

Chapter 2 Contents of the Project

Chapter 2: CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Purpose

Since the 1990's, when the population inflow from rural areas to urban areas began along with the introduction of the market economy, urban areas like Ulan Bator, Orkhon and Darkhan-Uul Provinces (target areas of the Project) have seen an explosive increase in population growth. The capacity of existing schools in those areas is too limited to accommodate the large growing numbers of students, so classroom shortages have become a serious problem in most urban schools. In addition, the Government of Mongolia has been planning to lower entering age at the primary level from 8 to 7, and eventually to 6 years old, which will lead to the severer classroom shortages. As a result, many schools, in dealing with these shortages, have had to adopt a multiple-shift teaching system as well as to use ancillary academic rooms as general classrooms.

In order to better the situation, the Government formulated its "Mongolia Education Sector Strategy 2000-2005" in 1999 as a medium-term education development plan to focus mainly on alleviating facility shortages. Also, the revised "Education Law", in 1998 stipulates that 20% of the nation's budget should be appropriated for the education sector. However, utilities (fuel, electricity, etc.) and teachers' salaries consume approximately 80% of the budget, and it is difficult for the Government of Mongolia to expand or improve educational facilities by its own effort.

The number of students in public primary schools and secondary schools has risen significantly during the 5-year period from 1997 to 2001. Orkhon Province shows a marked increase of 35% from 15,517 to 20,995, while Darkhan-Uul Province has had an increase of 20% from 17,773 to 21,368. Only one school was constructed in Orkhon Province during the same period. The schools in the urban areas of both Provinces have primarily accommodated the swelling population of students by increasing the number of shifts, worsening the overcrowded conditions of each school.

In light of such circumstances, the overall goal of the Project is to alleviate the shortage of education facilities in both Provinces. The Project purpose is to ease the overcrowded classrooms at all Project schools, thereby creating a more comfortable learning environment. As an indicator, the number of students per classroom is used, and it is expected to achieve less than 72 students per classroom in 2005, which means less than 36 students per classroom under double-shift.

2-1-2 Outline of the Project

In order to achieve the above-mentioned goal, the Project will be implemented at ten schools, seven schools in Orkhon Province and three schools in Darkhan Province. In the Project, the financial assistance will be provided for the construction of 117 classrooms, as well as teachers' rooms and toilets, and for the procurement of basic educational furniture, educational equipment, and the maintenance tool.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Principles of the Project

(1) Selection of Project Schools for Analysis in Japan

The Government of Mongolia originally requested that the Government of Japan build a total of fifteen schools under Japan's Grant Aid Project, of which five schools are in Darkhan-Uul Province and ten are in Orkhon Province. Those 15 schools selected by the two Provinces and reasons for the selection are shown in Table 1.

Table 1 Initial List of Requested Schools

Name of Province	Name of School	Reason for Request
Darkhan-Uul	No. 4 school	Overcrowded
	No. 9 school	Overcrowded
	No. 11 school	Over-aged
	Jiguur Complex (No.16)	Overcrowded
	No. 18 school	Overcrowded
Orkhon	No. 3 school	Overcrowded
	No. 4 school	Overcrowded
	No. 5 school	Overcrowded/Deterioration
	No. 7 school	Overcrowded
	No. 10 school	Overcrowded
	No. 11 school	Over-aged
	New school (No. 15)	No school in the area
	New school (No. 16)	No school in the area
	New school (No. 17)	No school in the area
New school (No. 18)	No school in the area	

Prior to conducting site surveys of the above listed school sites, Darkhan-Uul Province requested that School No.18 be replaced with School No.0d3, and Orkhon Province requested that School No. 4 and No.10 be replaced with School No.2 and No.6. Then during the site surveys in Orkhon Province, it was found by the Study Team that housing construction had not yet started in District 7 which contains one of the newly planned schools (School No.15), and furthermore, would not be finished by the targeted completion date (fiscal year) of the Project. For this reason, School No.4 was reinstated back onto the Request List instead of School No.15. The finalized fifteen

school sites are listed in Table 2.

Table 2 Final List of Requested Schools

Selected School for analyses (Final Requested Sites)		Problem explained from Mongolian side
Darkhan-Uul Province	No.4 school	<ul style="list-style-type: none"> • Over-aged building • Not enough capacity for the number of students in the school district
	No.9 school	<ul style="list-style-type: none"> • Over-aged building • Being overcrowded in the near future
	No.11 school	<ul style="list-style-type: none"> • Classroom size is smaller than the standard (overcrowded) • The construction of dormitory is planned for students who live too far to walk to school
	Jiguur Complex (No.16)	<ul style="list-style-type: none"> • Over-aged building • Being overcrowded along with the population increase
	Od. 3 school	<ul style="list-style-type: none"> • No school exist for secondary education program (too far to existing schools) • Non standardized classroom
Orkhon Province	No.2 school	<ul style="list-style-type: none"> • Overcrowded by population increase
	No.3 school	<ul style="list-style-type: none"> • Overcrowded population increase
	No.4 school	<ul style="list-style-type: none"> • Being overcrowded in the near future • Complex school
	No.5 school	<ul style="list-style-type: none"> • Overcrowded
	No.6 school	<ul style="list-style-type: none"> • Overcrowded
	No.7 school	<ul style="list-style-type: none"> • Overcrowded by population increase and special & vocational education program
	No.11 school	<ul style="list-style-type: none"> • Overcrowded by population increase
	No.16 school	<ul style="list-style-type: none"> • No school exists in the area (too far to existing schools)
	No.17 school	<ul style="list-style-type: none"> • No school exist in the area (too far to existing schools)
No.18 school	<ul style="list-style-type: none"> • No school exist in the area (too far to existing schools) 	

Since any problems could not be found in 1) land-ownership, 2) overlap with other projects, 3) accessibility to the sites, 4) the size and the lay of the land for construction, and 5) security from natural disaster, the requested fifteen schools were finally regarded as the objects of further analysis. The Government of Mongolia also requested the same basic educational equipment and furniture as in Phase I.

(2) Existing Problems at Project Sites

The existing problems at project schools can be summarized as follows:

① Multiple-Shift Classes (Overcrowdings in the classrooms)

Due to the shortage of classrooms, the schools are forced to use the existing classrooms in multiple-shift system to accommodate all of the classes being held in the school.

② Areas with Highest Population Increase Rate Without Schools

Although the population tends to increase in the new Gel areas, there are no schools in the areas, so students have to walk long distances to go to existing schools.

③ Problems Regarding School Facilities

The following conditions were listed in the request by the Government of Mongolia. Based on the results of the site survey, the conditions which were regarded as appropriate were taken into consideration for determining the number of existing classrooms:

1) Stability of Existing Buildings

Some schools buildings are too old and dangerous in danger of falling down.

As a result of the site survey and the analysis, except for School No.4 in Darkhan-Uul where some parts of the main structures have collapsed and are seriously damaged, and stables being used as a classroom, the existing buildings can be regarded as continuously usable.

2) Use of Other Buildings as Classrooms

Some of the proposed schools have converted other buildings, constructed previously for purposes other than education, into use as classrooms in order to meet the urgent needs to accommodate the increasing number of school-age children. However, it is reported that these classrooms are uncomfortable to use.

School No.11 (Darkhan-Uul) has classrooms whose floor area is smaller than the standard, which requires more teachers for the same number of students. However, it is judged that these classrooms are still usable. On the other hand, Od3 School in Darkhan-Uul Province has classrooms with center columns in the middle of the room, which obstruct the students' view of the blackboards, so they should not be counted as existing classrooms.

3) Use of Classrooms at the sacrifice of classrooms for Special Education

School No.7 (Orkhon) is the only school in the Province that offers vocational training and special education for the handicapped children. The problem is that because of the classroom shortages, both of these classes cannot be conducted adequately.¹ in their own classrooms. These classrooms for

¹ The classes for handicapped children are forced to double with other classes in "shifts," while the vocational classes can only be held every other day.

vocational and special education should be treated in the same way as ordinary classrooms under double-shift. In addition, the educational equipment and material for those vocational special education cannot be shared with ordinary classrooms.

4) Classrooms as Dormitories

School No.11 (Darkhan-Uul) is in a remote area, and more than half of all the students come to school from great distances, even during the severe winter and early spring. In order to improve this situation, the Darkhan-Uul provincial office plans to utilize six out of ten classrooms on the second floor as dormitories for those students coming from far away. From the viewpoint of providing equal opportunity for students who have limited access to basic education due to the living locations far from schools, this plan is meaningful and agrees with the principle of the promotion of compulsory education.

(3) Calculation of Number of Classrooms to be Constructed

From site survey results, the requests were deemed appropriate and approved, except for the overcrowded classrooms and over-aged school buildings in some schools. The scale of the Project will be determined on the basis of the amount of classroom shortages existing at the 15 proposed schools.

① Basic Policy

Based on the results of the site survey, the basic principles for determining the number of classroom shortage are set up as follows:

a) Double-shift

The estimate of classroom shortages will be based on the assumption that schools conduct double-shift classes.

b) School Districts

Each Province, Soum and Bag sets up its own approximate catchment areas for school districts. Basically, students are supposed to go to schools in their own districts. Although this guidance is followed comparably well at the primary level, there are many students at the secondary level who do not follow this guidance and go to schools outside their resident districts.

In this Project, school districts are established in both Darkhan-Uul and Orkhon Provinces. Usually, a school district and a Bag (local government administrative unit) coincide; however, they do not in the urban areas with

rapid population growth (such as School No.16 in Darkhan-Uul and School No.4, 5, and 11 in Orkhon). In this Study, through the interview with principals and government officials at the Provincial and Bag level, the following school districts are confirmed, as shown in Table 3.

Table 3 School District of Requested Schools

	Name of School	School District		Remarks
		Soum	Bag	
Darkhan-Uul	No.4 school	Darkhan	Part of No. 1, and No.2 and No. 3,	
	No. 9 school	Darkhan	No. 11, No, 12	
	No. 11 school	Horgon	No. 3	
	Jiguur complex (No. 16)	Darkhan	No.8, a part of No. 1, a part of No. 4, a part of No. 5, a part of No. 7	The school districts of Nos.1, 15 and 18 Schools are overlapped one another.
	Od. 3 school	Darkhan	Mangeruto in No. 15	
Orkhon	No. 2 school	BayonUnduul	Govil	
	No. 3 school	BayonUnduul	Sagancyonot, Naran, Shand, Rasyant	Shand Bag will be the school district of No. 17 (new school).
	No. 4 school	BayonUnduul	Zest, Hurenburag	No. 4 school is established as the complex school with Nos.6, 10 and 13 Schools.
	No. 5 school	BayonUnduul	Burenbust, Orterbrag, Burag	The school district is overlapped with the school district of No. 11 school. Burag Bag will be the school district of No.16 school (new school).
	No. 6 school	BayonUnduul	Zest	No. 6 school is established as the complex school with Nos. 4, 10 and 13 Schools.
	No. 7 school	BayonUnduul	Denzi	
	No. 11 school	BayonUnduul	A part of No. 5 Apartment (Burenbust, Orterbrag), Burag	The school district is overlapped with the districts of Nos. 5 13 Schools. Burag Bag will be the school district of No. 16 school (new school).
	No. 16 school	BayonUnduul	Burag	Students in Burag Bag attend Nos.5 and 11 schools.
	No. 17 school	BayonUnduul	Shando	Students in Shand Bag attend No.3 school.
	No. 18 school	BayonUnduul	A part of Byansagan	Students in Byansagan Bag go to schools at the centre of Orkhon.

c) Target Year of the Project

Assuming that Project implementation begins in 2003 and Project construction is carried out in two stages for two years, the completion year of the Project is estimated to be 2005. Thus, the Project scale should be determined based on

the estimate of the number of enrollments in 2005 and the capacity of the existing classrooms. The projection of enrollment in 2005 is based on the latest population statistics in 2000.

d) Number of Students per Classroom

According to the 'Standards', the number of students per classroom is stipulated as 30 for Grade 1 and 35 for the above Grade 2. However, the average number of students per class in Darkhan-Uul Province is 34.96, and in Orkhon Province 34.90 (Table 4). No.16 School in Darkhan-Uul Province is the only schools where the number of students per classroom is above 40.

Taking all into consideration, there are to be 36 students per class in accordance with the 'Standards' and present enrollment situation at the Project schools. The number of students in a classroom should be an even number because all the schools in both Provinces have 2-seater type desks.

As for Grade 1 which has 30 students per classroom in the 'Standards', it is difficult to include it in the policy without any arbitrary principle of pre-deciding the number of Grade 1 students. Since it depends on each year which grades occupy the new buildings, it is difficult to know the actual number of classes for Grade 1. Therefore, the number of students per classroom is 36 for all the grades.

Table4 Number of students per classroom and area per student

	D-4	D-9	D-16	D-od	total	O-2	O-3	O-4	O-5	O-6	O-7	O-11	total
number of seat	488	833	1062	64	2447	394	1047	1252	1262	229	390	416	4990
number of classroom	14	28	26	2	70	14	30	33	33	6	14	13	143
total area of classro	673.7	1344	1248	102.1	3367.8	674.2	1402.5	1900.8	1900.8	480	759.9	718.25	7836.45
					average								average
students per classro	34.86	29.75	40.85	32.00	34.96	28.14	34.90	37.94	38.24	38.17	27.86	32.00	34.90
area per student	1.38	1.61	1.18	1.60	1.38	1.71	1.34	1.52	1.51	2.10	1.95	1.73	1.57

*D-11 School is not included because their classroom is smaller than standard size.

e) Lowering the Starting School Age and Changing the School Year System

In Mongolia, the reforms of "Educational Laws" have been examined. The contents of the reforms are; a) change the current 10-year primary and secondary school system (4-4-2 years) to a 12-year school system (6-3-3 years), and b) lower the current school starting age from 8 to 6. The reform will be

proposed within this fiscal year, and the target year of the start of implementation is 2004.

The calculation of the number of students for the Project is based on the assumption that the starting age of 7 for primary schools would be fully in place in both Provinces by 2004.

The details for introducing the school starting age of 6, and the shifting of the school year system to 6-3-3 years, has not yet been established. Thus, measures for the introduction of the school starting age of 6 and the 6-3-3 school year system shall not be included for the Project.

D) Classrooms for Secondary Education (Grades 9 and 10)

For the students who desire to enter a higher school level after they complete Grade 8, they can select 10-year system schools in accordance with their needs regardless of school district.

Out of the fifteen requested schools for the Project, Schools No. 9 and No.16 (Darkhan-Uul), and School No. 2, 3, 4, 7 (Orkhon) are the 10-year system schools. Those schools offer vocational education courses, and/or special section such as science, mathematics and foreign languages with their own curriculum. In Phase I of the Project, the number of classrooms for secondary education (Grade 9 and 10) in the 10-year school system, was set at 10% of the total number of classrooms across the schools. However, due to the variety of the curriculum in each school, in the Phase II of the Project, the calculation of the number of necessary classrooms for each school will be based on either data regarding the number of students during the past five years, or the estimated number of students in the school district.

g) Maximum number of Project Classrooms

The "Standards" stipulate that the maximum number of ordinary classrooms is 33 per school. However, in order to reflect the reality of the increase in the number of students, Ministry of Science, Technology, Education and Culture (hereinafter referred to as "MOSTEC") and both Provinces are willing to permit larger-scale schools that have more than 33 classrooms.

School No.3 (Orkhon) which has the highest population increase rate in the Province, is expected to have more than 33 classrooms (45 classrooms). But, even if a new school (School No. 17) is built in that school district, the problem of classroom shortages will still not have been solved. Thus, after the

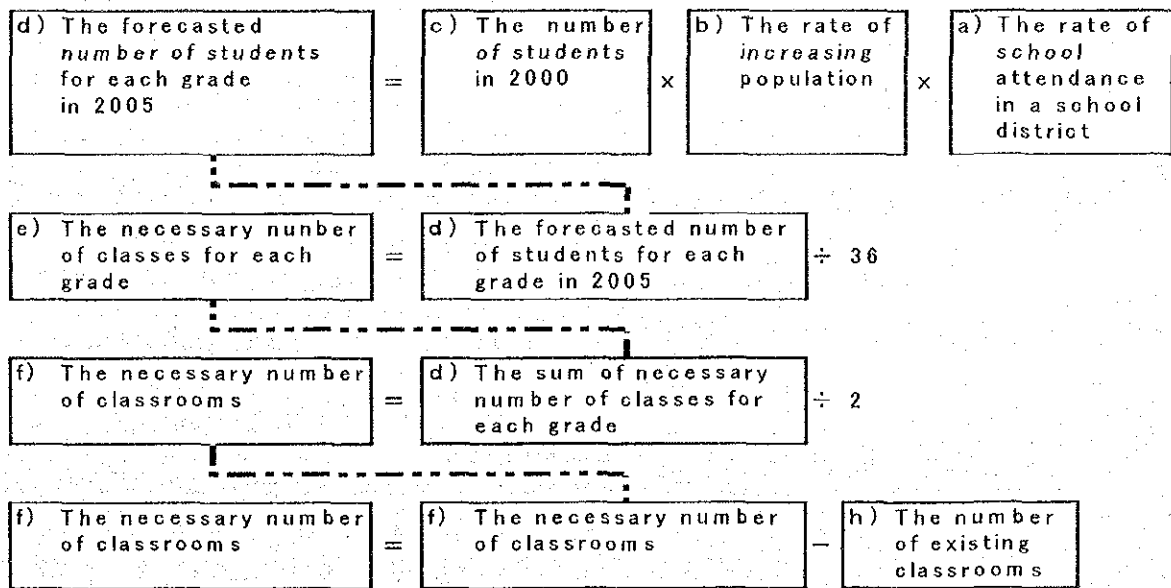
discussion with the Mongolian Bureau of Architectural Standards of the Ministry of Infrastructure, it was agreed that No.3 School will have more than 33 classrooms in total..

② Calculation of Classroom Shortages

The calculation for the shortage of classrooms is shown in Figure 1, Table 5 and 6.

- a) The rates of schooling in a school district can be calculated by dividing the number of the children who go to school in the district by the number of school-age children in the same school district.
- b) Increase trends of the population rates in each school district (of the candidate schools) can be calculated using the population statistics.
- c) The school-age population in 2005 is calculated based on the estimated number of 2 to 10-years old children. It is assumed that the number of Grade 2 will be much larger than the other grade in 2005 because the all Provinces will be adopting the regulation of "the school starting age at 7 " in 2004.
- d) The number of students by grades is estimated by multiplying it by c) The school-age population in 2005 and b) growth rate of population in each school district and a) the rate of schooling in the school district.
- e) The calculation of the number of necessary classes for each Grade should be based on the maximum number of students of 36 in a class.
- f) The necessary number of classrooms is the half the number of classes, as two-shift classes will be conducted.
- g) The number of classrooms to be built by the Project can be calculated by subtracting the number of existing classrooms from the number of needed classrooms calculated in f).

Figure 1: The Flowchart of the Calculation of Classroom Shortages for Each School



School	Item	Grade										f) No of C.R. needed (Half of class.)	h) Existing usable C.R.	g) No. of lacking C.R.	Remarks (Rationare for Adjustment)		
		1	2	3	4	5	6	7	8	9	10					Total	
Darkhan-Uul																	
D-4	c) 2000-2001 population	148	379	200	183	204	184	203	227							1728	<ul style="list-style-type: none"> From population change of Bag in school zone, we estimate 10% of population increase After construction new building, we estimate 80%(1to4) and 60%(5-8) of students will go to the school Demolition of existing building is needed. Existing cow house is not appropriate for class rooms
	b) $\times 1.1$ (Grade1~8)	162	416	220	201	224	202	223	242							1890	
	d) a) $\times 0.8$ (Grade1~4) $\times 0.6$ (Grade5~8)	129	332	176	160	134	121	133	145							1330	
	e) Estimated number of classroom in 2005	4	10	5	5	4	4	4	5							41	
D-9	c) 2000-2001 population	114	245	153	175	183	197	213	216	198	198					1892	<ul style="list-style-type: none"> There is no large gap between No. of school-age children in the school district and students enrollment. There is no population increase for last 5 years. 70% of students (Grade 9 to 10)are supposed to go to this school
	b) $\times 0.7$ (Grade9~10)	114	245	153	175	183	197	213	216	138	138					1772	
	d) a) $\times 1.0$ (Grade1~10)	114	245	153	175	183	197	213	216	138	138					1772	
	e) Estimated number of classroom in 2005	4	7	5	5	6	6	6	6	4	4					53	
D-11	c) 2000-2001 population	46	99	35	39	25	39	25	18							326	<ul style="list-style-type: none"> By comparing No. of school-age children and student enrollment, it becomes twice in each Grade(except for Grade8) Although population increase can be seen in 3rd Bag of Hongol Soum, its possible to cope with by the above mentioned adjustment We predict 6 of 10 small classroom will convert to dormitory, 4 will convert to normal classroom The maximum No. in 4 small classroom is 20. When higher grade students are supposed to use this room, 17 classrooms (9classes) are accommodated to new building
	b) $\times 2.0$ (Grade1~8)	92	198	70	78	50	78	50	36							652	
	d) a) $\times 1.0$ (Grade1~8)	92	198	70	78	50	78	50	36							652	
	e) Estimated number of classroom in 2005	3	6	2	3	2	3	2	1							22	
	Adjusted No.of Classroom when using 4 small classrooms	3	6	2	3	3	4	3	2							26	
D-16	c) 2000-2001 population	379	714	362	434	397	516	539	506							3847	<ul style="list-style-type: none"> School zone in old city is not so clear, so we will use the No. of school-age children in Bag4,5,6,7,8. 30% enrollment increase are predicted in 2005 from recent enrollment School zone of No1, 15,16,18 are overlapped in old city. In this school, proportion of student from old city is 30% (1 to 4) and 25% (5 to8). 5 year average will be used for Grade 9 to 10
	b) $\times 1.3$ (Grade1~8)	492	928	470	564	516	670	700	657							4997	
	d) a) $\times 0.25$ (Grade5~8) 5 year average(9 - 10)	162	317	155	186	129	167	175	164	140	168					1763	
	e) Estimated number of classroom in 2005	5	9	5	6	4	5	5	5	4	5					53	
D-Od3	c) 2000-2001 population	71	136	63	57	66	68	96	96							653	<ul style="list-style-type: none"> By comparing No. of school-age children and student enrollment, it becomes 1.2 times in each Grade. From the gap between estimated enrollment and enrollment in Bag, more than 30% (1 to 4) and less than 60% (5 to8) of students are supposed to go to this school Exising building is not deemed as appropriate for classroom
	b) $\times 1.2$ (Grade1~8)	85	163	75	68	79	81	115	115							781	
	d) a) $\times 0.5$ (Grade1~8)	42	81	37	34	39	40	57	57							387	
	e) Estimated number of classroom in 2005	2	3	2	1	2	2	2	2							16	
Darkhan-Uul Total												96	58	38			

(Note) b) : Population increase rate of school-age children from 2000 to 2005. a) : Rate of school-age children who go to school in their school district

School	Item	Grade											f) No of C.R. needed (Half of class)	h) Existing usable C.R.	g) No. of lacking C.R.	Remarks (Rationare for Adjustment)	
		1	2	3	4	5	6	7	8	9	10	Total					
Orkhon																	
O-2	c) School aged population	48	68	35	50	39	54	54	78	72	71	569	13 (4classes: single shift)	9	4	<ul style="list-style-type: none"> Considering population increase, multiply school-age children by 1.3 (Grade 1 to 8) Although enrollment tend to be larger than school-age children, its possible to cope with by above adjustment impossible to implement 2nd shift in one each class(Grade1 to 4) due to long hour class operation by special nature One standard classroom for special education is secured. 4 small classroom will be used for non-formal education 	
	b) x1.3 (Grade1~8)	62	88	45	65	50	70	70	101	72	71	694					
	d) a) x1.0 (Grade1~10)	62	88	45	65	50	70	70	101	72	71	694					
	e) Estimated number of classroom in 2005	2	3	2	2	2	2	2	3	2	2	22					
O-3	c) 2000-2001 population	250	484	213	257	261	272	287	261	384	348	3017	45	29	16	<ul style="list-style-type: none"> Considering population increase in school district, multiply current population by 1.3 After construction of new building, we estimate 70%(5to8) and 50%(9-10) of students will go to the school 	
	b) x1.3 (Grade1~10)	325	629	277	334	339	353	373	339	499	452	3920					
	d) a) x0.7 (Grade5~8) x0.5 (Grade9~10)	325	629	277	334	237	247	261	237	250	226	3023					
	e) Estimated number of classroom in 2005	10	18	8	10	7	7	8	7	7	7	89					
O-4	c) 2000-2001 population					172	187	189	214			762	23	29	-6	<ul style="list-style-type: none"> Population increase cannot be seen in community From enrollment data, 100 students enter to Grade 1 from other school districts every year. Add 100 to school aged children to Grade 5 to 8 There are 4 converted normal classrooms from special classroom, we premise 29 as normal classroom 	
	b) plus 100 (Grade5~8) 5 year average(9-10)					272	287	289	314	194	183	1539					
	d) a) x1.0 (1~8年)					272	287	289	314	194	183	1539					
	e) Estimated number of classroom in 2005					8	8	9	9	6	6	46					
O-5&11	c) 2000-2001 population	209	393	223	237	227	243	248	292			2072	42	40	2	<ul style="list-style-type: none"> The school ditricts of No5 & 10 is overlapped, students who live in No.5 area can be accomodated to both school Students (5 to 8) from other school districts go to this school, so multiply No. of student by 1.2 (5 to 8) 	
	b) x1.2 (Grade5~8)	209	393	223	237	272	291	297	350			2272					
	d) a) x1.0 (Grade1~8) 5 year average(9-10)	209	393	223	237	272	291	297	350	284	273	2829					
	e) Estimated number of classroom in 2005	6	11	7	7	8	9	9	10	8	8	83					
O-6	c) 2000-2001 population	90	189	82	111	116	122	118	123			951	12	6	6	<ul style="list-style-type: none"> Large population increase cannot be seen in Bag as school district A half of the school aged children (5 to 8) in community are supposed to go to No4 school 	
	b) x0.5 (Grade5~8)	90	189	82	111	58	61	59	61			711					
	d) a) x1.0 (Grade1~8)	90	189	82	111	58	61	59	61			711					
	e) Estimated number of classroom in 2005	3	6	3	4	2	2	2	2			24					
O-7	c) 2000-2001 population	57	127	53	38	62	73	75	68			553	17	8	9	<ul style="list-style-type: none"> Considering population increase in school zone, multiply No. of school-age children by 1.3 (Grade 1 to 8) 10% of students (5 to 8) are supposed to go to other schools We predict 5 of 14 existing classrooms will convert to special education for handicapped, 1 will convert to vocational classroom 	
	b) x1.3 (Grade1~8)	75	161	69	50	81	95	98	89			718					
	d) a) x1.2 (Grade1~8) 5 year average(9-10)	75	161	69	50	73	86	89	81	162	156	1002					
	e) Estimated number of classroom in 2005	3	5	2	2	3	3	3	3	5	5	34					
O-16	c) 2000-2001 population	102	235	110	106	135	152	152	153			1145	20	0	20	<ul style="list-style-type: none"> Considering population increase in school zone, multiply school-age children by 1.3 (Grade 1 to 8) We predict 20% of students (5to8) keep on going to school with better facilities and located in city center even after completion of new school building 	
	b) x1.3 (Grade1~8)	132	305	143	137	175	197	197	198			1484					
	d) a) x0.8 (Grade5~8)	132	305	143	137	140	157	157	158			1329					
	e) Estimated number of classroom in 2005	4	9	4	4	4	5	5	5			40					
O-17	c) 2000-2001 population	81	159	79	75	78	80	79	77			708	12	0	12	<ul style="list-style-type: none"> Considering population increase in school zone, multiply school-age children by 1.3 (Grade 1 to 8) We predict 30% of students (5to8) keep on going to school with better facilities and located in city center even after completion of new school building 	
	b) x1.3 (Grade1~8)	105	206	102	97	101	104	102	100			917					
	d) a) x0.7 (Grade5~8)	105	206	102	97	70	72	71	70			793					
	e) Estimated number of classroom in 2005	3	6	3	3	2	2	2	2			23					
O-18	c) 2000-2001 population	69	175	112	127	73	73	79	95			803	12	0	12	<ul style="list-style-type: none"> We predict one third of school-age children keep on going to city center school after the Project due to vast Bag area Considering the increase of primary education students, multiply No. of students by 1.5 (Grade 1 to 4) 	
	b) x2/3 (Grade1~8)	46	116	74	84	48	48	52	63			531					
	d) a) x1.5 (Grade1~4)	69	175	112	127	48	48	52	63			694					
	e) Estimated number of classroom in 2005	2	5	4	4	2	2	2	2			23					
Orkhon Total												160	83	77			

Table 6 Calculation of Necessary Number of Classrooms (2)

(Note) b) : Population increase rate of school-age children from 2000 to 2005. a) : Rate of school-age children who go to school in their school district

Table 7: Result of Analysis in Japan

	Name of School	Result of the Analysis	Result
Darkhan-Uul	No. 4 school	It is too dangerous for a school. Demolition is desirable..	○
		Many students go to schools outside of their school district.	
	No. 9 school	The existing building is still under a usable condition.	×
		Population increase in the school district is not serious.	
	No. 11 school	Existing building is still usable.	○
		A dormitory is needed. The number of existing classrooms will not be sufficient in the near future.	
No. 16 school	The present building is still in usable condition.	×	
	Population increase in the school district is not so serious as to require new classrooms.		
Od3 school	It is difficult for students to go to far school in winter.	○	
	Existing classrooms are not suitable because of the existing columns in the middle.		
Orkhon	No.2 school	The number of existing classrooms will not be sufficient in the near future.	○
	No. 3 school	Existing number will not be enough in the near future.	○
	No. 4 school	Population increase in the school district is not so serious as to require new classrooms.	×
		Classroom shortage does not come about by making the complex school.	
	No. 5 school	Population increase will be able to overcome by the construction of No.16 School and coordination with No.11.	×
	No. 6 school	The number of existing classrooms will not be enough in the near future.	○
	No. 7 school	The number of existing classrooms will not be sufficient in the near future.	○
	No. 11 school	Population increase problem will be solved by the construction of No.16 School and coordination with No.5.	×
	No. 16 school	New school is needed.	○
	No. 17 school	New school is needed.	○
No. 18 school	New school is needed.	○	

The number of classrooms to be built in the ten Project schools was based on the number of classroom shortages (Table 8).

Table 8 Number of Classrooms to be Built for Project Schools

Province	Name of School	No. of Classrooms to be Built	No. of Usable Existing Classrooms	Total
Darkhan-Uul	No. 4	21	0	21
	No. 11	9	4	13
	Od3	8	0	8
Orkhon	No. 2	4	9	13
	No. 3	16	29	45
	No. 6	6	6	12
	No. 7	9	8	17
	No. 16	20	—	20
	No. 17	12	—	12
	No. 18	12	—	12
Total		117	56	173

2-2-1-2 Considerations for Natural Conditions

(1) Considerations for the Cold Winter

Mongolia is a landlocked country located in the middle of the Asian continent and is bordered by Russia and China. The approximate latitude is N 49° and the elevation is about 700m above sea level. The distance of both Provinces to the border with Russia is about 300km. The climate in the area is typical continental climate and the temperature difference between winter and summer is large. In winter, the lowest temperature goes down below -30 °C. Annual rainfall is very little.

Under these conditions, the most important priorities be taken into consideration in the designing of the Project construction are measures for the cold winter.

Especially, the following items are taken into account in the Project:

- ① Use of insulation to prevent heat loss for roof, wall, and floor;
- ② Use of an efficient, economical, and environmentally acceptable (non-hazardous material) heating facility;
- ③ A lighting plan fully utilizing the natural light and heat from the sun;
- ④ Providing anti-freeze measures to all piping systems;
- ⑤ Construction schedules and methods taking the cold weather into account.

(2) Considerations for Earthquake and Another Natural Phenomena

According to seismic intensity maps, both Provinces are located in earthquake zones. Therefore, in the Project, structures and facilities should be designed to be earthquake resistant. In addition, relatively strong northwest winds prevail throughout the year in both Provinces. So floor plans and the arrangements of facilities should take wind direction into consideration.

2-2-1-3 Considerations for Social Conditions

(1) Ethnic Minorities

Ethnic minorities such as the Kazaf and the Briyaat live in Mongolia, but no racial problems to speak of have been clearly exposed so far. And due to the influences of socialism over a long period of time, there is virtually neither sexual discrimination nor religious conflicts in the education sector of the country. Although disparity in wealth has been increasing since the change to the market economy, it still remains small compared to other developing countries.

(2) Law and Regulation

For many years, Mongolia received a large percentage of its foreign assistance from the former Soviet Union. As a result, quite a few regulations introduced under the aegis of the Soviet Union still remain effective in various social aspects. As for printed materials of the regulations of each ministry or the provincial government, some documents still carry regulations of the former Soviet Union written in the Russian Language. These old regulations have been gradually replaced by new regulations that Mongolia has been making in parallel with its progressing socio-economic system reforms, but the old regulations still function because detailed regulations and rules have not yet been sufficiently addressed by the Government of Mongolian. Relationships between old regulations taken from the former Soviet Union and new regulations stipulated by the Government of Mongolia are not clear. Thus, it is critical, at the time of Detailed Design and application for the building permits, to confirm the details with the Provincial governments and the Building Standards Bureau.

2-2-1-4 Considerations for the Local Construction Situation

(1) Building Permits

① Application for Building Permits

In Mongolia, construction work can be started after obtaining building permits from the Heating, Drinking Water and Sewers, Electricity, Telecommunication, Fire Fighting, and the Health and Sanitation Bureaus of both Provinces. In addition, permits are also necessary from the Bureau of Architectural Standards, the Architectural and Urban Planning Bureau of the central government. The time necessary for issuing the building permits is approximately four months.

② Environment Impact Assessment (EIA)

When a development project is implemented in Mongolia, the contents of the project should be submitted to either the central government or the provincial government for examination of the project's environmental impact. However, construction of educational facilities, as in our case (the Project), is not subjected to examination by the central government. Thus, the Project will basically be examined only by the Governments of both Provinces. But, if boilers and infiltration-type septic tanks are installed, those facilities might need to be assessed by the central government.

a) When installing boilers, as long as the concentration of the exhaust gases does not exceed the following figures, the boiler will not be subjected to central government assessment:

SO₂: 500ppm (instantaneous value), 30ppm (daily average)

NO₂: 85ppm (instantaneous value), 40ppm (daily average)

From the site surveys, it was found that few Project schools need installation of coal burning boilers. For those schools, boilers should be designed to clear the above criteria in view of environmental considerations. Thus, any boilers installed by the Project will not be subject to assessment by the central government.

b) According to the standards of provincial governments, an infiltration-type septic tank and a drinking well must be separated. The areas around School No. 4 (Darkhan-Uul) and School No. 3, 16, 17 and 18 (Orkhon) are either presently surrounded by housing areas or will be developed in the future. Residents in those housing area use a drinking well, so infiltration-type septic tanks cannot not be

installed because enough distance stipulated in the "Standards" is not secured. Thus, a sewage water tank should be installed, and sewage water will be transferred to sewage treatment plants in both the Provinces by vacuum cars. Therefore, the Project is not subjected to the central government's assessment.

③ Construction Materials

Only a small number of construction materials are produced locally in Mongolia. Most construction materials are exported from Russia and China. Locally available materials are limited to aggregates, reinforcing bars, pre-cast concrete products, furniture and wood. Those locally available materials should be used for the Project as much as possible.

In the selection of construction materials, the following conditions will be considered:

- (1) Demand for concrete is very high in the summer season, and supply often cannot catch up with demand. Thus, pre-cast concrete products that can be manufactured in the winter are frequently used in order to reduce the volume of concrete pouring in the summer;
- (2) Exterior and structure work cannot be done in the winter. Thus the excavation and structural work must be started in April, when the frozen soil melts, and completed by October, when winter begins. The period for doing the structure work is short, so it is necessary to reduce the amount of work at the sites by using pre-made factory products;
- (3) Since pre-cast concrete methods have been used for a long time in Mongolia, sub-contractors and workers are used to it, so construction proceeds smoothly. For Projects like this one where construction schedules are limited, these methods should be fully utilized.

2-2-1-5 Use of Local Consultants and Contractors

(1) Local Consultants

As the Project areas are wide spread in two provinces, it is effective to utilize local consultants for the supervision of the construction. In addition, the Mongolian side is responsible for obtaining the building permits of the Project, and in order to proceed the process of the application for building permits smoothly, it is desirable that necessary information is collected from local consultants.

(2) Local Subcontractors

It seems that no problems will be encountered for utilizing several subcontractors in Darkhan-Uul and Orkhon Provinces for Project construction in terms of construction career and technical level. However, as Project sites are scattered over wide areas outside of and within city limits, careful construction supervision is necessary at each site to keep the construction quality at a certain level.

2-2-1-6 Capacity of the Implementing Agency

In this Project, both provinces shall be responsible for the operation and maintenance of buildings constructed by the Project. Operational budgets such as salary, heating and maintenance have been distributed to each school by the provincial governments, while instruction regarding maintenance and school management will be given to head teachers.

Each school has a 'Steering Committee for School Maintenance' and is organized by the teachers, parents, and neighbors with a head teacher in charge. The committee plans and implements maintenance activities using the money provided by the provincial government and donated by the parents.

Almost all the provincial educational budget goes to teachers' salaries and heating cost, with the small remaining amount being used for maintenance. Thus, in order to reduce necessary cost for the maintenance of the facilities, to be as free from maintenance as possible after completion of the Project, the followings shall be considered carefully in the designs and plans:

- Selection of the suitable measures for cold winter climates to prevent deterioration of the facilities;
- Selection of finishing materials with long durability;

- Selection of finishing material which do not get dirty easily and is easy for maintenance;
- Preparation of an 'operation and maintenance manual' for mechanical and electrical equipment in order to reduce an order with outside supplier.

2-2-1-7 Facilities and Equipment Types and Specifications

The grade of the Project facilities and equipment should basically be same as that of Phase I of the Project which followed the "Standards", and make a partly improvement. The grade of the facilities in the Project will be minimum as primary educational facilities. The exterior finishing is exposed brick wall, and polystyrene foam is installed for insulation. The interior wall is finished by particle board, roof is precast concrete, exposed ceiling, and floor is polyvinyl chloride sheets (except for the corridor where terrazzo blocks are laid, which is different from the Phase I).

Educational equipment should be limited to basic educational materials used daily in each subject. Because the equipment in the Phase I is selected based on the same policy, basically equipment plan follows the Phase I.

2-2-1-8 Construction Schedule

(1) Construction Schedule

Because the Project area is located in a cold region, the ground freezes in the winter season, so excavation work is extremely inefficient from an economical viewpoint. So, the excavation work should begin in early April. It is desirable that all exterior work and heating facility installations are completed before November (prior to the cold winter), so that interior work can be carried out thereafter. Thus, all preparation work should begin in March so that excavation work can begin in April; also, building structures should be completed by August. As it takes approximately four months to obtain building permits, it is necessary to complete the detailed design preparations and apply for the building permits by the end of September.

(2) Construction Stages

The Project plan is to construct buildings for ten schools, of which three schools are in Darkhan-Uul Province and seven are in Orkhon Province. The number of classrooms

to be built at each school varies from 4 to 21. The total floor area will be approximately 16,000 m². Judging from the construction capability of the subcontractor in each Province, it is impossible to complete construction work at all sites in one year. Thus, it is considered appropriate to divide the Project construction period into two stages.

Regarding construction priorities, the three new schools in Orkhon Province, located in Gel areas that are experiencing severe population increases, are considered to have the more urgent need for classrooms. At the present time, there are no schools in those school districts, and children are obliged to go long distances to schools located at the nearest city center. Furthermore, those children can only be accommodated if the schools conduct classes in triple shifts.

2-2-2 Basic Plan

2-2-2-1 Facility Plan

(1) Architectural Plan

① Architectural Standards for Educational Facilities

When the application for the building permits is submitted, the Bureau of Architectural Standards will check the plan according to the "Standards". Designs of the Project facilities are planned to meet the Standards as much as possible. However, if "Standards" do not match the current situation in Mongolia, or if requests made by MOSTEC contradict the "Standards", those matters should be discussed and agreed with the appropriate officials of the Bureau of Architectural Standards. Any such items should be reconfirmed in submitting documents for the building permits. The list in Table 9 shows the applicability of items in the "Standards" related to the Project.

② Layout Plan

Mongolia is situated at high latitudes, so daylight hours during the winter are very short. In a general principle, classrooms should be arranged facing south to get the best exposure to sunlight. However, if classrooms cannot be arranged facing south, depending on the shape of the site or a pre-existing infrastructure location, they should be arranged facing east so that they can receive the morning sunlight.

New school buildings will be laid out with enough space between them and existing buildings. In case that enough distance between buildings is impractical or impossible because of the size limitations or an odd shape of the site, the arrangement of said building should be decided on only after discussions with officials of the Bureau of Architectural Standards. The distance between roads and new school buildings should be more than 10m.

Table 9 Architectural Standards for Educational Facilities

Items		National Standards for Educational Facilities	This Project	Remarks
<Layout Plan>		Locate as far as possible from the north or south side of existing buildings	Locate as far as possible from the north or south side of existing buildings	Discussing with the Architectural Bureau if building site is limited or if existing building is odd shape
Spacing between new and existing buildings				
Classroom	No. of classroom per school	33	No Limit	MOSTEC's request
	Air volume per student	More than 4 m ³	4.5 m ³	Floor area per students × ceiling height
	Limit No. of students in a classroom	First Grade: 30 2nd to 9th Grade: 35	36	Flexible use may be possible if the special limit is not applied to first grade because a class arrangement is made every year
	Floor area per a student	First Grade: 2.0 m ² 2nd to 9th Grade: 1.5m ²	1.51m ²	
Corridor width (m)		2.2	Usable width 2.5	Column span = 3m
Teachers' room (m ²)		No. of teachers × 2.5	No. of teachers × 2.5	Refer to other table
Cloak area (m ²)		No. of students × 1.5	Coat hooks for all	Refer to other table
Entrance hall (m ²)		No. of students × 1.0	No. of students × 1.0	Refer to other table
<Section Plan>		Urban areas having more than 200,000 population: 4 Other areas: 3 or less	3 stories or less	
Stories				
Story height		more than 3.3m	more than 3.3m	
Window height		As high as possible	To shorten the beams to secure window size	To be discussed with the Bureau
<Facility Plan>		Female: 1 per 30 students Male: 1 per 40 students	Female: 1 per 30 students Male (bowls): 1 per 60 Male (urinal): 1 per 40	The ratio of toilet bowls to urinals is not specified. Use the same ratio as the Phase 1 of the Project
Toilets	No. of Toilets			
	No. of washbowls	1 per 30 students	1 per 30 students	
Washbowl		Supply cold and hot water	Supply cold and hot water	
Light	Classroom	300 Lux	300 Lux	
	Teachers' room	200 Lux	200 Lux	
	Corridor & Toilets	75 Lux	100 Lux	

③ Floor Plan

While the basic layout plan of arranging classrooms in a straight line followed Phase I of the Project, the floor dimensions of classrooms were changed to 7.5m×7.5m based on the result of the discussion with MOSTEC. The area and specifications of other rooms are compatible to the "Standards".

As the prevailing winds in Mongolia are from a northeastern direction, toilets are to be arranged on the east side of school buildings so that toilet odor does not enter into the classrooms.

Barrier-free facilities for the handicapped will be introduced in School No.7 (Orkhon province) which has special education for the handicapped, according to a request from MOSTEC. A ramp (for wheelchairs, the handicapped) will be arranged at the main entrance, and other barrier-free areas will be introduced in the entrance hall, corridors, and classrooms on the ground floor. Teachers' toilets will be designed so that they are suitable for the use by the handicapped.

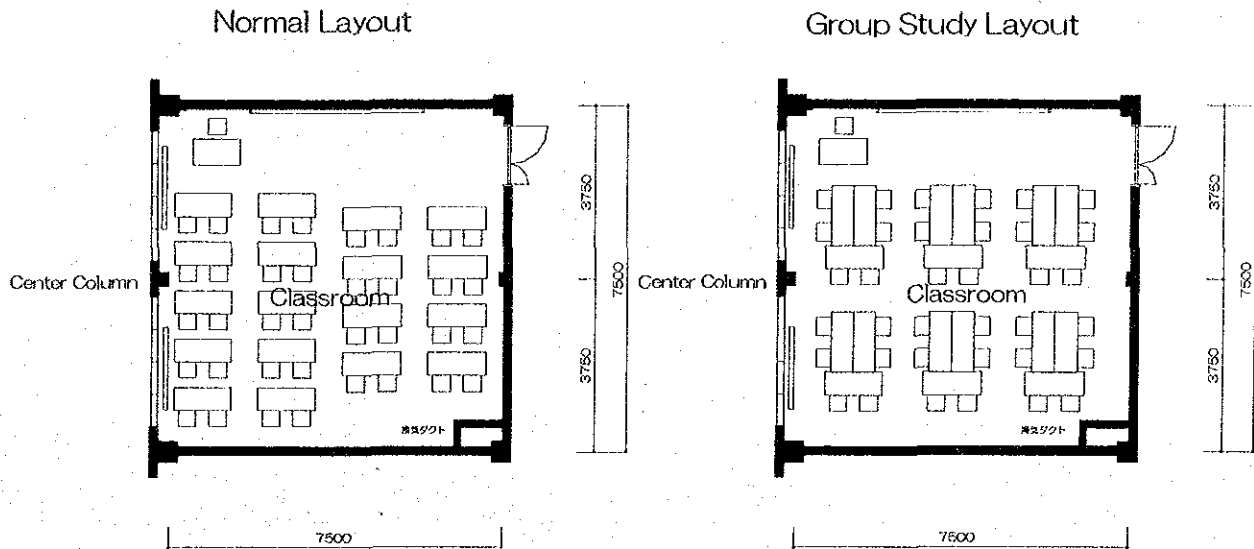
a) Classroom

Phase I of the Project adopted a rectangular-shaped classrooms with dimensions of 6m×9m (the standard of the former Soviet Union). But after discussions with MOSTEC, it was decided to adopt a square-shaped classroom with dimensions of 7.5m×7.5m for the Project. The following merits can be seen:

- The layout of the desks can be 4 desks in a row and 4 or 5 desks in a column in a classrooms. Compared with the Phase I which has 7 desks in a column, students seated at the back of the classroom will have a better view of the blackboard
- Construction costs will be minimized because the corridor length is shorter than that found in Phase I of the Project
- Heating costs will be cheaper because the total area of the exterior walls is smaller, although the floor area is the same as in Phase I of the Project

Another additional column will be designed in the middle of the span of the corner columns to reduce the distance of column span and the height of the beam. In this way, all the windows will be able to be designed higher in the same floor height as in Phase I of the Project. The outside window frame will be made of aluminum and the inside window frames will be made of steel galvanized with zinc and with a plastic finishing coat, so that not to develop water condensation.

Figure 2: Standard Classroom Floor Plan



b) Teachers' Room

Teachers' room will be planned in the school building(s) so that teachers can hold the meetings, do class preparation, and store basic teaching materials. Taken it into account that the number of subject teachers was approximately estimated as half of the number of classrooms, the number of teachers at each Project school was assumed to be 1.5 times of the number of classrooms. According to the "Standards", the floor space per teacher should be 2.5 m². By following this standard, different types of teachers' room could be planned according to the size of the school buildings.

c) Toilets

Although western style toilets are utilized and maintained well at Project schools in Phase I of the Project, the Project areas in Phase II are located in rural areas, so children may not be familiar with those toilets. Thus, squat style toilets (Asian style toilets) will be installed.

The estimation of the number of toilet bowls should be based on the "Standards". The rules specify installing one toilet bowl per every 30 or less female students, one toilet bowl per every 40 or less male students, and one washbowl per every 30 or less students. However, the "Standard" do not make a distinction between toilet bowls and urinals for male students. So, it was decided to install one urinal per every 40 male students and one toilet bowl per every 60 male students, the same as in Phase I of the

Project whose calculation is based on the "Standards" and installing situation at the existing facilities.

Four types of toilet arrangements were planned, and one or two of toilet facilities will be installed at each Project school. As more than half of all teachers are female, one or two toilets for the teachers will be installed based on the number of teachers at each school as stipulated in Phase I of the Project. Toilets for teachers will be western style.

d) Corridor

Due to the severe cold winter, people tend not to go outside almost all day. Similarly, during recess, when temperatures drop to minus 30, children generally stay inside the classroom. Thus, school corridors are regarded as spaces not only for walking through, but also for activities like relaxing and doing light exercises. Therefore, corridors will be designed as spaces where students can just sit and be comfortable for a certain time period. Some existing Project schools in both Provinces have corridors 6m wide which serve multi-purpose uses. For these reasons, and in line with the guidelines in Phase I of the Project, the width of the Project school corridors is set at 3m by the pillar/column span, with a usable width of 2.5m.

e) Entrances Hall

A main entrance will be installed at one end of each school building, and a second entrance at the other end. To prevent cold air from entering the building and to keep warm air from escaping from the building during the cold winters, an anteroom of sufficient size and volume will be installed. In addition, exterior and interior doors will be staggered. When students arrive at school and go home, the entrance hall in front of the cloakroom becomes congested, so it will have sufficient space.

f) Cloakroom

In the winter, students come to school wearing heavy coats, arctic boots, caps, gloves, and mufflers. If they bring these items into their classrooms, an extremely large wall space would be necessary to hang them, and personal belongings or class items might become lost among those clothing items. Thus, the "Standards" specify the installation of a cloakroom in school buildings.

Although the "Standards" specify installing a cloakroom of 0.15 m² per student, the amount of space designed at each Project school building is slightly smaller than that figure (Table 10). But, as shown in Figure 3, it is possible to arrange coat hooks for students to hang their winter wear. It is deemed that the designed space is sufficient.

Figure 3: Cloakroom Types and Coat Hook Arrangement

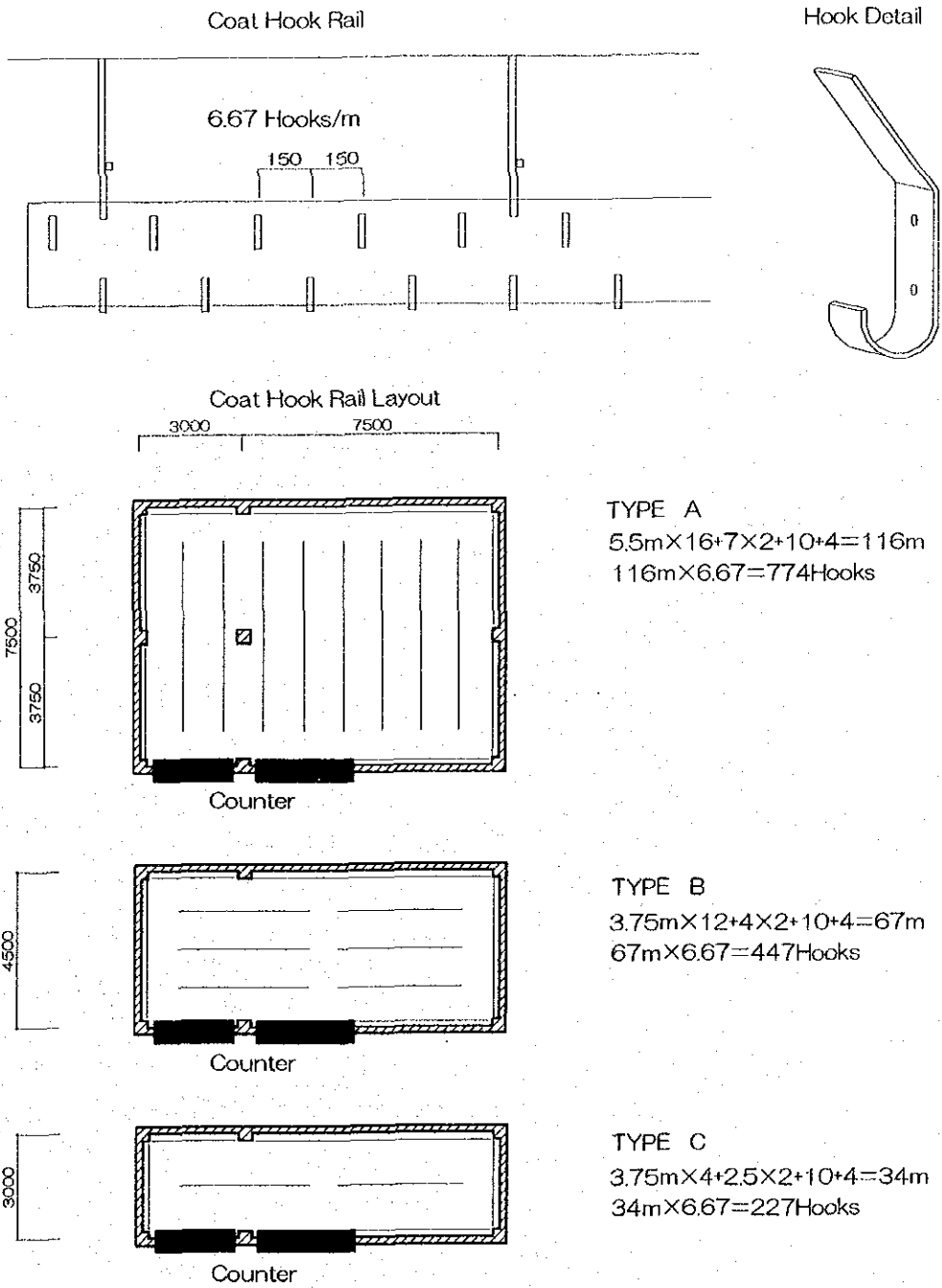


Table 10: Cloakroom in Each Project School

School	D-4	D-11	D-od	O-2	O-3	O-6	O-7	O-16	O-17	O-18
Number of Students	288	756	324	144	576	216	324	720	432	432
Required Space (m ²)	44	114	49	22	87	33	49	108	65	65
Designed Space (m ²)	47	78	47	31	78	31	47	78	47	47

Area of all rooms mentioned above can be referred in Table 11.

Table 11: Facilities for Each School

		Darkhan-Uul				Orkhon						Total
		D-4	D-11	D-od	O-2	O-3	O-6	O-7	O-16	O-17	O-18	
Building Stories		3	3	3	2	3	2	3	3	3	3	
Floor area (except basement) (m ²)		2,374.30	1,242.00	1,215.75	648.00	1,908.00	805.50	1,242.00	2,263.50	1,479.75	1,479.75	14,658.55
Number of Classrooms		21	9	8	4	16	6	9	20	12	12	117.00
Teachers' room	Area (m ²)	56.25	45.00	45.00	33.75	56.25	33.75	45.00	56.25	45.00	45.00	
	Area (m ²)	78.75	47.25	47.25	31.5	78.75	31.5	47.25	78.75	47.25	47.25	
Cloakroom	Number of coat hooks	773	446	446	226	773	226	446	773	446	446	5001
	Area (m ²)	92.70	68.40	68.40	39.15	92.70	39.15	68.40	92.70	86.40	86.40	
Toilet	Number	2	2	2	1	2	1	2	2	2	2	18
	Number	2	1	1	1	2	1	1	2	1	1	13
Drinking faucet	Number	2	1	1	1	2	1	1	2	1	1	13

④ Section Design

(a) Setting the Numbers of Floors

In winter, the ground surface freezes down to 3m, and volume increases thereby effectively "lifting" up buildings (this phenomenon is called frost heaving). For this reason, the bottom of building foundations should be at least as deep as the 3m level. From the point of view of keeping construction costs to a minimum, the ratio of the total floor area to the dead space should be as small as possible. Thus, it is necessary to build high story buildings to make the proportion of dead space small and total area floor large.

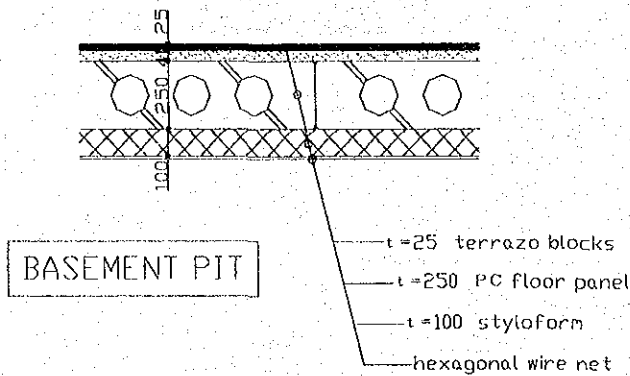
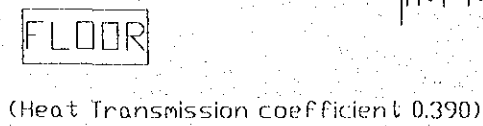
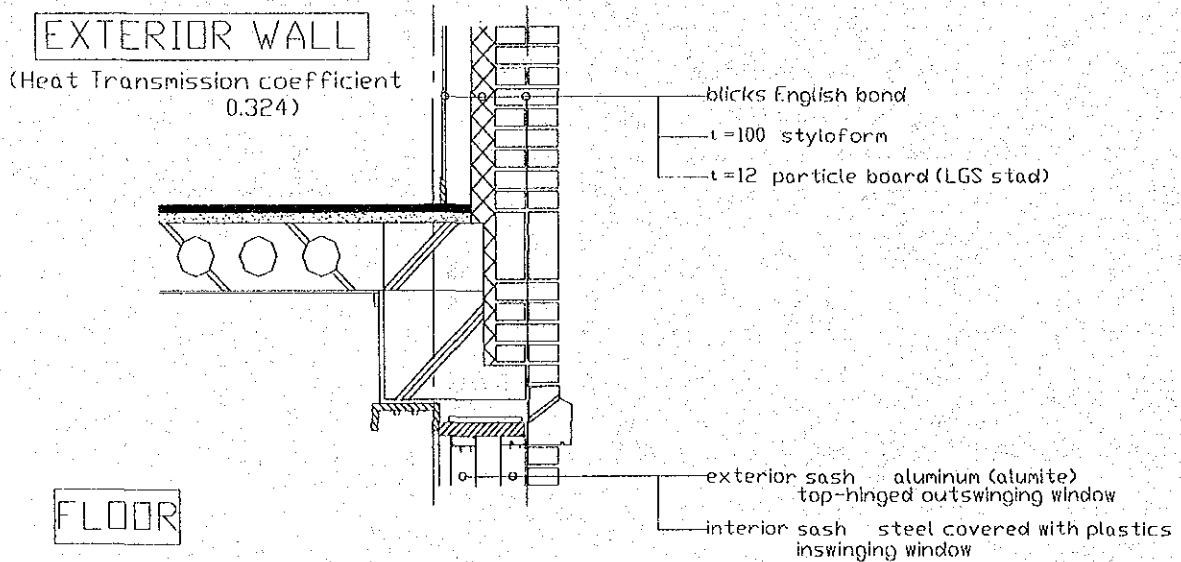
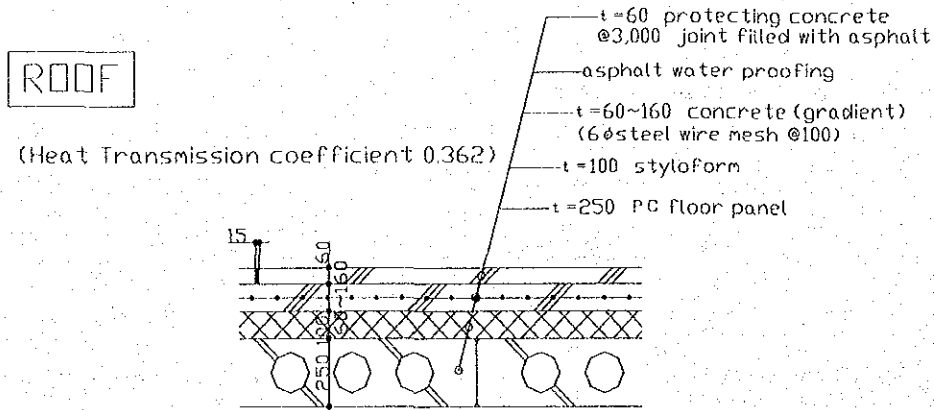
However, the "Standards" stipulate that school buildings must be three-storied or less in an area having a population of less than 200,000 people. In addition, there is a limit to the number of stories to a building from the viewpoint of the construction schedule that may be largely influenced by the cold winter. For these reasons, the Project's school buildings will basically be three-storied except for small schools that

need only a small number of classrooms. Those small schools will have two-storied buildings.

(b) Insulation Design

In Mongolia, every part of a school building, such as the roof, exterior walls, floors, openings, etc., must have a heat transmission coefficient of less than 0.4 that is specified by the Bureau of Heating. If this rule is not met, the Bureau of Heating will suspend the public heating supply. The Project school buildings should maintain the set value by following this rule. To avoid heat bridges (building portions having a large heat transfer rate) where insulation material cannot be placed, outside insulation should be provided. Figure 4 shows the detailed design of the roofs, exterior walls and floors of the Project schools. These portions are designed to have the heat transmission coefficient smaller than 0.4. The doors and windows of the school buildings will be "double-doors" and "double-windows" that are "double-sealed" with air between the front and back surfaces for better insulation capability.

Figure 4: Section Details



(2) Structure design

In this Project, the structures of the Project school buildings will be designed based on the "Standards",. Also, reinforce steel bar to the Japan Industrial Standards (JIS) is available in Mongolia, so structure design of reinforce steel bar will follow the JIS standard.

From the results of the hole boring surveys and loading tests, the site investigation report shows that there is sand from ground surface down to 4 or 5 meter depth, and loam at depths of more than 5 meter in the stratum of School No. 4, 11, and Od3 School (Darkhan Uul). The load bearing capacity is from 10 to 15 ton/m² at the 1.5m depth. The report also shows that there is loam from the ground surface down to 4 or 5 meter depth, and lock in depth more than 5 meter in the stratum of School No. 2, 17 and 18 (Orkhon).

① Standards for Earthquakes

The seismic scales of the Provinces are as shown in Table 12. The preparation of structure designs will be based on these figures. (Figure 5)

Table 12: Seismic Intensity Scales in Both Provinces

	Darkhan-Uul	Orkhon
MSK Seismic Scale	7	8
JMA Seismic Scale	4-5	5
Max. Acceleration (Gal)	Approx. 80	Approx. 150

Note: JMA : Japan Metrological Agency

② Standards for Wind Forces and Snow Loads

The standards for wind forces and snow loads are established in both Provinces as follows:

Wind forces, first zone: 27kg/m²

Snow load, first zone: 70kg/m²

③ Standards for Live loads

The standards of the former Soviet Union (used in Mongolia) are as follows:

Classroom floor: 200kg/m²

Corridor floor: 300kg/m²

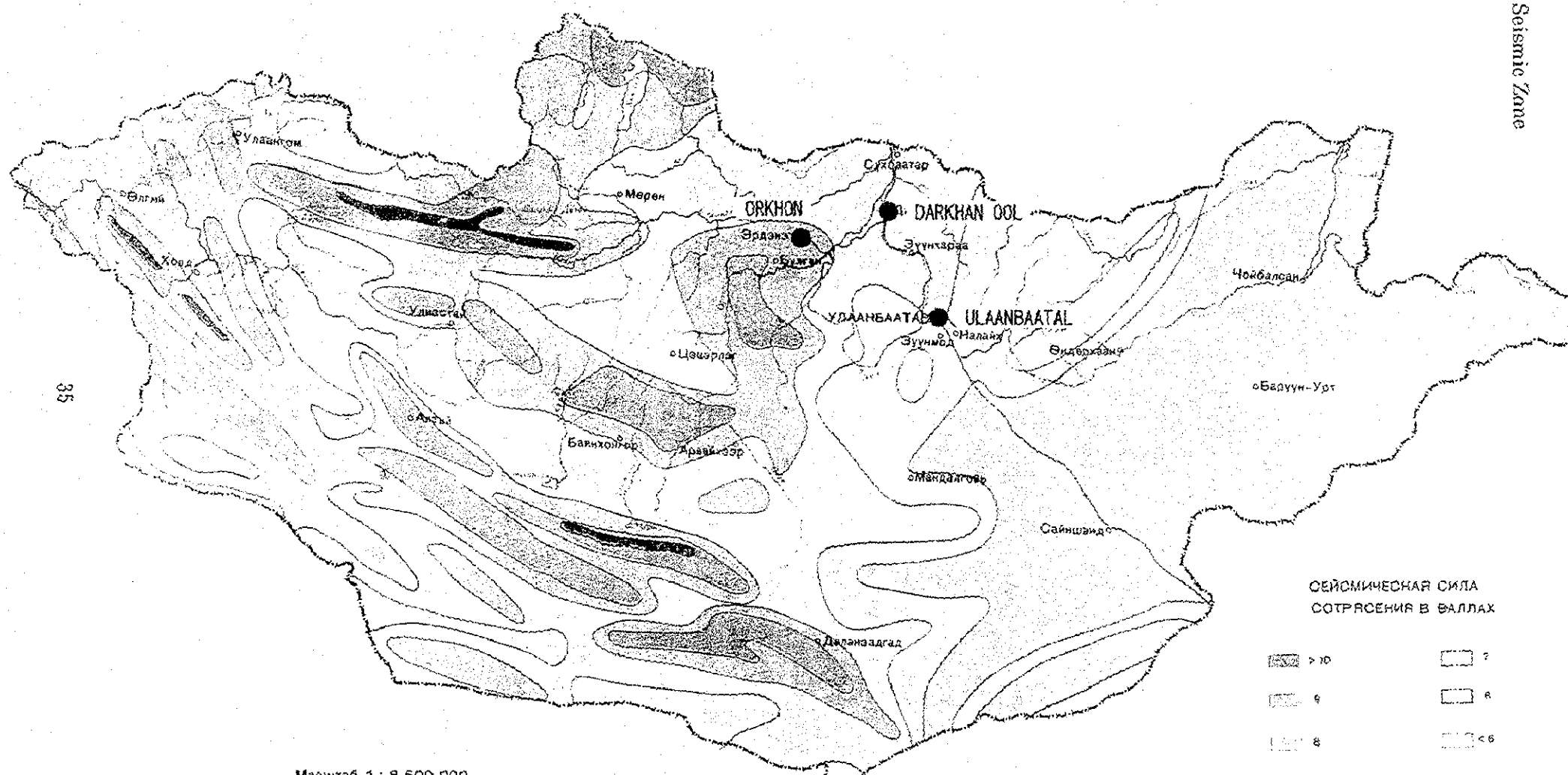
④ Structure of Foundations

The structure of foundations will be the independent footing type. The bottom of the foundations will be placed more than 3m deep from the ground surface. The exact depth of the foundations will be decided in accordance with the soil survey results.

⑤ Structure

In order to shorten the construction period as much as possible, building floors, lintels, window sills, parapet copings, and stairs will be of pre-cast concrete so as not to increase the demand for ready-mixed concrete in the summer when supplies are limited. Expansion joints will be provided to prevent cracking on building surfaces which exceed lengths of 40 m.

Figure 5: Seismic Zone



35

Масштаб 1 : 8 500 000

(3) Mechanical and Electrical Plan

Darkhan-Uul Province and Orkhon Province are relatively new developed industrial regions where urban infrastructure is well developed. However, in the Gel residential areas, installation of infrastructure has not yet caught up with the dramatic increases in population. Approximately a half of the Project schools, particularly the new schools, are located in the Gel residential areas. Based on the results of the site survey relating to water supplies, sewers, heating sources, and hot water, the following measures were planned for each facility type. At the time of detailed design, sometimes the condition of infrastructure differs from the time of basic design. In that case, necessary modification will be made based on the latest information.

① Water Supply Facility

In an area where city water is available, pipes will be tapped into the existing supply main and brought to the school site. The pressure of the city water is 5kg/cm^2 . Thus, there is no need to increase the water pressure by installing an elevated tank or a booster pump. However, at School No.4 (Darkhan-Uul) and School Nos.16, 17 and 18 (Orkhon), no city water supply is available, so water receiving tanks will be built in underground pits. The water receiving tanks will be located in underground pits to prevent freezing. Water to these receiving tanks will be supplied either by water wagons or from wells which the Mongolian side will provide (Figure 6).

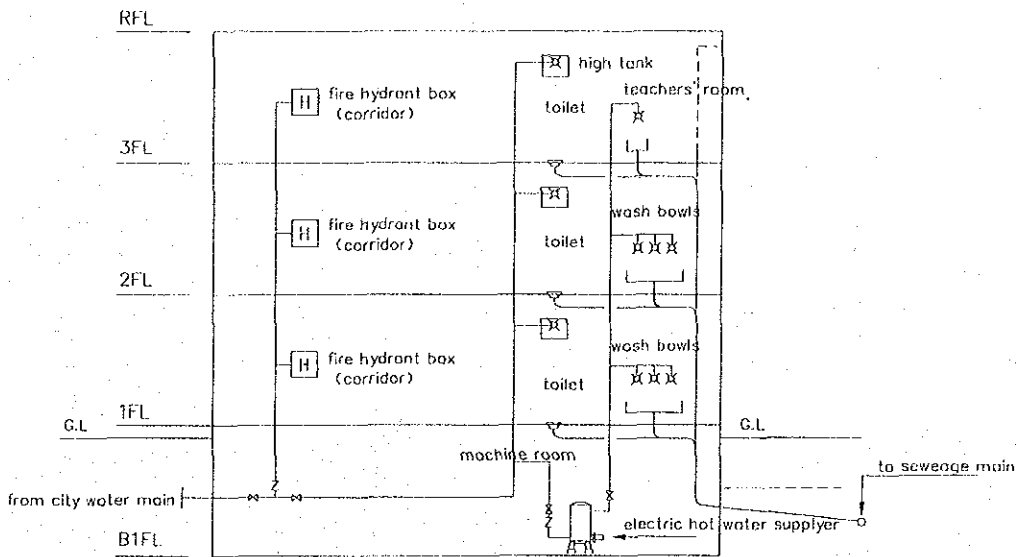
② Sewage System

For the Project schools having a public sewage system, sewer pipes will be connected to the public sewer main. For School No.4 (Darkhan-Uul) and School No.3, 16, 17 and 18 (Orkhon) that do not have access to the city public sewer system, sewage tanks will be installed. The sewage should be transported to a Provincial sewage treatment plant by vacuum vehicles provided by the provincial offices. Rainwater is filtered naturally into the ground. (Figure 6)

③ Hot Water Supply System

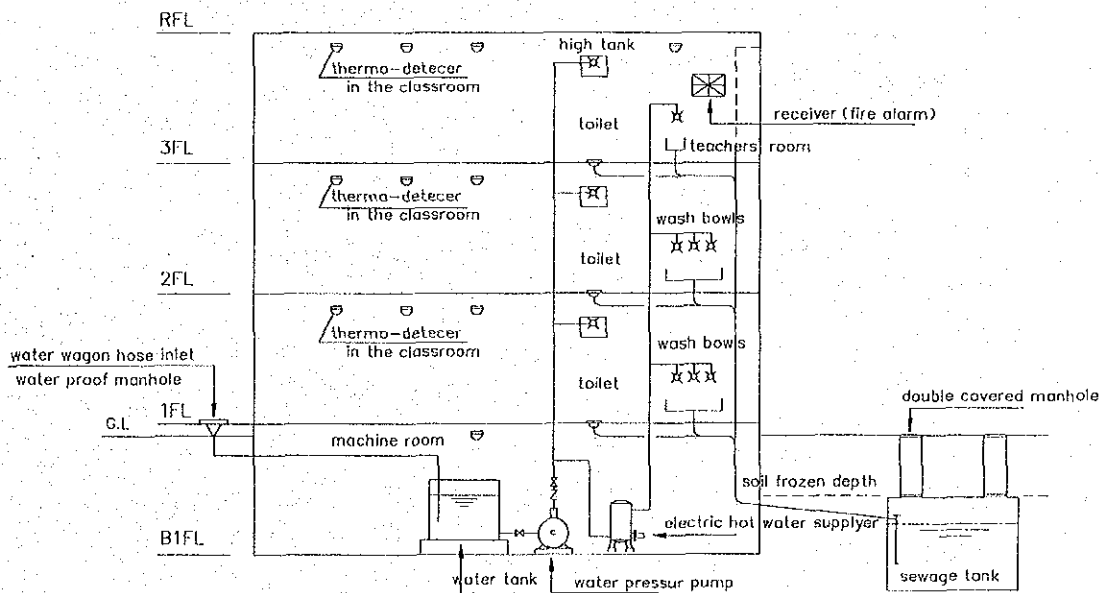
If a public hot water supply system is usable, a hot water pipe should be connected to the supply main. If a public hot water supply is not available, building water should be supplied through a heat exchange unit.

Figure 6: Water and Drainage System Diagram



WATER AND DRAINAGE DIAGRAM
(if there are city water and sewage line)

- D-0d
- D-11
- O-2
- O-3 (no sewage line)
- O-6 (hot water supply available)
- O-7



WATER AND DRAINAGE DIAGRAM
(if there are no city water nor sewage line)

- D-4
- O-16
- O-17
- O-18
- O-3 (this site has city water)

④ Sanitary Facility

The squat style (Asian style) toilet bowls will be installed for students and western style toilet bowls for teachers. Urinals will be installed in male toilets in accordance with Phase I of the Project. The number of toilet bowls and sinks/washbowls will be as stipulated in the "Standards". In addition to this, MOSTEC requested additional sinks/washbowls in other rooms such as science experiment-class and handicraft-class as well as in the toilet facilities. Based on the analysis in Japan, those sinks/washbowls will be also installed. The number of sanitary facility units to be provided to each Project school is listed in Table 13.

Table 13: Sanitary Facility Units to be Provided to Each Project School

Name of Item		Darkhan-Uul			Orkhon						Total	
		D-4	D-11	D-od	O-2	O-3	O-6	O-7	O-16	O-17		O-18
Teachers' Room	Washbowl	1	1	1	1	1	1	1	1	1	1	10
Toilets	Urinal for male	10	4	4	3	10	3	4	10	6	6	60
	Toilet bowls for males	6	2	2	2	6	2	2	6	4	4	36
	Toilet bowls for females	12	6	6	4	12	4	6	12	8	8	78
	Sink for cleaning	2	2	2	1	2	1	2	2	2	2	18
	Hand washing tap	24	12	12	8	24	8	12	24	16	16	156
	Toilet bowls for teachers (western)	2	1	1	1	2	1	1	2	1	1	13
	Washbowl for teachers	2	1	1	1	2	1	1	2	1	1	13
Drinking Fountain	Drinking water tap	4	3	3	2	4	2	3	4	3	3	31

⑤ Fire Extinguishing System

For those Project schools that have a city water supply system, indoor fire hydrants together with alarm systems will be installed on each floor at 50m intervals. For those Project schools that do not have a city water supply system, thermo-detecting type fire alarms and fire extinguishing units will be installed according to the specifications of the Bureau of Fire Stations. In addition, emergency exit signs will be installed at every exit and at other appropriate locations on each floor of the school buildings.

⑥ Heating system

In principle, the heating system of each Project school will be connected to a public heat supply main. However, School Nos. 16, 17, and 18 (Orkhon) do not have a public heat supply system in their vicinities, and School No.11 (Darkhan-Uul) relies on the heating system of the Railroad Bureau which is not equipped to supply any new school buildings. So, new heating boilers will be installed at those schools. (Figure 7)

⑦ Ventilation System

As school buildings will be built airtight and the windows are not opened frequently in winter, the rooms need to be periodically ventilated. The "Standards" stipulate the installation of a ventilation system. The intake air from outside should be heated by hot water from the heating system and delivered to each room by an air supply fan. The exhaust air from the room should be vented to the outside of the building by exhaust fans located in toilets, and the upper part of stairways. (Figure 8)

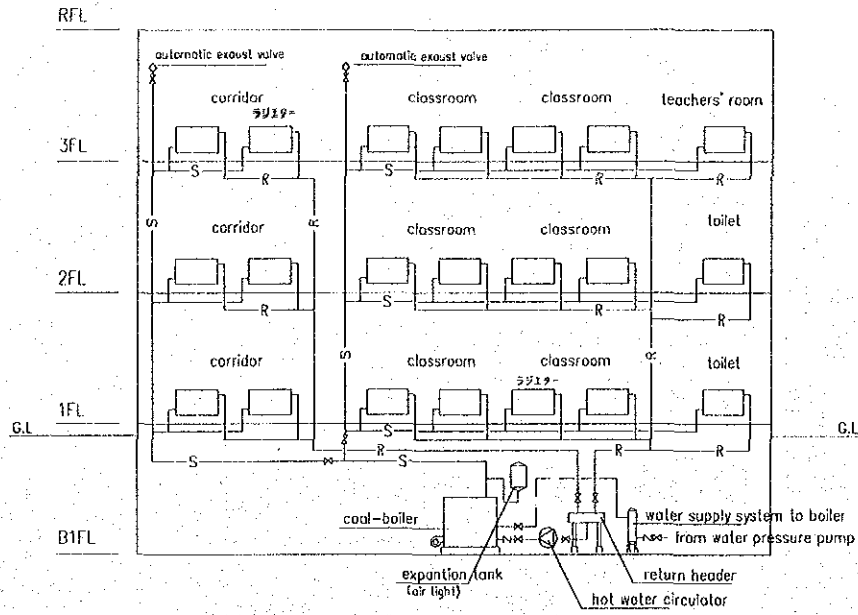
⑧ Electrical System

The power supply system in Mongolia is 3 phase, 400V, 50Hz. Electric power is delivered either through underground conduits or electrical poles. Thus, power connections to each Project school will be designed to suit the locally available supply methods. As stipulated in Phase I of the Project, the power supply system for Project schools will consist of a power receiving unit, a transformer unit, a lighting system, outlets, motor units for pumps, an emergency alarm system and a thermo-detecting type alarm system. (Figure 9)

⑨ Telephone System

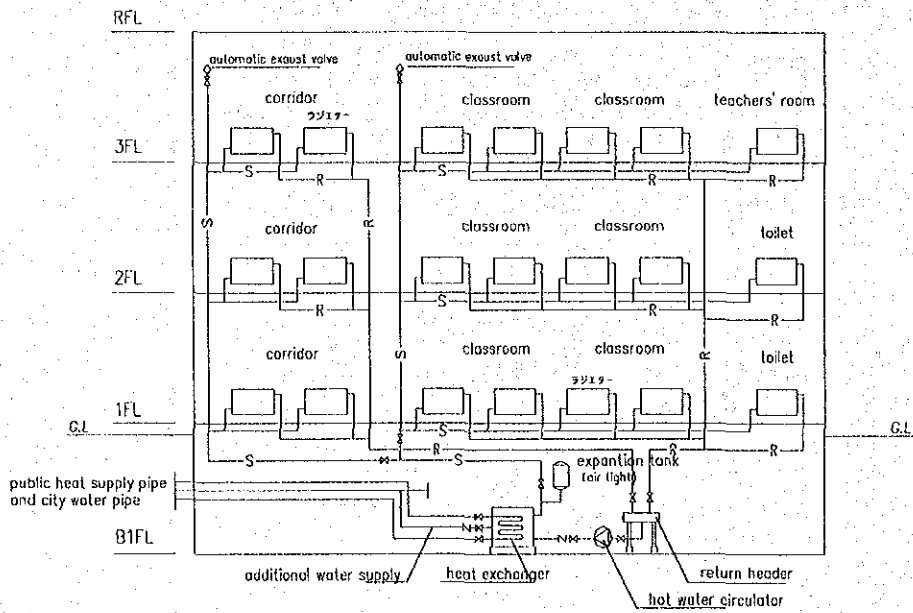
Considering the possibility of future increase of telephone lines, a telephone wire conduit and a wire outlet unit will be installed from the basement equipment room to the teachers' room.

Figure 7: Heating System Diagram



HEATING SYSTEM DIAGRAM (BOILER TYPE)

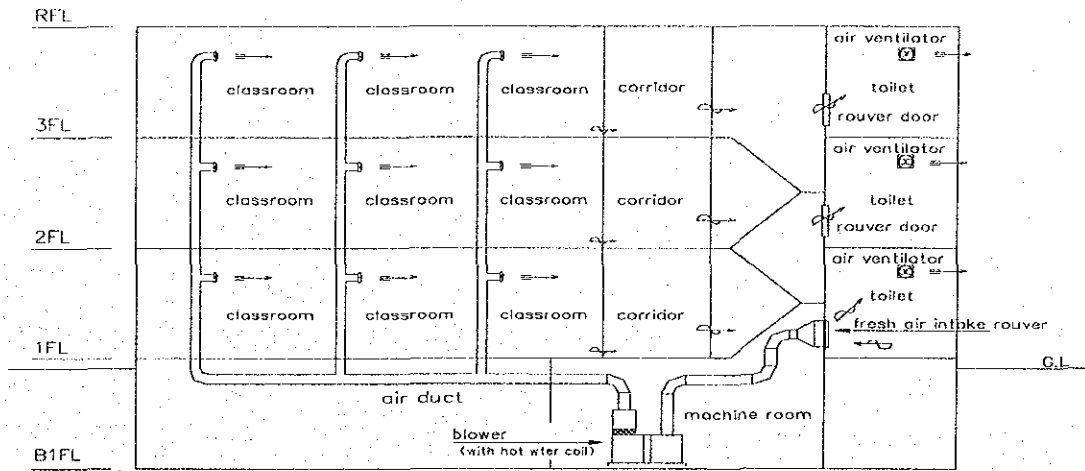
- D-11
- O-16
- O-17
- O-18



HEATING SYSTEM DIAGRAM (PUBLIC HEAT SUPPLY TYPE)

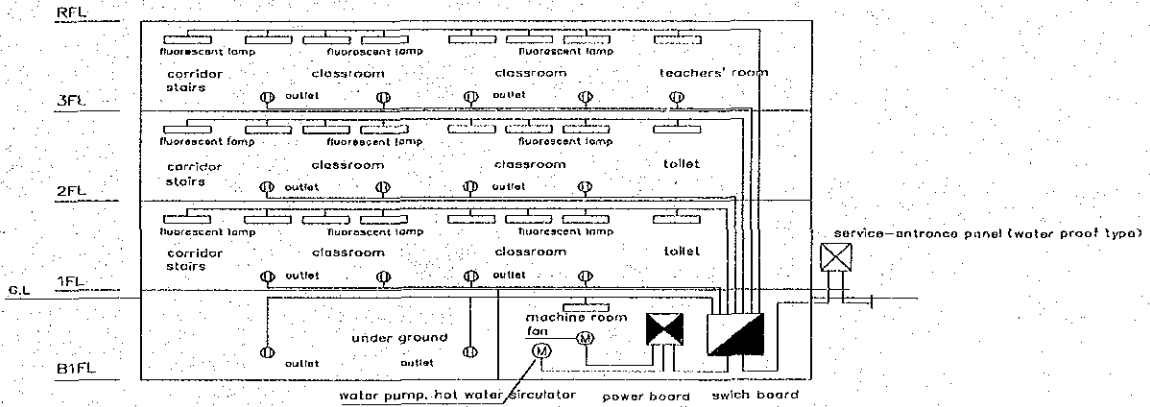
- D-od
- O-4
- O-2
- O-3
- O-6
- O-7

Figure 8: Air Ventilation System Diagram

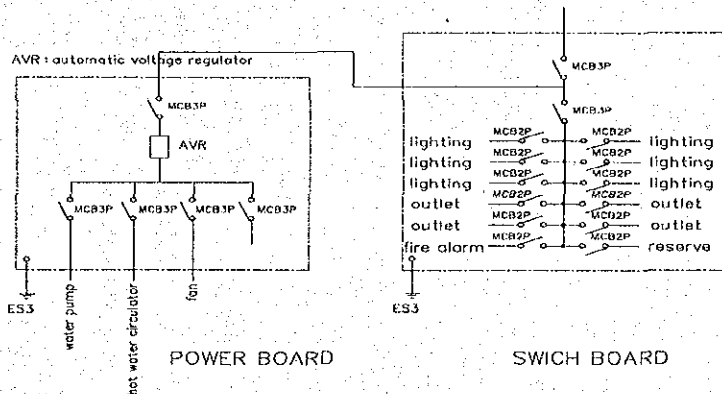


AIR VENTILATION SYSTEM DIAGRAM

Figure 9: Electric System Diagram



ELECTRICAL SYSTEM DIAGRAM



(4) Construction Material Plans

The climate in the Project area is similar to that of Ulan Bator, the Project area of Phase I. Thus, construction materials for the Project will be basically the same as those used in Phase I. In view of the construction customs and local technical skill, construction materials that will not require high maintenance costs should be selected for the Project.

Exterior portions, such as roofs, copings, walls, aprons and entrance steps, will be finished with plain concrete or bricks which as the structure material. Exterior finish with mortar, tiles or stone will be completely avoided because they tend to crack in the cold winter. Interior floors will be finished with terrazzo-tiles instead of long-sized polyvinyl chloride sheets that were used in Phase I of the Project.

Finishing methods to be used for the Project are listed in Table 14.

Table 14: Finishing Method to be Used for the Project and Reason

Portion	Common Local Method	Adopted Method	Reason for Use
Main Structure			
Foundation	Reinforced concrete	Reinforced concrete	To follow local method
Column and Beam	Precast concrete or Bricks	Reinforced concrete	Better earthquake resistance
Roof and floor	Precast concrete plate	Precast concrete plate	To follow local method
Wall	Bricks or Precast concrete plate	Bricks	To follow local method
Exterior Finish			
Exterior wall	Bricks or Precast concrete plate	Bricks	To follow local method
Roof	Asphalt sheets with anti dew treatment	Asphalt sheets plus waterproof concrete	Better durability
Outside window	Paint finish on wood	Aluminum sash	Easy maintenance
Inside window	Paint finish on wood	Plastic sash	Easy maintenance
Interior Finish			
Building floor	Long size polyvinyl chloride sheets, wood, or in-situ polished terrazzo	Hall: Terrazzo tiles Classrooms: long-sized polyvinyl chloride sheets	To follow local method To follow 'Standards'
Toilet floor	Ceramic tiles	Ceramic tiles	To follow local method
Baseboard	Wood	Hall: Terrazzo tiles Classrooms: Paint finish on wood	Better durability To follow local method
Inside surface of exterior wall	Paint finish on plaster	Particleboard EP for $h > 2000$ OP for $h < 2000$	Better insulation capability. Anti-foul paint on lower portion.
Interior wall (partition)	Paint finish on plaster	Trowel finish of mortar: EP for $h > 2000$ OP for $h < 2000$	To follow local method. Anti-foul paint on lower portion.
Ceiling	Paint finish on plaster	Paint finish on plaster	To follow local method.
Classroom door	Paint finish on wood	Paint finish on wood	To follow local method.