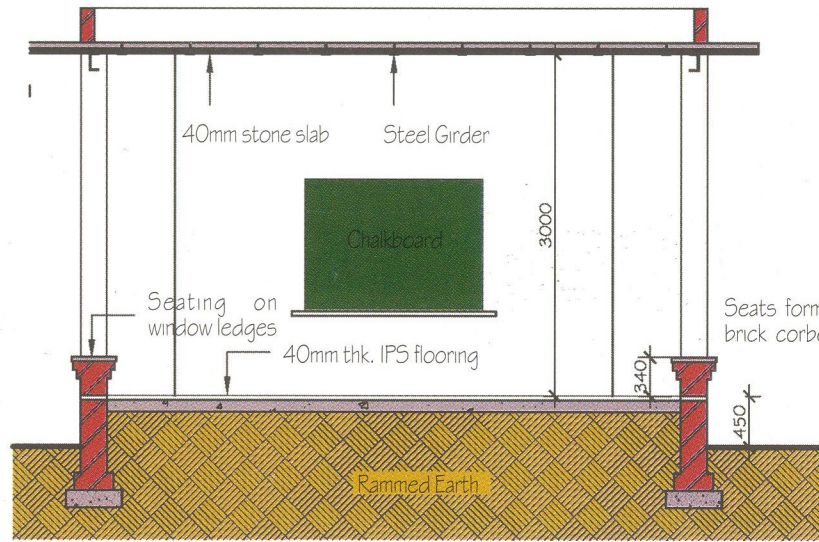


A verandah, which costs about 80% of a classroom.

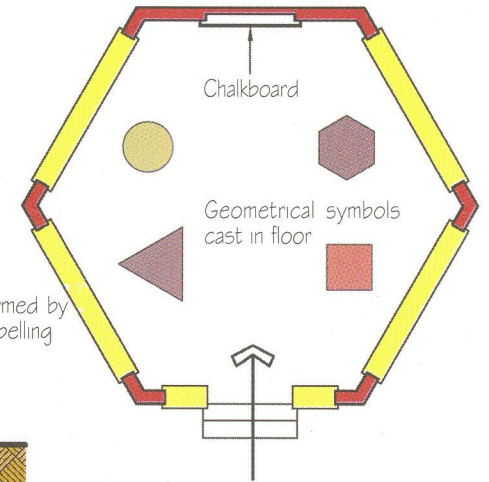
c h i l d f r i e n d l y e l e m e n t s f o r r u r a l p r i m a r y s c h o o l s



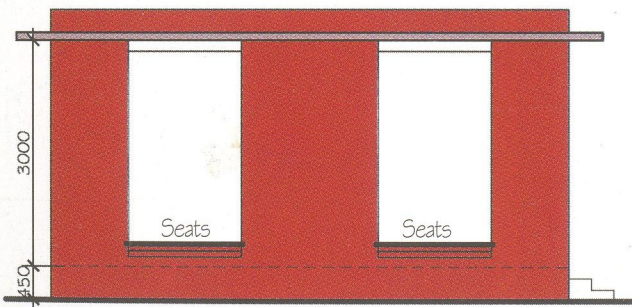
Plan of a typical pavilion.



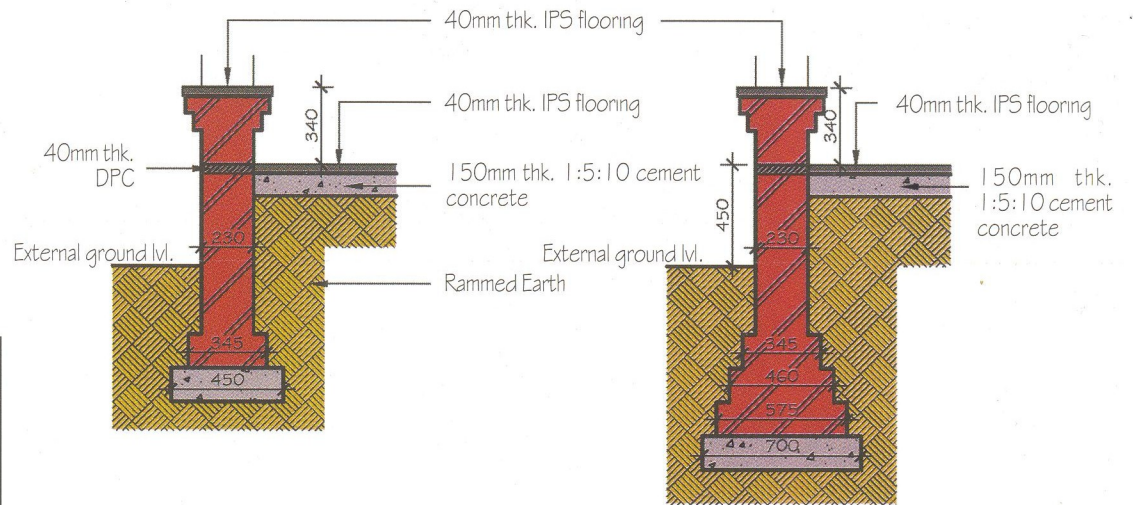
Section A



Plan of a typical Hexagonal Pavilion.



Elevation



Typical section through wall under the openings

Typical section through wall under supports.

Quantities of a typical rectangular pavilion as shown

1:4:8 PCC in foundation and sub floor.	5.03	cum
Brick work in 1:6 mortar.	15.2	cum
Cement Flooring	35.33	sqm
Roofing in sandstone and metal girders.	44.78	sqm

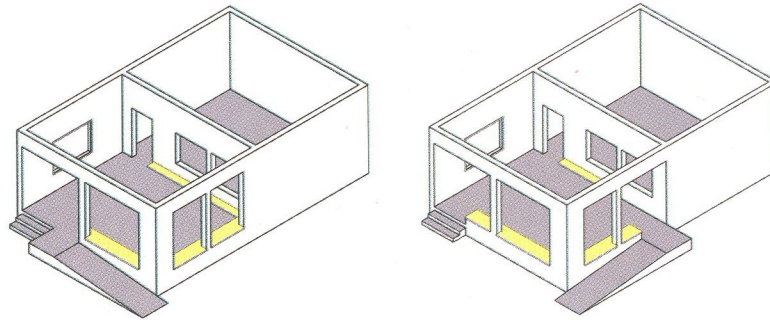
Access Ramps

Ramps should be provided to help physically disabled children to climb the plinth of the school.

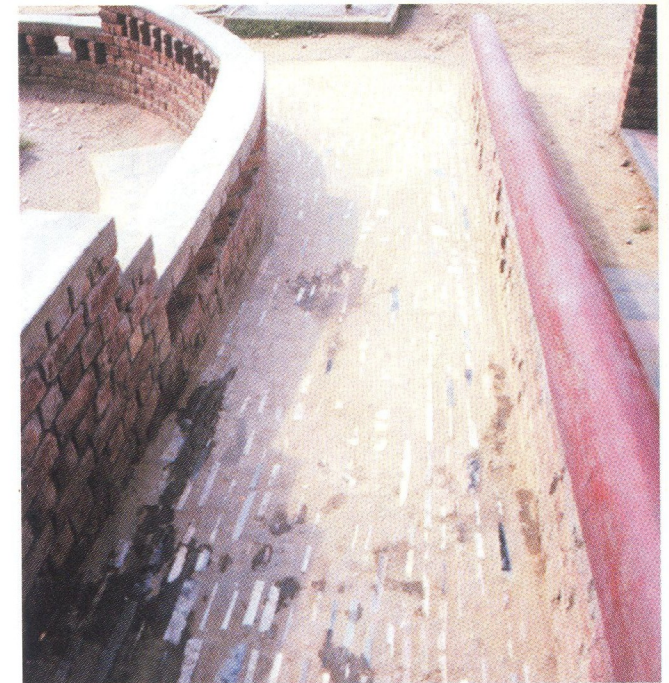
Placement

The ramp should be straight as far as possible. It should never turn sharply. If it does, a flat landing should be given at the turning point.

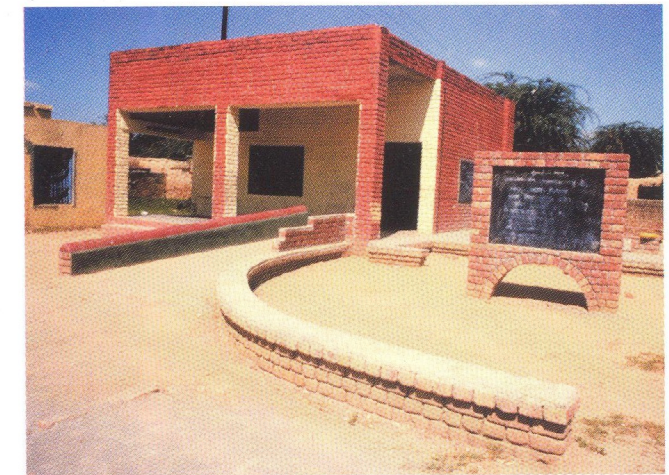
Normally, the ramp leads up to the verandah, which leads to the classroom. The ramp should be placed in such a way that the child can go easily from the ramp to the classroom door. The child should not need to turn sharply to do this.



An attractive ramp has been provided here and is the main entrance for all.



The walking surface should be non slip. Here waste stone chips have been used.



Ramp provided at side of verandah, leading directly to the classroom door.

Construction

A ramp can be made by simply creating a sloped surface with toe walls on the sides, and filling in the middle. The width should not be less than 1 m.

Walking Surface

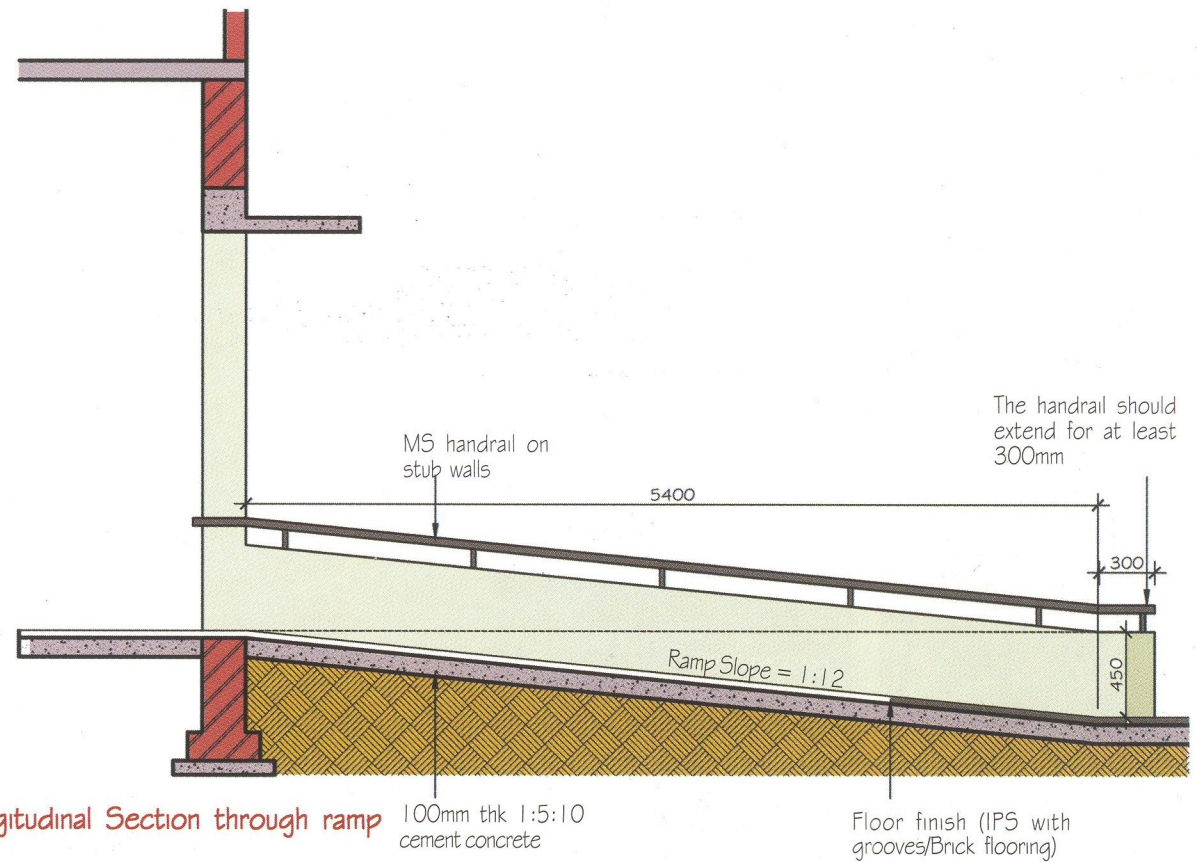
The walking surface should be just rough enough to prevent slipping, but smooth enough so as to not have any holes. Brick paving is a common finish. IPS cement flooring can also be provided, with closely-placed grooves on the surface.

Slope

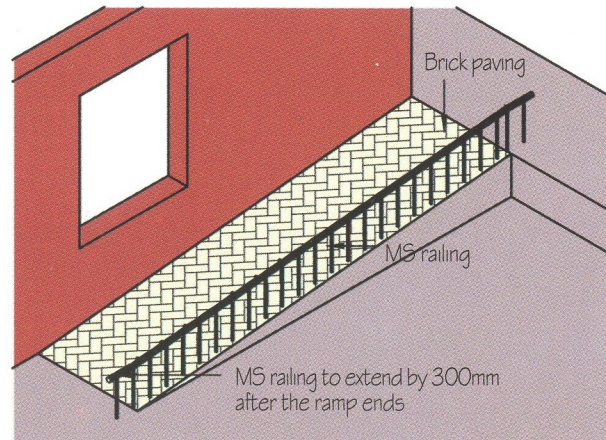
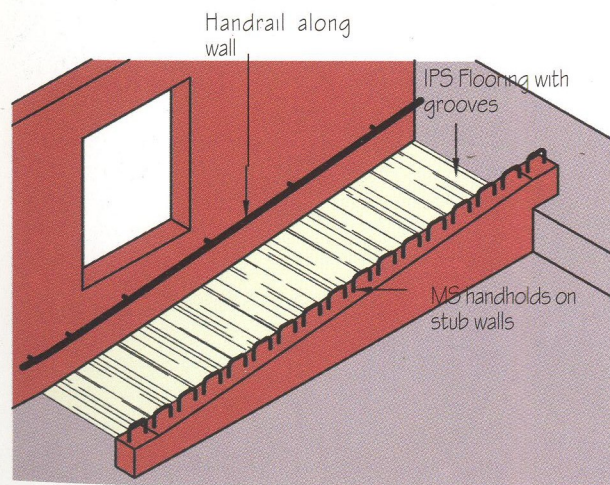
As per the IS: 4963 - 1987, the slope of a ramp should ideally be 1:12 up to 9m length, and 1:20 above that.

Handrail

A handrail is a necessary provision next to a ramp. It could be an MS rail attached to an existing wall, or a railing, or a stub wall with hand-holds provided. The handrail should extend beyond the ramp, at least 300mm both ways. The ends of the handrails should be bent downwards to avoid injuries.



Longitudinal Section through ramp



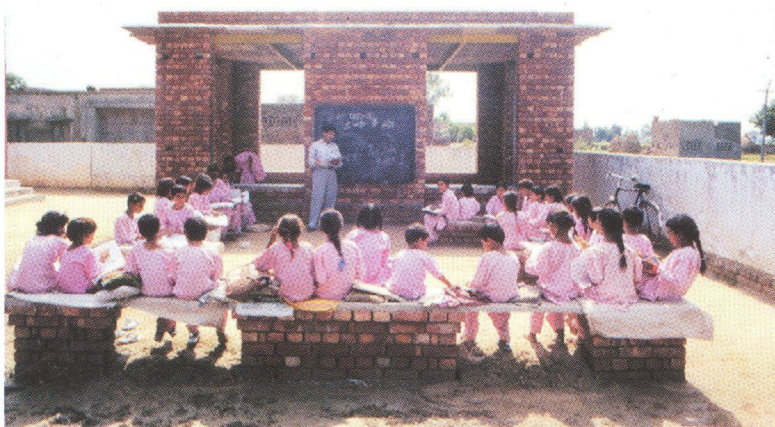
Quantities of a typical ramp for plinth ht. - 0.45m

Brickwork in side walls	1.73	cum
1:5:10 PCC in Sub Floor	0.67	cum
IPS Floor finish / Brick Flooring	6.74	sqm
MS railing on stub wall	0.85	sqm

Outdoor Learning Spaces

External Benches

In some cases, there is a shortage of classrooms, and classes need to be held outside. Benches can be constructed, such that they enclose an area where classes can be held. The space enclosed could be of any form; a rectangle, hexagon, circle etc.



A class being conducted outdoors in a rectangular space framed by benches.

Amphitheatres

An Amphitheatre is a series of wide steps, with a stage and chalkboard in front. The steps are used for seating, while the stage can be used for teaching, as well as children's programmes. It can be created by simply widening the steps up to the existing plinth, and adding a stage and chalkboard in front.



An amphitheatre made by widening the existing steps up to the plinth, with a stage and chalkboard in front.



**Low cost external 'classrooms' in Mandla distt., MP. the amphitheatre seats are in the shade of a tree, and face a chalkboard. A circular set of benches has a low cost roof as a shade.

Chabutaras (platforms under trees)

The shaded areas under trees are very often used to hold classes. A simple low platform (chabutara) with an external chalkboard could be constructed to improve this space. These platforms can be created with leftover material at very little cost.



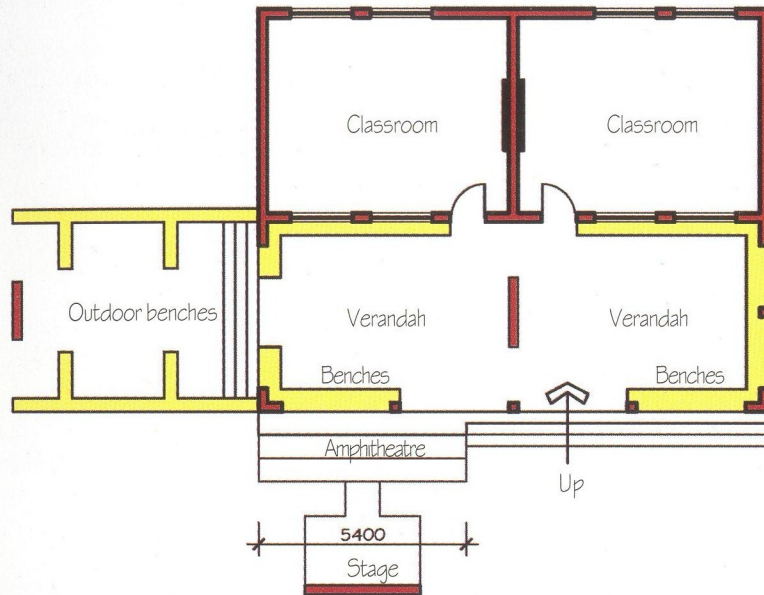
Here, the teacher is conducting activities on a chabutara, under the pleasant shade of a tree. An external chalkboard placed nearby helps her to conduct her classes.

Placement of Amphitheatre

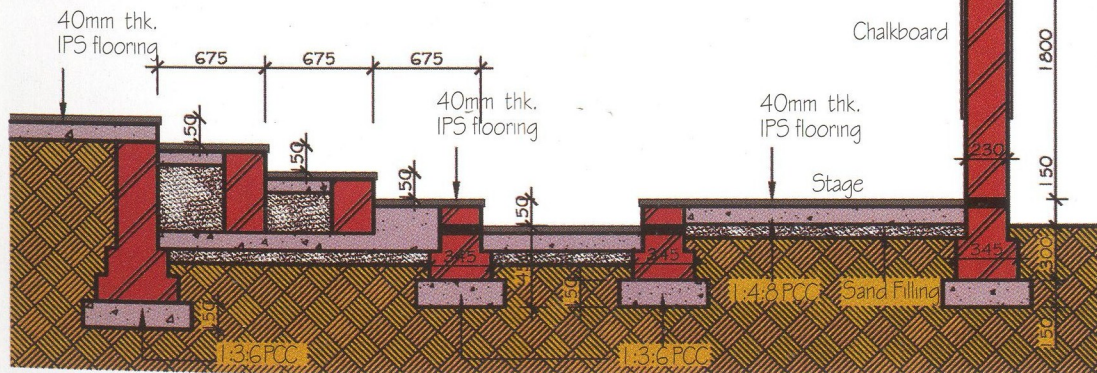
The most convenient place for an amphitheatre is in front of the verandah, with steps rising to the plinth. If it cannot be provided in this position, it should be located at a prominent spot on the plot so as to be visible and approachable from everywhere.

Construction

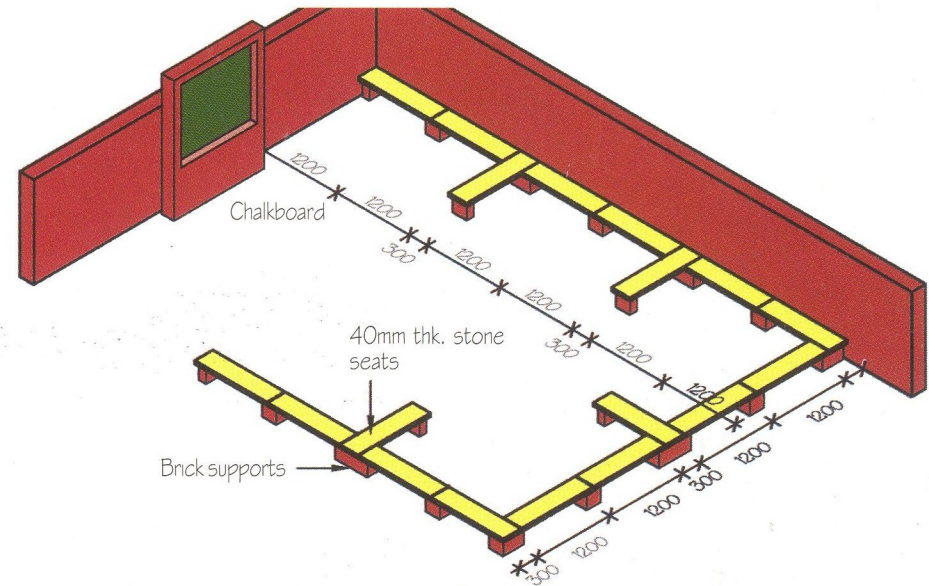
The amphitheatre can be economically made by providing toe walls for the steps, and filling in between.



Plan of an amphitheatre in front of a verandah.



Section through a typical Amphitheatre for plinth height of 600mm



Placement of external benches

These spaces should be placed so as to be in full view of existing classrooms. This helps the teacher to control the activities, and also allows for easy usage. They should preferably be in a shaded area.

Construction

The bench seats can be of stone or precast/ cast-in-situ ferrocement or RC. The supports could be of stone or brick masonry.

Quantities for a typical amphitheatre for plinth height 600mm.

PCC 1:4:8 in foundation	1.57	cum
Brickwork in 1:6 cement mortar	3.13	cum
40mm thk. cement floor.	13.32	sqm

Learning Aids

Geometrical figures, patterns, educational games etc. are items that are used for teaching children. These items can be included into building components such as floors, walls, window grilles etc. Thus, they become permanent 'aids' for children to learn with. Floor elements should ideally be placed in group activity areas, such as in the centre of classrooms, verandahs etc. This helps the teacher to use them effectively. Wall elements can be provided both indoors, and outdoors.

Construction

Floor patterns can be made with coloured IPS cement flooring, or with waste stone chips, as per site. The patterns can be engraved while casting or laying the floor. For wall displays, coloured cement plaster and waste stone chips are materials that could be used. Paint is normally not a good option, since it is not permanent.

Cost

The cost of these elements is negligible, and should be essentially covered in the cost of construction itself.



**Game of "Snakes & Ladders" is used to teach numbering to the children.



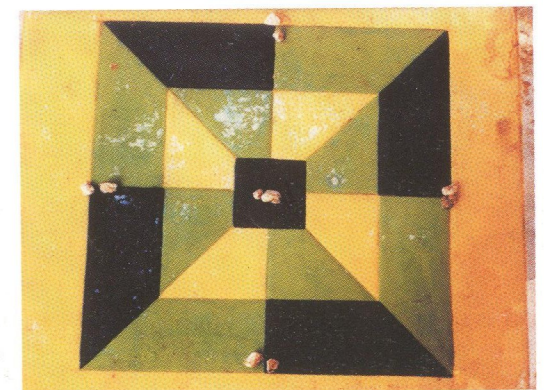
*Educational games inlaid into the verandah floor



Geometrical patterns made with coloured IPS in pavilion flooring.



Geometrical patterns made with broken tiles on benches.

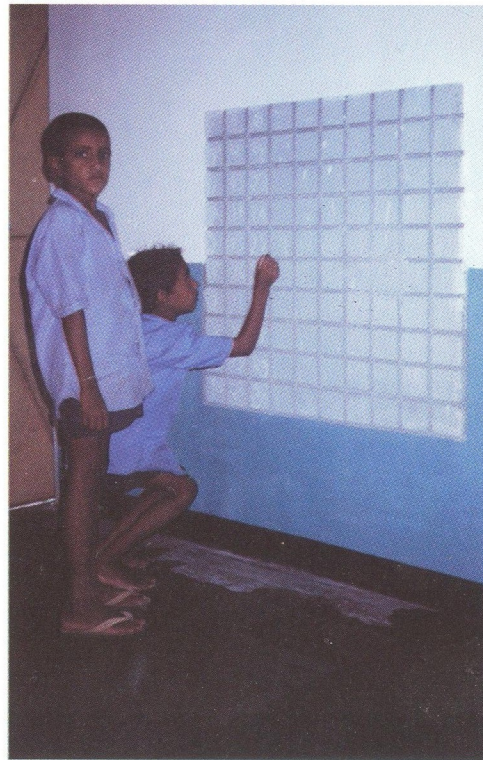


*Educational game in flooring in Rajasthan

c h i l d f r i e n d l y e l e m e n t s f o r r u r a l p r i m a r y s c h o o l s



***Chabutras made into various geometrical shapes act as valuable learning aid.



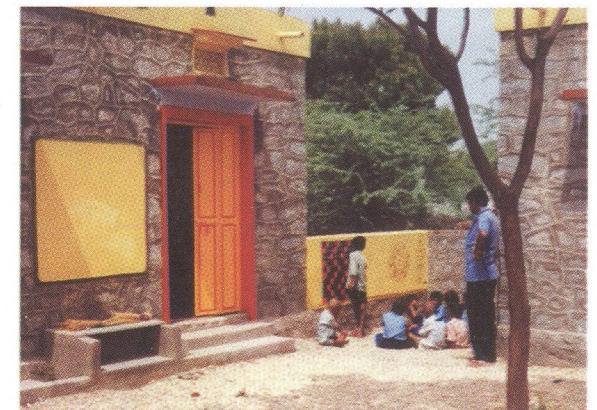
*A simple 10x10 grid made into the wall encourages all kinds of activities. The surface should be like that of a good blackboard so that children can write and wipe on it.



* The "Geometrical Man" made into a grill pattern.



* The window grill becomes an interesting learning aid. Care should be taken in design of grills that those which face the outside may be used only from inside, while those facing the verandah may be used from both sides.



* Educational murals on walls are used as teaching aids.

Chalkboards

Teachers' Chalkboards

Chalkboards should be provided in all places where classes are held – in classrooms, verandahs and also in outdoor teaching spaces.

Placement

In rectangular verandahs, chalkboards should be provided at the shorter ends, as shown. This makes the verandah more usable as a teaching space.

Outdoor chalkboards should be placed near external benches, under trees, with amphitheatres, etc. as per site requirements.

Construction of External Chalkboards

A simple freestanding wall can be made of the required height and width, and the chalkboard can be made on it in cement plaster.

Children's Chalkboards

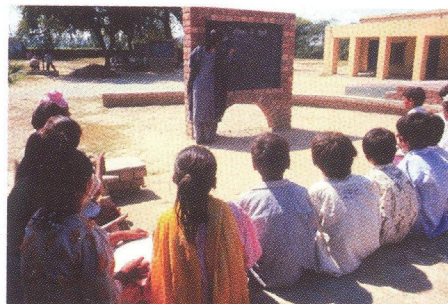
Attractive children's chalkboards should be provided on the classroom/ verandah walls. These can be in various shapes, of animals, fruits, geometrical figures such as hexagons, triangles etc., as shown.

Placement of Children's Chalkboards

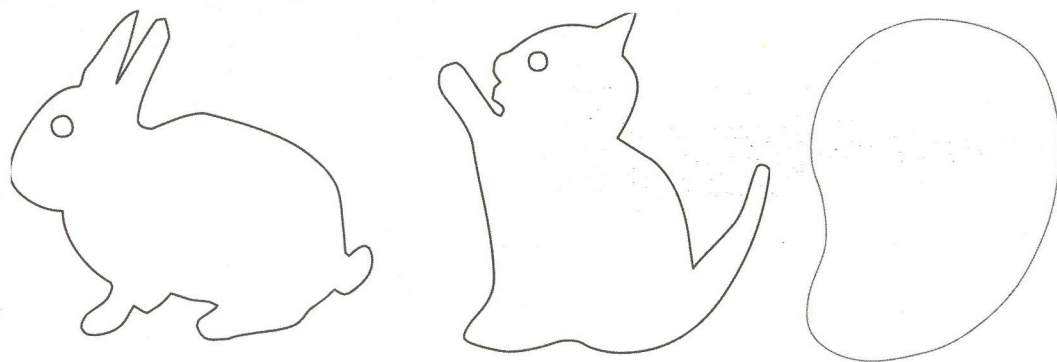
These boards should start from 150mm above ground level and can go up to 1350mm above ground level.



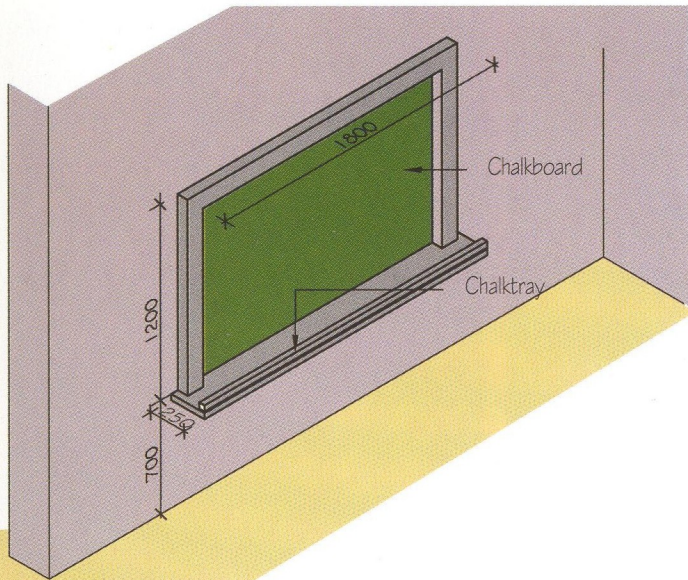
Chalkboard placed at the short end of the verandah to make the verandah usable for teaching.



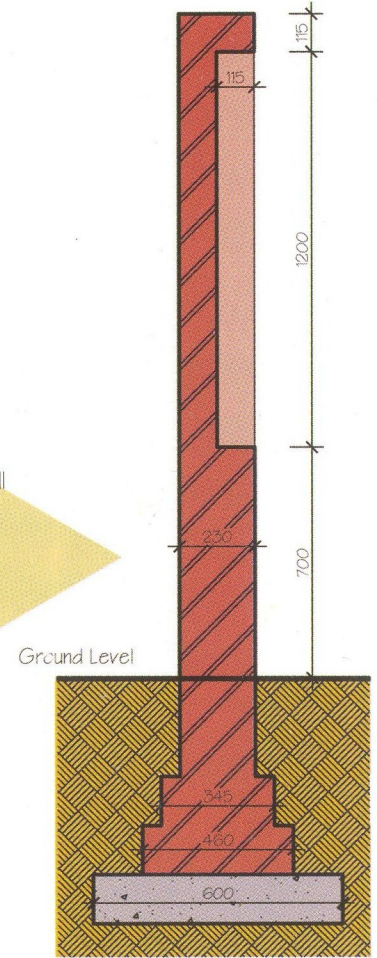
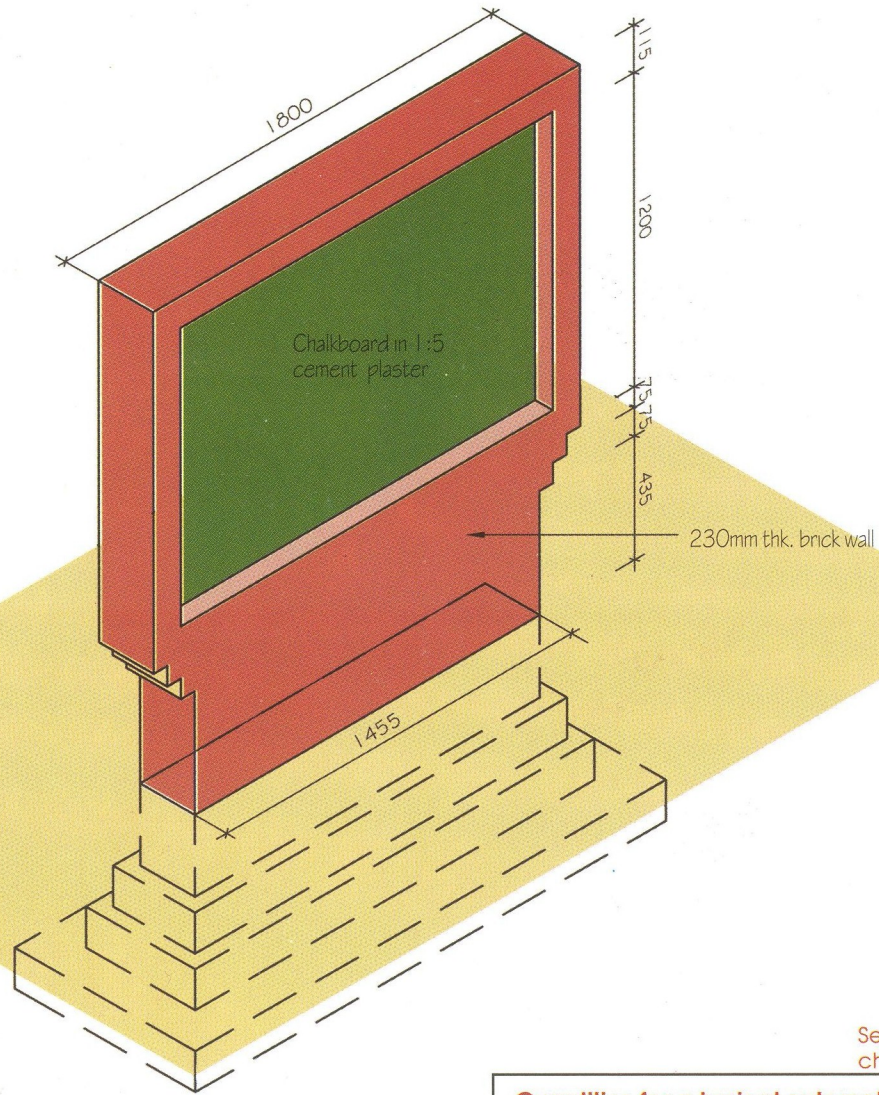
External Chalkboards.



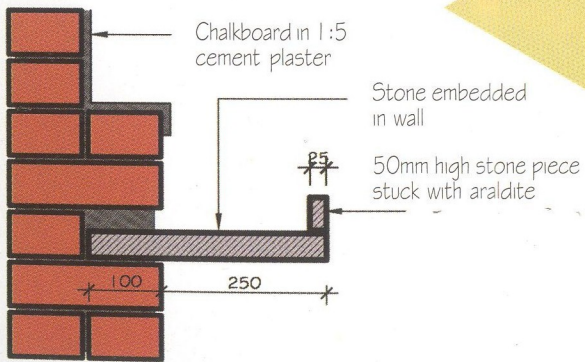
Some interesting shapes which can be used to make children's chalkboards.



Chalkboard with chalk tray.



Section through outdoor chalkboard



Detail of Chalktray.

Quantities for a typical external chalkboard as shown.

PCC 1:4:8 in foundation	0.157	cum
Brickwork in 1:6 cement mortar	0.82	cum
1:5 cement plaster for chalkboard.	2.5	sqm

Play Elements



**A slide in the form of an elephant

Play elements such as slides, swings etc. can be made at very little cost, and make the school environment more attractive.

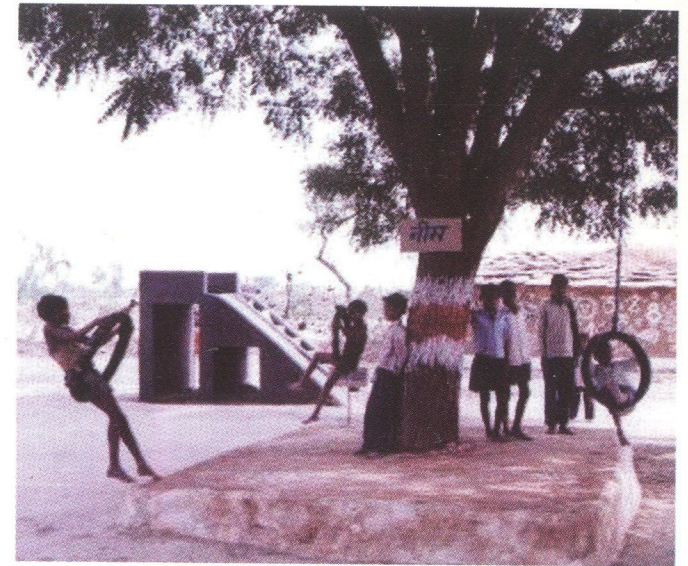
Placement

These play elements should be provided in front of the classrooms, so as to be in full sight of the teacher always. They should ideally be placed in a sandpit, to avoid injuries. Masonry slides can be placed next to ramps, as shown.

Construction

Local cheap materials should be used to make these elements. Stone or brick masonry can be used to make the slides. Attractive coloured IPS cement finish should be provided on all possible surfaces.

Some other low-cost play elements that can be provided are: playhouses, bamboo jungle-gyms, maze of brick walls, crawl-through arches etc.



**Low cost swings made with waste tyres.

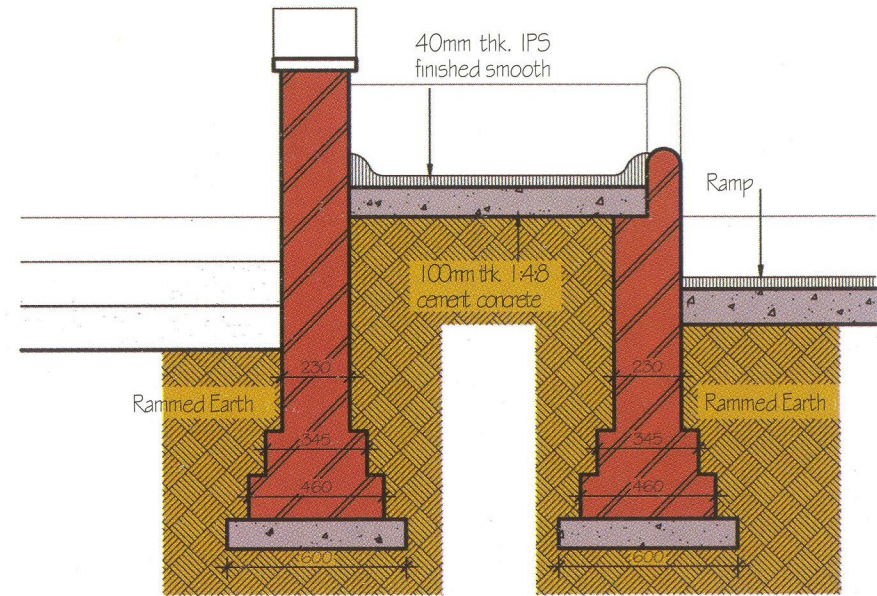
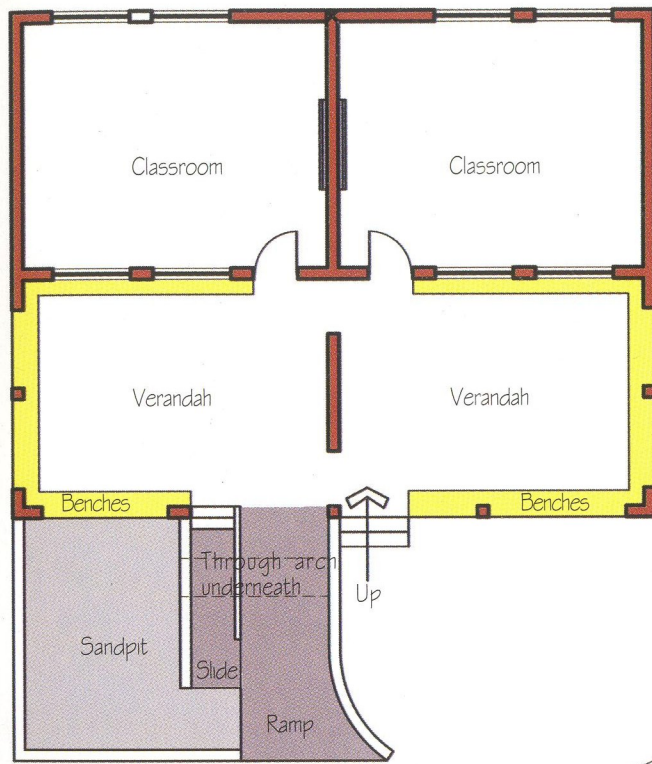


An arch has been provided under the slide for children to crawl through.



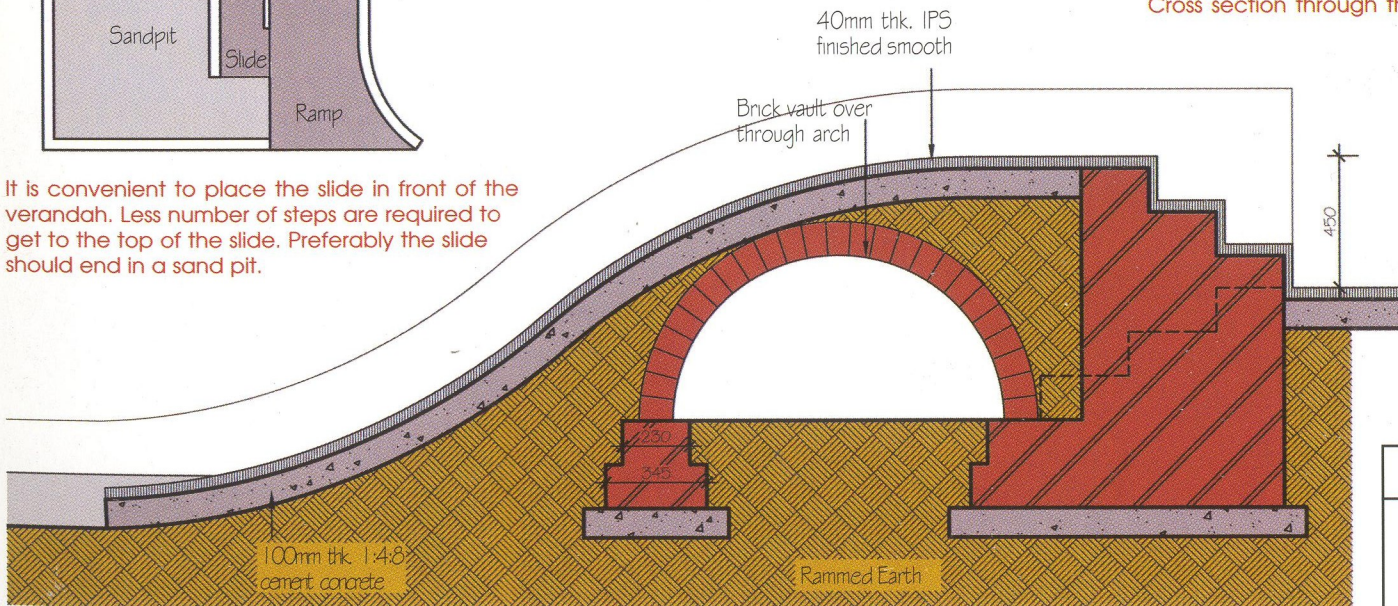
Steps up to the slide from the verandah. The side wall of the ramp is shared with the slide.

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Cross section through the Slide.

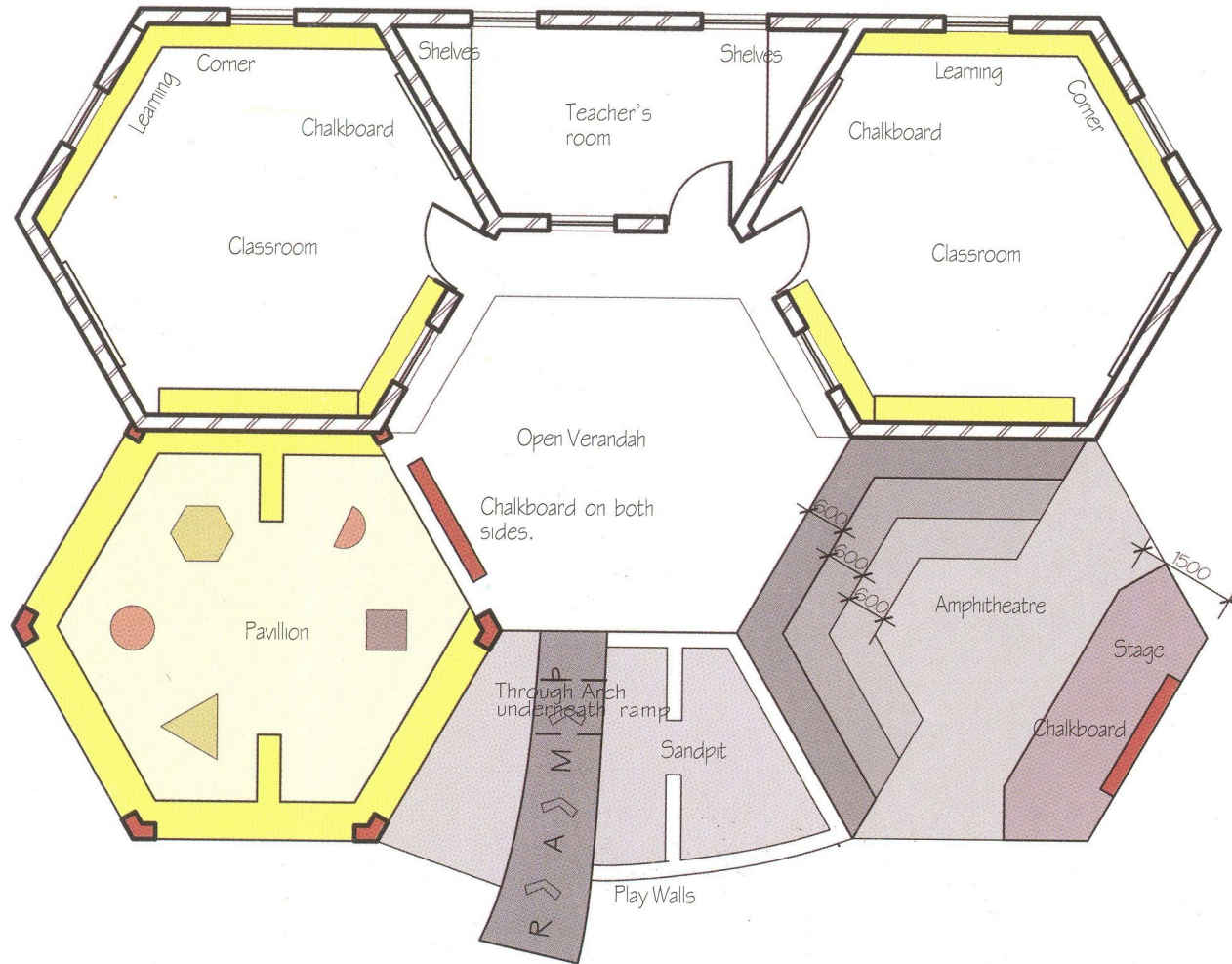
It is convenient to place the slide in front of the verandah. Less number of steps are required to get to the top of the slide. Preferably the slide should end in a sand pit.



Longitudinal Section through the slide

Quantities for a typical slide as shown.		
PCC 1:4:8 in foundation	0.137	cum
Brickwork in 1:6 cement mortar	2.05	cum
1:5 cement floor	2.76	sqm

Case Studies



Incorporation of Child-Friendly Elements into Existing designs

Case Study 1: MAHARASHTRA

In Maharashtra, a workshop was held with the state engineers to decide which elements could be easily incorporated into the designs, and how. Options were prepared for both of their designs – rectangular and hexagonal. The elements decided upon were:

1. Internal Elements:

- Benches along the classroom internal walls
- Children's Chalkboards
- Learning Corners
- Geometrical Patterns in floor
- Display Battens

2. External elements:

- Ramp
- Pavilion
- Amphitheatre
- Slide
- Sandpit

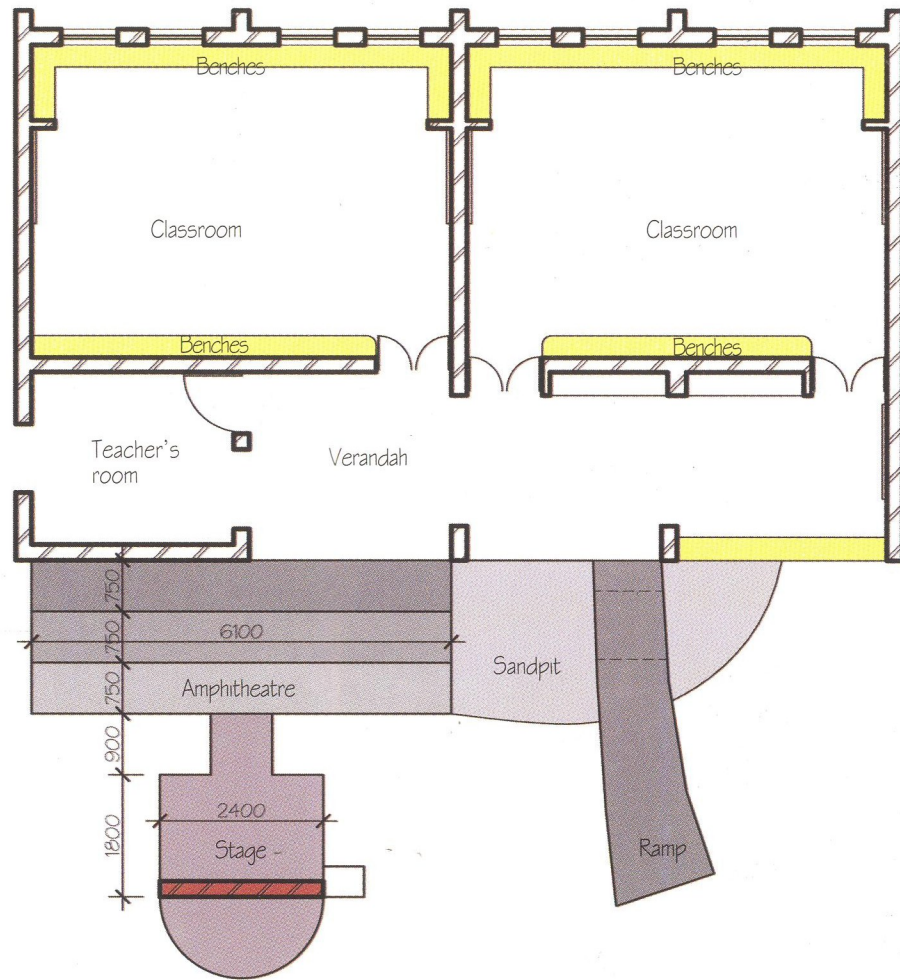
(Chabutaras and external chalkboards can be incorporated as per site conditions.)

The engineers also did a costing of some of the bigger elements. The results were as follows:

1. Platform between 2 existing buildings:
 - For size 6.5m x 7.7m : Rs. 16000/-
 - For size 6.0m x 5.0m : Rs. 13000/-
2. External Chalkboard, with foundation, of height 1.8m and length 2.0m : Rs. 2100
3. Chabutaras:
 - Square chabutara of side 2.5m for height of 0.30m : Rs. 2700/-
 - Circular chabutara of diameter 2.5m for height of 0.30m : Rs. 1900/-

Incorporation of elements into Hexagonal Design

c h i l d f r i e n d l y e l e m e n t s f o r r u r a l p r i m a r y s c h o o l s



4. Hexagonal pavilion of regular classroom size, with pyramidal RCC roof: Rs. 32000/-
5. Hexagonal amphitheatre for plinth height of 0.60m : Rs. 10000/-
6. Ramp for 0.60m plinth height, with width of 1.05m and length of 6.0m : Rs. 5500/-
7. Sandpit of 3.0m x 2.0m, of depth 0.30m, with retaining walls : Rs. 1500/-

Incorporation of elements into Rectangular Design

Case Studies

Incorporation of Child-Friendly Elements into Existing designs

Case Study II: ORISSA

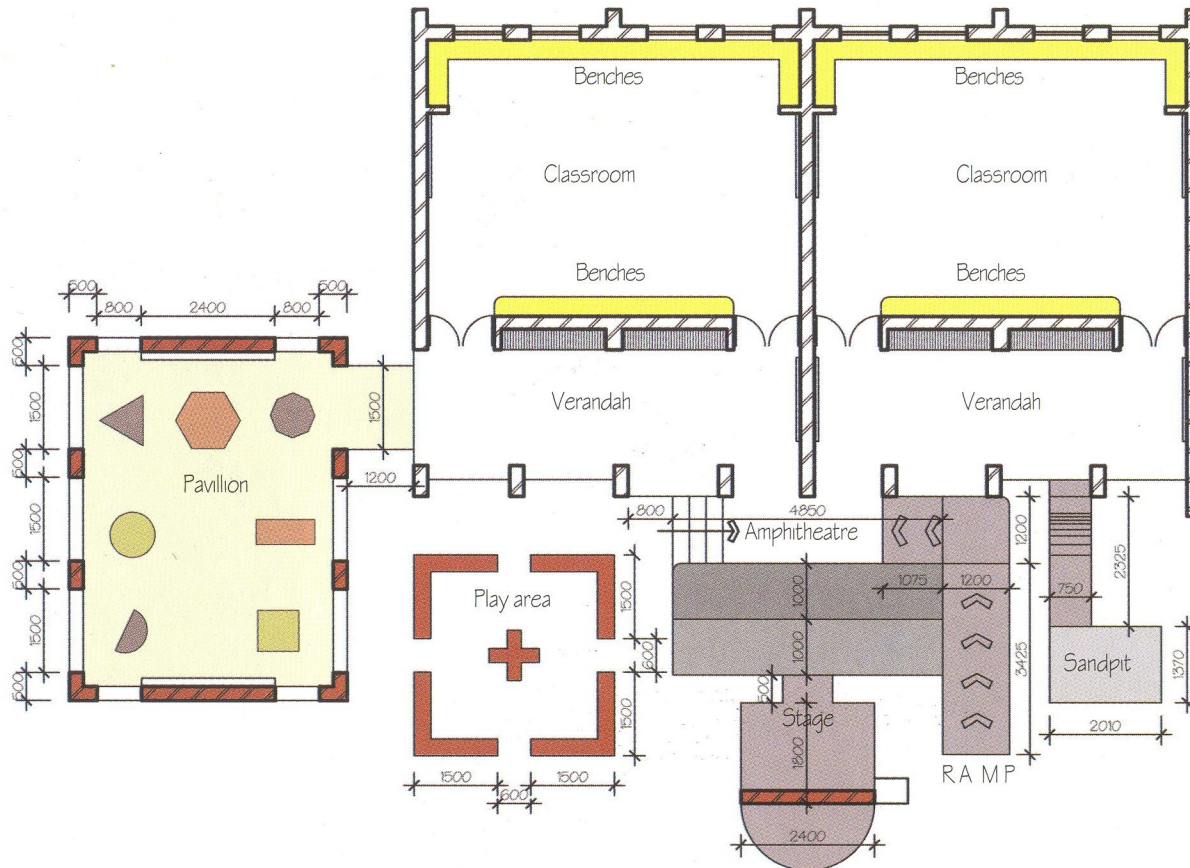
In this case, an independent consultant was appointed to incorporate the elements. Options were prepared for both types of designs. The elements incorporated were:

1. Internal Elements:

- Benches along the classroom internal walls
- Children's Chalkboards
- Learning Corners
- Geometrical Patterns in floor
- Display Batters

2. External elements:

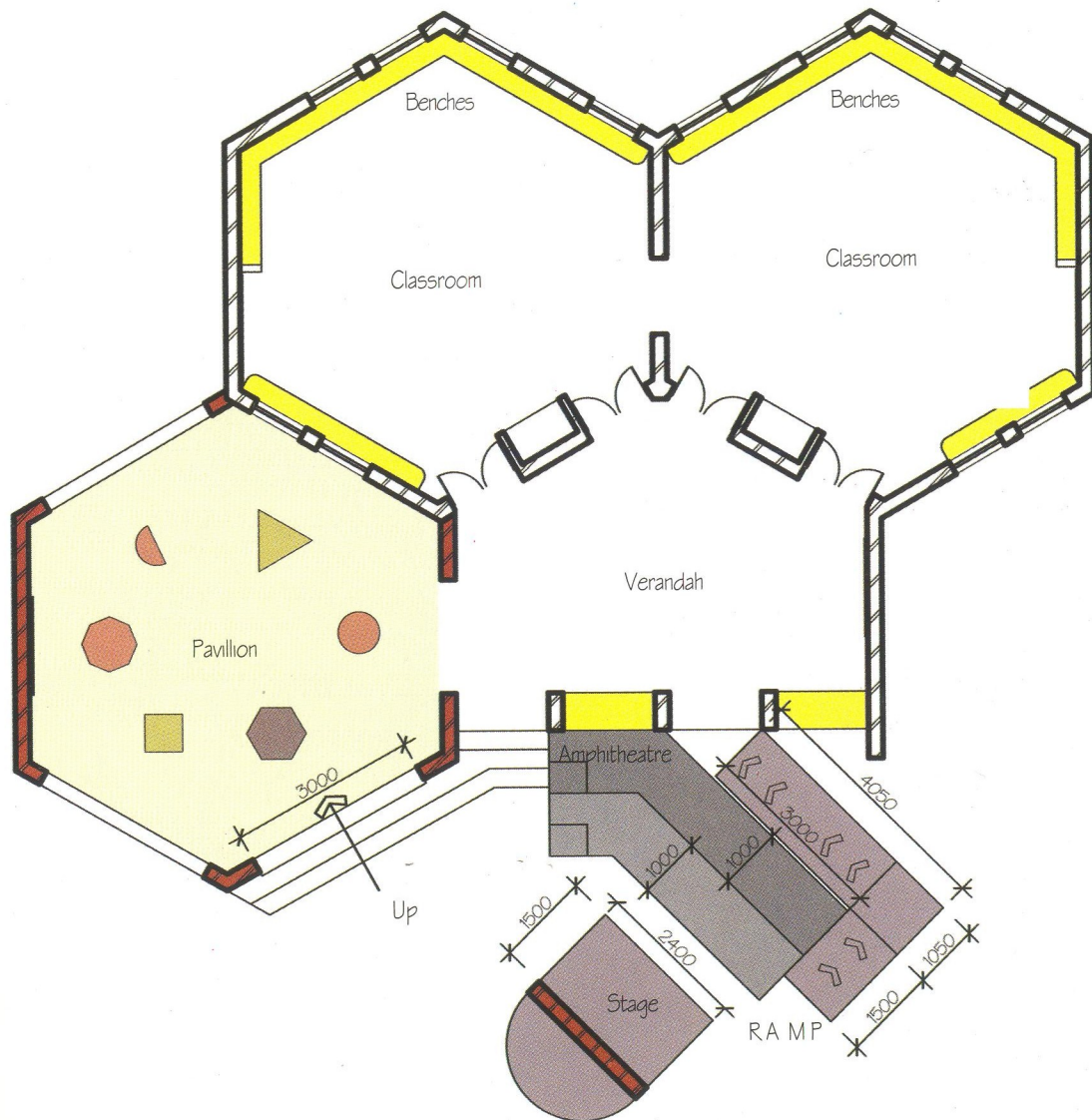
- Ramp
- Pavillion
- Amphitheatre
- Slide
- Sandpit
- Play Walls



(Chabutaras and external chalkboards will be added as per site conditions.)

A BOQ of some of the elements was also provided.

Incorporation of elements into Hexagonal Design



Incorporation of elements into Rectangular Design

Bill of Quantities

Item	Unit	Quantity
A. RAMP		
Size: 4500mm x 1200mm		
1:4:8 PCC in foundation	cum	0.128
Brick work in 1:6 cement mortar.	cum	1.26
Brickwork on edge soling	sqm	5.6
MS Handrail		
B. AMPHITHEATRE		
1:4:8 PCC in foundation	cum	0.645
Brickwork in 1:6 Cement mortar	cum	2.24
IPS Flooring	sqm	14.52
C. CHALKBOARD WITH WALL		
1800x1200 Chalkboard		
PCC (1:4:8) in foundation	cum	0.068
Brickwork in 1:6 Cement mortar	cum	1.35
Plaster and punning with green oxide	sqm	2.16
D. SLIDE		
PCC (1:4:8) in foundation	cum	0.077
Brickwork in 1:6 Cement mortar	cum	1.308
30mm thk. cement concrete with neat cement punning.	sqm	2.137
E. PLAY WALLS (per running metre)		
(450mm high wall with top layer brick on edge.)		
PCC (1:4:8) in foundation	cum	0.028
Brickwork in 1:6 Cement mortar	cum	0.17
F. SEATING LEDGE FOR CHILDREN (per running metre)		
(25mm thk. ferrocement slabs with 230mm high brick support)		
25mm thk. Ferrocement slab.	cum	0.028
Brickwork in 1:6 Cement mortar	cum	0.17

In Conclusion

Applicability

The elements described in this handbook are only examples of what can be done by the engineers, to improve the school environment and make it more 'child-friendly'. Many other types of useful elements can be made.

Also, all the elements shown may not be suitable in all cases. For example, in very hot areas of the country, the outdoor learning areas might not be very suitable (unless they are placed in some shaded area). In such cases, a pavilion might be a more correct option. However, elements such as storage and display elements, play elements etc. are applicable in all sites.

As we have seen in Orissa and Maharashtra, most of these elements can be incorporated easily into existing situations. They are low in cost and easy to construct. They do not need any special technical know-how or new materials, and can be implemented by any engineer anywhere in the country.

Implementation

In DPEP, these small-scale construction activities can be taken up in two ways:

- By the engineers, by Force Account
- Through the community

The funds for these can be found in various ways:

- By incorporating the elements into the estimates
- By using the savings from regular construction
- By community contribution
- From the state's Civil Works Innovation Fund
- From the district's annual Innovation Fund

(the last two are limited funds, though, and limited amount of construction can be done using these. However, they may be used for making prototypes, and for experimentation with the elements)

National-level consultants are also available for guidance. They can be called upon for the first few sites, if required.

The Engineer

The engineer, however, is the most important link in this chain. It is he who will interact with the teachers and community to finally *decide* how to improve the school environment, and what elements to use for this purpose. It is he who will do quality construction of these small items, and make them in as low a cost as possible.

It is hoped that this document will be of help to all the engineers who want to make their own attempts to make their schools more child-friendly.