International Journal of Engineering Research and Technology. ISSN 0974-3154 Volume 10, Number 1 (2017)

A Review of Evaluation of Appropriate Walling material for Zilla Parishad Schools in Panhala Taluka

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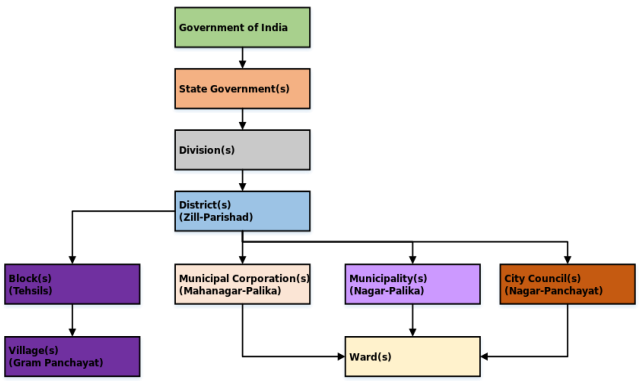
Abstract
The education system in rural areas of developing and underdeveloped countries are facing many challenges. The limited accessibility and challenges to education are attributed mainly to political, economic and social issues. The current status of higher education in rural areas is characterized by low enrolment, poor completion rates, poor physical infrastructure, and high drop out. Government are giving financial support to all government secondary schools for improving its infrastructure, on the other hand the private secondary schools are maintained by owners and private authorities. Unfortunately in India many of Secondary schools (both Government and private) don't have the minimum infrastructure facilities.
The research paper will provide information about the feasibility of applying alternative 'WALL' materials / technologies other than conventional material or techniques to the rural school buildings in terms of cost effectiveness, durability and maintenance free structure.
It will particularly deal with the evaluation of new walling materials available in the market currently. This study will be beneficial to the low income groups of rural society and it will add to the status of infrastructural facilities of rural education.
Furthermore, this research will be useful for many other villages in India and it will introduce new construction technology and create awareness about new technology among people.
Keywords: zilla parishad schools**,** panhala taluka**,** cost effectiveness, low maintenance

Introduction
Education is an indispensable for the development and prosperity of both a nation and society. It acts as a pillar of support and hence provides skills and development for effective employment in the future. A good school infrastructure include with building in good shape including an adequate number of well organized classrooms, sufficient blackboards, tables, desks, benches, chairs, an adequate number of sanitation facility, access to adequate clean drinking water, electricity, ventilation and light, fire exits and first aid kit, medical assistance, canteen, sufficient recreation ground, library, laboratory, computer facilities etc. As we know that school infrastructure is an essential part of secondary schools for realizing the objectives of education. Bad school infrastructure may be the cause of irritation and friction while a planned infrastructure is the center of satisfactory students learning.
The research paper will provide solutions to the existing problems of ZP schools in terms of cost effectiveness and low maintainability of walling materials and introduces alternate technologies for the same, in selected region that is Panhala taluka in Kolhapur district of Maharashtra. While providing the solution, the funds received from the Government from various policies towards repair and maintenance or buildings of new school unit are taken into consideration.

Administrative structure of India –



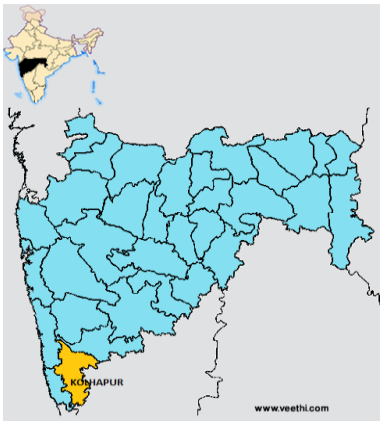
The Zilla Parishad – The Zilla Parishad has been divided into six subjects committees along with the standing committee. The subjects committees along with the departments of the Zilla Parishad which they control are as under-

Subjects Committee	Department controlled
Standing Committee	General Administration Department.
Finance Committee	Finance Department.
Education Committee	**Education Department.**
Co-operation Committee	Co-operation and Industries Department.
Agriculture Committee	Agriculture Department.
Works Committee	Works Department

Health Committee	Health Department

Overview of Selected region –

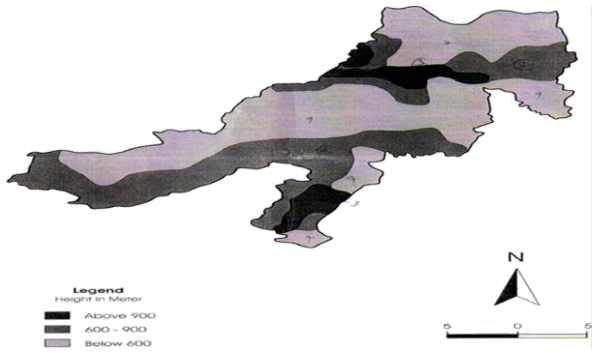
Why Panhala Taluka?



Neighboring regions -

Direction	District /tehsil
Eastern	Hatkalangle and Karveer tehsil
Southern	Gaganbavada and Radhanagari tehsil
Western	Ratnagiri district
Northwest	Shahuwadi tehsil
North	Sangli tehsil

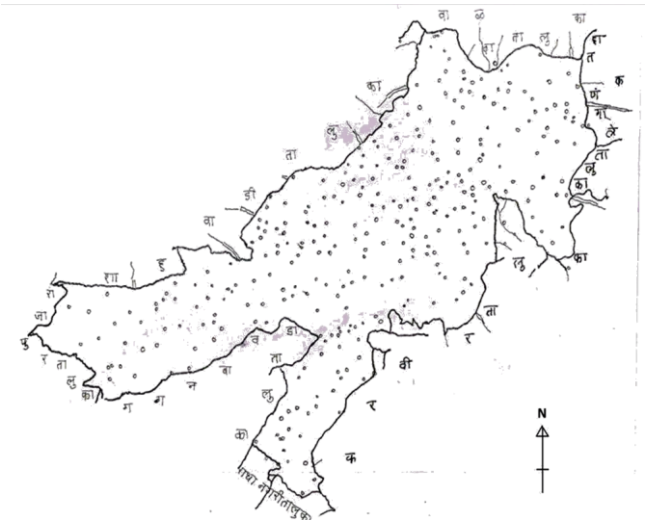
Physiographic study of Panhala Tehsil –Western part of study region is hilly in nature and above 900 meters from mean sea level. Eastern part of the Tehsil is 600 meters above mean sea level. That's why the slope of Tehsil is from westward to eastward. 'Masai Plateau' shows various endemic species and lie at the middle of Tehsil. Panhala-Jotiba hill range lie at the centre of the Tehsil in east-west direction.



Considering the above information regarding the Geographical location, topography and climate of Panhala Taluka, the settlements there experience extreme climatic conditions (rainfall, fog etc). Hence there is a need for development of infrastructure in this area which can definitely improve the lifestyle of people.

Statistics of ZP schools in Panhala Taluka –There are total 20 centers in the Taluka, under which several Zilla Parishad Primary schools run. Total number of schools is Panhala Taluka is **185.**

Distribution of ZP schools in Panhala Taluka-



Reference – Research Project 'Geographical study of Primary Schools in Panhala Taluka' done for The Western Grants Commission, Pune by Prof. Arun Patil, Kolhapur (2014)

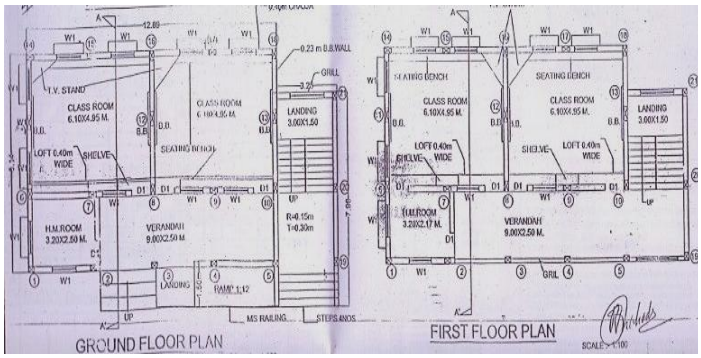
Government policies for Zilla Parishad schools –

1. Sarva Shiksha Abhiyan –
Sarva Shiksha Abhiyan is a State Government scheme started in 2001. It is an effort to universalize elementary education by community-ownership of the school system. It is a response to the demand for quality basic education all over the country. The SSA programme is also an attempt to provide an opportunity for improving human capabilities to all children, through provision of community-owned quality education in a mission mode.Following are the various activities of primary educations for which the Sarva Shiksha Abhiyan provides funds –

1. Co-curricular activities
2. Free textbooks
3. Uniforms
4. Wages for staff
5. Staff training
6. Group activities
7. Computer training
8. Research and development
9. **Repair and maintenance works**
10. Barrier free education
11. New activities
12. School administration board
13. **Infrastructure**
14. School Management
15. Social Awareness

Generally this policy provides Rs. 7,20,000/- for construction

of new school unit in the areas where there is need of construction of school. A typical school unit plan is designed by engineers of Civil Works Department of Zilla Parishad. Following is the typical 4 room plan executed for construction-



Following table shows Sarva Shiksha Abhiyan 2015-16 report of sanctioned amount for Repair and Maintenance in lakhs-

Repair and Maintenance of schools to be done	165
Actual repair and Maintenance carried out	79
Amount remaining from previous year sanctioned fund	539.18
Amount sanctioned in current year	32.30
Total amount sanctioned	571.48
Total amount available for expenses	364.84
Amount used for expenditure	160.88
Percentage of funds in hand	44.10%
Percentage of sanctioned fund	22.15%
Remaining amount from funds in hand	203.160

2. Policy of District Planning committee (Jilha Niyojan Samiti) –

District Planning Committee (DPC) is the committee created as per article 243ZD of the Constitution of India at the district level for planning at the district and below. The Committee in each district should consolidate the plans prepared by the Panchayats and the Municipalities in the district and prepare a draft development plan for the district.

Functions of DPC – In preparing draft development plan for a rural or urban settlement, the DPC shall have regard to matters of common interest between Panchayats and Municipalities which include –

- Spatial Planning
- Sharing of water and other natural resources
- Integrated development of Infrastructure
- Environmental conservation

As specified above, this committee provides funds for infrastructure development of Zilla Parishad schools, mainly for Repair and Maintenance works (Dekhbhal Durusti Anudan) Annually, DPC provides funds ranging from 2,00,00,000/- Rs to 4,00,00,000/- Rs according to the necessity and nature of Repair and Maintenance work in each district of Maharashtra state. (There are 34 districts in Maharashtra state)

How much fund a single unit of ZP School receives through DPC?

There are **12 Talukas** in Kolhapur District namely, Ajara, Bhudargad, Chandgad, Gadhinglaj, Gaganbavada, Kagal, Karveer, Hatkalangle, Panhala, Shahuwadi, Shirol, Radhanagari. The Kolhapur District has **total number of 2003 schools** spread all over these 12 Talukas / Tehsils. Minimum amount of funding received from DPC annually – **Rs. 2, 00, 00,000 /- (2 crore)**

Therefore each school receives – 200,00,000 Rs. / 2003 number of schools

= 9985 Rs. **Say 10,000 /- Rs. Annually**. Hence, each ZP school in Kolhapur District receives Rs. 10,000/- for Annual repair and maintenance works.

Panhala Taluka –There are 185 nos. of schools in Panhala taluka. Therefore, 10,000 Rs. X 185 number of schools = 1,850,000 Rs. Hence **Panhala Taluka receives minimum amount of Rs. 1,850,000 /-** from DPC for Repair and Maintenance works annually.

Report of Special repair and Maintenance works in Kolhapur District by DPC in the year 2015-16

Title	**Amount in lakhs**
Sanctioned amount	361.90
Amount available for works	361.90
Expenditure at the end of March 2016	70.97
Expenditure at end of July 2016	108.4
Percentile -	
Sanctioned fund	**Amount in hand**
29.95%	29.95%
Amount remaining from previous year 2014-15	49.75
Targeted number of schools for Repair and maintenance works	258 nos.
Actual number of schools where Repair and maintenance works were carried out	56 nos.

Nature of Repair and Maintenance works for walls in ZP Schools of Panhala Taluka –Usually such type of works are carried out before June i.e. before monsoons

Walls – Annually –

- Whitewashing
- Furnishing worn out doors and windows
- Waterproofing treatment

After Six months-

- Plastering the worn out walls
- Plastering of cracks

Body of Research –

Existing Materials and Construction practices – List of wall construction materials and assemblies being practiced historically in the selected geographic region are as follows –

1. Mud walls with dry grass reinforcement
2. Burnt brick walls without plaster
3. Burnt brick walls with mud plaster
4. Burnt brick wall with cement plaster
5. Burnt brick wall with cement plaster
6. Burnt brick wall paint finished without plaster
7. Deccan trap stone with mud plaster
8. Deccan trap stone with cement plaster
9. Deccan trap stone with lime plaster
10. Deccan trap stone walls paint finished without plaster
11. Timber framed and timber paneled wall
12. Timber frame and mud wall with bamboo and dry grass reinforcement

From the above list, we can extract basic building materials as follows:

1. Mud
2. Burnt clay bricks
3. Deccan trap stone blocks
4. Wood

The above listed materials are locally available and construction work can be done by local labor. However, the conventional construction techniques are time consuming which ultimately results into increase in cost (labor cost and overhead costs). Moreover these structures require maintenance once or twice a year, depending on the quality of construction.

To achieve cost effectiveness and economy with other factors required for school buildings such as thermal comfort, acoustical properties, and low maintainability following cases are worked out and compared against the existing conventional practice.

CASE 1 – Conventional construction techniques using

1. 230mm thick brick masonry. (existing practice)

Depending upon the availability of Funds for Zilla Parishad Schools, solutions are specified for the Walls. The following cases can be adopted when funds are scheduled for Repair and Maintenance works as well as for construction of new unit.

CASE 2 – Waterproofing treatment for walls.

CASE 3- There are certain vernacular techniques also which can be adopted for cost effectiveness which can be build in local material and labor such as,

1. Walls with Rat Trap bond
2. Rammed earth walls

CASE 4 – Use of Recycled bricks or cement blocks. (Demolition waste)

CASE 1 – Conventional construction using 230 mm thick Brick masonry (Existing Practice)

The ZP schools built in the region have basic specifications framed regarding construction of walls. Second class burnt bricks of 230mm thickness are used for construction of school. The funds are provided by Sarva Shiksha Abhiyan for construction of new school unit. The estimated cost of construction of 'Walls' for 2 classroom+ 1 H.M. room (plan given above) as received from the Public Works department of Zilla Parishad is approximately, Rs. 3,90,000/- (Three lakhs ninety thousand only).**Therefore, cost of construction of walls by conventional construction technique is Rs. 3, 90,000/-**

CASE 2 – Waterproofing Treatment of Walls.

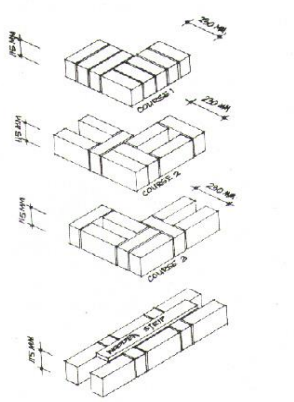
It is clear from the survey of schools in Panhala Taluka, the major defects in existing external walls (230mm thick brick masonry) of school buildings are formation of cracks.

Hence cracks can be filled with waterproof chemical compounds available in various forms. This method can be adopted when the Repair and Maintenance funds from District Planning committee (DPC) are not available sufficiently for demolishing and building new walls. Hence existing walls can be repaired within a short time and less cost.

As discussed earlier, amount of funds received annually by DPC for Repair and Maintenance works by a single school unit in Panhala Taluka is around Rs. 10,000/-. In case of severe leakages, it is not possible to demolish and built new external walls within such a small budget. Therefore waterproofing treatment can be done immediately and good results can be achieved within less time.

CASE 3 – Vernacular construction techniques –

1. 230mm thick walls with Rat trap bond- Brick placed on edge in 1:6 cement mortar as is a typical rat-trap bond. If the bricks available are having a compressive strength of more than 4 N/mm2, then Rat-trap Bond Masonry can be adopted.



Advantages –

Consumption of bricks is 25% less due to the cavity.
Consumption of mortar is 30% less.
Stability of wall is not affected
Dead load is less and hence saving in foundation cost by 20%
Since the wall is adjusted to have fair face, plastering can either be avoided or if plaster thickness can be reduced.
It has better thermal insulation properties between exteriors and interiors, i.e., 4-5 degrees cooler in summers as well as 4-5 degrees warm in winter. This thermal insulation property is developed because of cavity present in the wall.
Labor intensive and hence can generate employment.

Material and Labor required for 1 cu.m. Work of Rat-trap bond wall –

Material		**Labor**	
Material used	Quantity	Labor	Man days
Bricks	400	Skilled	1.56
Cement	36.0 kg	Unskilled	3.95
Sand	0.15 m3	Curing Labor	0.496
Scaffolding	2.00 m3		

Following figures indicated the Rat trap bond brickwork in various types of Junctions like-


Corner


Reinforced corner

Corner junction


Cross- Junction


Reinforced Cross- Junction

Cross junction

T junction

End situations like door openings, window jambs


T-Junction


Reinforced Sill or Lintel Band

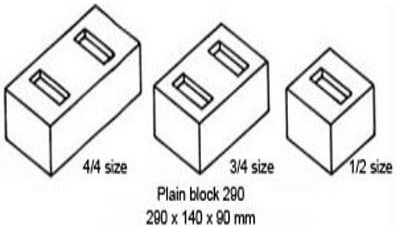
Obtuse angle joints

2. Rammed Earth Construction- Rammed earth is a construction method used primarily to build solid walls by compacting subsoil, sometimes stabilized with cement or other binders, in progressive layers inside temporary formwork.

Hence Rammed Earth Construction Technology can be used for walls of ZP school units in form of Compressed Stabilized Earth Blocks (CSEB). These blocks can be produced on site, with the help of technology adopted by Auroville Earth Institute. The type of soil present in the selected region i.e. Panhala Taluka is **gravely or gravely clay.** The hard strata are at the depth of 2 – 3 feet from ground surface.

As most of the schools constructed have load bearing construction it is suitable to select CSEB (Compressed Stabilized Earth blocks) suitable to this kind of construction. The initial cost for manufacturing equipments such as Auram 3000 from the Auroville Earth Institute is around Rs. 50,000/-. We can select **Block Plain 290 and Block Plain 190** which are easy to mould and ideally made for light load bearing structure. It has following features –

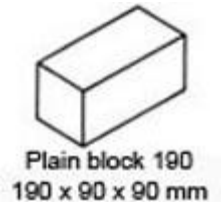
1. Block Plain 290 -



This block is used as a single block width for light load bearing structures, or as a double block width for heavy load bearingstructures. It presents the advantage of saving mortar and allowing a fast block laying.

Quantities of materials per 1000 Blocks -

Material	**Quantity**	**Rate (Rs.)**	**Amount (Rs.)**
Soil	5.17 m3	0.00	0.00
Sand	1.29 m3	3100	4000
Cement	8.62 bags	300	2586
		Total	6586



2. Block Plain 190 –

This block is used with the hollow block 390 for the partition walls. It can also be used for very light load bearing structures for ground floor only.

Quantities of materials per 1000 Blocks-

Material	**Quantity**	**Rate**	**Amount**
Soil	2.18 m3	0.00	0.00
Sand	0.54 m3	3100	1674
Cement	3.63 bags	300	1089
		Total	2763

Use of CSEB for Repair and Maintenance works -
It is clear from the survey of schools in Panhala Taluka, the major defects in existing external walls (230mm thick brick masonry) of school buildings are formation of cracks at the corners of the structure. In some structures the cracks are major having thickness more than 3mm. It can cause severe human injury if not treated properly.

In this case, instead of demolishing the entire structure and then reconstructing it , the corners can be demolished by keeping entire structure intact with the help of temporary supports or shuttering and Compressed Stabilized Earth Blocks (CSEB) can be used at the corners.

CASE 4 – Recycled Bricks or Concrete blocks –

This method of using recycled waste can be adopted when there are serious problems with walls (either the wall is damaged by the cracks, or it is partly demolished) of the school building and no sufficient funds are available for the repair and maintenance works. Hence recycled bricks can be used for repair and maintenance purpose as well as for construction of new school unit.

The demolition waste which can be recycled and used for Construction of walls. The bricks or concrete blocks which are in intact and are in good condition can be used. Hence waste can be recycled and cost of construction of walls can be reduced.

Only the transportation cost of bricks from demolition site to the construction site should be considered.

CONCLUSION-

The research done has tried to simplify the construction of walls in case of rural schools. As wall is the most energy fetching element of the structure. The solutions obtained can be adopted for Repair and maintenance as well as Construction of new school unit. This can give rise to awareness regarding school infrastructure and lead to the changes in norms of Zilla parishad construction techniques and specifications. These new techniques can be adopted for other schools at district and state level.

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