PN-ABX-737

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~~Annexure II.~~ Criteria for Sites Selection Design and Construction of New School

PED PROGRAM
BALOCHISTAN

1993

Government of Balochistan
Department of Education

A / E Services For

PESCP

Primary Education Schools Construction Programme

CRITERIA FOR SITE SELECTION DESIGN & CONSTRUCTION OF NEW SCHOOLS

ENGINEERING CONSULTANTS
Consulting Engineers, Architects & Planners

PRIMARY EDUCATION PROGRAMME BALOCHISTAN

DESIGN CRITERIA

Commentry	Criteria
SITE SELECTION CRITERIA **ASPECTS TO BE CONSIDERED**	
Physical Condition	
Land Configuration; The following parameters shall be taken into consideration for selection of site for the Primary schools:	
#1: Easily accessible from the main road but should be safely away from main roads which will cause noise pollution and will be a hazard for children.	#1: Site shall be, atleast, 200 yds away from major road.
#2: Should be away from any source causing pollution (both noise and air) i.e. away from tube well because the diesel pumps of tubewells will cause loud noise, which will disturb class room activities. Sewage disposal open drains which will generate odors and will also be hazardous for children. Likewise the site should be away from thresher plant and such mechanised agricultural units which cause air and noise pollution. Also site shall be away from cattle and dairy farm.	#2: External noise in class room should be less than 5 dbA.
#3: The site should be away from any depressed land use such as grave yard etc.	#3: Services should be within radius of 200'-0".
#4: All the services should be preferably in the vicinity of the prospect site for the school.	#4: Open drain should be, atleast, 200 yds away.
#5: The site should be away from any physical hazard such as open drain, high tension electric transmission line and any other such hazards.	

Topography & Contours

#1: The land should be high and above flood level.

#2: Water logged and saline soil will cause difficulty in construction. It will also increase the cost of construction and maintenance. This type of soil will also reduce the life of the building and its finishes.

#3: The contours should be such that the water shall drain out naturally, otherwise fill material will cost extra burden on the construction cost and will be an extra pay item.

#4: The site should have vegetation on it which will confirm its sustainability of vegetation. Preferably some trees should be there.

#5: If the site is on steep slope it will be a hazard to the safety of the children. Also it will be a costly affair to built a retaining wall to straighten up the site slope. Site with steep slope should be avoided.

#1: Site should be atleast 3'-0" above flood level of 20 years cycle.

#2: The site should neither be saline nor waterlogged.

#3: The site should be on natural high ground.

#4: The site must have vegetation on it.

#5: The site slope shall not be more than 3%.

PRIMARY EDUCATION PROGRAMME BALOCHISTAN

DESIGN CRITERIA

Commentary	Criteria
SITE SELECTION CRITERIA ASPECTS TO BE CONSIDERED	
SUB SOIL CONDITIONS :	
a) Soil Types:	
Soil encountered may be of the following types:	Soil shall be preferably either sandy Gravelly Soil or Silty Sandy Soil.
Gravel, sand, silt, clay, fine grained organic soil and peat. Clay and silt are classified as cohesive soil while sand and gravel are classified as cohesionless or non cohesive soil.	The site shall be on natural virgin ground and not on the filled material. Soil not to be of peat,muck or organic characteristics.
b) Bearing Capacity:	
The bearing capacity of a soil depends upon the physical characteristics of the soil particles, moisture content and the changes brought in by the atmospheric influences. Compact or dense soils have large unit weight and the angle of internal friction and consequently high bearing pressures.Compact soils are naturally not very compressive therefore cause little settlement.Loose soils on the other hand have small unit weight and angle of internal friction and therefore low bearing pressure.These soils under moderate loads may suffer large settlements. Unless it is very hard or dense,silt is often a poor foundation soil and should be avoided for supporting foundation.	The site shall have a bearing capacity of 0.50 t/sft to 1.50 t/sft, as for the bearing capacity beyond 1.50 t/sft there will be no effect on the foundation sizes for single storey buildings.
c) Ground water:	
The ground water level is very important in Engineering practice.For any foundation work,the ground water level must be determined with a reasonable accuracy.The ground water may disturb the soil at the bottom of the excavation and such disturbances may reduce the bearing power of the soil.	The site shall have ground water tabel at a level below the foundation level i.e.about 4' to 5' below ground level to avoid any dewatering operation during construction of foundations. Necessary field and laboratory tests shall be carried out for determining the geotechnical properties of the insitu soils and to arrive at the bearing capacity of the soil.

Drainage

#1: The contours shall be such that the water drain out naturally, otherwise fill material will cost extra burden on the construction cost and will be an extra pay item.

#2: The top level of the site should be above the invert level of the sewage, if such site condition exists then there will be no need for any pumping out of the sewage. This will result in overall cost savings and operating cost of the school.

#1: Site should be atleast 4'-0" above the invert level of the sewage line.

UTILITIES AND SERVICES

Existence of Utilities and Services such as Water, Sewerage disposal, Electricity and Gas play an important role in the selection of site for a school. The availability of water is an essential condition to be fulfilled; without water school cannot be constructed or function. Possible sources of water supply in order of preference considered in the selection of site for School are given below:

1. Water may be available from existing water main.

2. Water may be available from an existing well or tubewell.

3. Water may be available by boring a well.

4. Water may be carried from a pond or a lake.

Sewerage disposal can be arranged in following ways.

1. Discharge the effluent in existing sewerage main.

2. Discharge the effluent in nearby Nallah after septic treatment.

3. Discharge the effluent in a soakage pit.

4. Discharge the effluent in an open field and let it evaporate.

Preference will be given to a site where existing sewerage main is available.

ELECTRICITY

Electricity is an important utility, preference should be given to site where electricity at 400 volt AC 50 HZ 3 phase is available.

GAS

Gas connection is required for heating purpose or as a fuel for cooking food. Preference should be given to a site where gas connection is available.

- Ist choice will be given to a site where water supply main, sewerage main, electricity and gas connection are readily available.

- Second choice will be a site where water supply system doesn't exist, but it is possible to arrange these facilities.

Land

#1: There can be many geometrical shapes of any site. Preferably the plot should be of regular size so that the area can be optimally used. Apart from sizing, the plot should be rectangular in shape so that, if required future expansion plans may be implemented.

#2: To facilitate the future expansion in an effective manner the plot should be twice the width. This will give more room to expand the school in a linear manner and give optimum utilization of area.

#3: For in and out door activities and to accommodate a toilet block and also to have provision for future expansion, minimum area should not be less than 555.5 sq. yd.

#4: For the school building to be more energy efficient and to increase the comfort level, the longer side of the plot should, preferably, face north direction. This orientation will ensure that maximum surface area of the building will face the north and the other side should have veranda projection to shade the building.

#5: If the site is in the vicinity of an existing school than it should be as close to it as possible to facilitate the students to use the facilities of that school and to avoid duplication of facilities, which entails extra financial burden.

#1: The Plot shall be rectangular.

#2: Ratio of plot shall be 1:2.

#3: Plot area shall be 5000 sft.

#4: Longer side of the plot should face north-south side.

#5: Site should be close to the existing school.

Environment

#1: Easily accessible from the main road but should be safely away from main roads which will cause noise pollution and will be a hazard for children.

#1: There should be no grave yards in the vicinity.

#2: Should be away from any source causing pollution (both noise and air) i.e. away from tube well because the diesel pumps of tube wells will cause loud noise, which will intern disturb class room activities. Sewage disposal open drains which will generate odors and will also be hazardous for children. Likewise the site should be away from thresher plant and such mechanised agricultural units which cause air and noise pollution. Also site shall be away from cattle and dairy farm.

#3: The school is a learning center and the students, mostly children are psychologically very sensitive, their learning abilities are greatly dependent upon the kind of environment in which they are learning. More lively environment will generate more healthy learning environment. Any thing that is psychologically depressing in nature within the vicinity, should be avoided.

#4: Not only the site should be above the high flood level but the access road/path should also be above the flood level to give free and hindrance free access to the school all around the year

#6: As the children are energetic and usually in a hyper-active mood. It would be wise to choose a site where there are, no major cross drains. This type of drain may be a potential danger for small unattended children. As far as possible there should be no, ideally none, cross drain on the approach of the site.

#7: As stagnant water is a breeding ground for many insects and viruses and can pose health hazard. The site for school should be located away from these potentially dangerous locations.

#2: If tubewell is used, there shall be no septic tank or open sewage drain within a radius of 300 yds.

#3: There shall be access to site round the year.

#4: There shall be no high tension electric line within 1000 yds of the school site.

#5: There shall be no cross drain wider than 3'-0" on the main access path of the school.

#6: There shall be no stagnant water pond within 300 yds of the school site.

#7: No Open well shall be in the radius of 500 yds of the school site.

#8: There shall be no quick sand and poison ivy in the vicinity.

#8: In a rural seating where usually wells are the only source of water supply both for drinking and irrigation. Care should be exercised that these open wells are not in the vicinity of the school site.

#9: There can be many other potentially dangerous conditions around the school site such as Poison ivy and quick sand. It would be essential to avoid these types of situations.

DESIGN CONSIDERATIONS

Climatical

For climatical considerations of design, the Balochistan area has been divided into three (3) distinct climatic zones viz a viz Coastal Zone, Arid/hot Zone, Cold Zone.

Layout

The school should be, by and large, oriented on an east-west axis with the longer elevations facing north-south to reduce exposure to the sun. A deep (minimum of 8'-0" veranda should be made on the south side. Therefore the entrance to the school should invariably be on the south side. This orientation is efficient where thermal storage is not needed or discouraged i.e hot areas. In cold areas the schools should be oriented north-south side with veranda on east side. As usually the school sessions are in the morning.

School shall be oriented on north-south direction.

Locating School Building

Building should be well placed to allow for breeze penetration, if air can be used as a coolant mostly for the entire period of the year. As a general rule the longer side of the building and the boundary wall should be 2 times the height of the shorter structure.

The longer side of the building and boundary wall shall be two times the height of the boundary wall.

Ventilation:

#1: If air movement is needed for two to ten month of the year, spacing for breeze penetration is still needed, but building and painting should also be planned to give protection against dust, hot or cold winds.

#2: In cold areas the opening in the walls should be between 40-80 %. More opening will bring in sun light and make the building more efficient and comfortable in cold areas. While in hot areas, direct sun light is not advisable and thus the glazed area should be minimized to maintain the lighting level required. Also the glazed area is needed for ventilation and should be kept to maintain a comfort level.

#1:
- In cold areas the operable windows shall not be more than 20% of the total glazed area.
- In hot area, where air can be used as coolant, the operable area shall be more than 50% of the total glazed area.

#2:
- In cold areas the total glazed area shall not be less than 50% of the total wall surface area.

#3: Windows Location: Windows should be located at least 5-7 feet apart on the same surface to avoid short circuit between inlet and outlet.

#4: In order to have smooth and consistent flow and to avoid oust of air, preferably the windows should be on opposite side for cross and effective ventilation.

#5: In order to have consistent flow a given amount of aperture area of inlet and outlet should be equal in terms of square footage. If the outlet or the inlet is smaller than the other there will be an inner blanket of air which will not allow the air to ventilate.

#6: For area where precipitation is high, the windows should be set back or covered by projected over hangs. The size of setback of the overhang should be decided considering the wind velocity and frequency of storms. Also the operable panels should be upper hung to facilitate its opening in the rain.

#7: There are various means of insulating the vertical walls of a building such as plastering with a thermal insulator, Plantation of trees to shade the surface, cavity walls. However the cavity wall is the most efficient and permanent solution. However it costs extra money but it pays off in terms of low Running cost and increase comfort. If cavity walls are provided, weep holes should be provided at the bottom, to facilitate evaporation of any moisture that might penetrate in the cavity.

#8: As heat gain is directly proportional to the surface exposed to the source. It would be essential to reduce the surface area exposed directly to sun. To achieve this, corrugated surface should be avoided as far as possible. As this will produce more surface area to absorb solar radiation and reduce comfort level in hot areas.

- In hot areas the total glazed area shall not be less than 35% of the total wall surface area.

#3: Minimum distance between windows shall be 6'-0".

#4: Windows shall be on the opposite side of the class room.

#5: The aperture of inlet and out let shall be equal.

#6: - Over hang over the window shall not be less than 1'-6".
- Operable panels of windows shall be upper hinged.

#7: All external, exposed to sun walls shall be cavity walls with weep holes, no less than 1/2" dia at the bottom.

#8: External walls shall not be corrugated.

#9: Thicker wall of cavity wall shall be located in side the building.

#10: Plinth level shall be kept at 1'-6".

#11: Window frames shall be of Aluminum.

#12: External finishes shall be of permanent nature.

#13: All external finishes shall be of light colour.

#14: The overhang shall be minimum of 1'-6".

#15: Ventilator shall be provided over every window.

#16: - Room height in hot area shall be 14'-0".
- Room height in cold areas shall be 12'-0".

#9: In cavity wall the thicker wall should be kept inside as it will have more volume and absorb more solar radiation.

#10: The plinth level should be comfortably high. Plinth should be high enough to protect any localized flooding of the surrounding area but not high enough to pose any danger for children. The plinth should be kept at a height where children can also climb on it without steps. It is recommendable to avoid any steps in a primary school altogether, and provide ramp if possible. But as the area is limited and the gradient will be high therefore few steps would be ideal.

#11: Window frames shall be non corrosive and maintenance free. They should be composed of material which are tough, light weight and non corrosive.

#12: As far as possible the external finishes should be permanent for reducing the cost of maintenance. Permanent finishes which are easily available and executable in the remote areas should be preferred. These finishes may be; machine spray plaster, washed terrazzo, Brick pointing etc.

#13: All external finishes should be of lighter color with higher radiant loss, preferably white, which will have most radiant loss.

#14: The sun dial for the particular area should be the decisive measure for dimension of overhang and/or setback of the windows. Where sun can be utilized actively for heating purpose, the over hang should only project out for prevention of rain penetration. Where sun is to be kept out the overhang should be larger, depending upon the latitude and longitude of the site. It should also be considered that the sun path is at lower angle in winter and high in the summer.

#17: All rooms should have white color terrazzo flooring.

#18: White plastic emulsion shall be applied on internal walls in rooms.

#15: Almost all the girls perform vail in the Balochistan. Due to this reason mostly all the windows are kept closed resulting in suffocation. This is a usual thing and is hazard to health for growing children. To avoid this situation and facilitate good ventilation, ventilators may be provided.

#16: Height of the room plays an important role to enhance comfort level in hot areas. As a general rule the comfort level is directly proportional to the comfort level of the building in a hot area. Building become more warmer if the height is low.

#17: The floor finish should be sturdy and economical. Should be non porus and of high strength. Preferably of lighter color.

#18: Interior finishes should be of lighter colour. The wall and the ceiling should be of same colour and of same reflective index, so as to have equally distributed light. If paint has to be applied, care should be exercised that distemper, although inexpensive, should be avoided. Distemper does not bound with the wall and particles will fall and if got into the eyes of children, can be harmful.

Space Requirements

#1: Space requirements for the primary education according to international standards can vary per child, inclusive of circulation and space for the instructor. Since in Balochistan this is a unique situation, therefore customized standards has to be followed. In Pakistan various agencies has followed different standards from 6 sft to 9 sft.

In our case. since it is a multi grade teaching system. There will be students of age 6 to 14 and the space requirement varies from 8 sft to 10 sft.

#1: As per standard 9 sft per child shall be considered, inclusive of circulation and space for the instructor.

Enrollment Requirements

#1: Class rooms can vary in sizes according to the strength of students enrollment. Typically there will be one teacher to conduct classes for all grades. To have acceptable classroom and learning environment for children, enrollment should not exceed beyond 40 students.

#1: Each class shall have maximum of 40 students.

Inter Relationship

#1: In a typical scenario there will be one teacher for many classrooms, most probably multi grade classes. The main problem that was observed is that if, for example, there are 4 classes and one teacher, and if the teacher gives 10 minutes to one class, rest of three classes will remain unattended for 30 minutes! Therefore a design solution to this problem should be found.

Preferably all the classes should be grouped together or can be connected through a corridor.

- All the class rooms shall be connected through a corridor.
- According to the teaching pattern the class rooms shall be grouped for ease of teaching and access time for a single teacher.
- In each group the doors should be at the minimum distances.
- For a multi-grade class room the space for teacher's movement should be atleast 2'-0" wide. Overall movement space should be between 10-15% of the total area.
- Adequate arrangement should be kept to facilitate the movement of students. This circulation space should not be more than 20% of the total area including the movement space of the teacher.

Sanitation requirement

#1: Adequate provision should be given for the toilet. As per standard there can be 1 toilet per 10 students to 1 toilet for every 20 student. It should not be less then 1 toilet per 20 students.

#1: There shall be 1 toilet per 20 students.

Aesthetics

Elevation should be simple and easy to maintain. Too many and unnecessary offsets should be avoided which will render it difficult to maintain and expose more area to the sun. Also to increase square footage will increase the capital cost of construction.

The facade should be balanced in form and shape to give it a symmetrical look. It should have the provision of incremental expansion.

External surfaces should not only be of permanent nature but should also be vandalism proof. All renderings should be of light color and should be pleasing.

- Elevation shall be simple and easy to maintain.
- Unnecessary offsets should be avoided.
- The facade should be balanced in form and shape.
- Should have the provision of incremental expansion.
- At any stage the facade shall look complete.

Internal and external renderings should be of neutral colors as far as possible. As all neutral colors shall be muted and pleasing to eyes.

- External surfaces shall be of permanent nature.
- All renderings shall be of light color.
- Renderings shall require minimum maintenance. Can be locally maintained.
- Internal and external renderings should be of neutral colors.

Future Expansion

Adequate provision for future expansion should be kept in planning. Plan should be flexible as far as possible. The space should be universal in nature and can be used in other purposes such as community activities etc.

At any stage of expansion the school building should look complete. All the areas should be optimally utilized in all respects. Location of the building in the compound should be done keeping in view the future expansion.

- Provision for future expansion shall be kept in planning.
- Plan shall be flexible.
- In Multi-grade planning, there shall be no partition wall.

Selection of Material

All the materials should be indigenous and inexpensive. Materials should be of permanent nature. The material used on internal and external spaces should be fine and smooth as far as possible, should not protrude out of the surface, as children can be hurted and these objects can be dangerous in terms of the safety.

The materials should be long lasting. In costal areas special care should be exercised as any material can deteriorate rapidly in the saline air.

#1: All the materials shall be indigenous and inexpensive.

#2: Materials shall be of permanent nature.

#3: On internal and external surfaces no element shall protrude out.

Local Construction Techniques

#1: The indigenous construction techniques should be examined and if; and as far as possible, try to use those construction methods which are familiar to locals. In the process the designer should try to improve the technique to bring it at par with modern construction techniques.

#1: The indigenous construction techniques shall be followed.

B:**Structural Design:**
Aspects to be considered

1.Safety Hazards :

Seismicity:

Almost all the district of the Balochistan are located in the seismic activity zones. Each district have different seismic activity.Quetta Byelaws have recommanded certain measures to be taken for seismic activity in Quetta. UBC also recommends various measures to suit the different seismic activities which includes introduction of columns in walls, Horizontal and Vertical Reinforcement at appropriate location and Reinforced concrete band at foundation, plinth, lintel and roof levels.

Due to cost constrains all the recommended measures have not been provided.

As our buildings are only single storey buildings, therefore it is recommended that columns shall be provided only at every corner and in the centre also for long walls. R.C.C. bands to be provided at foundation, plinth, lintel and roof levels.

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Design Aspects :

a) Strength of Materials:

Various materials proposed to be used in the building construction works to be properly specified, particularly for thier strengths so that safety can be assured.Major construction materials are Concrete,Steel and Masonry,for which appropriate strengths to be specified.

Concrete for all works to have minimum cylinder crushing strength of 2500psi (equivalent to 3000psi cube strength) at 28 days curing.

All reinforcing bars to be either of Twisted Ribbed Tor Steel bars having minimum yield strengths of 60,000psi or Mild Steel or Deformed Grade 40 steel bars having minimum yield strength of 40000psi.

Bricks from best available quality of standard size to be selected for construction.

Blocks to be of good quality machine made from 1:3:6 concrete having minimum cylinder strength of 1250psi at 28 days curing.

b) Design Codes/Standards:

For production of any design,it is essential to select the Design codes and standards at the first instance so that all the requirements of selected code and standard can be considered and incorporated in the design.

Generally for all the designs either ACI or BS codes are followed in the absence of any Pakistani code.

Due to non provisions of any specification pertaining to seismic requirements in the BS Codes and due to more research based ACI codes, the Designers generally adopt ACI codes for all their designs.

For this project, it is recommended that for loadings and earthquake forces to be considered in designs as per ACI-318-89 and UBC-88.

Sound structural engineering practices to be followed in the structural design for the various building elements of the project. Latest American Code of Practice ACI-318- 89 to be used for all structrural designs.For the design of various elements to cater for the expected seismic activity the provisions given in the Uniform Building Code (UBC-88) to be followed.

c) Design Systems v/s Construction Materials:

All the proposed Design system to have consideration for the availability of construction materials, their strength and suitability for the proposed design.

Various roof system are available like RCC Slab, Tier Girders and Tiles, Trusses of Steel or Wood with G.I. Roof sheeting. RCC Slab is suitable for all areas but other system also considered particularly where there is heavy snow fales are logistic problems.

As most of the buildings in our project are single storey, buildings and bricks/blocks are commonly available in all the districts of Balochistan,therefore, Brick and Block masonry load bearing walls to be used for single storey buildings.

Frame structure shall be provided for ground plus one storey buildings considering the active seismic zone.

RCC slab shall be provided in General, Hot and coastal areas whereas wooden trusses with G.I. Roof sheeting shall be provided in Remote areas.

d) Loading Considerations:

All the dead loads of elements, anticipated live loads as per codes and any other loads as required by the code to be considered in the design.

Dead loads ,Live loads and Seismic loads shall be considered according to the relevant clauses of Uniform Building Code 1988.

e) Foundations:

Foundation an the basis of design loads and bearing capacity of the soil may be either isolated, strip, combined or raft.

Economics to be considered for various possible options of the foundations.

As most of the Buildings are single storey buildings, and load bearing structures shall be provided, therefore wall foundations of bricks masonry in case of brick masonry walls and of 1:3:6 in situ concrete in case of block masonry walls to be provided. The sizes of the foundations to be calculated on the basis of load per unit of length and the recommended bearing pressure for that site.

D) Materials and Construction:

1. Locally available Materials:

It is emphasized to consider the locally available materials but the use depends on their suitability based an the laboratory tests.

a) Testing and Selection:

Local Sources to be investigated and verified as the haulage have the maximum impact on the cost.

Suitability of the sources to be checked physically/visually and by carrying out the laboratory tests.

Laboratory tests to be carried out on Coarse Aggregates (i.e rock, boulders, gravels & crush) and on Fine Aggregates (sand) are as under

- Gradation
- Los Angeles Abrasion
- Plasticity index of fines
- Sodium Sulphate Soundness
- Flaky and Elongation particles
- Specific Gravity and water absorption
- Crushing value

b) Strength

To be judged and evaluated on the basis of the results of the laboratory and physical/visual observations at site.

c) Suitability for use

Based on the results of the laboratory tests and findings in the feild the suitability of the materials for use in construction to be evaluated and recommended accordingly.

2. General Aspects for materials:

All the materials to meet basic specification of standards and or the basis of these materials to be selected and properly stored on the site.

a) Basic Specifications:

Ordinary Portland cement manufactutred in Pakistan conforming to BS-12 to be used for all concrete works.

The basic requirements to be tested are fineness, chemical composition, strength, setting time and soundness.

Based on the results of Sub Soil Investigation report the use of S.R.cement to be recommended.

Aggregates to conform with the requirements of BS-882 and ASTM C33.

Fine aggregates called sand are the aggregates passing No.4 seive.Material coarser than this is classified as coarse aggregate (gravel or crush).

Twisted Ribbed Tor Steel bars conforming to BS 4461 and Mild steel bars of Grade 40, plain or deformed , manufactured in Pakistan and conform the requitrements of ASTM A615.

b) Selection :

Materials to be seleted are the same as specified or to meet the specified requirements.

c) Storage :

Materials to be stored as per the requirements laid down in the specifications.

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3. Use of local Construction Techniques :

It is emphasized to avail best use of local construction techniques and know how to reduce the cost as materials will be locally available and labour will not be required to brought from out side.

Each area has its own construction techniques,to suit their requirements and based on their past experiences.It is to be considered in the design prepared for that area so that the locally available materials and knowhow of the area can be utilised.

4. Requirements of Major Buildings Elements:

All Building Elements Selected to use have to meet the specification required by the codes and standard.

a) Basic Specification for ;

i) Brick Masonry:

Best available 1st class Bricks of standard size to be used in the foundations and superstructure.The brick masonry to be set with 1:4 cement sand mortar except in areas of high seismic intensity where 1:3 cement sand mortar to be used.The bricks on external faces of walls to be cement pointed with 1:1 cement sand mortar and also using 'Gurmuchi'.

ii) Block Masonry:

Good quality preferably machine made blocks of 1:3:6 concrete having minimum cylinder strength of 1250psi (or 1500psi cube strength) to be used in superstructure. The blocks to be set in 1:4 cement sand mortar.

iii) Concrete:

Concrete for all reinforced works to have minimum cylinder strength of 2500psi at 28 days curing.

Concrete for block masonry walls to be of 1:3:6 concrete having minimum cylinder strength of 1250psi at 28 days curing.

iv) Steel Reinforcement:

All bars to be of twisted ribbed Tor steel bars conforming to BS 4461 or of mild steel bars of grade 40,plain or deformed,conforming to ASTM A615 and having yield strength of 40000psi.

5. Alternative Systems:

Considering the logistic problems, alternative system for Remote areas has been considered to use the local techniques.

a) Remote area construction:

In Remote area the structure of building are same as in other areas except the roof system will be of wooden trusses and galvanised corrugated sheets with soft board false ceiling and with wooden doors and windows.

This system is preferred considering the logistics proble of the Remote areas.

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BALOCHISTAN PRIMARY SCHOOL

ELECTRICAL WORKS

DESIGN CRITERIA

Commentary	Criteria
ELECTRICAL WORKS Electrical energy essential to illuminate the school building and to run the pumps is but without electrical energy school buildings can be constructed and function. Electrification work should be specified to the school buildings, where electrical power supply from WAPDA is available.	1. Electrification will be specified to the schools where electrical power supply exists. 2. Schools where power supply does not exist will not be electrified.

ILLUMINATION LEVEL

The classes in schools will be held in day shifts only when day light is available in abundance. Illumination is required for night classes or when some night gathering is expected. Various international bodies have recommendations about lux levels for different utility buildings such as CIE (International Commission on Illumination), IES etc.

1. Illumination levels recommended by CIE will be followed.

2. Following lux levels will be specified as produced below:

CLASS ROOM	=	250
CORRIDORS	=	150
OFFICE	=	250
STORES	=	100
LABORATORY	=	400
SECURITY LIGHT	=	50

LIGHTING FIXTURES

Following consideration will form the basis while deciding type of lighting fixtures.

Fixture should match the Architecture of the Building.

Fixture should be efficient from the energy or Energy conservation point of view.

It should not produce glare or noise to an objection level, it should be cost effective, light weight yet durable. Lighting fixtures where possible should be of flourscent tubes.

Areas such as toilets, kitchen may be provided with in luminare with incandescent lamps.

1. TMS 140 or 240 Phillips type or equal will be specified for class rooms, store, corridors, laboratory etc.

2. GMS 140 or 240 will be specified for offices.

3. NBR 501 with 1 No. 60 Watts Lamp incandescent lamps will be specified.

FANS

Ceiling Fans having 56", 48", 36", sweeps are being manufactured locally under different brand names such as Millat, Climax, Asia, National. Ceiling Fans should be energy efficient durable having a pleasant look. It's revelation should be controllable and it should run noise free.

Brand name of Fans stated above are among the best fans being manufactured but performance of Millat fan, manufactured by M/s. Metalex Corporation (Pvt) Limited are most satisfactory of all the fans.

Sizes of the class room governed the number of fans required therein. A 56" seeps fan is sufficient for a class room of 4x4 m^2. For a class room 4 meter wide and 5 to 6 meter in length will require two fans.

Fans should be installed in co-ordination with lighting fixtures so that flickering effect should not be felt.

The distance between lighting fixtures and fan should be ascertained by plotting candle diagram of the fixtures.

The blades of fans should be kept at a level so that it may not obstructive to the propagation of light.

1. 1 fan of 56" sweep will be used for room size upto 4 x 4.5. m^2.

2. 2 fan of 56" sweep will be used for room size upto 4m x 5 to 6m.

3. 1 fan of 48" sweep will be used for room size upto 3 x 3. m^2.

ELECTRICAL DISTRIBUTION

Electrical distribution system consists of electrical control boards and cables to pass electric current. Electrical distribution boards consist of a sheet metal box having ordinary Porcelain fuses, high rupturing capacity fuses, moulded case circuit breakers or miniature circuit breakers of required rating. Since moulded case circuit breakers or miniature circuit breakers offer positive safety to cables and apparatus, they are preferable.

1. Moulded case circuit breakers and miniature circuit breakers of required rating enclosed in steel sheet box shall be specified.

ELECTRICAL CABLES AND WIRES

IEE regulation in in practice can be followed in determining the size of cable and wires. The conductor of a cable can be either of aluminum or copper. Cable can be of PVC insulated, rubber insulated, but PVC insulated cable are being manufactured and used in almost all the electrical works. The copper conductor having less resistance to electrical flow is desireable. Cable directly buried in ground are armoured with steel wire. Cable passing in pipe or in duct are non armoured. Four core cables with reduce neutral are used.

Wire used for circuit wiring, point wiring are copper conductor PVC insulated single core.

Point wiring from switch board to point is done by two single core copper conductor 1.5 m2 PVC insulated with earth continuity conductor in bare copper of the same cross section. Length of point wiring may vary from 4 m to 8 m.

Circuit wiring from distribution board to the switch board is done by two single core copper conductor 2.5 m2 PVC insulated with earth continuity conductor in bare copper of the same cross section. Length of circuit wiring may vary from 6 m to 15 m.

Wiring may be opened type on baton, in PVC pipe or in MS conduit wiring can also be done in PVC Pipe or MS conduit concealed in wall or roof. In Buildings such as schools concealed wiring is preferable from the safety and security point of view.

1. All wiring shall be in PVC Pipe concealed in walls, roofs or floor.

2. For directly buried cable 3 1/2 core PVC insulated, PVC sheathed armoured cable will be specified.

3. For cables in pipe 3 1/2 core PVC insulated, PVC sheathed non-armoured cable will be specified.

4. For point wiring 2 x 1.5 m2 copper conductor PVC insulated cable of six meter length will be considered.

5. For circuit wiring 2 x 2.5 m2 copper conductor PVC insulated cable of fifteen meter length will be considered.

6. For Power circuit wiring 2 x 4 m2 copper conductor PVC insulated cable of fifteen meter length will be considered.

SWITCH AND SOCKET BOARD

Switch and Socket outlet may be fixed on wooden box or on steel boxes. Different brands of imported switches and sockets are available in local market. Locally manufactured brands are also available. Since switches and socket manufactured by M/s. PPI are of approved by Pakistan Standard Institute they are recommended to be used. Installation height of switch and socket board should be sufficient so that it may remain out of reach of small children.

1. PPI switches and sockets will be used. They will be fixed on steel boxes.

2. Mounting height of switch board shall be 1.2 m.

EARTHING

Entire electrical system should be connected to earthing system by means of earth conductor of sufficient cross section to pass electric shock circuit current to ground so that losses of life and material are avoided.

Earth pit shall be provided for each installation.

The maximum resistance of earthing should be less than 5 ohms.

1. Installation shall be completely earthed.
2. Earthing resistance shall be less than 5 ohms.

BALOCHISTAN PRIMARY SCHOOL

PLUMBING AND SANITARY WORKS

DESIGN CRITERIA

Commentary

WATER CONSUMPTION

Some of the school buildings will be used in single shift, some, will be utilised in double shifts. For the calculation of water demand, attendance of students should be considered in two shifts. Water mostly consumed will be in wash rooms, for drinking, preparation of tea and washing of utensils etc.

Water consumed by each student. For locations where water is available in abundance.

USE	LITRES
WASH ROOM	20.00
DRINKING	2.00
PREPARATION OF TEA AND WASHING OF UTENSIL	1.00
TOTAL	23.00
SAY	25.00

Another use of water is for probable plantation. The water used for this purpose depends upon area of plantation. If irrigation is done for 20 minute at the rate of 10 Liters per minute water required for this purpose will be 200 liters.

Since Water Supply System will be very small there is no need to consider leakage factor.

Water consumed by each student at location where water in scarcity is encountered.

USE	LITRES
WASH ROOM	10.00
DRINKING	2.00
PREPARATION OF TEA AND WASHING OF UTENSIL	1.00
TOTAL	13.00
SAY	15.00

Criteria

1. Daily Water Demand will be computed on the basis of two shifts.
2. Water consumption will be taken at the rate of 25 liters/student.
3. 200 liters/day will be added for plantation.
4. Leakage will not be Consicered.

1. Water Consumption will be computed at the rate of 15 litres/student.
2. Water will not be considered for plantation.
3. Leakage will not be considered.

WATERCOL

WATER STORAGE

Under ground or surface storage tank be constructed to store water where daily water requirement will be more than 5000 liter and water source is from existing main. In case water consumption less then 5,000 liter then water will be pumped directly to over head tank. The storage capacity of such tank will be for 2 days, as recommended in most of the water supply system. Storage Tank should be of RCC construction with Man holes, vent pipe and pumping arrangement.

OVER HEAD TANK

Over head tank may be either of reinforced concrete or of fibre glass having capacity for one day's water requirement. Over head tanks of reinforced concrete construction are preferable.

SOURCE OF WATER

Source of Water will be connected from a Municipal or Town Committee Main, Boring a tube well with a suction pump for small water quantities, for higher water demand i.e. about 2000 gallons/day, or more tubewell with turbine pump or submersible pump will be specified.

1. Under ground Water Tank will be proposed at locations where source is from existing water main and water consumption is 5,000 liter per day or more.

2. Under Ground Tank will be sufficient for 2 day's water requirement.

3. Over head tank will be of the capacity to meet 1 day's water requirement.

4. Both over head tank and underground tank will be of reinforced Concrete construction.

5. Over head tank will be of sufficient height to deliver at net head of minimum 10 feet.

Following source of water will be explored.

1. Connection from existing main of Municipal committee or town committee where available.

2. Boring for suction pump will be specified where water demand is upto 2,000 gallon per day.

3. Tube well with submersible pump will be specified where water demand is above 2,000 gallon per day.

QUALITY OF WATER

If water is tapped from boring or a Tube well it should be tested to ascertain its suitability for human consumption.

Turbidity should not be more than 5 units. Colour should be less than 10 units at cobalt scale. Water should be odourless. Total dissolve and suspended solid, should range from 500 to 1000 PPM.

PH value should range between 6.6. to 8.5. Hardness should be from 75 to 115 PPM, chloride content should not exceed 250 PPM.

Iron content should be 0.3 PPM, Magnese content should be 0.05 PPM. Water should be free from Pathogenic bacteria, fungi and Plankton.

Water Tapped from municipal main should not be tested.

1. Sample of water from boring, or tube well must be laboratory tested for physical, chemical and Bacterial test.

2. Water Quality must be according to the recommendation of WHO.

WATER COL

WATER TRANSPORT

Where Electrical Power is available, Centrifugal pump can be employed necessary to pump water form under ground tank, or directly from Boring or Tube well to over head tank. Pump may be vertical split type complete with motor upto 1 HP will be single phase 220 volts, 50 HZ motor lager than 1 HP will be 3 phase 400 volt 50 Hz. Pump brand may Javed, or equal motor will be either of Seimen or China make.

Where Electrical power is not available manually operated lift pumps can be employed.

Pipes used for transportation of water may be of galvanized iron confirming B.S.S. 1387/57 light quality of Karachi Pipe Mills, Steelex, Pioneer or UPVC Pipe: but preference in given to G.I Pipe.

PIPE INSULATION

In areas where ambient temperature goes down 0°C or below exposed water pipes must be insulated. Pipes can be insulated by maximum of thermophore insulation, or fiberglass insulation. Premoulded fiberglass section with outer protection jacket is preferable.

Gate value shall be of Brass body produced by M/s. Anwar Industry or imported from china. Check valves, foot valves will also be of brass body, all valves shall be served end capable of sustain a power of 30 PS2.

1. Where Electricity is available Centrifugal pumps javed with standard or China make of suitable rating.

2. Where Electricity is not available manually operated lift pumps will be specified.

3. G.I. Pipe of required diameter will be used to transport water.

4. Valves will of brass body Gate, Check, or foot will be screwed type.

5. For areas having ambient temperature zero or below all exposed pipe shall be insulated with premoulded fiberglass section and outer protective jacket of G.I.

PLUMBING FIXTURE

At location where water supply is in abundance, flush down type toilet will be constructed, water closet and wash basin will be white standard type Victory or Three Star make, since victory or three star make are cheaper the equally good as other therefore they are preferred. Flush tank shall be of plastic body of Golden or equal.

Where Water Scarcity is experienced, Dry Toilets can be provide with CC constructed can pass drain directly into a pit.

1. Water closet ASIAN (Orissa) type, white in colour standard size manufactured by 3 star, Kasam Cera, Victory will be used.

2. Wash Basin 56x22 cm, white vitreous china manufactured by 3 star, Kasam Cera, victory.

3. Squatting type urinal will be constructed in glazed tile where required.

4. Taps, stop cock, pillar cock will be chrome plated Brass manufactured.

5. Flush tank will be of plastic body manufactured by Golden or equal.

6. Dry Toilet will be constructed where water scarcity is experienced.

INTERNAL SANITARY DRAIN

Sanitary pipe from water closet should be of 100 mm cast iron spun pipe. Sanitary Drain pipe for kitchen sink, wash basin and floor drain will be of 75 mm cast iron spun pipe. Every kitchen and toilet will be provided with 1 No. 75 mm dia floor drain.

Cast iron vent pipe will be provided at all pipes from water closets and wash basins.

1. Cast iron Spun pipe 100 mm dia for water closet and 75 mm dia for wash basin and floor drain will be used.

2. Floor drain of 75 mm dia will be provided in Toilet.

3. Vent pipe of 75 mm dia cast of iron pipe will be provided to all water closet and wash basin drain pipe.

SEWERAGE DISPOSAL

Effluent from Toilet, kitchen should be treated in septic tank before it is disposed off finally.

Size of septic tank should be sufficient to provide minimum 24 hr and maximum 40 hr holding capacity. The length and width of the septic tank will be such as to provide a longest travel. The net capacity of the septic tank will be 85% of the water consumed per day plus space for free air about 20 to 30 cm above liquid level space for one year sludge will also be added to the volume. There should be a minimum width of 1 m to allow space for cleaning. The septic tank shall of two or three compartment type.

1. Effluent will be treated before it is discharged to any ditch, nalah or septic tank.
2. Septic tank will be of 85% capacity of water consumed per day with additional spaces for one year sludge and 200 to 300 mm additional height for air space.
3. Minimum width will be 1 meter.
4. Rate of length to width will be 1 1/2.
5. Septic tank will be of three compartment.
6. Manholes, vent pipe steel ring will be provided to manhole.
7. Septic Tank will not be provided at dry Toilet.

Effluent will be collected through RCC pipe. Manhole, will be provided at each connection from toilets, gully traps, and at change of direction. Manhole will also be provided at every 50 metre.

Effluent from kitchen sink Wash Basin will pass through gully trap before it is connected to a manhole.

ULTIMATE DISPOSAL

The effluent after treatment in septic tank are either discharged into municipal main, or any nearby ditch or nallah. Sometimes when municipal sewer main, or disposal ground is not available, effluent are discharged into soakage pits. Such pits should have a dia of 1.5 metre maximum and 6 meter deep. Soakage pit should be located at a minimum distance of 15 meter from building. If more than one soakage pits are required then the distance between two pits should be 5 meters.

1. RCC pipe will be used in external sewerage disposal.

2 The gradient of RCC pipe will be 1:100 upto 150 mm dia and 1:200 for 200 mm dia.

3. Manhole will be provided at all incoming connection, from toilet, kitchen gully trap.

4. All every change of direction and at any 50 meter or. straight distance.

5. Manhole will be 600 x 600 for 750 mm depth and 1000 x 1000 for deeper then 750 mm.

6. Gully trap will be provided for all drain connection from Kitchen and wash basin.

7. Minimum distance between soakage pits should be 5 m.