CONSTRUCTION

Working Paper
for the
Primary Education Development Program

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CONSTRUCTION COMPONENT

I. CURRENT STATUS OF PRIMARY SCHOOLS

Many existing primary school facilities are substandard. They range from no buildings at all, to tents, to temporary shelters, to partially collapsing and poorly constructed, dark, badly ventilated structures. They are generally overcrowded with 60 to 100 students crowded into small classrooms and extending onto verandahs or courtyards. In many facilities, especially in rural areas, toilets or latrines are lacking and drinking water is often a problem. Furniture is sparse to non-existent. In the first three grades students normally sit on floor mats, and boys and girls usually attend separate schools. Rural school buildings are commonly one or two room structures. Many small schools in the rural areas are the norm as walking distances must be reasonable for small children.

With overcrowding to the extent indicated above, there still are many, many rural children not enrolled in school. And the participation rates in Baluchistan and NWFP are the lowest of the four provinces: For Baluchistan boys about 70%, girls about 14%; for NWFP boys about 75%, girls about 28%. [USAID calculations 1989 where the denominator includes 4-year-olds to account for presence of "kachi" in first grade].

Construction of approximately 4,500 primary schools in Baluchistan and 7,000 in NWFP (along with appropriate teachers, etc.) would be needed to allow enrollment to expand to 90% of the population of boys and 60% of girls by the year 2,000. Recent history of primary school construction by the two provinces is not encouraging. The achievements reported for the previous year by the Ministry of Planning in successive Detailed Annual Plan documents are as follows:

New Primary Schools Constructed

Location/Year	1983	1984	1985	1986	1987	1988 (projected)
Baluchistan	75	100	50	10	50	(52)
NWFP	201	124	5	108	50	(52)

The construction capacity in the provinces indicated above clearly requires massive intervention to expand enrollment. This effort will be limited, however, by the work that realistically can be attained by construction contractors under the administration of the provincial organizations.

Given what is described hereafter, the target of building 11,500 schools is overly ambitious. The program described would result in more modest achievements in enrollments.

II. PROPOSED PROGRAM

Providing additional school buildings must be coordinated with the supply of teachers, books, and related instructional materials for an effective instructional system. The rate of construction ideally would be just ahead of the teacher training output. In actual practice such close coordination will rarely occur. The emphasis of the proposed program is to provide schools for presently unserved rural localities, particularly for girls. Given the overcrowding that is endemic, a large part of the proposed program no doubt will be sited at, or adjacent to, existing schools. Classrooms will be provided at shelterless schools; and classrooms will be added or replaced at existing schools. The efficiency of the site selection procedure in the provinces and the volume of manageable construction will limit the size of the annual construction program.

A. Rehabilitation of Existing School Buildings

Initial planning for this program at the PID level included rehabilitation of thousands of school buildings. Applying "band-aids" of this type is too often throwing good money after bad. Rehabilitation of an already substandard school building is not what this program is about.

In addition to being a costing and implementation nightmare, rehabilitation would generally just prolong the life of already unsatisfactory facilities and perpetuate recurring repair costs. If the "rehabilitation" required goes beyond "maintenance" -- painting, patching, glass replacement, latch repair, etc. -- into reconstruction of walls and roofs then replacement by a new durable facility is more appropriate.

B. Construction of New Buildings

While the main thrust of the building program is to provide more primary schools in rural areas, a significant component of the program is provision of middle schools for girls. The program also provides an office building for Curriculum Development in NWFP and for the Textbook Board in Baluchistan, Government Colleges for Elementary Teachers (GCETs) in Baluchistan and NWFP, expansion of existing GCETs in Baluchistan, Education Extension Centers at existing GCETs in Baluchistan and NWFP, cluster hostels for female primary teachers in Baluchistan and NWFP, and storage facilities for books in Quetta. The program is summarized in Table 1 at the end of this section.

1. Primary Schools

Most of the primary schools will consist of either two or three classrooms (average 2-1/2) about 16 by 25 feet in size (400 square feet), opening onto a covered verandah. This is illustrative, not a rigid requirement, with final design tailored to NWFP and Baluchistan requirements. In addition, some areas may require a room for a teacher's residence. All schools will have toilet facilities and most a perimeter (boundary) wall, a requirement for girls' schools.

Financial considerations aside, the number of schools that can be built will be limited by the maximum construction contractor resources that can be brought to bear and the administrative capacity of the provincial Departments of Education and related engineering/construction units. Annex 1 shows the development of figures utilizing three contracting modes. A manageable program that would nonetheless stretch administrative resources is about 1,700 two- or three-room schools in Baluchistan and about 3,300 in NWFP, constructed over an eight-year period. This would have to rely heavily on pre-fabricated construction and require reinforcement of the provincial administrative machinery, perhaps in the form of adhoc organizations or directorates set up for the duration of the program.

A maximum contracting effort using three different contracting modes (see section F below and Annex 1) could produce about 2,100 schools in Baluchistan and 4,100 in NWFP. This would severely overload the provincial administrative system for site selection, contract administration, construction management, and inspection. A building program of such magnitude is not deemed feasible.

2. Middle Schools for Girls

To encourage higher education for girls, middle schools (grades 6-8) will be provided adjacent to selected primary schools. The future trend may well be toward schools providing instruction in Grades 1 through 8. From the construction standpoint there will be little, if any, difference in primary and middle schools although some differentiation may be indicated in the final design stage. As the program progresses there may be some trade-off between the projected number of middle schools (1,800 in the PID stage) and the primary schools based on perceived need. Middle schools are included in the numbers presented above for primary schools.

3. Office Buildings for Curriculum Development and the Textbook Board

An office building will be built for curriculum development in NWFP and for the Textbook Board in Baluchistan. These facilities will be constructed in Abbottabad (NWFP) and Quetta (Baluchistan) to complement other program activities for strengthening and upgrading the staffs dealing with curriculum and textbooks. A building containing 15 offices is planned in NWFP and a somewhat larger one in Baluchistan.

4. Government College for Elementary Teachers (GCETs)

This will comprise two 100-student facilities for boys and one for girls in Baluchistan and seven for girls in NWFP. Further, additions will be made to the six existing GCETs in Baluchistan.

5. Additions to Existing GCETs

Five or six rooms will be added to enlarge the six GCETs now operating in Baluchistan.

6. Education Extension Centers

These centers will be located adjacent to existing GCETs, six in Baluchistan and five in NWFP.

7. Cluster Hostels for Female Primary Teachers

Five 20-resident hostels for teachers serving schools in selected areas where living accommodations are unsuitable are programmed for Baluchistan and six for NWFP.

8. Warehouses (Godowns) for Book Storage

Three storage facilities of 24 by 40 feet are programmed for Baluchistan.

TABLE 1

CONSTRUCTION PROGRAM

	STRUCTURE	LOCATION	NO.	CONSTRUCTION PERIOD Year 1 2 3 4 5 6 7 8 9 10
1.	New Primary and Middle Schools	Baluchistan	1,700	————
		NWFP	3,300	————
2.	New GCETs	Baluchistan	3	———
		NWFP	7	————
3.	Existing GCET Expansion	Baluchistan	6	————
4.	Education Extension	Baluchistan	6	————
		NWFP	5	————
5.	Cluster Hostels	Baluchistan	6	————
		NWFP	5	————
6.	Office Building	Baluchistan	1	—
7.	Office Building	NWFP	1	—
8.	Book Warehouses	Baluchistan	3	—

C. Site Selection

Site selection for each school will involve the Provincial, District, and Sub-District Education Offices in consultation with community officials.

Approval by the Provincial Education Department should come only after a clear showing of the nature and extent of need, local community support, and the capacity within the Department to provide teachers and learning materials at the location. Details of the physical facilities to be constructed on a specific plot of land provided by the local community will then be developed.

D. Facilities Design

The basic model for primary and middle schools is two or three classrooms and a verandah. The layout should readily accommodate future expansion. The building must be of durable, low-maintenance construction. Toilets or latrines must be provided as well as a water supply or water room. A boundary wall is essential for girls' schools and desirable for boys' schools. The building design must allow for good natural lighting and natural-flow ventilation. In cold locations a facility for simple heating should be provided using locally available fuel. In some localities it may be necessary to provide a resident teacher's room in the school design.

1. Conventional

The conventional design for schools would incorporate readily available local construction materials and be suitable for construction by a list of pre-qualified contractors. In NWFP the basic design for primary and middle schools is a 16 foot by 25 foot classroom(s) opening onto a covered verandah. Construction material is brick for bearing walls, concrete roof beams, and concrete slab roof. In Baluchistan there is more diversity in school building design which reflects extremes of climate between the north and south. In the warmer southern districts the roof may be of corrugated iron sheets or tiles on steel framing with walls of local stone, brick, or concrete block. Detailed design must include a seismic resistance factor. Windows and doors, including frames, all should be made of metal, not wood, for increased durability and low maintenance.

2. Conventional and Pre-fabricated Combined

The school building program would be most effective if it would utilize both conventional and pre-fabricated construction modes. A combination utilizing pre-fabricated steel framing and roof members may be desirable, especially if it were based on locally available material for walls, e.g., stone, brick, or concrete block.

3. Pre-fabricated

The pre-fabricated design would provide the same basic layout described above. However, construction would utilize factory-produced framing, wall, and roof units that meet durability and low-maintenance requirements. A variation might use factory produced structural framing and roof units with filler walls made from locally available stone, brick, or concrete block. Size/weight restrictions on components will be required so that transportation to isolated sites not accessible by road can be accomplished by men and/or animals. See section F below for

elaboration on the pre-fabricated building currently being produced in Pakistan. The opportunity to provide pre-fabricated units for the program would not be restricted to the one firm currently producing these units in Pakistan (Harmain, Ltd). International tenders would be invited under design/specifications developed by an Architect/Engineer firm.

4. Architect/Engineer Support

Essential to the design and construction management of the project is a qualified local Architect/Engineer firm (A/E). Such firms are currently operating in Pakistan. Each of the Provincial Education Departments must retain the services of an A/E(s) to do the following. In addition the same A/E(s) firm will provide construction management services as set forth in Section G. below:

- o Develop a series of conceptual (preliminary) designs for school construction to suit conditions in the Province(s). The Education Department would select and approve the design deemed most appropriate for each locality.

- o Prepare detailed drawings, technical specifications, and cost estimates for each of the designs selected.

- o Prepare standard tender documents for securing construction contracts.

- o In both Baluchistan and NWFP design, prepare drawings, technical specifications, cost estimates, and tender documents for the new Government Colleges for Elementary Teachers (GCETs); for additions to existing GCETs in Baluchistan; and for satellite Education Extension Centers at existing GCETs in Baluchistan and NWFP.

- o Design Cluster Hostels for female primary school teachers in both Baluchistan and NWFP.

- o In both Baluchistan and NWFP design, prepare drawings, technical specifications, cost estimates, and tender documents for the Office Building for Curriculum Development (BCD) in NWFP and for the Textbook Board in Baluchistan.

- o In Baluchistan design, prepare drawings, technical specifications, cost estimates, and tender documents for the Book Storage facilities.

The same A/E firm will provide construction management services as set forth in section G below.

E. Facilities Construction

1. Primary Schools

The bulk of new construction will provide many primary schools having two or three classrooms to accommodate 60-120 students. The small size of schools is dictated by the need to locate schools so that small children

will not have to walk long distances. Based on the advice of knowledgeable District Education Officers and local officials in a given area, two kilometers may be considered the maximum walking distance that will sustain high enrollment for boys with a shorter distance for girls -- one kilometer suggested by one informed source. It is likely that the optimum will be different in Baluchistan and NWFP, and indeed in different areas within each province. As mentioned above, standard designs for schools will be developed by an A/E firm working with the provincial Education Departments to assure durable functional teaching and learning facilities.

2. Middle Schools for Girls

These will account for a significant portion of the construction effort. In most instances the middle schools will be located adjacent to primary schools and the facilities will be of similar construction with three classrooms to accommodate grades 6 through 8.

3. Office Buildings for Curriculum Development

These buildings will be located at Abbottabad, NWFP and for the Textbook Board at Quetta, Baluchistan. The facilities design (15-offices in NWFP, somewhat larger in Baluchistan) will stress functional adequacy and utilize materials and style suitable to the area. Particular attention in planning and scheduling must be given to availability of land and utilities (i.e., electricity, water, sewer, telephone).

4. Government Colleges for Elementary Teachers

Three GCETs will be built in Baluchistan and seven in NWFP. The design for these facilities will assure functional adequacy and utilize materials and style to suit the location. Particular attention in planning and scheduling must be given to siting, availability of land, and utility connections.

5. Addition to Existing GCETs

Additions of five or six rooms will be made to each of the six existing GCETs in Baluchistan, and will include a 200-seat auditorium at one location.

6. Education Extension Centers

At six existing GCET's in Baluchistan and five in NWFP Education Extension Centers will be built. These "satellites" will be self-contained with three seminar rooms, a 50-person lecture hall, a library, a materials display room, a dining hall/kitchen, a 25-room double occupancy hostel, and staff quarters for 3-5 persons.

7. Cluster Hostels

Five 20-resident double occupancy hostels will be constructed for female primary teachers serving in Baluchistan and six in NWFP where living

conditions are difficult. The design will assure functional adequacy and a pleasant living environment with water, electricity, and heating. Siting must be carefully coordinated with locations of schools served by the resident teachers.

8. Book Warehouses

Three storage facilities in Baluchistan will be of simple construction utilizing local building materials with assurance of security for the stored material.

F. Construction Contracting Mode

From the northern end of NWFP to the southeastern extremity of Baluchistan includes a distance of 1,000 miles. In such a vast territory with great diversity in climate, topography, settlement patterns, and economic development a single contracting mode is not suitable throughout. Three separate approaches should be considered, all utilizing a common crucial ingredient: the services of an A/E firm for construction management. Modes I through III are discussed immediately below.

1. Mode I - Conventional Construction, Local Contractors

This is the least attractive of the three approaches. There would be many individual contracts to administer, poor equipment, poor quality work, and a slow construction schedule (six months minimum per school). It also would be very difficult and costly to monitor and inspect the work at crucial times. It may be impossible to avoid this mode of contracting altogether. If it must be done, however, the work should only be given to pre-qualified contractors whose satisfactory past performance is known by the concerned Provincial implementing office or Communications and Works Department. Using this approach it would be unlikely that more than 100-150 schools would be completed annually in the two provinces combined due to the shortage of qualified local contractors and the extended construction schedule.

2. Mode II - Conventional Construction, Large Contractors

With school construction in the Provinces, a recurring theme is the extreme difficulty -- almost impossibility -- of securing quality control in building by small local contractors. Under a massive building program with many schools under simultaneous construction, effective monitoring and inspection is very difficult. To attract well-organized and efficient contractors to the program it is proposed to "package" 100-200 schools in a vicinity, or more if the area will permit. Investigation indicates that a contract of Rs. 20,000,000 - 40,000,000 would encourage the larger Pakistani contractors to mobilize and undertake such multi-unit construction in a given area. Better workmanship and control of materials would be expected from such firms and it should be possible for the A/E firm to work out a rational monitoring and inspection program. Collaterally, a well-organized, phased construction operation should reduce completion time for the individual schools, by half compared to a

one school-one local contractor approach. Such an operation should be able to complete each school in 3-4 months with many schools under construction simultaneously.

3. Mode III - Pre-fabricated Construction, Large Contractor

An earlier World Bank project promotes the use of "pre-fab" school buildings — factory-built components to be assembled at sites on concrete foundations. A factory at Jahurabad in Punjab province (Harmain, Ltd.) is manufacturing the components and a prototype structure has been erected at Lahore. A contract has been signed for 3,000 one-classroom buildings under the World Bank-financed Second Primary Education Project (PEP II). Construction of the initial units began in Swabi District, NWFP, and Lasbella District, Baluchistan at the end of February 1989. Inspection of the prototype shows the building to be of durable construction, and well-lighted and ventilated. Construction time is the major advantage over the conventional design -- 10-20 days scheduled from foundation to completion. Costs are slightly less than a functionally equivalent school built with conventional materials and methods. The pre-fab building, or a variation using some factory-produced components, is one of the design options to be studied and presented by the A/E firm for consideration by the provincial Departments of Education. Its use would in large degree solve the problem of quality control in local conventional construction. It also might be most suitable for isolated locations where availability of labor and materials for conventional construction (including water for concrete-making and curing) poses a problem. In terms of construction time per unit it has about a 6 to 1 advantage over single-contract conventional construction.

G. Construction Management Services

No single item will be more crucial to the success of the school construction program than the quality and scope of the construction management services to be provided by the same A/E firms(s) whose design services are described above in section D. It will be the A/E's responsibility, as the provincial Department of Education's representative, to schedule construction of the approved school building program, issue tenders for construction contracts, and evaluate bids. Most importantly, the A/E firm must devise, organize staff, and oversee a system working with staff of the Provincial implementation unit or Engineering Division of the Department of Education (in Baluchistan) to monitor construction and assure quality control at each building site. This is a complex task that will require talent and skill to manage the hundreds of sites throughout the Province at any one time. An outline Scope of Work for A/E services is presented in Annex 2.

To upgrade construction management skills of involved provincial personnel, contractors, and A/E, it is proposed that intermittent short term training programs be given in each province. The program would be executed by two/three U.S. technicians who are specialists in field construction scheduling and management, and in related computer applications. The program would include provision of computer equipment

for use in both training and execution of the construction program. Annex 4 presents the proposed training element in more detail. The cost is budgeted under the Training and Technical Assistance component of the PAAD.

II. Work Phases

Thousands of widely dispersed schools are to be constructed over a large area based on selection criteria and prioritizing by the Department of Education. The provincial Department of Education together with its supporting units (PIU, LGRD, C&W, etc.), along with the efficacy of contracting procedures, will control the direction and volume of work. This is a program, not a discrete project, that will move only as policy and workable implementation procedures are developed. At this juncture projections of facilities to be constructed and related expenditures represent goals rather than a specific finite construction schedule. The construction program is phased over a period of eight years. The first two years of the ten-year program will be required for securing the services of an A/E firm(s), initial design work, and securing initial construction contracts. After five years the program should be evaluated and the succeeding five years of construction activity re-programmed based on experience up to that time.

The outline which follows shows engineering and construction activities over the ten-year program.

1. Year One

   - o A/E contracts secured by Baluchistan and NWFP Departments of Education.
   - o Conceptual/preliminary designs of school facilities prepared.
   - o Primary school maps prepared by District and Province for planning, tracking site selection, and construction of schools.

2. Year Two

   - o Conceptual/preliminary designs of school facilities approved by Department of Education.
   - o Standard design of primary and middle schools completed and approved. First construction contracts tendered.
   - o Design of GCETs initiated.
   - o Design of office buildings for Curriculum Development (NWFP) and Textbook Board (Baluchistan) initiated.
   - o Design of hostels for female primary teachers initiated.

3. Year Three

   - o Construction program for primary and middle schools underway. 195 Schools completed in Baluchistan: 390 schools completed in NWFP.
   - o Construction initiated for first GCETs in Baluchistan and NWFP.
   - o Design of additions to Baluchistan GCETs initiated.
   - o Design of Education Extension Centers at GCETs initiated for Baluchistan and NWFP.

- o Design of office buildings for NWFP and Baluchistan approved.
- o Design of hostels for female primary teachers approved.

4. Year Four

- o Construction program for primary and middle schools continues; 210 schools completed in Baluchistan; 420 in NWFP.
- o Construction initiated for office buildings for Curriculum Development in NWFP and Textbook Board in Baluchistan.
- o Construction initiated for one additional GCET for Baluchistan and one for NWFP.
- o Construction completed first GCETs for Baluchistan and NWFP.
- o Construction initiated for additions to GCETs and for Education Extension Centers in Baluchistan.
- o Construction initiated for Education Extension Centers in NWFP.
- o Construction initiated for first cluster hostels for female primary teachers in Baluchistan and NWFP.
- o Design initiated and completed for book storage facilities in Baluchistan.

5. Year Five

- o Construction program for primary and middle schools continues; 210 schools completed Baluchistan; 420 in NWFP.
- o Construction completed for Office Buildings in NWFP and Baluchistan.
- o Construction completed for one GCET in Baluchistan and one in NWFP (second ones).
- o Construction completed for hostel in Baluchistan and one in NWFP (first ones).
- o Construction complete for first addition to existing GCET and for Education Extension Center for Baluchistan.
- o Construction complete for first Education Extension Center at GCET in NWFP.
- o Construction initiated for book storage facilities in Baluchistan.

Construction program evaluated; program for succeeding five years laid out; program for years 6-10 below is indicative of what is needed to complete all facilities.

Funds for the five-year program outlined above should be tranched. Funding decision for the years 6-10 should be based on findings of the evaluation of the first five years.

6. Year Six

- o Construction program for primary and middle schools continues; 210 schools completed Baluchistan; 420 in NWFP.
- o Construction continues for GCETs: the third one is completed for Baluchistan; the third one is completed for NWFP.

- o Construction continues for hostels; the second one is completed in Baluchistan; the second one is completed in NWFP.
- o Construction continues for additions to existing GCETs and for Education Extension Centers in Baluchistan; the second completed.
- o Construction continues for Education Extension Centers in NWFP; the second one completed.
- o Construction is completed for the book storage facilities in Baluchistan.

7. Year Seven

- o Construction program for primary and middle schools continues; 210 schools completed Baluchistan; 420 in NWFP.
- o Construction continues for NWFP GCETs; the fourth one is completed.
- o Construction continues for Baluchistan and NWFP hostels; the third ones are completed.
- o Construction continues for additions to existing GCETs and for Education Extension Centers in Baluchistan; the third completed.
- o Construction continues for the Education Extension Centers in NWFP; the third one is completed.

8. Year Eight

- o Construction program for primary and middle schools continues: 210 schools completed in Baluchistan; 420 in NWFP.
- o Construction continues in NWFP for GCETs; the fifth one completed.
- o Construction continues for additions to existing GCETs and for Education Extension Centers in Baluchistan; the fourth one completed.
- o Construction continues for the Education Extension Centers in NWFP; the fourth one is completed.
- o Construction continues for Baluchistan and NWFP hostels: the fourth ones are completed.

9. Year Nine

- o Construction program for primary and middle schools continues: 210 schools completed in Baluchistan; 420 schools in NWFP.
- o Construction continues for NWFP GCETs; the sixth one is completed.
- o Construction continues for additions to existing GCETs and for Education Extension Centers in Baluchistan; the fifth completed.
- o Construction continues for the Education Extension Centers in NWFP: the fifth one is completed.
- o Construction continues for the Baluchistan and NWFP hostels: the fifth is completed.

10. Year Ten

- o Construction program for primary and middle schools completed: 210 schools completed in Baluchistan: 420 schools in NWFP.

- o Construction is completed for GCETs: the seventh one is completed in NWFP.
- o Construction is completed for addition to existing GCETs and Education Extension Centers in Baluchistan; the sixth one is completed.
- o Construction completed for the sixth NWFP hostel.

I. Cost Estimate

At this juncture only an order of magnitude cost can be assigned to the various construction program components. Design of the various facilities must be completed by the A/E firm before reasonably firm costs can be determined. On the other side of the equation, the volume of annual construction will depend (1) on the efficacy of Department of Education school site selection procedures, (2) on the success in attracting good construction contractors to undertake the works and (3) on the effectiveness of the provincial contracting and construction administrative procedures. A summary cost estimate for the construction program is given on the following page. Estimating details are presented in Annex 3.

Estimate of
Construction and Engineering
Cost ($ millions)

	Component	BALUCHISTAN CASES		NWFP CASES	
		II & III	I, II & III	II & III	I, II & III
1.	Primary & Middle Schools	33.3	41.3	66.7	82.7
2.	New GCETs	3.5	3.5	7.0	7.0
3.	Additions to 6 GCETs	0.6	0.6	-	-
4.	Education Extension Centers	4.5	4.5	3.8	3.8
5.	Cluster Hostels, Primary teachers	1.0	1.0	1.2	1.2
6.	Office Buildings	0.5	0.5	0.3	0.3
7.	Book Warehouses	0.1	0.1	-	-
	Subtotal Case II & III	43.5		79.0	
	Subtotal Case I, II, III		51.5		95.0

Combined Program CASE II & III: 5,000 schools

Construction Cost	43.5+79.0=	122.5
Architect Engineer @ 9%	122.5x0.09=	11.0
		133.5 = $134 million (rounded)

Combined Program CASE I, II, III: 6,200 schools

Construction Cost	51.5+95.0=	146.5
Architect Engineer @ 9%	146.5x0.09=	13.2
		159.7 = $160 million (rounded)

Note: Physical contingency and escalation not included. Add 10% contingency and inflation rate 7% compounded annually beginning Year 2 on total program budget.

PED - Baluchistan and NWFP

SCHOOL CONSTRUCTION CAPACITY OF ALTERNATIVE CONSTRUCTION MODES

CASE I: Conventional Construction - Small Local Contractors, Single Schools

Baluchistan : 50 schools/year
NWFP: 100 schools/year
150 schools x 8 years = 1,200 schools

Some 2-room schools; some 3-room schools. Average for program 2.5 rooms.

Cost 1,200 x 2.5 x $8,000/classroom = $24,000,000

CASE II: Conventional Construction/Multiple Units - Large Contractors

Baluchistan: 100 schools/year
NWFP: 200 schools/year
300 schools x 8 years = 2,400 schools

Cost 2,400 x 2.5 x $8,000/classroom = $48,000,000

CASE III: Pre-fabricated, factory-produced units - Large Contractors

Baluchistan: 12 crews; each complete
9 schools/year = 108 schools/yr
NWFP: 24 crews; each complete
9 schools/year = 216 schools/yr
Total per year 324
324 schools/year x 8 years = 2,592 schools

Cost 2,592 x 2.5 x $8,000/classroom = $52,000,000

THE ABOVE COSTS ARE WITHOUT CONTINGENCY OR ESCALATION

NOTE: The above figures represent a construction program limited by contractor availability and accomplishable volume of construction in the two Provinces under the three contracting modes. The more critical limiting factor is the administrative capability of the provincial Departments of Education to handle such a large volume of contracting and construction activities beginning with a vastly accelerated site selection program.

Of course various permutations within the Cases are possible and should be examined as the program gets underway. As mentioned in the main text, Case I (small local contractors) brings a host of adverse factors: limited financing, poor quality control, long construction period, difficult and costly

to monitor and inspect. This leads one to consider a combination, properly scaled over time, of Cases II and III and this is recommended as the preferred course of action. It would produce about 5,000 schools at a cost of $100 million (unescalated) over the ten-year program.

Though it would be a stretch, with motivation and a good A/E directing construction management the Provinces have a fighting chance to handle a construction program based on Cases II and III. Adding Case I with its many contracts would swamp the system and is not recommended.

Derivation of Case I, II, and III program on preceding Sheet 1:

CASE I: From field inspection and discussions with various officials and engineers, it was concluded that a conventional primary school of two or three classrooms requires a minimum of six months to build by a small local contractor. Also from the above inputs, bolstered by the construction achievement record reported for 1983-1988 (see Section I of the narrative), a judgment was made that a realistic year's construction projection would not exceed 50 schools in Baluchistan and 100 schools in NWFP.

CASE II: Construction time for each conventional school:

- Mobilization	1/2 week
- Site preparation/foundation excavation	1 week
- Pour concrete foundations/form columns/ pour concrete columns	1-1/2 week
- Form roof frame and slab/pour concrete	1-1/2 week
- Build masonry walls	3 weeks
- Pour and finish floor slab	1/2 week
- Complete roof water proofing/finish	1 week
- Finish door and windows	1 week
- Plaster/finish walls	1 week
- Demobilize	1/2 week
Total	11-1/2 weeks
Say = 3 months	

Therefore each crew (12-15 persons) will construct 12/3 = 4 schools/year.

To complete 100 schools in a year will require 25 crews -- a manageable number for a large contractor.

Requirement of one contractor in Baluchistan; two contractors in NWFP.

Value of 100-school contract = 100 x $20,000 = $2,000,000, say Rs. 40 million.

That sum should attract the big operators.

CASE III: Analysis of contractor's schedule on World Bank PEP II pre-fabs leads to conclusion that 15 working days is a realistic time for erecting a one classroom Harmain prefab.

For a 2.5 classroom average school:
Time required = 2.5 x 15 = 37.5 work days

Some economies of time associated with multiple units at one site. Therefore assume 35 work days to complete one school.

Elapsed time assuming 6-day work week. 35/6 = 5.83 weeks/school.

52 weeks/5.83 = 8.9 schools
Say = 9 schools constructed per year per crew

Harmain is organizing 12 crews in Baluchistan and 24 crews in NWFP to construct PEP II classrooms. Use same crew organization for proposed program.

12 crews Baluchistan = 9 x 12 = 108 schools/year
24 crews NWFP = 9 x 24 = 216
Total for year = 324 schools

Total for 8-year program = 324 x 8 = 2592 schools

(Equivalent to 2592 x 2.5 = 6480 one-classroom Harmain units)

PED - Baluchistan and NWFP

ARCHITECT ENGINEER (A/E) - OUTLINE SCOPE OF WORK

The outline below covers the A/E Scope of Work in both Baluchistan and NWFP. For World Bank PEP II, the Federal Coordinating Unit (FCU) has a contract with a single A/E (NESPAK) for the work in both Baluchistan and NWFP. For the PED program it is recommended that the A/E contract(s) be directly with the provincial Education Department(s). Given equal competence, there may be an advantage to having different A/Es for each province. On the other hand, if a large well-qualified A/E submits the best proposal and has sufficient experienced personnel to handle both jobs, there should be no objection to using a single firm. In any event it is planned to use Pakistani A/E firms. They are available and qualified to undertake the work planned for the PED Program. The A/E firm(s) engaged to do the work for GCETs, etc. need not necessarily be the same ones handling the primary school components.

Scope of Work

A. Design

1. Develop conceptual/preliminary designs for Primary and Middle Schools to suit functional and climatic conditions in the provinces of Baluchistan and NWFP.

2. After agreement with Department of Education on designs for final development, prepare detailed drawings, technical specifications, and cost estimates for each of the approved designs.

3. Prepare standard tender documents for securing construction contracts to include small local contracts (single structure), large contracts for conventional construction at multiple sites, and large contracts for pre-fabricated structures.

4. Prepare School Maps by Province and District for planning and tracking site selection and construction of schools in the program.

5. Make site investigations and prepare detailed drawings, technical specifications, cost estimates, and tender documents for securing construction contracts for:

a. Baluchistan

- 3 GCETs (one for girls; two for boys)
- Additions to 6 existing GCETs
- 6 Education Extension Centers adjacent to existing GCETs
- 1 Textbook Board Office Building
- 5 Hostels for female primary teachers
- 3 Warehouses for book storage

b. NWFP

- 7 GCETs for girls
- 5 Education Extension Centers adjacent to existing GCETs
- 1 Curriculum Development Office Building
- 6 Hostels for female primary teachers

B. Construction Management

In coordination with the implementation unit(s) designated by the Department of Education:

1. Prepare and maintain tendering and construction schedules for all the facilities mentioned under "Design" above.

2. Evaluate bids received for construction of all the facilities mentioned under "Design" above.

3. Prepare a field construction management plan including staffing and transportation requirements of the A/E and the Department of Education implementing unit(s).

4. Provide Resident Engineers, Assistant Engineers, and Inspectors to organize, direct, and supplement monitoring/ inspection personnel of the Department of Education implementing unit(s).

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COST ESTIMATE DETAILS

Average cost per school for program estimates

Many sources were examined and informed local professionals were queried about costs of school construction in Baluchistan and NWFP. This exercise gathered data from actual construction contracts and knowledgeable individuals from PIUs and Division Engineers in the provinces and NESPAK (A/E) Resident Engineers. The cost per square foot of covered area ranged from Rs. 180 (NWFP -- brick bearing wall/concrete roof); Rs. 240 (Baluchistan -- reinforced concrete frame and roof with brick walls); Rs. 230 (Harmain Prefab -- steel frame, composite wall and roof panels); to Rs. 260 (Turbat -- reinforced concrete frame and roof, concrete block walls). In devising a "standard school" for estimating purposes, classroom size is assumed to be 400 square feet opening onto an 8-foot covered verandah. All schools are assumed to contain 2 or 3 classrooms (2-1/2 average per school for costing) lying on 2 "kanals" of land (about 1/4 acre) enclosed within a 400-ft boundary wall. The cost of the verandah and the boundary wall is prorated to the cost per classroom. The cost per square foot of covered space used for the standard school is the average for the costs of NWFP and Baluchistan: Rs. 210/square foot. Cost of standard school:

2 Classrooms 16' x 25'	= 800 sq. ft.		
1 Verandah 8' x 50'	= 400 sq. ft.		
Total covered area	= 1,200 sq. ft.		
Cost at Rs. 210/sq. ft. = 1,200 x 210		=	Rs. 252,000
Boundary wall: 400 ft. x Rs. 150/ft		=	Rs. 60,000
	Total: 2 rooms =		Rs. 312,000
For 3-room school:			
Add extra classroom	= 400 sq. ft.		
Add extra verandah	= 200 sq. ft.		
	600 x 210	=	Rs. 126,000
	Total: 3 rooms =		Rs. 438,000
Converting @ Rs. 19 = $1.00			
Cost 2/room = 312,000/19		=	$ 16,421 = $16,500
Cost 3/room = 438,000/19		=	$ 23,053 = $23,000
Average cost/room = $16,421/2		=	$ 8,211
or = $23,053/3		=	$ 7,684
For "standard" 2-1/2 room school			
Average cost/room = (8,211 + 7,684)/2		=	$ 7,948
	Say	=	$ 8,000
Standard 2-1/2 room school cost 2.5 x 8,000		=	$ 20,000

GOVERNMENT COLLEGES FOR ELEMENTARY TEACHERS (GCET)

Covered area

(100 students, five tutors, five administrative staff)

School Building: Four classrooms, one auditorium, one library, one laboratory, three offices, toilets.	8,500 sq. ft.
Hostels: 2 students per room, a lounge, dining facilities, a laundry room, a pantry, warden's office/room, toilets.	24,000
Residences: Senior staff, 2x1,500 Others, 8x750	9,000
Garage	500
Total covered area	42,000 sq. ft.

Cost

Assuming a unit rate of Rs 600 per sq. ft. which includes roads, boundary wall, tubewell, and overhead and underground tanks:

Total cost, 42,000 sq. ft. x Rs 600 per sq. ft.	Rs 25 million
US $ equivalent, $1.00 = Rs 19	$1.3 million**

**NOTE: GCET's for girl students will require hostel space for only 50 residents. Reduce hostel area by 10,000 sq. ft. at a saving of $300,000. Total cost of a GCET for girls: $1,000,000.

TEACHERS' HOSTEL

Covered area

(20 teachers, five single staff)

2 teachers per room, a lounge, a dining room, kitchen, stores, a laundry room, a pantry, warden's office/room, staff rooms.	6,500 Sq. ft.

Cost

Assuming a unit cost of Rs 600 per sq. ft.

6,500 sq. ft. x Rs. 600 per sq. ft.		Rs 3.9 million
US $ equivalent, $1.00 = Rs 19.00		$205,000
	Say	$200,000

OFFICE BUILDINGS

Abbottabad: Curriculum Development

15 offices 16-ft x 25-ft		6,000 sq. ft.
Corridors, bathrooms, conference room, storage, etc. Add 75%		4,500 sq. ft.
		10,500 sq. ft.

Assume unit cost Rs. 600/sq. ft to include site preparation.

10,500 sq. ft. x Rs. 600/sq. ft.		Rs. 6,000,000
U.S. $ Equivalent @ $1.00 = Rs 19		$ 315,000
	Say	$ 300,000

Quetta: Textbook Board

Cost furnished by Dept. of Education		Rs. 10,000,000
U.S. $ Equivalent @ $1.00 = Rs. 19		$ 526,000
	Say	$ 500,000

Baluchistan: Addition to 6 existing GCETs

Add 6 rooms at each GCET
Add 1-200 seat auditorium at one GCET

6 rooms @ 20-ft x 25-ft = 3,000 sq. ft. each GCET

1 Auditorium @ 40-ft x 60-ft

Total Area 3,000 sq. ft. x 6 bldgs = 18,000 sq. ft.
40 ft. x 60 ft. = 2,400
20,400 sq. ft.

Cost @ 600 Rs./sq.ft :

20,400 sq. ft. x Rs. 600 = Rs.12,000,000
U.S. $Equivalent @ $1.00 = Rs.19 = $631,000

Say $600,000

Baluchistan and NWFP Education Extension Centers

Construction similar to New GCET's.

Covered area 75% of GCET design.

Cost GCET w/25 room hostel $1,000,000

Cost each Education Extension Center 0.75 x $1,000,000 $ 750,000

Baluchistan : 6 Centers @ $750,000 $4,500,000

NWFP : 5 Centers @ $750,000 $3,750,000

Baluchistan: Book Storage Warehouses

No. Warehouses (godowns) : 3

Size 24 ft x 40 ft = 960 sq. ft. each

Total area : 3 x 960 = 2,880 sq. ft.

Cost assumed Rs. 400/sq. ft. incl. site preparation

Total cost = 2,880 sq. ft. x Rs. 400 = Rs. 1,152,000

U.S. $Equivalent @ $1.00 = Rs. 19 $ 60,600

Say $ 60,000

Annex 4

TRAINING FOR PROVINCIAL ENGINEERS

The number of the new primary school buildings envisaged over the life of the program is almost ten times what the agencies responsible for construction of primary schools in the two provinces have managed over the last five years. As such the provincial engineers, whether working for the government or for the local contractors, will have a critical role in the successful implementation of the program. Therefore in-country training for the local professionals in advance techniques of construction management, using personal computers, will indirectly help the program achieve its goals.

Two components are envisaged:

Technical Assistance: Expatriate teams of two/three persons will visit each provincial capital for about four weeks every year beginning with Year Two. The teams will conduct one/two week courses in the following fields:

- Project management and scheduling.
- Training of field inspectors in monitoring, inspection and quality assurance.

All engineers working for the agencies responsible for construction of education buildings, C&W in NWFP, and Directorate of Works, Department of Education in Baluchistan, will be eligible to attend. In addition civil engineers employed with the construction firms listed with these agencies will also be eligible. Travel and boarding/lodging costs will be borne by the employers.

Commodities: The agencies responsible for implementation of primary education school construction in each province will be supplied personal computers. It is estimated that six will be required to serve the Divisions in each Province, for a total of twelve.

Estimate of cost and funding for this activity is covered under the Training and Technical Assistance element of the PAAD.