No.

OUTLINE DESIGN STUDY
ON
THE PROJECT
FOR
THE DISASTER RECONSTRUCTION
OF BASIC HUMAN NEEDS RELATED FACILITIES
AFFECTED BY THE INDONESIA EARTHQUAKE
IN
THE REPUBLIC OF INDONESIA

AUGUST 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of Indonesia, the Government of Japan decided to conduct an outline design study on the Project for the Disaster Reconstruction of Basic Human Needs Related Facilities Affected by the Indonesia Earthquake in the Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team from June 2006 to August 2006.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft outline design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the teams.

August, 2006

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

August, 2006

We are pleased to submit to you the outline design study report on the Project for the Disaster Reconstructioin fo Basic Human Needs Related Facilities Affected by the Indonesia Earthquake in the Republic of Indonesia.

This study was conducted by Yachiyo Engineering Co., Ltd., under a contract to JICA, during the period from June, 2006 to August, 2006. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

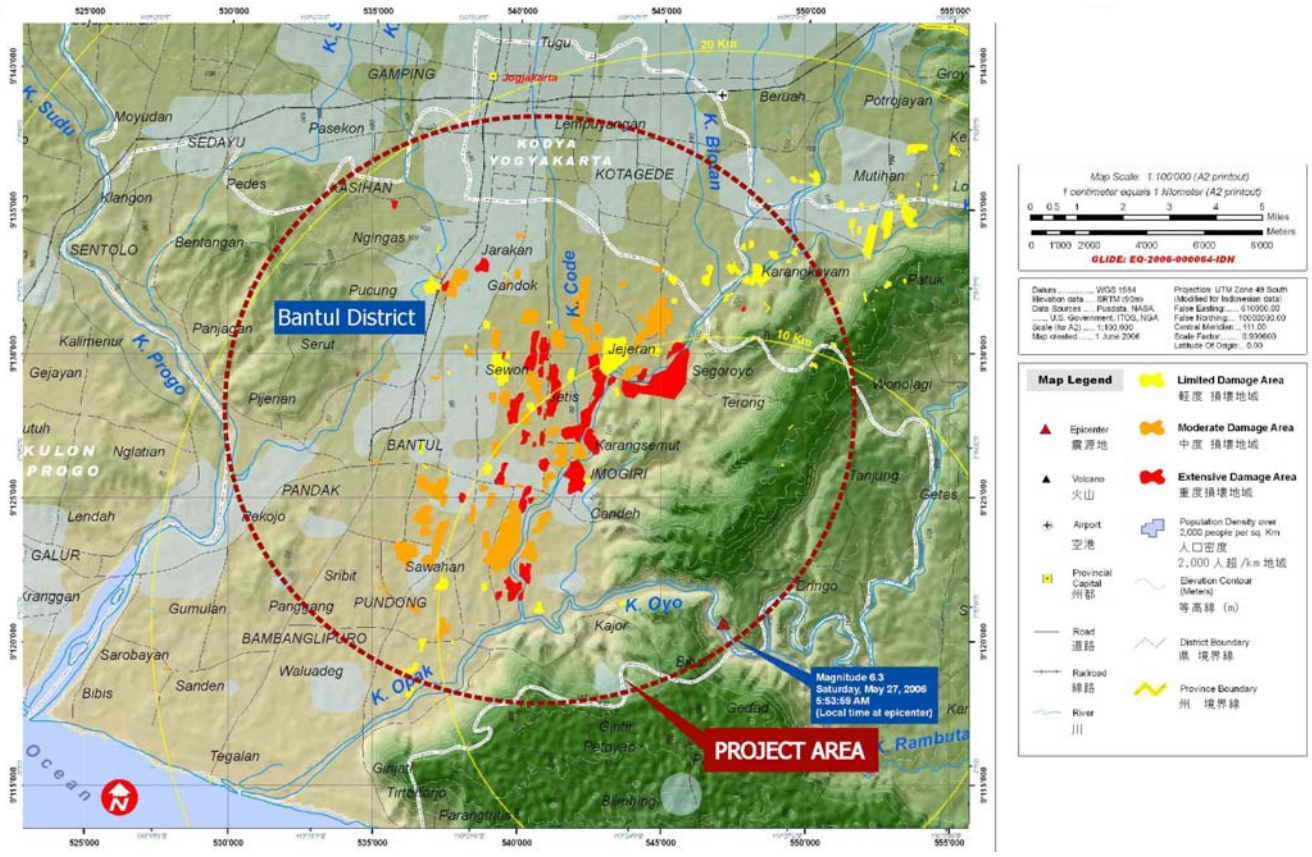
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

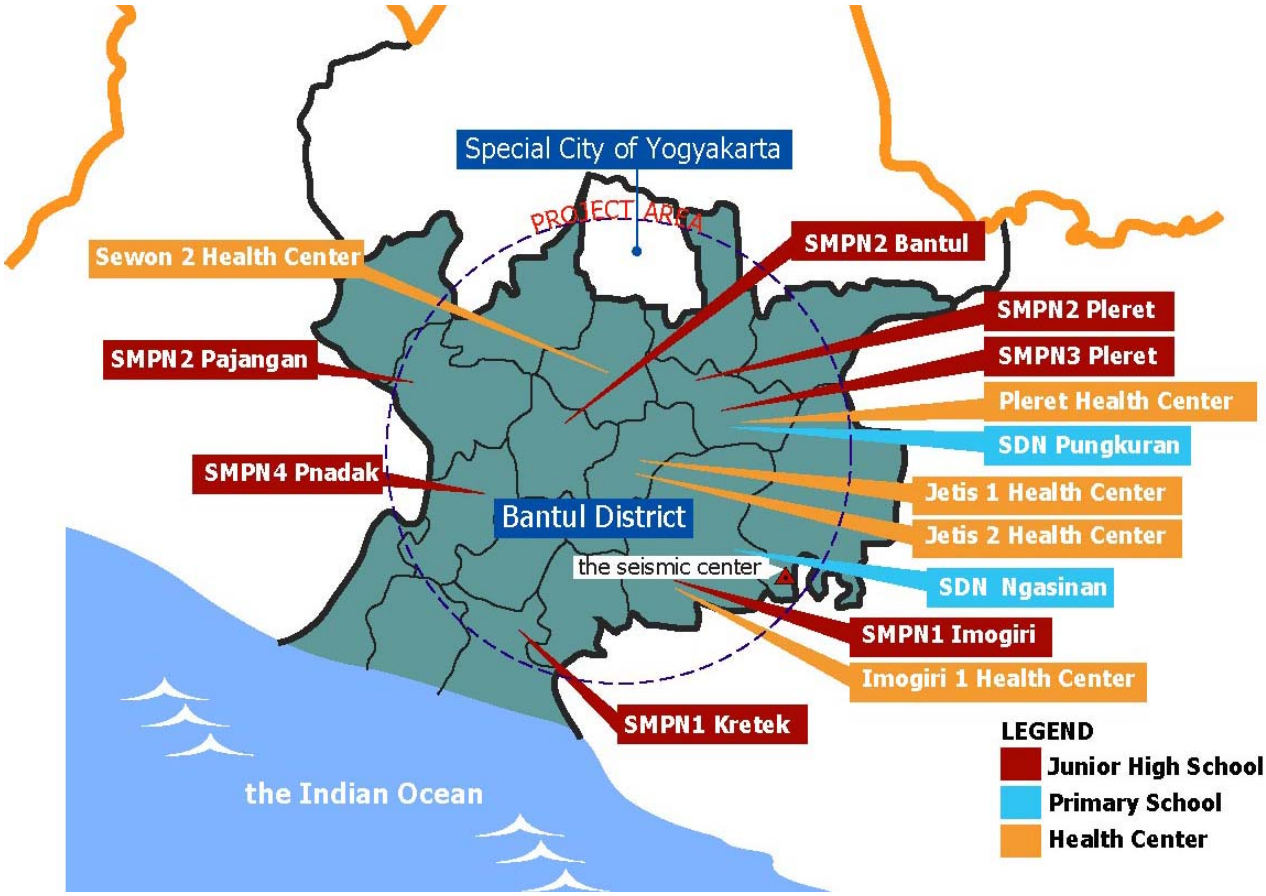
Naoyuki Minami

Project Manager,
Outline Design Study Team
on the Project for the Disaster Reconstructioin
fo Basic Human Needs Related Facilities
Affected by the Indonesia Earthquake
in the Republic of Indonesia

Yachiyo Engineering Co., Ltd.



Location of Project Area



Location of Project Sites

THE PROJECT OF THE DISASTER RECONSTRUCTION
OF BASIC HUMAN NEEDS RELATED FACILITIES
AFFECTED BY THE INDONESIAN EARTHQUAKE IN THE
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PERSPECTIVE VIEW

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BANTUL, YOGYAKARTA （AUG・2006）

From
the People of Japan

THE PROJECT OF THE DISASTER RECONSTRUCTION OF BASIC HUMAN NEEDS RELATED FACILITIES AFFECTED BY THE INDONESIAN EARTHQUAKE IN THE REPUBLIC OF INDONESIA

PERSPECTIVE VIEW

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Summary

The earthquake on May 27, 2006 caused the enormous damage over the Yogyakarta Special Province and Central Java Province, in particular Bantul Regency. There were about 5,760 people died and 126,000 houses destroyed out of 583,000 unit of damaged houses. The total damage and loss was estimated as US$3,134 million.

Support in the education and public health and medical sectors is limited to emergency restoration. Social services for residents are in an appalling state, while sector-separate support for the reconstruction of facilities has hardly taken place at all. Accordingly, it is necessary to immediately rebuild elementary schools, secondary schools and public health centers with a view to restoring basic services in the education, public health and medical sectors. In the circumstances, the Government of Indonesia requested the support for the reconstruction of BHN related facilities affected by the earthquake in Yogyakarta and Central Java.

BAPPENAS (National Development and Planning Agent), the Provincial Government of DI Yogyakarta, the Provincial and Local Government of Central Java made “Action Plan of the Rehabilitation and Reconstruction for the Post-earthquake Affected Areas in the Province of Yogyakarta and the Province of Central Java, 2006.” This project has been reflected in the Action Plan.

In response to a request from the Government of Indonesia, the Government of Japan decided to conduct an outline design study on the Project for the Disaster Reconstruction of Basic Human Needs Related Facilities Affected by the Indonesia Earthquake in the Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a study team from June 2006 to August 2006. The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft outline design, and as this result, the present report was finalized.

The project facilities were selected as follows:

[Elementary schools] In Bantul Regency, where the earthquake damage was particularly severe, the schools which have suffered critical damage and are in need of demolishing and reconstruction were selected. In response to the request, and in order to assist communities that face difficulty because they don’t have basic education facilities, the Project shall target two schools that have not been allocated recovery budget by the government nor any support of donors.

[Secondary schools] The schools in which all school facilities have suffered critical damage and are in need of demolishing and reconstruction were selected. The Project shall target seven schools that have not been allocated recovery budget by the government.

[Public health sector] In order to raise the effectiveness of assistance, the Project shall target five health centers in Jetis, Sewon, Pleret and Imogiri, which suffered particularly serious damage in Bantul Regency.

The buildings are designed with consideration of rationality and cost reduction of the followings:

- Setting standard types of simple grid planning
- Using the above standard types as much as possible
- Using reinforced concrete structure in viewpoint of cost, earthquake-resistance, fire-resistance and local conditions
- Using original low-cost finishing such as mortar - paint for walls
- Considering natural ventilation

The following table shows the contents and scale of major facilities and equipment to be prepared in the Project. All the Project facilities are located in Bantul Regency, Yogyakarta Special Province.

Table 1 Scale of Project Facilities

Sector	Facilities	Contents of Restoration	Scale
Education	Elementary schools	Reconstruction of 2 elementary schools: 12 classrooms, corridors, principal's rooms, staff rooms, reception rooms, offices, storerooms, libraries, janitor room, toilets; plumbing and sanitary installations, electric and telephone equipment	Total floor area approximately 1,743m^2
	Secondary schools	Reconstruction of 7 secondary schools: 99 classrooms, corridors, principal's rooms, staff rooms, reception rooms, offices, storerooms, infirmaries, counseling rooms, libraries, science rooms, workshops, IT rooms, assembly rooms, janitor room, toilets; plumbing and sanitary installations, electric and telephone equipment	Total floor area approximately 19,950m^2
Public health	Health centers	Reconstruction of 5 health centers and procurement of medical equipment: Facilities: examination rooms, dental clinics, pharmacies, guidance rooms, hospital rooms, etc. Medical equipment: examination tables, diagnostic instrument sets, dental units, obstetric examination tables, fetal heart tone meters, microscopes, etc.	Total floor area of facilities: Outpatient and administration building: 441m^2: 5 buildings Emergency and inpatient building: 297m^2, 3 buildings Connection Corridor etc. Total approximately 3,144m^2, Medical equipment for 5 sites according to the standard medical equipment list

Table 2　Planned Total Floor Area of Target Elementary and Secondary Schools (m^2)

School	Administration rooms	Classrooms	Special classrooms	Toilets	Other (stairs, connecting corridors)	Total
Pleret 2 secondary school	1,458	972	684	122	186	3,422
Pleret 3 secondary school	729	603	563	108	117	2,120
Imogiri 1 secondary school	1,458	945	585	162	148	3,298
Pajangan 2 secondary school	1,458	950	585	122	360	3,475
Bantul 2 secondary school	972	830	481	126	178	2,587
Pandak 4 secondary school	972	567	630	162	196	2,527
Kretek 1 secondary school	1,044	590	680	126	81	2,521
Secondary schools total	8,091	5,457	4,208	928	1,266	19,950
Pungkuran elementary school	480	160	222	18	80	960
Ngasinan elementary school	416	144	137	14	72	783
Elementary schools total	896	304	359	32	152	1,743
Total	8, 987	5, 761	4, 567	960	1, 418	21, 693

Table 3　Floor Area of Target Health Center（m^2）

Health center	Out-patient+Admi.	In-patient+Emergency	Corridor etc.	Total
Jetis 1	441	297	0	738
Jetis 2	441	0	0	441
Sewon 2	441	0	0	441
Pleret	441	297	36	774
Imogiri 1	441	297	12	750
Total	2,205	891	48	3,144

The estimated project cost are anticipated approximately ¥900 million (¥890 million by the Japanese side and ¥10 million by the Indonesian side). This cost estimate is provisional and would be further examination by the Government of Japan for approval of the Grant.

The total implementation period is expected to be approximately 15 months including the pre-qualification and tendering period.

The major effects anticipated as a result of Project implementation are as follows.

(1) Direct effects

[Elementary and secondary schools]

- 12 elementary school classrooms, 99 secondary school classrooms and the required special classrooms and administration rooms, etc. will be constructed, thereby enabling 480 elementary school students and more than 3,900 secondary school students to receive education in a safe and proper environment.

[Health centers]

- Five core health centers will be constructed, thereby enabling basic public health and medical care services to be provided to approximately 220,000 residents and allowing them to maintain their health in the same way as before the earthquake disaster.

(2) Indirect effects

[Elementary and secondary schools]

- With the planned safe and functional facilities, the education effect will improve.

[Health centers]

- With the planned safe and functional facilities, the safety and efficiency of public health and medical care services will increase and it will be possible to provide more appropriate services.

In order to maximize the benefit of the Project, the Indonesian side should undertake the following:

1) To ensure that the project facilities will be operated appropriately after the handing over, proper operation and maintenance system should be secured, providing and assigning necessary manpower without delay.
2) To ensure suitable maintenance of the facilities, an appropriate budget and revenue should be allocated and secured.

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Appendises

CHAPTER 1

BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

The earthquake on May 27, 2006 caused the enormous damage over the Yogyakarta Special Province and Central Java Province, in particular Bantul Regency. There were about 5,760 people died and 126,000 houses destroyed out of 583,000 units of damaged houses. The total damage and loss was estimated as US$3,134 million[1]. Support in the education and public health and medical sectors is limited to emergency restoration. Social services for residents are in an appalling state, while sector-separate support for the reconstruction of facilities has hardly taken place at all. Accordingly, it is necessary to immediately rebuild elementary schools, secondary schools and public health centers with a view to restoring basic services in the education, public health and medical sectors.

In the circumstances, the Government of Indonesia requested the support for the reconstruction of BHN related facilities affected by the earthquake in Yogyakarta and Central Java.

The Ministry of Education has decided to supply 420 million rupiah (approximately 5,250,000 yen) per school to 25 secondary schools (including 20 schools in Bantul Regency), and this has already been paid to five of these schools. The amount is very small and far from sufficiency, only just for construction of several classrooms. However, it has been decided not to include these five schools in the scope of the project.

Regarding elementary schools, 200 million rupiah each is to be provided to 10 schools from the Minister of Education and 320 million rupiah each to two schools from the emergency budget; also, support for individual schools will be provided by other regencys and public agencies, and a list of 100 schools has been drawn up. Various types of support are also being provided by PLN (power company), SCTV, TransTV, ManuLife and other companies and NGOs. But the support is not enough for the needs for normal education. The schools for this project have not got any support or reconstruction budget yet.

BAPPENAS (National Development and Planning Agent), the Provincial Government of DI Yogyakarta, the Provincial and Local Government of Central Java made “Action Plan of the Rehabilitation and Reconstruction for the Post-earthquake Affected Areas in the Province of Yogyakarta and the Province of Central Java, 2006.” This project has been reflected in the Action Plan.

[1] ACTION PLAN OF THE REHABILITATION AND RECONSTRUCTION FOR THE POSTEARTHQUAKE AFFECTED AREAS IN THE PROVINCE OF YOGYAKARTA AND THE PROVINCE OF CENTRAL JAVA; BAPPENAS, the Provincial Government of DI Yogyakarta, the Provincial and Local Government of Central Java, and International Partners, 2006

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

The Project is intended to implement reconstruction of the above facilities and to restore the functions and capability of public services to the state they were in before the disaster. Specific works targeted for cooperation comprise the reconstruction of seven secondary schools (99 classrooms, special classrooms and administrative rooms, etc.), two elementary schools (12 classrooms, special classrooms and administrative rooms, etc.) and five health centers providing medical treatment in Bantul Regency in the Special Province of Yoyakarta. The Government of Japan will implement these works upon examining the appropriateness and urgency, etc. of support and selecting items of high priority.

The current conditions of facilities that are in need of reconstruction and have been included in the request for cooperation are as follows:

(1) Education facilities:

Two elementary schools (12 classrooms, special classrooms and administrative rooms, etc.) and seven secondary schools (99 classrooms, special classrooms and administrative rooms, etc.) that suffered extensive damage from the earthquake

(2) Public health and medical care facilities:

Five public health centers equipped with medical care functions that suffered extensive damage from the earthquake

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

The Project target area shall be Bantul Regency in the Special Province of Yoyakarta, which suffered the greatest damage in the earthquake, and the candidate target facilities in the high priority education, public health and medical care sectors shall be as indicated in Table 2-1.

Table 2-1 Project Target Facilities

Sector	Regency	Target Facilities	Reason for Selection
Education	Bantul	7 secondary schools (99 classrooms, special classrooms, etc.) 2 elementary schools (12 classrooms, special classrooms, etc.)	All facilities are damaged and in need of reconstruction. Moreover, the schools are receiving no support from the Indonesian government, donors, NGOs or private sector; they are in urgent need of reconstruction, and the Indonesian government has strongly requested assistance for them.
Public health and medical care	Bantul	5 public health centers	All facilities are damaged and in need of reconstruction. Moreover, they are in urgent need of reconstruction, and the Indonesian government has strongly requested assistance for them.

Also, the following items shall be adopted as the basic policy for formulation of the cooperation plan:

- Target the reconstruction of facilities that were damaged in the earthquake.
- Aim for scale of facilities necessary to restore pre-disaster functions and capacity.
- Build facilities that can withstand an earthquake of a similar magnitude.
- Offer cooperation for high priority components upon taking the extent of damage, contents of temporary restoration measures, effects of recovery and the state of preparations and procedures for reconstruction on the Indonesian side into account.

2-2-1-2 Policy regarding Natural Conditions

(1) Weather

Buildings shall be provided with the following performance characteristics in order to function under conditions of high temperature and high humidity.

- Enhance heat insulation characteristics and give high waterproofing resistance to roofs.
- Install eaves, etc. for blocking out sunlight, but also incorporate natural light into buildings.
- Secure good ventilation.
- Adopts structures able to withstand strong winds.

(2) Earthquakes

Reasons for the collapse of buildings in the Yogyakarta & Central Java Earthquake cover a wide range of factors such as ground subsidence, deterioration and poor workmanship, and are not just limited to present design standards. It is difficult to set a coefficient for increasing anti-earthquake resistance in new structural design because the theoretical basis cannot be proven.

If the existing Indonesian criteria are adopted, the Central Java Region including Yogyakarta belongs to Zone 3 and the basic coefficient of seismic force is 0.07, while the importance coefficient (I) = 1.0 and the structural coefficient (K) = 1.0. Accordingly, the seismic coefficient (Cd) = C x I x K = 0.07 x 1.0x 1.0 = 0.07.

However, when the present design standard is compared to the intensity of the earthquake that actually occurred, there is concern that adopting the present design criteria in Indonesia would lead to insufficient strength. In the Project, considering that the target facilities are for the public benefit, and taking into account earthquake-proof design to ensure that the facilities do not collapse in future earthquakes, a seismic coefficient of 0.2 shall be adopted and the structural design set so that structures can withstand seismic vibration intensity of 5~6.

The horizontal load that acts on buildings during earthquakes is calculated by the following equation:

Horizontal load (H) = Building weight (W) x seismic coefficient (Cd)
Seismic coefficient (Cd) = C x I x K
Importance coefficient (I) = 1.0 (maximum value)
Structural coefficient (K) = 1.0 or 2.5
(Adopt 1.0 if frame structure is adopted and 2.5 if brace structure is adopted).

(3) Geology

The sites in the Project are dispersed over areas in which fluvial sediments form strata on the south side. These areas were largely formed by the sedimentation of ash from volcanic eruptions during the Tertiary to the Quaternary eras. Although this land could serve as bearing ground for low-rise buildings, it is not suited to supporting high-rise buildings. Although most of the facilities in the Project are single story buildings, since there are some two story buildings, ground conditions shall be surveyed and based on the results appropriate and economical design and construction methods shall be selected.

2-2-1-3 Policy regarding Social Conditions

Bantul Regency – the target area in the Project – has a population of roughly 800,000 and has the highest population density in the country. Accordingly, it suffered a lot more damage and the need to improve the living conditions of sufferers is pressing.

Table 2-2 Population and Area of Bantul Regency

	Regency	Area (ha)	Population in 2004	Density (people/ha)
1	Srandakan	421	29,271	69.5
2	Sanden	991	34,087	34.4
3	Kretek	892	31,060	34.8
4	Pundong	881	33,054	37.5
5	Bambanglipuro	1,165	42,968	36.9
6	Pandak	936	48,440	51.8
7	Bantul	1,147	58,473	51.0
8	Jetis	1,245	49,802	40.0
9	Imogiri	1,181	56,684	48.0
10	Dlingo	513	36,796	71.7
11	Pleret	872	34,263	39.3
12	Piyungan	1,417	38,081	26.9
13	Banguntapan	1,466	77,207	52.7
14	Sewon	1,372	76,436	55.7
15	Kasihan	707	78,514	111.1
16	Pajangan	263	30,271	115.1
17	Sedayu	1,023	43,804	42.8
	Bantul Regency total	16,492	799,211	48.5

The Project target area has a comparatively high level of culture and puts a lot of energy into education compared to the rest of Indonesia. In the request from the Special Province of Yogyakarta and Bantul Regency, the order of priority was 1) education and 2) public health and medical care.

In 2004, the elementary education attendance rate (net) was 93% and was the same level for both sexes. The senior high school attendance rate was 43.6% in Yogyakarta, far higher than the national average of 6.9%. In 2005, 70% of the smallest administrative units in Yogyakarta had secondary schools, although the average in Central Java Province and the rest of the country at the time was only around 30%.[2)]

The Governor of Yogyakarta Province has stated that the bottom-up approach to resolving issues based on citizen participation is well established, however, regarding construction, residents do not possess sufficient know-how or technology regarding earthquake resistance and the fact is that a similar size earthquake would probably generate similar damage.

2) Preliminary Damage and Loss Assessment, Yogyakarta and Central Java Natural Disaster; BAPPENAS, the Provincial Government of DI Yogyakarta, the Provincial and Local Government of Central Java, and International Partners, June 2006

The provincial government has a plan whereby it uses schools as evacuation centers. In this, the Coordination Department (Satkorlad PBA) and Social Bureau (Dinad Sosial), etc. play the roles of coordinator and compiler respectively. Whenever Mt. Merapi erupts, schools are used as evacuation centers for citizens. However, in the natural disaster here, the schools themselves were damaged and could no longer be used for this purpose. Conventionally speaking, schools should be designed with earthquake-proof and fireproof characteristics and be treated as disaster prevention centers.

2-2-1-4 Policy regarding the Construction Situation and Utilization of Local Contractors

(1) Construction Situation in Indonesia

The construction industry of Indonesia accounts for approximately 6% of GDP and employs between 7~8% of the working population. Moreover, almost all building materials can be procured in Indonesia, and the ratio of imported products is low. Building contractors in Indonesia either belong to the Indonesian Contractors' Association (AKI: Asosiasi Kontraktor Indonesia) or the National Builders' Union of Indonesia (Gapensi: Gabungan Pelaksana Konstruksi Nasional Indonesia). This setup is similar to the one in Japan, so registration of operators to the Ministry of Public Works is only granted following review by the CSDB (Construction Industry Development Committee). At registration, each company is ranked according to its capital, capacity, experience and owned equipment, etc., and the scale of works that a company can contract is determined by this.

Table 2-3 Ranking of Construction Operators in Indonesia

Group	Rank	Scale of Works	
Large	B (Besar)	10 billion rupiah or more	(Around 125 million))
Medium	M1 (Menengah 1)	3~10 billion rupiah	(Around 24~125 million)
	M2 (Menengah 2)	1~3 billion rupiah	(Around 12.5~24 million)
Small	K1 (Kecil 1)	0.4~1 billion rupiah	(Around 5~12.5 million)
	K2 (Kecil 2)	0.1~0.4 billion rupiah	(Around 1.25~5 million)
	K3 (Kecil 3)	100 million rupiah or less	(Around 1.25)

(Source: Indonesia Yearbook 2006)

Apart from the state-run construction companies (Caria) and some major private sector corporations, around 80% of registered operators are minor concerns belonging to the M group or smaller. Most companies are very small possessing a minimum of 15~20 employees in the M group and 5 employees in the K group. In terms of labor, companies largely depend on temporary workers from the regions and the fact is that technology is not well rooted among craftsmen and skilled workers.

Table 2-4 Number of Companies Affiliated with the Indonesian Contractors' Association

Year	1996	1997	1998	1999	2000	2001	2002
Affiliated companies	135	134	134	138	119	129	124

(Source: Indonesia Yearbook 2006)

(2) Policy regarding utilization of local operators

The basic policy for the Project is that local contractors will be utilized subject to quality control and schedule management by the Japanese consultant. However, the technical levels of local operators are very low and because many operators in the sector have no experience of design criteria and quality control, it is not possible to secure a certain degree of quality without conducting adequate management and guidance. In addition to considering a setup whereby the Japanese consultant can fully implement quality control, schedule management and guidance, care shall be taken to select local contractors that can surely implement quality control and schedule management in the Project.

(3) Condition of local consultants

The history of engineering consultants in Indonesia is relatively short. Starting from state-operated consultants based on government agent engineers from around the start of the 1970s, numerous state and private sector consultant firms have since been established. The Indonesian Consultants Association (Inkindo: Ikatan Nasional Konsultan Indonesia) is the main consultant industrial group, and the engineering department of this belongs to the FIDIC (Federation of International Consulting Engineers). However, one of the problems confronting the consulting sector in Indonesia is the absolute shortage in the number of engineers, and Inkindo only has less than 30,000 registered engineers in the whole country. In particular, because there is low social tendency to learn new technology, there are few senior level engineers who possess experience of technical tie-ups with overseas consultants, and medium level consultants who don't possess experience tend to lack basic technical capacity. In the Project, since it is intended to compile the design documents by utilizing local consultants, attention shall be paid to the necessity to implement sufficient technical guidance.

2-2-1-5 Policy regarding Operation and Maintenance Capacity of the Implementing Agent

The Project objective is the restoration of facilities that existed before the earthquake disaster. Accordingly, if the facilities remain at the same scale, it should be possible to operate and maintain them based on the same setups as before. Moreover, the government and local communities provided the human resources and funding for operation and maintenance before the disaster without any problem.

2-2-1-6 Policy regarding Setting of Facilities Grades

Facilities comprising the same type and grade of those damaged in the disaster shall be planned. However, the scale and scope of facilities shall be set at levels sufficient to restore pre-disaster functions.

2-2-1-7 Policy regarding Environment

Materials containing asbestos shall not be used or procured in the Project facilities. Moreover, when demolishing and dismantling facilities and equipment that contain asbestos, measures shall be taken to prevent asbestos from flying off. The Indonesian government will be expected to provide final disposal sites that entail no nearby environmental problems, however, if these cannot be arranged, waste materials from the demolition of existing buildings shall be temporarily stockpiled.

Concerning sanitary sewage drainage, digestion tanks with capacity equivalent to or better than existing facilities shall be installed and treated effluent shall be percolated or discharged.

2-2-1-8 Policy regarding Works Schedule

Since the Project aims to realize post-disaster recovery, it shall be planned so that the works can begin immediately.

Moreover, since it is planned to bind works contracts with local construction operators, the construction schedule shall be set in consideration of local construction conditions. Since the scope of cooperation covers a number of different sectors, it will be necessary to compile a construction schedule that spans many years in order to implement all the cooperation components, however, the work shall be planned so that they are finished as surely and quickly as possible. Moreover, because a procurement agent will manage funds and oversee contracts and payments to contractors, there will be no need to conform to accounting years.

2-2-1-9 Policy regarding Procurement Method

The medical/health equipment for the project shall be those that are generally used in usual operation in the health centers and was selected in accordance with the equipment guidelines[3)] and standard equipment list[4)] issued by the Ministry of Health of Indonesia. All the equipment can be available in the domestic market in Indonesia including imported equipment. The quality of the equipment is secured in the past performance in the health centers. The local agents for the equipment provide the spare parts and consumable supplies as well as repair services.

Equipment was selected in accordance with the equipment guidelines[5)] and standard equipment list[6)] for the health centers by the Ministry of Health of Indonesia as a standard for normal operation.

2-2-2 Outline Plan

2-2-2-1 Reconstruction Policy

The Project shall be compiled based on the following policies upon considering the request of the Indonesian government as well as the results of the assessment survey of Central Java earthquake disaster recovery support needs, site surveys and discussions.

- The scale of facilities shall be sufficient to restore pre-disaster functions and capacity.
- Rational plans that allow the functions and capacity of facilities to be effectively realized shall be adopted, without necessarily adhering to the layout of facilities before the disaster. [7)]
- Facilities shall be endowed with sufficient earthquake resistance to withstand an earthquake of similar magnitude to the one that caused the disaster.
- Local resources (materials and human resources, etc.) shall be utilized, rational designs shall be adopted, and efforts shall be made to reduce costs.

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3) PEDOMAN KERJA PUSKESMAS JILID I, DIADAKAN UNTUK KEPERLUAN DEPARTEMEN KESEHATAN RI., 1997/1998
4) DAFTER PERALATAN PUSKESMAS DALAM GAMBAR, DIRECTORAT JENDERAL BINA KESEHATAN MASYARAKAT, TAHUN 2001 (The common equipment list used by heath centers in Indonesia was published in 2001, but this is the latest version).
5) PEDOMAN KERJA PUSKESMAS JILID I, DIADAKAN UNTUK KEPERLUAN DEPARTEMEN KESEHATAN RI., 1997/1998
6) DAFTER PERALATAN PUSKESMAS DALAM GAMBAR, DIRECTORAT JENDERAL BINA KESEHATAN MASYARAKAT, TAHUN 2001(The common equipment list used by heath centers in Indonesia was published in 2001, but this is the latest version).
7) In both the school and public health sectors, since building extensions have been repeatedly implemented on limited site land, the gaps between buildings constitute corridors. In the public health sector especially, rooms inside buildings are not functionally arranged and layouts are inconvenient and inefficient.

- Quality and earthquake resistance shall be secured through conducting appropriate supervision during design and execution.
- Consideration shall be given to the landscape of the ancient capital Yogyakarta.[8)]

(1) Selection of Target Facilities

<Schools>

[Elementary schools]

In Bantul Regency, where the earthquake damage was particularly severe, the schools which have suffered critical damage and are in need of total demolishing and reconstruction were selected. In response to the request, and in order to assist communities that face difficulty because they do not have basic education facilities, the Project shall target two schools that have not been allocated recovery budget by the government nor any support of donors.

[Secondary schools]

The schools in which all school facilities have suffered critical damage and are in need of demolishing and reconstruction were selected. The Project shall target seven schools that have not been allocated recovery budget by the government.

[Public health sector]

In order to raise the effectiveness of assistance, the Project shall target five health centers in Jetis, Sewon, Pleret and Imogiri, which suffered particularly serious damage within Bantul Regency.

(2) Construction Concept

[Elementary schools]

Elementary schools shall be the general standard type based on six grades.

As the standard minimum school composition, each school shall consist of six general classrooms, a principal's room, a staff room, a storeroom, a library, an IT room, toilets and a corridor.

8) Concerning roofs, metal plating roofs are light and can be installed in shorter time, however, since roofs in Yogyakarta are almost all tile roofing, this shall also be adopted in the Project. Since the local construction method entails simply placing tiles over wooden crosspieces, roofing boards shall also be planned in the Project in order to prevent damage caused by falling pieces during earthquakes and also prevent rain leaks during high winds.

The general classrooms, each catering to 40 students, shall measure 56 m^2 (8 m x 7 m) and have an external corridor of 2 m in width.

[Secondary schools]

Depending on the number of classes that existed before the disaster, the scale of secondary schools shall be divided into three types comprising 9, 12 and 18 classes respectively, and facilities shall be provided based on the floor area of facilities before the disaster.

In designing the facilities, economic plans shall be adopted based on standard types (without conforming to previous layouts) and with a view to ensuring adequate functions and securing earthquake resistance and safety.

Sufficient facilities that enable lessons and school management to be appropriately conducted according to the number of students and classes before the disaster shall be installed. Special classrooms such as music rooms and so on shall be considered case by case according to the characteristics of each school. The number of students and classes, etc. before the disaster were as follows.

Table 2-5 Number of Students, etc. in the Target Elementary and Secondary Schools Before the Disaster

School	No. of Students	No. of Teachers	No. of Staff	No. of Classes	General classrooms	Special classrooms	Other rooms
Pleret 2 secondary school	698	46	11	18	18	6	2
Pleret 3 secondary school	339	28	8	9	9	5	18
Imogiri 1 secondary school	714	47	14	18	18	14	15
Pajangan 2 secondary school	*720*	*56*	*18*	18	18	3	6
Bantul 2 secondary school	479	38	15	13	13	10	11
Pandak 4 secondary school	412	27	6	12	11	10	5
Kretek 1 secondary school	478	41	9	12	12	5	10
Secondary schools total	3,840	283	81	100	99	53	67
Pungkuran elementary school	226	9	1	6	6	9	0
Ngasinan elementary school	145	12	1	6	6	3	2
Elementary schools total	371	21	2	12	12	12	2
Total	4,211	304	83	112	111	65	69

<Figures in italics are estimates>

(Source: Bantul Regency Board of Education, June 2006. Since the method of counting special classrooms and other rooms differs, figures differ from those obtained in the site surveys by the Study Team).

Table 2-6 Total Floor Area and Lot Area of Target Elementary and Secondary Schools Before the Disaster

School	Regency	Lot area (m^2)	Total Floor area (m^2)	Surrounding wall length (m)
Pleret 2 secondary school	Pleret	10,240	3,930	440
Pleret 3 secondary school	Pleret	9,990	4,670	406
Imogiri 1 secondary school	Imogiri	6,770	3,210	343
Pajangan 2 secondary school	Pajangan	12,960	2,260	420
Bantul 2 secondary school	Bantul	5,080	2,160	326
Pandak 4 secondary school	Pandak	7,520	1,970	288
Kretek 1 secondary school	Kretek	5,080	2,850	386
Secondary schools total		57,640	21,050	2,609
Pungkuran elementary school	Pleret	1,840	840	170
Ngasinan elementary school	Imogiri	920	400	120
Elementary schools total		2,760	1,240	290
Total		60,400	22,290	2,899

(Source: Outline measurements by the Study Team)

In accordance with Indonesian national standards, general classrooms, each catering to 40 students, shall measure 63 m^2 (9 m x 7 m). The special classrooms shall consist of science rooms, workshops, libraries, meeting rooms and IT rooms. Administrative rooms shall consist of staff rooms, principal's rooms, offices, infirmaries, counseling rooms, storerooms and guardrooms. In addition, toilets and connecting corridors shall be included.

[Health centers]

Health centers provide elementary services pertaining to public health and medical care in order to secure healthy and sanitary lifestyles for local citizens. Since health centers are divided into two types, i.e. those with hospitalization facilities and those without, these two types shall be constructed.

When constructing facilities, rather than restoring pre-disaster facilities, the primary principle shall be to store pre-disaster functions. Common specifications in accordance with the standard design stipulated by the Department of Health shall be adopted in order to secure functions, earthquake resistance and economy, and plans shall be designed according to conditions on each site.

The Project facilities shall be designed to restore pre-disaster functions and enable efficient operation. The following table shows the total floor area and lot area of health centers before the disaster.

Table 2-7 Total Floor Area and Lot Area of Health Centers before the Disaster

	Health Center	Pre-disaster scale(m^2)	
		Total floor area	Lot area
1	Jetis 1	460	1,600
2	Jetis 2	330	680
3	Sewon 2	400	1,600
4	Pleret	500	1,200
5	Imogiri 1	550	2,100
	Total	2,240	7,180

The functions of each center before the disaster, judging from the composition of employees and contents of facilities, are analyzed as follows.

Table 2-8 Analysis of Health Center Functions Before the Disaster

No.	Site	Medical Service								Public Health Service					
		Internal medicine	Dental	Dispensary	Clinical inspection	X-ray inspection	Emergency care	Minor surgery and disposition*	In-patient care	Maternal and child health	Childbirth delivery	Family planning guidance	Nutritional guidance	Inoculation	Public sanitation activities
1	Jetis 1	○	○	○	○	Δ	○	○	○	○	Δ	○	○	○	○
2	Jetis 2	○	○	○	○	×	×	○	×	○	×	○	○	○	○
3	Sewon 2	○	○	○	○	×	×	○	×	○	×	○	○	○	○
4	Pleret	○	○	○	○	×	○	○	○	○	Δ	○	○	○	○
5	Imogiri 1	○	○	○	○	×	○	○	○	○	○	○	○	○	○

Δ : Facilities exist, however, equipment and human resources are not yet available or cannot be used.

*:: Minor surgery and disposition refers to that conducted by general doctors, not that conducted by specialist surgeons.

The following table shows the facilities required in order to secure the above functions.

Table 2-9 Planned Facilities in Each Health Center

No.	Site	Medical Service Facilities								Health Service Facilities						Administrative Facilities	
		Medical diagnosis room	Dental surgery	Pharmacy and medicine store	Clinical inspection room	X-ray inspection room	Emergency treatment room	Minor surgery and treatment room	Patient room	Delivery room	Postpartum bedroom	Maternal and child health examination room	Family planning guidance room	Nutritional guidance room	Public health officer's room	Administrative rooms	Conference room*
1	Jetis 1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	Jetis 2	○	○	○	○	×	×	○	×	×	×	○	○	○	○	○	○
3	Sewon 2	○	○	○	○	×	×	○	×	×	×	○	○	○	○	○	○
4	Pleret	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○
5	Imogiri 1	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○

*: Conference rooms shall be utilized for meetings, lectures and inoculations, etc.

The scale of the above facilities shall be determined in line with scale before the disaster and based on reference to standards and criteria of the Ministry of Health. Since accommodation facilities are required for doctors and nurses, site land shall be secured, however, actual construction of the said facilities shall be left to the Indonesian side (i.e. not included in the Project).

2-2-2-2 Design Conditions

(1) Applicable regulations and standards

Design shall be implemented in accordance with the following Indonesian criteria and regulations as well as Japanese standards.

1) Indonesian building design standards

- Tata Cara Perhitungan Struktur beton untuk Bangunan Gedung (SNI 03-2847-2002) (design of reinforced concrete buildings)
- Tada Cara Perencanaan Kethanan Gempa untuk Bangunan Gedung (SNI 03-1726-2003)

- Pedoman Perencanaan Pembebanan untuk Rumah dan Gedung
  (SKBI-1.3.53.1987, UDC; 624.042)
- Pedoman Perencanaan Ketahanan Gumpa untuk Rumah dan Gedung
  (SKBI-1.3.53.1987, UDC;699.841)
- Petunjuk Perencanaan Beton Burtulang dan Struktur Dinding Burtulang untuk Rumah dan Gedung
  (SKBI-2.3.53.1987, UDC;693.55;6, 693.25)

2) Japanese building design standards

- Architectural Institute of Japan structural calculation guidelines
- Architectural Institute of Japan reinforced concrete structural calculation guidelines
- Architectural Institute of Japan load criteria
- Architectural Institute of Japan basic structural design guidelines for buildings
- Japan Society of Soil Mechanics and Foundation Engineering geological survey method

(2) Design Load

Design load is classified into, ① fixed load, ② live load and ③ short-term horizontal force (seismic load and wind load). ① Fixed load arises from the actual weight of the building frame and finishing materials, etc. ② Live load is determined according to the purpose of use of the building. Since the facilities here comprise offices and accommodation facilities, the following live loads have been adopted upon referring to criteria of the Architectural Institute of Japan.

Table 2-10 List of Live Loads

Purpose of use	Design Region		
	Beams Load for floor design	Structural frame Load for foundation design	For calculation of horizontal load during earthquake
Patient rooms and examination rooms	180 (kg/m^2)	130 (kg/m^2)	60 (kg/m^2)
Classrooms and corridors	230 (kg/m^2)	210 (kg/m^2)	110 (kg/m^2)
Roofs	0 (kg/m^2)	(kg/m^2)	0 (kg/m^2)

According to criteria of the Architectural Institute of Japan, the live load for design of structural frames (pillars and girders) and foundations is smaller than that for beam and floor design in consideration of load dispersion. Moreover, live load shall not be taken into account for roofs because tile and zinc plate roofs will be adopted and roofs will not be used as wide areas. As for ③ short-term horizontal force (seismic load and wind load), since seismic load is clearly greater

than wind load in this case, the horizontal force during earthquakes shall be adopted in the Project. Simultaneous action of seismic and wind load shall not be adopted because it would entail excessive design.

(3) Used materials

Materials that can be easily obtained in markets in Bantul Regency and Yogyakarta Special Province shall be selected. Care shall be taken to adopted appropriate design strength in line with the scale of buildings, and there shall be no utilization of special high-strength concrete and reinforcing bars, etc.

Adopted concrete strength	For structural frame design	For concrete slab on grade and concrete sub-slab
	K220 (220kg/cm^2)	K150 (150kg/cm^2)

Adopted reinforcing bars	Deformed reinforcing bars	Round bars
	BJD 32 Yield point strength (3200kg/cm^2)	BJTP24 (2400kg/cm^2) Yield point strength (2400kg/cm^2)

(4) City Planning Regulations

Since Bantul Regency has building regulations on some designated roads, caution shall be exercised regarding the health centers, which have to be built on small lot areas. As city planning regulations on health center sites, buildings must be constructed away from the centerlines of roads by at least the distances shown in the following table. Extrusion of eaves, etc. without pillars is permitted in buildings.

Table 2-11 Site Conditions by Health Center

Item		Jetis 1	Jetis 2	Sewon 2	Pleret	Imogiri 1
Type of district		Rural area	Farming village	Roadside commercial and residential area	Farming village	Rural area
Adjacent land use		Fields	Housing	Housing	Housing	Fields and former school
Shape of lot		Horizontally rectangular	Vertically rectangular	Vertically rectangular	Vertically rectangular	Horizontally rectangular
Terrain		Flat	Flat	Flat	Flat	Flat
Building regulations(*)	Building	12.0m	5.5m	15.0m	10.0m	15.0m
	Fence	6.0m	-	10.0m	5.0m	10.0m

(*) Distance from road center line

2-2-2-3 Design Outline

The buildings are designed with consideration of rationality and cost reduction of the followings:

- Setting standard types of simple grid planning
- Using the above standard types as much as possible
- Using reinforced concrete structure in viewpoint of cost, earthquake-resistance, fire-resistance and locality
- Using original low-cost finishing such as mortar - paint for walls
- Considering natural ventilation

The following table shows the content and scale of major facilities and equipment to be procured in the Project. All the Project facilities are located in Bantul Regency, Yogyakarta Special Province.

Table 2-12 Scale of Project Facilities

Sector	Facilities	Contents of Restoration	Scale
Education	Elementary schools	Reconstruction of 2 elementary schools: 12 classrooms, corridors, principal's rooms, staff rooms, reception rooms, offices, storerooms, libraries, janitor room, toilets; plumbing and sanitary installations, electric and telephone equipment	Total floor area approximately 1,743m^2
	Secondary schools	Reconstruction of 7 secondary schools: 99 classrooms, corridors, principal's rooms, staff rooms, reception rooms, offices, storerooms, infirmaries, counseling rooms, libraries, science rooms, workshops, IT rooms, assembly rooms, janitor room, toilets; plumbing and sanitary installations, electric and telephone equipment	Total floor area approximately 19,950m^2
Public health	Health centers	Reconstruction of 5 health centers and procurement of medical equipment: Facilities: examination rooms, dental clinics, pharmacies, guidance rooms, hospital rooms, etc. Medical equipment: examination tables, diagnostic instrument sets, dental units, obstetric examination tables, fetal heart tone meters, microscopes, etc.	Total floor area of facilities: Outpatient and administration building: 441m^2: 5 buildings Emergency and inpatient building: 297m^2, 3 buildings Corridor etc. Total approximately 3,144m^2, Medical equipment for 5 sites according to the standard medical equipment list

Table 2-13 Floor Area of Target Elementary and Secondary Schools (m^2)

School	Administration rooms	Classrooms	Special classrooms	Toilets	Other (stairs, connecting corridors)	Total
Pleret 2 secondary school	1,458	972	684	122	186	3,422
Pleret 3 secondary school	729	603	563	108	117	2,120
Imogiri 1 secondary school	1,458	945	585	162	148	3,298
Pajangan 2 secondary school	1,458	950	585	122	360	3,475
Bantul 2 secondary school	972	830	481	126	178	2,587
Pandak 4 secondary school	972	567	630	162	196	2,527
Kretek 1 secondary school	1,044	590	680	126	81	2,521
Secondary schools total	8,091	5,457	4,208	928	1,266	19,950
Pungkuran elementary school	480	160	222	18	80	960
Ngasinan elementary school	416	144	137	14	72	783
Elementary schools total	896	304	359	32	152	1,743
Total	8,987	5,761	4,567	960	1,418	21,693

Table 2-14 Floor Area of Target Health Center（m^2）

Health center	Out-patient+Admi.	In-patient+Emergency	Corridor etc.	Total
Jetis 1	441	297	0	738
Jetis 2	441	0	0	441
Sewon 2	441	0	0	441
Pleret	441	297	36	774
Imogiri 1	441	297	12	750
Total	2,205	891	48	3,144

Table 2-15 Health Centers: Necessary Rooms and Scale of Outpatient and Administration Buildings

Planned rooms			Average scale(m^2)	Planned scale($m^{2)}$	Need and basis for setting scale
Floor	Room	Dept			
1st	Reception, accounts and records store		10.17	12.00	Patients' reception and collection of fees
	Maternal and child health guidance room		19.38	12.00	Maternal and child health inspection and guidance
	Family planning guidance room		10.55	12.00	Also used as a midwife's workroom
	General examination room		13.04	12.00	Examination of patients, standard size
	Treatment room			12.00	Bandages, incisions, stitches, blood sampling
	Clinical inspection room		11.20	12.00	Work space for 1 inspector
	Pharmacy		10.92	12.00	Mixing space for 1 pharmacist
	Medicine store		9.00	8.00	Average scale
	Dental surgery		15.05	18.00	Give consideration to installation of a dental unit and dental craft table
	Waiting room			48.00	Also used as the corridor
	Toilets			16.00	For staff and patients. Separate total for men and women
	Corridor			12.00	Traffic space comprising half the waiting room, corridor, stairs, entrance and porch is 75 m^2, accounting for 1/3 the total area (standard value).
	Stairs			18.00	
	Entrance hall			12.00	
	Subtotal			216.00	
2nd	Office		16.08	12.00	Space for 4 office staff
	Director's room		10.50	12.00	Office desk and reception corner
	Doctors' room		18.67	12.00	Office work, changing and rest area for 2 doctors
	Reception room		19.50	0	Can be handled in the director's room and meeting room
	Meeting room		33.30	36.00	Multipurpose use for meetings and assemblies, etc.
	Inoculation room		10.00	12.00	Also used as a midwife's workroom
	Nutrition guidance room		8.50	12.00	Also used as a workroom for the nutritionist
	Public sanitation guidance room		12.00	12.00	Also used as a work room for the public health inspector
	Kitchenette		5.69	4.00	Average size
	Equipment store		6.67	12.00	Scale for storage of equipment and documents and other modules
	General storeroom		12.58		
	Shelves			2.00	Remainder as a result of the room arrangement
	Corridor and hall			56.00	Traffic space is 74 m^2, accounting for 1/3 the total area (standard value).
	Stairwell			18.00	
	Subtotal			216.00	
Total				432.00	
1st floor		Porch		9.00	
Grand total				441.00	

Average scale = simple average of hospital rooms, rooms and existing facilities of Type-2 and Type-4 250 m^2 type facilities according to health center reference drawings by the Department of Health in 1999

Table 2-16 Health Centers: Necessary Rooms and Scale of Emergency and Inpatient Buildings

Planned rooms			Average scale(m^2)	Planned scale(m^2)	Need and basis for setting scale
Floor	Room	Dept			
1st	Delivery room	Obstetric	11.17	16.00	Delivery table, wash basin, work bench
	Post partum bed room			16.00	2-bed room, 8 m^2/bed
	Emergency reception and rest room	Emergency		12.00	Rest beds
	Emergency treatment		12.25	36.00	Minimum required scale for examination, sedation, observation, treatment and minor surgery. Common space is more efficient.
	Treatment and minor surgery room		16.00		
	Doctors' and nurses' room	Wards	11.50	16.00	Equipment space, ward treatment preparation, recording and standby space
	4-bed patient room		51.63	24.00	6 m^2/bed: minimum dimensions
	6-bed patient room			36.00	6 m^2/bed: minimum dimensions
	Kitchen		10.13	12.00	Sink and cooking top, dish cart, shelves
	Laundry room			12.00	Laundry sink, workbench
	Linen closet			4.00	Storage for sheets, etc.
	Waste treatment room		9.72	4.00	Treatment of patients' waste materials, equipment washing
	Patients' toilets and bathroom	Common	11.75	16.00	2 x (toilet + bathroom) booths
	Staff toilets and bathroom			8.00	1 x (toilet + bathroom) booth
	Corridors and hall			60.00	Traffic space is 81 m^2, accounting for 1/4 the total area (minimum value).
	Entrance hall			12.00	
	Subtotal			288.00	
	Porch			9.00	
Total				297.00	

Average scale = simple average of patient rooms, rooms and existing facilities of Type-2 and Type-4 250 m^2 type facilities according to health center reference drawings by the Department of Health in 1999

(1) Facilities structure and outline finishing

The structure and outline finishing of facilities are as follows:

[Elementary and secondary schools and health centers]

- Structure : reinforced concrete structure, spread foundations, single story (2 stories in parts: 2 elementary schools, 2 secondary schools)
- Walls : concrete block masonry, mortar coating on both sides, paint finish
- Floors : reinforced concrete slab on grade 15 cm thick, with tiling
- Roof structure : (schools) reinforced concrete beams, steel base
  (health centers) steel truss, wooden base

- Roof finishing materials : roofing boards, asphalt roofing, hooked roof tiles

Water supply equipment

Wells : closed type wells with submersible pump for lifting water to elevated tanks. Schools shall have shallow wells, while health centers shall have deep wells in consideration of sanitation.

Elevated water tanks : first floor water supply height 6 m, second floor supply height 10 m; tanks shall have capacity greater than the average hourly consumption.

Sanitary sewage drainage and treatment equipment

Toilet sewage and general domestic wastewater shall be drained in separate systems. The former shall basically be treated in septic tanks, while the latter shall be directly fed to percolation pits and percolated underground. As the wastewater treatment method, septic tanks, which are the common facility locally, shall be installed and ground percolation and natural discharge adopted.

Toilets

Water tanks shall be provided for each booth in order to enable flush toilets.

Electric equipment

Power lines

Power shall be drawn in from existing overhead lines (low voltage) on frontal roads to lead-in columns and conveyed to distribution panels inside buildings.

Lighting equipment

Electric lights shall basically be installed in each room and the required light intensity shall be secured.

Outlets

Basically every room will be equipped with electrical outlets.

Telephone equipment

One telephone line (the existing line) shall be drawn in. Handsets will not be included and prepared by Indonesian side.

(2) Outline of equipment

[Elementary schools and secondary schools]

Since there are large numbers of desks and chairs in usable condition and other supporting scheme will be possible, no equipment shall be included in the Project.

[Health centers]

At Jetis 2 and Sewon 2, all standard equipment for health center shall be procured because everything was destroyed in the disaster. At Jetis 1, some equipment (dental chair, centrifuge and microscope) was not destroyed by the earthquake, however, they exceeded economic life and were damaged during transferring. Therefore all standard equipment shall be procured at Jetis 1 also. Blood test equipment should be included in the standard equipnment.

At Pleret and Imogiri 1 health centers, since equipment has survived in usable condition, it has been omitted here.

2-2-2-4 Structural Plan

(1) Outline of existing structures

The targeted secondary schools and health centers are relatively new buildings that were constructed around 1985, however, judging from the existing standard drawings, earthquake-proof performance has hardly been taken into consideration at all. Figure 2-1 shows the standard cross-sectional drawing for Indonesia, while Figure 2-2 shows the bar arrangement drawing for each member. As is shown in Table 2-16, even compared to the minimum standards under the Japanese building standard law, the diameter of main reinforcement bars and strength of shear reinforcement bars, etc. are extremely deficient.

Table 2-17 Comparison of Indonesian Standard Drawings and Japanese Building Standard Law

Member		Indonesian standard drawings	Minimum standard in Japanese building standard law
Pillars	Main reinforcement diameter	Normal round bars, diameter 10mm	Deformed reinforcing bars diameter 13mm or more
	Main reinforcement quantity	4-φ10 (cross sectional area =3.14cm^2) → 0.78%	0.8% or more
	Shear reinforcement	Normal round bars: diameter 6mm/interval 150mm	Normal round bars 9mmor more, interval 100mm or less
	Minimum diameter	20cm→1/187 the distance between fulcrums	1/150 the distance between fulcrums; therefore at least 25 cm is needed.
Beams	Main reinforcement	Normal round bars: diameter 10mm	Deformed reinforcing bars diameter 13mm or more
	Shear reinforcement	Normal round bars: diameter 6mm	Normal round bars: diameter 9mm or more

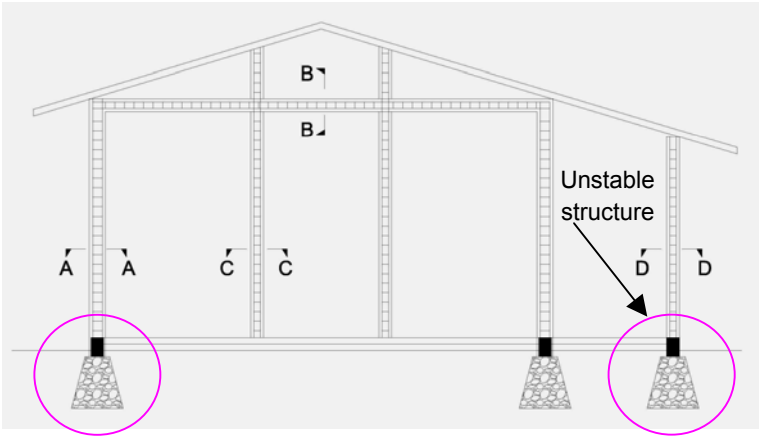


Figure 2-1 Standard Cross Sectional Bar Arrangement Drawing

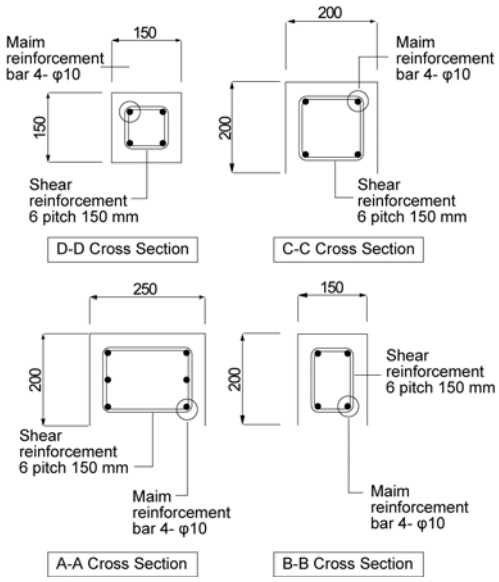


Figure 2-2 Member Bar Arrangement Drawings

Moreover, the foundations that support the buildings are not rigid structures but rather simple structures comprising piled stones, and these are extremely vulnerable regarding the horizontal force of earthquakes. Also, pillars and beams are not connected in parts of the structures, and this again contributes to structural instability. Because there are no footing beams and overall rigidity is fragile, buildings are greatly deformed in earthquakes. Footing beams play a major role as may be gathered from Figure 2-12, which shows the differences in building deformation between the case where footing beams are installed and the case where they are not installed.

Deformation of the building structure in the case where footing beams are not installed is between 3.5~4.0 times greater than in the case where they are. Assuming a single story building, in the case

where an earthquake of 4~5 on the Japanese seismic vibration scale occurs, if the Indonesian standard drawing criteria are adopted, the amount of deformation on pillars will be 3~4 cm, meaning that the overall structure will be completely destroyed.

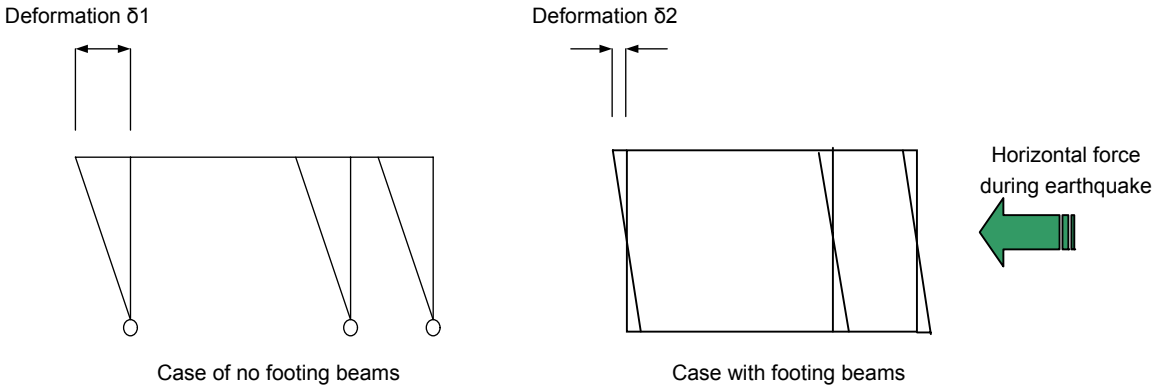


Figure 2-3 Deformation of Buildings

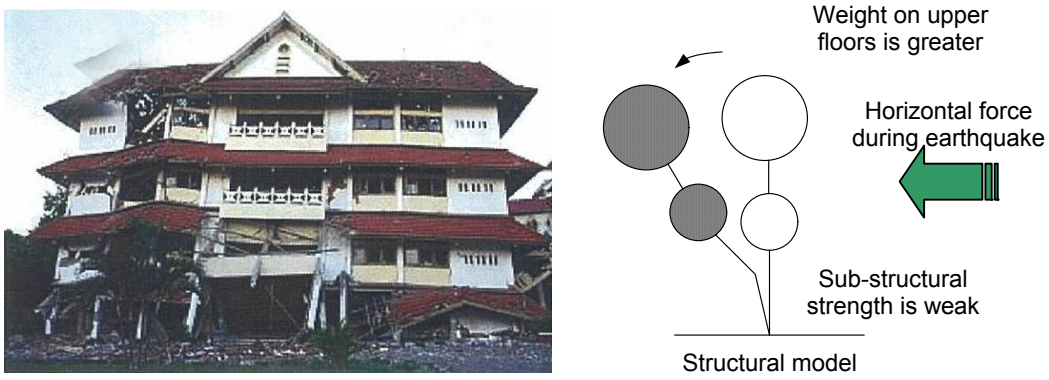
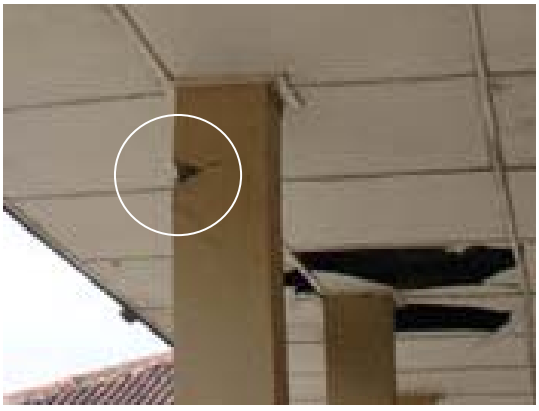


Figure 2-4 Collapsed Building of the University of Economics (Bantul Regency)

The substructure is weak in relation to the load on upper floors and the balance of structural strength is poor. Moreover, poor quality of concrete contributed to the collapse.

Bantul 2 Secondary School: pillars and beams are not linked, making the structure unstable.



Bantul 2 Secondary School: shearing cracks caused by insufficient shear reinforcement bars on pillars

(2) Basic policy

The facilities targeted by this emergency reconstruction assistance are broadly divided into three types: ① buildings that have been completely destroyed, ② buildings that retain their original form but have badly damaged skeletons and are in a dangerous state, and ③ buildings that appear to have only light damage on the surface but are badly damaged in parts. Concerning ① and ②, since it would clearly be dangerous not to totally rebuild, these shall be demolished and then reconstructed. As for type ③, it is thought that dangerous cracks have occurred in main structural members, there is sinkage of underground foundations that are invisible to the eye, and there are numerous areas of structural damage to finishing materials. Accordingly, it is thought that implementing only partial reinforcements would create major risk and not guarantee structural safety in the event of future earthquakes; moreover, taking into consideration the mental security of children and teachers and securing of safe learning environments, all damaged buildings shall be removed and replaced with new structures.

(3) Selection of structural forms

Three types of structure can be considered for facilities of the scale concerned: ① reinforced concrete structure, ② wooden structure, and ③ reinforced concrete block structure, etc. Concerning ②, this is combustible and thus inappropriate for building public facilities; moreover, in buildings that need to secure relatively large spaces such as classrooms and so on, it is not possible to secure sufficient earthquake resistance with wood. As for ③ reinforced concrete block structure, this is inappropriate because classrooms (63 m^2) and special classrooms (105 m^2) greatly deviate from the criteria prescribed in Japanese building standard law, which requires that the horizontal projected area of parts surrounded by walls be 60 m^2 or less. As a result, it has been decided to adopt reinforced concrete structure pillars and beams in the Project.

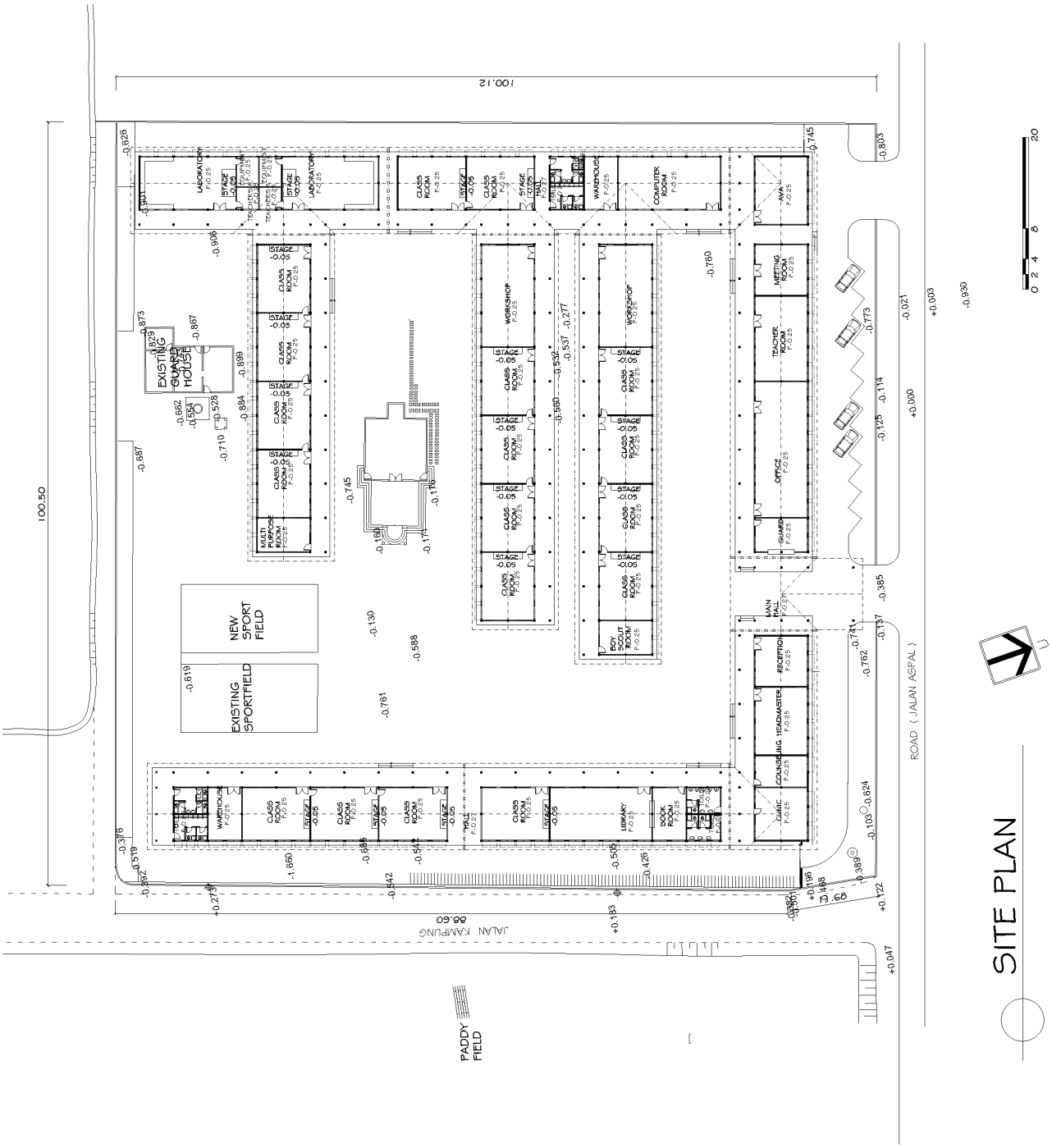
(4) Important points to consider in earthquake-proof design in the Project

The following table shows important points to consider regarding earthquake-proof design in the Project.

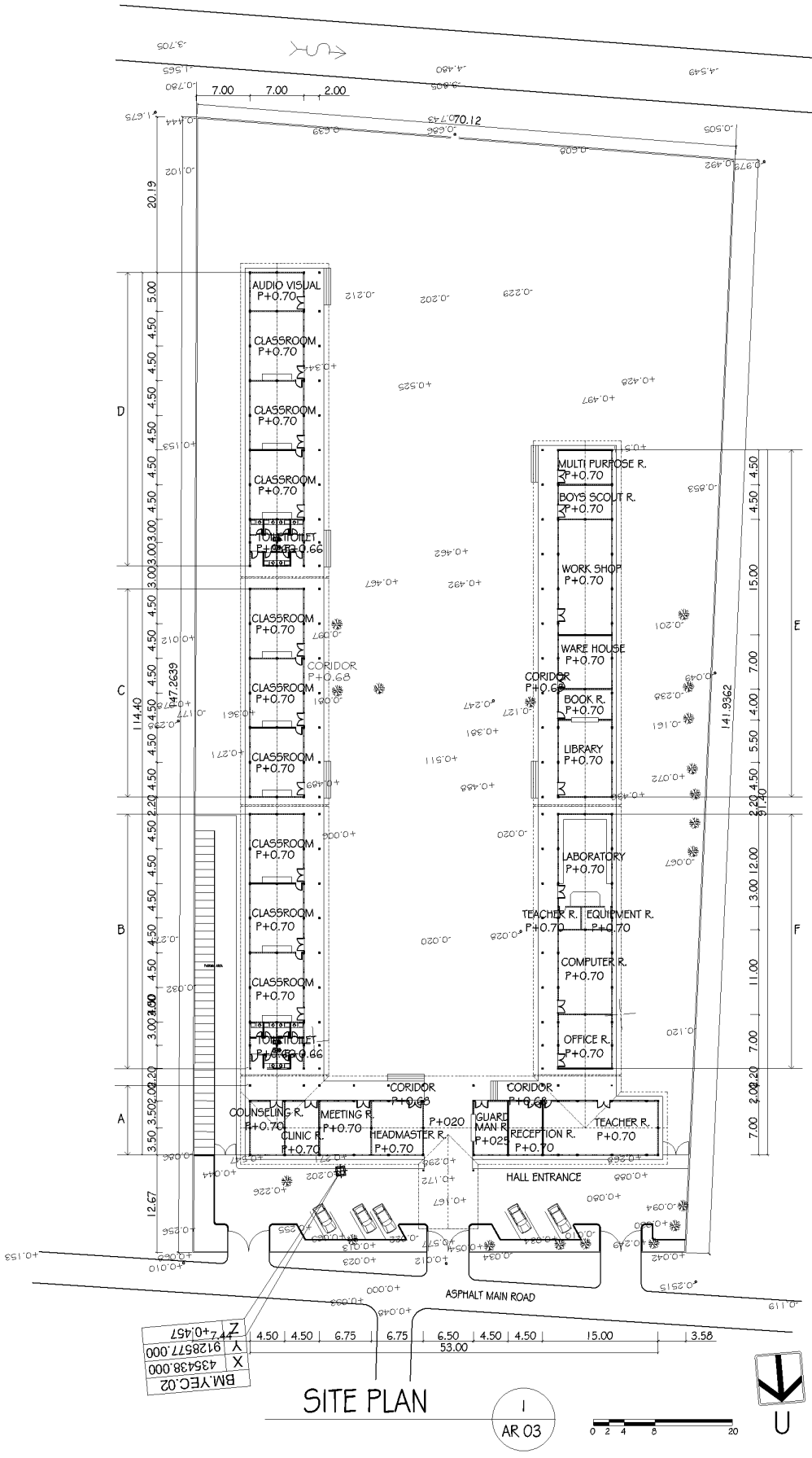
Table 2-18 Important Points in Earthquake-Proof Design

	Region	Existing structures, Indonesian standards	Improvements in the Project
1	Foundations	Almost all the existing low-level structures only have simple concrete foundations placed on piled stones. In this state, heavy structures cannot be supported and uneven subsidence is apt to occur; moreover, damage in the event of earthquakes will be great.	Apply reinforced concrete foundations corresponding to ground bearing force and the scale and weight of buildings.
2	Footing beams	Existing structures either do not have footing beams to connect foundations, or they are small section fragile structures. In this state, buildings do not have enough overall rigidity and major deformation will be caused by horizontal force during earthquakes.	Apply footing beams that have proper cross sectional dimensions like foundations in order to raise building rigidity, mitigate building deformation caused by horizontal force during earthquakes, and make sure that stress doesn't concentrate on the main structures of pillars and beams.
3	Pillars and beams	Pillar and beam sections are small, while some buildings only have 6 mm ordinary bars for main reinforcement. Moreover, intervals between shear reinforcement bars are too large to withstand horizontal force during earthquakes.	Implement structural analysis and arrange deformed reinforcing bars with sufficient resistance against earthquakes. Also, appropriately set the interval between shear reinforcement bars.
4	Reinforcement bars	The mutual anchorage length of main reinforcement bars in main structures such as pillars, beams and foundations is insufficient, so there is frequent cracking of joints during earthquakes.	Specify the minimum anchorage length, etc. of main reinforcement bars in each member on the standard design and specifications, and conduct full checks in works supervision.
5	Structural fame	Reinforced concrete frame structure (frame structure of pillars and beams) is not formed in some areas.	Adopt structural fames which ensure that the main structural parts of buildings, i.e. foundations, footing beams, pillars, beams and floors, possess sufficient mutual rigidity.

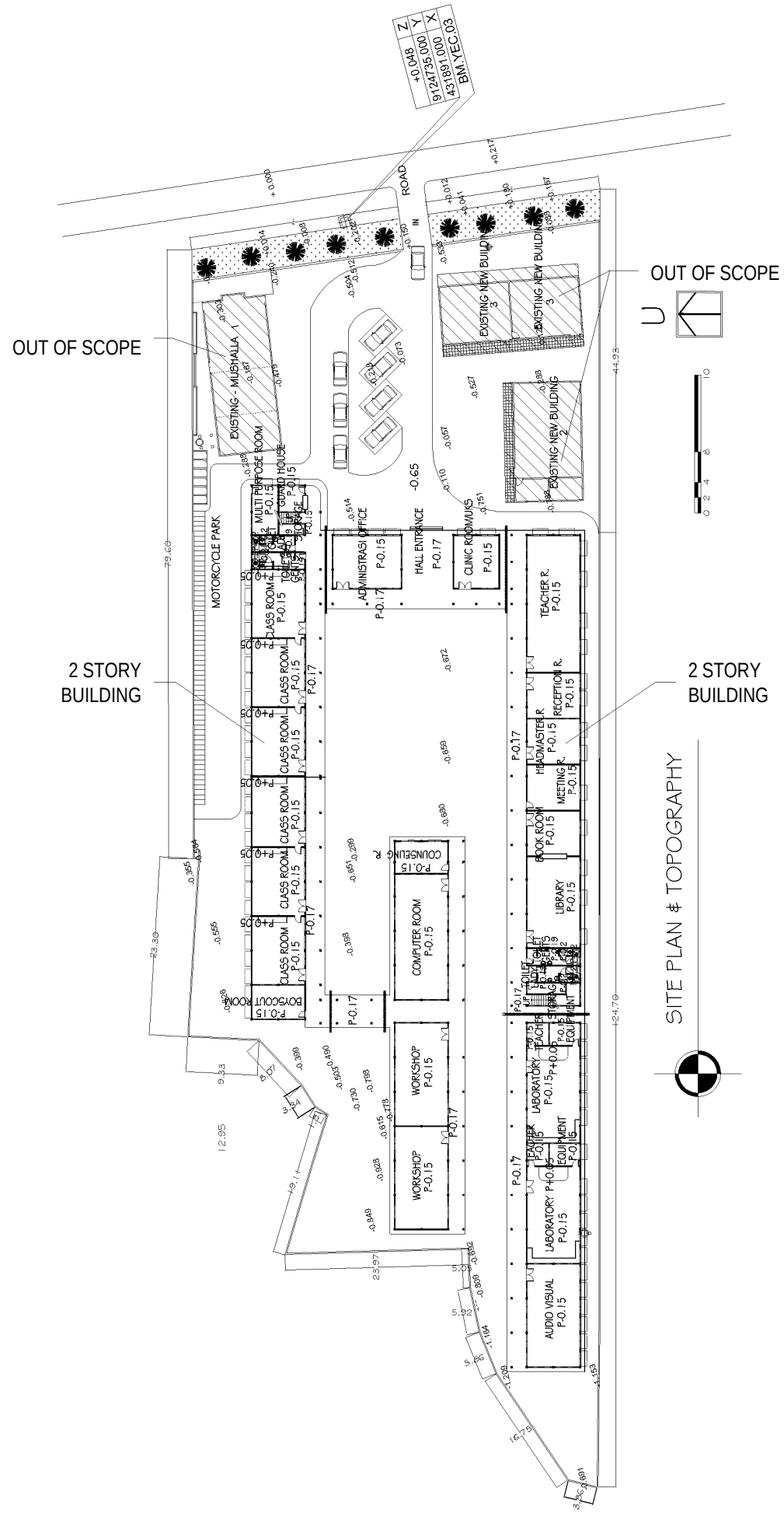
2-2-3 Outline Design Drawings



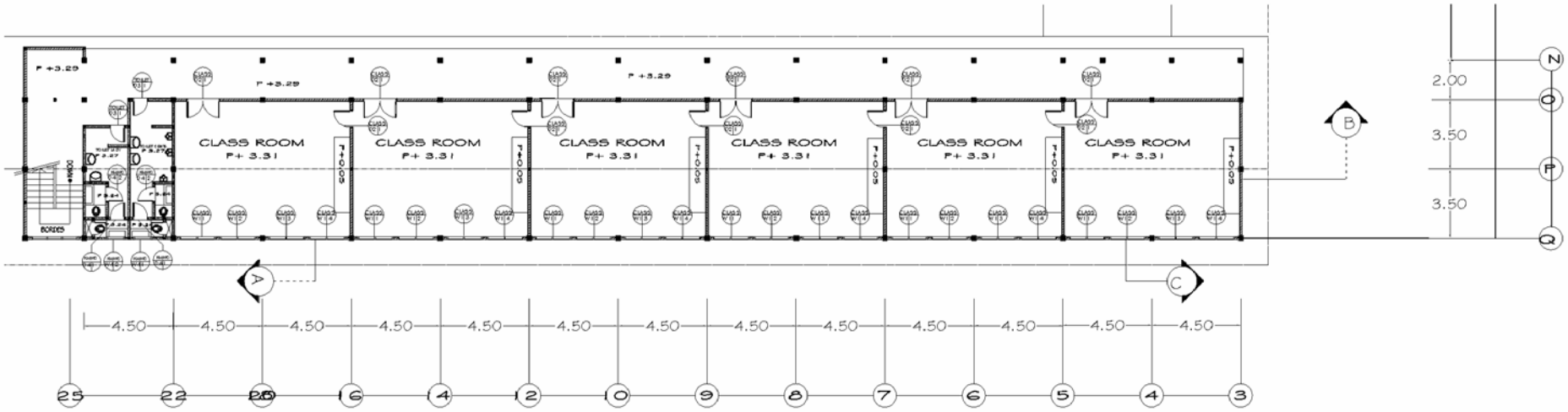
SITE PLAN
PLERET 2 SECONDARY SCHOOL



SITE PLAN
PLERET 3 SECONDARY SCHOOL

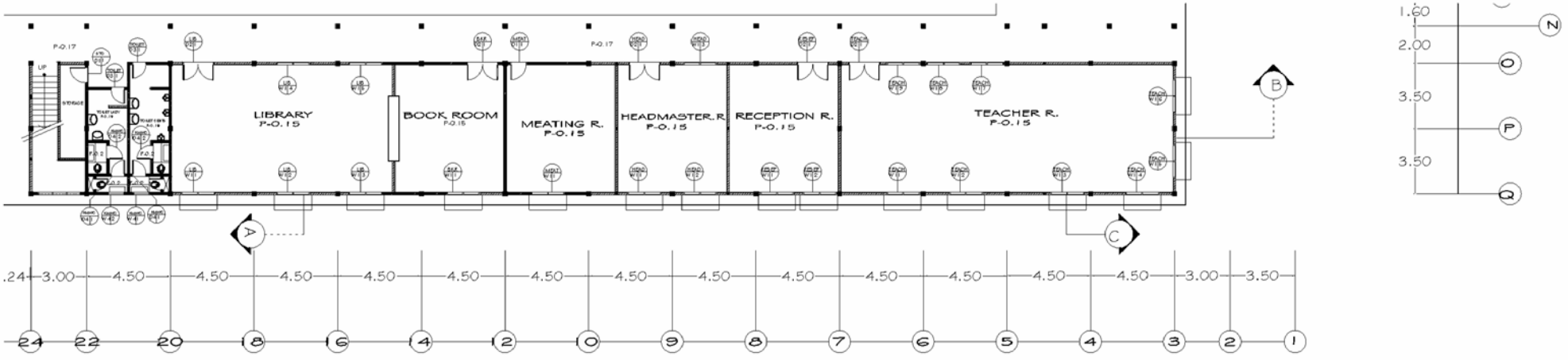


SITE PLAN
IMOGIRI 1 SECONDARY SCHOOL



SECOND FLOOR PLAN

CLASSROOM BUILDING 2ND FLOOR PLAN

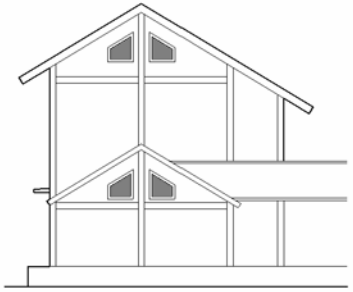


GROUND FLOOR PLAN

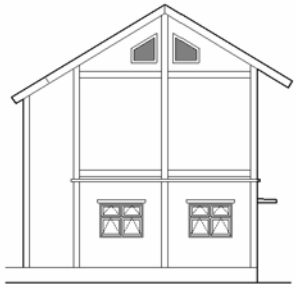
CLASSROOM BUILDING 1ST FLOOR PLAN

IMOGIRI 1 SECONDARY SCHOOL

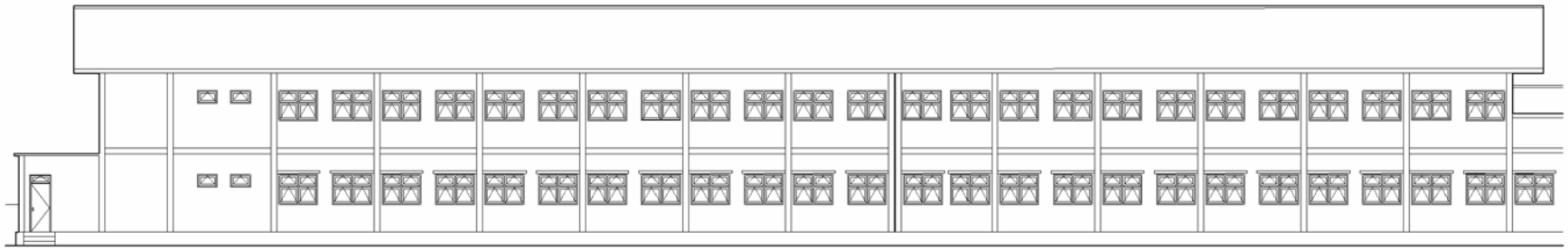
0 2 4 6 8 10 m



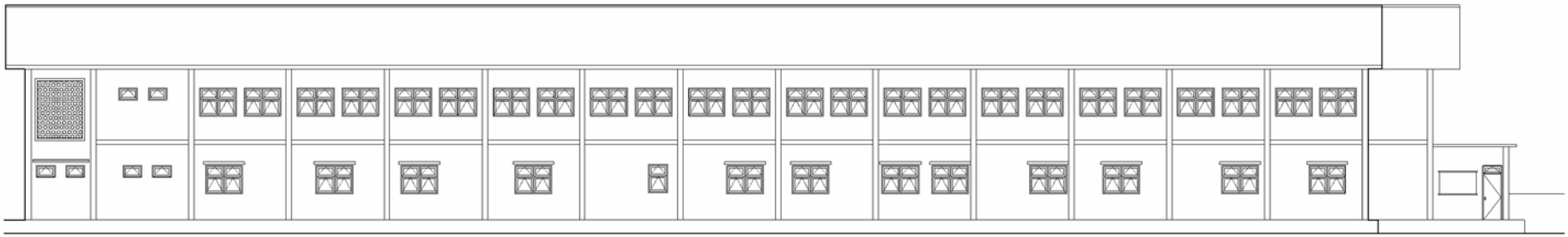
BACK ELEVATION



FRONT ELEVATION



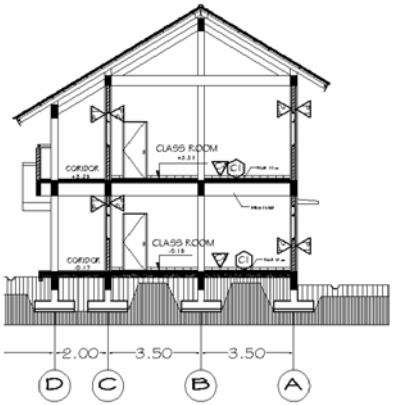
SIDE ELEVATION - R

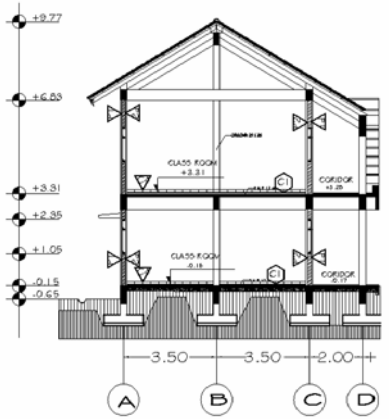


SIDE ELEVATION - L

0 2 4 6 8 0m

CLASSROOM BUILDING ELEVATION

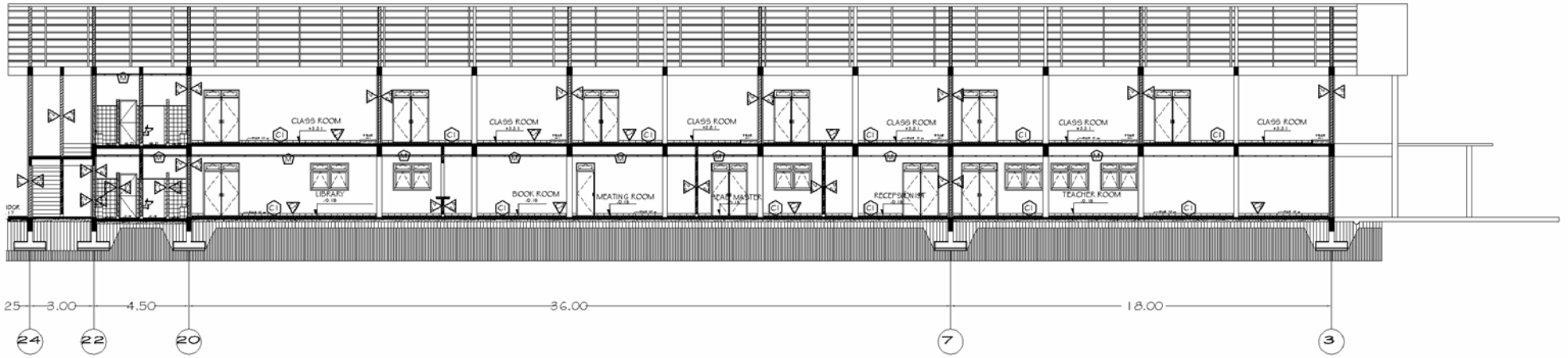




SECTION A - A'

SECTION C - C'

CLASSROOM BUILDING SECTION



CLASSROOM BUILDING SECTION

SECTION B - B'

0 2 4 6 8 10 m