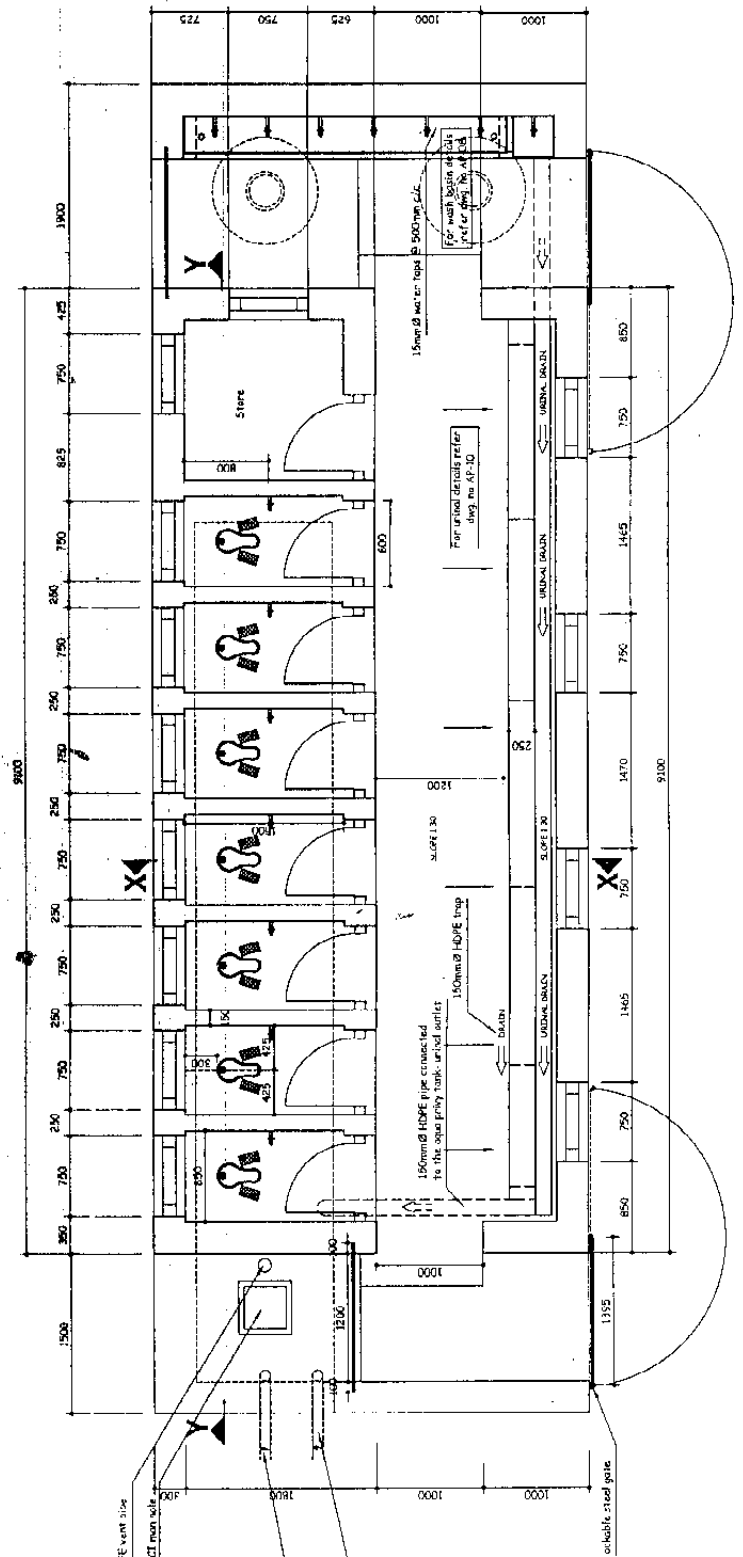


Project No.	Design Type	Modified Design	
Building	Aqua Privy Toilet	2/3/2/063	
Title	PLAN for boys	15/06/99	
JL Director	SPBD	Date	
Engineer	Karma Sonom	Checked	S.HIRAYAMA
Drawn	Karma Sonom	Scale	1:50
Index No.	AP-01(A)		

標準設計図  
7 水洗トイレ(男子) 平面図



PLAN

100mm Ø HDPE vent pipe  
500x500mm CT from side

100mm Ø HDPE (class 20) pipe  
connected to the soak pit from the  
top of the open privy tank

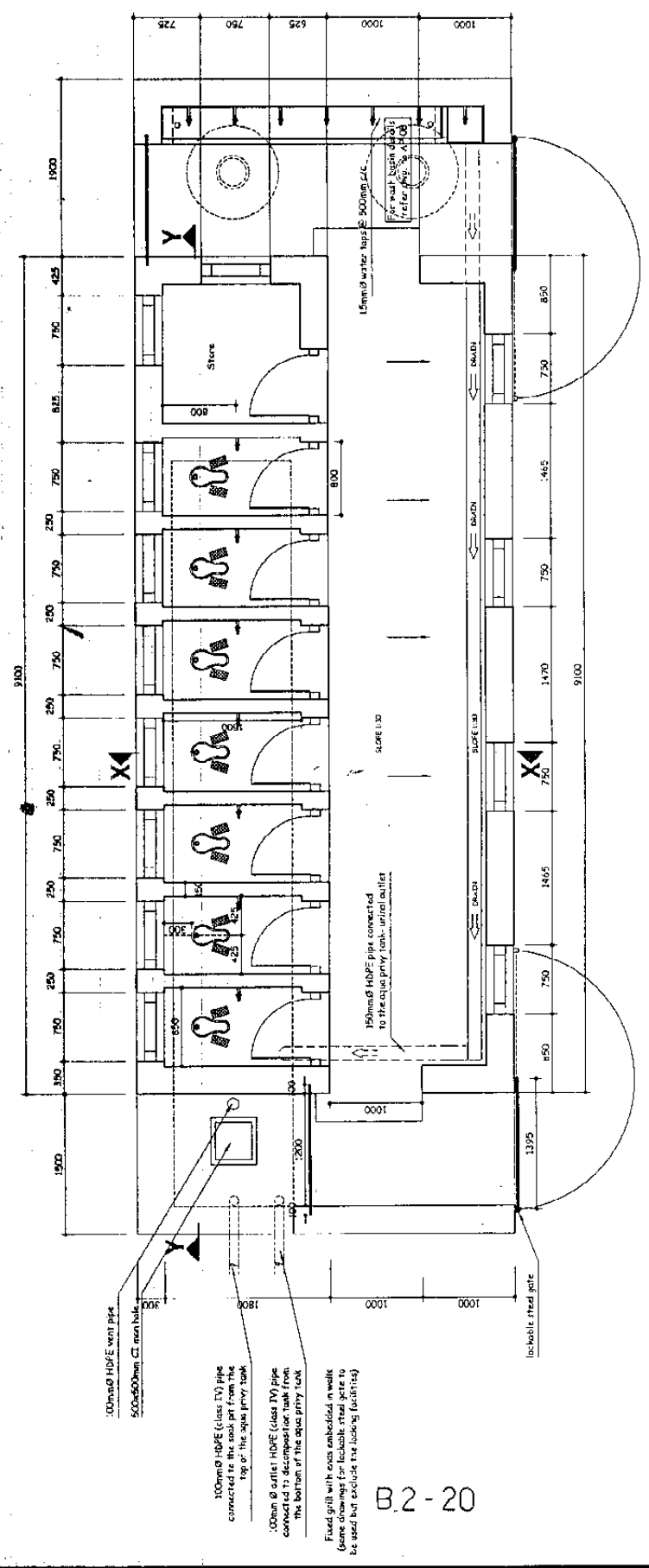
100mm Ø vent HDPE (class 20) pipe  
connected to decomposition tank from  
the bottom of the open privy tank

Fixed grill with axle embedded in walls  
(same drawings for jackable stove gate to  
be used but substitute the locking facilities)

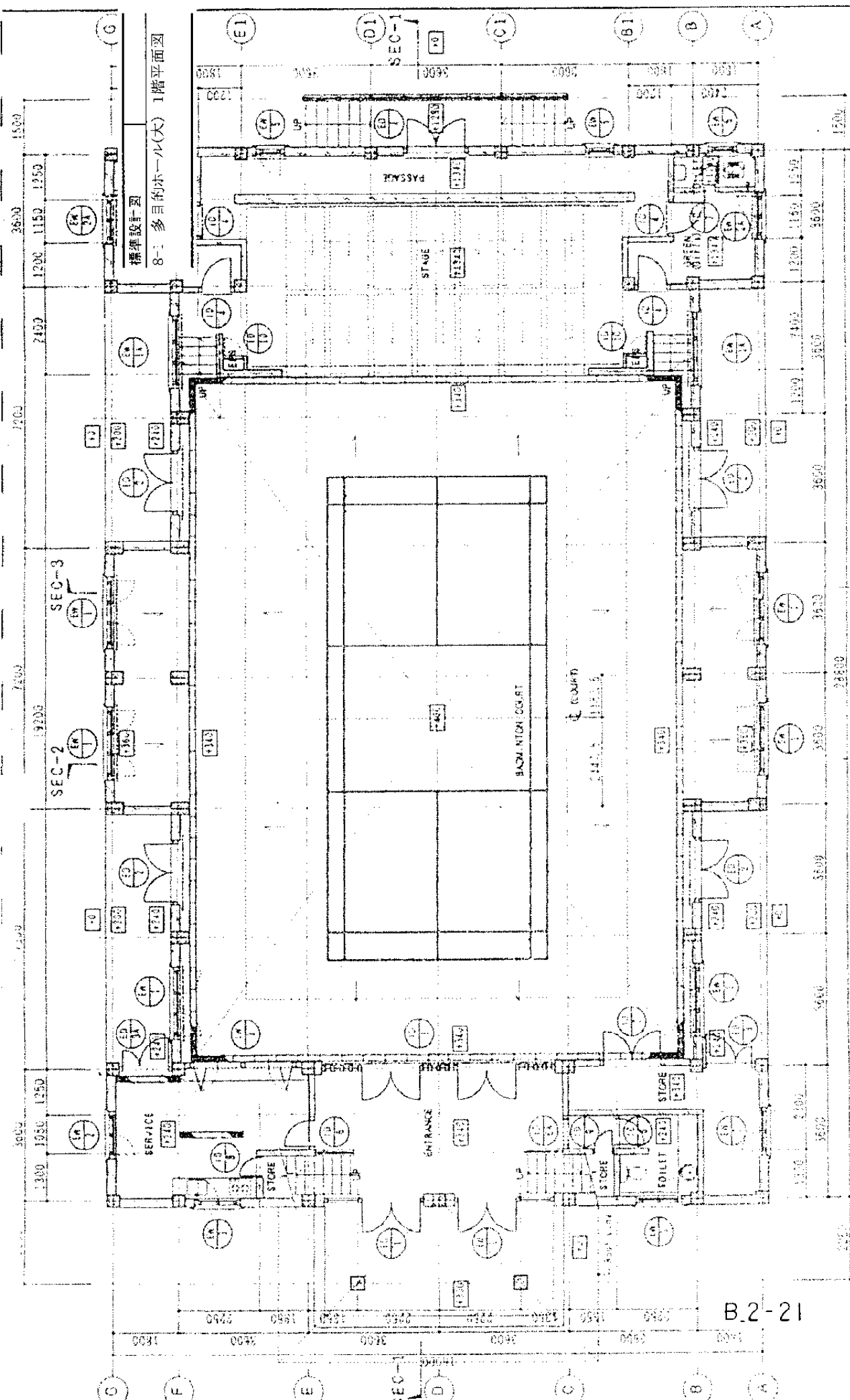


Project No.	Design Type	Title	
Engineer	Building Aqua Privy Toilet	PLAN for girls	
Off-In-Charge	Revision	Checked	Scale
SPBC	03/2/2003	S.HIRAYAMA	1:50
Chief, PHE Cell	UNICEF, Representative	Drawn	Checked
15/06/99	Date	K.SOHAM	S.HIRAYAMA
Index No	AP-01(B)		

標準設計区  
7 水洗トイレ(女子) 平面図

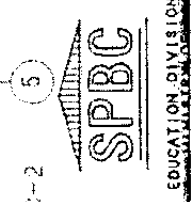


PLAN



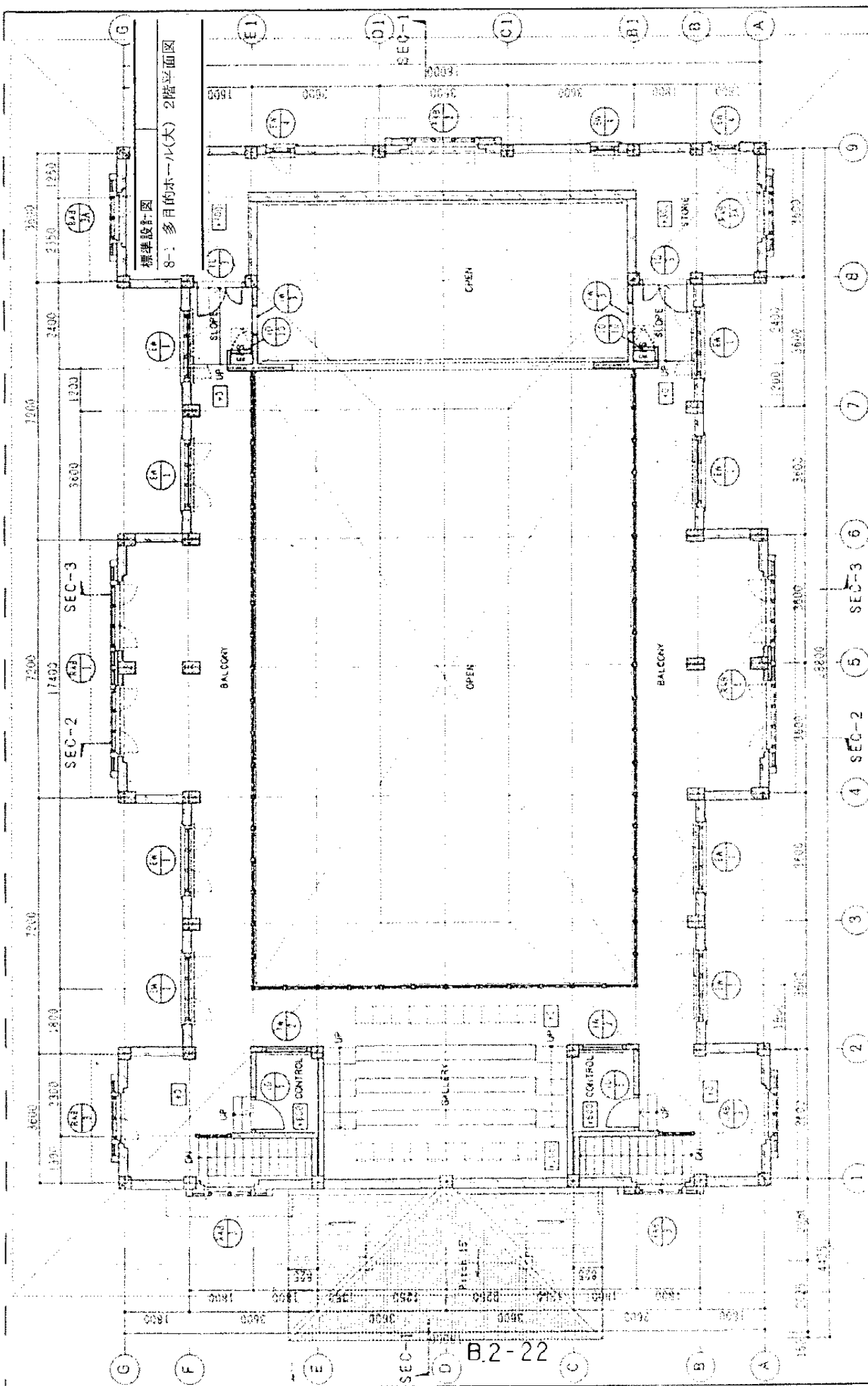
標準設計図  
8-1 多目的ホール(大) 1階平面図

PROJECT NO:	BUILDING: S.E.P. (MULTI-PURPOSE HALL)	DWG NO:	AR-1
TITLE:	GROUND FLOOR PLAN	REVISION:	
MINISTER OF EDUCATION DIVISION	20/10/1979	INDEX NO.:	



LEGEND	
	R.C.C.
	Brick
	Timber
	Water to Carina

B.2-21



標準設計図  
8-1 多目的ホール(大) 2階平面図

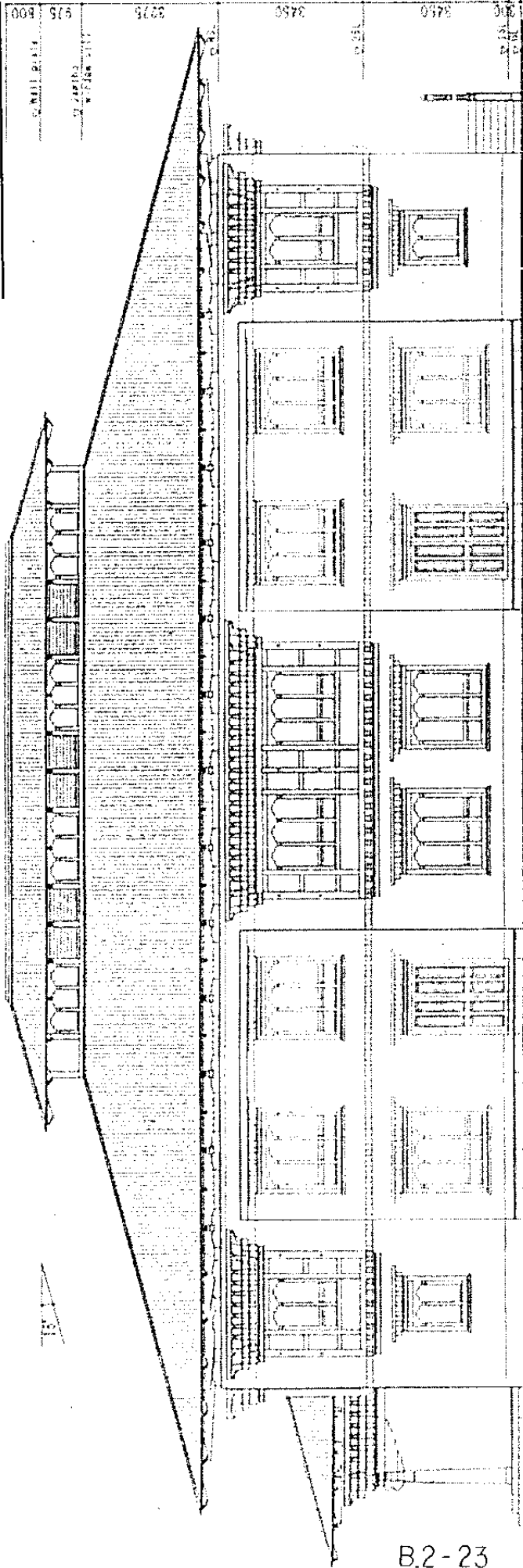
PROJECT NO:	BUILDING: S.E.P. (Multi Purpose Hall)	DWG. NO.:	AR-2
TITLE:	FIRST FLOOR PLAN	PROJECT NO. 1	
		DATE:	20/10/1988
		REVISION:	



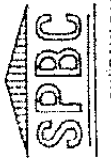
B.2-22

標準設計図

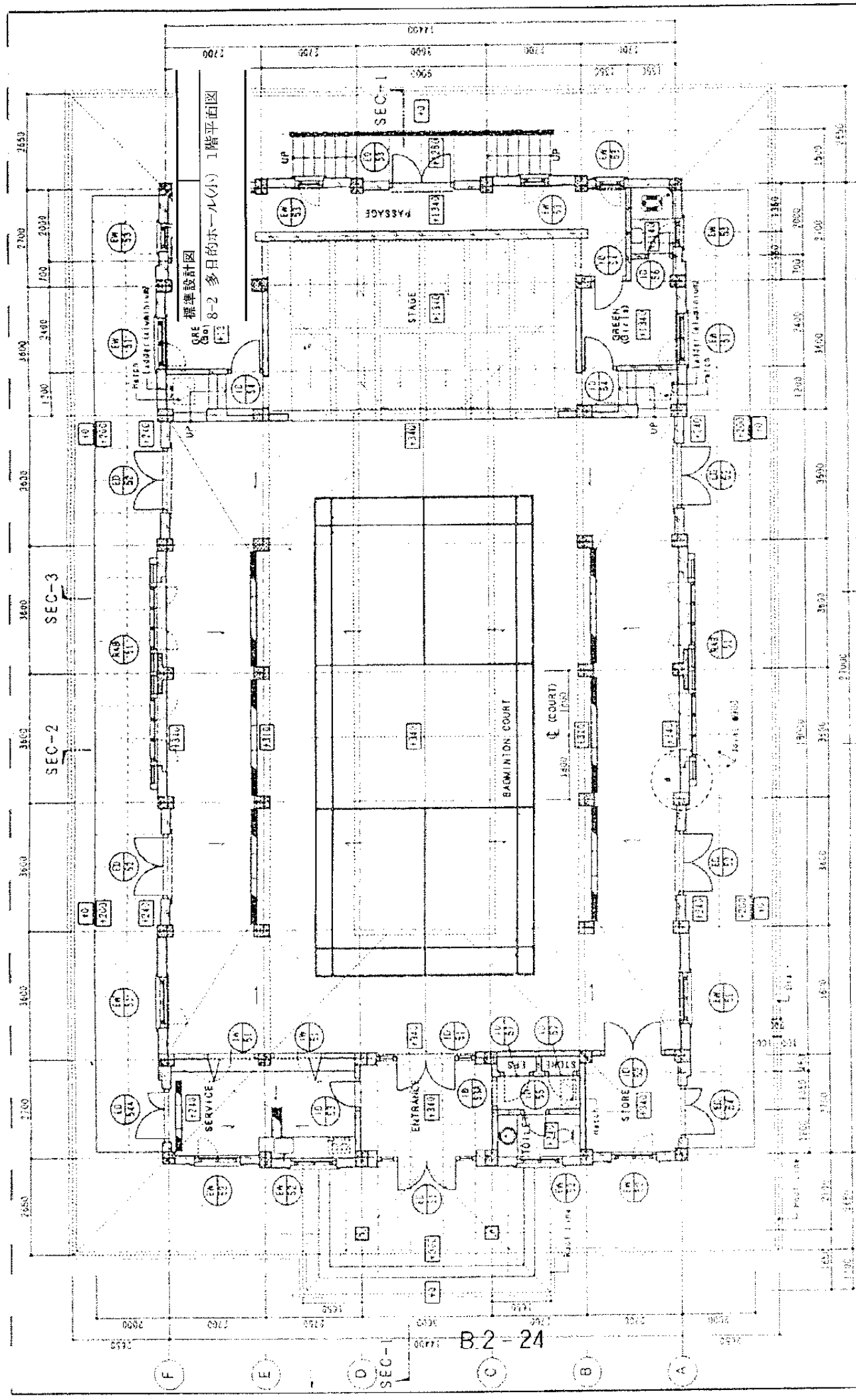
8-1 多目的ホール(大) 立面図



B.2-23



PROJECT NO:	BUILDING: S.E.P. (Multi Purpose Hall)	DWG NO.:	REVISION
	TITLE:	AR-7	
		INDEX NO.:	



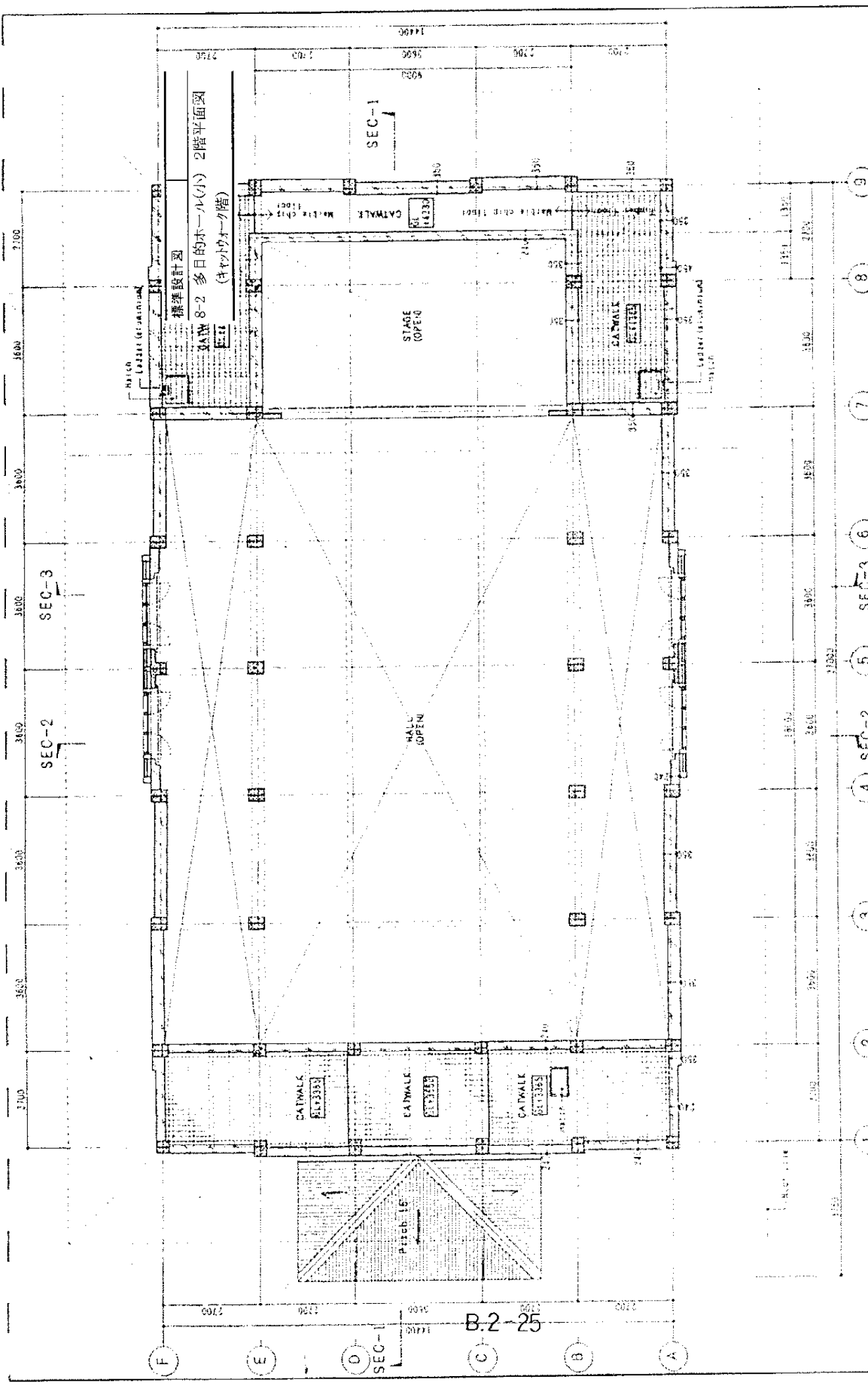
標準設計図  
8-2 多目的ホール(小) 1階平面図

PROJECT NO.:	SEC-3 (6)
BUILDING: S. E. P. (N. P. N. Small Type)	
TITLE:	GROUND FLOOR PLAN
INDEX NO.:	AR-1
REVISION	



- 1
- 2
- 3
- 4 SEC-2
- 5
- 6 SEC-3 (6)
- 7
- 8
- 9

LEGEND	
SS	N. S. C.
WB	W. B. C.
MB	M. B. C.
DB	D. B. C.
LB	L. B. C.
SB	S. B. C.
CB	C. B. C.
FB	F. B. C.
GB	G. B. C.
HB	H. B. C.
JB	J. B. C.
KB	K. B. C.
LB	L. B. C.
MB	M. B. C.
NB	N. B. C.
OB	O. B. C.
PB	P. B. C.
QB	Q. B. C.
RB	R. B. C.
SB	S. B. C.
TB	T. B. C.
UB	U. B. C.
VB	V. B. C.
WB	W. B. C.
XB	X. B. C.
YB	Y. B. C.
ZB	Z. B. C.



REVIS. ON

DWG. NO. :	AR-2
INDEX NO. :	

BUILDING: S. P. (K. P. K. Small Type)	PROJECT NO. :	SEC-3 (6)
TITLE:		
CATWALK FLOOR PLAN		

PROJECT NO. :	SEC-3 (6)



PROJECT NO. :	SEC-2 (4)

PROJECT NO. :	SEC-3 (5)

PROJECT NO. :	SEC-2 (3)

PROJECT NO. :	SEC-2 (2)

PROJECT NO. :	SEC-2 (1)

LEGEND	

B.2-25

EDUCATION DIVISION  
MINISTRY OF  
HEALTH AND EDUCATION



PROJECT NO:

BUILDING: E. P. (M. P. H. UNIT TYPE)

DWG. NO.

AR  
-5

FRONT ELEVATION-1  
SIDE ELEVATION-1

INDEX 1

ARCHITECT  
TAKASHI

ENGINEER  
TOMIYAMA

DRAWN  
TAKASHI KUMAKURA

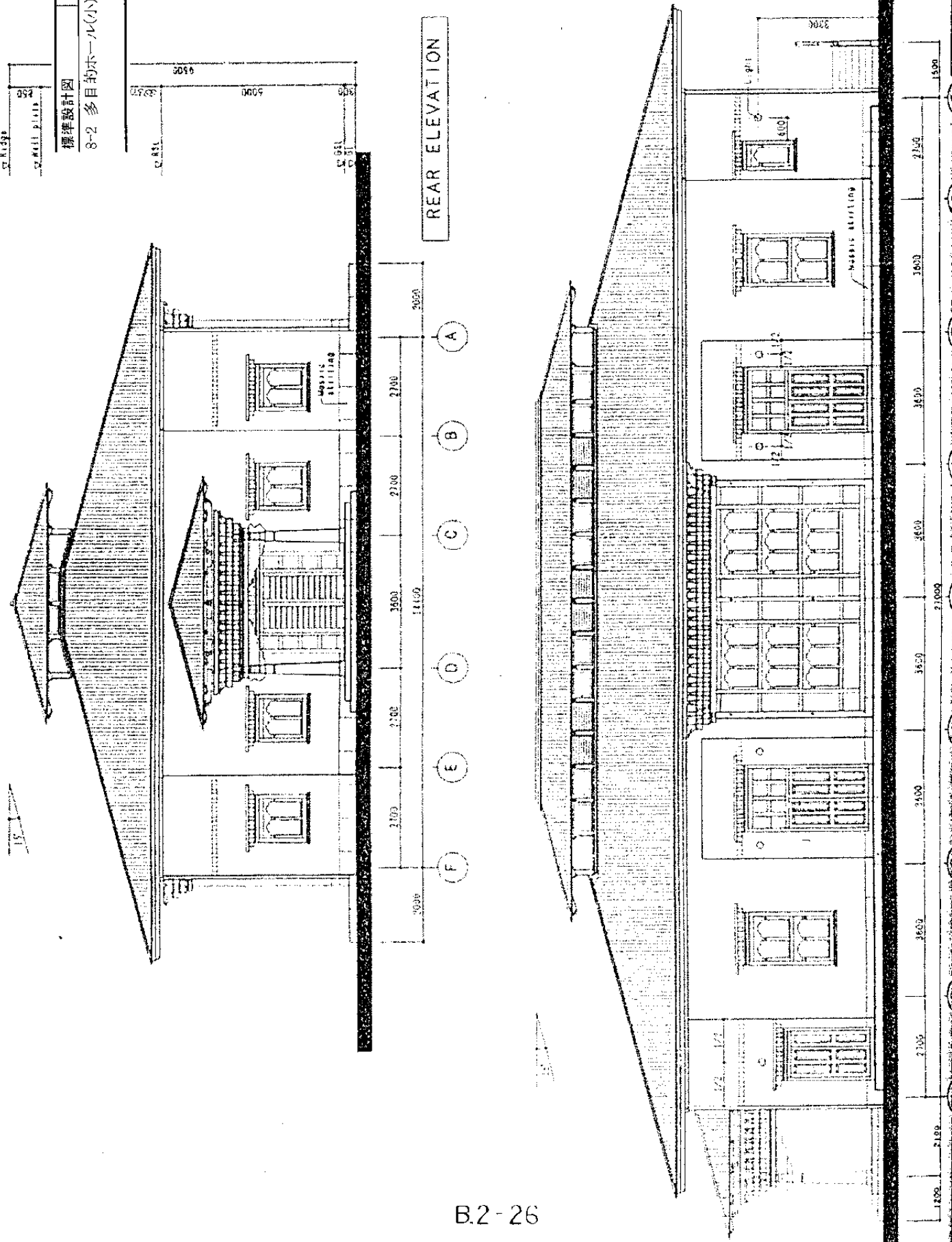
SCALE  
1/100

CHECKED

OFF. IN-CHARGE DATE  
26/12/1990

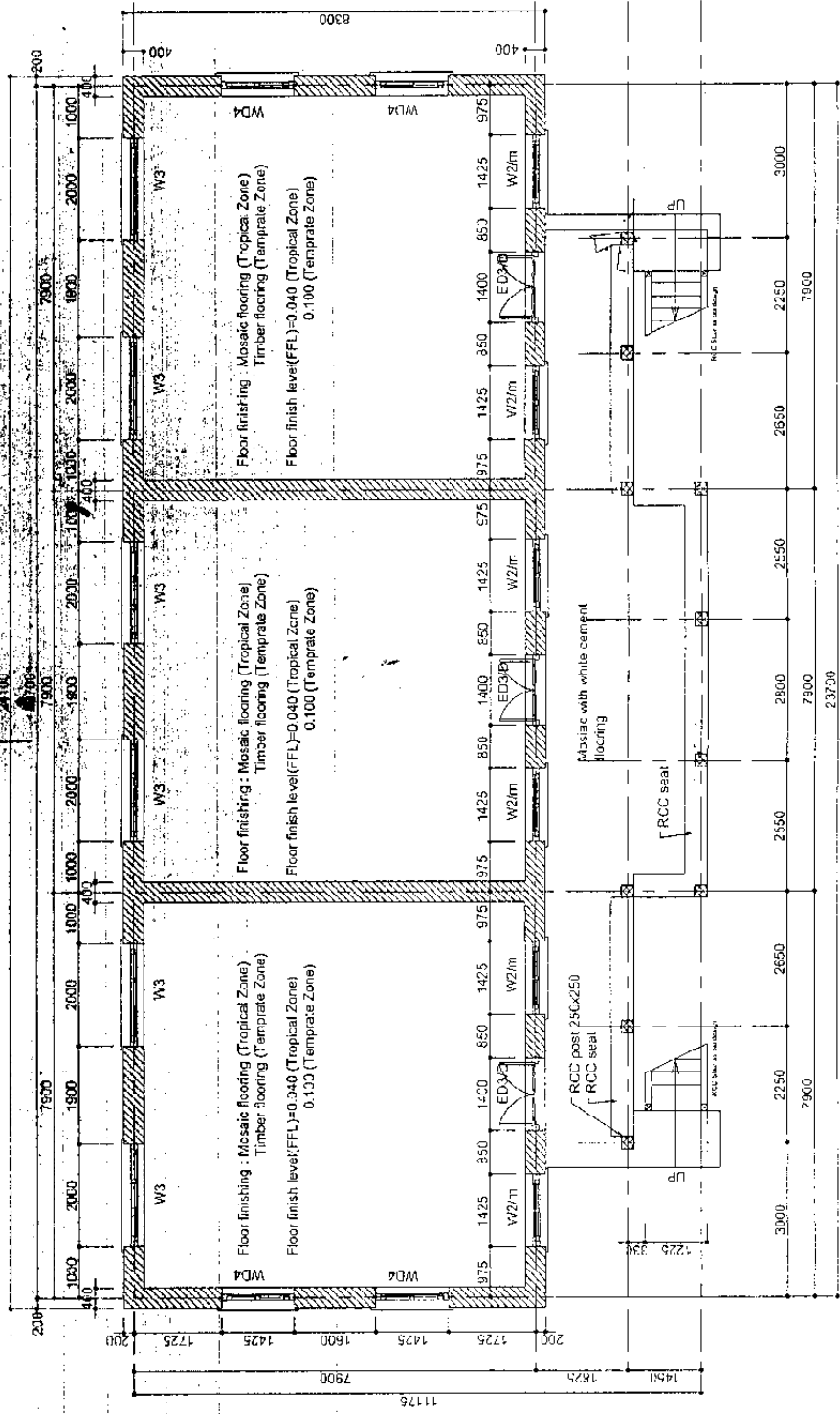
標準設計図  
8-2 多目的ホール(小) 立面図

REAR ELEVATION





標準設計圖  
6 寮(96人用) 1階平面圖



Project SEP

Building 96Bed Hostel Block  
Title First Floor Plan

Revision 9/12/02

Index No. 96HB-AR-02

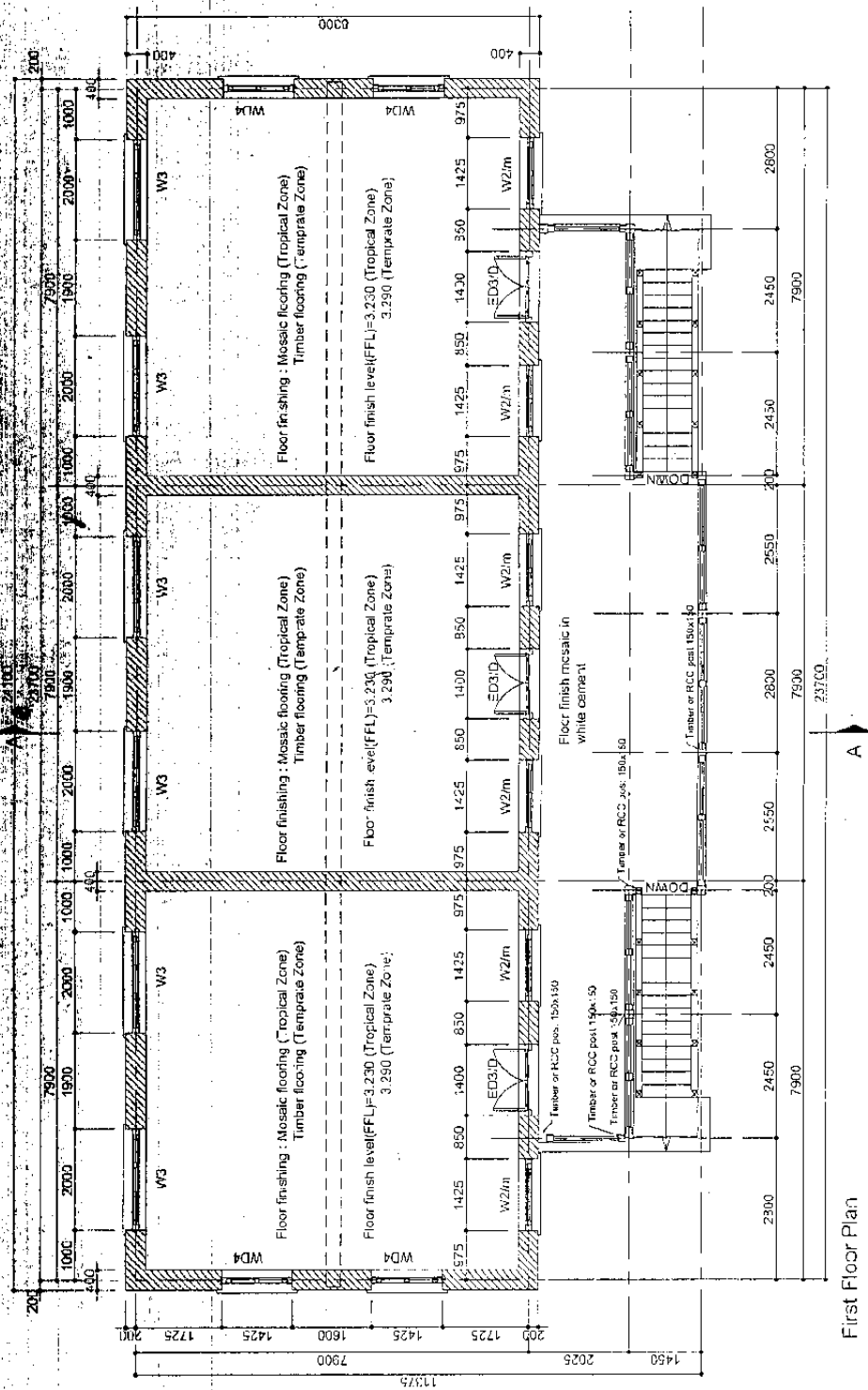
Minister Namgye Keyi  
Architect Namgye Keyi

Director Kamya Sonam  
Engineer Namgye Keyi/H

3/4/2001 Date  
Checked

Scale 1:100

標準設計圖  
9 寮 (96人住) 2階平面図



First Floor Plan

Project  
SEP

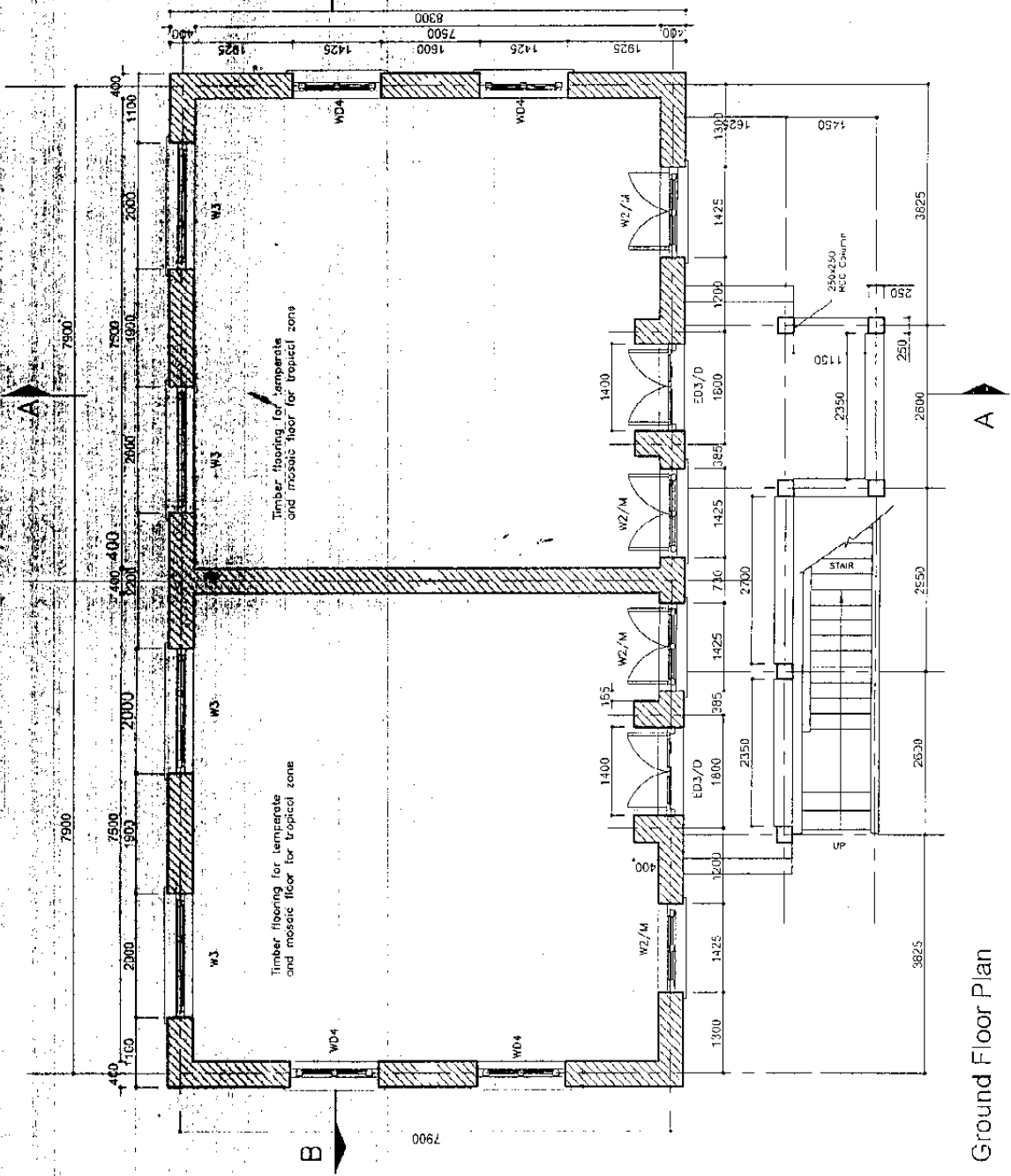
Building  
64Beds Hostel Block

Minister	Director	Engineer	Architect
	Jt. Director	Phub Ishering	N.Retty
Checked	Date	Drawn	
S.Hirayama	04/9/2000	Yeshey	
Scale			
1:75			

Index No

64HB-AR-01

標準設計図  
10 寮(64人用) 1階平面図



Ground Floor Plan

Project SEP

Building 64Beds Hostel Block

Revision

4/12/02

08/05/2003

Date 01/9/2000

Checked S.Hirogama

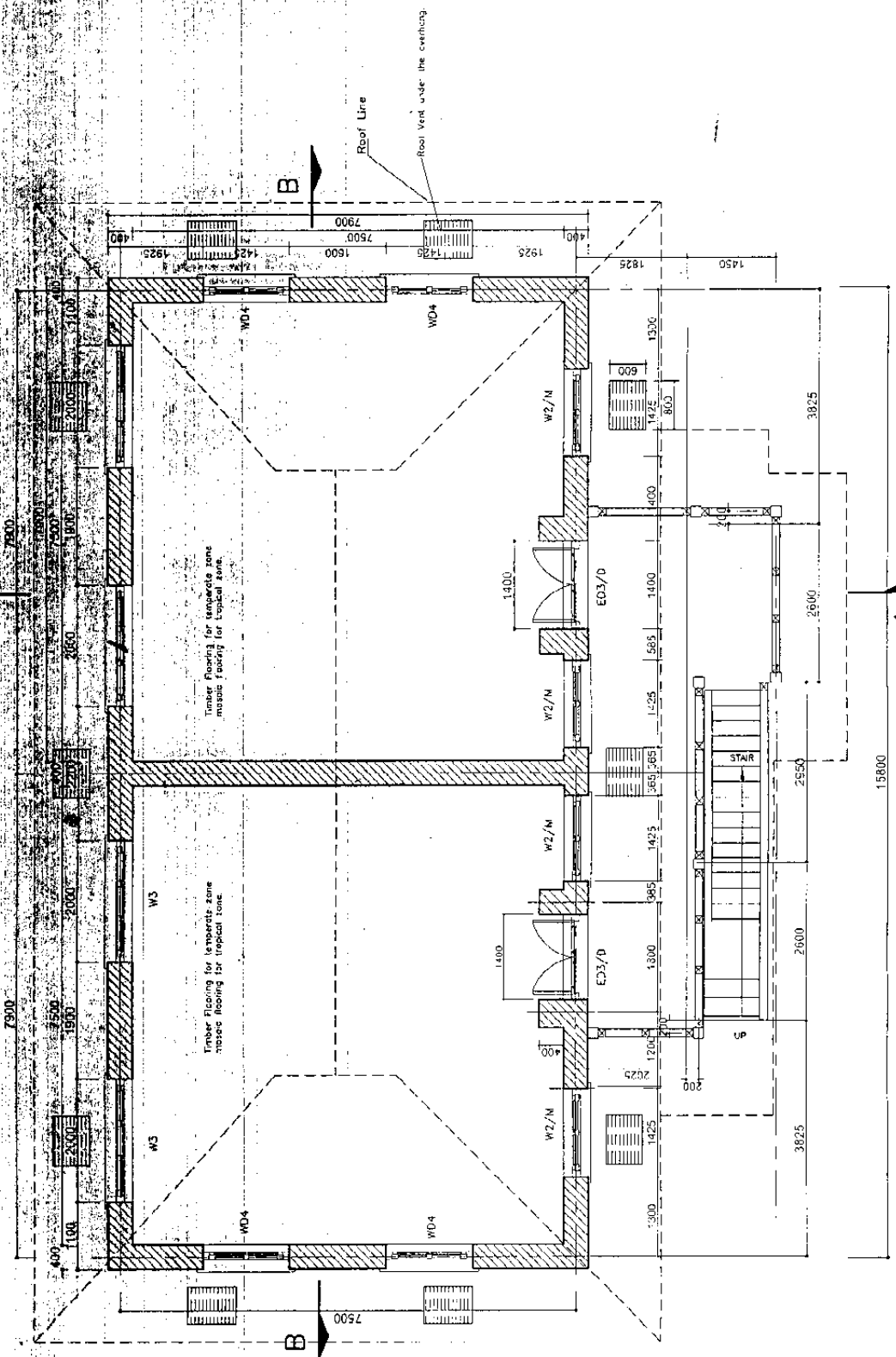
Scale 1:75

Minister N.Retty  
 Director Jt. Director  
 Engineer Pnuo Tsherng  
 Draughtsman Ysheny

64HB-AR-02

Index No.

標準設計図  
10 寮 (64人用) 2階平面図



First Floor Plan

Project SEP

Building Kitchen and Store  
Title Floor Plan

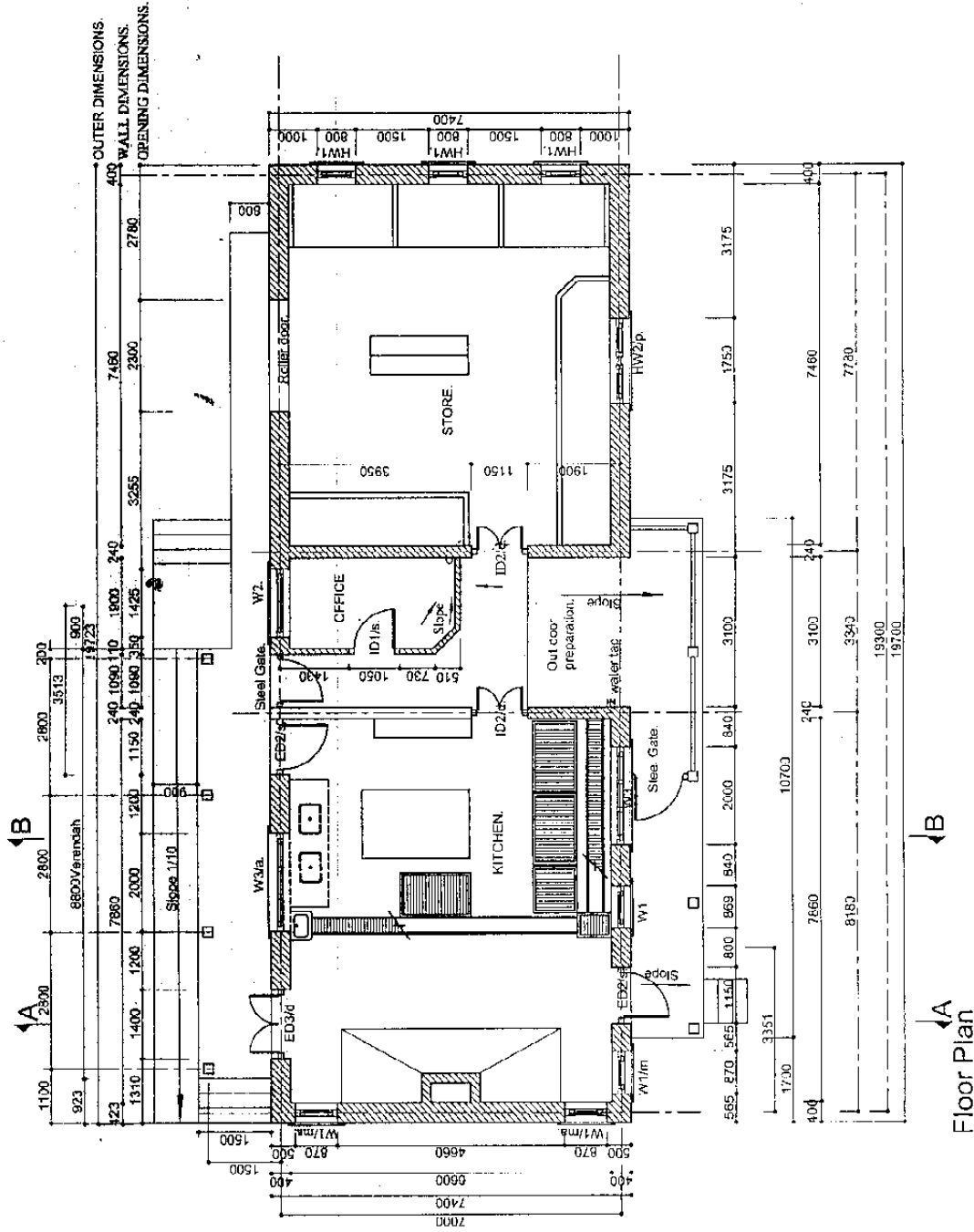
Revision 17/12/02  
Index No K5-AR-01

Director J. Director  
Checked  
Scale 1:100

Engineer Kairina Soearta  
Drawn S.R.Dutia / Andra

Architect Timothy Horne

標準設計圖  
11 廚房·食糧倉庫 平面圖



Project

SEP

Building Hostel Toilet (LARGE)

Title

Floor Plan  
 Boys Toilet

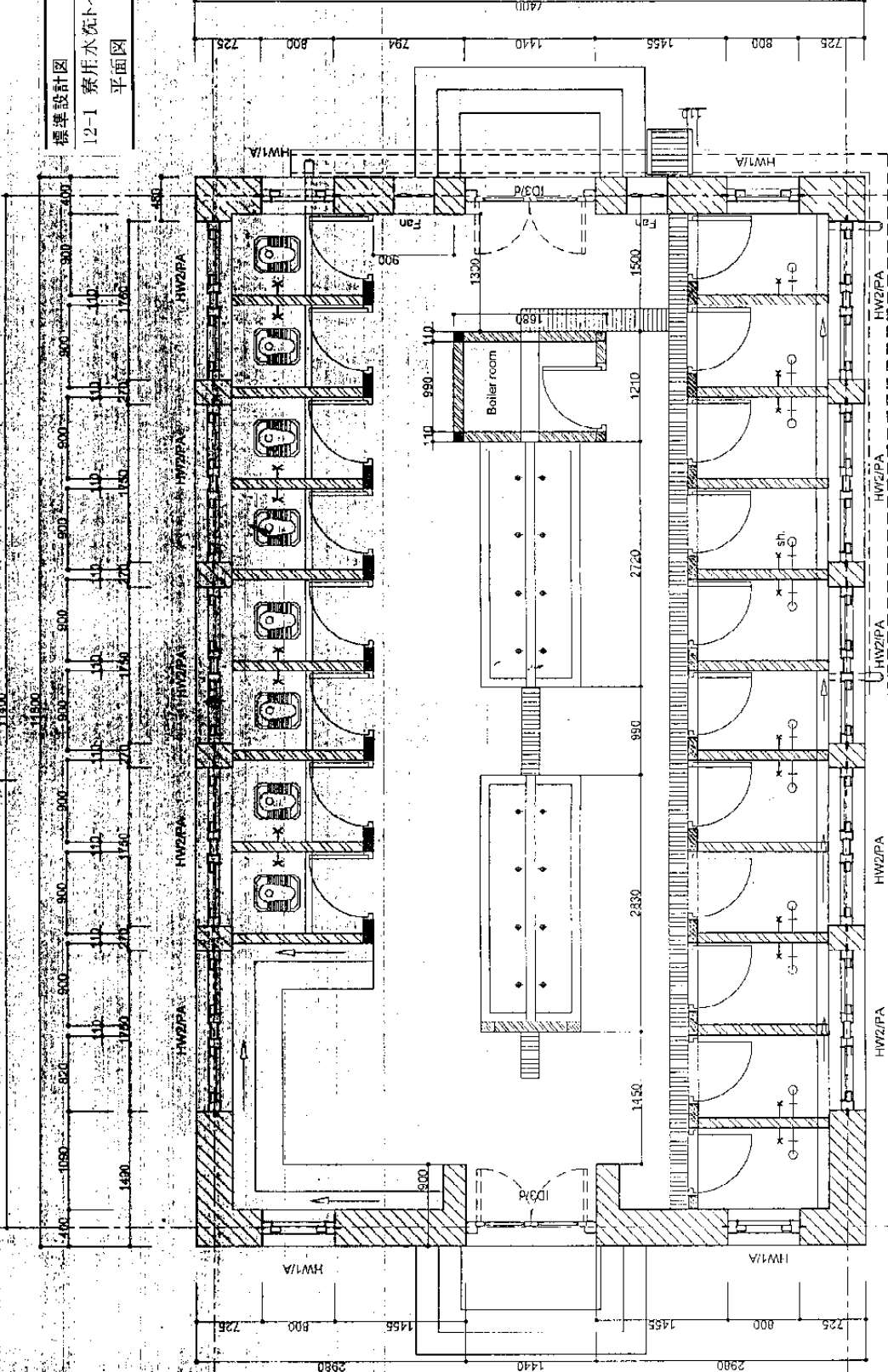
Revision

28/01/2008

HTL-AR-01

標準設計図  
 12-1 寮用水流トイレ(男子、大型)  
 平面図

Checked	Date 6/2/98	Director	Minister
Scale 1:50		U. Director	Architect
		Indira / Pemo C	Timothy Horne
		Somom Wongschuk	Engineer
		Drawn	



- LEGEND**
- 400mm wide screed wall
  - internal partition wall.
  - 10mm brick raisec.
  - 250mm above the floor level
  - 1900mm height from floor level
  - Reinforced column to stabilize partitions
- Note:**
- Paint ceiling finishing white primer painting with 2 coats
  - Floor 40mm mosaic
  - Plaster 1:4 above tiles painting with of white distemper

PLAN-BOYS TOILET

Project  
**SEP**

Building Hostel Toilet (LARGE)

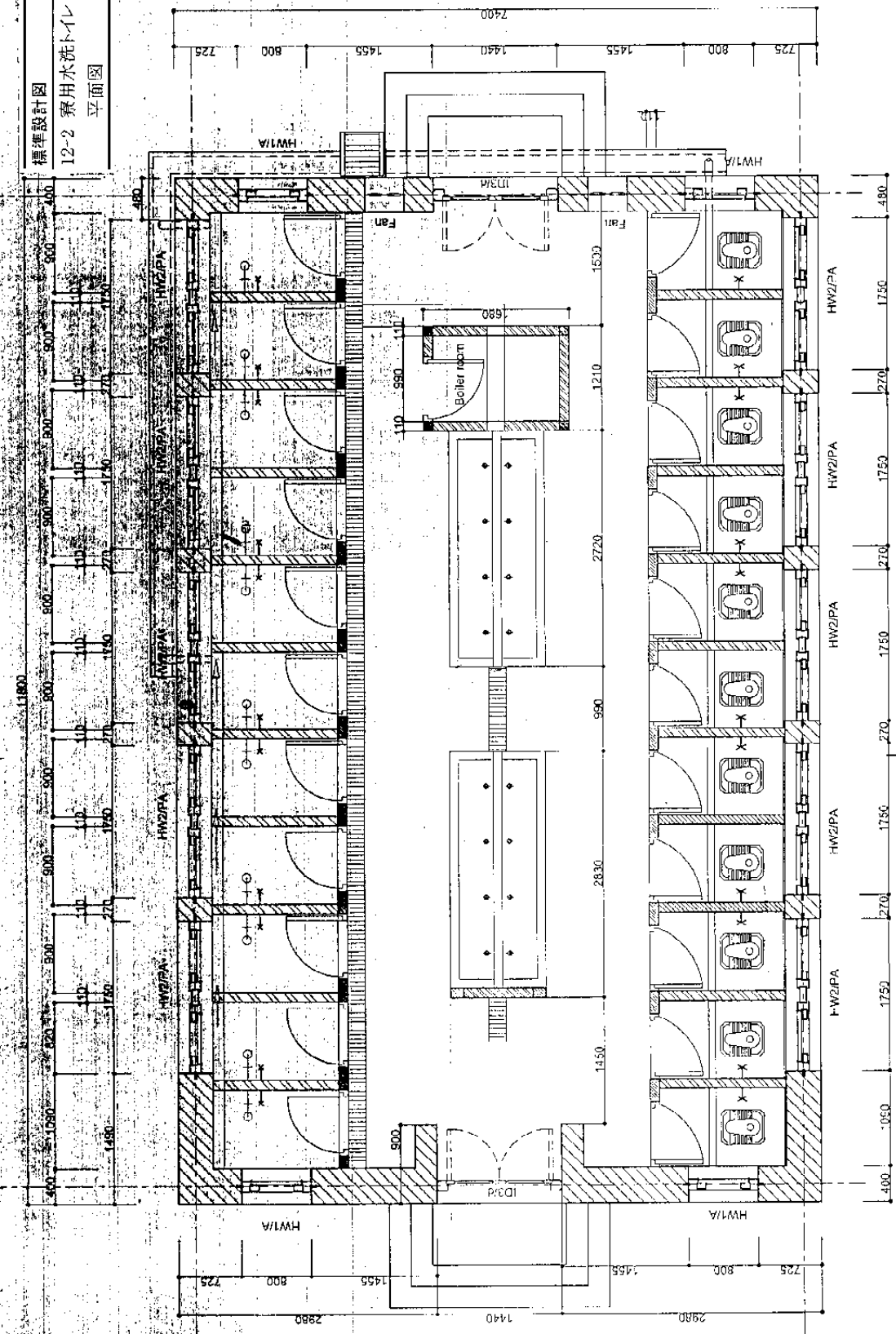
Title  
**Floor Plan  
Girls Toilet**

Revision  
28/01/2003

Index No  
**HTL-AR-02**

Director	Director	Checked	Scale
Soram Wongchuk	Jt. Director	Date 6/2/98	1:50
Engineer	Drawn		
Timothy Horne	Indro / Pema C		
Architect			

標準設計圖  
12-2 兼用水洗トイレ(女子、大型)  
平面図



- LEGEND**
- 400mm wide sicre wall.
  - Internal partition wall.
  - 110mm brick raised.
  - 250mm above the floor level
  - 1900mm height from floor level
  - Reinforced column to stabilize partitions
- Note:**
- Paint ceiling finishing white primer painting with 2 coats
  - Floor 40mm mosaic
  - Plaster 1:4 above tiles painting with off white distemper

PLAN-GIRLS TOILET

Project SEP  
Title Floor Plan  
Building Hostel Toilet (MEDIUM)  
Boys Toilet

Director  
Minister  
Architect  
Timothy Horne

Engineer  
Sonam Wangehuk  
Drawn  
Indira / Pema C

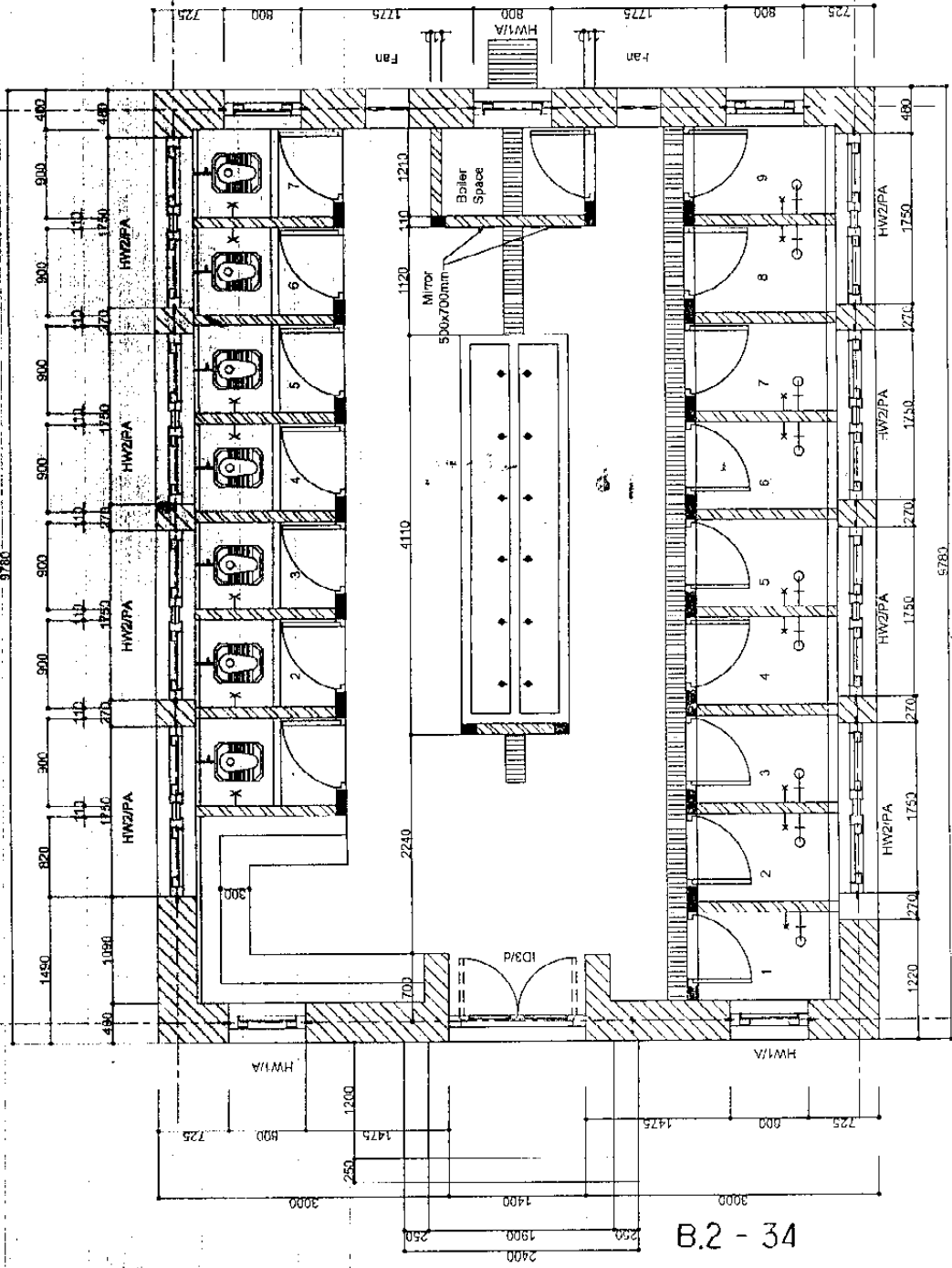
Checked  
Date 6/5/98  
Scale 1:50

Revision  
17/01/2003  
Dwg No  
HTM-AR-01  
Index No

**LEGEND**

- 400mm wide stone wall.
- internal partition wall.  
110mm brick raised.  
250mm above the floor level.  
1900mm height from floor level
- Reinforced column to stabilize partitions

標準設計図  
13-1 寮用水洗トイレ(男子、中型)  
平面図



Notes:

- Ceiling finishing  
white primer painting with 2 coats
- Floor 40mm mosaic  
Plaster 1:4 above tiles  
painted with off white distemper

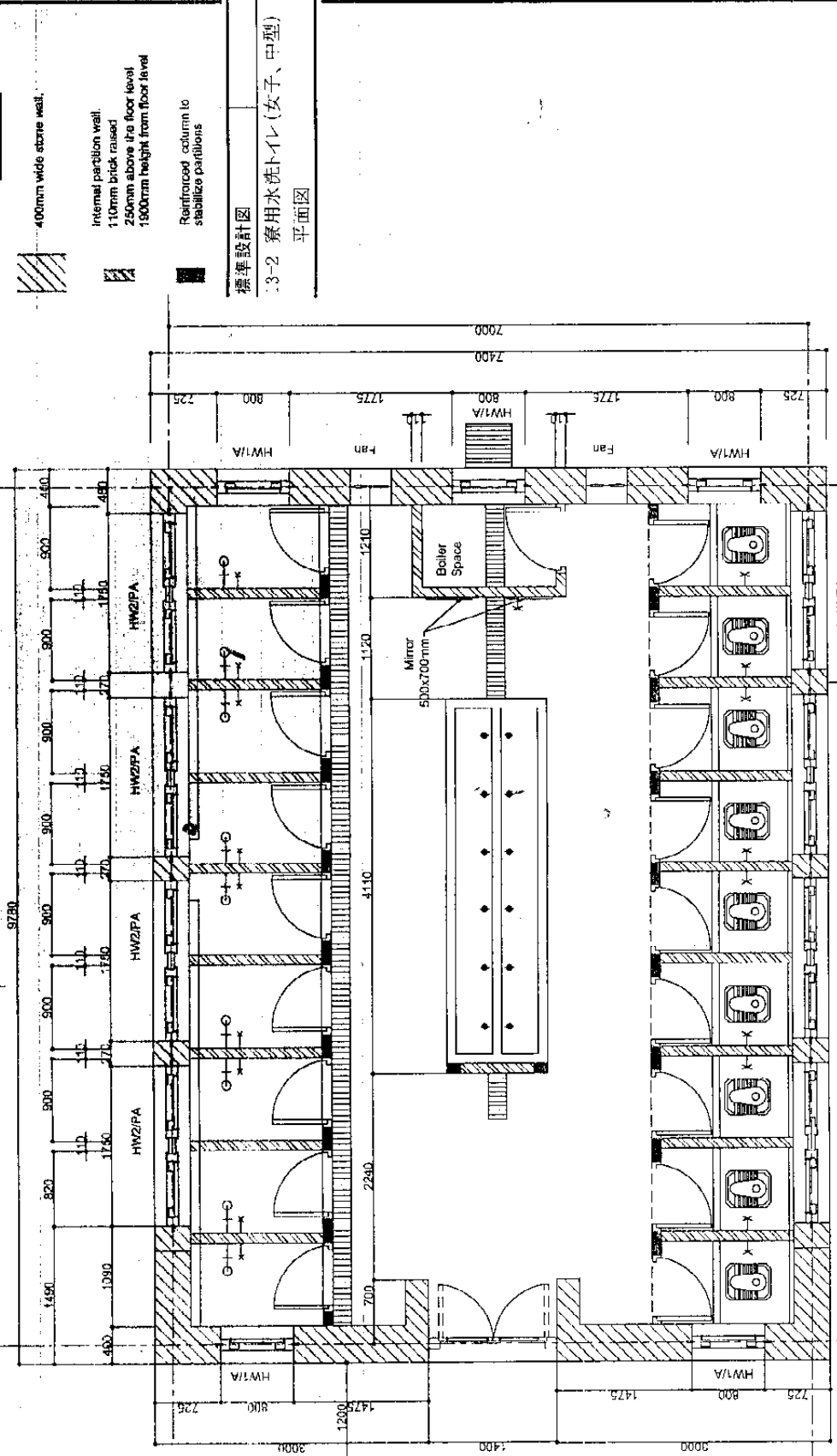


Project SEP  
Building Hostel Toilet (MEDIUM)

**Floor Plan  
Girls**

HTM-AR-02  
Index No

Director U. Director  
Checked Indira / Pema C  
Date 6/5/98  
Scale 1:50



**LEGEND**

- 400mm wide store wall.
- Internal partition wall
- 110mm brick raised
- 250mm above the floor level
- 1500mm height from floor level
- Reinforced column to stabilize partitions

標準設計図  
3-2 寮用水洗トイレ (女子、中型)  
平面図

**Note:**

- Ceiling finishing
- White primer painting with 2 coats
- Floor 40mm mosaic.
- Plaster 1:4 above tiles
- Painted with off white distemper

**FLOOR PLAN-GIRLS TOILET**

Project SEP

Building Hostel Toilet (SMALL)

Title Floor Plan-Boys Toilet

Revision 16/12/2002  
 Dwg No HTS-AR-01  
 Index No

Date 4/5/98  
 Checked  
 Scale 1:50

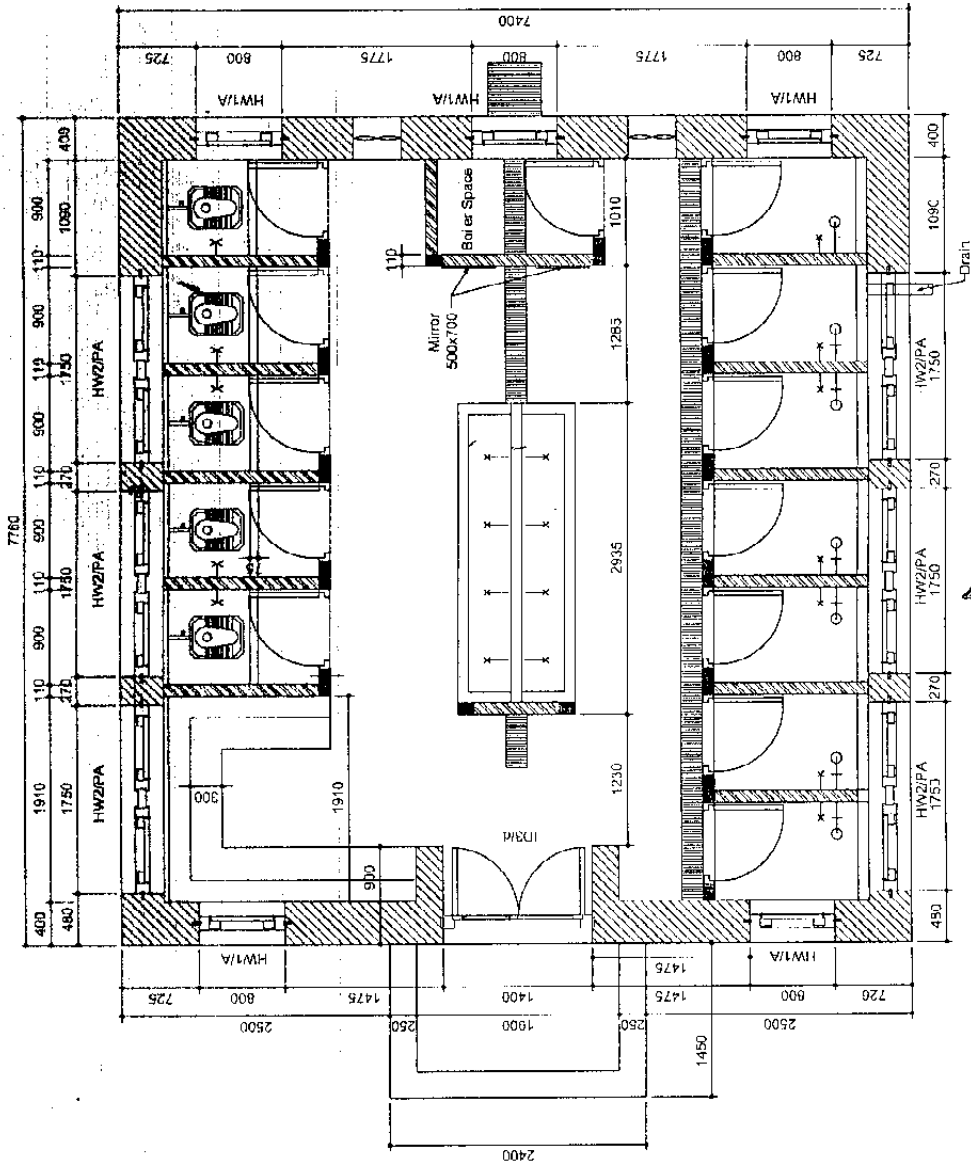
Director Jt. Director  
 Engineer Sonam Wengchuk  
 Architect  
 Drawn Indira / Pema C

**LEGEND**

- 400mm wide stone wall.
- Internal partition wall.
- 110mm brick raised
- 250mm above the floor level.
- 1800mm height from floor level
- Reinforced column to stabilize partitions
- Exhaust fan



標準設計図  
 14-1 寮用水洗トイレ (男子、小型)  
 平面図



Ceiling finishing  
 White primer-painting with 2 coats  
 Floor 40mm mosaic  
 Plaster 1:4 above ties  
 Painted with off white distemper

FLOOR PLAN-BOYS TOILET (SMALL)

Project

Building Hostel Toilet (SMALL)

Title

Floor Plan - Girls Toilet

Revision

16/12/2002

Dwg No HTS-AR-02

Index No

Architect

Surani Wanjulik

Engineer

Drawn

Indira / Pema C

Checked

Scale

1:50

Minister

Jl. Director

Director

Date

4/5/98

**LEGEND**

400mm wide stone wall.

Internal partition wall.

110mm brick raised.

250mm above the floor level.

1900mm height from floor level.

Reinforced column to stabilize partitions

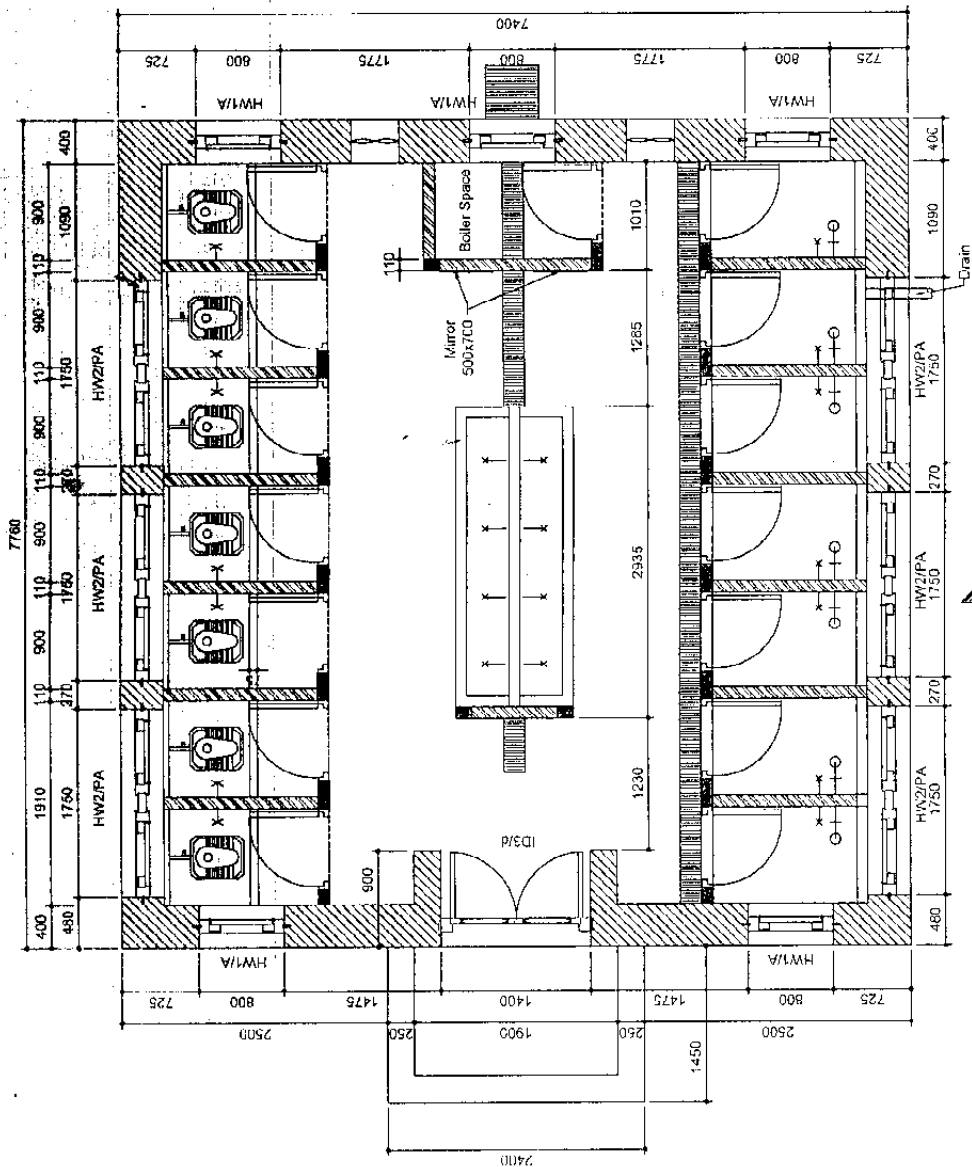
Exhaust fan

標準設計図

14-2 寮用水流トイレ(女子、小型)

平面図

Ceiling finishing  
White primer painting with 2 coats  
Floor 40mm mosaic  
Plaster 1:4 above tiles  
Painted with off white disemper



FLOOR PLAN-GIRLS TOILET (SMALL)

Project SFP

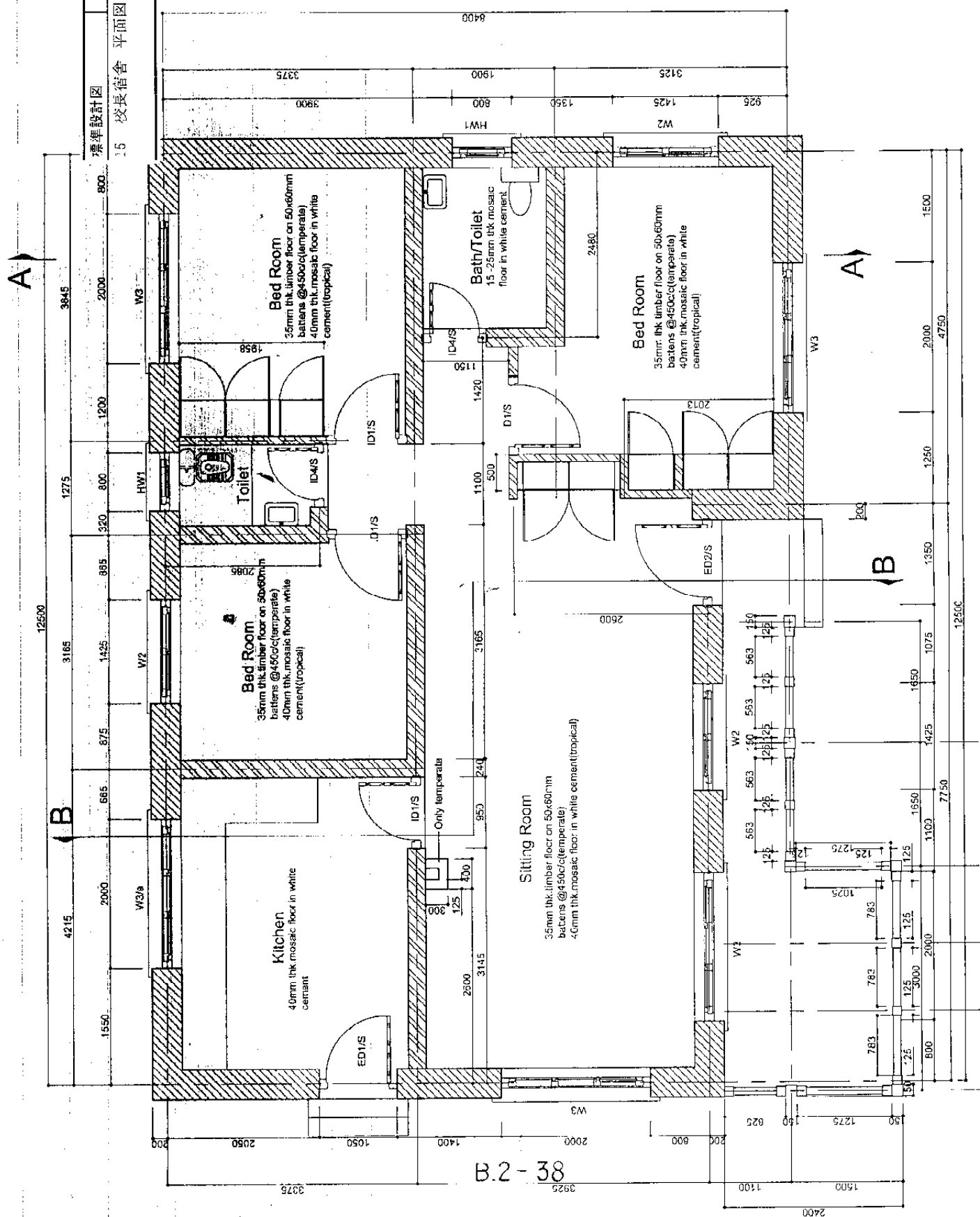
Title Floor Plan

Building Head Master's Quarter

Minister	Timothy Horne
Architect	Karna Sonam Engineer
Director	Jl. Director
Drawn	Indra Gunging
Checked	
Date	4/11/99

Scale	1:50
Index No	HMQ-AR-01
Revision	26/2/03

標準設計圖  
1.5 校長宿舍 平面圖



B.2 - 38

Plan

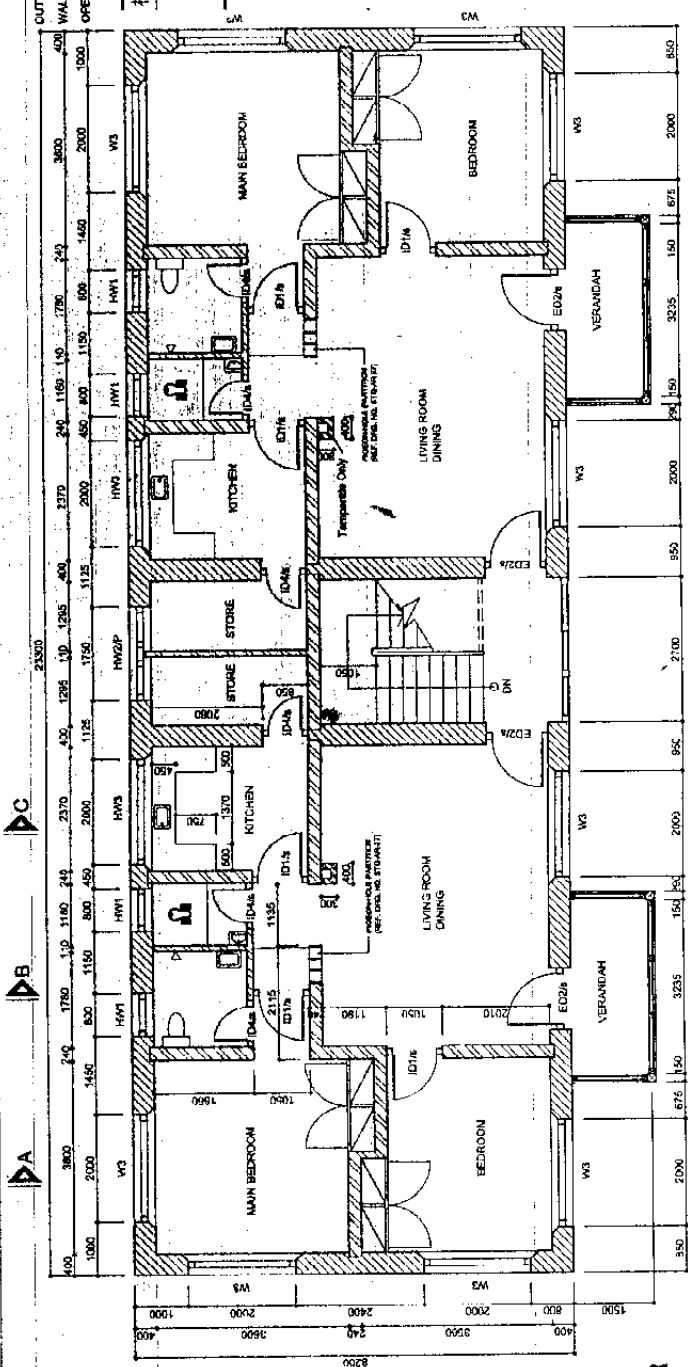
Project SEP

Building Double storey Staff Quarter  
Title Ground and First Floor  
Revision 12/04/03

Checked Padam Tamang  
Date 22/10/97  
Scale 1:100  
Index No DSA-AR R-01

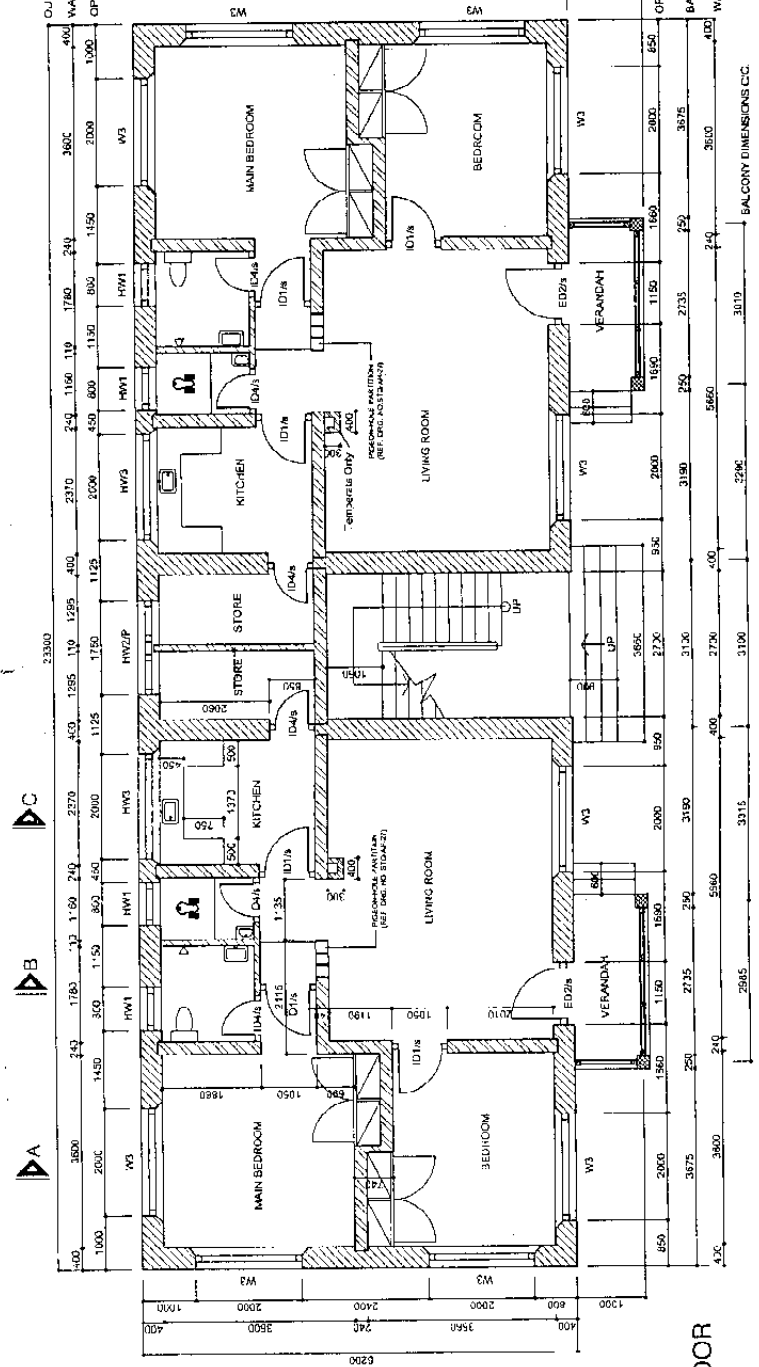
標準設計圖  
16 教員宿舍 平面圖 (1/F, 2/F)  
(4住戶棟)

OUTER DIMENSIONS.  
WALL DIMENSIONS.  
OPENING DIMENSIONS.



FIRST FLOOR

OUTER DIMENSIONS.  
WALL DIMENSIONS.  
OPENING DIMENSIONS.



GROUND FLOOR

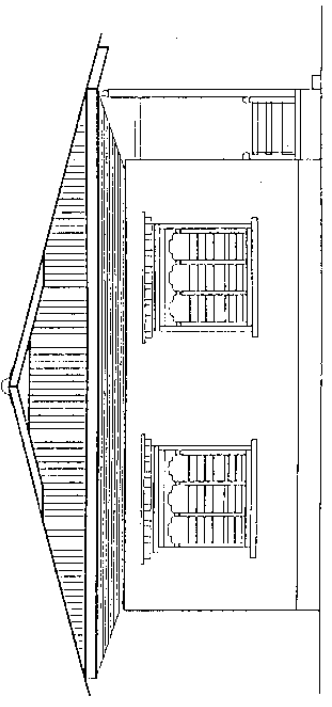
Project SEP

Building WARDEN QUARTER

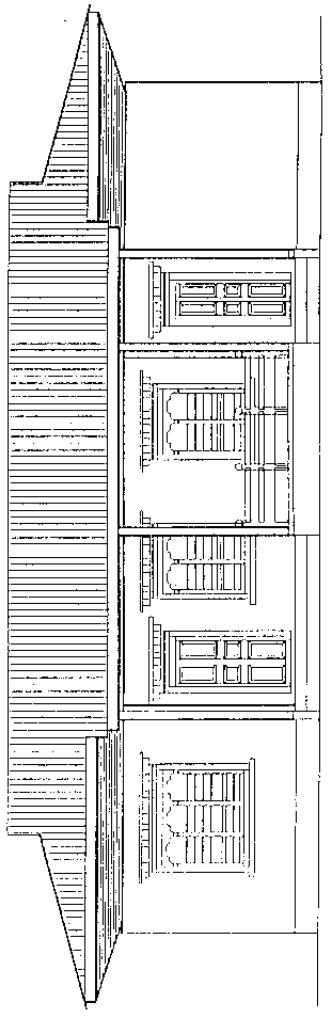
Title PLAN & ELEVATION

Revision: 7/01/03

WQ-AR-01

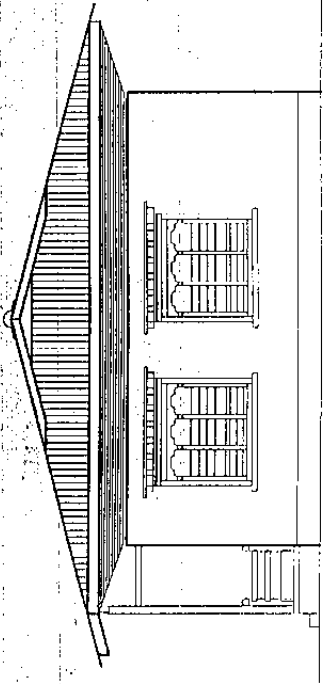


LEFT SIDE ELEVATION



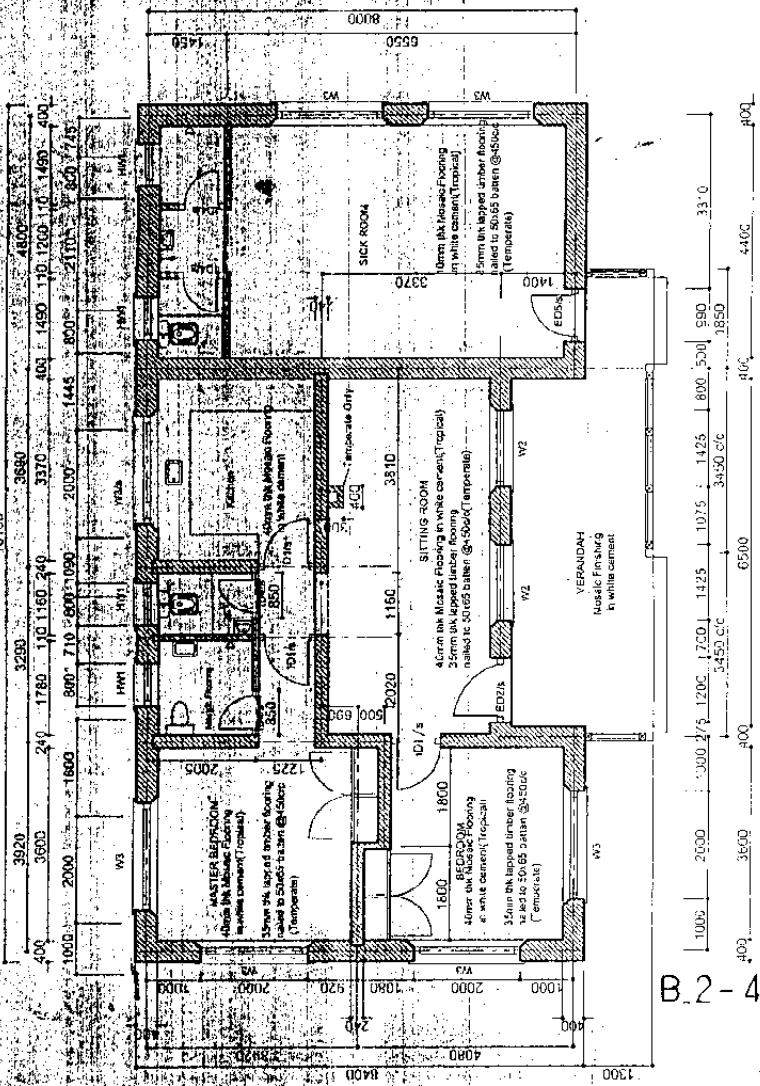
FRONT ELEVATION

RIGHT SIDE ELEVATION



B-2-40

GROUND FLOOR



標準設計圖  
17 寮監宿舍 平面圖、立面圖

Minister	Director	Checked	Scale
Nangay Kelly	Jr. Director	Checked	1:100
Architect	Date		
	22/12/1997		
Engineer			
Karna Soan			
Urawn			
Mrant Pradhan/Veshey			
Index No			

Project  
SEP

Building  
12 Classroom Block

Plan - 1

Revision  
31/12/2000

Minister  
Nangay Rolly

Director  
Kainga Suam

Architect  
Nangay Rolly

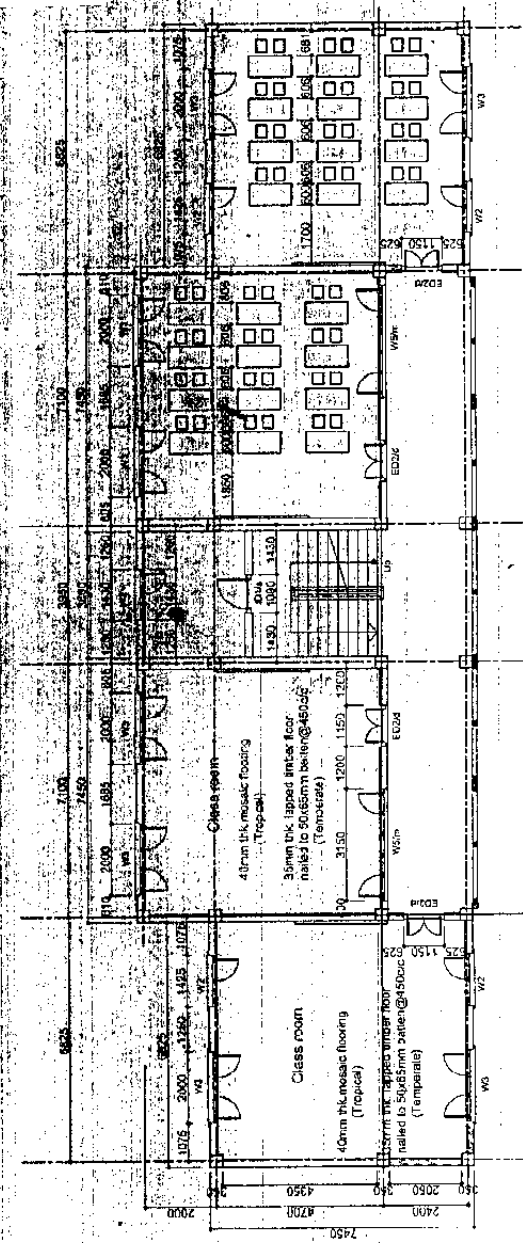
Jr Director  
Benita Tamang/Mai

Checked  
Date  
25-09-2000

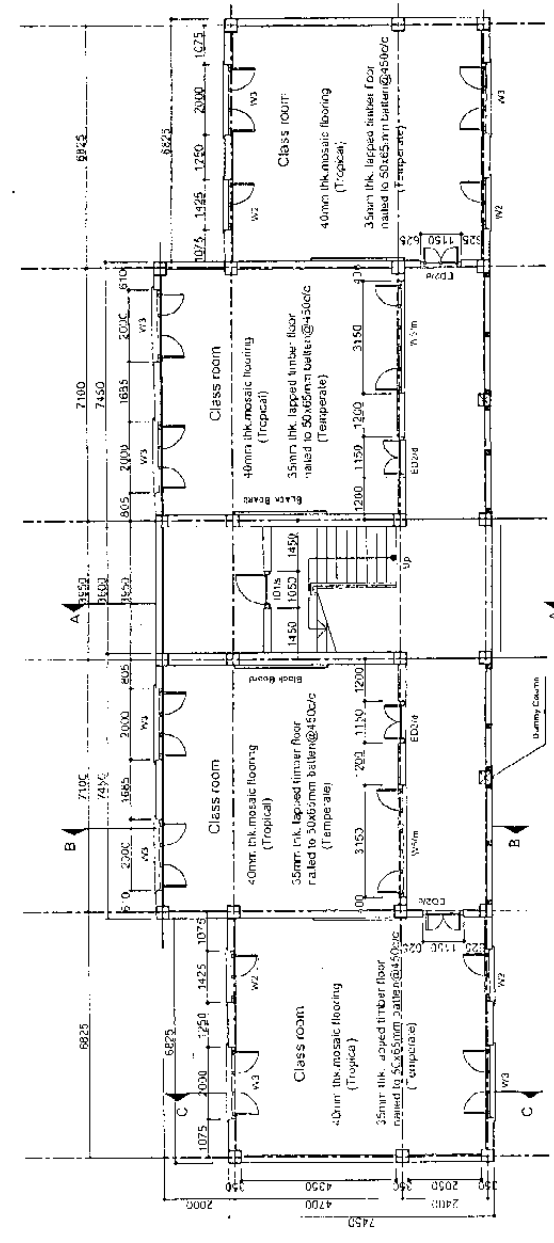
Scale  
1:150

Index No  
12CL-AR-01

標準設計図  
参考: 12教室棟(3階建て)  
1階、2階平面図



First Floor



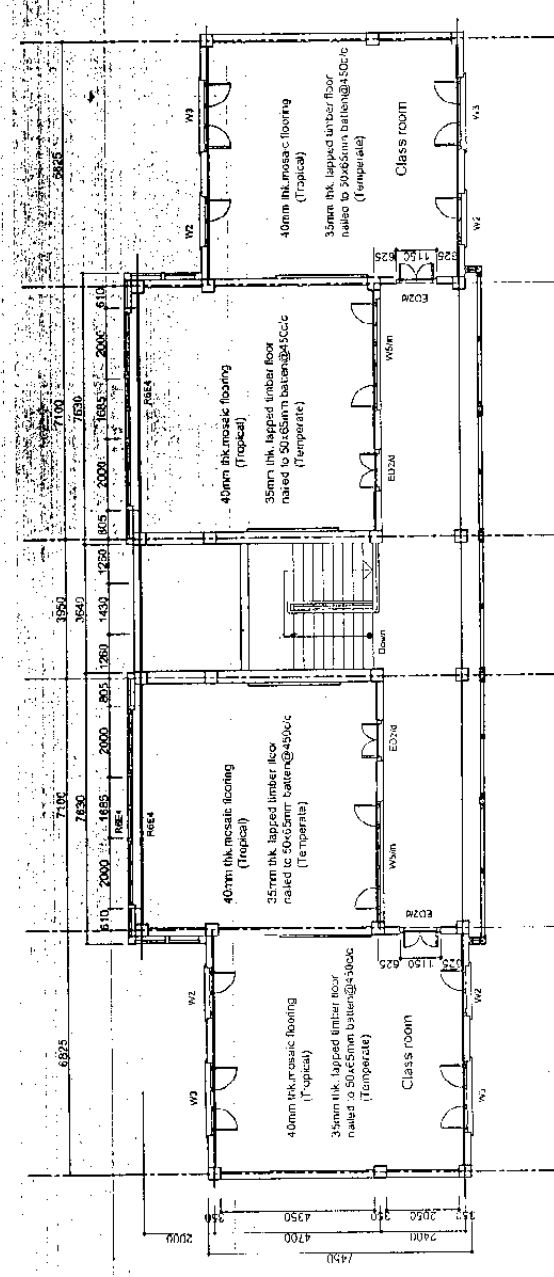
Ground Floor

Minister	
Director	
Engineer	Karima Sonam
Drawn	Mam Pradhan

Checked	
Date	25/09/2000
Scale	1:150

Project	SFP
Title	Plan - 2
Building	12 Classroom Block
Revision	1st/22/2000
Index No	12 CL-AR-02

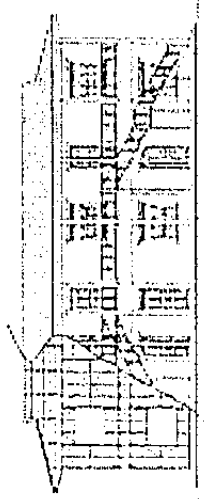
標準設計図  
 参考：12教室棟(3階建て)  
 3階平面図



Second Floor



INTRODUCING  
LIGHT GAUGE STEEL FRAMING  
(LGSF)  
IN BHUTAN



A severe housing shortage after WWII demanded for an efficient means of delivering new housing in the US. Steel construction presented an idea: alternative due to the excess post-war production capacity for this material. It has remained a popular material for construction, especially in the US and Australia. Bhutan is today faced with a demand that similarly dwarfs both the delivery capacity in the construction sector and the time available. Bhutan can therefore also benefit tremendously from the practical advantages of steel construction.

**TIME** LGSF requires much shorter construction periods. The 4200 square-foot Six Classroom building takes approximately 12 months to complete using stone and timber. The same building using LGSF is expected to take no more than 3, working months.

**LABOUR/EMPLOYMENT** LGSF will reduce labour needs by as much as 80% from 3575 man-days to about 700 man-days. This addresses the Royal Government's goal of minimizing imported labour. Some of the balance 20% is targeted to be replaced with skilled Bhutanesse workers.

**MATERIALS** Because steel is a manufactured product, quality

of the materials is more or less guaranteed. Local construction materials however, require substantial on-site input which are harder to monitor. They are also often delayed by the weather, a poor supply system etc. Imported materials are more likely to facilitate success than local materials.

COMPARING STONE AND LGSF (6 Classroom Building)	
Stone	LGSF
Time	12 months
Labour	3 months
Man-days	20 Expatriates
Truckloads (material)	8 Nationals
Quality Control	700
% of imports (cost)	10
Cost	Difficult
Cost/sft	60%
	Nu. 2.4 mil*
	Nu. 2.3 mil**
	Nu. 571
	Nu. 547

\*Based on actual average \*\*Based on pilot building

**TRANSPORT** LGSF is substantially lighter than materials used in conventional construction and generates far less waste. Therefore transport requirements are greatly reduced. For the Six-Classroom building for example, an estimated 126 truckloads of materials is required using conventional materials. This is reduced to 10 truckloads using LGSF and is significant in the context of Bhutan's expensive transport system.

**QUALITY** The industrialized production techniques incorporated in LGSF enable a high degree of production and construction quality control. This feature reduces the workload of site engineers and other workers. For a country that suffers from a manpower shortage, this provides a much needed 'multiplier' effect.

**OPPORTUNITIES** LGSF offers an exciting opportunity for Bhutanesse youth to enter a highly skilled vocation, one that provides a worthwhile and fulfilling career, and substantially reduces the requirement for expatriate workers. The tasks are less demanding of physical strength and thus offer women an equal opportunity.

**COST** Preliminary costing indicates that LGSF will cost

approximately the same as stone and timber. The higher initial cost of the steel is offset by the savings in labour, transport and time. However, other costs that are less easily calculated such as loss of educational opportunities for students caused by long construction periods, will be saved through LGSF construction.

**SAFETY** Light Steel Buildings are only about 10% the weight of stone buildings. The effect of earthquakes are therefore greatly reduced and the effect of wind governs. The United States is the leader in light steel construction so the codes followed are adopted from the US. Dead and live load combinations have been determined in accordance with the ASCE Minimum Design Loads for Buildings and other Structures (ASCE 7-93). Cold formed steel design parameters followed are according to AISI specifications for the design of cold-formed steel structural members (AISI-86 with 1989 Addendum). For educational buildings, the Live Load considered was 4kN/sqm. The design wind load used was 50 metres per second or 180km per hour. Factor of safety used was 1.22. The steel strength assumed was 200Mpa. As a check, the seismic design was also done using Australian codes (AS1170-4 1993) for Zone V (most seismic activity). The design was prepared by a certified engineering firm from Australia.

**OTHER FEATURES**

- o Galvanized steel is long lasting.
- o Easily accommodates traditional features.
- o Steel is recyclable.
- o Modifications are easily done.
- o Steel will not support combustion.

**PILOT BUILDING** The pilot 6 classroom building has been constructed with assistance from DANIDA. The superstructure has been built completely by Bhutanesse construction trainees from the Construction Training Centre (CTC).

