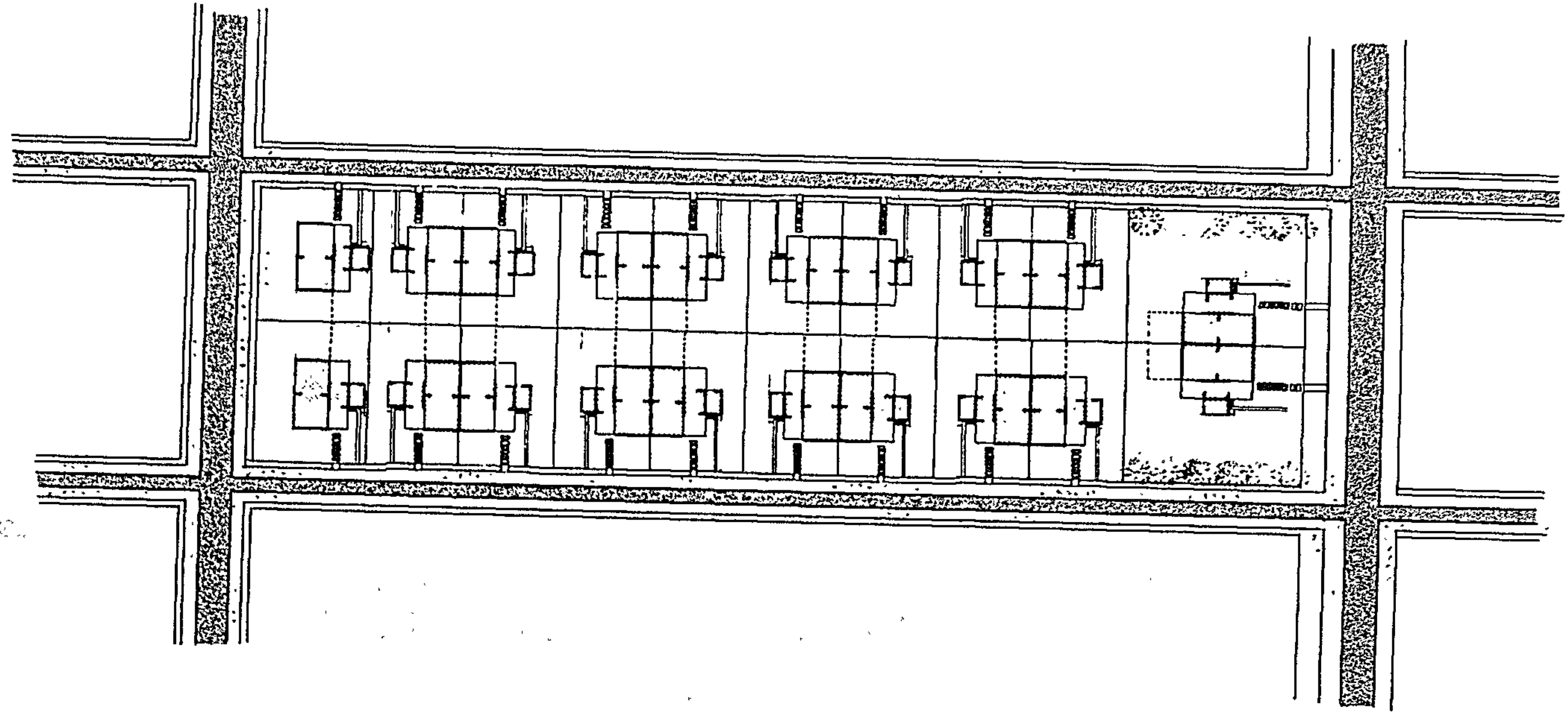


Fig. 6-29 LAYOUT PLAN OF D-21

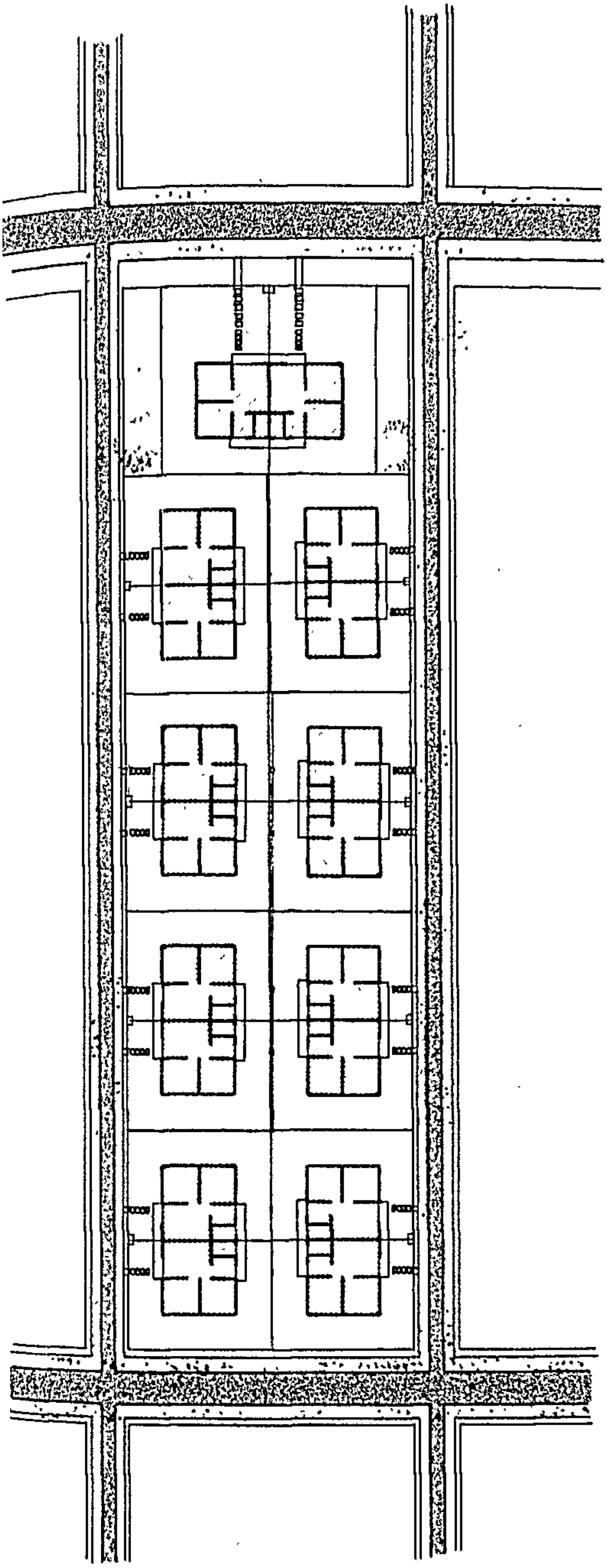


Fig. 6-30 LAYOUT PLAN OF D-36

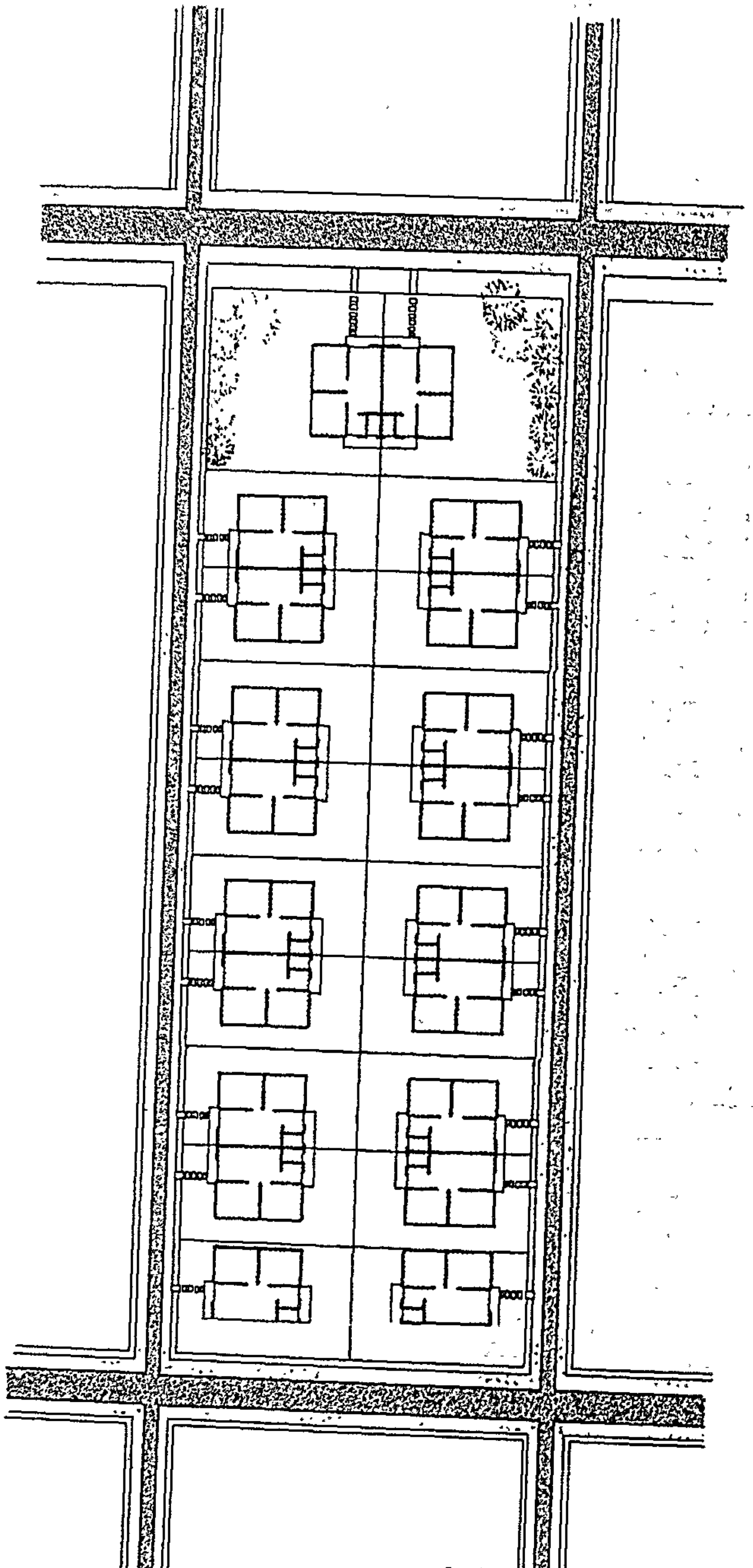
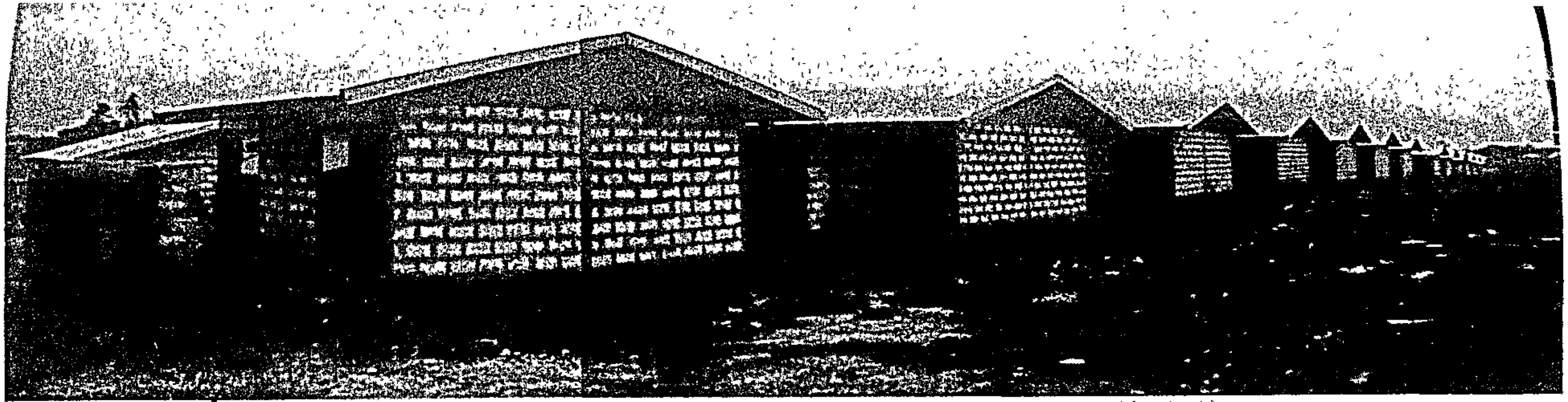
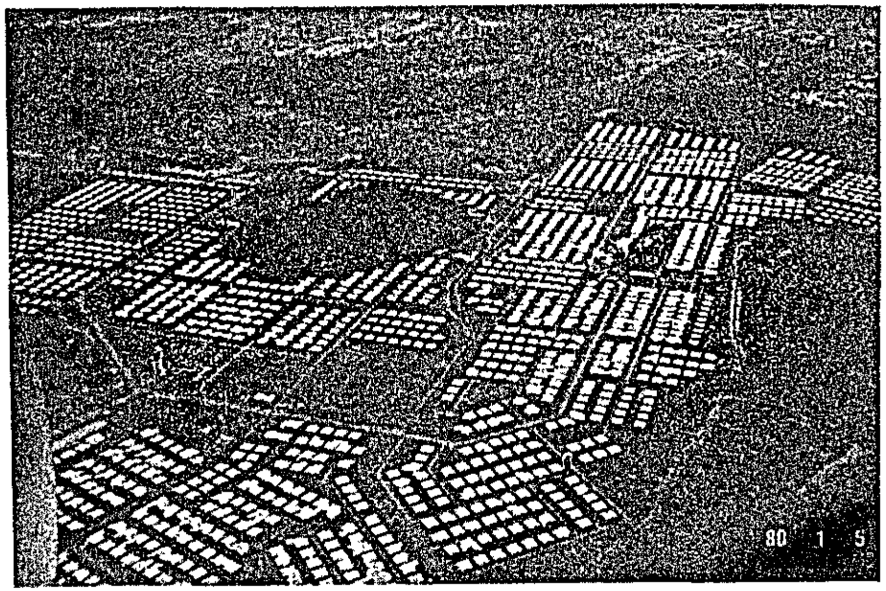


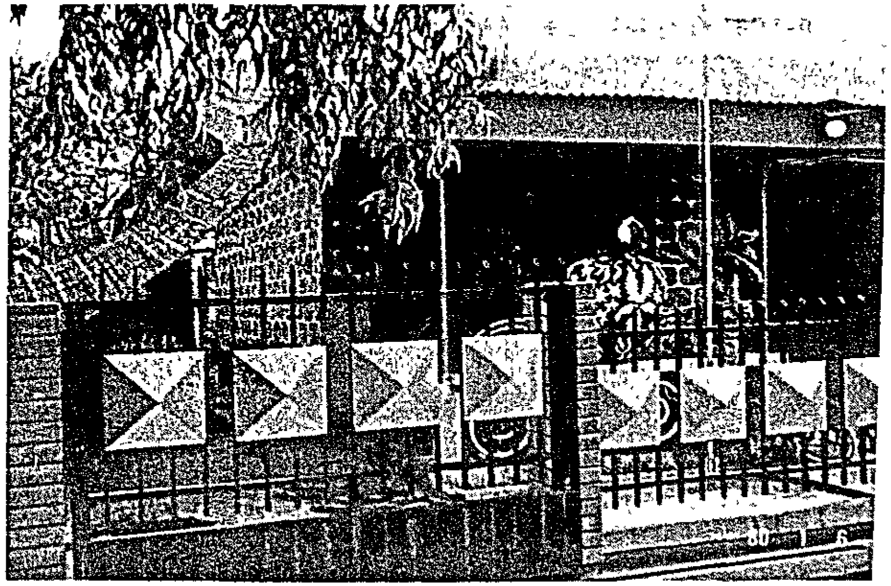
Fig. 6-31 LAYOUT PLAN OF D-45



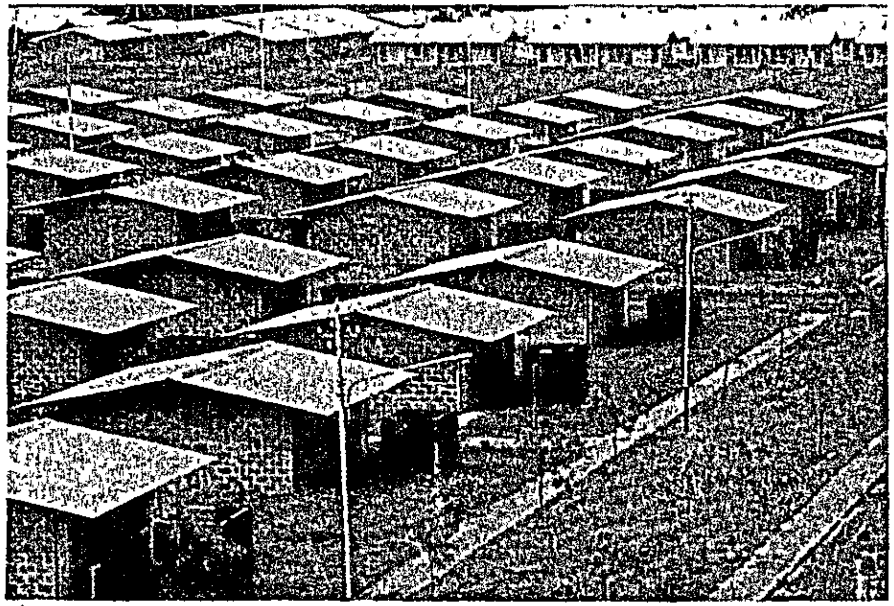
Unoccupied Houses (DEPOK II)



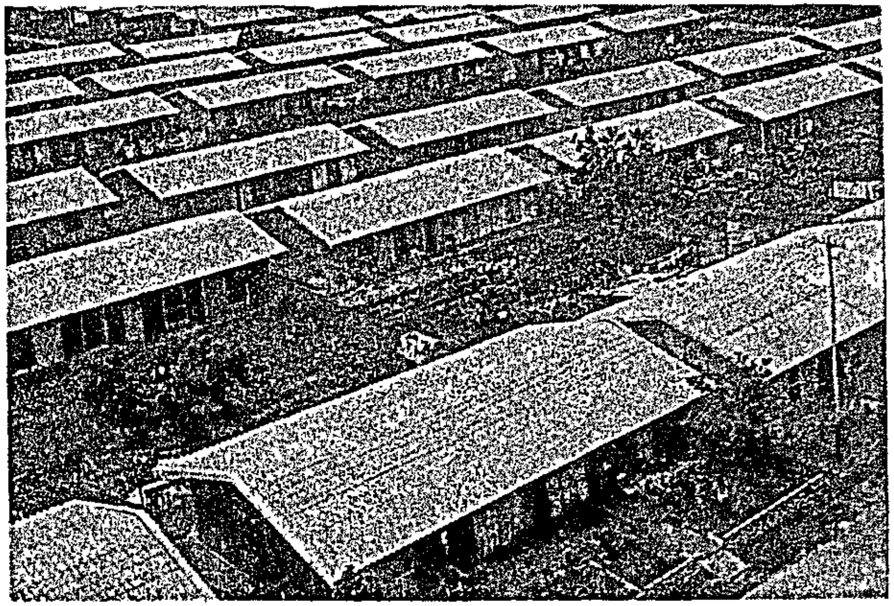
BEKASI Project



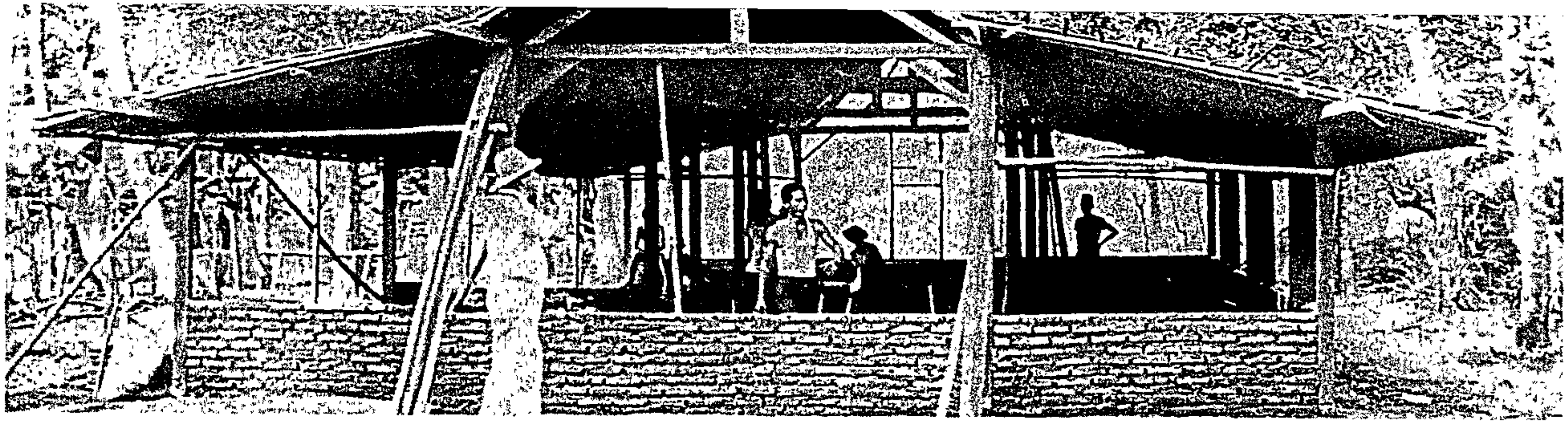
Occupied and Extended House (KLENDER)



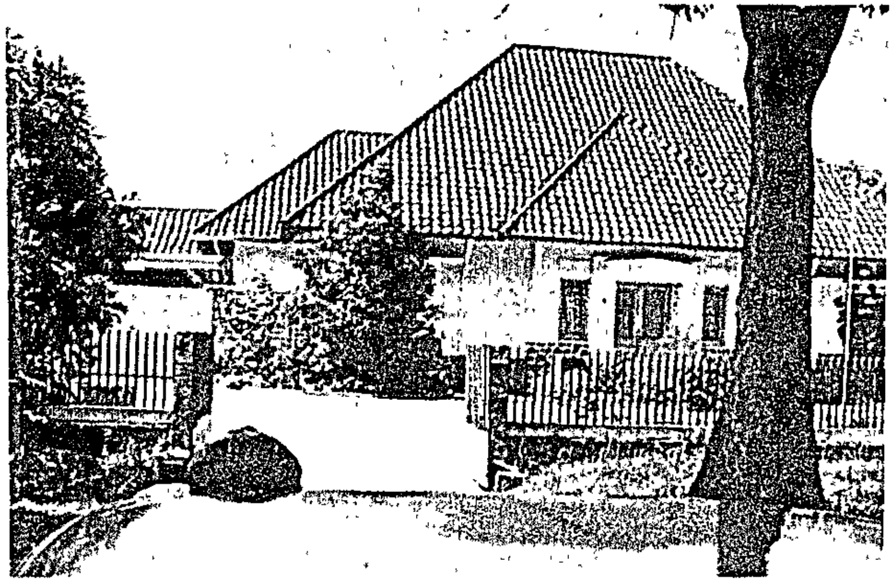
D-20 Type with BATACO Wall



D-45 Type with Wooden Frame + Particle Board

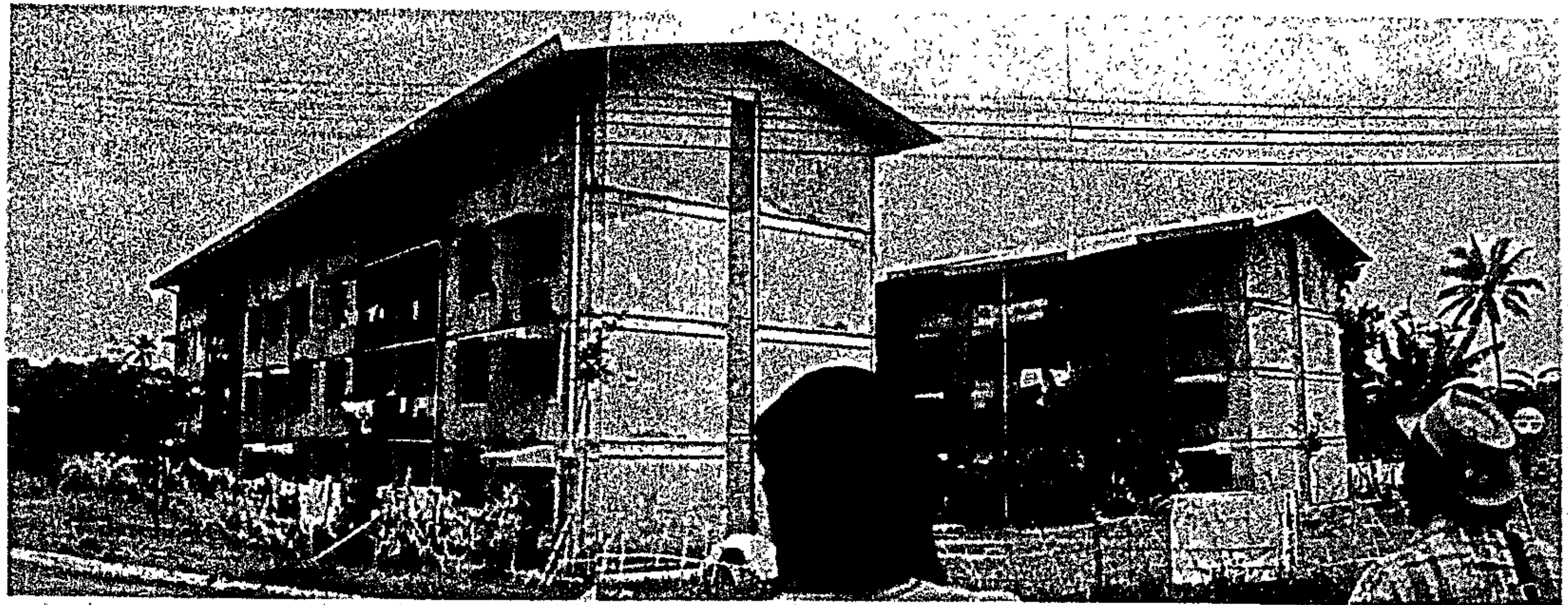


Typical Construction Site of Kampung (CENGKARENG)

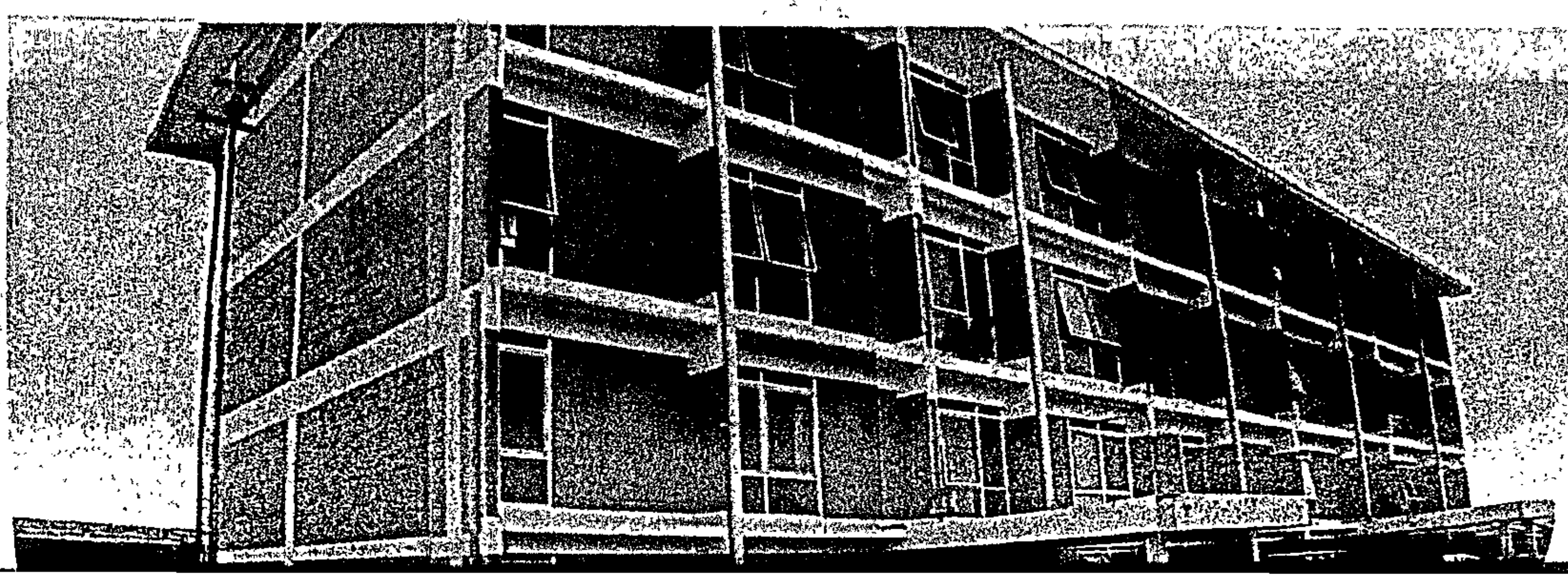


Private Estate (BANDUNG)

Private Housing Project (JAKARTA)

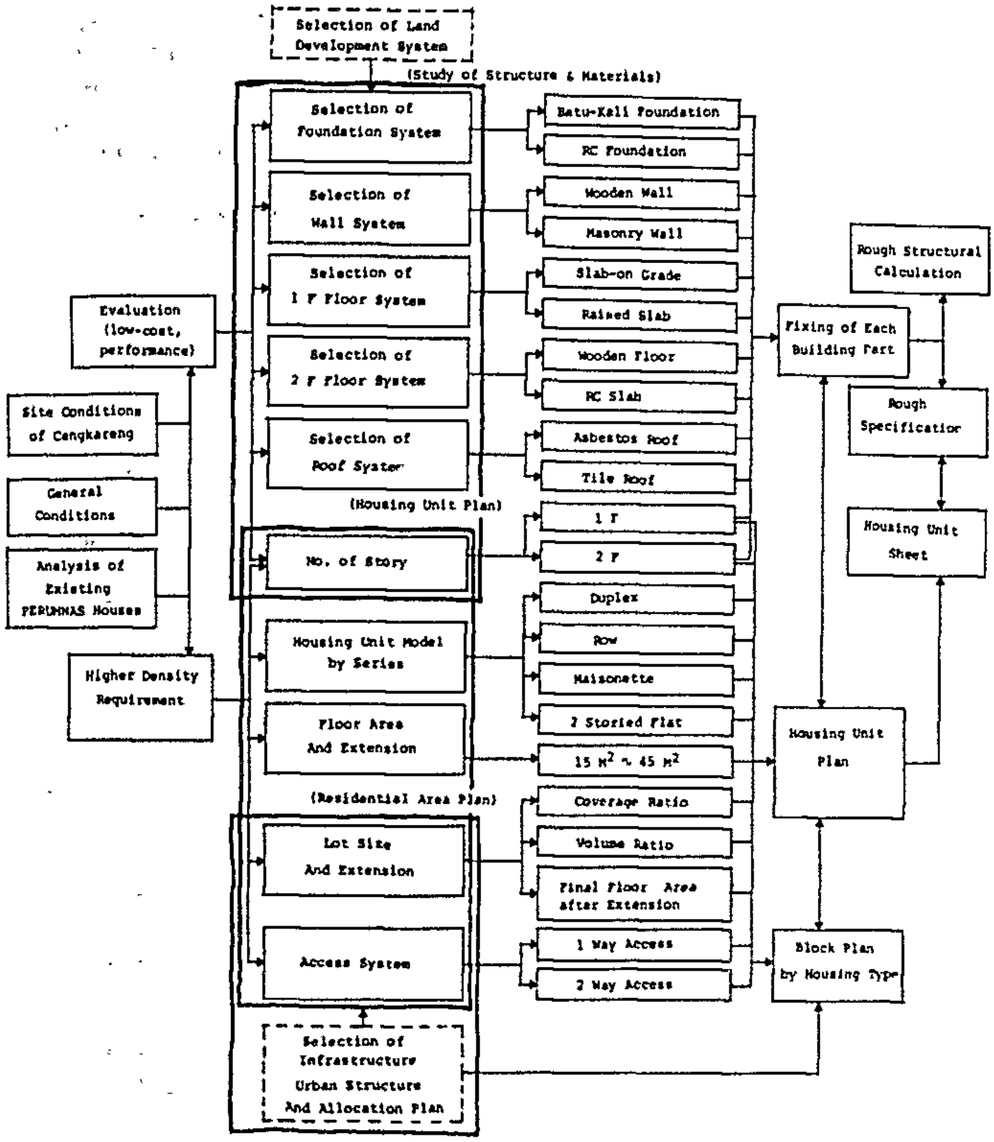


Experimental Flats by BRECAST System (PASAR JUMAT)



6—4 LOW-RISE HOUSING PLAN

6-4-1 Study flow



6-4-2 Low-rise house planning process

a. Analysis of existing PERUMNAS housing types and floor areas

Hereunder is the analysis of the seven basic PERUMNAS housing types, namely Duplex types D-20, 36, 45, 54 and 70, with their variations, and Maisonette types M-45 and 70.

Duplex type D-20 is composed of a one room plus WC. D-36 and 45 are qualitatively the same, being composed of 2·LDK (two bedrooms, living-dining and kitchen) plus WC, but the rooms are larger in D-45 than with D-36. D-54 and 70 are each composed of 3·LDK (three bedrooms, living-dining and kitchen) plus WC and storage; they are qualitatively much the same except that D-70 is larger, being provided with two living rooms and two WCs. Storages are seen only at this level. The above may be summarized as follows:

One room type ..... for comparatively lower income group
2·LDK type ..... for middle income group
3·LDK type ..... for high income group

Following is the distribution of housing types in various PERUMNAS projects:

Table 6-18 DISTRIBUTION OF HOUSING TYPES IN DIFFERENT PERUMNAS PROJECT

Floor area / Project	One-room	2·L.D.K		3·L.D.K	
	$20m^2$	$36m^2$	$45m^2$	$54m^2$	$70m^2$
DEPOK 1	5.1%	26.7%	48.2%	-	20.0%
DEPOK UTARA	-	9.2%	23.2%	-	67.6%
DEPOK II	46.7%	23.2%	14.7%	8.7%	6.6%
KLENDER	-	-	76.7%	14.9%	8.4%

D-36 and 45 are predominant in each project, though with variations depending on the character of the project or its policy background. Depok Utara, for example, has a lofty target consisting mainly of the $70m^2$ type while Depok II, which is new among these projects, has a low target consisting mainly of the D-20 type. As to structural system and materials, currugated asbestos sheets and PC tiles are used for roofs and floors for nearly all types, while walls can be generally divided into two: bataco and wood-framed walls. But, in all cases, partition walls are of bataco. Practically no interior finish is involved, leaving it to be done by occupants on the do-it-yourself basis, and initial cost is thereby held to a minimum. The general impression gained from visits by the study team to different housing complexes was as follows:

One room type: There are many cases of expansion effected at relatively early periods after the start of occupancy.

D-36 : There are some cases of building expansion, but expansion consists mostly of the addition of verandas and awnings.

D-45 and over: There are few cases of building expansion and expansion consists of the addition of verandas and awnings or, more rarely, of car ports.

The construction of fence and gates and the addition or improvement of buildings is performed by individual occupants in different ways, often with construction materials bought from shops having been established near the housing complexes to supply these needs. The above may be summarized as follows:

1. Distribution of housing units, mainly 2·LDK type, by floor area.

2. Recent tendency for floor area: to decrease.

3. Two structural types: bataco wall and wood-framed wall.

4. Positive use of do-it-yourself pattern.

   o Finish is held to minimum.

   o Boundary between expansion and improvement only is $36m^2$.

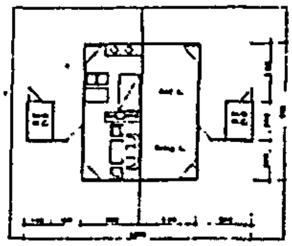
Table 6-19 EXISTING HOUSING TYPES

OF

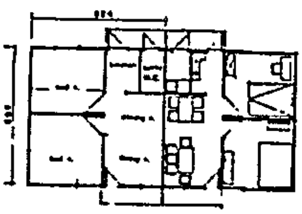
PERUM PERUMNAS

1. DUPLEX TYPES

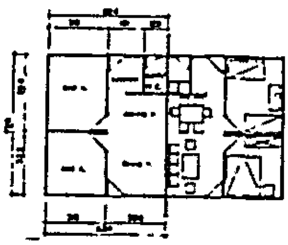
TYPE D-20



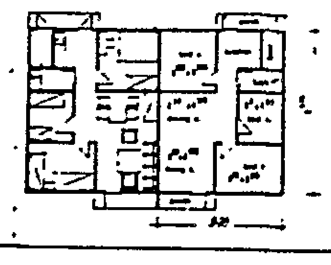
TYPE D-36



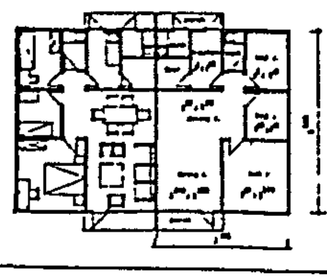
TYPE D-45



TYPE D-54



TYPE D-70



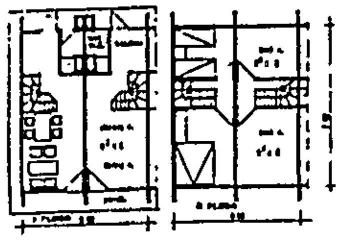
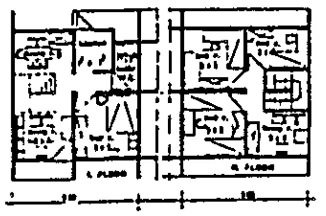
Type	Floor Area (M2)	Dinning Living	Kitchen	Bed R. 1	Bed R. 2	Bed R. 3	M/wc	Storage	Main Material: Skelton	Main Material: Floor	Main Material: Wall	Main Material: Roof
D-20	23.8	21.0			—	—	2.8	—	Steel/concrete	con.slab	bataco	corr.asbestos
D-36	37.25	11.84	3.70	9.49	9.49	—	2.73	—	Steel/concrete	PC tile + multiplex	bataco	corr. asbestos
D-45	44.93	16.37	3.35	10.24	12.66	—	2.31	—	Steel/concrete	PC tile + multiplex	bataco/particle board	corr. asbestos
D-54	58.77	19.43	6.84	10.30	9.71	6.48	3.00	2.51	Steel/concrete	PC tile + multiplex	bataco	corr. asbestos
D-70	72.59	27.82	6.10	13.96	7.90	6.22	5.99	3.49 + 1.11	Wood or Steel/concrete	PC tile or PC tile + multiplex	bataco or bataco/particle board	corr. asbestos

EXISTING HOUSING TYPES

OF

PERUMNAS

2. MAISONETTE TYPE

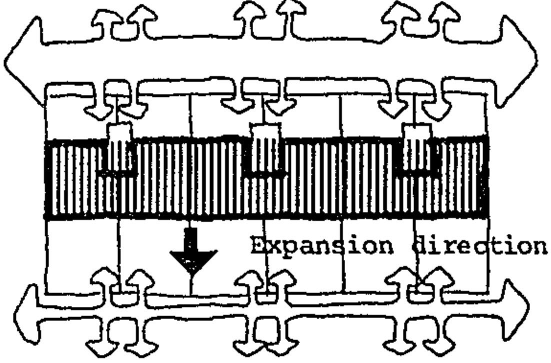
	Floor Area (M^2)	Dinning Living	Kitchen	Bed R. 1	Bed R. 2	Bed R. 3	M/wc	Stair	Main Material	Skelton	Floor	Wall	Roof
TYPE M-45 	44.88	13.21	3.64	11.10	7.20		2.42	7.31	—	Steel/concrete	tile + multiplex	bataco	corr. asbestos
TYPE M-70 	71.35	6.00+14.00	2.89	9.00	9.00	6.00+9.00	3.25	2.21+10.00		Steel/concrete	tile + multiplex	bataco	corr. asbestos

b. Design concepts for planning of row-house

This row house design concepts are also suitable for M.and F_2 types.

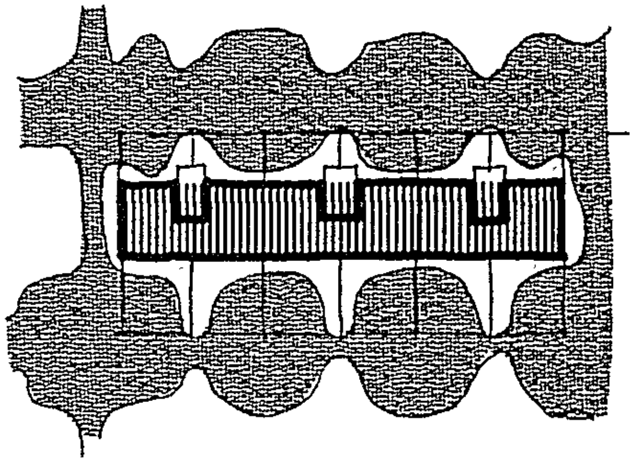
2-way access and 2-way escaping route will be provided because of continuous (row) type of houses are planned.

So called service alley at the rear side of houses will function as:bellow.



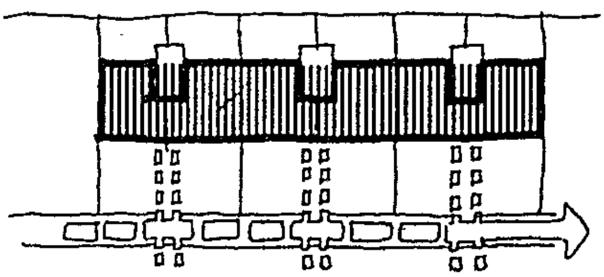
Footpath or road,as main access, for people and car.

Service alley,as sub-access,for energy,garbage, sewer and escaping route,and functions also as carry-in-route of construction materi-als for expansion

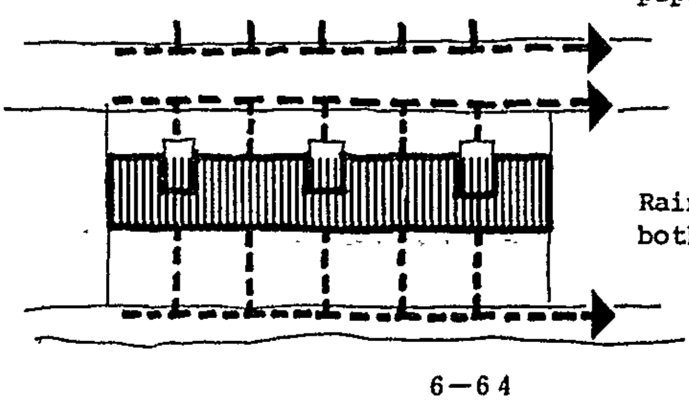


Continuity of green shall be considered.

Fig. 6-32 ROW HOUSE PLANNING CONCEPT



Sewerage and water supply piping via service alley



Rain water disposal via both sides of houses.

c. Essentials of housing plan by housing types

o Two-storied flat (F2)

This is a new type; it actually consists of two separate flats because different families live on the first and second floors. The land is collectively owned. This type is suitable for high density because the lot can be smaller than $60m^2$, which is the minimum per-unit lot size under DKI Regulations. The construction cost can be much less than that of walk-up RC flats of three to five stories, by using concrete blocks and adding necessary rainforcement. Also, no piling is necessary.

However, since separate families use the first and second floors, it would be realistic to use RC floor slab for the second floor, for the purpose of fire precautions and sound insulation, and also to provide water-proof kitchens and WC/M flooring on the second floor. In spite of the cost increase involved, the construction cost can probably be held to the same level as that for the maisonette type, by cutting the per-unit lot size by about $10m^2$.

One of the demerits of flat type housing can be eliminated, by planning the front and rear gardens for the exclusive use of each family, thereby enabling them to be used almost similarly to the gardens of non-flat houses. Our present proposal is for two-storied flats with these exclusive gardens.

The escape route for the second floor is via the service veranda to be provided with the WC/M.

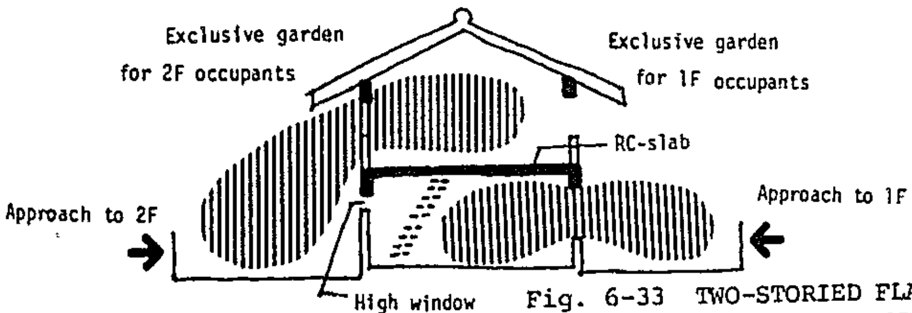
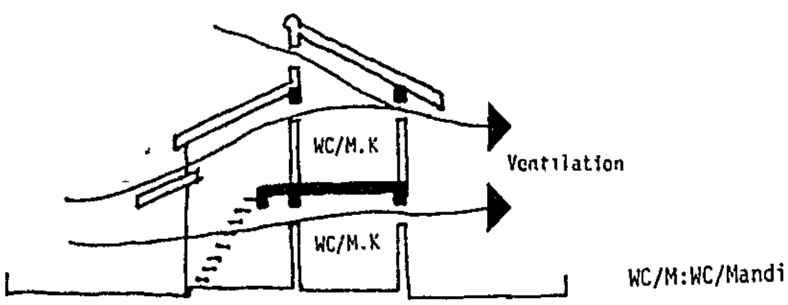


Fig. 6-33 TWO-STORIED FLAT PLANNING CONCEPT

Further, the staircase is used as a ventilation route, thereby correcting poor ventilation, which is often the case with flats.



o Maisonette (M)

PERUMNAS has already constructed a considerable number of $54m^2$ and $70m^2$ maisonette type houses. This study particularly stresses maisonettes of small floor area, ranging from $24m^2$ to $45m^2$.

Though this type does not requires as much reinforcement as the two-storied flat, it must be considerably reinforced because its weight and wall height exceed those of a single storied house. Since the same family uses the first and second floors, a wooden floor, which is inexpensive, is adopted for the second floor, though it involves the problem of sound insulation in the interior of the house. To counteract this problem, the present plan follows the common practice of using the first floor by day and the second floor by night as bedrooms.

In the $24m^2$ type, the second floor consists of one bedroom while in the $36m^2$ and $45m^2$ types, the second floor consists of two bedrooms.

With maisonettes, it is possible to considerably reduce the coverage ratio, and expansion in the rear can be facilitated by adjusting the positions and shapes of the roof and the windows.

It is important to secure the escape route for the second floor, taking advantage of eaves, etc., if no veranda is provided on the second floor.

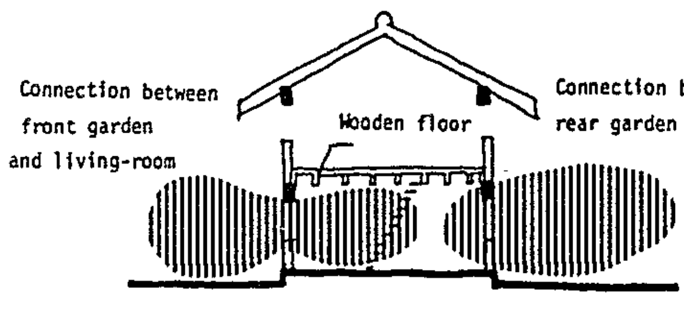
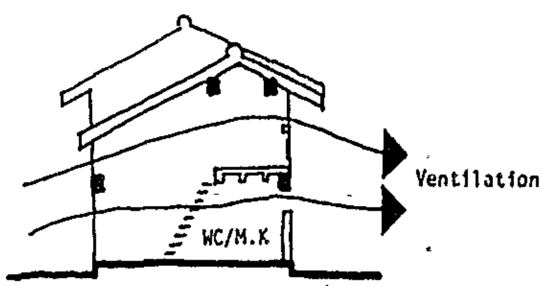


Fig. 6-34
MAISONETTE HOUSING
PLANNING CONCEPT

In the maisonette also, the staircase is used as a ventilation route and, at the same time, external appearance is given variety.



o Single Storied Row-houses (R) Type and Duplex (D) Type

Needless to say, PERUMNAS has abundant experience in planning of these types and has plan suitable for the duplex type, to be adopted by us.

For the Rtype, we use a form convenient for expansion (especially with respect to roofing techniques) because none have yet been developed for floor areas of $15m^2$ to $24m^2$, and houses of this type naturally require drastic expansion. Also, a mode has been planned, having a narrow frontage of 4m, which is, indeed, in accordance with the principle of frontage saving.

R-type houses of $36m^2$ to $45m^2$ have rather monotonous appearance because of their row-house style. Therefore, and because these are intended for the relatively high income class variety shall be given these models with the knowing that they will incur extra construct in cost. Further, since medels suiting the 15m-depth, series of R-36 houses will be necessary in future housing layout, we also study the R-36N type having a frontage of only 5m. This type is a derivative from the R-15, R-22, etc.

6-4-3 Process of selecting materials and structural system

d. Process of selecting foundation system

a. Present foundation system

This section deals with housing foundations. The following types of foundation are now commonly used:

- Bataco foundation: This system consists of laying a certain number of layers of bataco or brick continuous footing on top of compacted sand and installing building sills on this footing. It is usually used for light-weight buildings.

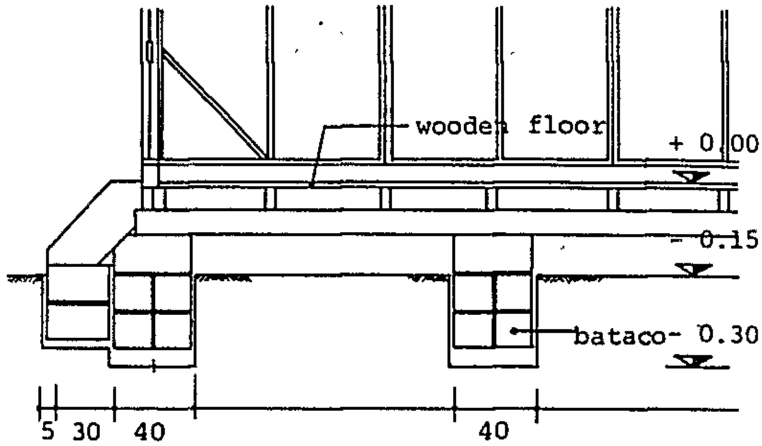


Fig. 6-35 BATACO FOUNDATION

- Batukali foundation: This system consists of using bed gravel (cobble stones) for a thickness of 200mm, placing large broken stone (river stones) on top of this gravel, and forming a continuous footing by uniting these, using mortar. Usually, two proportions are used for the mortar (cement· sand ratio: 1:3 and 1:5) but, as can be seen from the drawing below, the batukali at the top is reinforced by using enriched mortar.

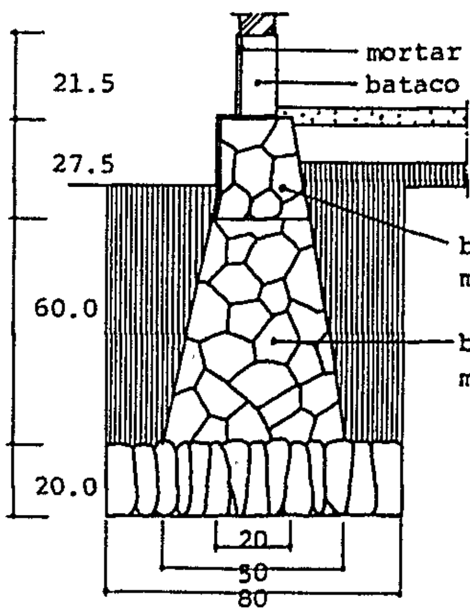


Fig. 6-36

BATUKALI FOUNDATION

• Reinforced concrete foundation: This system is used if the ground is weak or if the building to be built on top of it is heavy. Concrete is cast in after arranging reinforcing bars above compacted sand. A kind of mat foundation, this system anticipates resistance about the footing beam.

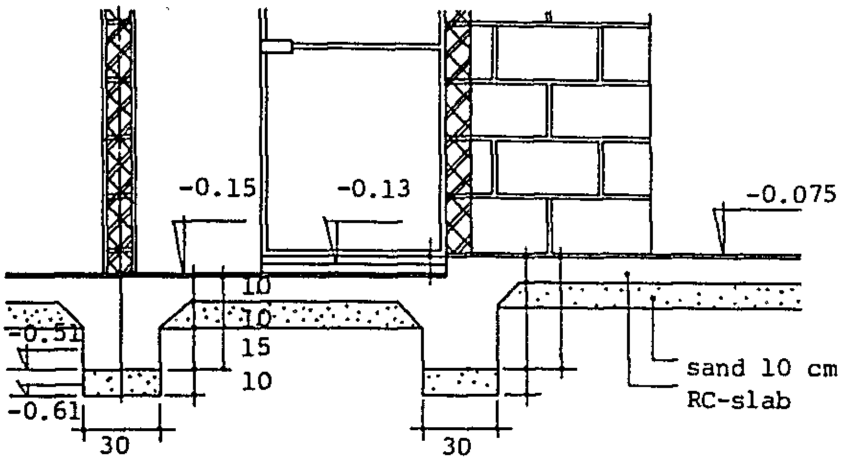


Fig. 6-37 RC-FOUNDATION

* Batukali: River stone

ii. Ground and its allowable bearing capacity

The ground supporting the foundations of low-rise buildings concerned consists of, as indicated in Fig. ,

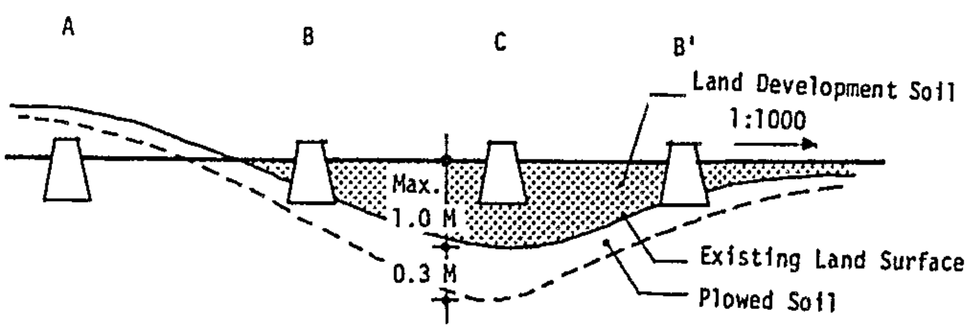
A. Land fill soil (From Cengkareng Floodway)

B. Plowed soil (Surface layer 20 - 30cm)

C. Existing surface layer (Lower layer of plowed soil)

Therefore, the design soil bearing capacity can be classified as follows: However if drainage and dry-up is incomplete, the values will be smaller than that shown below. Also, the lower values will apply if the foundation comes between the above-mentioned different layers.

Permanent soil bearing capacity	Details of work
$3.0t/m^2$	• Land fill soil and plowed soil with moisture content improved by dry-up to less than 60% and thoroughly compacted.
$5.0t/m^2$	• Land fill soil and plowed soil with moisture content improved by dry-up to less than 50% and thoroughly compacted. • Existing surface layer (lower layer of plowed soil) that has not been disturbed.



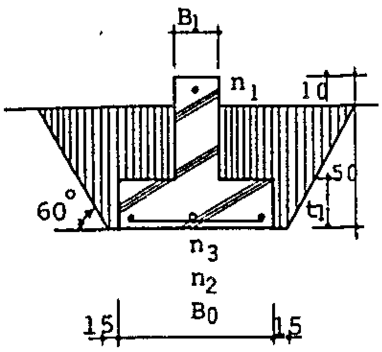
Existing surface Layer

iii Selection of foundation system

Study is made by different structural conditions as foundation systems ((RC and Batukali), bearing capacity of soil, different upper-structure and foundation cost (foundation cost per floor area) conditions of computation are as indicated below.

Foundation Details

RC foundation (continuous)



cm

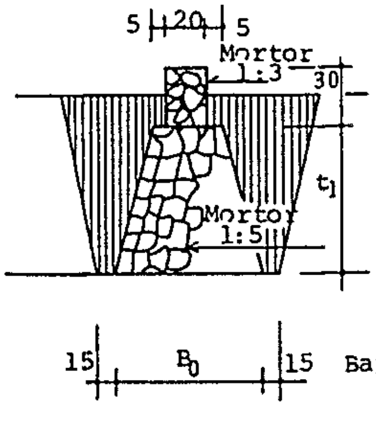
B_0	B_1	t_1	Reinforcing Bar		
			n_1	n_2	n_3
50	15	15	1-13φ	3-13φ	-
70	15	15	1-13φ	3-13φ	9φ-300@
100	15	20	1-13φ	4-13φ	9φ-300@
150	20	20	2-13φ	4-13φ	9φ-200@
200	20	25	2-13φ	6-13φ	9φ 13φ-200@

Concrete Strength: Fc ≥ 175 kg/cm

U • 24

Fig. 6-38 RC-CONTINUOUS FOUNDATION DETAIL

Batukali foundation (continuous)



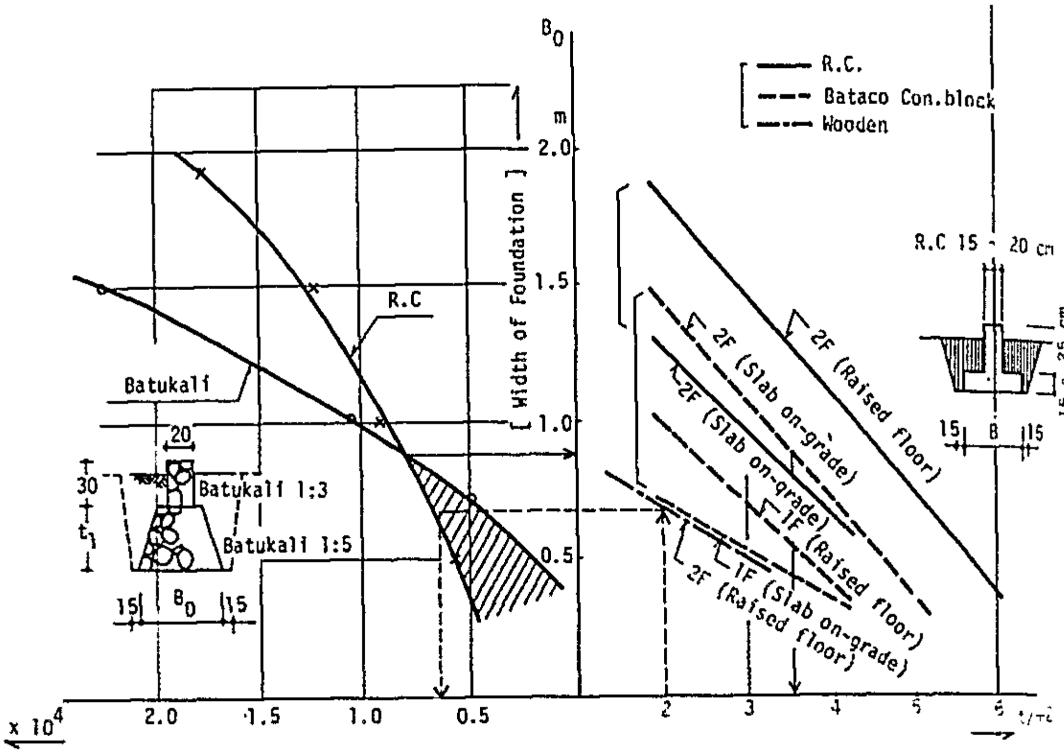
cm

B_0	t1
50	20
70	55
100	80
150	150
200	

Batukali:Riverstone

Fig. 6-39 BATUKALI-CONTINUOUS FOUNDATION DETAIL

Foundation cost and structural types



Foundation cost (Rp/ M^2)
(1/2 value shall be adopted in case of 2 storied types)

Bearing capacity of soil (expected)

Note: Cost is 1979 Oct.

Fig. 6-40 FOUNDATION COST-STRUCTURAL TYPE

Types of building studied are two: raised floor and slab-on-grade for one-storied bataco or concrete-block buildings. For two-storied buildings (wooden, bataco, or concrete-block, with wooden second floor and reinforced concrete), the first-floor slabs were similarly divided into raised floor and slab-on-grade. Thus there are four building types involved. As for soil bearing capacity, study was made of 2 t/m^2 to 6 t/m^2 presumed for the ground after dry up. The width of foundation ranges 40cm to 200cm as parameter. The results are shown in next page. It can be seen from these results that, in the case of two-storied bataco or concrete-block buildings, the cost of RC foundation and the cost of batukali foundation are identical at the soil bearing capacity of about 3.5 t/m^2 and that batukali foundation costs less, if the soil bearing capacity exceeds this value. In the figure, the slant-line section ▨ shows combined RC + batukali foundation.

iv . Proposal of foundation formula

• Setting of permissible settlement

The dynamic characteristics of the ground concerned (contact pressure and soil bearing capacity) are as shown in Appendix. Meanwhile, the criteria set for the permissible settlement of buildings by the Architectural Institute of Japan as follows:

Table 6-20 PERMISSIBLE SETTLEMENT OF J.A.S.S.

cm

Types of foundation	Permissible settlement	
	Standard value	Maxim value
Footing foundation	5	10
Mat foundation	15	30

Criteria for settlement by the difference of building types and foundation systems are as follows:

Table 6-21 PERMISSIBLE SETTLEMENT CRITERIA

cm

Upper structure	Foundation system	Permissible settlement	
		Standard value	Maxim value
R.C	Independent	5	10
	Continuous	10	20
	Mat	10∿15	20∿30
R.C wall system	Continuous	10	20
Concrete block etc.	Continuous	2.5	5

(Source: Soil Engineering Library - 1)

In this study, a maximum permissible settlement of 5cm is used for concrete block structures with a view to low cost housing. Settlement increases with time and, since the above values are as of the time of design, the final settlement is likely to be about three times this level. There are, therefore, parts where upper-structure load is not necessarily the same and it is important to take countermeasures against differences in settlement, namely, differential settlement.

v. Proposed foundation system

The role played by the foundation consists of two main points: transmitting upperstructure load to the ground as evenly as possible, and transmitting horizontal load of an earthquake to the ground. Installing members with considerable bending flexibility and unity with the foundation is necessary, because uneven settlement caused by uneven upperstructure load may result in damage to the upperstructure. It is also important that filling be packed as compact as possible. So, we hereby propose the below-illustrated foundation system from the results of our dynamic and economic studies. This system is aimed at not only preventing differential settlement, but also at acquiring unity with the upperstructure by installing an RC sill atop the batukali under the wall. The dimension of this RC beam is closely related to the structural design of the upperstructure and is often determined by the system of the upperstructure (see Appendix for Structural Calculation).

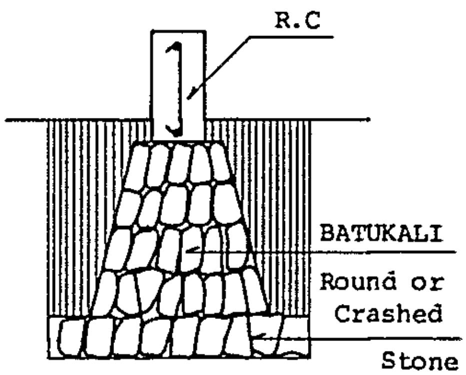


Fig. 6-41 PROPOSED FOUNDATION SYSTEM

e. Process of selecting wall system

i. Present wall system

There are two wall systems for low cost housing presently supplied by PERUM PERUMNAS namely the wooden system and masonry system.

o Wooden wall system

Aimed at mass production, panel materials of this ligneous panel system now being used, comprise particle boards and cemented fiber boards. (However, WC/M walls are of masonry construction.) Plywood is not yet used because of its expensiveness. As a structural material, Meranti is commonly used. Lately, Meranti coated with creosote or water born or oil soluble preservation has begun to be widely used as countermeasures against termites and fungi. Preservation treatment by vacuum injection is now in practice in some places. By this method, the material cost alone is 70% higher. So, it is difficult to decide whether this method should be adopted for the Cengkareng area. where termites damage seemingly is smaller than at Depok and other housing complexes on laterite-soil.

As joint method, nails, cramps, bolts, etc. are used.

o Masonry wall system

Bataco, concrete blocks, and bricks are used, and these three types will have to be studied. Bataco involves many uncertainties but has been used in large quantities because of its low cost. However, the transportation of bataco to Cengkareng site from Sukabumi, southern part of Bogor, from where mass-produced bataco by mechanical press is available is too risky. There are two types of bataco: truss lime block (lime: pozzolan 1:5 Fc $\doteqdot$ 25 kg/cm^2) and truss cement block (cement: pozzolan 1:8 Fc $\doteqdot$ 50 kg/cm^2), and usually the former is used. It is available in the following sizes: 40cm × 20cm × 10cm, 15cm and 20cm.

As structural system, many PERUMNAS houses have bataco walls and wooden roof structure, but some use the above-mentioned light-weight steel columns for the corners, these columns being joined to the roof truss above (steel truss in this case). Most are one-storied, but even houses of the maisonette type use this bataco material. No reinforcing material is used for one-storied houses and only houses of the maisonette type have 100mm or 150mm square columns (RC) for pitches not exceeding 3m, and also have beams of the same square along the floor of the second floor. However, they do not use RC reinforcement for the top walls. The unity between the reinforcing bars and the bataco lacks in tenacity, because only mortar is used. But as shown in next page more recent details incorporate ideas for the uniting of reinforcing material and bataco. The following are the problems associated with this system (including concrete blocks):

1. Assurance of quality of bataco material: Confirmation of great variation in strength, damage rates and water permeability.

2. Improvement of form of bataco material: It is advisable to make the arrangement of horizontal bars possible, to assure unity with the reinforcing material.

3. Assurance of the unity of bataco structure: Study of reinforcing methods and capacities; manner in which buildings collapse during earthquakes and time necessary for escape.

Concrete blocks are available in two strengths: Fc ≑ 40 kg/cm^2 and Fc ≑ 60 kg/cm^2, and PERUMNAS usually uses concrete blocks of the former strength. They are shaped similarly to bataco, but blocks with the thickness of 15cm are not in production. However, from the point of view of mass production, reasonable cost, and structural capacities, it would be, indeed, realistic to develop blocks with a thickness of 15cm.

As for bricks, exposure bricks have begun to be used for some low cost housing and their use is expected to increase in the future, for such reasons as the merit of appearance and the ease of maintenance, etc. However, they are still expensive.

Example of Column practice (reinforcement)

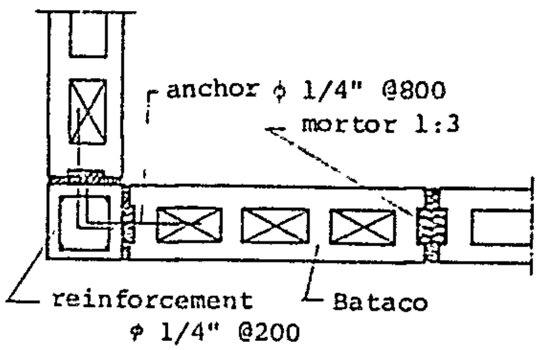
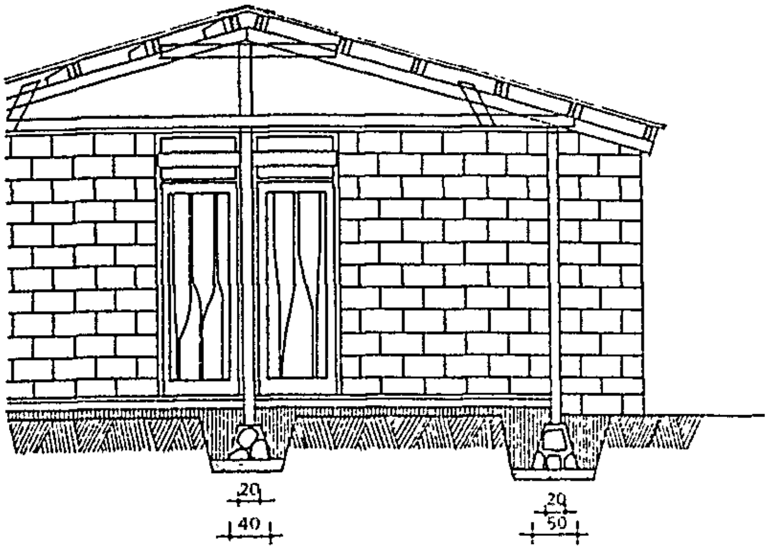
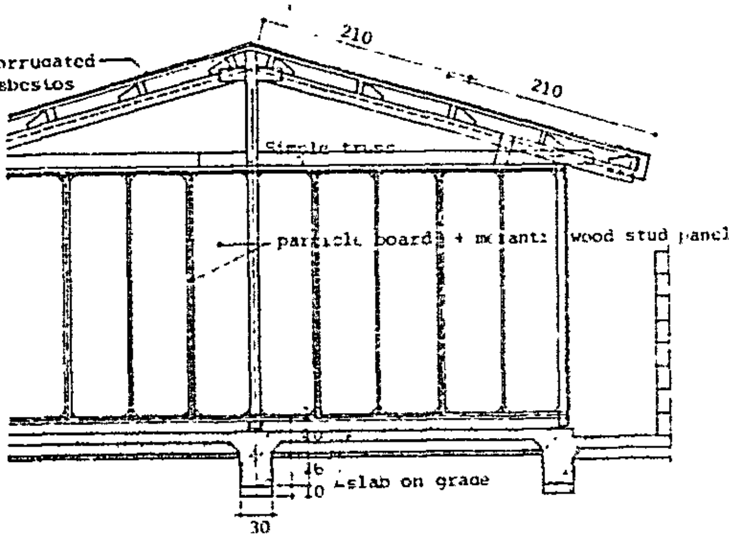


Fig. 6-42 COLUMN PRACTICE



Two examples of PERUMNAS wood panel wall system



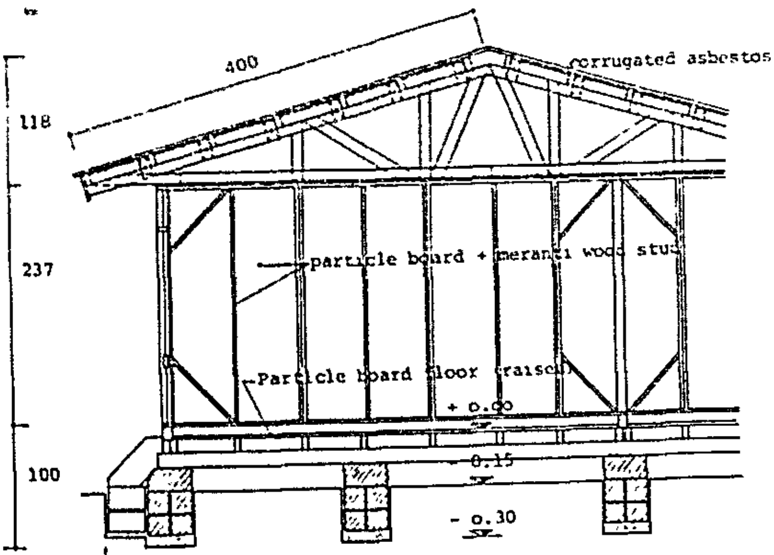
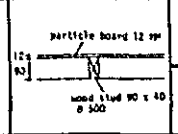
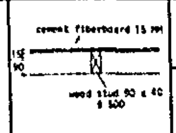
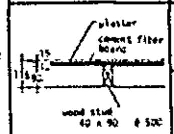
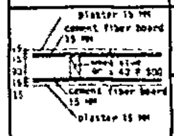
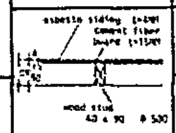
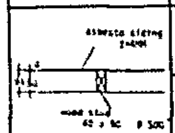
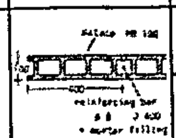
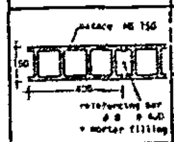
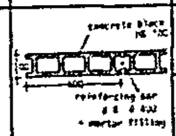
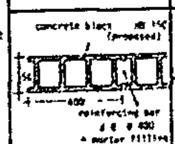
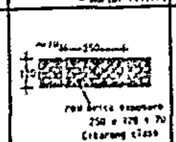
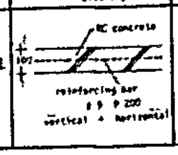


Fig. 6-43 EXISTING WALL SYSTEM OF PERUMNAS HOUSING

. Overall evaluation of wall

Cost in June,1980

wall system		specification	cost Rp/M^2	performance				structure evaluation	work efficiency			material availability and transportation	mainte-nance	appearance and people's favour	selected type						Total evaluation
				weight (kg/M^2)	sound insulation dB (1000Hz)	fire proof	Water and damp-proof ( ) : wall base		execution term	failure ratio	accuracy requirement				bearing wall			non-bearing wall			
															outer wall	unit wall	parti-tion	outer wall	WC/M wall	parti-tion	
wooden wall	particle board panel system		2,610 *1	21		flamable	Very small (small)	after the corrosion of particle board regidity decrease extremely	short	small	medium	from Sukabumi factory no problem	preserving and painting are not still sufficient	good if painted						●	Weather-, fire-proofing performance shall be developed
			2,945 *2				Very small (medium)														
	cement fibre board panel system		2,450 *1	20		under F.P leve	small (small)	not sufficient regidity	short	relatively small	medium	not sufficient in availability for mass order	frequent maintenance needed	not popular among people							hard type of cement-fibre board is expected
			2,785 *2				small (medium)														
			2,800 *1	30		one side F.P level	medium (small)	- ditto -	relatively short	relatively small	medium	same	mortar stripping problem	good if painted							same
			3,135 *2				medium (medium)								○			○			
			5,760 *1	50		both side F.P level	medium (small)	good rigidity	normal	relatively small	medium	same	mortar stripping problem (but for inside wall small problem)	same		●					For upper gable and unit wall, this type is selected in this study
			6,095 *2				medium (medium)														
			4,305 *1	27		one side nearly F.P level	medium (small)	relatively rigid	relatively short	relatively small	large	same	surface get dirty durability of paint short	normal							fixing method of asbestos sheet is difficult
			4,640 *2				medium (medium)														
	asbestos sheet panel system		2,395 *1	18		under F.P level	medium (small)	not sufficient regidity easy to collapse	short	relatively small	large	from Cengkareng factory no problem	same	normal				●			Use is limited to only upper gable wall in this study
			2,730 *2				medium (medium)														
masonry wall	bataco block system		1,770 *3	130	-35	over F.P level	relatively small	compressive strength 25kg/CM^2 no reinforcement -deformation resistance very small	normal	large	small	Transportation from Sukabumi factory not feasible because of too high failure ratio	durability questio-nable even painted	good if painted							Transportation problem to Cengkareng is decissively large, use will be limited to only open gutter, fence etc.
			2,520 *4	150																	
			2,300 *2	170	-40	over F.P level	relatively small	with reinforcement -deforcemation resistance increase Decrease of strength by shrinkage	normal	large	small			same							
			3,050 *4	190																	
	concrete block system		2,270 *3	110	-35	F.R 1 hr.	medium	compressive strength 40kg/CM^2 no reinforcement -deformation resistance small	normal	normal	small	easily available from Cengkareng area enough capacity for mass order	frequent painting needed	same				○	●		For 1 storied types' wall
			3,020 *4	130											●	●	●				
			2,990 *3	150	-40	F.R 1 hr.	medium	with reinforcement -deformation resistance increase	normal	normal	small	new type-need new mold no other problem		same				○	●		For 2 storied types' wall new production of 15CM thick type needed.
			3,740 *4	170											●	●	●				
	brick exposure system		5.450	190	-42	F.R 1 hr.	large	compressive strength 100kg/CM^2 deformation resistance small	normal	normal	small	availability for mass order is unknown	no maintenance needed	very good							still expensive for low rise houses, but good for flats because of good appearance and easy maintenance.
RC wall	RC wall panel system		8,875	240	-45	F.R 2 hr.	large	compressive strength 175kg/CM^2 deformation resistance big	long	small	medium	no problem	repainting needed	good if painted							still too expensive

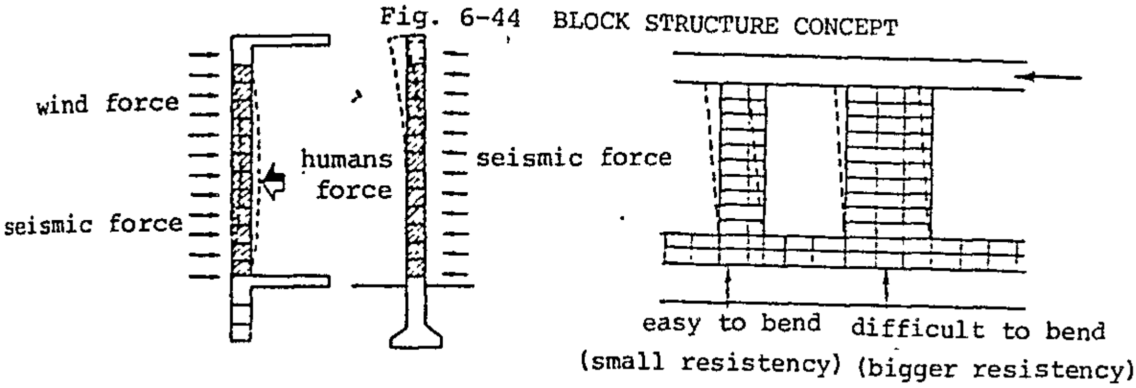
*1 no preserved wood
*2 preserved wood
*3 no reinforcement
*4 reinforcement

● selected type ○ convertible

iii. Conception of block structure

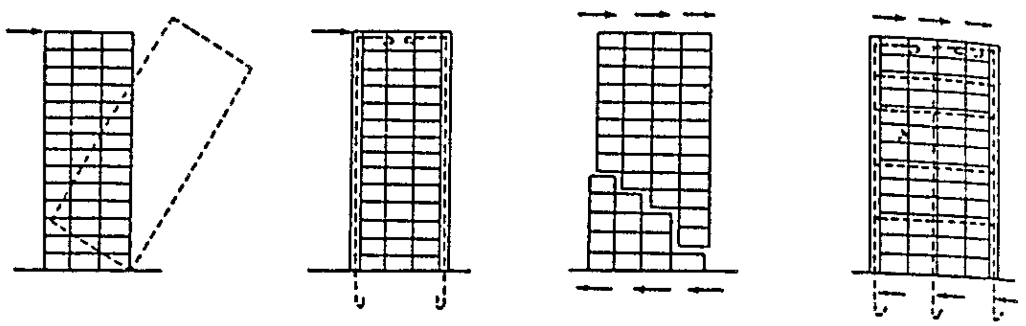
Structurally, blocks must be able to support vertical load as well as horizontal load in the direction of the interior and exterior of the plane by seismic force, wind pressure, etc. Walls particularly charged with vertical load and horizontal load are called bearing walls. Under seismic force, walls are deformed by shear and bending action, as shown in next figures, and the deformation is in proportion to the narrowness and length of the wall. Test results in Japan show that if blocks are reinforced as a whole for a two-storied building, cracks develop, but no collapse occurs at two to three times the seismic intensity of 0.2. But, if reinforcement is inadequate, shearing or bending fracture may occur.

Fig. 6-44 BLOCK STRUCTURE CONCEPT



Next figures show how building characteristics change, depending on the quantity and position of the reinforcing bars. The reinforcing method with a larger ▨ area in the load-deformation curve is desirable, because it produces the greatest ductility. It indicates that, as in (b), the bending reinforcing bars at the end of the wall are effective, but this is, of course, the case when work on mortar joints, which resist shear, has been adequate. What, then, should the quantity of reinforcing bars be? Past tests show that the load that causes cracks is the same, regardless of whether the quantity of reinforcing bars is large or small, and the maximum load after the development of cracks differs.

In the absence of information on input seismic force, it is necessary for a building to be as ductile as possible.

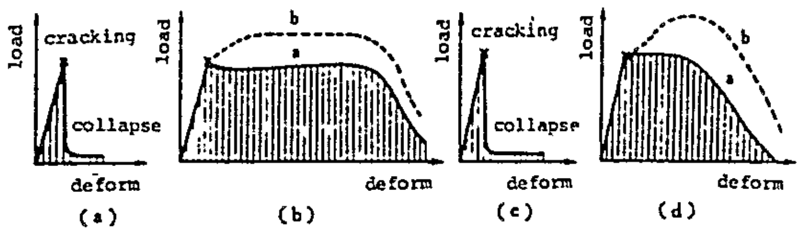


(a) A wall without reinforcing bars at its end falls if bending cracks develop.

(b) A wall without reinforcing bars at its end continues to resist external force even if bending cracks develop.

(c) A wall without horizontal and vertical reinforcing bars develops stair-shaped cracking and collapses.

(d) A wall with horizontal and vertical reinforcing bars may crack, but continues to resist external force.



a curve: If quantity of reinforcing bars is small

b curve: If quantity of reinforcing bars is large.

Fig. 6-45 REINFORCING CONCEPT OF BLOCK STRUCTURE

iv. General specifications of reinforced concrete block buildings

The presently proposed buildings satisfy the following requirements: Note: AIJ standards

- Concrete blocks, reinforcing bars, mortar and concrete must meet the Indonesian quality standards.

- Mortar to be used to fill joints and hollows, concrete strength, RC-course, foundations must be at least as follows:

Table 6-22 MORTAR STANDARD FOR BLOCK STRUCTURE

Material	Mixing ratio	28 days strength (kg/cm^2)
Joint mortar	PC: sand $\geqq$ 1:4	125
Filling mortar	PC: sand: aggregate; 1:2:3	125
RC-course, foundation	- ditto -	125

* PC: Portland cement

- The strength of concrete blocks, the number of story and the height of eaves must not exceed the following values:

Table 6-23 NO. OF STORY — HIGHT OF EAVES—BLOCK STRUCTURE

Reinforced concrete block	Compressive strength (kg/cm^2)	No. of story	Height of eaves (m)
	more than 40	2	7

- Arrangement of bearing walls

  - The bearing walls of the upper floor must be above the bearing walls of the lower floor.

  - The distance between the center lines of neighbouring walls must not exceed 50 times the thickness of bearing walls.

  - The value (to be referred to hereafter as wall quantity) obtained by dividing the total length (cm) of bearing walls of the structure prescribed in the "Structure of Bearing Walls" by the floor space (m^2) of the same floor with respect to the direction of each span on each floor must be at least as indicated in the following table:

Table 6-24 WALL QUANTITY—BLOCK STRENGTH

Concrete block	Compressive strength of Cross sectional area of block (kg/cm^2)	Wall quantity (cm/m^2)	
		First floor or upper most floor	Second upper most floor
	$\geqq 40$	15	21*

* In case of the thickness of wall is 15cm; $\geqq 27$ (cm/m^2).

- Structure of bearing walls

  ⊙ The actual length of a bearing wall must be at least 55cm for one-storied houses and at least 40cm for two-storied houses. Adequate integration must be achieved by means of reinforcing bars.

  - The thickness of a bearing wall must be at least as indicated below, except for the finished part.

Table 6-25 THICKNESS OF BEARING WALL

Story	Thickness of bearing wall (cm)	Note
First floor or upper most floor	15 and h/20	h(cm); height of con. block wall
Second upper most floor	19 and h/16*	

* In the case of 2-storied buildings, these values must be at least 15cm and h/20.

- Arrangement of bars for bearing walls: wall ends, cross-points, corners and openings

  - This is described in the Structural Design.

- Lintel structure

  - Lintels are provided, as a principle. (RC-course functions also as lintel)

- RC course structure

  - RC course must be provided effectively and continuously on top of bearing walls on each floor.

  ⊙ RC-course sections must have sufficient strength against vertical load and horizontal load. Resistance against horizontal load can be offered by effectively arranging horizontal braces.

- Foundation structure

  ⊙ Under the bearing walls on the bottom floor, RC foundation beams that support the walls must be provided effectively and continuously. (Assurance of building unity).

  ⊙ Continuous footings or foundation beams must be effectively provided against the bending moment and shearing force acting against the vertical load and horizontal load of the upperstructure.

- Joining and anchoring of reinforcing bars

  - This must be done in accordance with the Indonesian standards (N1-2)

- Covering depth of reinforcing bars

Table 6-26 COVERING DEPTH OF REINFORCING BAR

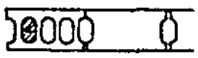
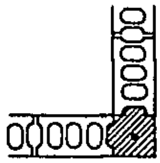
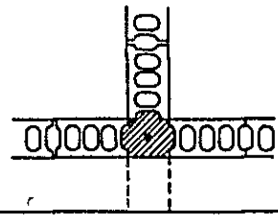
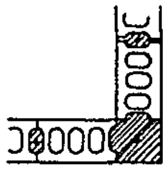
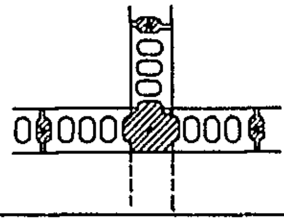
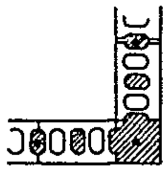
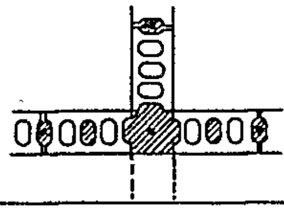
Structural part	Covering depth (cm)
Bearing wall	2 (except the thickness of concrete block itself)
RC-course	3
Foundation beam	4
Foundation	6

v. Proposal on block reinforcing system

We propose a structural system under the following conceptions, and in accordance with the above specifications, and the characteristics of block structure.

A wall of which the actual length satisfies the specified value, is presumed to be a bearing wall. Also, vertical bar reinforcement of the building is made by the method indicated in next figure. Blocks having undergone vertical bar reinforcement must form a rigid frame by being united with the top and bottom RC beams. This is based on the assumption that in a severe earthquake the block structure without any reinforcement will be surely destructed or collapse, but this rigid frame system, composed of reinforced blocks and top and bottom RC beams, can stay erect for a moment, so that occupant can have time to escape. And section design must be made so as to enable the wall to withstand such earthquake. So, the foundation must be provided with underground beams capable of absorbing the bending moment of the upperstructure.

Table 6-27 PROPOSED BLOCK REINFORCING SYSTEM

		Wall end	L-wall end	T,+,- wall end	note
A	∅ -9				1 storied type
B	∅ -9				1,2 F. of maisonette types 2 F. of 2 storied flats
C	∅-13				1 F of 2 storied flats

* Note: Reinforcement around openings same as A.

The quantity of block walls is in accordance with the specifications. The allowable unit stress is shown in next table, and the following is adopted from the past test results:

(Temporary allowable unit stress against wall) =
(block strength) × (bond coefficient)
÷ (true safety factor for temporal stress)

(Permanent allowable unit stress against wall) =
(block strength) × (bond coefficient)
÷ (true safety factor for permanent stress)

Here, "bond coefficient" is the reduction coefficient for wall strength due to bonding. It is 0.5 for both compression and shear.

True safety factor for temporal stress = 1.5
True safety factor for permanent stress = 3.0

Table 6-28 TEMPORARY ALLOWABLE UNIT STRESS

Compressive strength of concrete block (kg/cm^2)	Temporary allowable unit stress (kg/cm^2)	
40	Compression	Tension shearing
	$40 \times 0.5 \times \frac{1}{1.5} = 13.6$	$13.6 \times 0.1 = 1.36$

* Value is for the total cross-sectional area of con. block.

* Permanent allowable unit stress = $\frac{1}{2}$ × temporary allowable unit stress.

The following formula is used to compute the shearing stress intensity of the wall:

$$J = \frac{Q \cdot d}{l_o \cdot t} = \frac{0.15 \Sigma w}{l_o \cdot t}$$

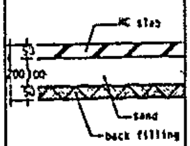
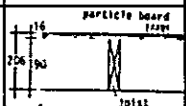
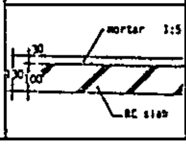
J: Design shearing stress that develops in wall
d: Concentration coefficient = 1.5
Q: Seismic force per $1m^2$ of floor acting on floor conceived $0.1 \times \Sigma w$

In planning according to the above conceptions, curtailment in the quantity of reinforcing bars is necessary, because of the present problems involved in the details of block materials, such as the impossibility of lateral bar reinforcement and the economic limitations. To underscore the grounds for our proposal, therefore, the capacities must be confirmed by partial or reduced-scale tests.

f. Process of selecting floor system for first floor

Slab on-grade is mostly used as the floor system for the first floors of present PERUMNAS houses and no PERUMNAS houses of the raised floor structure can be found. Here however, a comparative study of both the slab on-grade system and the raised floor system is made below.

Table 6-29 EVALUATION OF FLOOR SYSTEM FOR 1F

	Specification	Cost (RP/M²) Unit Cost	Foundation Cost Increase	Evaluation	Selected Type Gen. Floor	Selected Type HC/H Floor
Slab-on-grade	 (Lime Contained)	110	nil	As a system depending on improvement by occupants themselves, this system serves to cut construction cost at first. Specified value may be increased by means of lime treatment.	○	
Slab-on-grade		1785	nil	This system is superior because of smaller construction and maintenance cost and the prevention of moisture. In areas with the problem of inundation above the floor, care must be taken as to difference from the ground level.	●	●
Raised Floor	 (Wood Preserved)	7.020	* ∿650	Questionable durability. Especially damp proofness of particle boards, and in spite of the preservative treatment and ventilation under the floor, something must be done to keep the ground dry. This system is also costly.		
Raised Floor		11.760	* ∿3300	This system is best in all respects, but too expensive.		

Cost in June,1980

* In case of expected soil bearing capacity 5 t/m²
concrete block
roof tile

● Type selected in this study
○ Convertible

Expansion test results show that lateritic soil does not expand. With paddy-field soil at the Cengkareng site, an expansion pressure of 1.5 t/m^2 and maximum expansion of 2 CM (on assumption of groundwater level variation of about 1 M) were obtained at the expansion coefficient of 2%. (This probably is the same with soil brought from the Cengkareng Floodway for land fill.) So, expansion may occur in the case of the slab on-grade system, since the floor weight is only about 0.5 t/m^2. Pre-wetting is recommended as a realistic, though not ideal, counter-measure. Upon completion of the foundation, it would be well to cast floor slab concrete immediately after wetting the soil under floor.

Ground floor level will be decided based on many different conditions, and especially following items shall be taken into consideration.

- Open gutter, micro-drainage aredesigned based on the two-year rainfall curve.

- Addition to footpath, higher density housing types require service alley with open gutter on the opposite side of footpath, and open gutter interval is rather small.

- For the first floor material, concrete slab-on grade system is recommended.

- Construction of macro-drainage is not yet finally authorized.

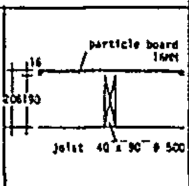
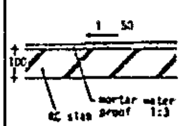
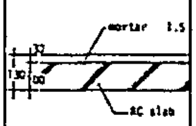
Based on the above mentioned items, 15cm height of ground floor level (from G.L.) will be adequate except the case of exceptional hard rain.

g. Process of selecting floor formula for second floor

The wooden floor system is the only floor system now used for the second floors of PERUMNAS houses; it is used in maisonette type housing units.

However, in newly studied two-storied flats at this time, it is necessary to consider RC floors also.

Table 6-30 EVALUATION OF FLOOR SYSTEM FOR 2F

Specification		Cost Rp/ M²	Performance			Evaluation	2 storied flat		Maiso-nette	
			Weight Kg/M	Sound insulation *	Fire-proof		Gen. floor	wc/M "	Gen. "	wc/M "
Wooden floor		7,020	30	~25	flamm-able	Unsutable for unit floor; Realistic as floor for maisonette.			●	
RC floor		13,162	300	-45	Fr. 2 hr.	Costly but satisfactory in performance.		●		
		11,760	300	-45	Fr. 2 hr.	Same as above	●			

● Type selected in this study

* Sound insulation value is, in case of 1000 Hz, dB

Cost in June, 1980

h. Process of selecting roof system

Roof systems are studied by the divisions of roof materials and roof construction.

i. Roof materials

Corrugated asbestos sheets are now mostly used for PERUMNAS houses in Java. Meanwhile, unglazed roof tiles of different grades are commonly used for ordinary houses. If glazed tiles and other high-class roof materials are to be left out of consideration for reasons of price, corrugated asbestos sheets and unglazed roof tiles called "Genteng Kodok" are relatively worth considering. The roof gradient suitable for them would be 15° and 30°, respectively.

ii. Systems of roof construction

The truss system is usually used. The commonly used truss material is Borneo wood without preservation (still expensive), or Meranti with preservation. Light-weight steel trusses are sometimes used for their advantage of speedy work performance, but they are generally more costly than other trusses. The forms of truss used are as shown below. For spans of 6m or so for corrugated asbestos sheets, 1 is usually used but, for tiled roofs, 4 would be necessary. Yet, purlins, rafters, and tile battens, are as necessary as ever. Thus, both the quantity of wood used and roof weight increase, and the cost increases considerably.

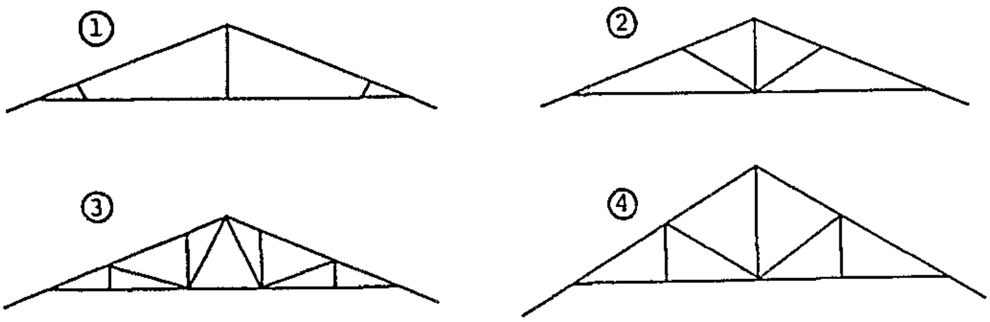
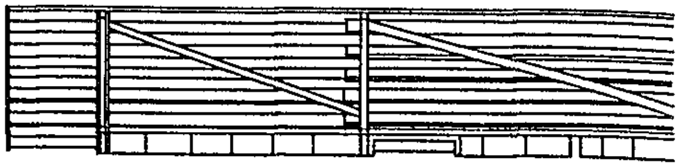


Fig. 6-46 ROOF TRUSS SYSTEM IN PERUMNAS HOUSING

There are the following two methods of truss reinforcement in the direction of cross-beams.

Ridge truss



Roof top truss

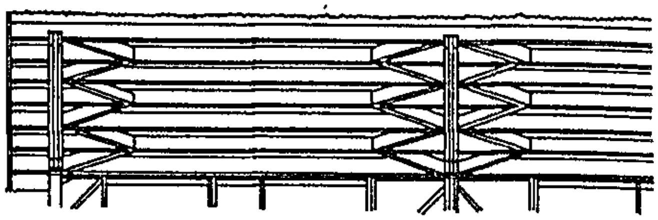
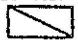


Fig. 6-47 TRUSS REINFORCEMENT SYSTEM IN PERUMNAS HOUSING

The ridge truss is the truss of the  shape diagonally inserted in the ridge direction in the central part of the roof truss, while the roof top truss is designed to prevent lateral fall by partially forming a truss inside the roof top and thereby achieving horizontal rigidity.

The rafter structure system may replace the truss as a roof construction system for tile roofs.

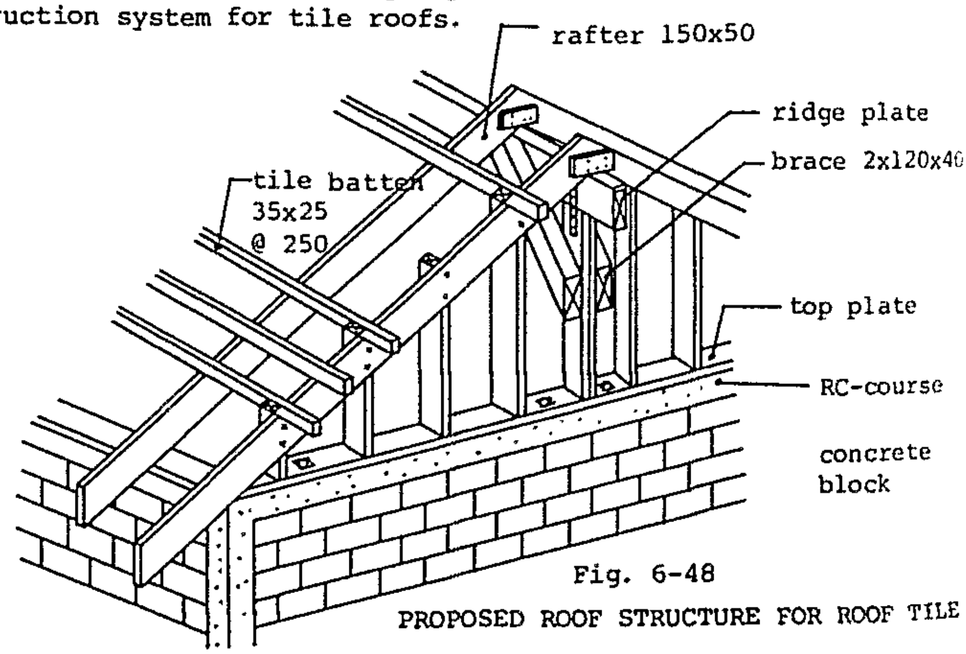
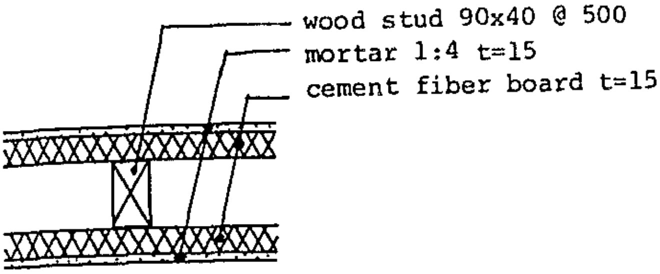


Fig. 6-48
PROPOSED ROOF STRUCTURE FOR ROOF TILE

This is a system composed of only rafters and tile battens instead of the conventional truss + purlin system, and normally requires a ridge piece. It can considerably reduce the quantity of wood used but not to the extent of the corrugated asbestos sheet + truss system.

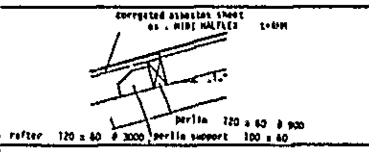
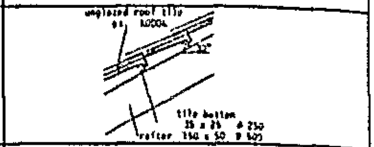
Roof weight generally increases through the use of tiles, compared with corrugated asbestos roofs and roofs of galvanized sheet-iron. As shown in the above sketch, therefore, it is necessary to assure sufficient rigidity for the roof part, so as to prevent lateral fall. Particularly, great care must be taken on the joint between the RC beam at the top of the wall and the roof structure. As a principle, two braces in the direction of cross-beams are provided for each housing unit of either the row-house or duplex type. To reduce weight, materials shown in the sketch below are used instead of concrete blocks above the gable, and above the wall between housing unit.



* See e. Process of selecting wall system, for information on cost and evaluation.

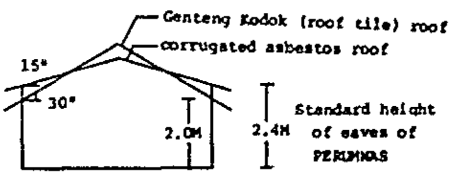
Fig. 6-49 PROPOSED UPPER UNIT WALL SYSTEM

iii. Evaluation of roof system.

		corrugated asbestos roof	Unglazed tile roof (Kodok)
material & spec.			
roof structure		truss + perlin	rafter + tile batten
roof gradient		15°	30°
adequate heights of eaves *1	1F	2.4M	2.4M
	2F	2.4M	2.0M
ridge-wise reinforcement		ridge truss 2 places/unit	brace 2 places/unit
cost (per horizontal area)	unit cost Rp/M²	4,535 (exclud. ridge plate) – wood preserved –	5,820 (exclud. truss) – " –
	total cost (in case of M-36) x 10³Rp/M²	roof work 5.90 wall work (incl. foundation) 16.37 upper gable wall and timber work 4.64 door & window 3.28 others 3.33 total 33.52 (incl. 10% overhead)	roof work 6.97 wall work (incl. foundation) 16.04 upper gable wall and timber work 5.02 door & window 3.19 others 3.33 total 34.54 (incl. 10% overhead)
roof weight kg/m²		35	60
amount of wood used per horizontal area (m³/m²)		0.0109	0.0145
rainwater proof		easy	difficult and for end roof costly
ceiling materials and system		triphex horizontal ceiling base necessary	asbesto sheet for declining ceiling without base for horizontal ceiling base costly
work efficiency	execution term	short	long
	failure ratio	small	large
	accuracy requirement	large	small
material availability and transportation		• no problem because of mass modern sector production • factory also near Chengkareng,	• mass production starting now • 300,000 pc/month producing factory in JAKARTA • 20% failure ratio during transportation
maintenance		• easy but difficult to replace	– a bit troublesome, but easy to replace
appearance & people's favour		• gray and gloomy looking not popular	• good appearance and good harmony with green • popular
selected type	1 storied	○	●
	2 storied	○	●

Cost in June, 1980

● Types selected
○ convertible

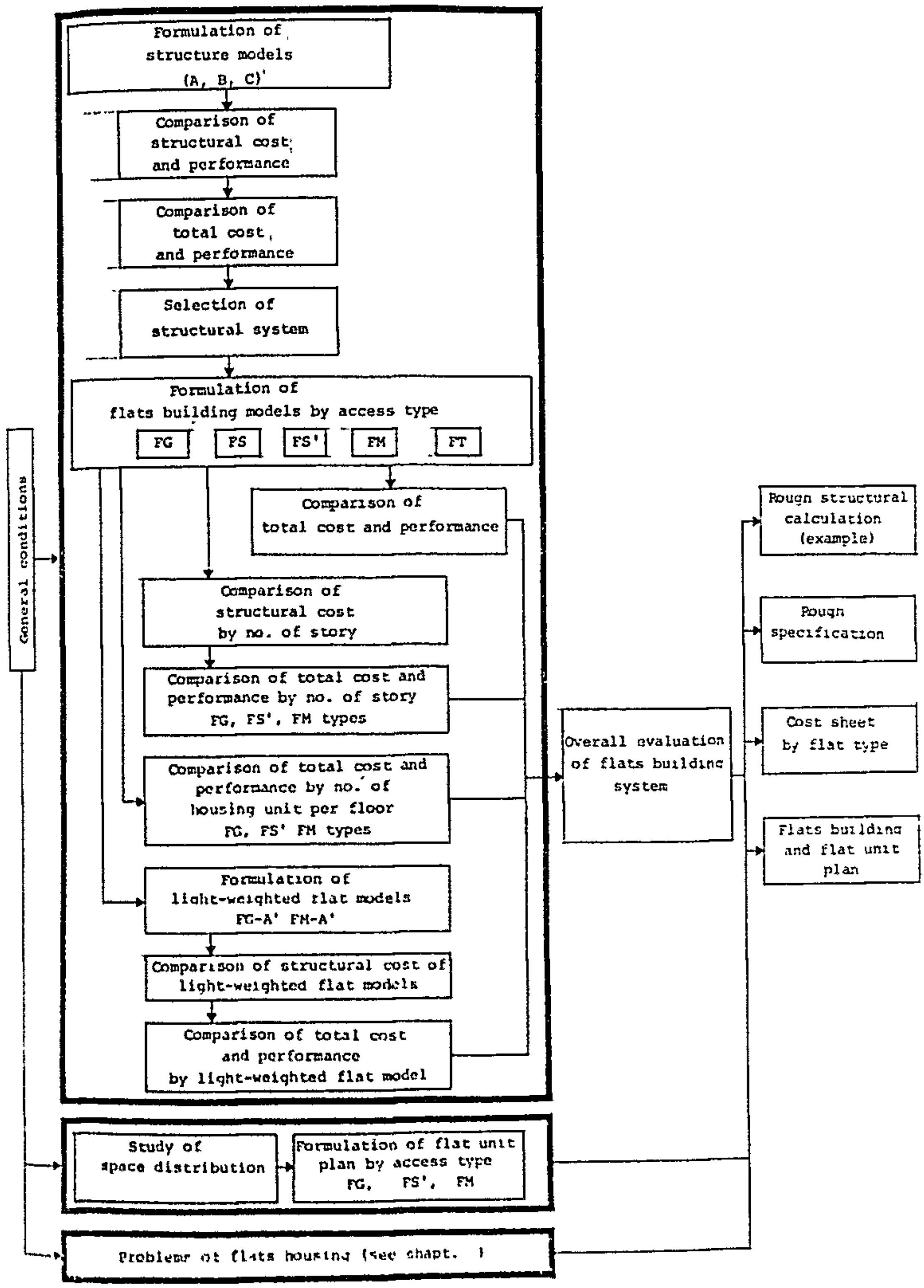


*1 Air volume under roof is important item especially in tropical area, and tile roof enable to reduce the height of eaves by ~40cm keeping air volume same as that of asbestos roof.

But in 1-storied house, the height of eaves will be too low and min. 2.4M height can not be reduced, and the above calculated cost difference (M-36 case) will be bigger.

6-5 FLAT HOUSING PLAN

6-5-1 Study flow of walk-up flat planning



6-5-2 Flat building model

a. Items to be studied for the selection of flat building model

- Comparison of costs and performance by structural system
- Comparison of costs and performance by access types
- Comparison of costs and performance by number of floors
- Comparison of costs and performance by number of housing units per floor
- Comparison of costs and performance by light-weightning of building weight.

b. Studied flat building models

By Access

FG-36, 45	(Gallery access type walk-up flat)
FS-36	(Outer staircase access type walk-up flat)
FS-24, 36, 45	(Inner staircase access type walk-up flat)
FM-36, 45	(Maisonette type walk-up flat)
FT-36	(Tower type walk-up flat)

By structural models

FG-36A	(Wall rahmen structure)
FG-36B	(Rahmen structure)
FG-36C	(Wall rahmen + rahmen structure)

By light-weightning models

DG-36A'	(Weight reduced type of FG-36A)
FM-45A'	(Weight reduced type of FM-45A)

Attic type model

FS'-36R	(Attic type)

c. Comparison of costs and performance by structural systems

i. Model study of structures

Cost differences by structural system were compared by making approximate structural computation on the planned four-storied gallery access type already explained.

For upperstructures, we use Indonesian standards as far as live load and seismic load are concerned. Regarding seismic load in particular, we use the seismic intensity of 0.1, because only approximate computing is required. As for materials, we use a concrete strength of 175 kg/cm^2, and U-24 (soft steel) as the type for reinforcing bars. As finishing materials, tiles for roofs, bricks, and concrete blocks, for external walls and walls between housing units, and bamboo or wood for internal walls, constitute standard finish. Four-storied buildings are taken for this study.

The substructure used is the independent foundation with piles (site-manufactured concrete piles) driven for about 10m into the ground by diesel hammer. The specification standards used are Japanese design standards. The material is concrete with a strength of 400 kg/cm^2.

ii. Characteristics of different structural models

- Model of FG-36A type

  Characteristically, this type has formed by -, L and T shaped column sections, and is wall rahmens system in both directions. It is aimed to secure effective space in the interior of the building.

  As indicated in the drawing, the section of each part is of two foundation types: one-pile type and two-pile type, and of three column types. Their dimensions, such as length and thickness, are the same for the first through fourth floor, this reflecting the effort to unify members as much as possible. Two sizes (20cm × 50cm and 20cm × 60cm) are used for beams. The slabs are of 10cm.

- Model of FG-36B type

  A square section is used for columns of the above-mentioned type so as to unify dimensions further. Otherwise, this type is the same as the 36-A type.

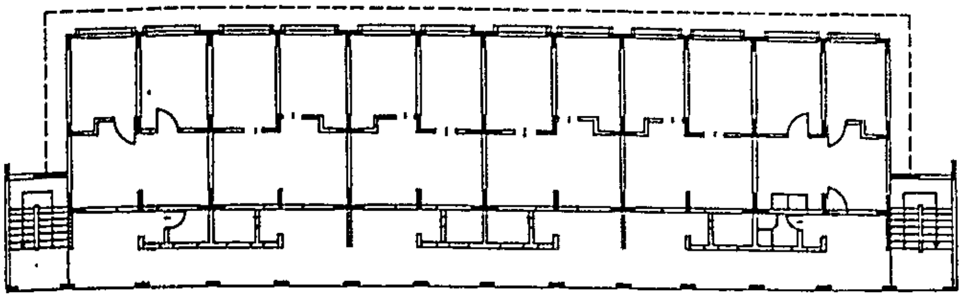
• Model of FG-36C type

In this type, earthquake resisting walls with wall rahmens are arranged in the shorter-side direction of every three housing units, so as to be architecturally able to cope when the area per housing unit increases in the future. It differs from the 36-A type in that the span is 5.4m instead of 2.7m, since space in the housing unit becomes flexible through the elimination of columns in the center of unit.

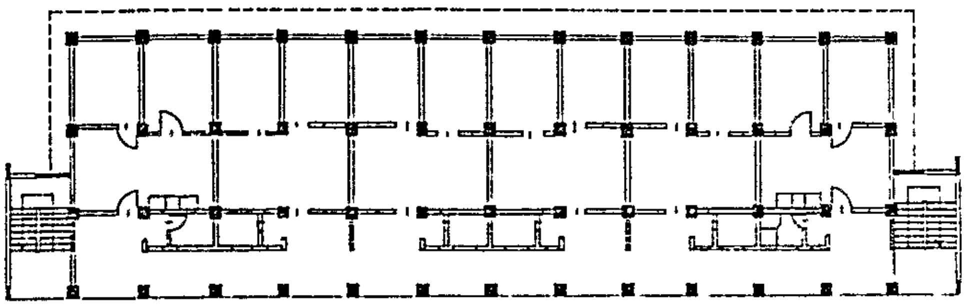
iii. Chart comparing structural costs with various structural models

Figures show structural costs part by part with respect to reinforced concrete and forms. The dotted lines on the left side show % for each part. It can be seen that with any type, structural costs do not greatly change in the case of, say, four-storied buildings, unless different conditions, such as performance and materials, are used. Table lists principal quantities for structural parts.

FG-36 A



FG-36 B



FG-36 C

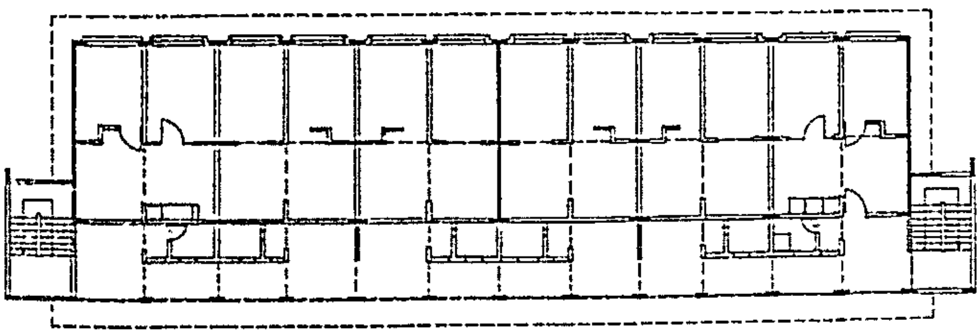
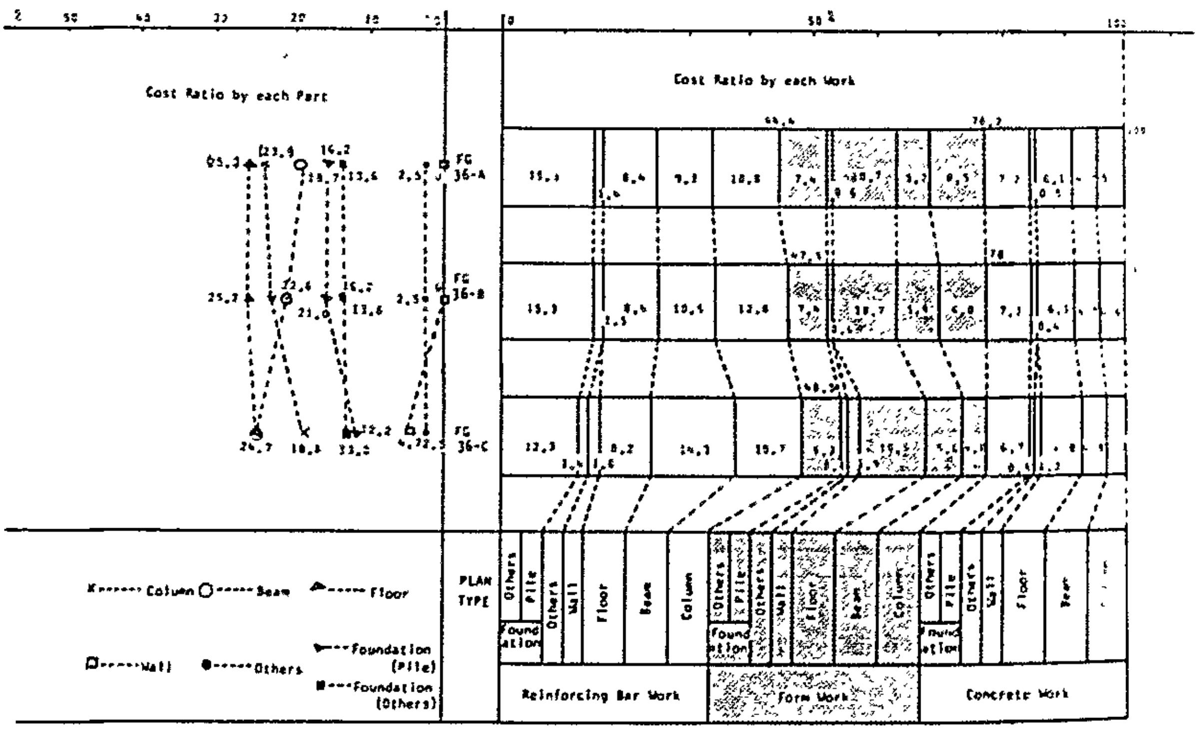


Fig. 6-50 STRUCTURAL MODELS FOR WALK-UP FLAT

Table 6-32 VOLUME OF CONSTRUCTION MATERIALS

PLAN TYPE	part		Concrete M^3	Concrete M^3/Total Floor Area		Form M^2	Form M^2/Total Floor Area	Form M^2/M^3 of Concrete	Reinforcing Bar Tons	Reinforcing Bar Kg/Total Floor Area	Reinforcing Bar Kg/M^3 of Concrete
FG36-A	Column		107.64	0.0898		1309.28	1.0922	12.1635	10.30	8.5919	95 6893
	Beam		85.88	0.0716		884.18	0.7376	10.2955	9.56	7 9746	111 3181
	Floor		124.56	0.1039		1297.50	1 0823	10.4167	8 58	7.1572	68 8825
	Others (Canopy)		9.81	0.0082		102.82	0.0858	10.4811	1 43	1.1929	145 7696
	Foundation	Pile	48.75	0.0407		780.00	0.6507	16.0	8.72	7.2739	178 8718
		Others	84.5	0.0705		677.99	0.5656	8.0217	6.88	5.7391	81 4009
		Sub-Total	133 27	0.1112		1457.99	1.2162	10.9401	15.60	13.0130	117 0556
	Total		461.16	0.3847		5051 77	4 2140	10.9545	45.47	37 9296	98 5991
FG36-B	Column		93.18	0.0777		931.84	0.7773	10.0004	12 28	10.2436	131 7873
	Beam		95.84	0.0799		986.96	0 8233	10.2980	10.68	8.9089	111 4357
	Floor		124.70	0.1040		1299.00	1.0836	10 4170	8.59	7 1655	68 8853
	Others (Canopy)		7.94	0.0066		108.19	0 0902	13.6259	1.52	1 2679	191 4358
	Foundation	Pile	48.75	0.0407		780.00	0 6507	16 0	8 72	7.2739	178 8718
		Others	84.52	0.0705		677.99	0.5656	8 0217	6.88	5.7391	81 4009
		Sub-Total	133.27	0.1112		1457.99	1.2162	10 9401	15.60	13.0130	117 0556
	Total		454 93	0.3795		4783.98	3 9906	10.5159	48 67	40 5989	106 9835
FG36-C	Column		67.20	0.0561		716.80	0 5979	10.6667	10 92	9 1091	162 50
	Beam		97.78	0.0816		946.80	0 7898	9 6830	14 59	12 1705	149 2125
	Floor		123.26	0.1028		1284.00	1.0711	10.4170	8 42	7.0237	68 3109
	Wall		23 89	0.0199		319 60	0.2658	13 3417	1.64	1.3680	[illegible]
	Others (Canopy)		10.26	0 0086		105 12	0.0985	10.3431	1 48	1.2346	144 2495
	Foundation	Pile	41 45	0 0346		596.00	0.4972	14 3788	6 24	5.2052	150 5428
		Others	83 84	0.0699		656.59	0.5477	7.8315	6.35	5.2970	75.7395
		Sub-Total	125.29	0.1045		1252.59	1.0449	9 9975	12 59	10 5022	100 4869
	Total		447.67	0.3734		4839.95	4 0373	10 3462	49 64	41 4081	106 1137

Table 6-33 CONSTRUCTION COST BY SEVERAL TYPES OF STRUCTURES (in case of 36-A type = 100)



iv. Comparison of total cost on various structural models

When the total cost of each structural model was computed from the comparison of structural costs obtained in iii, the results were as follows:

(Comparison by 36m^2 types of a four-storied building comprising 24 units.)

Cost is in 1979.

	$\times 10^3$Rp/M^2 (net)
FG-36A (Wall-rahmen system)	83.68
FG-36B (Rahmen system)	85.13
FG-36C (Wall-rahmen + rahmen system)	83.78

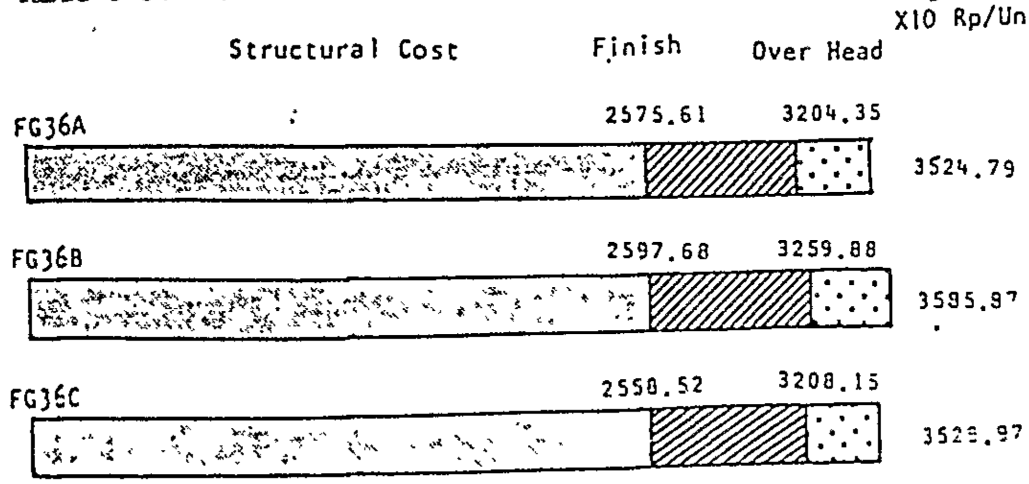
Cost change due to the difference of structural formulae is extremely small. Particularly, there is little difference between types A and C. However, the C type is somewhat more advantageous in capacities, as follows:

- o The gable walls and the unit-to-unit walls (one for every three housing units) are RC walls and, as such, excel in their sound insulating, and weather-proofing performance. Furthermore, these RC walls serve as fire resistant walls, and are effective as structural supports.

- o No columns in the housing unit are necessary; therefore, the planning of the interior of the unit can be highly flexible. The details of cost are as follows:

Table 6-34 TOTAL COST DISTRIBUTION BY STRUCTURAL MODEL

$\times 10^3$ Rp/Unit



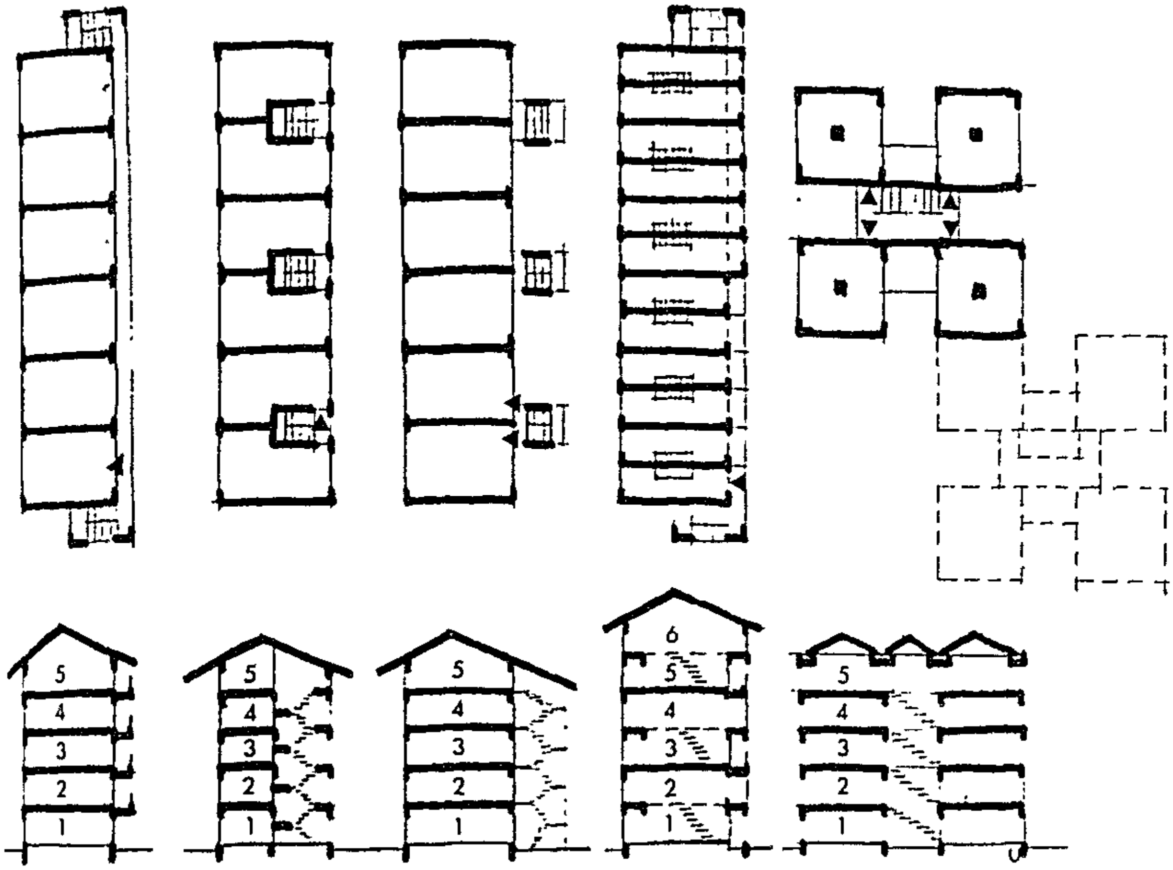
1979. cost

The building cost is cheapest with the A type, but the piling cost is less with the C type, while the total building cost is cheapest with the C type. However, the cost of external walls, openings, partition walls, etc. is slightly higher with the C type than with the A type. The B type is the most expensive in structural and other cost.

The above results show that there is little difference by structural model and the difference is so small that it may well change with any rather subtle change of cost conditions. So, we will generally use the A type for the whole of this study.

d. Comparison of costs performance by access types

Comparison is made with respect to five typical flat building types.



FG type	FS' type	FS type	FM type	FT type
Gallery access	Inner stair case access	Outer stair case access	Flat maisonette	Tower type

i. Cost comparison (In case of 36m type 5 storied, only FM-type 6 storied)

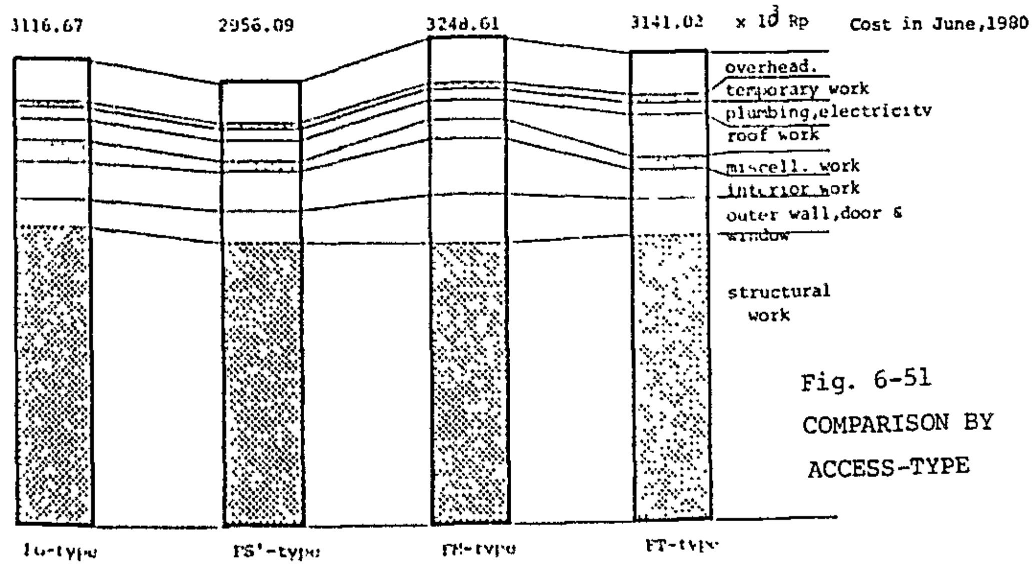


Fig. 6-51
COMPARISON BY
ACCESS-TYPE

ii. Comparison of various access types (Example in $36m^2$ type)

Table 6-35 COMPARISON BY ACCESS TYPE

Cost in June,1993

Performance	FG	FS'	FS	FM	FT
Exclusive-use area ratio	Low ; about 78%	High ; about 88%	High ; about 88%	Relatively high about 84%	Can be made highest about 90%
Cost	High. Cost of and corridor semi-independent stair case is high.	Cheapest. Stair case structure and main structure can be shared.	Ordinary. Cost of outer independent stair case is high but other costs are low.	Fairly cheap. Number of intermediate floor slabs can be reduced.	Highest. Number of stairs can be reduced but area of external walls increases and body itself somewhat increases
Cost for exclusive-use area x 10^3 Rp unit	80.16 $x10^3Rp/M^2$	76.23 $x10^3Rp/M^2$	————	83.94 $x10^3Rp/M^2$	85.12 $x10^3Rp/M^2$
lot size per unit	Can be reduced.	Can be reduced.	More is necessary.	Intermediate	More is necessary
Appearance	Liable to be monotonous.	Same as left.	Same as left.	Same as left.	Full of variety.
Openness	Open on two sides.	Open on two sides.	Open on two sides.	Oepn on two sides. Upper floor is exceedingly open.	Open on two sides Can be made fairly open. Can be fairly open on four sides independent house system is used
Privacy and sound insulation	privacy and Problem with sound insulation on corridor side.	Privacy can be maintained satisfactorily.	Care must be taken to assure privacy from stair case.	Visual privacy on upper floor is satisfactory. Problem with sound insulation between upper and lower floors and sound insulation of rooms beneath corridor.	Sound insulation is exceedingly satisfactry. Problem with visual privacy
Ventilation	Much the same.				
Fire escape	Escape in two directions is satisfactory.	Satisfactory, if escape to adjacent housing unit via veranda is possible.	Same as left.	Escape via veranda is necessary for upper floor.	Extremely unsatisfactory
Others	Adjacent housing units can be easily merged together.	Merger of adjacent housing units is difficult.	Designing of outer stairs is difficult. Adjacent housing units can be easily merged together.	Problem with waterproofing of corridor. Position of gauges is uneconomical. Adjacent housing units can be easily merged together, but this confuses internal traffic lines.	Roof structure is complicated. Problem with insolation and waterproofing if flat roof is used. Long walking distance for ascent/decent of stairs. Merger of adjacent housing units is difficult.

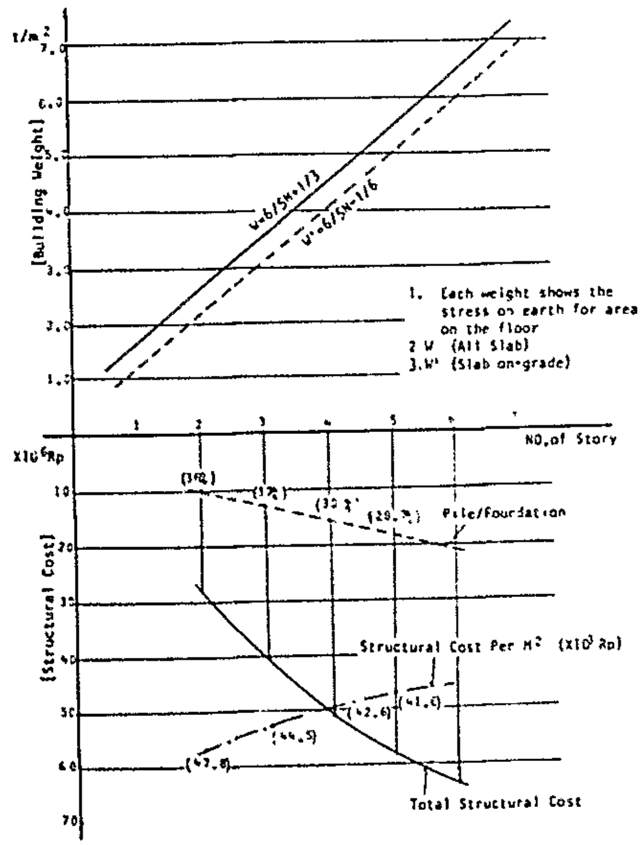
e. Comparison of costs and performance by number of floors

This study is concerned with cost variation occurring with the number of floors varying between three and six.

i. Number of building floors and structural cost

Here, we studied the structural cost by number of floors incurred, when constructing reinforced concrete structures in the Cengkareng Area, the variation of cost per floor area, and the variation of foundation and pile cost ratios. Next shows the results of computation using the FG 36-A type. The results clearly point to the importance of weight reduction, as the weight of a building linearly increases with the number of its floors, and as there naturally is difference, depending on whether the ground floor is with raised floor or without (slab on-grade). As to the cost of the entire structure, the curve slowly reduces with increase of the number of floors, and clearly is not proportional to the increase in weight. It can also be seen that, the cost per floor area gradually becomes comparatively cheaper. Further, the cost of foundation and piles is in proportion to the weight increase due to increase in the number of floors, but its ratio in the cost of the entire structure clearly decreases. On the other hand considering the soil conditions of the site, max. no. of story bearable without pile is estimated 2 storied.

Fig. 6-52 STRUCTURAL COST BY NO. OF STORY



Cost: 1979

ii. Number of floors and total cost

Next figure shows the results of computation by number of floors of the total cost (m^2 cost for exclusive-use area) consisting of the structural cost obtained in (i) above and other costs. Cost naturally becomes comparatively cheaper with an increase of the number of floors, but there is no change in the order. FS' type is always cheapest. The cost difference between the FG and FM types is large with buildings having an even number of floors, and small with buildings having an odd number of floors. This, of course, is due to the fact that FM type with an odd number of floors has a gallery on the top floor. In the cost comparison between FG and FS', the cost for a three-storied building of either type is 4.5% more than that for a four-storied building, while the cost for a five-storied building of either type is 2.5% less. Thus it can be seen that three-storied RC buildings are costly. From the view-point of cost, five-storied buildings are advantageous, but these involve a physical burden on the part of fifth-floor occupants, particularly old people.

Besides this cost downing through the increase of number of floors in the building itself, lot size reduction by about 10 m^2/housing unit through the addition of an extra floor is possible, if the building coverage is the same, but in this case, the ratio of building volume to lot increases.

In reality, therefore, environments at about the same level can be maintained, by reducing the site by only about 5 m^2/housing unit. Thus, it is possible to cut costs by about 5,000 RP/m^2 = 3,000 RP/m^2 (site) + 2,000 RP/m^2 (building) = 500 RP/m^2.

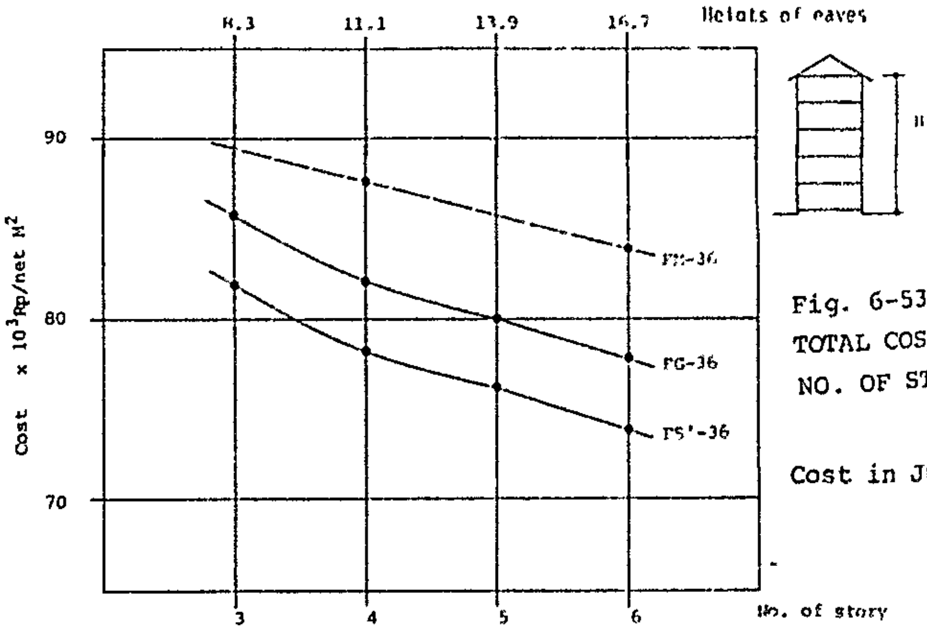


Fig. 6-53
TOTAL COST AND
NO. OF STORY

Cost in June,1980

f. Number of housing units per floor and cost

The total cost can, of course, be retrenched, by increasing the number of housing units to be provided on each floor. Mention of the structural effects of this increase is omitted, because they are rather negligible. The results of comparison by approximate computation are as shown in next figure. First, as can be expected, cost reduction for the FS' type is extremely small, while the reduction trends with FM and FG are nearly parallel. However, there is no change of order if the number of housing units per floor is within 10 (escape distance: L = 60m or so).

Table 6-36 COST COMPARISON BY HOUSING UNITS/FLOOR
(in case of 6 unit/floor = 100)

	4 unit/floor	6 unit/floor	8 unit/floor
FG type	105	100	97.5
FS' type	100.2	100	99.9
FM type	105	100	97.5

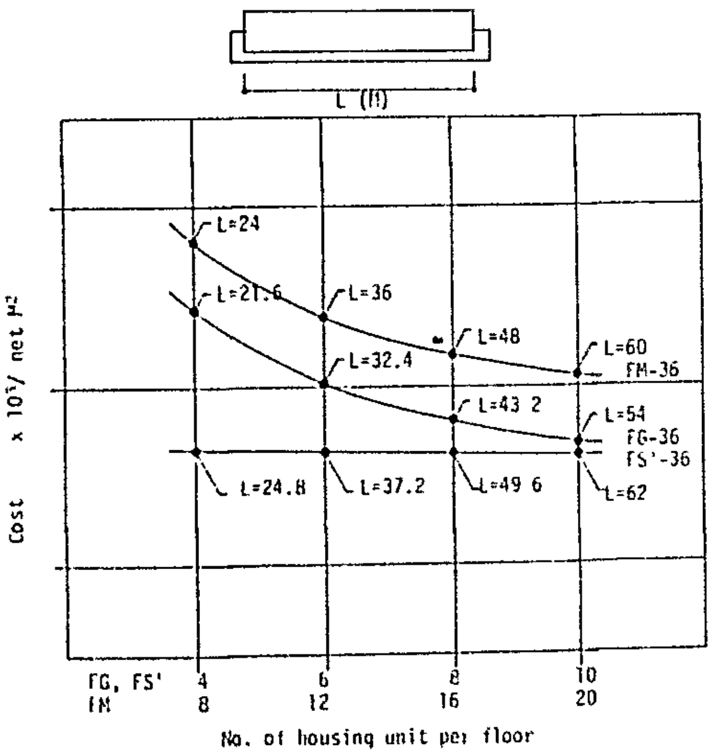


Fig. 6-54 TOTAL COST/M^2 — NO. OF UNIT/FLOOR

Cost in June, 1980

As the number of housing units that can be easily arranged, while avoiding a proportion that is structurally extreme, and holding the escape distance to within 40m, the following is hereby proposed:

FG : 6 housing units per floor

FM : 12 housing units per 2 floors

FS': 8 housing units per floor

g. Comparison of costs and performance by light-weightning of building

i. Reduction of building weight and structural cost (FG-36A' type and FM-45A' type)

Next figure shows structural types by the axis of abscissas, and building weight and structural cost ratio by the axis of ordinates, and compares the aforementioned FG types and the FM types with respect to the case where light-weight materials, such as excelsior boards and asbestos slates are used instead of heavy materials, such as con. block and bricks. A' mark indicates examples of reduced weight. The FG-36A' type and the FM-45A' type are lighter by about 10% and about 25%, respectively. The reason why weight decrease is greater with the latter, is that it has more partition walls than the former. As to the relationship between cost and weight, it can be seen that a building with reduced weight costs less than a heavier building of the same type due, largely, to the different forms of access. Numerically, using FG-36A as the standard, FG-36A', FM-45A and FM-45A' are lighter by about 4%, about 10% and about 22%, respectively.

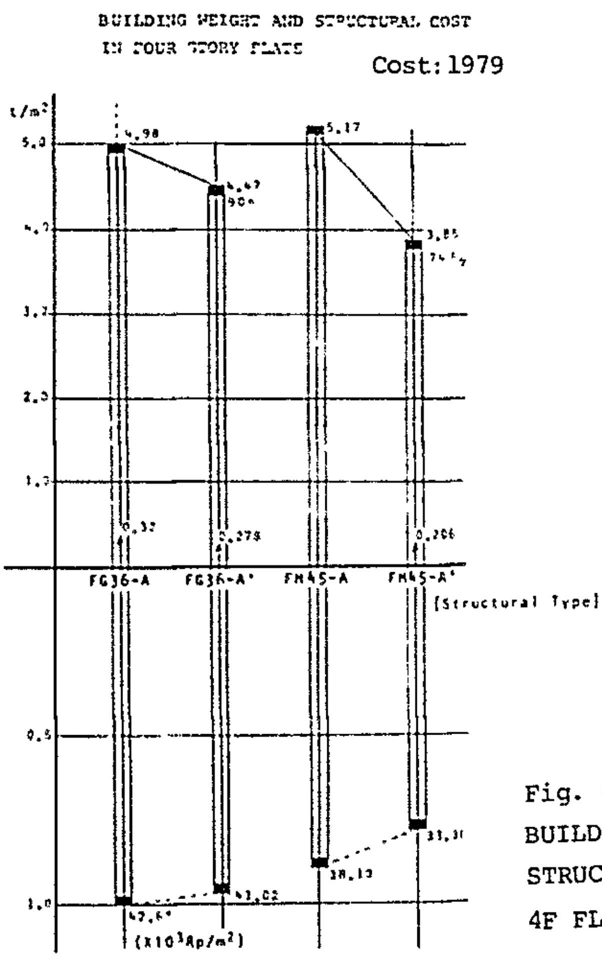


Fig. 6-55
BUILDING WEIGHT AND STRUCTURAL COST IN 4F FLAT

ii. Reduction of building weight and total cost

The effects of weight reduction on the total cost was studied, based on the structural costs obtained from (i) above.

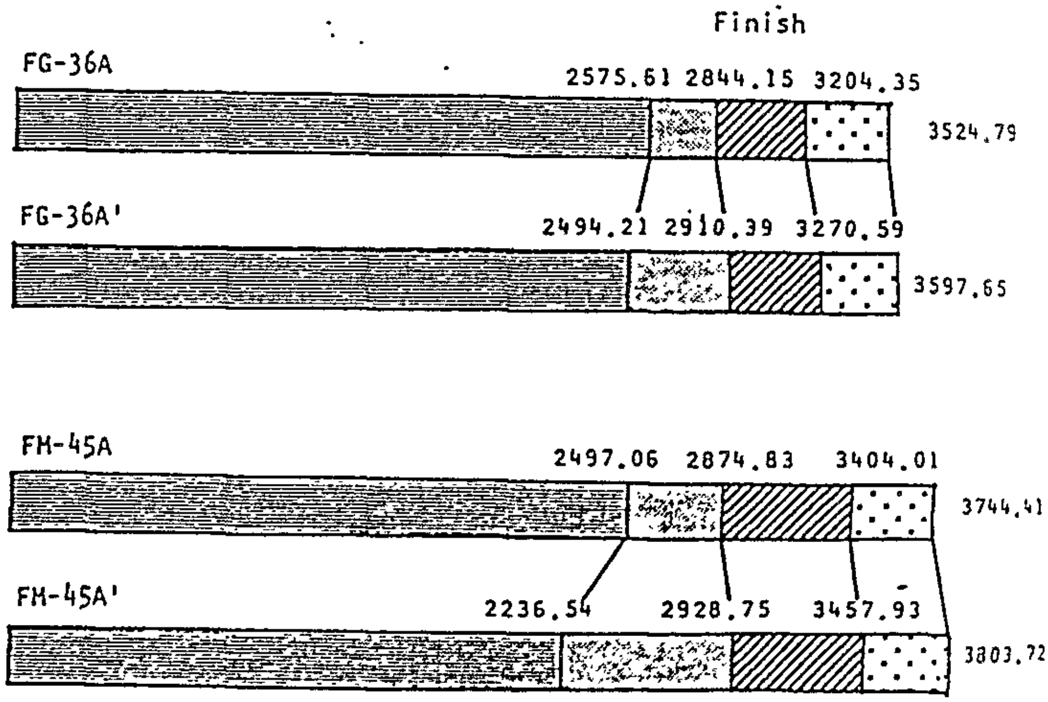
The results of this study were as follows: (Comparison between four-storied buildings containing 24 housing units each.) (cost in 1979)

Weight reduction type of FG-36A (FG-36A' type)
$83.68\times10^{3}Rp/M^{2}$(NET) → $85.41\times10^{3}Rp/M^{2}$(NET)

Weight reduction type of FM-45A (FM-45A' type)
$77.77\times10^{3}Rp/M^{2}$(NET) → $79.00\times10^{3}Rp/M^{2}$(NET)

In both cases, the total cost increases on the contrary: thus the weight reduction was not succeeded. Let us see details of the cost of each type, to determine the cause of this failure.

Table 6-37 TOTAL COST DISTRIBUTION BY WEIGHT REDUCED TYPE



Cost is in 1979.

As this drawing clearly indicates, in both cases the walling cost increase exceeds the structural cost decrease, thus causing an increase in total cost. This is particularly remarkable with the FM type, where excelsior cement boards, plus wood studs, replace con. block as materials of unit-to-unit walls and, to maintain at least the same performance (particularly fireproofing and sound insulation), the cost of reduced-weight walls inevitably increase. This means that no light-weight materials that can compete with bataco or concrete blocks are presently available in Indonesia.

h. Overall Evaluation of housing formulae

As the conclusion of our above studies, ranging from (c) to (g) we hereby recommend the FS'-type 5-storied 6-unit/floor building.

6-5-3 Flat unit model study

a. Space distribution

i. Space distribution of existing PERUMNAS walk-up flat.

Table 6-38 SPACE DISTRIBUTION OF EXISTING PERUMNAS WALK-UP FLAT

Housing Type		Distribution								Total	
		B1	B2	K	L	D	WC/M	Stor.	Balco.	Net	Gross
Pasar Jumat Type 2 (FS Type)	M2	12.6	12.6	5.0	13.1		3.2		3.8	50.3	57.3
	%	25.0	25.0	9.9	26.0		6.4		7.6	100	
Bundung Flat-64 (FS Type)	M2	11.7	10.8	6.3	17.3		2.7	3.6	5.4	57.8	64.4
	%	20.2	18.7	10.9	29.9		4.7	6.2	9.3	100	
Tanah Abang (FT Type)	M2	13.6		3.2	11.1		2.7		4.7	37.3	41.2
	%	41.8		8.6	29.8		7.2		12.6	100	
Tanan Abang (FS Type)	M2	17.2		3.2	11.8		2.2		2.2	36.6	43.1
	%	47.1		8.8	32.4		5.9		5.9	100	

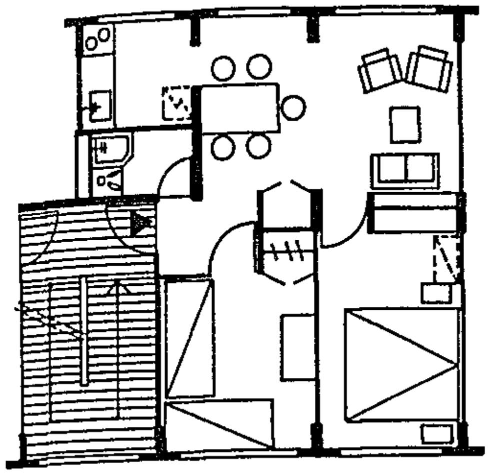
ii. Space distribution of studied walk-up flat.

Table 6-39 SPACE DISTRIBUTION OF STUDIED WALK-UP FLAT

Housing Type		Distribution								Total	
		B1	B2	K	L	D	WC/M	Stor.	Balco.	Net	Gross
FS-24	M2	22.4					2.2		1.6	26.2	30.8
	%	85.6					8.3		6.2	100	
FG-36	M2	8.1	8.0	19.4			2.2		1.2	38.9	49.7
	%	20.6	20.8	50.0			5.6		3.1	100	
FS-36	M2	8.8	8.7	17.5			2.2		1.6	38.8	43.4
	%	22.6	22.6	45.1			5.6		4.2	100	
FM-36	M2	9.4	8.8	13.6			2.1	2.2	2.6	38.7	46.4
	%	24.4	22.6	35.3			5.4	5.6	6.7	100	
FT-36	M2	16.2		3.1	13.1		2.6		1.9	36.9	40.9
	%	43.9		8.5	35.4		7.1		5.1	100	
FG-45	M2	9.0	12.3	19.4			2.2	2.3	2.9	48.1	58.3
	%	18.8	25.5	40.4			4.5	4.7	6.0	100	
FS-45	M2	8.7	12.0	22.3			2.2		1.6	46.8	51.5
	%	18.7	25.6	47.6			4.6		3.5	100	
FM-45	M2	9.8	8.3	17.3			2.2	5.9	3.3	46.8	54.5
	%	21.0	17.6	37.1			4.6	12.7	7.1	100	

b. Study process of flat unit plan

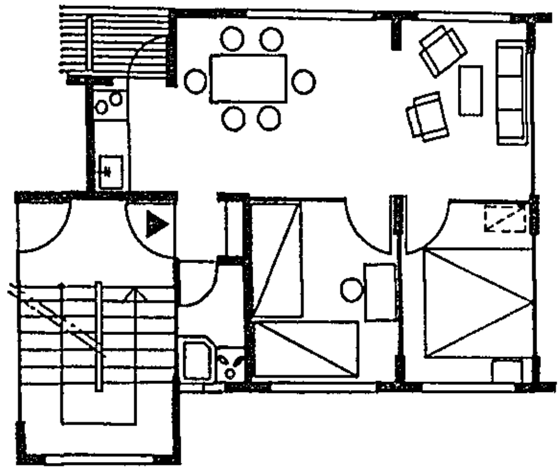
i. Planning development of FS' series.



Not suitable for tropical area.

Mechanical ventilation system is necessary.

Noisy to B2



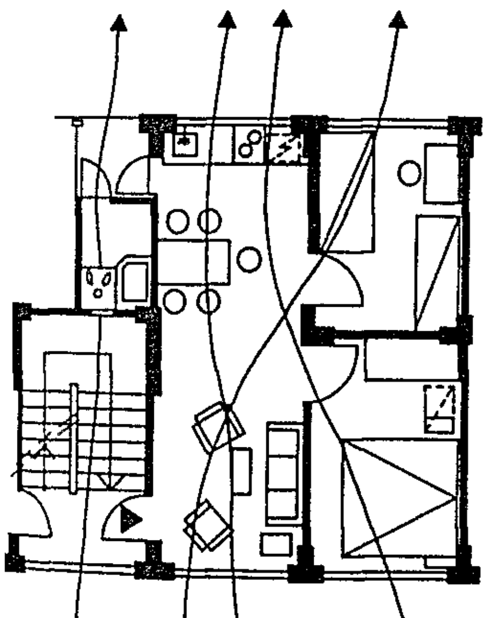
Introduction of service veranda.

2-way escaping route within unit.

Disconnected utility space and piping.

Too wide frontage.

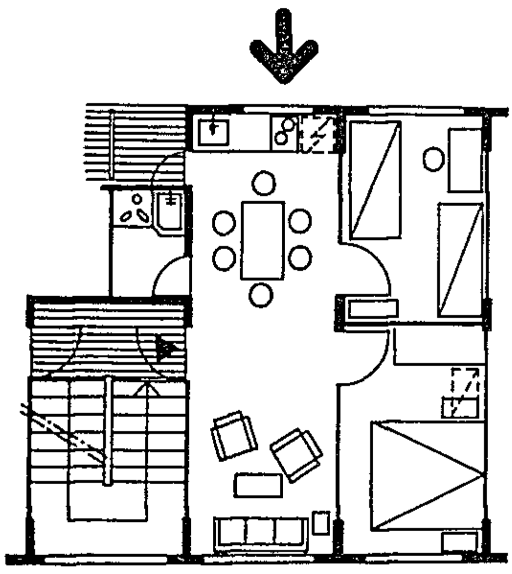
Complicated home work route.



Concentration of utility space and piping.

Simplification of home work route.

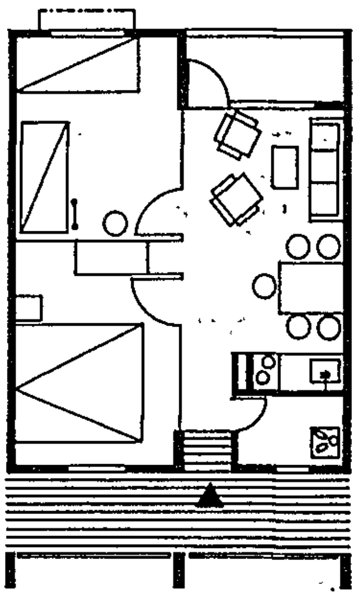
Decreasing of foundation beams' height by changing of walk-up direction.



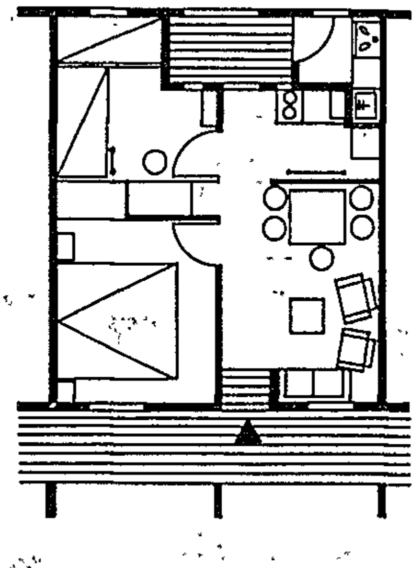
Combination with service veranda,mandi and kitchen.

Too close arrangement of dinning and wc.

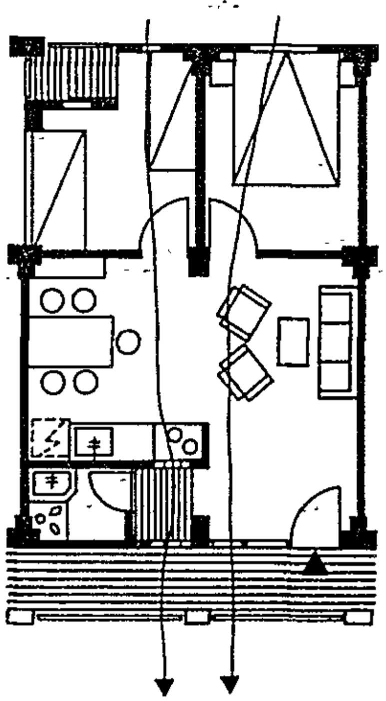
ii. Planning development of FG series



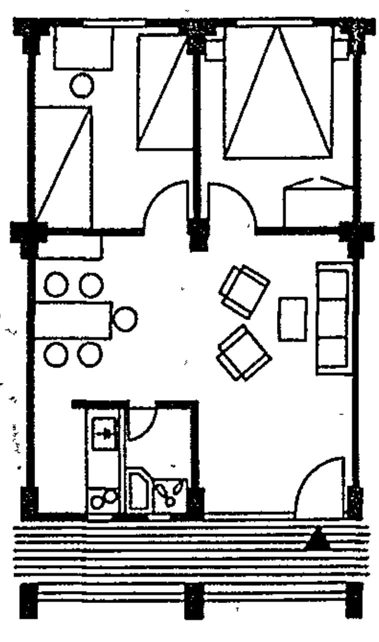
Europeam style efficiency type
Not suitable for tropical area.
Mechanical ventilation system is necessary.
Privacy of B1 is problematical.



Combination with mandi and service veranda.
Natural ventilation for kitchen exhaust.

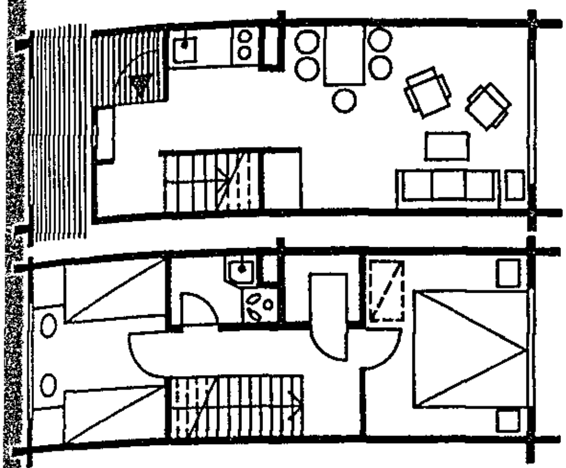


Introduction of semi-private space beside mandi
...Hierarchy of privacy
Introduction of 2 way escaping route within unit.
Cost reduction by taking off the colums along corridor.



Too close arrangement of mandi and living space.
Piping route and moters are closely arranged.

iii. Planning development of FM series



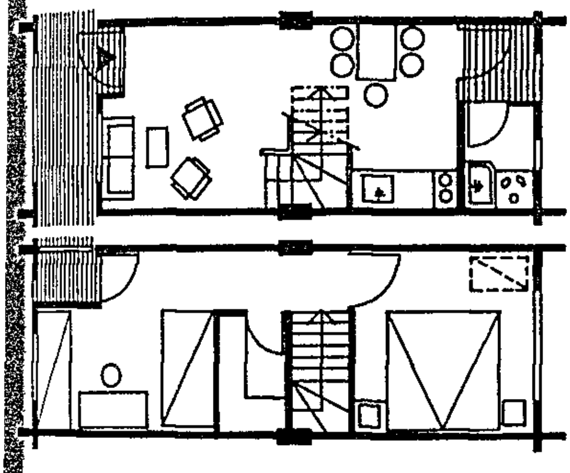
European style efficiency type.

Not suitable for tropical area.

Mechanical ventilation system is necessary.

Difficulty of piping maintenance.

Waterproof problem of 2nd floor wc.



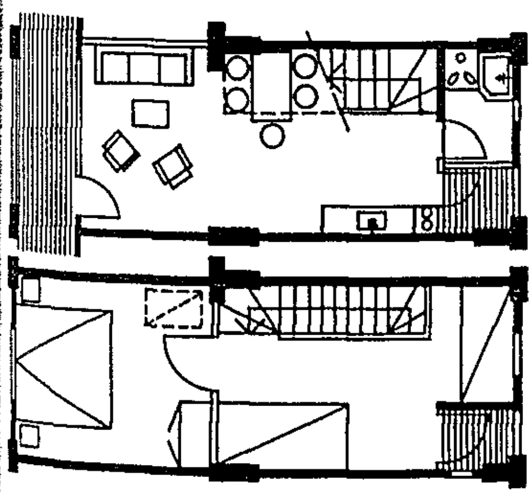
Combination with mandi and service veranda.

Introduction of 2 way escaping route within unit.

Not efficient arrangement of piping and meters.

Waterproof and sound insulation problem for B2
(in case of wooden middle floor)

Kitchen exhaust is not well arranged.



Better natural ventilation by re-arrangement of stair.

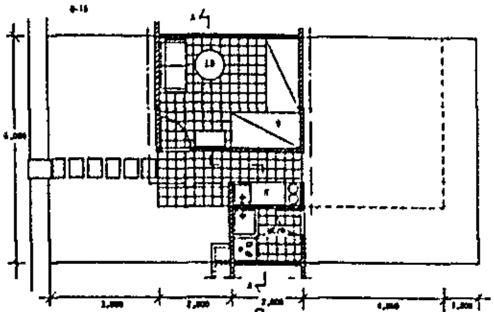
Natural kitchen exhaust.

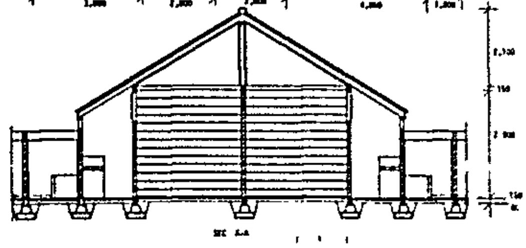
Leveling up of sound insulance and waterproof by
introducing RC-slab into both side of middle floor.

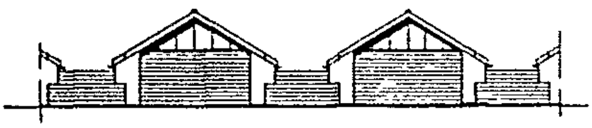
D-15

Floor Area/unit	Lot Size 72.0 M²	Construction Stage			After Extension
	Net Floor Area	Living F.A. 12.0 M²		Total 18.0 M²	36.0 M²
		WC/M & Stor. 6.0 M²			
		Veranda M²			
	Gross Floor Area	18.0 M²			36.0 M²
	Building Area	18.0 M²			36.0 M²
	Volume Ratio	25.0 %			50.0 %
	Coverage Ratio	25.0 %			50.0 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length			51.94 cm/M²
		Depth Direction Wall Length			44.72 cm/M²
	Fire Proof				
	Inundation Differential Settlement				
Health Performance	Ventilation	Cross Ventialtion			
		Effective Ventilation Area			M² %
					0.43 M² 3.5 %
	Daylight	Effective Daylight Area			M² %
					1.31 M² 10.9 %
	Rain Water				
	Toilet & Other Sewer	Combined System			
	Kitchen Exhaust				
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok			
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)			
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side			
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4			
	Partition Wall	Concrete block t=150			
	Door & Windows	Wood frame + flash door , Naco or fixed window			
	Stair				
	Floor -f:	Concrete slab on grade t=50,sand fill t=100			
	Structure	Reinforced corner and edge blocks and RC-course			
	Foundation	Batukali foundation + RC-foundation beam			
Number of Units/Row		2 Units			
Cost June,1980	Per Unit	620.83 x 10³RP/unit			
	Per Square Meter	34.49 x 10³RP/net M²			34.49 x 10³RP/gross M²

D-15



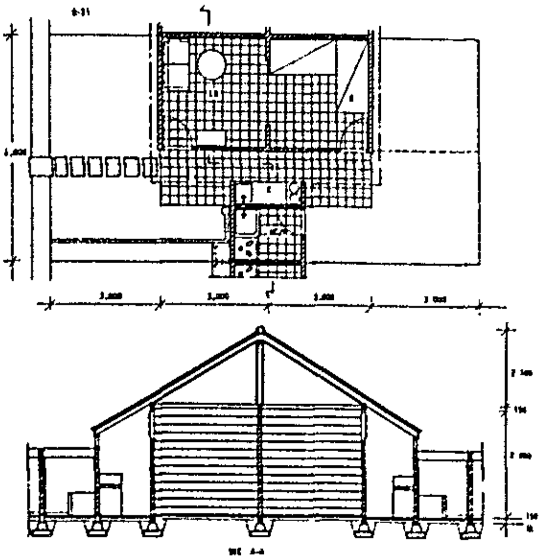


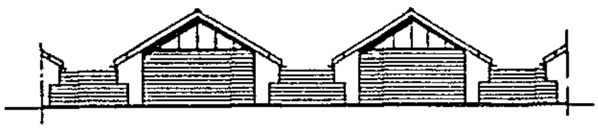


D-21

	Lot Size 96.0 M^2	Construction Stage		After Extension
Floor Area/unit	Net Floor Area	Living F.A. 18.0 M^2	Total 24.0 M^2	33.0 M^2
		WC/M & Stor. 6.0 M^2		
		Veranda M^2		
	Gross Floor Area	24.0 M^2		33.0 M^2
	Building Area	24.0 M^2		33.0 M^2
	Volume Ratio	25.0 %		34.4 %
	Coverage Ratio	25.0 %		34.4 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		44.38 cm/M^2
		Depth Direction Wall Length		37.50 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				0.85 M^2 4.7 %
	Daylight	Effective Daylight Area		M^2 %
				2.61 M^2 14.5 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen:	Concrete block t=150		
	Unit Wall upper:	Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen:	Concrete block t=150		
	Gable Wall upper:	Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		2 Units		
Cost June,1980	Per Unit	819.24 x 10^3RP/unit		
	Per Square Meter	34.14 x 10^3RP/net M^2		34.14 x 10^3RP/gross M^2

D-21

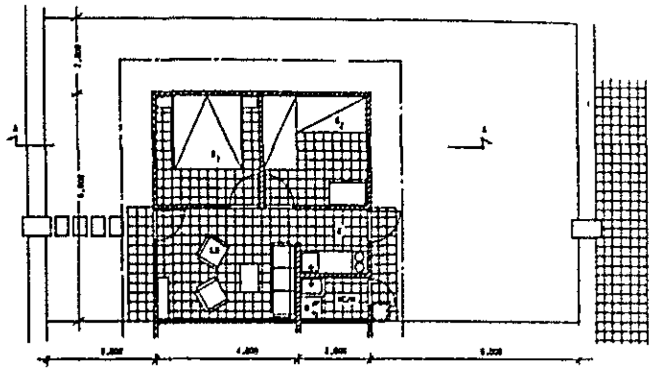


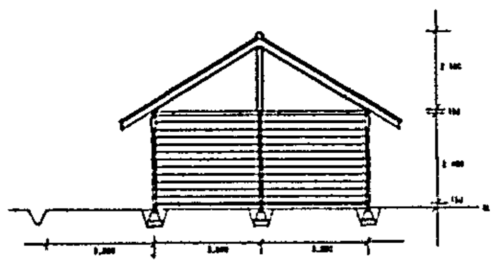


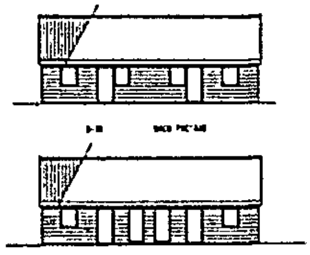
D-36

Floor Area/unit	Lot Size 108.0 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 33.6 M^2 WC/M & Stor. 2.9 M^2 Veranda M^2	Total 36.0 M^2	45.0 M^2
	Gross Floor Area	36.0 M^2		45.0 M^2
	Building Area	36.0 M^2		45.0 M^2
	Volume Ratio	33.3 %		41.7 %
	Coverage Ratio	33.3 %		41.7 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		29.58 cm/M^2
		Depth Direction Wall Length		40.56 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				1.20 M^2 3.6%
	Daylight	Effective Daylight Area		M^2 %
				4.43 M^2 13.2%
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4 (under the window)		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50, sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		Units		
Cost June, 1980	Per Unit	1246.14 x 10^3RP/unit		
	Per Square Meter	34.62 x 10^3RP/net M^2	34.62 x 10^3RP/gross M^2	

D-36



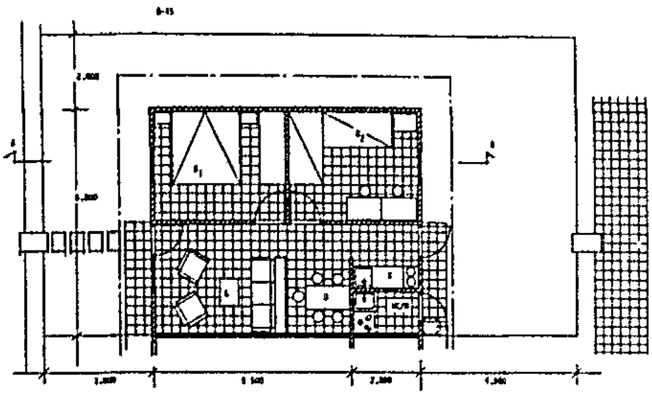


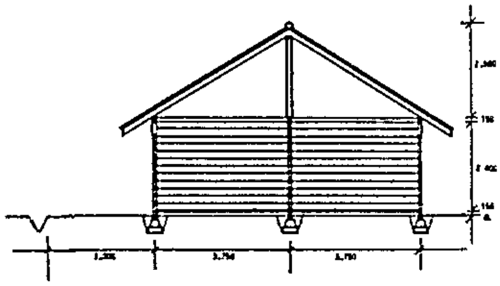


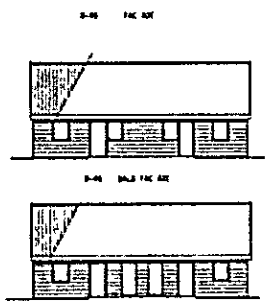
D-45

	Lot Size 120.0 M^2	Construction Stage		After Extension
Floor Area/unit	Net Floor Area	Living F.A. 42.6 M^2 / WC/M & Stor. 2.4 M^2 / Veranda M^2	Total 45.0 M^2	M^2
	Gross Floor Area	45.0 M^2		M^2
	Building Area	45.0 M^2		M^2
	Volume Ratio	37.5 %		%
	Coverage Ratio	37.5 %		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		24.33 cm/M^2
		Depth Direction Wall Length		40.78 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				1.20 M^2 2.8 %
	Daylight	Effective Daylight Area		M^2 %
				4.43 M^2 10.4 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		2 Units		
Cost June,1980	Per Unit	1470.26 x 10^3RP/unit		
	Per Square Meter	32.67 x 10^3RP/net M^2		32.67 x 10^3RP/gross M^2

D-45



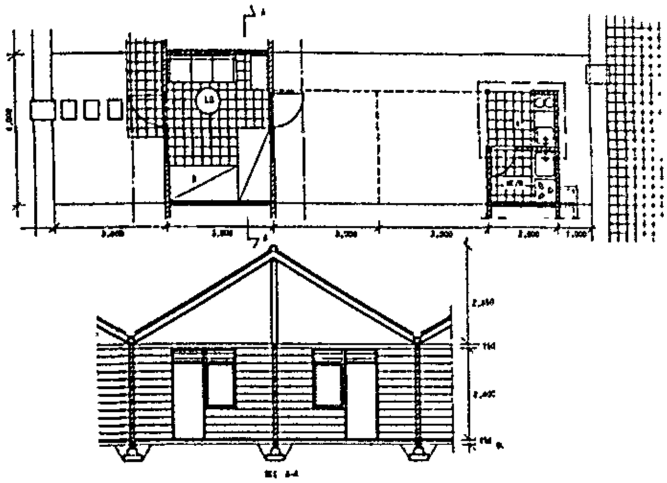




R-15

			Construction Stage	After Extension
Floor Area/unit	Lot Size 60.0 M^2		Construction Stage	After Extension
	Net Floor Area	Living F.A. 12 M^2	Total 18.0 M^2	36.0 M^2
		WC/M & Stor. 6 M^2		
		Veranda M^2		
	Gross Floor Area		18.0 M^2	36.0 M^2
	Building Area		18.0 M^2	36.0 M^2
	Volume Ratio		30.0 %	60.0 %
	Coverage Ratio		30.0 %	60.0 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		53.89 cm/M^2
		Depth Direction Wall Length		37.50 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				0.80 M^2 6.7 %
	Daylight	Effective Daylight Area		M^2 %
				2.56 M^2 21.3 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row				6 Units
Cost June,1980	Per Unit			705.44 x 10^3RP/unit
	Per Square Meter		39.19 x 10^3RP/net M^2	39.19 x 10^3RP/gross M^2

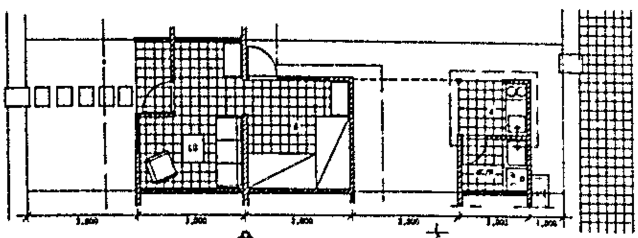
R-15

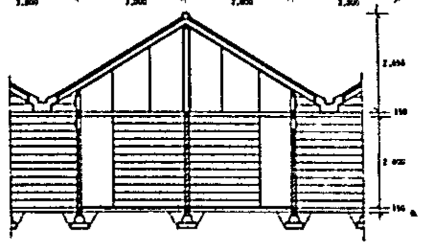


R-22

Floor Area/unit	Lot Size 60 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 19.0 M^2 WC/M & Stor. 6.0 M^2 Veranda 2.0 M^2	Total 27.0 M^2	36.0 M^2
	Gross Floor Area	27.0 M^2		36.0 M^2
	Building Area	27.0 M^2		36.0 M^2
	Volume Ratio	45.0 %		60.0 %
	Coverage Ratio	45.0 %		60.0 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		30.68 cm/M^2
		Depth Direction Wall Length		27.47 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				0.80 M^2 4.2 %
	Daylight	Effective Daylight Area		M^2 %
				2.56 M^2 13.5 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		6 Units		
Cost June,1980	Per Unit	971.49 x 10^3RP/unit		
	Per Square Meter	35.98 x 10^3RP/net M^2		35.98 x 10^3RP/gross M^2

R-22

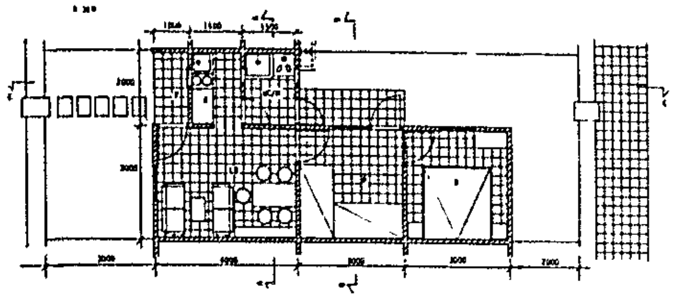


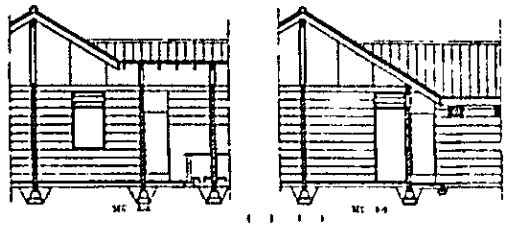


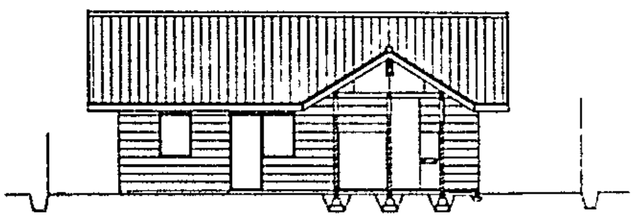
R-36N

Floor Area/unit	Lot Size 75.0M²	Construction Stage			After Extension
	Net Floor Area	Living F.A. 30.0 M²	Total 38.0 M²		44.0 M²
		WC/M & Stor. 6.0 M²			
		Veranda 2.0 M²			
	Gross Floor Area	38.0 M²			44.0 M²
	Building Area	38.0 M²			44.0 M²
	Volume Ratio	50.7 %			58.7 %
	Coverage Ratio	50.7 %			58.7 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length			34.82 cm/M²
		Depth Direction Wall Length			33.80 cm/M²
	Fire Proof				
	Inundation Differential Settlement				
Health Performance	Ventilation	Cross Ventialtion			
		Effective Ventilation Area			M² %
					1.0 M² 3.3 %
	Daylight	Effective Daylight Area			M² %
					3.64 M² 12.1 %
	Rain Water				
	Toilet & Other Sewer	Combined System			
	Kitchen Exhaust				
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok			
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)			
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side			
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4			
	Partition Wall	Concrete block t=150			
	Door & Windows	Wood frame + flash door , Naco or fixed window			
	Stair				
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100			
	Structure	Reinforced corner and edge blocks and RC-course			
	Foundation	Batukali foundation + RC-foundation beam			
Number of Units/Row		6 Units			
Cost June,1980	Per Unit	1387.73 x 10^3RP/unit			
	Per Square Meter	36.52 x 10^3RP/net M²			36.52 x 10^3RP/gross M²

R-36N



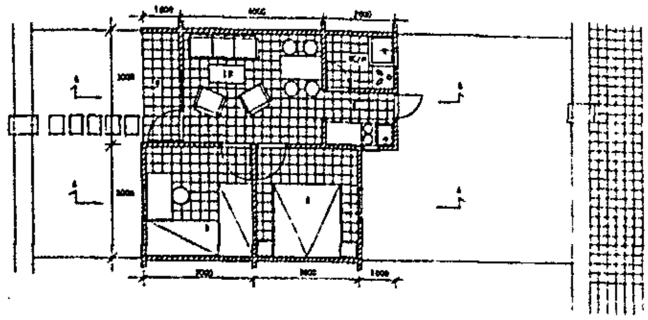


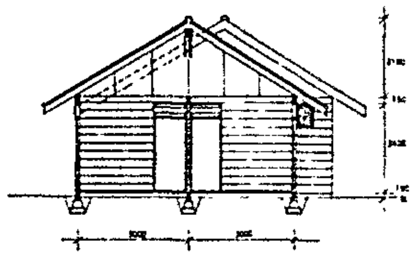


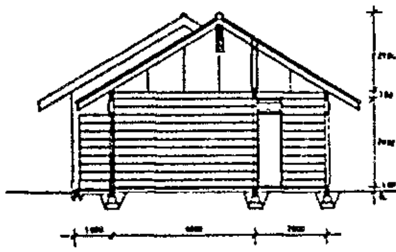
R-36

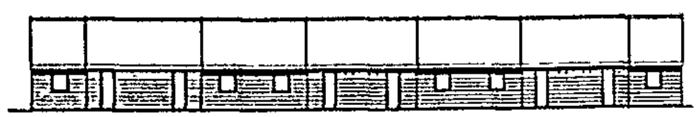
Floor Area/unit	Lot Size 90.0 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 33.0 M^2	Total 39.0 M^2	45.0 M^2
		WC/M & Stor. 3.0 M^2		
		Veranda 3.0 M^2		
	Gross Floor Area	39.0 M^2		45.0 M^2
	Building Area	39.0 M^2		45.0 M^2
	Volume Ratio	43.3 %		50.0 %
	Coverage Ratio	43.3 %		50.0 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		34.52 cm/M^2
		Depth Direction Wall Length		31.54 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				1.24 M^2 3.8 %
	Daylight	Effective Daylight Area		M^2 %
				4.35 M^2 13.2 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		Units		
Cost June,1980	Per Unit	1222.52 x 10^3RP/unit		
	Per Square Meter	31.35 x 10^3RP/net M^2	31.35 x 10^3RP/gross M^2	

R-36





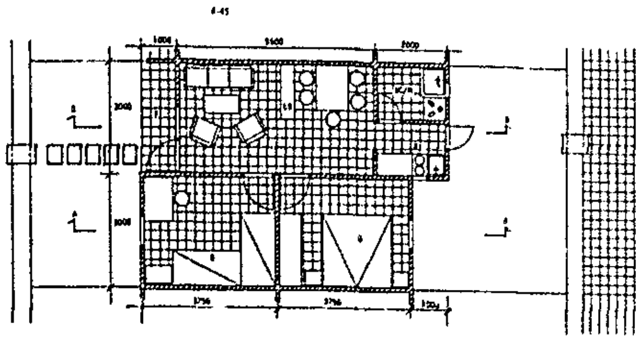


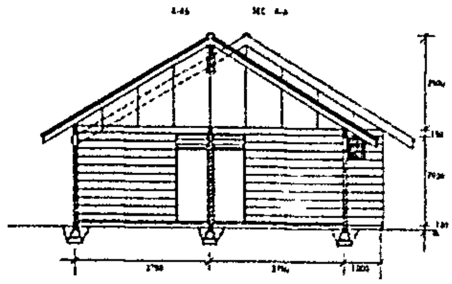


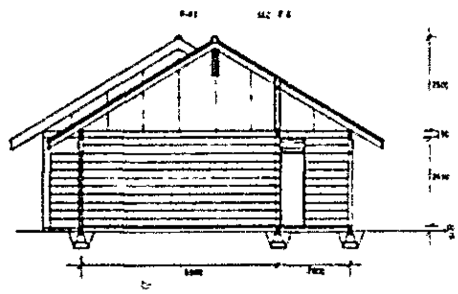
R-45

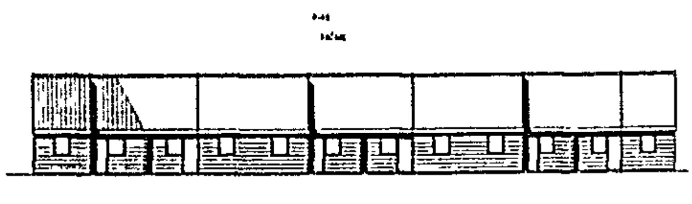
	Lot Size 90.0 M^2	Construction Stage		After Extension
Floor Area/unit	Net Floor Area	Living F.A. 42.0 M^2	Total 48.0 M^2	M^2
		WC/M & Stor. 3.0 M^2		
		Veranda 3.0 M^2		
	Gross Floor Area	48.0 M^2		M^2
	Building Area	48.0 M^2		M^2
	Volume Ratio	53.3 %		%
	Coverage Ratio	53.3 %		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		27.33 cm/M^2
		Depth Direction Wall Length		32.36 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				1.24 M^2 3.0 %
	Daylight	Effective Daylight Area		M^2 %
				4.35 M^2 10.4 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair			
	Floor 1F:	Concrete slab on grade t=50,sand fill t=100		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		Units		
Cost June,1980	Per Unit	1375.71 x 10^3RP/unit		
	Per Square Meter	28.66 x 10^3RP/net M^2		28.66 x 10^3RP/gross M^2

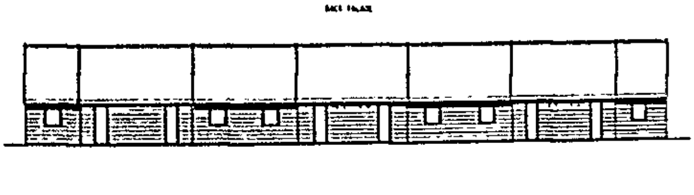
R-45











M-24

<table>
<tr><td rowspan="7">Floor Area/unit</td><td>Lot Size 60 M²</td><td colspan="3">Construction Stage</td><td>After Extension</td></tr>
<tr><td rowspan="3">Net Floor Area</td><td colspan="2">Living F.A. 18.8 M²</td><td rowspan="3">Total 26.4 M²</td><td rowspan="3">44.4 M²</td></tr>
<tr><td colspan="2">WC/M & Stor. 6 M²</td></tr>
<tr><td colspan="2">Veranda 1.6 M²</td></tr>
<tr><td>Gross Floor Area</td><td colspan="3">30.0 M²</td><td>48.0 M²</td></tr>
<tr><td>Building Area</td><td colspan="3">18.0 M²</td><td>36.0 M²</td></tr>
<tr><td>Volume Ratio</td><td colspan="3">50.0 %</td><td>80.0 %</td></tr>
<tr><td></td><td>Coverage Ratio</td><td colspan="3">30.0 %</td><td>60.0 %</td></tr>
<tr><td rowspan="4">Safety Performance</td><td rowspan="2">Seismic Proof (Wall Volume)</td><td colspan="3">Frontage Direction Wall Length</td><td>28.06 cm/M²</td></tr>
<tr><td colspan="3">Depth Direction Wall Length</td><td>43.75 cm/M²</td></tr>
<tr><td>Fire Proof</td><td colspan="4"></td></tr>
<tr><td colspan="4">Inundation Differential Settlement</td><td></td></tr>
<tr><td rowspan="9">Health Performance</td><td rowspan="3">Ventilation</td><td colspan="3">Cross Ventialtion</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Effective Ventilation Area</td><td>2F</td><td>0.64 M² 6.3 %</td></tr>
<tr><td>1F</td><td>1.0 M² 11.6 %</td></tr>
<tr><td rowspan="2">Daylight</td><td colspan="2" rowspan="2">Effective Daylight Area</td><td>2F</td><td>3.20 M² 31.4 %</td></tr>
<tr><td>1F</td><td>2.92 M² 34.0 %</td></tr>
<tr><td>Rain Water</td><td colspan="4"></td></tr>
<tr><td>Toilet & Other Sewer</td><td colspan="4">Combined System</td></tr>
<tr><td>Kitchen Exhaust</td><td colspan="4"></td></tr>
<tr><td rowspan="11">Rough Specification</td><td>Roof</td><td colspan="4">Unglazed roof tile ex. Genteng Kodok</td></tr>
<tr><td>Outer Wall</td><td colspan="4">Concrete block t=150
Wood stud + asbestos sheet t=4(under the window)</td></tr>
<tr><td>Unit Wall gen:
upper:</td><td colspan="4">Concrete block t=150
Wood stud + cement fiber board(t=15) + plaster t=15 both side</td></tr>
<tr><td>Gable Wall gen:
upper:</td><td colspan="4">Concrete block t=150
Wood stud + asbestos sheet t=4</td></tr>
<tr><td>Partition Wall</td><td colspan="4">Concrete block t=150</td></tr>
<tr><td>Door & Windows</td><td colspan="4">Wood frame + flash door , Naco or fixed window</td></tr>
<tr><td>Stair</td><td colspan="4">Wooden stair</td></tr>
<tr><td>Floor 1F:
2F:</td><td colspan="4">Concrete slab on grade t=50,sand fill t=100
Wood joist + particle board t=16</td></tr>
<tr><td>Structure</td><td colspan="4">Reinforced corner and edge blocks and RC-course</td></tr>
<tr><td>Foundation</td><td colspan="4">Batukali foundation + RC-foundation beam</td></tr>
<tr><td colspan="2">Number of Units/Row</td><td colspan="4">6 Units</td></tr>
<tr><td rowspan="2">Cost June,1980</td><td>Per Unit</td><td colspan="4">1162.16 x 10³RP/unit</td></tr>
<tr><td>Per Square Meter</td><td colspan="4">44.02 x 10³RP/net M² 38.74 x 10³RP/gross M²</td></tr>
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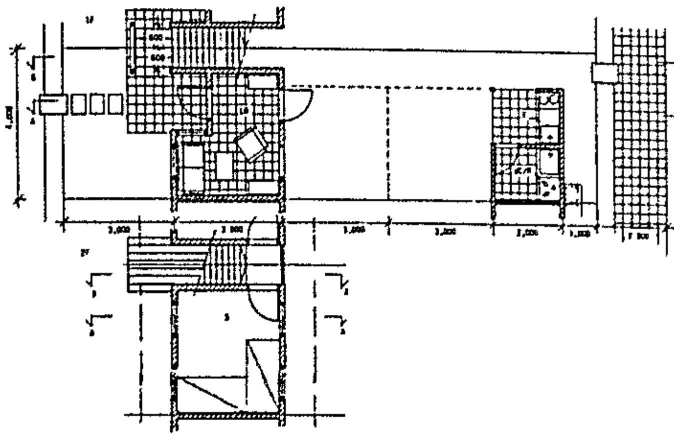
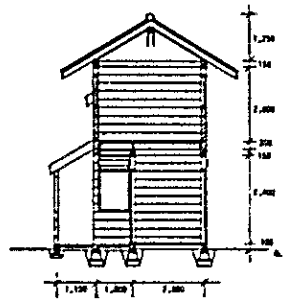
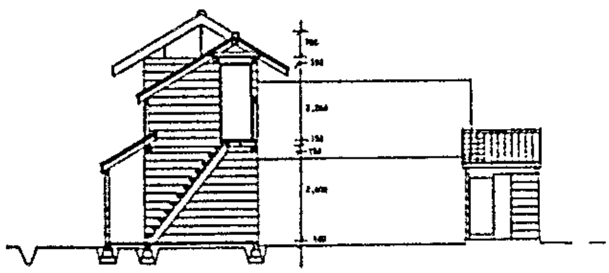
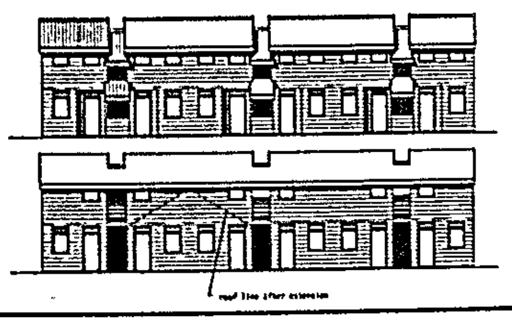
M-24





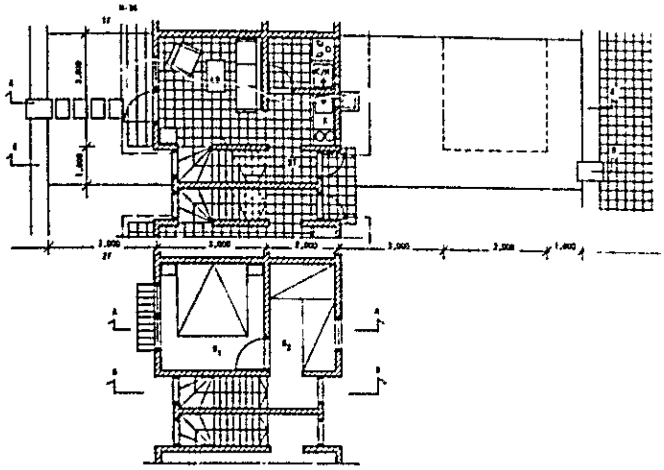


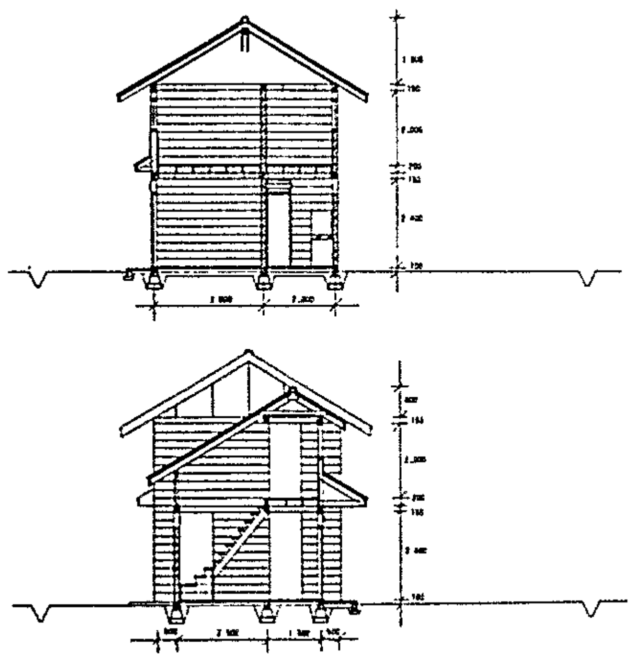


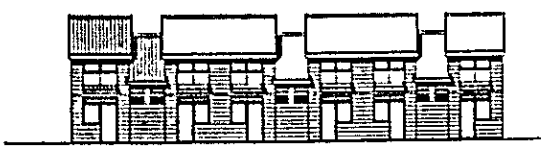
M-36

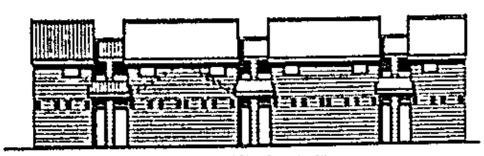
Floor Area/unit	Lot Size 60 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 27.0 M^2 WC/M & Stor. 11.0 M^2 Varanda M^2	Total 38.0 M^2	45.0 M^2
	Gross Floor Area	38.0 M^2		45.0 M^2
	Building Area	19.0 M^2		28.0 M^2
	Volume Ratio	63.3 %		75.0 %
	Coverage Ratio	31.7 %		46.7 %
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		35.79 cm/M^2 (1F)
		Depth Direction Wall Length		53.20 cm/M^2 (1F)
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area	2F	0.48 M^2 3.2 %
			1F	0.83 M^2 6.88%
	Daylight	Effective Daylight Area	2F	2.4 M^2 16.0 %
			1F	1.47 M^2 12.25%
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair	Wooden stair		
	Floor 1F: 2F:	Concrete slab on grade t=50,sand fill t=100 Wood joist + particle board t=16		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		6 Units		
Cost June,1980	Per Unit	1338.13 x 10^3RP/unit		
	Per Square Meter	35.21 x 10^3RP/net M^2	35.21 x 10^3RP/gross M^2	

M-36





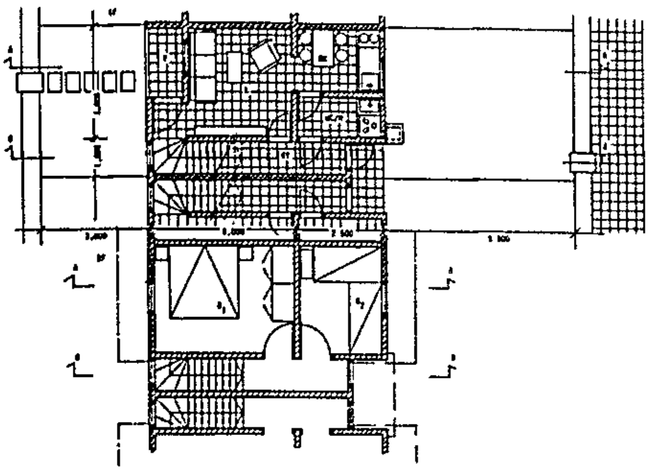


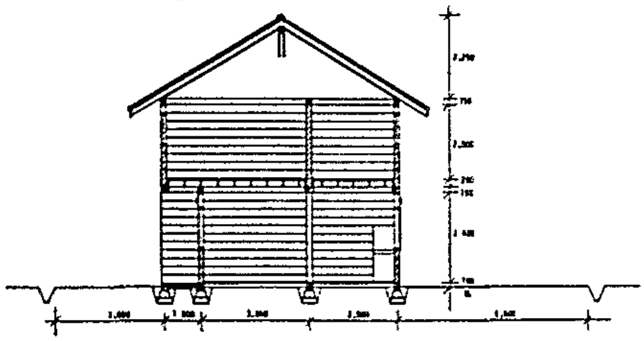


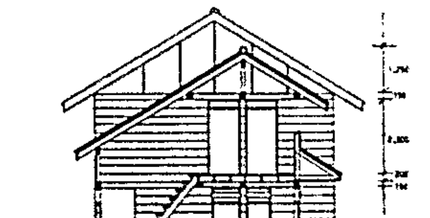
M-45A

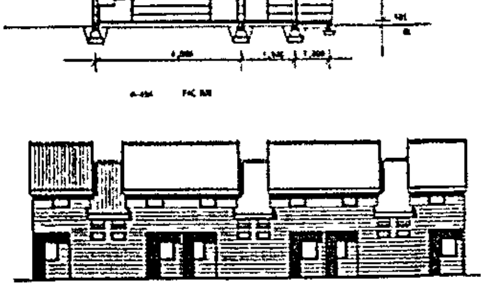
Floor Area/unit	Lot Size 60 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 34.0 M^2 / WC/M & Stor. 14.0 M^2 / Veranda 2.0 M^2	Total 50.0 M^2	M^2
	Gross Floor Area	50.0 M^2		M^2
	Building Area	25.0 M^2		M^2
	Volume Ratio	83.3 %		%
	Coverage Ratio	41.7 %		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		29.0 cm/M^2 (1)
		Depth Direction Wall Length		52.23 cm/M^2 (1)
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area	2F	0.43 M^2 2.2 %
			1F	0.60 M^2 4.1 %
	Daylight	Effective Daylight Area	2F	2.11 M^2 10.8 %
			1F	2.08 M^2 14.3 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4 (under the window)		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair	Wooden stair		
	Floor 1F: / 2F:	Concrete slab on grade t=50, sand fill t=100 Wood joist + particle board t=16		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		6 Units		
Cost June,1980	Per Unit	1636.67 x 10^3RP/unit		
	Per Square Meter	32.73 x 10^3RP/net M^2		32.73 x 10^3RP/gross M^2

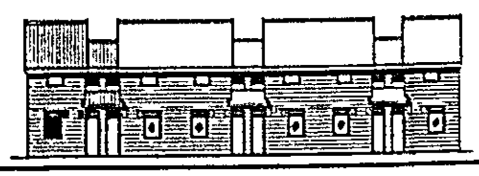
M-45A







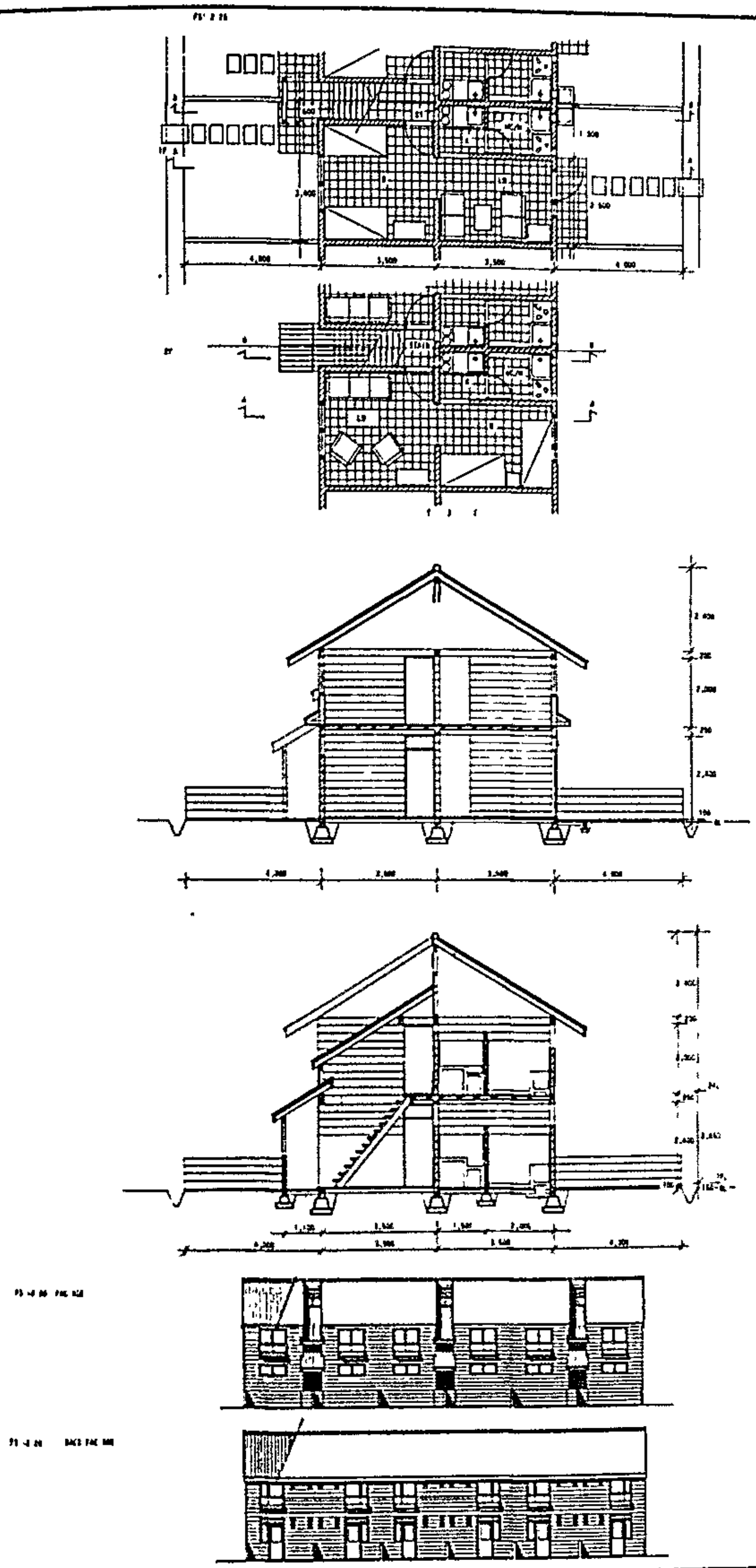




FS'2-26

Floor Area/unit	Lot Size 35 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 22.9 M^2 WC/M & Stor. 3.0 M^2 Veranda M^2	Total 25.9 M^2	M^2
	Gross Floor Area	28.0 M^2		M^2
	Building Area	14.0 M^2		M^2
	Volume Ratio	80.0 %		%
	Coverage Ratio	40.0 %		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		27.00 cm/M^2 (1F)
		Depth Direction Wall Length		41.76 cm/M^2 (1F)
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				0.54 M^2 2.4%
	Daylight	Effective Daylight Area		M^2 %
				2.70 M^2 11.8%
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4 (under the window)		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair	Wooden stair		
	Floor 1F: 2F:	Concrete slab on grade t=50, sand fill t=100 RC-slab t=100, mortar t=30		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		12 Units		
Cost June, 1980	Per Unit	1017.41 x 10^3RP/unit		
	Per Square Meter	39.78 x 10^3RP/net M^2		36.34 x 10^3RP/gross M^2

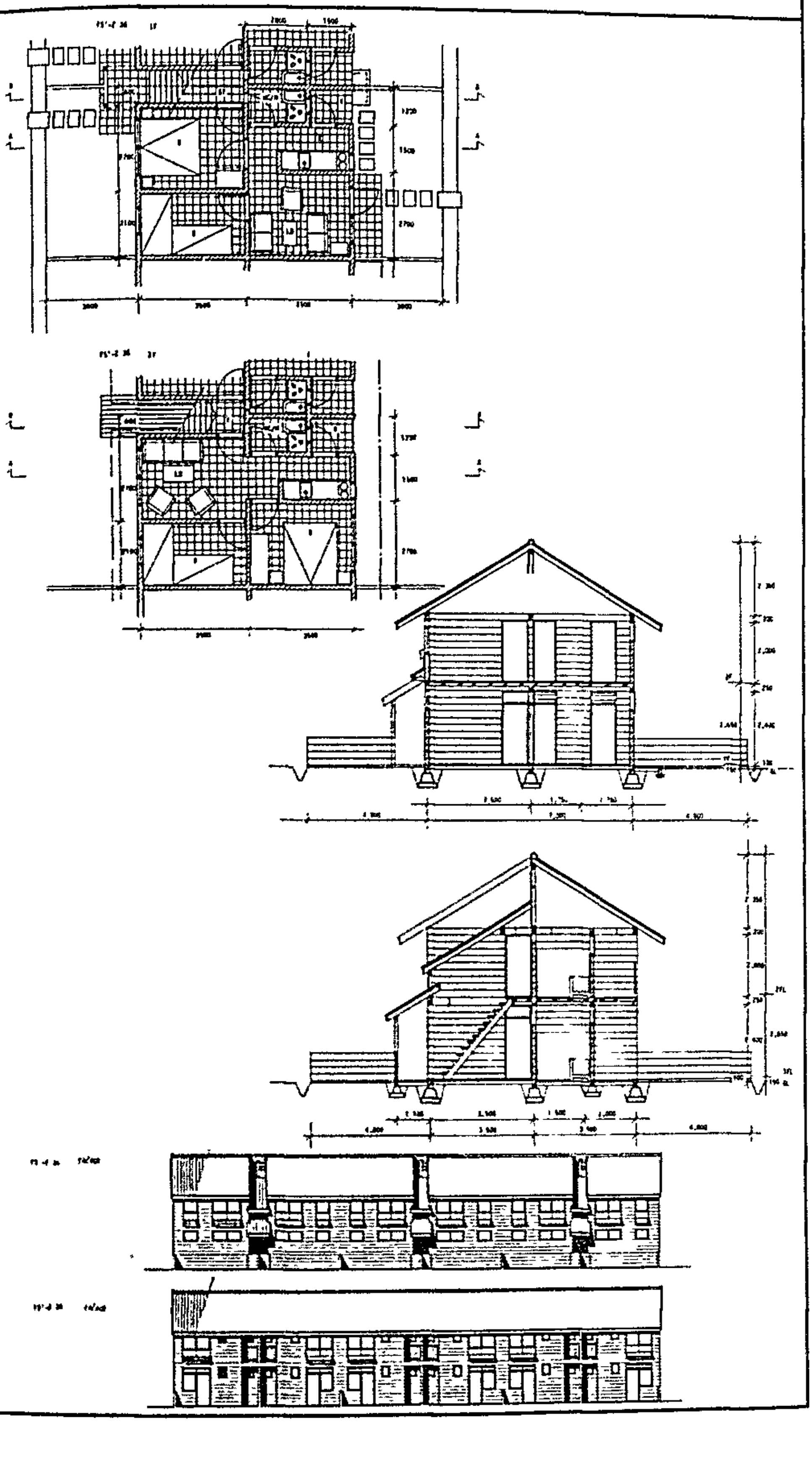
FS'2-26



FS'2-36

Floor Area/unit	Lot Size 50 M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 31.50M^2 / WC/M & Stor. 2.40M^2 / Veranda 1.80M^2	Total 35.70 M^2	M^2
	Gross Floor Area	37.80 M^2		M^2
	Building Area	18.90 M^2		M^2
	Volume Ratio	75.6 %		%
	Coverage Ratio	37.8 %		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		27.68 cm/M^2 (1F)
		Depth Direction Wall Length		45.35 cm/M^2 (1F)
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		
		Effective Ventilation Area		M^2 %
				0.67 M^2 2.11%
	Daylight	Effective Daylight Area		M^2 %
				3.42 M^2 10.85%
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Concrete block t=150 Wood stud + asbestos sheet t=4(under the window)		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Concrete block t=150 Wood stud + asbestos sheet t=4		
	Partition Wall	Concrete block t=150		
	Door & Windows	Wood frame + flash door , Naco or fixed window		
	Stair	Wooden stair		
	Floor 1F: / 2F:	Concrete slab on grade t=50,sand fill t=100 RC-slab t=100,mortar t=30		
	Structure	Reinforced corner and edge blocks and RC-course		
	Foundation	Batukali foundation + RC-foundation beam		
Number of Units/Row		12 Units		
Cost June,1980	Per Unit	1414.47 x 10^3RP/unit		
	Per Square Meter	39.62 x 10^3RP/net M^2		37.42 x 10^3RP/gross M^2

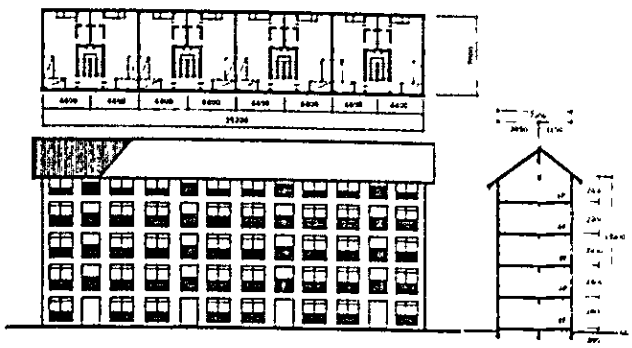
FS'2-36

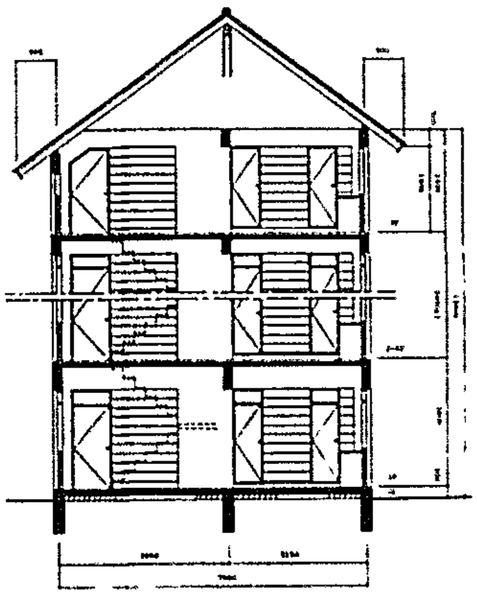


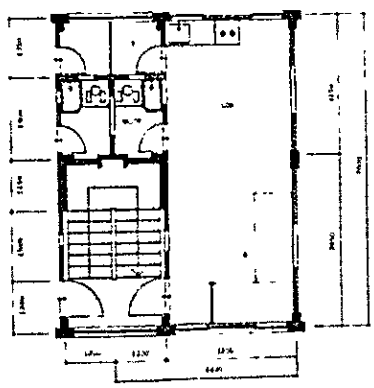
FS'5-24

Floor Area/unit	Lot Size M²	Construction Stage		After Extension
	Net Floor Area	Living F.A. 22.40 M² WC/M & Stor. 2.16 M² Veranda 1.62 M²	Total 26.18 M²	M²
	Gross Floor Area	30.80 M²		M²
	Building Area	M²		M²
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		6.90 cm/M²
		Depth Direction Wall Length		8.77 cm/M²
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adequate
		Effective Ventilation Area		M² %
				0.53 M² 2.4 %
	Daylight	Effective Daylight Area		M² %
				2.69 M² 12.0 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Red brick exposure 1/2 brick Cikarang class Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Windows	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F: / 2,3,4,5F:	Concrete slab on grade t=50, sand fill t=100 RC-slab t=100 + mortar t=30		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		40 Units		
Cost June, 1980	Per Unit	2141.61 x 10³RP/unit		
	Per Square Meter	81.80 x 10³RP/net M²	69.53 x 10³RP/gross M²	

FS'5-24



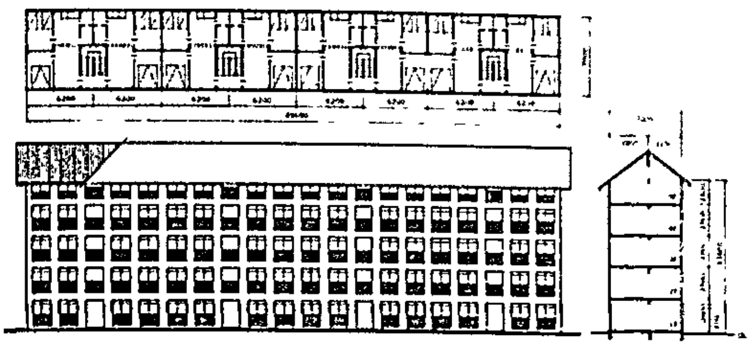


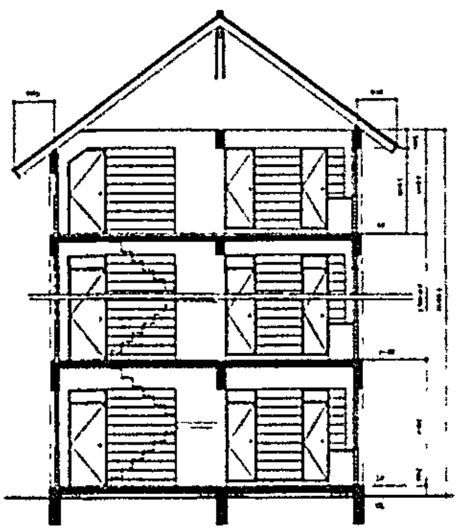


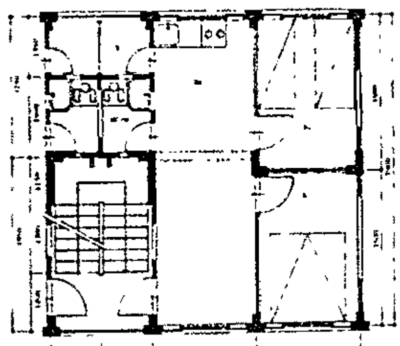
FS'5-36

Floor Area/unit	Lot Size M^2	Construction Stage			After Extension
	Net Floor Area	Living F.A. 35.0 M^2		Total 38.78 M^2	M^2
		WC/M & Stor. 2.16 M^2			
		Veranda 1.62 M^2			
	Gross Floor Area	43.40 M^2			M^2
	Building Area	M^2			M^2
	Volume Ratio	124.0 %			%
	Coverage Ratio	24.8 %			%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length			cm/M^2
		Depth Direction Wall Length			cm/M^2
	Fire Proof				
	Inundation Differential Settlement				
Health Performance	Ventilation	Cross Ventialtion			Adequate
		Effective Ventilation Area			M^2 %
					1.06 M^2 3.0 %
	Daylight	Effective Daylight Area			M^2 %
					5.62 M^2 16.1 %
	Rain Water				
	Toilet & Other Sewer	Combined System			
	Kitchen Exhaust				
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok			
	Outer Wall	Red brick exposure 1/2 brick Cikarang class			
	Unit Wall gen:	Concrete block t=150			
	Unit Wall upper:	Wood stud + cement fiber board(t=15) + plaster t=15 both side			
	Gable Wall gen:	Red brick exposure 1/2 brick Cikarang class			
	Gable Wall upper:	Wood stud + asbestos sheet t=4			
	Partition Wall	Wood stud + particle board t=12			
	Door & Windows	Wood frame + flash door or Naco windows			
	Stair	RC stair			
	Floor 1F:	Concrete slab on grade t=50, sand fill t=100			
	Floor 2,3,4,5F:	RC-slab t=100 + mortar t=30			
	Structure	RC wall rahmen structure			
	Foundation	Pile foundation			
Number of Units/Row		40 Units			
Cost June,1980	Per Unit	2956.09 x 10^3RP/unit			
	Per Square Meter	76.23 x 10^3RP/net M^2			68.11 x 10^3RP/gross M^2

FS'5-36.



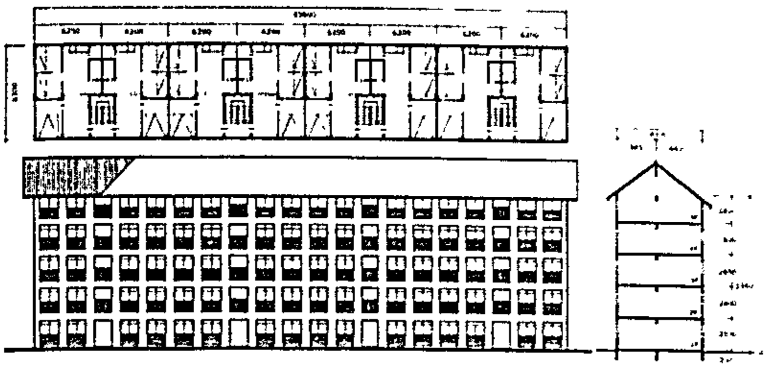


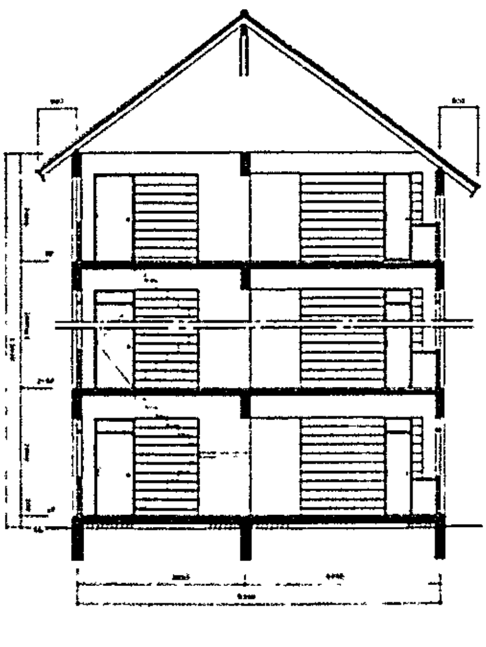


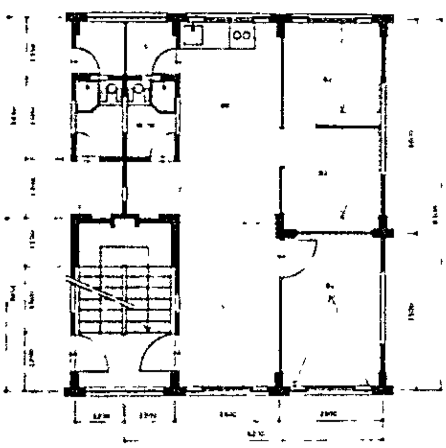
FS'5-45

Floor Area/unit	Lot Size. M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 41.50 M^2 WC/M & Stor. 3.72 M^2 Veranda 1.62 M^2	Total 46.84 M^2	M^2
	Gross Floor Area	51.46 M^2		M^2
	Building Area	M^2		M^2
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		7.65 cm/M^2
		Depth Direction Wall Length		7.87 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adequate
		Effective Ventilation Area		M^2 %
				1.06 M^2 2.6 %
	Daylight	Effective Daylight Area		M^2 %
				5.62 M^2 13.5 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen: upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: upper:	Red brick exposure 1/2 brick Cikarang class Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Windows	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F: 2,3,4,5F:	Concrete slab on grade t=50,sand fill t=100 RC-slab t=160 + mortar t=30		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		40 Units		
Cost June,1980	Per Unit	3372.08 x 10^3RP/unit		
	Per Square Meter	71.99 x 10^3RP/net M^2	65.53 x 10^3RP/gross M^2	

FS'5-45



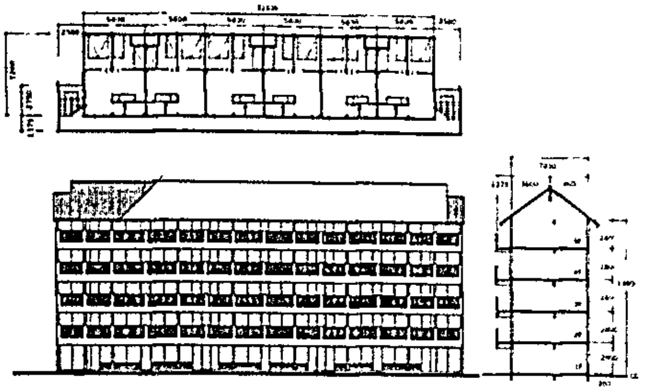


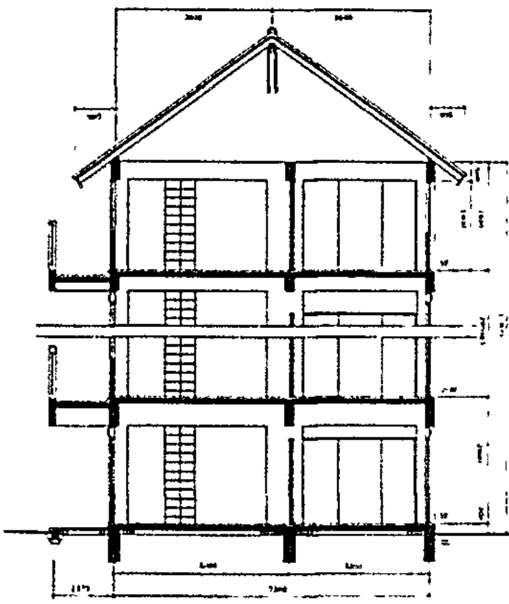


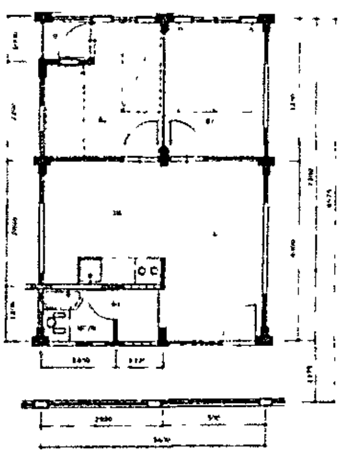
FG5-36

Floor Area/unit	Lot Size M^2		Construction Stage	After Extension
	Net Floor Area	Living F.A. 34.20 M^2	Total 38.88 M^2	M^2
		WC/M & Stor. 3.48 M^2		
		Veranda 1.20 M^2		
	Gross Floor Area	49.74 M^2		M^2
	Building Area	M^2		M^2
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		6.93 cm/M^2
		Depth Direction Wall Length		7.81 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adeouate
		Effective Ventilation Area		M^2 %
				0.85 M^2 2.5 %
	Daylight	Effective Daylight Area		M^2 %
				4.15 M^2 12.1 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen:	Concrete block t=150		
	Unit Wall upper:	Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen:	Red brick exposure 1/2 brick Cikarang class		
	Gable Wall upper:	Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Windows	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F:	Concrete slab on grade t=50, sand fill t=100		
	Floor 2,3,4,5F:	RC-slab t=100 + mortar t=30		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		30 Units		
Cost June,1980	Per Unit	3116.67 x 10^3RP/unit		
	Per Square Meter	80.16 x 10^3RP/net M^2	62.66 x 10^3RP/gross M^2	

FG5-36



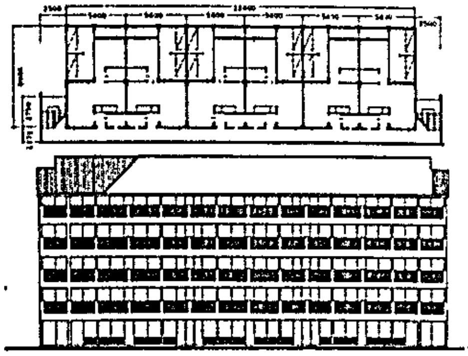


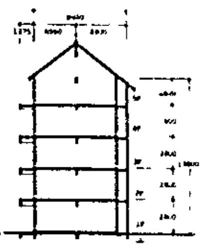


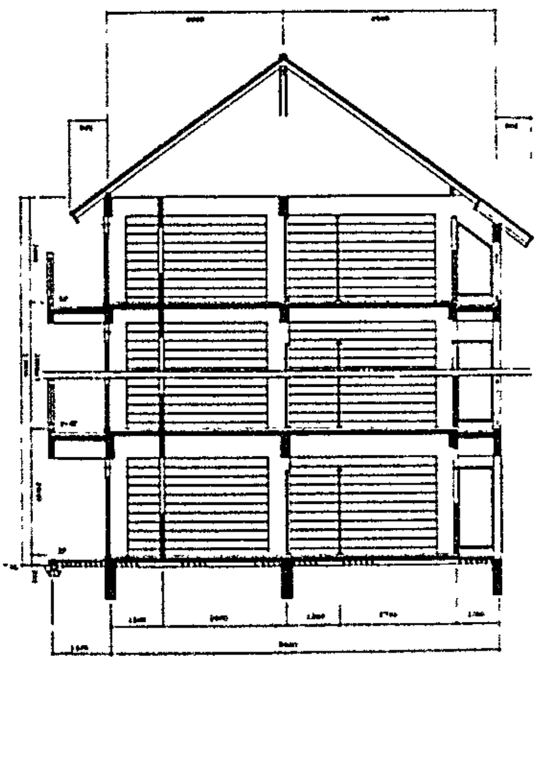
FG5-45

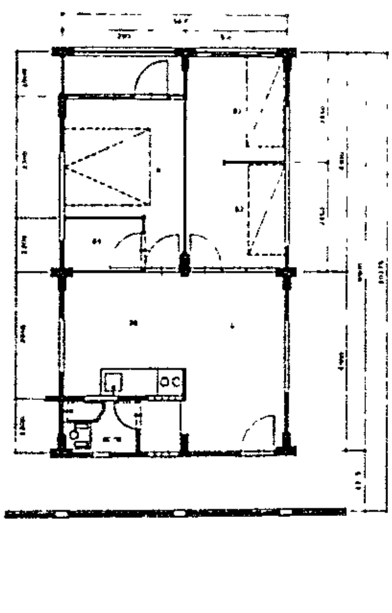
Floor Area/unit	Lot Size M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 39.40 M^2	Total 48.06 M^2	M^2
		WC/M & Stor. 5.76 M^2		
		Veranda 2.9 M^2		
	Gross Floor Area	58.92 M^2		M^2
	Building Area	M^2		M^2
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		7.0 cm/M^2
		Depth Direction Wall Length		7.02 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adequate
		Effective Ventilation Area		M^2 %
				1.12 M^2 2.9 %
	Daylight	Effective Daylight Area		M^2 %
				5.18 M^2 13.2 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Red brick exposure 1/2 brick Cikarang class Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Windows	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F: / 2,3,4,5F:	Concrete slab on grade t=50, sand fill t=100 RC-slab t=100 + mortar t=30		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		30 Units		
Cost June, 1980	Per Unit	3688.25 x 10^3 RP/unit		
	Per Square Meter	76.33 x 10^3 RP/net M^2		62.26 x 10^3 RP/gross M^2

FG5-45





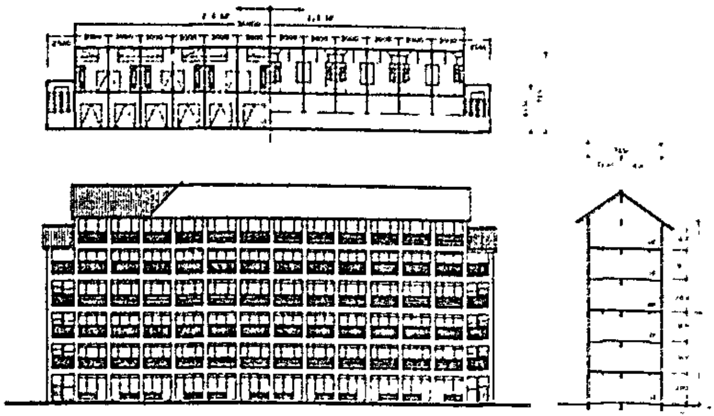


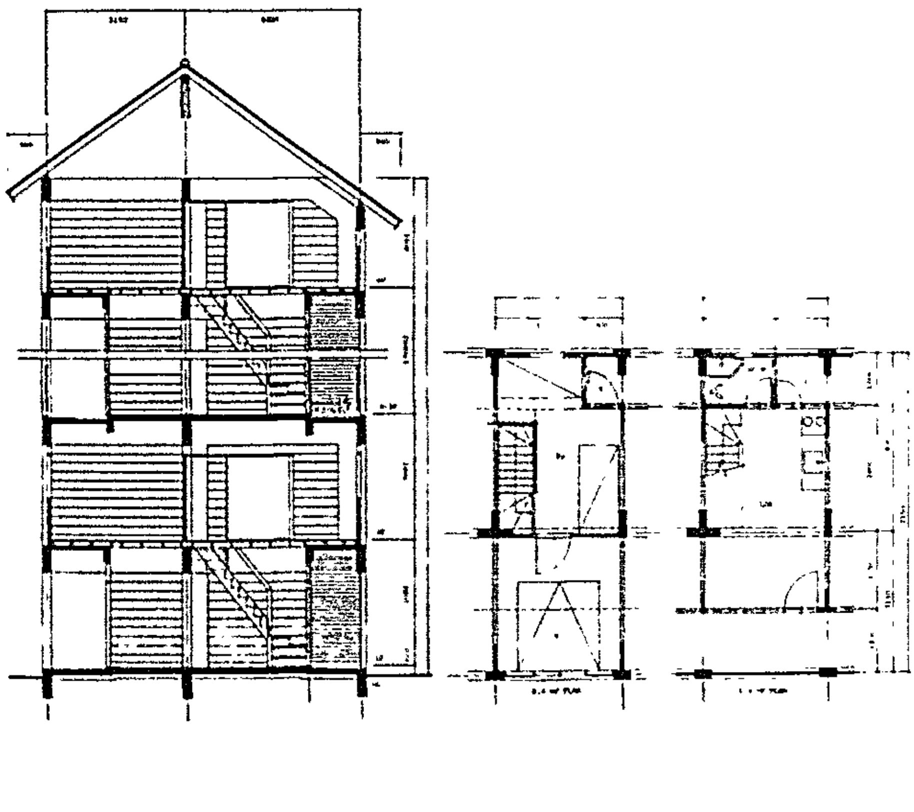


FM6-36

Floor Area/unit	Lot Size M^2	Construction Stage			After Extension
	Net Floor Area	Living F.A. 31.86 M^2	Total 38.70 M^2		M^2
		WC/M & Stor. 4.26 M^2			
		Veranda 2.58 M^2			
	Gross Floor Area	46.36 M^2			M^2
	Building Area	M^2			M^2
	Volume Ratio	%			%
	Coverage Ratio	%			%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length			6.83 cm/M^2
		Depth Direction Wall Length			7.05 cm/M^2
	Fire Proof				
	Inundation Differential Settlement				
Health Performance	Ventilation	Cross Ventialtion			Adequate
		Effective Ventilation Area		F n+1	0.55 M^2 3.0 %
				F n	0.84 M^2 6.2 %
	Daylight	Effective Daylight Area		F n+1	2.35 M^2 12.9 %
				F n	3.58 M^2 26.2 %
	Rain Water				
	Toilet & Other Sewer	Combined System			
	Kitchen Exhaust				
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok			
	Outer Wall	Red brick exposure 1/2 brick Cikarang class			
	Unit Wall gen: / upper:	Concrete block t=150 / Wood stud + cement fiber board(t=15) + plaster t=15 both side			
	Gable Wall gen: / upper:	Red brick exposure 1/2 brick Cikarang class / Wood stud + asbestos sheet t=4			
	Partition Wall	Wood stud + particle board t=12			
	Door & Windows	Wood frame + flash door or Naco windows			
	Stair	RC stair			
	Floor 1F: / 3,5F: / 2,4,6F:	Concrete slab on grade t=50,sand fill t=100 / RC-slab t=100 + mortar t=30 / Wood joist + particle board t=16			
	Structure	RC wall rahmen structure			
	Foundation	Pile foundation			
Number of Units/Row		30 Units			
Cost June,1980	Per Unit	3248.61 x 10^3RP/unit			
	Per Square Meter	83.94 x 10^3RP/net M^2			70.07 x 10^3RP/gross M^2

FM6-36





FM6-45

Floor Area/unit	Lot Size M^2	Construction Stage		After Extension
	Net Floor Area	Living F.A. 35.40 M^2	Total 46.80 M^2	M^2
		WC/M & Stor. 8.10 M^2		
		Veranda 3.3 M^2		
	Gross Floor Area	54.46 M^2		M^2
	Building Area	M^2		M^2
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		6.95 cm/M^2
		Depth Direction Wall Length		6.98 cm/M^2
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adequate
		Effective Ventilation Area	F n+1	0.68 M^2 3.8 %
			F n	0.95 M^2 5.5 %
	Daylight	Effective Daylight Area	F n+1	3.26 M^2 18.1 %
			F n	3.85 M^2 22.2 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen:	Concrete block t=150		
	Unit Wall upper:	Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen:	Red brick exposure 1/2 brick Cikarang class		
	Gable Wall upper:	Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Wind	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F:	Concrete slab on grade t=50, sand fill t=100		
	Floor 3,5F:	RC-slab t=100 + mortar t=30		
	Floor 2,4,6F:	Wood joist + particle board t=16		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		30 Units		
Cost June, 1980	Per Unit	3686.28 x 10^3RP/unit		
	Per Square Meter	78.77 x 10^3RP/net M^2	67.69 x 10^3RP/gross M^2	

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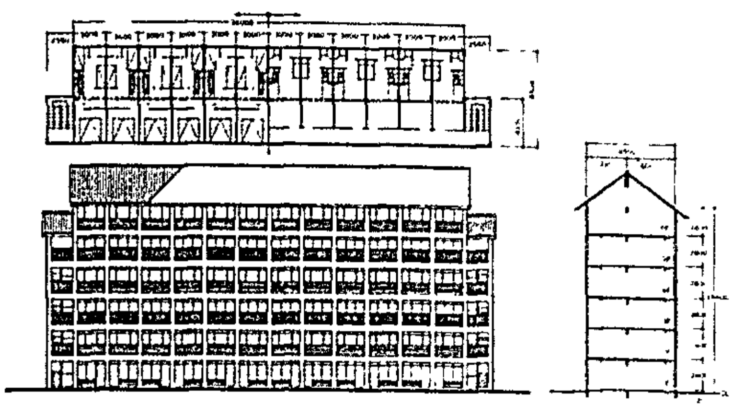

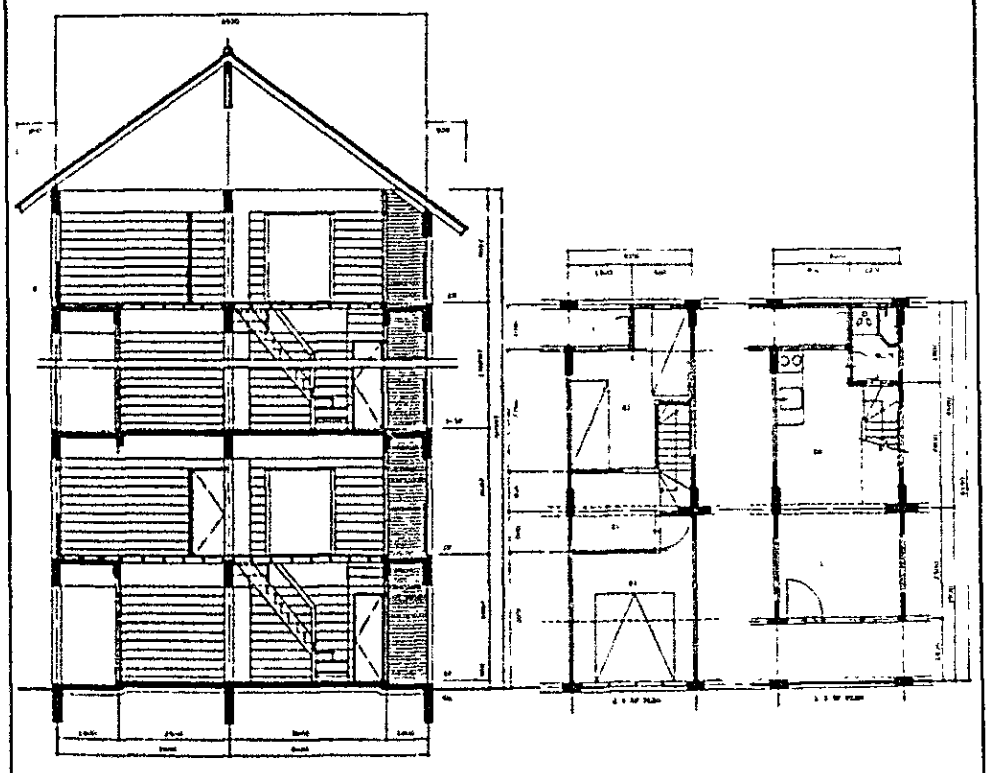

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Floor Area/unit	Lot Size M²	Construction Stage		After Extension
	Net Floor Area	Living F.A. 32.40 M²	Total	
		WC/M & Stor. 2.63 M²	36.90 M²	M²
		Veranda 1.88 M²		
	Gross Floor Area	40.93 M²		M²
	Building Area	M²		M²
	Volume Ratio	%		%
	Coverage Ratio	%		%
Safety Performance	Seismic Proof (Wall Volume)	Frontage Direction Wall Length		7.09 cm/M²
		Depth Direction Wall Length		7.09 cm/M²
	Fire Proof			
	Inundation Differential Settlement			
Health Performance	Ventilation	Cross Ventialtion		Adequate
		Effective Ventilation Area		M² %
				0.88 M² 2.7 %
	Daylight	Effective Daylight Area		M² %
				3.92 M² 12.1 %
	Rain Water			
	Toilet & Other Sewer	Combined System		
	Kitchen Exhaust			
Rough Specification	Roof	Unglazed roof tile ex. Genteng Kodok		
	Outer Wall	Red brick exposure 1/2 brick Cikarang class		
	Unit Wall gen: / upper:	Concrete block t=150 Wood stud + cement fiber board(t=15) + plaster t=15 both side		
	Gable Wall gen: / upper:	Red brick exposure 1/2 brick Cikarang class Wood stud + asbestos sheet t=4		
	Partition Wall	Wood stud + particle board t=12		
	Door & Windows	Wood frame + flash door or Naco windows		
	Stair	RC stair		
	Floor 1F: / 2,3,4,5F:	Concrete slab on grade t=50, sand fill t=100 RC-slab t=100 + mortar t=30		
	Structure	RC wall rahmen structure		
	Foundation	Pile foundation		
Number of Units/Row		20 Units		
Cost June,1980	Per Unit	3141.02 x 10³RP/unit		
	Per Square Meter	85.12 x 10³RP/net M²		76.74 x 10³RP/gross M²

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