2-3 Basic Design

2-3-1 Design Concept

This project is to construct additional classrooms at the existing primary schools in and around Ulaanbaatar City, and to provide basic teaching materials for the purpose of expanding study opportunities and improving the educational environment at the primary level. The basic design of the school facilities shall be drawn in accordance with the following principles, also taking into consideration the requests presented by the government of Mongolia, field surveys and the results of discussions with authorities concerned during the basic design study in Mongolia.

(1) Principles for Natural Conditions

Mongolia, set in the central area of the Asian Continent, is a highland country neighboring Russia on the north and China on the east, south and west. Its capital, Ulaanbaatar City, is surrounded by mountains and located 1,350 m above sea level at 48° N, 107° E. This is where the project schools are located.

The climate of Mongolia is a typical inland climate, and the temperature differs greatly throughout the year. The following table shows the average climate data in and around Ulaanbaatar City during 1994 and 1998.

Average temperatures are below 0°C during 5 months of the year, and averages of the lowest temperatures range from -20°C～-30°C. However, during May and August the highest temperature may rise up to 30°C. In general, heating is provided for 8 months spanning from September 15 to May 15 of the next year. The rainy season lasts about 3.5 months from June to the middle of September. Though the total annual rainfall is less than 300 mm, heavy showers and thunderstorms often cause floods in city areas due to insufficient sewage systems. The relative humidity is rather low. The maximum wind velocity is about 20 m/sec, which is not strong enough to cause serious disasters.

Climate Data of Ulaanbaatar City (Average of 5 years from 1994 to 1998)

	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Monthly Avg. Temp.	-21.3	-14.8	-6.5	2.9	9.8	14.8	18.1	15.9	8.9	0.8	-10.0	-18.4	
Monthly Max. Temp.	-8.1	1.7	10.8	20.8	27.3	29.7	33.0	28.9	26.0	18.0	6.2	-4.0	
Monthly Min. Temp.	-32.4	-27.9	-23.7	-11.1	-4.8	1.6	6.6	5.0	-4.0	-15.1	-25.4	-30.4	
Monthly Avg. Rainfall (mm)	1.7	0.7	2.4	7.0	10.4	37.2	77.2	93.5	29.4	11.2	4.6	3.9	279.2

Monthly Avg. Rainy Days (day)	6.4	4.4	5.8	6.2	8.8	13.8	17.4	16.6	9.4	6.4	8.2	7.8	9.4
Monthly Avg. Fine Days (day)	29.4	27.2	29.8	28.8	30.0	28.8	29.6	29.8	28.8	28.8	29.0	28.0	348.0
Avg. Daytime Hours (hours/day)	5.5	7.3	8.4	7.8	8.4	8.4	7.8	7.6	7.8	7.8	6.0	4.9	7.3
Monthly Avg. Relative Humidity (%)	75.4	68.6	54.6	44.0	40.8	54.6	61.0	64.6	57.4	55.8	66.8	74.2	60.0
Monthly Avg. Lowest Relative Humidity (%)	48.6	30.2	16.2	15.0	13.2	17.2	21.4	22.4	18.2	18.6	30.8	46.4	
Monthly Avg. Thunder-storm Days (day)	0	0	0	0.2	1.6	4.0	9.0	7.2	2.0	0	0	0	
Predominant Wind Direction	E	E	WN	WN	NWN	NWN	E	E	E	WN	E	E	
Avg. Velocity (m/sec)	1.3	2.0	2.5	3.4	3.7	3.4	3.0	2.5	2.9	2.3	1.8	1.2	
Max. Velocity (m/sec)	13.0	13.0	16.0	20.0	20.6	19.0	16.0	14.6	15.8	16.2	13.6	9.4	

Past records			
	Highest Temperature	36.7	July 1997
	Lowest Temperature	-39.6	January 1979
	Daily Maximum Rainfall	51.7 mm/day	
	Maximum Velocity	28 mm/sec	

In consideration of the above-mentioned climate conditions, heating systems equivalent to those equipped in the existing schools will be planned in order to create a comfortable study environment during severe winter seasons. To maintain good heating efficiency, window and door openings shall be designed air tight, and exterior walls will be constructed of high heat insulation performance. Sunlight can also be utilized as an effective heat source as Ulaanbaatar has many clear days with long daytime hours. Buildings will be planned to have the east to west axis in principle in order to take ample solar heat from the south. Natural air intake is another important design factor to deal with the high temperature during the summer. Finally, the ground floor height will be raised to avoid flood water due to heavy rain and also to avoid frosting in winter due to accumulations of snow.

Compared to other areas in Mongolia, Ulaanbaatar belongs to an area where seismic damage is rare. Some earthquakes as large as Magnitude 8 were recorded about 300 ~ 600 km away from Ulaanbaatar in the past, however, no damage was reported. In this project, buildings will be designed to resist tremors of the 7th degree on the MSK seismic scale according to the seismic design standards.

(2) Principles for Social Conditions

Most of the schools surveyed as well as existing schools have two or three floors. They were built in or before the 1980s based on the former Soviet Union standards. Ordinary classrooms are designed in the standard module of 6.0 m×9.0 m. Many schools use specified classrooms like science laboratories to make up for a shortage of ordinary classrooms, however, they are equipped with a language laboratory, workshop, music room gymnasium, library, dining room and even a large sports ground. Compared to good external structures, interior finishes, door and window sashes and equipment seem rather poorly maintained. If proper maintenance is ensured, existing school facilities can be used continuously.

To survive in severe winters, existing schools are equipped with good heating systems with reliable heat sources. Most schools have sufficient heating capacity to spare for an expansion of school facilities. Other infrastructures of the schools surveyed are shown in Table "Conditions of School Facilities Surveyed".

For the convenience of the school staff (who are assumed to be responsible for maintenance of expanded areas), the same utility systems as those installed in the existing facilities shall be planned for the expanded areas.

(3) Principles for Construction Conditions

1) Capacity of local construction companies

Most schools in Ulaanbaatar were built in or before the 1980s. In fact, a school designed in the 1980s opened in 1997. It called for tenders in 1989 and was constructed in early 1990s based on the equivalent specifications of other school facilities. There were no new school facilities designed and constructed during the past 10 years.

According to the Statistical Office of Mongolia, the amount of completed building construction in Ulaanbaatar in the past five years are shown below:

(Million Tg)

Year	Amount of Completed Construction	Sectors		
		Public	Private	Foreign or Hybrid
1994	6,467.7	3,617.0	3,763.3	571.4
1995	9,155.6	2,910.6	5,037.0	2,086.1
1996	12,721.3	3,369.9	6,150.5	3,200.9
1997	16,704.0	2,463.1	11,747.1	2,493.8
1998	20,948.9	3,911.3	12,562.2	4,718.5

Source: Statistical Office of Mongolia

The study team was not able to obtain data of the amount of building construction indicated on the basis of floor area, so assuming the unit construction cost per square meter, we estimate the area of completed building construction in Ulaanbaatar in the same years to be as follows.

Year	Area of Completed Construction (㎡)
1994	23,412
1995	23,936
1996	17,607
1997	21,245
1998	24,645

As shown in the table, an average of 24,000 ㎡ are completed each year. We also need to assume that there are some construction works which were not included in the statistical data. Thus, we can assume as much as 30,000 ㎡ of construction work per year were completed in the past five years.

On the other hand, major construction companies we researched in Ulaanbaatar employed about 100 engineering staff and skilled laborers. Each company seems to be able to construct 3,000 to 4,000 ㎡ a year. (A newly built luxurious hotel of about 30,000 ㎡ took five years for construction by a Belgian contractor.)

Under the severe natural conditions in Ulaanbaatar, construction is limited to inside of the buildings in winter. Usually framing work, concrete work and exterior work are conducted only only during the six months from mid April to mid October, and interior finishing work is conducted in winter in the heated inside of buildings. The hearing survey also showed that local construction companies usually need a two to three-year construction period to build one school because the work is suspended during winter. Therefore, in order to complete construction work of this project within a single fiscal year, proper scheduling and work management is indispensable.

2) Use of locally available materials and equipment

To facilitate maintenance of the expanded school facilities after the completion of the project, locally available materials and equipment will be used as much as possible. The design of the expanded facilities shall match the existing facilities. Basic construction materials such as sand, gravel, cement, bricks, lumbers and steel bars are available locally.

Due to the fact that the standard specifications of schools buildings are not established in Ulaanbaatar, and that there have not been any new school construction in recent years, we can refer to the specifications of the existing school facilities and draw a design that harmonizes with the existing facilities so that they have good heat insulation.

(4) Principles for Construction Period

In Ulaanbaatar, the temperature falls below -30°C in winter, which makes exterior work and building construction impossible. That is, foundation and building construction work have to be done within the 6 month time period from mid April to mid October. This limits the size of buildings as high as three. The largest expansion work in this project, which consists of 14 classrooms in three floors, requires about 11 months. Within this period, the building and exterior wall construction work will be conducted by the middle of October, and then the interior finishing work will follow. (The heating system will operate after the middle of October.)

This project is to construct additional ordinary classrooms with minimum necessary utility systems at 16 schools in and around Ulaanbaatar. Depending on the necessity of each school, a school building composed of 4 to 14 classrooms will be constructed in consideration of the site topography, layout of existing school facilities and location embedded pipe lines. The total floor areas expanded of 16 schools will reach about 21,000 ㎡, and in consideration of the capacity of local construction companies as mentioned in (3) 1) above, five or six schools facilities, floor areas being about 7,000 ㎡, can be constructed in a year. In other words, expansion of 16 school facilities can be completed in three phases.

Most of the grounds of candidate school sites are flat, but some will require site preparation work or relocation of the existing electric or sewage pipe lines. Those which require preparation work by the government of Mongolia are planned to be constructed in Phases 2 and 3. The following tables show details of construction work to be covered in each phase.

Phase I

Schools	Duureg	No. of class-rooms	Type	Floor Areas (m²)	Current Topography: Site Preparation Work	Heating: Type	Heating: Capacity (m²)	Water Supply	Sewage
No.62 School	Songinokhairkhan	8	C8-2	997.5	School ground Removing trees & play equipment, relocating embedded electric piping	Central	2,600	City Water	Discharge into sewage main
No.65 School	Songinokhairkhan	12	C12-3	1,429.5	School ground Removing concrete board, relocating aerial electric wiring	City	6,000	Water Wagon	Privy (Sewage tank)
No.72 School	Chingeltei	12	C12-3	1,429.5	School ground	Private	6,000	City Water	Privy (Sewage tank)
No.58 School	Sukhbaatar	12	C12-3	1,429.5	Flat land	School	2,300	Well	Privy (Sewage tank)
No.13 School	Bayangol	8	C8-2	1,200.0	School ground Removing trees, etc.	Central	1,500	City Water	Discharge into sewage main
Buyant Ukhaa SD (Ex No. 7)	Khan-uul	8	C8-2	997.5	Flat land Soil cutting & filling ±1.0m	City	3,000	Water Wagon	Privy (Sewage tank)
Total		62		7,483.5					

Phase 2

Schools	Duureg	No. of class-rooms	Type	Floor Areas (m²)	Current Topography: Site Preparation Work	Heating: Type	Heating: Capacity (m²)	Water Supply	Sewage
No.67 School	Songinokhairkhan	12	C12-3	1,429.5	School ground Relocating embedded electric piping, restoring main gate	City	5,800	Water Wagon	Privy (Sewage tank)
No.37 School	Chingeltei	14	C14-3	1,632.0	School ground Removing trees and benches, soil cutting & filling ±1.0 m	City	6,600	Well	Privy (Sewage tank)
SEGEMJ SD (Ex No.46 School)	Chingeltei	14	C14-3	1,632.0	School ground Removing concrete plates	School	1,500	Water Wagon	Discharge into sewage main
TSETSEE GUN SD (Ex No.60 School)	Khan-uul	14	C14-3	1,632.0	Flat land	City	5,700	Well	Privy (Sewage tank)
No.76 School	Songinokhairkhan	12	C12-3	1,429.5	School ground Removing concrete plates	Private	1,300	Well	Privy (Sewage tank)
Total		66		7,755.0					

Phase 3

Schools	Duureg	No. of class-rooms	Type	Floor Areas (m²)	Current Topography: Site Preparation Work	Heating: Type	Heating: Capacity (m²)	Water Supply	Sewage
No.94 School	Bagakhangai	4	C4-1	498.0	Flat land	Area	◎	Well	Discharge into sewage main
No.9 School	Songinokhairkhan	14	C14-3	1,632.0	School ground Soil cutting & filling ±1.0 m	City	15,520	Well	Discharge into sewage main
No.105 School	Songinokhairkhan	14	C14-3	1,632.0	Flat land Relocating sewage piping	City	4,700	City Water	Privy (Sewage tank)
No.92 School	Bayanzurkh	14	C14-3	1,632.0	School ground Soil cutting & filling ±1.0 m, relocating sewage piping	Private	3,200	City Water	Discharge into sewage main
No.28 School	Bayangol	8	C8-2	997.5	School ground Removing trees and concrete plates	Central	200	City Water	Discharge into sewage main
Total		54		6,391.5					

2-3-2 Principles for Design Standards

In principle, the national standards of Mongolia or those predominant in Mongolia will be respected as the design standards for this project. In case they are far different from the actual situations, alleviated criteria will be adopted.

(1) Architectural Design Standards

The Design Standards of School Facilities specifies requirements of school facilities at each educational level. These standards were deliberated among seven national institutions including MOSTEC and UBC Public Health Department, and approved by UBC Construction and Engineering Facility Department.

The following table shows requirements of the design standards relevant to this project and the criteria to be applied in this project.

Items	Design Standards	Applied Criteria
School District	In urban areas, a circle 750 m radius or less	
Classrooms in a School	Max. 33	
Students per Class	Grade 1 30 Grade 2 ~ 9 35	40
Building Floors	Ordinary 3 or less City larger than 200,000 population 4 or less	3 or less
Floor Height	3.3 m	3.3 m
Width of Corridor in the Classroom Building	2.2 m	2.5 m
Volume of Classroom	4.0 m^3 per seat (without mechanical ventilation system)	4.0 m^3

(2) Structural Design Standards

There are no national structural standards in Mongolia and those of former Soviet Union are prevalent. The permissible live loads and seismic loads relevant to this project are as follows:

1) Live loads

Classroom	200 kg/m^2
Corridor	300 kg/m^2

2) Seismic loads

UBC had no records of building damage or collapse by earthquake in the past but seismic zones of big earthquakes lie west and southwest of UBC. The National Seismic

Standards of Mongolia have been planned based on those of the former Soviet Union and seismic design is recommended for building constructions in UBC. As the project buildings are expected to accommodate quite a lot of people, seismic strength will be considered in the structural design with reference to the Seismic Design Standards (draft). The criteria specifies UBC areas as shown below:

Subsoil Grade	MSK Seismic Scale	Applied Criteria
I	6	7 (80 gal)
II	7	
III	8	

3) Bearing capacity of subsoil

Subsoil of UBC is mixed with gravel and very rigid except for the riverside areas along the Dund River. All the target schools are located on the rigid subsoil whose bearing strength can be 20 tons/㎡ or higher. The design bearing strength of subsoil will be determined after the soil investigations, but till then, the figure 20 tons/㎡ is taken tentatively.

(3) Mechanical Design Standards

As shown in the following table, Some requirements for utility design are different in the Design Standards of School Facilities and data obtained from UBC Public Health Department. The table also shows criteria to be adopted in this project.

Item	Design Standards of Schools Facilities	UBC Public Health Dept.	Adopted Criteria
Toilet, for girls	1 per 30 persons	1 per 20 persons	1 per 40 persons
Toilet, for boys	1 per 40 boys	1 per 25 boys	(toilet) 1/60 persons (urinal) 1/40 persons
Wash basin	1 per 30 persons	1 per 20 girls 1 per 25 boys	1 per 40 persons
Light intensity (classroom)		300 Lx	300 Lx
Light intensity (teachers office)		200 Lx	200 Lx
Light intensity (corridor, toilet)		75 Lx	100 Lx

2-3-3 Basic Design

(1) Site Layout and Plot Plan

This project is to construct additional school buildings in the existing school premises. The entrance of the additional buildings will be located near that of the existing building to facilitate school management after the completion of the project as well as to design the entire layout of the school buildings in neat arrangement. Also, the location of embedded pipe systems requires consideration. The additional buildings will not be situated above the embedded heating pipes, because it will require considerable cost to relocate the heating pipes.

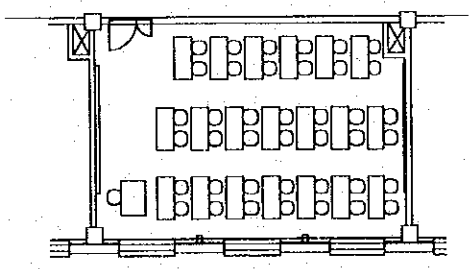
The school grounds will be left as they are as much as possible.

(2) Architectural Plan

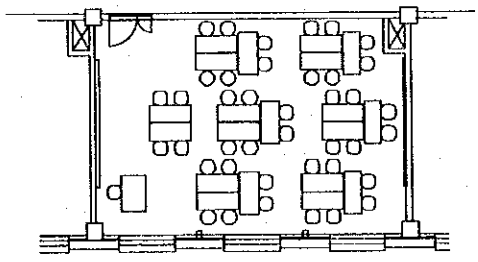
Additional classrooms and the corresponding number of toilets and teachers' office (also serving as teaching material storage) will be constructed in this project.

1) Floor plan

The existing classrooms are designed based on the standard module of 6.0 m×9.0 m. The additional classrooms will also be designed on the same module. Classes in the ordinary classrooms are expected to be held in all-together or group lessons. Room layouts of each lesson type based on the above-mentioned design module, assuming 40 students will be accommodated, are shown below.



All-together Lessons



Group Lessons

The existing buildings have about 3.0 meter wide corridors, and lounge spaces about 3.0 m×9.0 m are designed in various places around the corridors. Many schools convert these spaces into temporary classrooms by separating them with partition boards. The additional buildings are also designed to have 3.0-meter wide corridors which will

serve as resting and communication space for students whose outside activities are assumed to be limited during freezing winters.

An anteroom will be designed inside the entrance to prevent cold air from flowing in during the winter. The existing schools have a coat cloak in the entrance hall. Sufficient space for storage of thick and heavy coats Mongolian people usually wear in winter will be necessary to avoid bringing-in of coats into the classrooms and stealing of teaching materials. For this purpose, a cloak space will also be designed in the additional buildings adjacent to the entrance.

The classrooms will be arranged to have ample natural light and fresh air. The corridors will be designed on the northern perimeter of the building so that the classroom windows can face south and thus contribute to inviting solar heat into the room in winter.

The number of toilets and stalls will be determined in correspondence with the number of additional classrooms conforming to the design standards mentioned in Section 2-3-2.

2) Sectional plan

The Design Standards for School Facilities recommend 3.0 meters as the ceiling height for the classrooms. It specifies the required volume of space per student as 4.0 m3. From this figure, the required ceiling height is calculated as 2.962 meters.

(40 students $\times$ 4.0 m^3) $\div$ (6.0 m $\times$ 9.0 m) $=$ 2.962 m

Accordingly, the ceiling height will be designed as 3.0 meters.

The height of window openings will be from about 0.9 m above the floor to the beam soffit for exterior wall windows, and from about 1.5 m above the floor to the beam soffit for corridor side windows to avoid the nuisance of people in the corridor looking into the classroom. With such wide openings, natural light and fresh air can easily be drawn into the classroom.

The average depth of frost penetration in Ulaanbaatar is very deep and building foundations are usually set on the level GL–3.0 meters. Therefore, the foundation bottom will be set at this level. Space beneath the ground floor slab will be used as an underground pit. It is expected that the warm air in the underground pit will serve as a natural temperature control of the building through the ground floor slab. This pit can also be used for the heating pipe space. In the winter, air temperature in this pit will be much warmer than the outside temperature due to heat emission from the heating pipe. This warm air can be drawn into the classrooms or toilets as a fresh air supply during the

winter.

3) Structural plan

All the schools in UBC are constructed of brick walls and precast concrete floor slabs. It is probably because the concrete structures were not common and massive brick walls were necessary for good heat insulation.

Recently, however, anti-seismic design has been spread among building construction in Mongolia. Structural calculation sheets which include seismic force calculation are required in application for building permit. In this project, beams and columns will be constructed of reinforced concrete to satisfy the seismic design standards. A new heat insulation method will avoid massive bricks and thus will contribute to shorten the construction period. The roofs and floors will be constructed of traditional precast concrete slabs.

The existing school facilities are constructed on the raft foundations which is suitable for masonry structures but not for the frame construction of the project schools. Instead, isolate footings will be adopted.

As mentioned above, the depth of foundations will be set on the level GL–3.0 meters to prevent frosting of buildings. The concrete surfaces to be exposed to soils will be applied with a coat of bitumen to protect the concrete from cracking due to frosting.

4) Mechanical plan

A. Mechanical Installations

① Water supply system

a. In the sites where the city water supply system is provided, a branch pipe will be drawn from the existing intake pipe into the project facilities to distribute water to the designed consumption points.

b. For the other sites water supplied by water wagons will be stored in the receiving tank located in the project facilities and distributed to the designed consumption points.

As the countermeasures against freezing, the receiving tank room will be equipped with heating, and outside water supply pipe will be either laid within the same pipe trench with the hot water pipe for heating or will be embedded at 2 meters or below in the ground.

② Sewage system

a. In the sites where the city sewage system is provided, sewage water from the project facilities will be led to the existing sewage pit and then discharged into the sewage main..

b. For the other sites sewage water from the project facilities will be led into a sewage tank which will be newly constructed near the project facilities, and will be retrieved by vacuum cars. As the countermeasures against freezing, the double manhole lid type will be used, and the level of sewage pipe will be set at least 1 m above the water level.

Rainwater will be discharged in the ground around the buildings as is done by the existing facilities.

③ Hot water supply system

As the places where hot water will be supplied are not so many, electric water tank-heaters will be installed where necessary.

④ Sanitary wares

Water closet system will be applied to all the toilets; western style toilets and wall mounted urinals for boys. Durable, unbreakable wash basin will be selected because those in the existing facilities are frequently damaged or broken.

⑤ Indoor fire hydrant system

a. In the sites where the water pressure is high and stable, a branch pipe will be taken from the water supply pipe and connected directly to the interior hydrant system. The water hydrants will be installed at every 40 meters in each corridor.

b. In the other sites where water pressure is not stable or where the city water supply system is not provided, fire extinguishers will be installed in the entrances and near the stairs.

⑥ Heating system

In principle, a branch pipe for heating purpose will be taken from the existing hot water intake pipe and will be connected to the radiator to be constructed in the project facilities. In case the capacity of the existing heating source is not

enough to provide for the expanded facilities, an electric boiler will be installed as a supplementary source to generate hot water.

⑦ Ventilation system

Fresh air will be introduced through the air intake grids to be located in the underground pit, and will be supplied into the classrooms via a vertical duct shaft by the air supply fan. Air in the underground pit will be warmed by the heating pipe system installed there. Air in the classrooms will be flown into the corridors through the windows installed in the partitions between the classrooms and the corridors, and will be discharged outside through the exhaust grids with check dampers which will be installed at the end of corridors in each floor.

For the ventilation of toilets, likewise, fresh air will be supplied from the underground pit through the air duct shaft, and then will be discharged outside through the exhaust fans which will be installed in the toilets.

The design ventilation rate for the classrooms will be set at 8 m^3/hour per student, which is about a half of the Mongolian standard rate, for the purpose of avoiding too much heat loss during the winter period. The air change for the toilets will be designed at 7 times/hour to eliminate odors as much as possible.

B. Electric Installations

① Power receiving system

An electric power intake line will be taken from the nearest area substation and led to the distribution panel to be installed in the project facilities.

② Lighting / Outlet system

In principle, the classroom will be designed to have ample natural light. As an alternative lighting system for rainy and cloudy days or short daytime periods during winter, lighting fixtures will be installed to ensure 300 Lx intensity on the desk top level. Two electric outlets will be provided in each classroom, four in the teachers' room and one in each toilet.

③ Telephone system

In this project empty piping will be installed for future extension of telephone lines from the existing school facilities. A telephone outlet will be provided in

the teacher's room.

④ Broadcasting system

The broadcasting system is not considered in this project, because there is scarce possibility of future extension of broadcasting line from the existing school facilities.

⑤ School bell system

The same as the broadcasting system.

⑥ Fire alarm system

In compliance with the Fire Code, a manual fire alarm that will be activated by pushing alarm buttons when a fire is found, will be installed at every 40 meters in the corridors.

5) Construction material plan

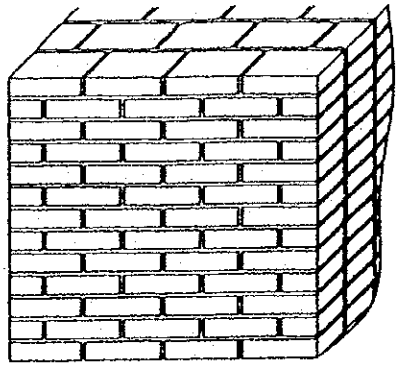
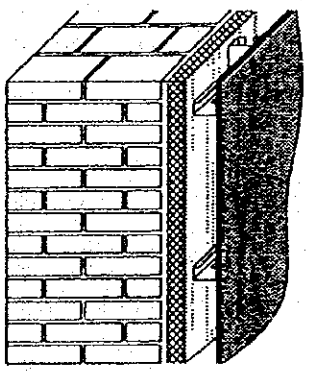
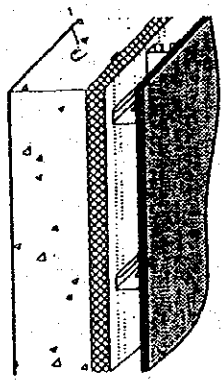
In general, quality of materials to be used for this project will be equivalent to the materials commonly used locally, in order to reduce operation and maintenance costs as much as possible. In selection of the materials, special concerns will be given to the climate conditions of Ulaanbaatar.

① Finishes and heat insulation of exterior walls

The schools in Ulaanbaatar are usually built out of approximately 650 mm thick brick walls finished with fair face bricks or painting on mortar base.

The City Construction and Engineering Department recommends 1,000 mm or thicker brick walls or other construction methods ensuring equivalent and efficient heat insulation. Viewing from the availability of materials locally, three types of exterior walls can be assumed as shown in the following figure. Type A wall will lead to massive and heavy building and have difficulty in shortening the construction period. It requires a large quantity of bricks and may have difficulty in procuring them in a short period. Type C uses a sealing compound in the joints between PC slabs.

Heat Transmission of Each Construction Method

outside  inside	Type A Brick t=1,000mm Coefficient of overall heat transmission = 0.48
outside  inside	Type B Brick t=250mm + Foam polystyrene t=100mm + Vacancy t=100 + Plywood t=12mm Coefficient of overall heat transmission = 0.37
outside  inside	Type C PC panel t=150mm + Foam polystyrene t=100mm + Vacancy t=100 + Plywood t=12mm Coefficient of overall heat transmission =0.37

Note) The smaller is the heat transmission rate, the better is the heat insulation.

The trouble is that the sealing compound is not very durable against weather. The PC slabs are custom made and it seems quite difficult to manufacture a sufficient quantity of PC slabs to cover the exterior walls as large as 7,000 ㎡ in total, and install them in six months. Also PC slabs are finished with a coat of paint which needs to be repainted every three to five years. Compared to types A and C, type B will enable good heating efficiency and the wall finish will not require further maintenance costs. Type B is regarded as most suitable for this project.

② Openings

All the windows of the existing schools are double sash wooden windows. Dry air and a wide temperature difference between the inside and outside of windows reaching 40～50℃ may easily warp wooden sashes. Most school windows have slits between the wall and window frame or between the window frame and glass, which are filled with cloth during the winter. Though the wooden window sashes were originally painted, most of the paint has been peeled off without regular repainting.

Newer buildings in Ulaanbaatar often use aluminum window sashes or hard plastic sashes with double glass windows. During the field survey, the study team observed some buildings newly built or reconstructed in the town areas, which used these types of windows. Some buildings even used glass curtain walls for exterior walls.

Instead of wooden sashes which are easily warped and need regular repainting, aluminum sashes which are highly weatherproof will be installed on the external side. Hard plastic sashes which show good insulation efficiency will be installed on the internal side of the windows. The double sash window system will ensure air tightness and heat insulation, which is expected to contribute to saving both maintenance and heating costs of the school facilities.

Many of the window glasses of the existing school buildings are broken, due mainly to children's mischievous behavior. Since the renewal of double glass windows is difficult and expensive, common plate glass windows will be adopted for this project.

③ Structure and finish of roofing

Among the 35 school facilities the study team researched, 28 were constructed of flat roofs with exposed bituminous waterproofing, leaving only seven schools constructed of metal sheet roofing on a wooden roof frame. Most of the office buildings and apartment buildings in the city areas were also constructed with flat roofs. The hearing in the surveyed schools revealed that the metal sheet roofing have corrosion holes and the bituminous waterproofing roof have cracks; both cause leakage of water.

Lumber for structural use and metal sheets with a laminated surface are hardly available locally. Zinc plated iron sheets are relatively easily available, but they will be corroded and have pinholes unless repainted regularly, at least once every three to five years. Thus, asphalt sheet waterproofing that is commonly employed locally will be adopted in this project, and to increase the durability against weather, 25 mm thick cement boards will be installed over the waterproofing layer. In Japan, usually 80 mm thick concrete is poured as the covering layer, however, its maintenance is difficult and expensive when water leakage is found. The cement boards will facilitate maintenance and are considered more appropriate.

Comparison of local standard specifications of building structures and finishes to the project specifications are shown in the following table.

Member	Local Standard Spec	Project Spec	Remark
〔Main Structure〕			
Foundation	Reinforced concrete	Reinforced concrete	
Footing beam	PC concrete block	PC concrete block	
Column	Brick	Reinforced concrete	
Beam	No beam (Lintel on top of the Opening)	Reinforced concrete	
Floor slab	PC floor slab	PC floor slab	
Roof slab	PC roof slab	PC roof slab	
Exterior wall	Brick PC slab	Brick	
Partition wall	Brick	Brick	
Stairs	PC slab for stairs	PC slab for stairs	

〔Finishes〕			
Exterior wall	Fair face brick	Fair face brick	
Roof	Asphalt sheet waterproofing over heat insulation layer	Sheet waterproofing over heat insulation layer Cement board	Cement board, 25 mm thick 300×300×25
Opening (Exterior)	Inswinging casement wooden window, painted finish	Aluminum window sash	
Opening (Interior)	Inswinging casement wooden window, painted	Hard synthetic resin sash	
Floor	Wooden board, painted Vinyl floor sheet	Vinyl floor sheet	
Baseboard	Wooden baseboard, painted	Wooden baseboard, painted	
Interior wall (exterior wall side)	Paint over cement sealant base	Light-gauge steel frame and heat insulation layer (cavity) Particle board, painted	
Partition wall	Paint over cement sealant base	Paint over cement sealant base	
Ceiling	Paint over cement sealant base	Paint over cement sealant base	
Beam		Paint over cement sealant base	
Classroom door	Wooden door, painted	Wooden flush door, painted	

(3) Equipment Plan

Basic teaching materials and equipment to be supplied in this project will be selected according to the list of equipment presented by MOSTEC with due consideration of school curricula and comments from the educational authorities in Mongolia. Those to be easily handled and managed by the teachers and to be widely used for general purposes will be provided. As to other materials and equipment, those commonly used in Mongolia will be selected. The number of materials and equipment will be determined corresponding to the number of additional classrooms except for maintenance equipment.

1) Classroom equipment

For each classroom to be constructed in this project, 20 two-student desks, 40 chairs and one set of a teacher's desk and chair will be supplied. In the teachers' room three meeting tables (2 tables for type 4C-1), chairs for each teacher and teaching material storage cabinets according to the number of classrooms will be provided.

2) Basic teaching materials/equipment and maintenance equipment

The following table shows basic teaching materials/equipment and maintenance equipment as well as the target student grades.

	Items	Subjects	Target Grades
1	Geographic map of Mongolia	Social Science	1 ~ 8
2	Administrative map of Mongolia	Social Science	5 ~ 8
3	Mineral resources map of Mongolia	Social Science	5 ~ 8
4	Floral distribution map of Mongolia	Life science	1 ~ 4
5	Animal distribution map of Mongolia	Life science	1 ~ 4
6	World geographic map	Social Science	5 ~ 8
7	World country map	Social Science	5 ~ 8
8	Chemical element chart	Science	7 and 8
9	Physical measurement unit chart	Science	7 and 8
10	Human body dissection chart	Life science, Science	6 ~ 8
11	Thermometer	Science	1 ~ 4
12	Magnetic compass	Life science, Science	1 ~ 4
13	Figure/word cards	Mathematics, Language	1 ~ 4
14	Tape measure	Life science, mathematics	1 ~ 4
15	Block set	Mathematics	1 ~ 4
16	Abacus	Mathematics	1 ~ 4
17	T-square	Mathematics	1 ~ 8
18	Wooden geometry measure	Mathematics	1 ~ 8
19	Maintenance tool set – I	---	1 set for each school
20	Maintenance tool set - II	---	1 set for each school

(4) List of Facilities and Equipment to be Provided

The following tables show lists of schools facilities and equipment to be provided in this project.

<Facilities>

Type of Facilities	Symbol	Floors	Total Floor Areas (m^2)	Number of buildings to be constructed		
				Phase I	Phase II	Phase III
4-classroom bldg.	C4-1	1	498.0	0	0	1
8-classroom bldg.	C8-2	2	997.5	2	0	1
10-classroom bldg.	C10-2	2	1,200.0	1	0	0
12-classroom bldg.	C12-3	3	1,429.5	3	2	0
14-classroom bldg.	C14-3	3	1,632.5	0	3	3

<Equipment>

	Items	Components	Number of equipment to be supplied		
			Phase 1	Phase 2	Phase 3
Equipment for classrooms	Student desk	desk for two persons, 20/classroom	1,240	1,320	1,080
	Student chair	individual chair, 40/classroom	2,480	2,640	2,160
	Teacher's desk & chair	1set/classroom	62	66	54
	Meeting table	3/school	18	15	14
	Teacher's chair	(No. of classroom + 6) /school	98	96	82
	Cabinet	1 per 2classrooms	31	33	27
Basic teaching materials	Topographic map of Mongolia	1/classroom	62	66	54
	Special map of Mongolia	1/classroom	31	33	27
	World map	1/classroom	31	33	27
	Chemical elements, unit charts	1 per 4 classrooms	16	18	15
	Human body dissection chart	3 per 8 classrooms	25	26	22
	Teaching tools	one each set per 2 classrooms	31	33	27
	Blackboard tools	1 set/classroom	62	66	54
Others	Maintenance tools – I	1 set/school	6	5	5
	Maintenance tools – II	1 set/school	6	5	5

(5) Basic Design Drawings

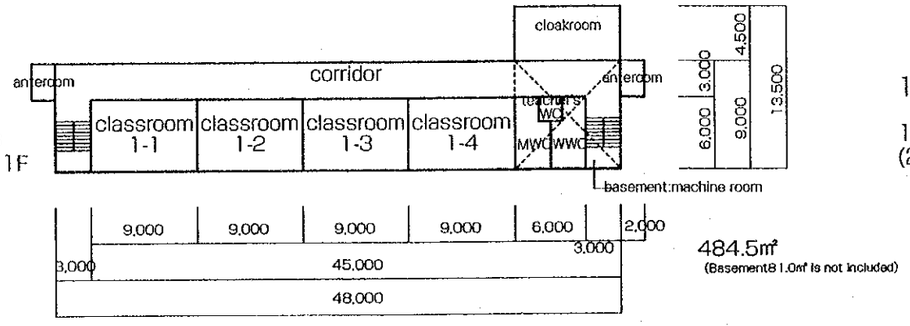
In the following pages are shown basic design drawings of this project.

① Unit Type Floor Plan (1)

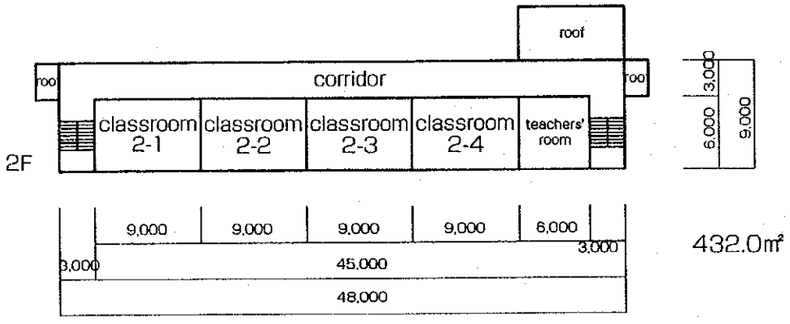
② Unit Type Floor Plan (2)

8C-2

8 Classrooms
(2Floors)



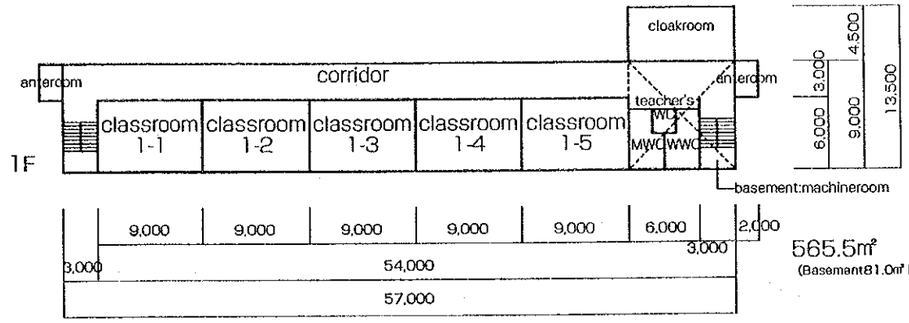
484.5㎡
(Basement81.0㎡ is not included)



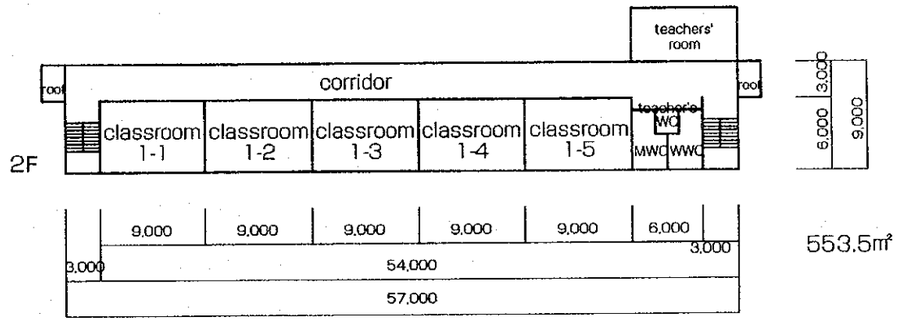
432.0㎡

10C-2

10 Classrooms
(2Floors)



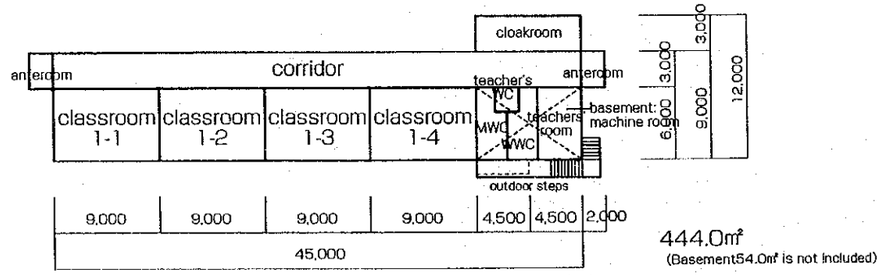
565.5㎡
(Basement81.0㎡ is not included)



553.5㎡

4C-1

4 Classrooms
(1Floor)



444.0㎡
(Basement54.0㎡ is not included)

List of Unit Type of Facilties

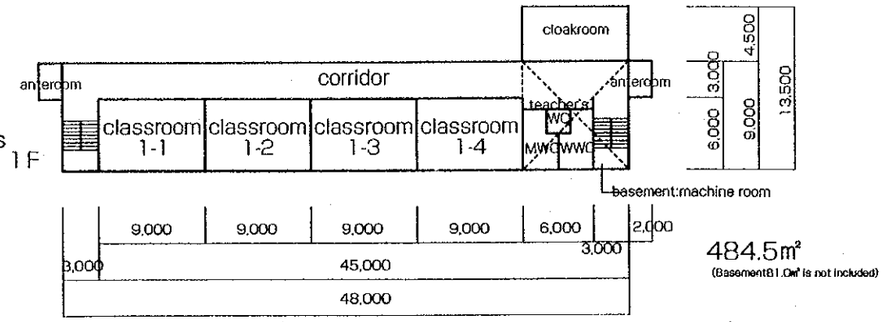
Type	Floor	Class	Basement (㎡)	1F (㎡)	2F (㎡)	3F (㎡)	Total Foor Areas (㎡)
4C−1	1	4	54.0	444.0	—	—	498.0
8C−2	2	8	81.0	484.5	432.0	—	997.5
10C−2	2	10	81.0	565.5	553.5	—	1,200.0
12C−3	3	12	81.0	484.5	432.0	432.0	1,429.5
14C−3	3	14	81.0	525.0	513.0	513.0	1,632.0

Unit Type Floor Plan - 1 S=1:500

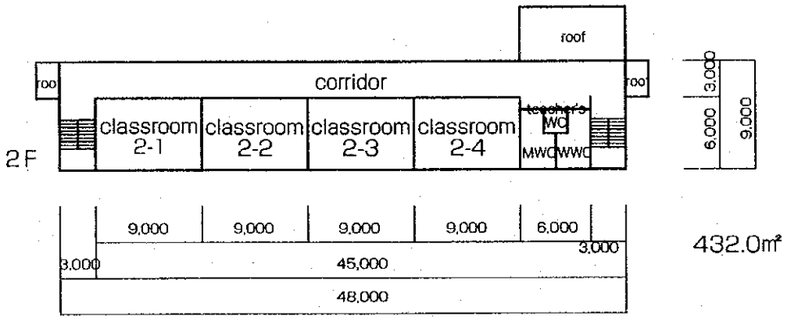
The Project for the Improvement of Primary Education Facilities in Mongolia

12C-3

12 Classrooms
(3 Floors)



484.5㎡
(Basement B1.0㎡ is not included)



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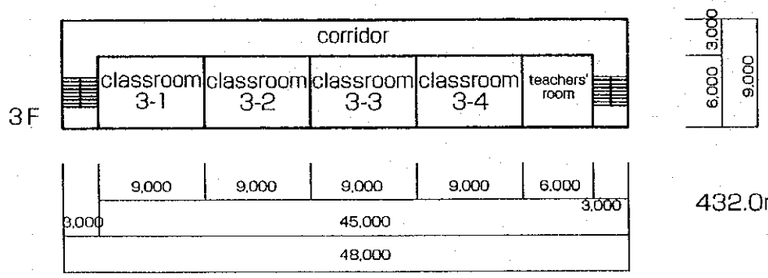
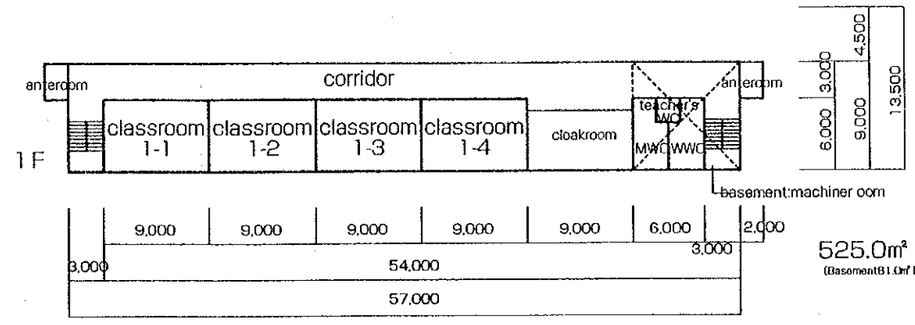


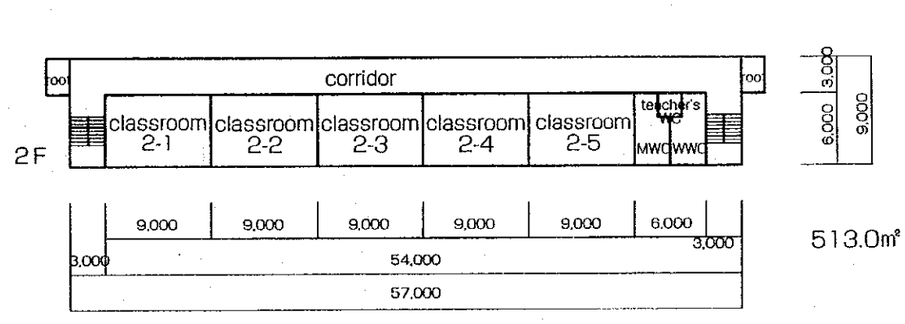
432.0㎡

14C-3

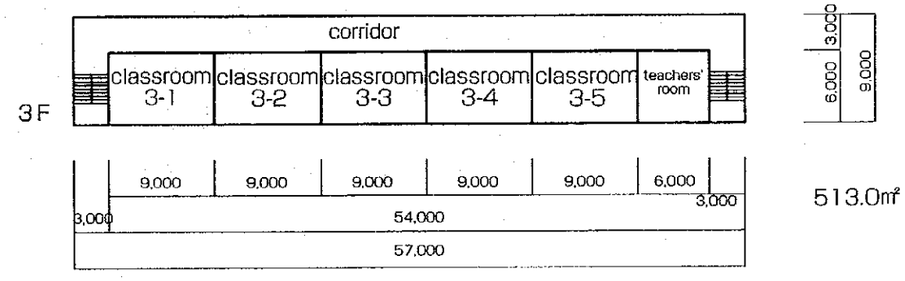
14 Classrooms
(3 Floors)



525.0㎡
(Basement B1.0㎡ is not included)



513.0㎡



513.0㎡

Unit Type Floor Plan - 2 S=1:500

2-4 The System for the Realization of the Project

2-4-1 Organization

The Mongolian side for implementation of this project is as follows: Ministry of External Relations is to take on the responsibility for the whole project including proper use of the facilities and equipment after the completion of the project. Ministry of Science, Technology, Education & Culture (MOSTEC) is to administrate and coordinate the project as well as to follow the necessary procedures concerning approval of contracts. UBC Education Department, which is the implementation body of the project and the contract signer is to take charge of construction planning, operation and maintenance of schools.

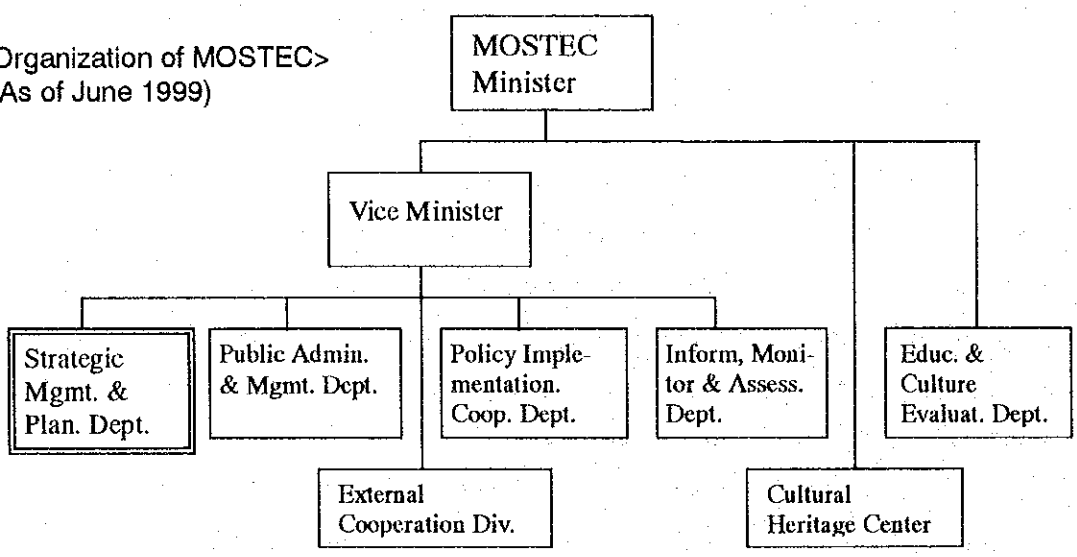
Educational administration of national level is under the control of MOSTEC at the central government level. MOSTEC has 86 staff in 4 departments (Strategic Management and Planning Department, Public Administration and Management Department, Policy Implementation Coordination Department, and Information Monitoring and Assessment Department) and 1 division (External Cooperation Division) under the control of the minister and the vice minister. Among these departments and division, the Strategic Management and Planning Department, which is in charge of educational planning for pre-school education, primary and secondary school education, higher education and non-formal education, is mainly concerned with this project. This department, however, has only one staff for each education level and they may be overloaded with work. It is desirable to increase the number of staff during the implementation of this project.

At the local level, Education Department and Education Center of each Aimag or Hoto is in charge of educational administration. In the case of Ulaanbaatar, seven staff of the Education Department manage arrangement and evaluation of teachers, distribution of textbooks, maintenance of school buildings etc., and 15 specialists of each subject working in the Education Center instruct teachers about new curriculum. During the basic design, staff of the Education Department extended the study team full support, but when the project is implemented, it should be concerned for the difficulties in obtaining statistical data or budget records and complex administrative procedures.

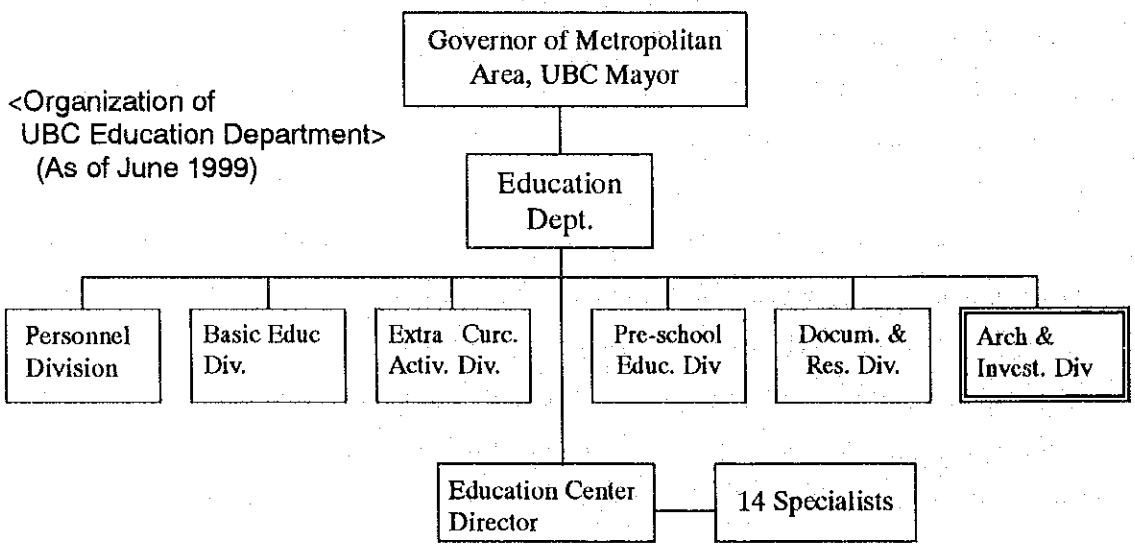
School operation after completion of the project is supposed to be done by the School Operating Committee set up in each school in Ulaanbaatar. The committee, which

consists of staff of each Duureg, representatives of parents, teachers and community leaders, decides the contents of teaching and adoption and dismissal of school headmasters. Headmaster of each school and the school headmasters' committee are responsible for ordinary school management. As for maintenance of school facilities, the parents' committee is responsible for that of each classroom and the school authorities are responsible for common areas such as corridors and toilets by the UBC government budget. The following figures show the organizations for administration concerning this project.

<Organization of MOSTEC>
(As of June 1999)



<Organization of
UBC Education Department>
(As of June 1999)



※ ▭ Divisions concerned with this project

Note: These charts are drawn based on the answers to the study team questionnaire.
The names of each department and division are not official translation.

2-4-2 Budget

In "Mongolian Conception for Development" and "Action Program of Mongolia toward the 21st Century" described the necessity for development of the education sector as one of the most important sectors in the society, and the educational budget increased more than twice from 1995 to 1998. The budget in 1998 accounts for over 20% of the national budget, which shows that education is regarded as essential in the national policies. But the expense for school construction accounts for less than 1% of the annual educational budget. The tendency that a sum of investment for educational infrastructure including the expenses for educational equipment and materials and for maintenance of facilities and equipment is confined seems to continue.

Budget of the Mongolian Government for Educational Sector (1995 ~ 1997)

(in million Tg)

	1995	1996	1997
Educational sector budget	25,327.1	33,668.9	42,087.4
Recurrent expenditure	24,246.9	32,187.6	40,539.0
Personnel	9,915.0	13,701.7	16,757.8
Social insurance	1,801.7	2,480.5	4,380.7
Heating	4,827.6	6,445.2	9,271.5
Water & electricity	1,287.8	1,904.5	2,727.5
Scholarship	107.8	65.2	138.4
Others	6,307.0	7,590.5	7,317.1
Educational investment	1,080.2	1,481.3	1,548.4
Construction	218.6	0.0	300.0
Equipment	309.3	853.9	410.0
Maintenance & repairs	552.3	627.4	838.4

Source: Compiled from answers by MOSTEC to the study team questionnaire

As mentioned above, expenses on the education sector account for a high ratio of the national budget. Also in the budget of the UBC government, educational expense account for over 40%. In the educational expense the largest portions are allocated for the costs of personnel and heating, which indicates the necessity for heating in the cold season of Mongolia. The social insurance and food costs share next to these two. The reason the food cost has a high ratio in the budget is because UBC supports a half the food cost of kindergartens. Meanwhile, the expenses for maintenance of school facilities is less than 3% of the whole educational expense. The expenses on maintenance and repairs are supposed to be paid by each Duureg. As the city finance supports the Duuregs that have low income, there are small imbalances among Duuregs. On the other hand, the budget allocated for maintenance of each school may remain rather small.

UBC Government Balance Sheet (1996 ~ 1998)

(in million Tg)

		1996	1997	1998	Percentage in 1998 expenditure
Revenues					
1	Tax income	19,107	18,603	25,400	
2	Income other than tax	2,758	10,006	9,589	
3	Asset income		39	1,988	
4	Total	21,864	28,547	36,977	
Expenditures					
1	Public projects	1,582	1,771	2,860	7.4%
2	Maintenance of social order	1,596	1,730	2,685	7.0%
3	Education	8,811	11,677	16,106	41.8%
4	Public health	7,768	9,889	12,519	32.5%
5	Welfare	204	137	210	0.5%
6	Urban utility projects	877	1,495	1,821	4.7%
7	Sports and culture	679	715	1,251	3.2%
8	Others	347	1,235	1,093	2.8%
9	Total	21,864	28,647	38,546	100%
Education sector expenditure					
1	Personnel	3,516	4,319	5,577	34.6%
2	Social insurance	607	962	1,509	9.4%
3	Office expenses	352	349	346	2.1%
4	Electricity	232	438	529	3.3%
5	Heating	1,232	2,199	3,256	20.2%
6	Transport	23	38	45	0.3%
7	Communication	38	68	80	0.5%
8	Water service charges	275	494	668	4.1%
9	Textbooks, books	25	31	42	0.3%
10	Class relevant costs	57	86	114	0.7%
11	Equipment	100	96	420	2.6%
12	Food	864	1,233	1,445	9.0%
13	Medicines	4	3	5	0.0%
14	Regular maintenance costs	262	292	371	2.3%
15	Extensive maintenance costs	274	113	478	3.0%
16	Other construction relevant costs	951	100	255	1.6%
17	Others		858	968	6.0%
18	Total	8,811	11,677	16,106	100%

Source: Compiled from data presented by UBC Finance Dept.

2-4-3 Staff and Skills

(1) Teachers

Training of primary class teachers is done by Teachers' College and its branch schools in Alhangai Aimag and Dortono Aimag. And that of secondary class teachers who are in charge of special subjects in grade 5 and over is done in Pedagogical University and other national universities and private colleges. Elementary class teachers were once regarded as lower level teachers than secondary class teachers and got less payment because elementary class teachers could got only diploma in spite of the education of 4 years in Teachers' College. But after 1995, graduates from Teachers' College could get bachelor's degree and now they are regarded as equivalent teachers to secondary class teachers.

In 1999 the number of the teachers who work for basic education (from grade 1 to 10) is about 18,000 and four-fifths of them are women. As for the demand and supply of teachers, teachers are over supplied in cities and insufficient in rural villages. In Mongolia, many teachers prefer working in cities where there are many opportunities of side jobs, they are allowed to take side jobs by Education Law. In fact, excessive number of teachers are dismissed every year in UBC. Moreover, Pedagogical University and Teachers' College produce many graduates every year. In these circumstances it seems not so difficult to employ excellent teachers in UBC where the project schools are situated.

Till 1990, in-service training of teachers had been held once in every five years following the training system of Soviet Union but, in social confusions afterwards this training system disappeared. Today the annual schedule for in-service training programs (from short training for about one week to long one as long as one year) is announced every year and teachers who would like receive training can take part in. About 80% of all the teachers attend any of these programs. The training system is expected to help continuously to improve the skills of the teachers. The fact of high ratio of participation seem to attribute to two reasons; that more popular and effective programs are practiced according to questionnaire to teachers before making the training schedule, and that teachers can promote to chief teachers by attending the training programs repeatedly and thus can be rewarded with higher payment.

In addition to the in-service training, evaluation of teachers on duty is made

systematically. At schools in Ulaanbaatar, staff of the UBC Education visit schools to check teachers according to 4 criteria: (1) to enhance students learning motivation (2) to keep good relations with students (3) to be skillful in teaching (4) to use textbooks and teaching materials appropriately. The result of this evaluation is used for reference at teachers' promotion examinations, and is useful for improvement of teachers' morale.

As mentioned above, there seems no problems in supplying teachers of primary and secondary levels at least in UBC, and their skills are expected to improve continuously through the training, etc. Thus, it is believed that the schools facilities and equipment to be supplied through the project will be made good use of in the future.

(2) Implementation Organization

UBC Education Department which is in charge of this project has 22 staff, but the actual counterpart staffs of this project are only two, director of the department and specialist of architecture and investment (to be referred to as the "architect"). During the field surveys, other staffs of the department and architects from private sectors coordinated with the study team when necessary. The architect, who knows well about the actual situations in schools, is becoming familiar to the Japanese way of proceeding works, however, when this project starts, there may be a shortage of staffs. The Project Unit which will consist of the members from MOSTEC, Ministry of Finance, UBC Education Department, City Construction and Engineering Facility Department and Land Management and Real Estate Registry Department, may function well, but this unit is not for carrying out this project but for management and advise. At the end of the basic design study in June 1999, it was requested to and UBC Education Department to allocate skillful staff under the architect at least during the project. It is sincerely expected that this request will be realized.

CHAPTER3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

This project is to construct school facilities mainly consisting of ordinary classrooms at 16 primary and secondary schools in Ulaanbaatar and to provide necessary equipment, during a determined period, with the use of local construction companies as well as materials and equipment procured locally and in a third country. The work shall be implemented according to the construction schedule which reflects construction and procurement conditions of the recipient country as well as the third country. The construction schedule will be planned based on the following principles:

(1) Principles for the Implementation of the Project

After it is approved by the Cabinet in Japan and the Notes are exchanged between the Governments of Japan and Mongolia (E/N) regarding its implementation, this project will be carried out in accordance with the following principles:

1) This project will be funded based on the taxes of the Japanese people, and will be implemented within the regimen of the national budgets and Grant Aid of Japan.

2) The Government of Mongolia will conclude a contract with a consultant, a company existing under the Japanese jurisdiction, and will entrust working design and supervision of construction work based on the basic design of this project. The Consultant will assist the Government of Mongolia during selection of a construction contractor and conclusion of contract.

3) The construction work for this project will be conducted by a construction company existing under the Japanese jurisdiction, who will be selected by competitive bidding. The selected contractor will conclude a lump sum contract with the Government of Mongolia to construct the buildings and to procure the equipment under the terms of the contract.

(2) Principles for Construction Work

1) Local consultant and construction firms will be utilized as much as possible as subcontractors in order to proceed the work efficiently while respecting local

construction situations and to prompt technology transfer to the recipient country.

2) In the construction sites, the Japanese general contractor will maintain strict quality control, schedule management and safety assurance. They will keep in mind the need to transfer their technology to the local subcontractors for this purpose.

3) To facilitate maintenance of the facilities and equipment after the completion of project, Mongolian products or imports widely distributed in the local market will be used as much as possible for the construction materials and equipment, teaching materials and classroom furniture which are planned in the project. However, the materials or products may be purchased from a third country like China, if the capacity of local suppliers seems insufficient.

3-1-2 Observations for Construction

(1) Observations for Construction

Ulaanbaatar has extremely cold winters, with the temperature falling below –30°C, which makes exterior work and concrete casting work that require strict temperature controls impossible. Excavation work is not usually done in winter, either, because digging of frozen soils requires special machinery. Interior work is possible, but it necessitates additional costs for heating, thus, the local construction contractors usually close the work sites until next spring and sustain the construction work. However, frames and main structures will be constructed by mid September when heating is usually started and interior work will be carried out during the winter, so that the project will progress through the year, as this project needs to be proceeded under the strict schedule containment of the Japanese fiscal year.

Most buildings in Mongolia are made of brick or concrete block masonry construction except for some skyscrapers, and such a method to cast concrete for beams and columns at the site is not prevalent yet, though it has gradually been increasing. The cast-in-situ concrete method will be adopted in this project partly for the transfer of Japanese contractor's technology including work mechanization, strict schedule control for prompt performance and quality control for universal and good quality of workmanship.

The work conditions of construction workers are regulated by Labor Law, which will be sincerely observed. The peculiar terms of the Mongolian Labor Law are, in addition to the regular wages, double wages for extra-work hours, and allowance for food and

transfer shall be paid. For the regular workers the basic payment shall be paid during the winter season. The workers need to be employed through local companies, because foreign companies are not permitted to hire labor force directly due to the Mongolian laws.

(2) Division of Work Phase

The construction work will be divided into three phases. In consideration of the capacity of local construction companies as mentioned in Section 2-3-1 Basic Design (3) 2), the floor areas to be constructed in this project shall be around 7,000 ㎡ per year. As the total floor areas of all the extension work in 16 schools reaches approximately 21,000 ㎡, the work can be completed in three phases.

3-1-3 Scope of Work

Responsibilities of Both Countries

This project will be implemented under the collaboration between Japan and Mongolia. The scope of responsibilities of both countries in accordance with the Grant Aid scheme are as follows:

① Expropriation of the land for project sites	..... Mongolia
② Demolition of obstacles in the land, clearing leveling and reclaiming of the construction sites	..... Mongolia
③ Access road to the site for construction work	..... Mongolia
④ Intake of electric power and water to the site	..... Mongolia
⑤ Application and acquisition of permits required for the project according to the Mongolian laws	..... Mongolia
⑥ Construction of school facilities, exterior work within the site premises, mechanical work, procurement of materials and equipment, and inland transportation to each site	..... Japan
⑦ Landscaping, construction of gates and fences and other exterior works	..... Mongolia
⑧ Exemption of materials and equipment to be procured for the project from duties and internal taxes to be imposed in Mongolia	..... Mongolia
⑨ Exemption of Japanese nationals concerned to the project from internal taxes to be imposed in Mongolia	..... Mongolia

⑩ Facilitation of formalities necessary for the Japanese nationals to enter/exit and stay in Mongolia for accomplishment of their services relevant to the project ..... Mongolia

⑪ The Banking Arrangement (B/A) and necessary costs ..... Mongolia

⑫ All the costs except for those for construction of school facilities as well as procurement, transport and installation of the equipment ..... Mongolia

⑬ Budget necessary for operation and maintenance of the facilities and equipment and for securing sufficient personnel ..... Mongolia

⑭ Proper management and maintenance of the school facilities and equipment as well as submission of reports when so required by the Government of Japan ..... Mongolia

3-1-4 Construction Supervisory Plan

The construction work will be divided into three phases in consideration of the capacity of local construction companies and tight work schedule. Proper supervisory management system is indispensable for completing the work upon schedule ensuring good workmanship. For these reasons, the following principles are established under which the work will be conducted.

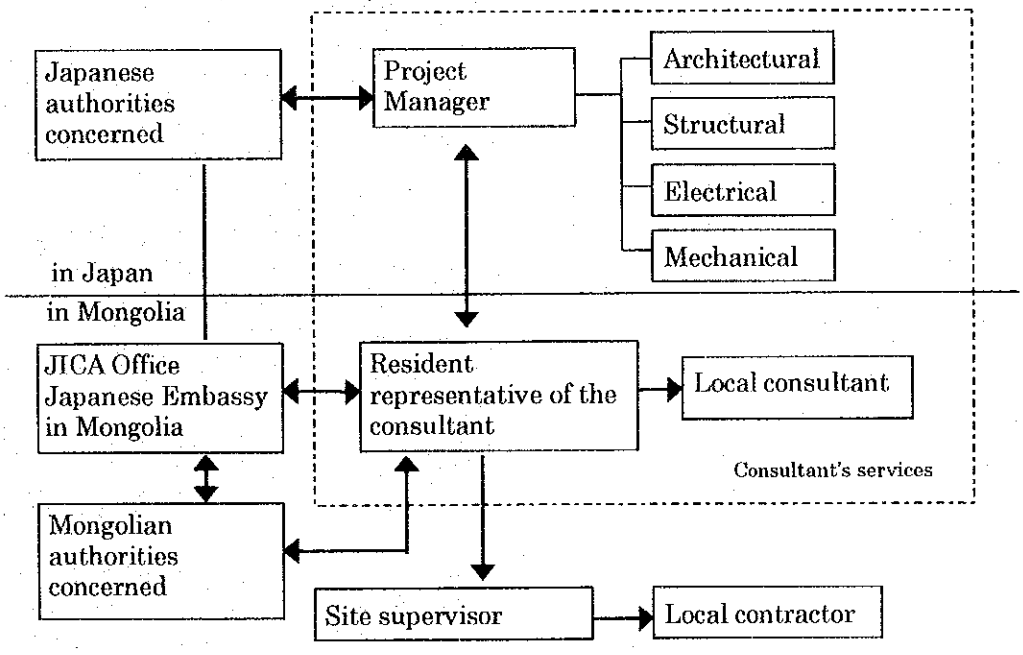
1) The consultant will maintain close communication with the authorities concerned of the governments of Japan and Mongolia. The consultant will open a site management office in UBC and post a resident representative of the consultant who will be responsible for management of the construction work and technology transfer.

2) The consultant will contract with a local consultant company as a subcontractor which will supervise the construction work under the Japanese resident representative. In this project the work will be conducted in plural sites at the same time, and the consultant will have to supervise them simultaneously. However, there is a limit in the capacity that one engineer can control, the number depending on the scale of the work and geographical conditions. For the size of this project sites, it is assumed that one engineer can take care of three sites at the maximum, according to our past experiences in similar projects.

3) The consultant will keep in mind to transfer Japanese technologies during the work through the local consultant.

4) The Japanese resident representative of the consultant will report to and communicate with MOSTEC, UBC Education Department, the Japanese Embassy and the JICA Mongolia Office frequently. He will be responsible for the entire management of all the sites under construction.

5) Based on the above-mentioned principles, the construction supervisory system will be organized as shown below.



Construction Work Supervising System Diagram

3-1-5 Procurement Plan for Materials and Equipment

In principle, construction materials and classroom furniture and equipment will be procured in Mongolia. Some materials and equipment will be purchased in a third country in consideration of the work schedule, supplier's capacity, product quality and reliability, workmanship, cost and convenience for maintenance afterwards, etc.

Procurement of Materials and Equipment

Materials & Equipment	Mongolia	Third Country (China)	Remarks
<Construction Materials>			
Cement	○		Available in local manufactures in good quality.
Aggregate	○		Both sand and gravel are locally available in good quality.
Reinforcing bars	○		Available in a Japanese-Mongolia joint manufacturer in good quality (recycled steel bars).
Steel frames	○		As the amount of frames to be used in this project is not very much, products commonly available in the market will be sufficient.
Wooden forms for concrete casting		○	Plywood forms for concrete casting except those for lean concrete will be procured in China, because they are scarcely distributed locally.
Bricks	○		Bricks are major products of Mongolia and available in good quality, some types of bricks may be insufficient in quantity.
Precast concrete slab	○		Plenty available, though the quality varies a little.
Lumber	○		Plenty of pine wood lumber is available, though the quality may vary depending on the seasoning period.
Wooden chip boards		○	Not manufactured locally; only small amount of imports are available on the market.
Rolled vinyl floor sheets		○	Not manufactured locally.
Steel doors & windows	○		As the amount of steel doors and windows to be used in this project is not very much, locally manufactured products will be sufficient.
Aluminum doors & windows		○	Not manufactured locally.
Hard plastic door & window sash		○	Not manufactured locally.
Metal accessories	○	○	Some imports are available in the local market, but insufficient in quantity.
Glass		○	Some imports are available in the local market, but insufficient in quantity.
Paint	○		Though they are expensive, local products will be purchased for the convenience of maintenance afterwards.
Roof waterproofing sheets		○	Not manufactured locally; only small amount of imports are available in the market.
Furniture, equipment	○	○	Locally available, with no problems in quality and quantity. Aluminum blackboards and bulletin boards are not manufactured locally.
<Electrical Materials>			
Distribution panel	○		Though there may be a little problems in quality, local products will be purchased for the convenience of maintenance.
Cables & wires		○	Not manufactured locally; only small amount of imports are available in the market.
Lighting fixtures		○	Not manufactured locally; only small amount of imports are available in the market.
Low tension current appliances		○	Not manufactured locally; only small amount of imports are available in the market.
<Plumbing and Heating Materials>			
Steel pipes	○		Though there may be a little problems in quality, plenty of imports are available in the market.

Zinc coated steel pipes		○	Not manufactured locally; only small amount of imports are available in the market.
Valves, pipe fittings	○	○	Except for a certain type, valves and pipe fittings are not manufactured locally; only small amount of imports are available in the market.
Pumps		○	Not manufactured locally; only small amount of imports are available in the market.
Radiators		○	Not manufactured locally; only small amount of imports are available in the market.
Sanitary wares	○		As the amount of sanitary wares to be used in this project is not very much, imports available in the market will be sufficient.
<Teaching Materials>			
Maps & drawings	○		Plenty available.
Textbooks		○	Local products are hardly available.
<Maintenance Tools and Materials>			
Maintenance tools & materials	○	○	Plenty of local products are available except for maintenance tools.

Most materials and equipment will be purchased in Peking and Shanghai, and will be transported to Mongolia in containers by the Chinese National Railroads.

For the purpose of maintaining the weight balance of cars and prevention of robbery, the Chinese National Railroads regulates that even number of containers shall be loaded with their doors facing each other. Watch guards are required when odd number of containers are loaded. Transporters often wait until the even number of containers to the same destination are collected in order to avoid the round transportation fees to the country border and daily wages for the watch guards. In general, materials and equipment are delivered from the factories to the container yard by trucks and loaded into the containers there. This is because transport hours of large container trucks are regulated in major cities in China to reduce traffic congestion. Careful countermeasures need to be prepared against damage or loss of materials and equipment during transportation so that unexpected troubles may not occur at the construction sites.

It usually takes one to four weeks for the transport from Peking or Shanghai to Ulaanbaatar, including customs clearance and reloading of containers (because of the different rail widths in China and Mongolia) at the country border. This period of time needs to be included when the procurement order is placed in order not to cause unnecessary delays in the construction schedule.

3-1-6 Implementation Schedule

This project will be officially implemented after the Notes are exchanged between the two governments. The Japanese responsibilities are mainly divided into working design stage, tender stage and construction work stage. The following schedules show the three stages in each phase of the project. The construction work of each phase has to be commenced in April in consideration of the climatological conditions of Ulaanbaatar.

Project Implementation Schedule

Services (Phase 1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Exchange of Notes	■																					
Working Design	■	■	■																			
Tender			■	■	■	■																
Construction						■	■	■	■	■	■	■	■	■	■	■	■					

Services (Phase 2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Exchange of Notes	■																					
Working Design	■	■	■	■	■																	
Tender						■	■	■	■													
Construction										■	■	■	■	■	■	■	■	■	■	■	■	■

Services (Phase 3)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Exchange of Notes	■																					
Working Design	■	■	■	■	■																	
Tender						■	■	■	■													
Construction										■	■	■	■	■	■	■	■	■	■	■	■	■

3-1-7 Responsibilities of Mongolia

The descriptions of the responsibilities of the Mongolian side are as mentioned below:

1) Expropriation of the land for project sites

The construction sites of project school facilities have to be properties of the local government or national land to which the local government has legal right of use.

2) Clearing, leveling and reclaiming of the construction sites

The following sites need clearing, leveling and reclaiming work which has to be completed before the commencement of building construction work by the Japanese side. All the obstacles in the site ground will also have to be demolished and removed before the commencement of building construction work.

① Schools that require clearing, leveling and reclaiming of the land

Buyant Ukhaa School District (former No. 7 School), No. 9 School, No. 37 School, No. 92 School

② Schools that require demolition of on-the-ground and underground obstacles that may hinder the project construction work

No. 28 School, No. 37 School, SETGEMJ School District (former No. 46 School), No. 62 School, No. 65 School, No. 67 School, No. 76 School, No. 92 School, No. 105 School

3) Access road to the site for construction work

The following school need an access road between the main streets and the site for the convenience of construction work.

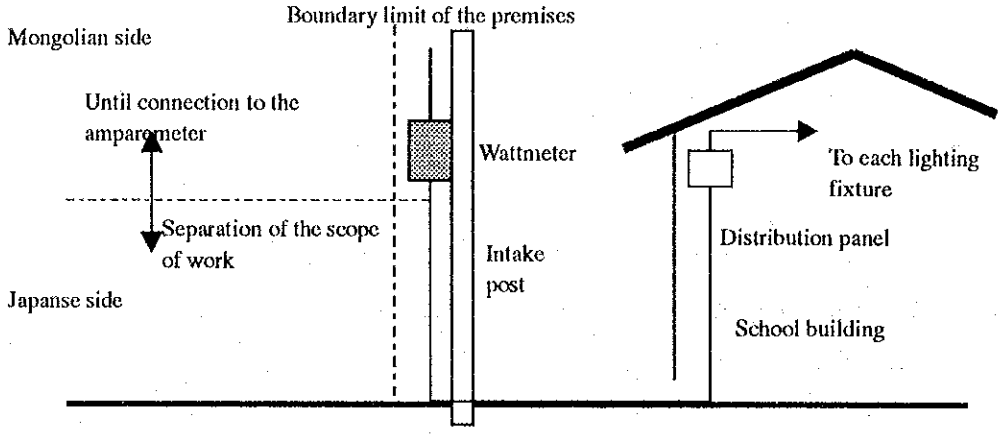
No. 62 School, No. 67 School, No. 76 School, No. 65 School, No. 9 School, No. 105 School, No. 37 School, No. 58 School, No. 92 School, Buyant Ukhaa School District (former No. 7 School),

4) Intake of electric power and water to the site

① Power receiving work

The construction work to be conducted by the Japanese side will be limited in the site premises within the boundary limit. Therefore, the intake wiring of electric power until the wattmeter that will be installed in the site shall be

undertaken under the responsibility of Mongolia.



Zoning of Power Receiving Work

② Water intake work

Like the electric power receiving work, the intake piping work until water meter which will be installed in the site are under the responsibility of the Mongolian side.

③ Connection of sewage pipe

A final pit of sewage system will be installed by the boundary limits of the site premises. This is Japanese side work. The Mongolian side shall be responsible for pipe connection from this pit to the UBC sewage main. The exact location of the final pit will be determined through close discussions and examinations.

5) Application and acquisition of permits required for the implementation of the project

The application and acquisition of various permission including the building permits to be required for the implementation of the project is the responsibility of the Mongolian side. The consultant will assist in preparation of documents necessary for the application.

6) Landscaping, construction of gates and fences and other exterior

Where gates and fences need to be constructed around the site premises, the work belongs to the Mongolian scope of work. It is also recommended the landscaping and construction of school ground will be done by the Mongolian government after the

completion of the project if they are necessary for the improvement of school environment.

7) Exemption of materials and equipment to be procured for the project from duties and internal taxes

In Mongolia, a value-added tax (VAT: 13%) is imposed on the purchase of products and services. The Government of Mongolia has to exempt all the materials, equipment and services to be procured for the project from all the taxes in compliance with the Exchange of Notes.

8) Exemption of Japanese nationals concerned to the project from duties, internal taxes and all the levies

The Government of Mongolia has to exempt all the Japanese nationals concerned with the project to enter/exit and stay in Mongolia for accomplishment of their services from all the taxes and levies in compliance with the Exchange of Notes.

9) Facilitation of formalities necessary for the Japanese national to enter/exit and stay in Mongolia for accomplishment of their services

The Government of Mongolia needs to facilitate formalities like visas and legal permission to stay in the country for the Japanese personnel concerned to the project who enter/exit and stay in Mongolia for accomplishment of their services.

10) The Banking Arrangement (B/A) and necessary costs

The Government of Mongolia has to enter into the banking arrangement with a Japanese bank promptly after the Exchange of Notes. The costs for issuing the irrevocable authorization to pay and commissions including that for the payment for construction work, etc. will be borne by the Mongolian side.

11) All the costs except for those for construction of school facilities as well as procurement, transport and installation of the equipment

The costs necessary for the purchase of things other than those to be supplied through Grant Aid will be borne by the Mongolian side. They may include textbooks, reference data, books and other teaching materials, and facilities like specified classrooms, multi-purpose rooms, libraries, etc. which may be required in the future

when necessary.

12) Budget necessary for operation and maintenance of the facilities and equipment and for securing sufficient personnel

The Mongolian side is responsible for securing sufficient budget and teaching and other school staff for the operation and maintenance of the school facilities after the completion of the project. The operation and maintenance costs will be composed of regular expenses including service charges of electricity, water supply and sewage, seasonal expenses like heating service charges, continual expenses like painting, and miscellaneous expenses including repairs of damaged tools and equipment.

Also, skillful staff need to be additionally assigned under the expert of UBC Construction and Investment Division for the purpose of smooth procedures during the implementation of the project as the implementation agency of the Government of Mongolia and for coordination with authorities concerned.

13) Proper management and maintenance of the school facilities and equipment as well as submission of reports when so required by the Government of Japan

The Mongolian side is responsible for proper and efficient operation and maintenance of the school facilities and equipment to be supplied in the project. When so requested by the Government of Japan, they shall promptly inform of the situation how the facilities and equipment are utilized.

3-2 Project Cost Estimation

3-2-1 Project Cost

Costs to be borne by the Government of Mongolia are assumed as follows:

(1,000 Tg)

	Phase I	Phase II	Phase III
Site measurement	1,000	1,000	3,000
Clearing, leveling and reclaiming	1,800	1,500	8,700
Demolition of obstacles	4,606	7,342	15,171
Intake of electric power and water, etc.	7,237	8,883	9,858
Bank commission according to the banking arrangement	6,700	6,700	6,000
Total (in Tg)	21,343,000 Tg	25,425,000 TG	47,729,000 Tg
Total (in yen)	2,560,000 yen	3,050,000 yen	5,130,000 yen
Grand Total	89,497,000 Tg (10,740,000 yen)		

These costs were estimated based on the following calculation conditions:

(a) Time of estimation : as of August 1999

(b) Conversion rate : US$1.00 = 120 yen = 1,005 Tg

This project is supposed to be implemented in compliance with the Grant Aid scheme of the Government of Japan.

3-2-2 Operation and Maintenance Costs

(1) Operation and Maintenance Plan

In line with the recent devolution program of the Government of Mongolia in the education sector, responsibilities for the operation and maintenance of schools facilities have been transferred to the local governments. They are also responsible for bearing necessary expenses. The following table indicates the responsibilities for management and finances of schools from pre-school to secondary education levels.

Items	Management	Finance
Maintenance of facilities and equipment	Local Govt., School	Local Govt.
Management of teachers and school staff	Local Govt., Headmaster	---
Payment to the teachers and school staff	---	Local Govt.
Cleaning	School	Local Govt.
Water & electric power supply, sewage, heating	Local Govt.	Local Govt.

As shown above, the UBC government takes most of the responsibilities. However,

there only a few government staff who deal with school management, and in fact, UBC supervises and approves the school management and payment of necessary expenses, and practical services are conducted through Duuregs and Horoors. Architects in the UBC Construction and Investment Division, Education Department is in charge of maintenance of school facilities.

For the furniture and equipment maintenance in classrooms, the class teachers takes leadership and conducts at the end of every school year with financial and labor support from the parents of students. The parents have expressed their continual support at the time of the meetings with the area residents.

According to the UBC government balance sheet on page 48, which shows revenues and expenditures during the past three years, the total revenue of UBC has grown by approximately 30% every year, and expenses on the education sector shows larger increase. Annual costs required after the completion of this project are mentioned below. When this project is completed, the expenditure on education sector is estimated to increase by about 2.6% compared to that in 1998, which is much less than the increase of the budget. In other words, the financial influence of the implementation of this project to UBC government will remain trivial.

(2) Operation and Maintenance Costs

The estimated annual costs for operation and maintenance of school facilities in each project phase are as shown below. The right end raw indicates rate of each cost compared to that in 1998.

Annual Costs for Operation and Maintenance of School Facilities

(1,000 Tg)

Items	Phase 1	Phase 2	Phase 3	Total	Rate to 1998
Operation and Maintenance Costs of School Facilities	6,069	6,087	5,394	17,550	4.7%
Electricity	4,854	5,168	4,228	14,250	2.7%
Water supply	5,270	6,415	4,342	16,027	20.6%
Sewage	48,265	56,740	16,776	121,780	
Heating	42,623	56,997	49,904	149,524	4.6%
Personnel	13,020	36,780	42,624	92,424	1.65%
Total				411,555	2.56%