PN-AAU-600

FILE

EMPLOYMENT GENERATION THROUGH BUILDING CORE HOUSING IN PERU

Report P - 5

By

W. Paul Strassmann
Professor of Economics and Principal Investigator
Housing in Development Unit
Michigan State University
East Lansing, Michigan

November 1980

Preliminary report based on data collected by Norma L. Botero. The research has been sponsored by the Office of Urban Development, Bureau for Development Support, Agency for International Development, in accordance with Contract AID/DS-otr-C-0012.

EMPLOYMENT GENERATION THROUGH BUILDING CORE HOUSING IN PERU

The number of jobs created by a housing construction program can be measured in two ways: Physically and economically. The physical way gives workdays per square meter, and the economic way shows workdays for a given volume of spending. If the optimal design, construction method, and type of firm is to be used in a building program, however, both measures of employment generation must be considered. With only the first measure, workdays per square meter could be multiplied at an excessive cost; and with only the second measure, workdays per expenditure could be raised without enough growth in physical output. Both considerations remind us that additional employment must be productive.

Focus

In this report we shall consider the employment generated by two types of core housing built in three alternative scales by three types of organization. One core house, Nucleo Basico, has been designed by the Peruvian Ministry of Housing and Construction; and the other is a Tunisian plan, Logement Evolutif, for which we have previous estimates for six other countries. The volumes are small (10 units), medium (50-80), and large (100-1,000), or 10, 65, and 550. The principal conclusion is that the intermediate volume is best because it generates the most work and yet builds dwellings at lowest cost. Although this result matches findings in the other countries, it must be regarded as tentative since it is based on only three (very thorough) estimates.

Another objective of this report is to demonstrate a simple guideline for estimating employment generation from construction without a highly detailed item by item cost analysis. That formula can be used on projects at other places and times.

Before proceeding, we should itemize what this report does not do. First, it says nothing about net employment generation. If additional core housing is built, some workers may leave other jobs to do so, thus making the net employment rise less than the jobs counted on the core houses. Second, offsite and indirect employment are not part of this report. Infrastructure employment on streets, electrical lines, and water and sewerage pipes are treated separately in "Urban Infrastructure and Employment in Peru" (East Lansing: Michigan State University, October, 1980; mimeographed). Work by designers, inspectors, salesmen, supervisors, and others in the contractor's office is omitted because it does not vary directly with the volume of building. Still it might be as high as 5-10 percent of the total. Indirect employment generated in building materials production (and inputs into that, etc.) is also not counted. A recent study by Rufino Cebrecos Revilla estimated that for five jobs in construction, only two are generated indirectly in materials, etc., for low-cost single-story housing.[1] This estimate is close to those found in Mexico, Brazil, and elsewhere, so repeating the work did not appear worthwhile.

Finally, one should remember that loans or expenditures by government for a housing program do not lead directly to an equivalent amount of building and employment. Varying amounts of funds must be diverted to the purchase of raw land, and that does not necessarily create employment. Moreover, new funds will generate additional matching savings for housing

by some income groups and merely substitute among others for funds that they would have spent for dwelling construction all along. In the first case the effect on employment is greater and in the second case it is less than might have been anticipated.[2]

The Two Core Dwelling Types

The two core dwellings for which onsite employment was estimated are very similar, as may be seen in Figures 1 - 4, but the Peruvian Nucleo Basico is larger and has more equipment. Both are rectangular with a flat roof supported by reinforced concrete posts and a collar beam. With a floorspace of 34.4 m^2 on a 90 m^2 lot, the Peruvian plan is larger than the Tunisian Logement Evolutif with its floorspace of 24.9 m^2 on a 77 m^2 lot. The Tunisian roof consists of concrete panels, while the Peruvian roof has cement poured over lightweight bricks among supporting reinforced beams. Plumbing fixtures for the Tunisian plan consist of no more than a Turkish toilet and one sink in the kitchen. The Peruvian plan has a Western toilet a shower, a washbasin, and the kitchen sink. These are connected to a sewerage system while the Tunisian plumbing goes to a septic tank. The Tunisian plan is more rudimentary, hence more improvable, and aimed at a lower income group. However, it includes an approximate 4 percent expenditure for whitewashing the walls and painting doors and window frames, which the Peruvian plan leaves to the occupants.

Estimates for the Tunisian plan were made in Lima in order to compare Peruvian costs with those of six other countries. Even for a standard plan such comparisons are a bit hazardous because techniques and designs may be unfamiliar in some countries and because of foreign exchange rate conversion.

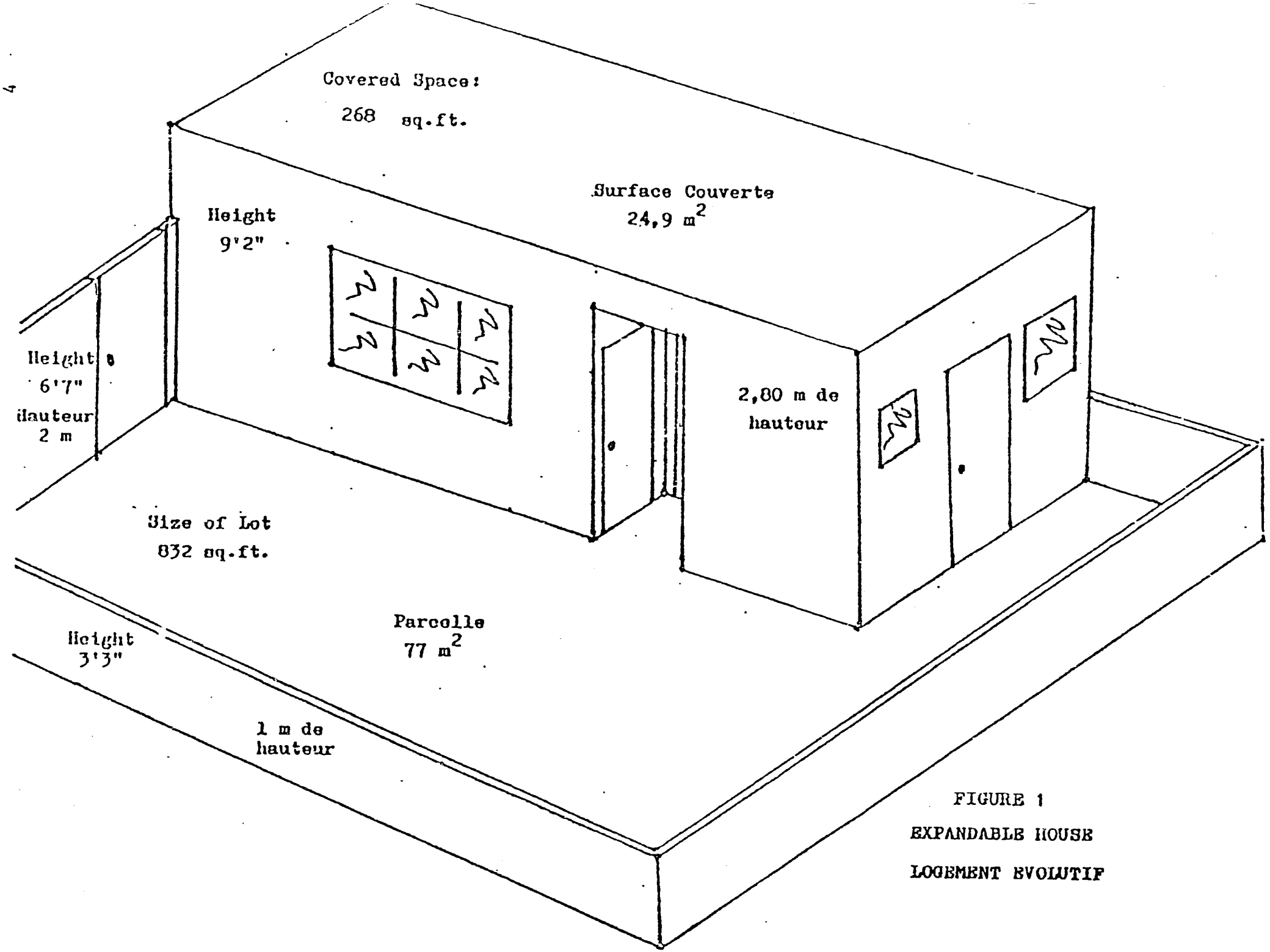
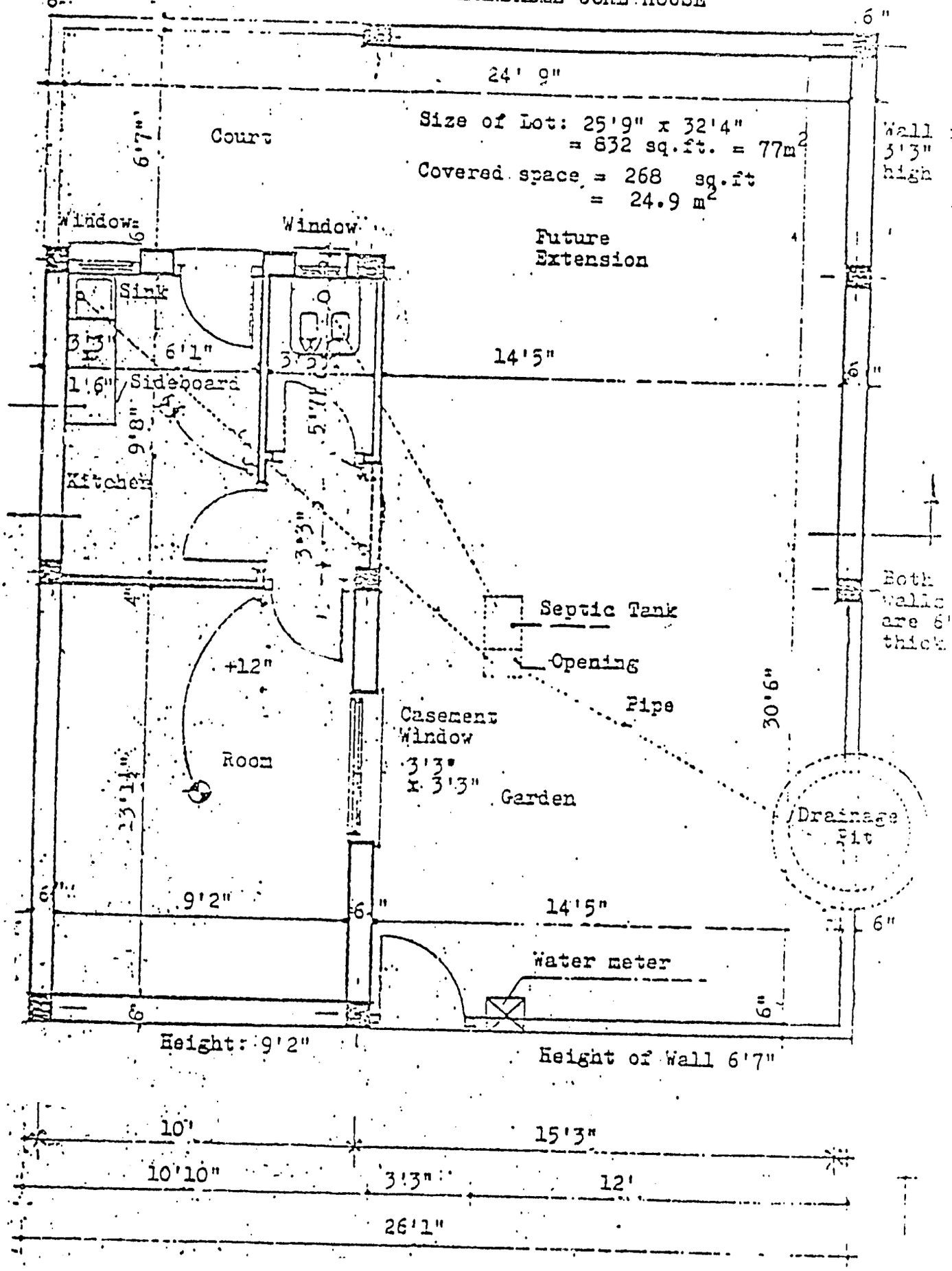


FIGURE 1

EXPANDABLE HOUSE

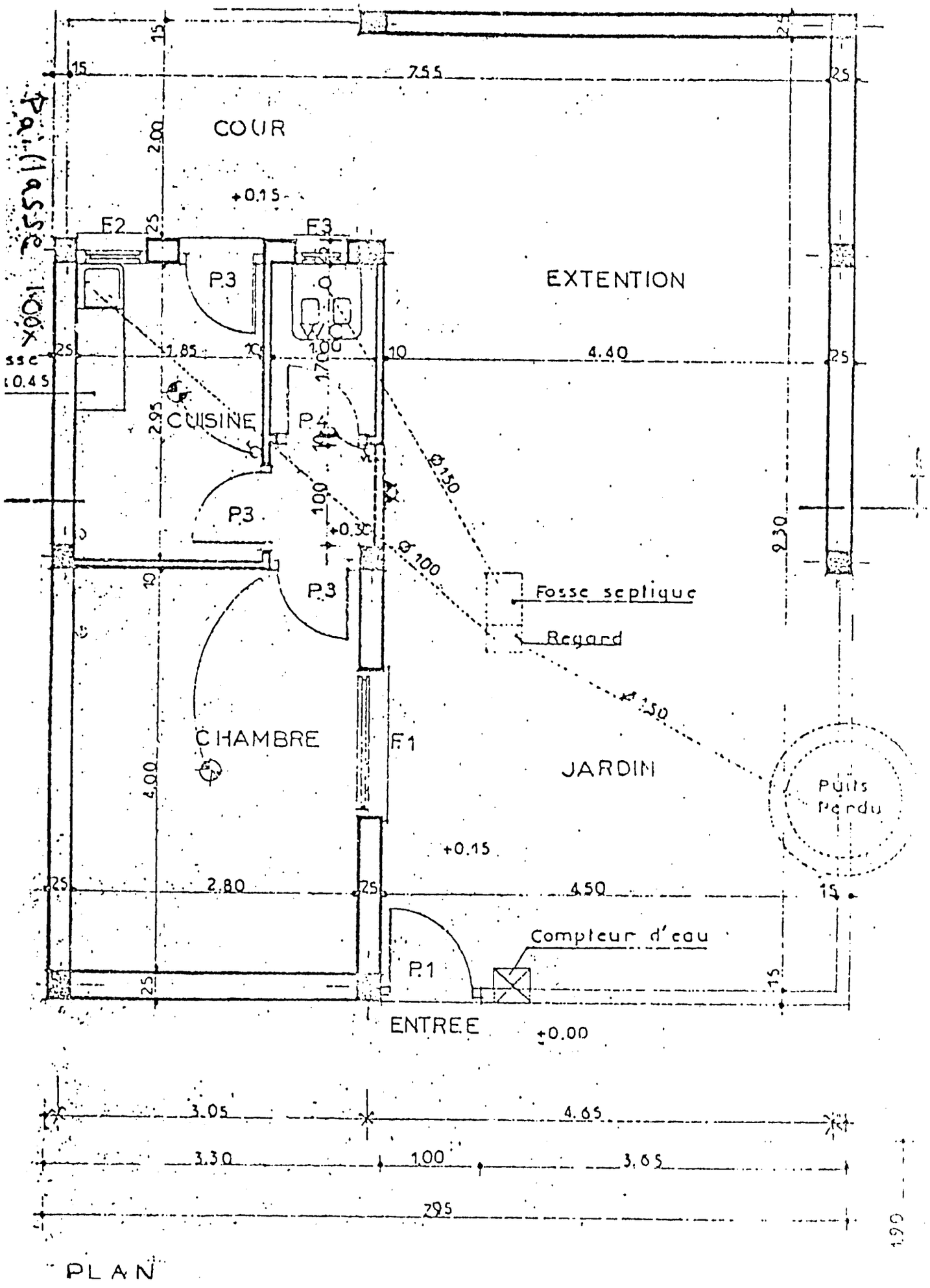
LOGEMENT EVOLUTIF

FIGURE 2. a. EXPANDABLE CORE HOUSE

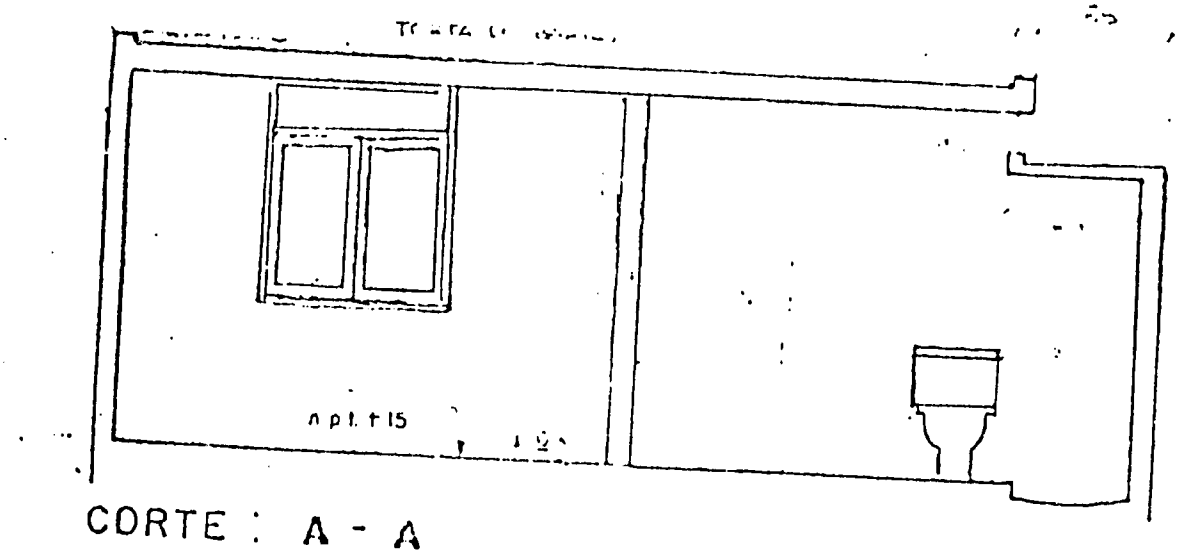


LOGEMENT EVOLUTIF

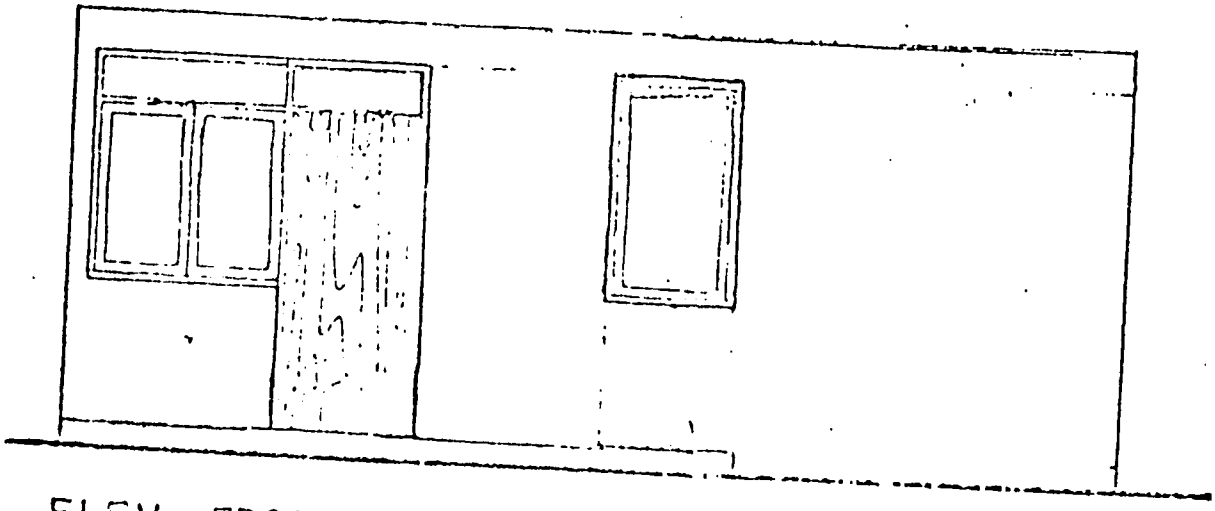
Fibure 2 b.



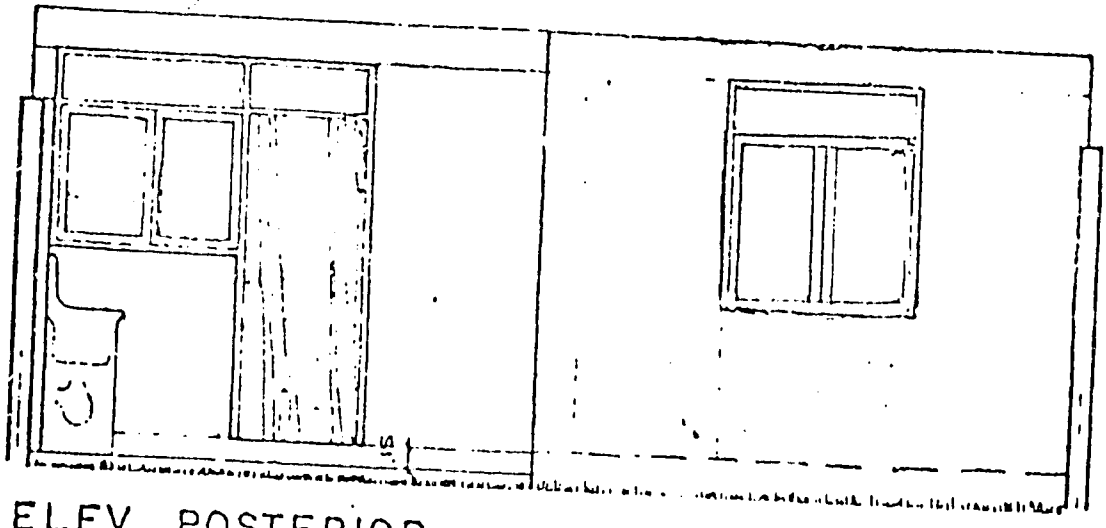
PLAN



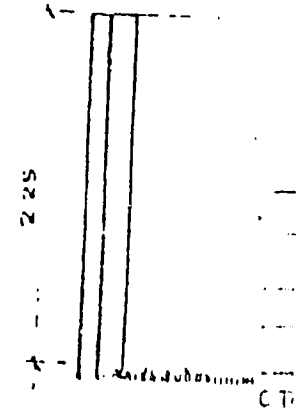
CORTE : A - A



ELEV. FRONTAL (NUCLEO BASICO)



ELEV. POSTERIOR (NUCLEO BASICO)



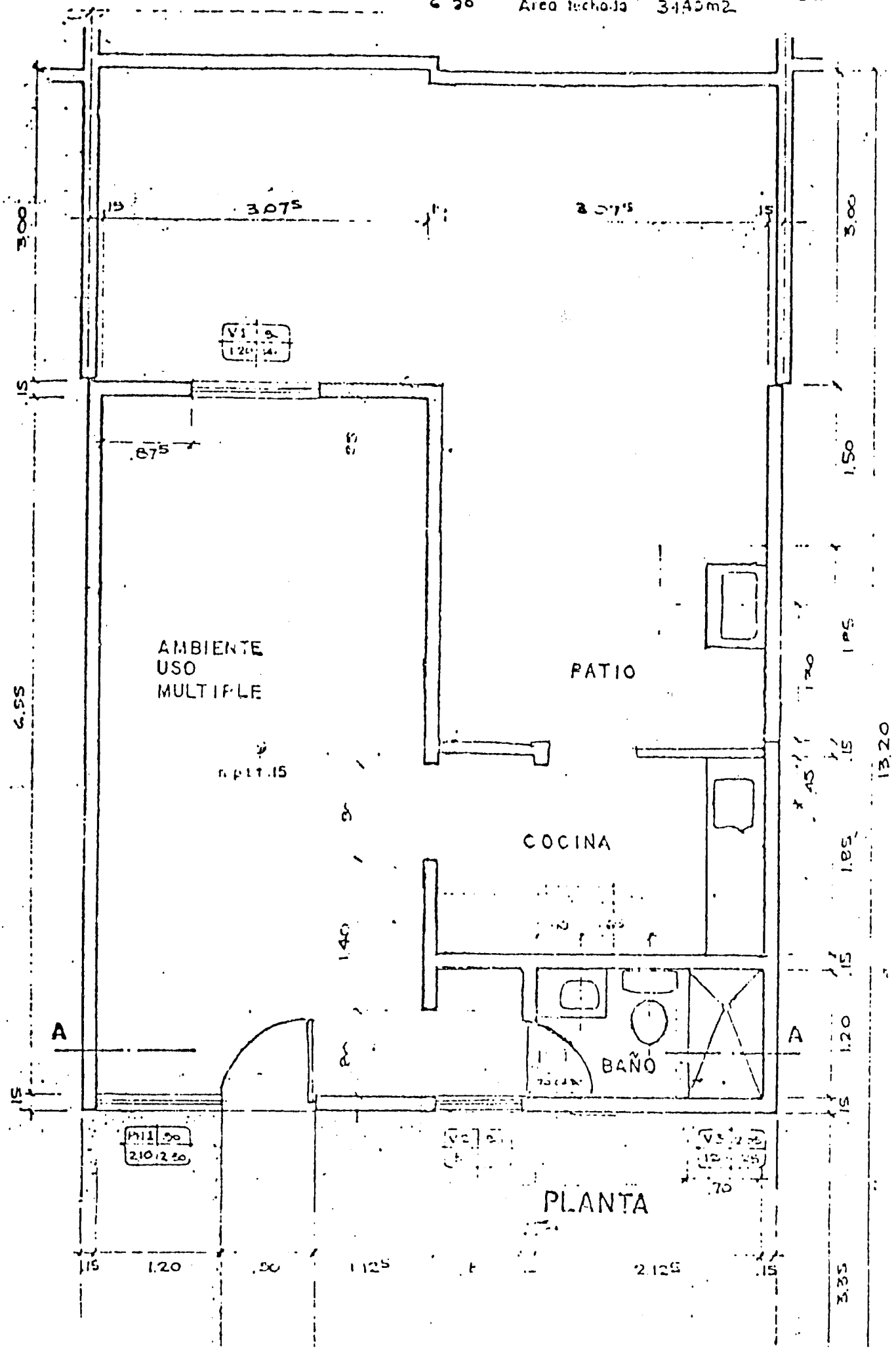
CORTE

FIGURE 3
NUCLEO BASICO (LIMA)

NUCLEO BASICO

Area techada 34.40m2

FIGURE 4



The exchange rate reflects events in international trade and finance, not relative productivity in building homes, which are non-traded commodities. Nevertheless, it is noteworthy that construction cost for Peru was lower than in any of the other six countries, US $2,852 when the house was built at a volume of 1 - 10 units. Average for the other countries was US $4,338 in 1979. (See Tables 1 and 2). Lowest cost among the other countries was found in Colombo, Sri Lanka, where the unit could have been built for $3,117. In Tunisia itself the cost would have been $4,253.

In terms of workdays per unit, Peruvian construction seemed even more efficient compared with the other countries. To build the unit would have taken only 92 workdays in Lima, compared with 280 workdays for the average of the other six countries. This difference is mainly due to the difference in wage levels and the substitution of equipment, easily installable components, and better management for labor. Daily wages for unskilled labor in Lima were the equivalent of US $7.32 in June-July 1980, while daily wages in the six other countries in July 1979 averaged less than half as much: US $3.09 according to employers and US $2.67 according to workers.

An anomaly in Peru, however, was the low premium for skilled workers. These received only 6 percent more than the unskilled, compared with 100 percent more in the other countries. In Medellín, Colombia, the skilled received nearly 200 percent more than the unskilled. Substitution of the unskilled for the skilled was therefore intense in Medellín. In Lima, out of 15 workers, 9 would typically be skilled and 6 unskilled; but in Medellín the proportion was 5 skilled and 10 unskilled. The Medellín proportion is actually not far from the average unskilled-to-skilled employment ratio, $q = 1.7$, in the six countries. Workdays per unit in Medellín were not much above those in Lima: 112. All this may be found in Tables 1 and 2.

Table 1. Cost of Construction and Employment Generation for a Standard 24.9 M^2 Dwelling Built with Reinforced Concrete Posts in Six Countries, Summer 1979.

Volume: 1-10 Units

	Colombo, Sri Lanka	Rawalpindi, Pakistan	Lusaka, Zambia	Nairobi, Kenya	Medellín, Colombia	Tunis, Tunisia	Average, Six Countries
1. Cost of construction, C	$3,117	$3,482	$5,107	$6,276	$3,794	$4,253	$4,338
2. Daily pay, w_u, of unskilled workers, According to:							
a. Workers	$ .94	$ 1.92	$ 3.05	$ 2.65	$ 3.30	$ 4.17	$ 2.67
b. Builders	1.02	$ 2.00	3.80	2.79	4.24	$ 4.70	3.09
3. Ratio of skilled to unskilled wages, p, According to:							
a. Workers	1.713	1.818	1.898	1.574	2.706	1.808	1.93
b. Builders	2.125	2.300	2.000	2.000	2.975	1.654	2.17
4. Unskilled workers employed per skilled worker, q, According to:							
a. Workers	1.50	1.73	1.50	3.00	1.46	.48	1.61
b. Builders	1.31	1.53	1.62	2.86	2.11	1.37	1.80
5. Ratio of labor costs to total cost, r,	.150	.185	.198	.352	.205	.314	.234
6. Employment generator, $\phi = \frac{r(1+q)}{(p+q)}$							
a. Worker-based	.117	.142	.146	.308	.119	.203	.173
b. Builder-based	.101	.121	.143	.280	.125	.246	.169
7. Workdays for the dwelling. According to:							
a. Workers	388	258	244	729	137	207	327
b. Builders	309	210	192	632	112	223	280

Table 2

Employment Effect of Volume of Construction
Two Core Housing Types, Lima, Peru, 1980

	Units in Contract (1)	Cost per Unit (2)	Workdays per Unit (3)	Employment Generator (4)	Number of Units per $1,000,000 (5)	Employment months per $1,000,000 (6)
Tunisian Plan, 24.9 m^2						
1. Firm A	10	2,852	101	.255	351	1,418
2. Firm B	65	2,687	102	.372	372	1,518
3. Ministry	550	2,153	63	.217	465	1,186
Peruvian Plan, 34.4 m^2						
1. Firm A	10	4,358	132	.219	229	1,209
2. Firm B	65	3,334	128	.241	300	1,536
3. Ministry	550	2,565	76	.208	390	1,137

Sources: Records were examined and costs estimated in June and July of 1980. Since Ministry of Housing data came from a period when the unskilled wage would have been only US $6.37 when converted at a rate of 196.80 soles per dollar, its cost estimates were raised by 14.8 percent. By June 1980 the dollar was worth 284.50 soles and the unskilled wage was US $7.32. The unadjusted estimates can be seen in the appendix tables.

The high cost of unskilled labor in Lima was thus partly offset by the greater use of comparatively inexpensive skilled labor. The additi substitution of non-labor inputs for workers kept the proportion, r, of onsite wages in total costs down to 24.2 percent, not far from the average of 23.4 percent for the other countries, but above the 20.5 percent share for Medellín.

A pessimist might look at these patterns and conclude that if skill workers in Peru get US $7.78 daily, the unskilled should perhaps get only half that, about US $4.00 daily. As a result, construction employment migl rise by 50 percent. The 24.9 m^2 core unit could generate 138 not / 101 workd

An optimist, by contrast, might accept the high wage levels as an inevitable product of history and note that builders have been ingenious enough to more than accomodate their working methods to that level. They have introduced so many modifications in building techniques, even without changing the design, that construction costs are actually lower than those in other countries. The main problem with that explanation is that the lov costs may partly reflect the depressed state of the construction sector during the late 1970's.

Analysis by Components and Volume

For a better understanding of the determinants of construction costs and employment, we must look at the way specific components of the dwelling are built at various volumes of construction. In addition to the 10-unit volume already discussed, we have an intermediate range of aroung 65 units and a high range around 550 units. We shall concentrate on the Peruvian Nucleo Basico. Details for the Tunisian plan can be found in an appendix to this report.

The Peruvian plan costs about one-third more than the Tunisian and generates one-fifth more employment. As Table 2 showed, cost of Firm B is 23.5 percent below Firm A at a volume of about 65 units, but emplo generation @ 128 days per unit is about the same. The difference is primarily due to the way the basic shell -- foundations, walls, floors, and the roof -- are built: Concrete and masonry work. This result is not surprising since at all volumes the shell and associated carpentry for windows and doors account for slightly above 80 percent of the cost. (See Table 3.) Firm B reported a labor content of the shell of 41 percent, compared with 31 and 23 percent for the lower and higher volumes. At the same time, Firm B estimated that 3 unskilled workers would be employed with each skilled man, while the other two organizations estimated q as being much lower, 0.6 and 1.3 respectively. A glance at Appendix Tables A-4, A-8, and A-12 shows that these differences apply to each of the subcomponents of the shell, walls, roof, etc. At the same time, Firm B chose to prepare the site very skill-intensively with a q of only .06. But cost of site preparation is less than one percent of the total. Excavation is another low percentage of cost. It is carried out with fewer but less skilled

workers at the highest volume of 550 houses. Plumbing and electrical work account for about 16 percent of costs in all three cases.

As can be seen in the appendix tables, A-1 - A-12, the distribution of costs between the shell and other components is about the same for both the Tunisian and the Peruvian plan. The same applies to the lower cost, yet greater labor-intensity, of the intermediate volume. As Table 7 shows, this pattern was also found in Tunisia: a medium-sized firm building 100 units annually was more efficient and more employment-generating than a large firm building a large volume, a small firm building a small volume, or any other combination. Large firms were likely to be highly mechanized, primarily for other than residential building, and seemed unwilling or incapable of switching to a simpler approach. Need to amortize equipment was a high fixed cost for them, one that actually fell per unit, making operations more labor-intensive at the highest volumes. Small firms at volumes of 1-10 have high costs because of absent economies of scale and inability to buy materials at a discount. They also have a lower ability to use unskilled workers as a supplement to a critical minimum of skilled workers.

Insofar as the three organizations studied have provided representative information, we may summarize the comparison in the following way: For any given (fairly large) amount to be spent on Nucleo Basico housing, intermediate firms will produce over 25 percent more units than small firms. They will employ more onsite workers than either large or small firms. (See Table 2). These are preferences and tendencies that existed in 1980 and that could change if discounts go to all and if incentives for using labor instead of machines or rapidly installed materials are provided.

Table 3. Share of Onsite Wages in Cost, r, Ratio of Unskilled to Skilled Workers, q, and Employment Generator, Ø, by Component in Peruvian Core Housing at Alternative Volumes.

Component	Firm A V = 10	Firm B V = 65	Ministry V = 550
1. Site preparation, % of total cost	.73	.21	.27
r	.94	.71	.95
q	1.00	.06	1.00
Ø	.91	.68	.92
2. Excavation, %	1.22	1.26	2.85
r	.94	.71	.29
q	5.37	9.45	22.22
Ø	.93	.71	.29
3. Shell, %	39.67	53.94	64.43
r	.31	.41	.23
q	.62	2.98	1.31
Ø	.30	.40	.22
4. Carpentry and Metalwork, %	42.30	29.50	15.83
r	.10	.11	.10
q	.90	1.05	1.00
Ø	.10	.11	.10
5. Plumbing, %	8.72	6.94	10.81
r	.23	.17	.23
q	.53	1.05	1.00
Ø	.22	.16	.22
6. Electrical, %	7.36	8.15	5.81
r	.29	.13	.25
q	1.08	1.58	.39
Ø	.28	.13	.24
7. TOTAL, %	100.00	100.00	100.00
r	.23	.29	.21
q	.77	2.43	1.22
Ø	.22	.28	.21

Source: Records were examined and costs estimated in June and July of 1980.

Table 4. Percentage Distribution of Costs by Component for a Standard 24.9 M^2 Dwelling Built with Reinforced Concrete Posts in Six Countries, Summer 1979.

Volume: 1-10 Units

Component	Colombo, Sri Lanka	Rawalpindi, Pakistan	Lusaka, Zambia	Nairobi, Kenya	Medellín, Colombia	Tunis, Tunisia	Average, Six Countries
1. Site preparation	0.7	1.3	—	2.8	2.9	69.8	63.0
2. Excavation and trenching	0.1	0.2	0.4	1.2	2.8		
3. The shell: reinforced posts and non-load-bearing blocks	40.9	68.6	58.7	64.6	62.9		
4. Carpentry	26.8	17.8	14.3	9.2	15.0	21.3[1]	17.4
5. Painting	2.3	1.6	6.6	5.9	3.4	--	4.0
6. Plumbing	25.9	6.7	17.6	9.3	9.0	8.9	11.3
7. Electrical	3.3	3.8	2.5	7.1	4.0	—	4.1
8. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] For Tunisia, Item 4 includes 5 and 7.

Table 5. Ratio of Labor Cost to Total Cost, r
by Component for the Standard Floor Plan (Posts)

Volume: 1-10 Units

Component	Colombo, Sri Lanka	Rawalpindi, Pakistan	Lusaka, Zambia	Nairobi, Kenya	Medellín, Colombia	Tunis, Tunisia	Average
1. Site preparation	0.738	0.769	--[3]	0.765	0.708		0.745
2. Excavation and Trenching	0.632	0.769	0.849	0.774	0.419[2]		0.689
3. The Shell	0.139	0.173	0.144	0.381	0.221[2]	.319[1]	0.230
4. Carpentry	0.195	0.180	0.183	0.129	0.078	.307[1]	.179
5. Painting	0.393	0.235	0.510	0.443	0.415		0.399
6. Plumbing	0.089	0.160	0.247	0.248	0.103	.267	.185
7. Electrical	0.176	0.215	0.280	0.196	0.244		0.222
8. Total	0.150	0.185	0.198	0.352	0.205	.314	.214

Note: 1. For Tunisia Component 3 included 1 and 2, Component 4 included 5 and 7.
2. For Colombia the Components 2 and 3 have been modified to suit specific local requirements.
3. For Zambia Component 1 data was unavailable.

Table 6. Ratio of Unskilled to Skilled Workers, q, and the ratio of Skilled to Unskilled Wages, p, by Component for the Standard Floor Plan (Posts)

Volume: 1-10 Units

Component	Colombo, Sri Lanka	Rawalpindi, Pakistan	Lusaka, Zambia	Nairobi, Kenya	Medellín, Colombia	Tunis, Tunisia	Average
1. Site preparation	9.490	—	—	—	15.000	—	12.245
2. Excavation and Trenching	—	—	8.000	18.500	10.500[2]	—	12.333
3. The Shell	2.775	2.202	2.000	3.814	1.923[2]	2.380[1]	2.515
4. Carpentry	.475	.276	1.000	.974	1.000	.292[1]	.670
5. Painting	.570	.604	1.000	.357	.600	—	.626
6. Plumbing	.660	.604	1.000	.967	.657	.304	.698
7. Electrical	1.000	1.139	1.000	0.000	.833	—	.794
8. Total	1.307	1.528	1.616	2.855	2.107	1.370	1.797
9. Ratio of Skilled to Unskilled Wages, p	2.13	2.30	2.00	2.00	2.98	1.65	2.17

Note: 1. For Tunisia, Component 3 included 1 and 2, Component 4 included 5 and 7.
2. For Colombia, Components 2 and 3 were modified to suit specific local structural requirements.

Table 7

Employment Effects of Size of Firm and Volume For Building a 24.9 M^2 Dwelling in 1979, Tunisia

Size of Firm	Units in Contract (1)	Cost per Unit (2)	Number of Units per $1,000,000 (3)	Monthly Unskilled Wage (4)	Employment Generator Ø (5)	Employment per $1,000,000 (6)
Small	1	5,407	184.9	$117.50	.284	2,417
Medium	10	3,550	281.7	123.25	.288	2,337
Medium	100	3,283	304.6	123.25	.305	2,475
Large	100	4,450	224.7	137.50	.249	1,811
Large	1,000	3,650	274.0	137.50	.275	2,000

NOTE: Managers of the three firms were asked to make detailed cost and employment estimates for an identical unit. Its 24.9 M^2 are divided among a kitchen, room, and water closet with a connection to a septic tank. Walls are made out of concrete blocks, but the flat roof is supported by six reinforced concrete posts and a collar beam. Interviews with other firms suggest that the results are typical though not necessarily the arithmetic mean. The monthly wage assumes 25 working days. The high employment generators prevail generally in North Africa and the Middle East, except for Israel.

Altogether nine firms were surveyed in Tunisia. Small firms averaged 16 employees, none offsite, and could build 23 small dwellings per year. Medium-sized firms averaged 101 workers onsite and 14 offsite and could build 200 units annually. Large firms averaged 775 workers onsite, 89 offsite, and could build 750 small units annually. The survey was carried out by Dr. Ridha Ferchiou.

As stated in the introduction, employment generated per spending program is not the only measure that policy makers might seek. Cost per square meter is another measure, and that was around US$109 for the Tunisian plan and US 397 for the Peruvian plan for the intermediate volume. Still more relevant may be employment per square meter, an item shown in the last column of Table 8. It averaged 3.5 workdays per m^2 for the Tunisian plan. In Sri Lanka or Pakistan with US $1.00-2.00 daily unskilled wage levels, 10-12 workdays would have been used. With US $4.00 daily unskilled wages, 5-6 workdays per square meter could be expected. In Peru the level ranged from 2.5 workdays for the large-volume method to 4.1 for the labor-intensive approach.

For building the Peruvian core house an average of only 3.75 workdays per square meter is needed by A and B. To build 38 percent more space (an additional 9.5 m^2), only 28 percent more workers (28.5 workdays) are needed. The marginal productivity of labor on extra space seems higher than the average because the number of doors, windows, and the amount of plumbing does not rise in proportion to the square meters. Only 3.0 workdays per square meter are needed for the extra amount of space.

In the absence of reliable direct measures, therefore, 3.0 workdays/m^2 can be used as the employment generated by self-help expansion for an extra room without plumbing. If an inexperienced household should require more building time, the extra amount should probably be considered learning, not working time.

Table 8

Determinants of Construction Employment:
Two Core Housing Types, Lima, Peru, 1980

Case	Units in Contract (1)	Cost per Unit, C US $ (per m^2) (2)	Share of onsite Wages, r (3)	Ratio of unskilled to skilled workers, q (4)	Ratio of skilled to unskilled wages, p (5)	Employment generator, Ø (6)	Workdays per unit, N (per m^2) (7)
Tunisian Plan, 24.9 m^2							
1. Firm A	10	2,852 (115)	.265	.738	1.070	.255	101 (4.0)
2. Firm B	65	2,587(109)	.281	2.171	1.050	.279	102 (4.1)
3. Ministry	550	2,153 (86)	.223	1.043	1.064	.217	63 (2.5)
Average	208	2,564(103)	.256	1.317	1.061	.250	89 (3.5)
Peruvian Plan, 34.4 m^2							
1. Firm A	10	4,358 (127)	.228	.773	1.070	.219	132 (3.8)
2. Firm B	65	3,334(97)	.285	2.433	1.050	.281	128 (3.7)
3. Ministry	550	2,565 (75)	.214	1.221	1.064	.208	76 (2.2)
Average	208	3,419(100)	.242	1.476	1.061	.236	112 (3.2)

Sources: Records were examined and costs estimated in June and July of 1980. Unskilled wages were $7.23 for Firm A; $7.40 for Firm B; and for comparability, adjusted to $7.32 for the Ministry of Housing data. The employment generator $Ø = r(1 + q)/(p + q)$. $N = ØC/w_u$. Here w_u equals the daily cost of unskilled labor.

A Guideline for Rapid Estimates

All statements so far have been based on the detailed cost estimates provided by three organizations. In some future project there may not be time for such an assessment. If nothing has happened in the meantime besides inflation and a rise in the skill premium to 20 percent, one can easily estimate onsite employment in accordance with the simple guideline,

$$(1) \quad N = \emptyset \frac{C}{w_u},$$

where N is onsite employment, C is total cost, w_u is the unskilled wage, and $\emptyset$ is the employment generator:

$$(2) \quad \emptyset = \frac{r(1 + q)}{(p + q)}$$

Here r equals the share of onsite wages in total costs, q is the ratio of unskilled to skilled workers, and p is the ratio of the daily earnings of skilled to unskilled workers. The derivation of the equation is in the appendix.

In 1980 for the volume of 550 units

$$\emptyset = \frac{.214\ (1 + 1.221)}{(1.064 + 1.221)}$$

$$= .208$$

If US $10,000,000 had been spent on that project, given an unskilled wage rate of $7.32, the number of workdays would have been:

$$N = \frac{.208\ (\$10,000,000)}{\$7.32}$$

= 284,153 workdays or 11,366 work months @ 25 days/month.

How much employment would $10,000,000 generate by the time the unskilled wage has risen to US $8.00 and assuming that the skill premium has gone to 20 percent, assuming other things are unchanged?

Now,

$$\emptyset = \frac{.214\ (1 + 1.221)}{1.20 + 1.221}$$

$$= .196$$

And, with respect to employment,

$$N = \frac{.196\ (\$10,000,000)}{\$8.00}$$

$$= 245,000 \text{ workdays or } 9,800 \text{ work months.}$$

The 9.3 percent rise in wages of unskilled workers and the 23.3 percent rise in skilled wages would have reduced employment by 1,566 work months or by 13.8 percent.

Conclusion

Employment generation in Peruvian core housing -- or any other construction -- is comparatively low because Peruvian wages have been comparatively high. As in other countries, builders have responded to cost pressures with labor-saving measures that are mainly too varied and small for simple identification. Even with a given design, when wages double employment falls by half, and the total cost of building does not change much. The share of labor costs in the total remains about the same. Higher productivity and higher wages thus go together. Since low productivity goes with more employment, economic policy should not aim at raising productivity prematurely in a few sectors. The test of prematurity is whether or not unemployment and wages are rising or falling throughout the rest of the econo

Under Peruvian conditions of 1980, a 25 m^2 core house would generate about 195 workdays, and a 35 m^2 dwelling about 223 workdays. In this estimate employment in materials is taken to be 40 percent of onsite employment. The total breakdown is as follows:

	25 m^2	35 m^2
Onsite employment, workdays	100	130
Employment in materials	40	48
Offsite employment	10	10
Infrastructure, onsite employment	34	34
Infrastructure, materials employment	11	11
	195	233

These figures are orders of magnitude subject to all the variations and qualifications discussed in the text of this and related papers in the series

FOOTNOTES

[1] Rufino Cebrecos Revilla, Construcción de Vivienda y Empleo (Lima: Documentos de Trabajo No. 35, Departemento de Economía, Pontificia Universidad Católica del Peru, April 1978).

[2] W. Paul Strassmann, "Empleo en la construcción, valor de la tierra, y financiamento: Un estudio comparativo," Demografía y Economia, Volume VII, No. 3, 1973, pp. 338-49.

"Measuring the Employment Effects of Housing Policies in Developing Countries," Economic Development and Cultural Change, April 1976, pp. 623-32.

APPENDIX

I. GUIDELINES FOR ESTIMATION

Derivation

With the assumption of separability, we shall now derive the employment generator, $\emptyset$, using the three ratios:

$r = W/C$,	the wage bill, W, in total costs, C.
$p = w_s/w_u$,	the ratio of skilled to unskilled wages.
$q = N_u/N_s$,	the number of unskilled workers employed for every skilled worker.

The wage bill, W, is equal to the daily wage rate, including fringes, w, times the number of workdays, N, of each type of worker--skilled, s, and unskilled,

$$W = w_s N_s + w_u N_u \tag{2}$$

Using the second two ratios above, we can simplify matters by expressing everything in terms of the wages of unskilled workers, w_u, and the number of skilled workers, N_s, since $w_s = w_u p$ and $N_u = N_s q$.

$$W = w_u N_s (p + q) \tag{3}$$

We now have the employment of skilled workers for a given wage bill.

$$N_s = \frac{W}{w_u (p + q)} \tag{4}$$

Using the ratio, r, or $W = rC$, skilled employment can be related to the cost of the project,

$$N_s = \frac{rC}{w_u (p + q)} \tag{5}$$

Since the number of unskilled workers is equal to qN_s, total employment, $N = N_s(1 + q)$, or

$$N = \frac{r(1 + q)}{(p + q)} \cdot \frac{1}{w_u} \cdot C \quad \text{and} \quad \emptyset = \frac{r(1 + q)}{(p + q)} \tag{6}$$

$$N = \emptyset \cdot \frac{1}{w_u} \cdot C \tag{7}$$

The first term of (6) relates the three ratios to one another and is the generator, $\emptyset$. The second term is the reciprocal of the unskilled wage rate. Together these two constitute a multiplier that relates the total cost of a project, C, to the employment, N, that is generated. Because of the possibility of inflation, the term with the ratios, $\emptyset$, is likely to be more stable than the other two. But r and q may vary with the type of project, i, and should actually be expressed as r_i and q_i.

TABLE A 1

DWELLING - BREAKDOWNS LIMA 1980

FIRM A. V:10 POSTS - PLAN

COMPONENT	CT	%	W	NH	NS
1. SITE PREPARATION	23.87	0.84	22.53	12.0492	12.045[illegible]
2. EXCAVATION	40.04	1.40	37.71	34.8112	6.481[illegible]
3. THE SHELL	1301.56	45.64	409.90	166.8662	268.144[illegible]
4. CARPENTRY	712.74	24.99	73.40	37.010	41.352
5. PAINTING	73.11	2.56	32.90	7.1772	27.331[illegible]
6. PLUMBING	380.09	13.33	86.90	31.9996	60.003[illegible]
7. ELECTRICAL	320.59	11.24	92.32	51.4054	47.47[illegible]
TOTAL	2851.97	100.00	755.66	341.3188	462.836

1 U$ = 284.50

TABLE A 2

DWELLING - BREAKDOWNS LIMA 1980

FIRM A V: 10 POSTS - PLAN

COMPONENT	r	q	p	ϕ
1. SITE PREPARATION	0,9438	1.0000	1.0700	0.9118
2. EXCAVATION	0.9419	5.3705	1.0700	0.9317
3. THE SHELL	0.3199	0.6223	1.0700	0.3018
4. CARPENTRY	0.1030	0.8950	1.0700	0.0993
5. PAINTING	0.4500	0.2626	1.0700	0.4236
6. PLUMBING	0.2286	0.5333	1.0700	0.2186
7. ELECTRICAL	0.2880	1.0828	1,0700	0.2786
TOTAL	0.2650	0.7375	1.0700	0.2323

W_u = 257 Soles / hour

W_s = 275 Soles / hour

TABLE A 3

LIMA 80
LOCAL PLAN

DWELLING - BREAKDOWNS
FIRM A V: 10

COMPONENT	Ct	%	W	Nu	Ns
1. SITE PREPARATION	31.70	0.73	29.92	16.00	16.0[illegible]
2. EXCAVATION	58.18	1.22	50.09	46.24	8.61
3. THE SHELL	1728.71	39.67	544.43	222.62	357.7[illegible]
FOUNDATIONS	536.67	12.31	124.52	45.12	86.66
WALLS	378.05	8.68	204.21	85.28	134.0[illegible]
ROOFING	559.36	12.84	122.89	44.04	85.95
FLOORING	254.63	5.84	92.81	48.18	50.99
4. CARPENTRY	1843.62	42.30	189.40	95.50	106.70
5. PAINTING	—	—	—	—	—
6. PLUMBING	380.09	8.72	86.90	32.00	60.00
7. ELECTRICAL	320.56	7.36	92.32	51.40	47.47
TOTAL	4357.86	100.00	993.06	461.06	596.56

1 U$ = 284.50 Soles

TABLE A 4

DWELLING - BREAKDOWNS

FIRM A V: 10

LIMA 1980

LOCAL PLAN

COMPONENT	t	q	p	$\bar{p}$
1. SITE PREPARATION	0.9438	1.0000	1.0700	0.9118
2. EXCAVATION	0.9419	5.3705	1.0700	0.9317
3. THE SHELL	0.3149	0.6223	1.0700	0.3018
FOUNDATIONS	0.2320	0.5206	1.0700	0.2218
WALLS	0.5402	0.6159	1.0700	0.5177
ROOFING	0.2197	0.5121	1.0700	0.2099
FLOORING	0.3675	0.9449	1.0700	0.3519
4. CARPENTRY	0.1030	0.8950	1.0700	0.0099
5. PAINTING	—	—	—	
6. PLUMBING	0.2286	0.5333	1.0700	0.2186
7. ELECTRICAL	0.2880	1.0828	1.0700	0.2786
TOTAL	0.2279	0.7729	1.0700	0.2190

W_u = 257 soles / hour

W_s = 275 soles / hour

TABLE A 5

DWELLING - BREAKDOWNS

FIRM B V: 50 ---- 89

LIMA 1980

POSTS - PLAN

COMPONENT	Ct	%	w	Nu	Ns
1. SITE PREPARATION	5,29	0.19	5,03	0.2086	3.7[illegible]
2. EXCAVATION	31,72	1.18	30,13	22.1024	2.33
3. THE SHELL	1353.96	50.39	733.01	441.4427	148.[illegible]
4. CARPENTRY	695,53	25.88	104,33	42.5251	40.94
5. PAINTING	97,48	3.63	43,87	7.1527	27.23
6. PLUMBING	231,28	8.61	52,04	21.209	20.1[illegible]
7. ELECTRICAL	271,83	10.12	47.57	23.2693	14.7[illegible]
TOTAL	2,687.09	100.00	1016,08	557.9117	257.[illegible]

14$ = 284.50 Soles

TABLE A 6

DWELLING - BREAKDOWNS
FIRM B V: 50 — 80

LIMA 1980
POSTS - PLAN

COMPONENT	x	q	p	ϕ
1. SITE PREPARATION	.7126	0.0553	1.0503	.6805
2. EXCAVATION	.7125	9.4500	1.0503	.709
3. THE SHELL	.4061	2.9774	1.0503	.4010
4. CARPENTRY	.1125	1.0502	1.0503	.1098
5. PAINTING	.3375	0.2626	1.0503	.3245
6. PLUMBING	.1688	1.0502	1.0503	.1647
7. ELECTRICAL	.1313	1.5754	1.0503	.1287
TOTAL	.2813	2.1708	1.0503	.2792

W_H = 263.23 Soles / hour

W_S = 276.47 Soles / hour

TABLE A 7

LIMA 1980

DWELLING - BREAKDOWNS

LOCAL PLAN

FIRM B V: 50 — 80

COMPONENT	C.T	%	w	Nu	Ns
1. SITE PREPARATION	7,03	0.21	5.01	0.2706	4.8960
2. EXCAVATION	41,41	1.26	30.02	29,1961	3.0888
3. THE SHELL	1798,26	53.94	730.18	583.0118	195.8116
- FOUNDATIONS	413,44	12.40	147.29	146.3800	12.1713
- WALLS	646,36	19.39	327.22	247.5299	101,0083
- ROOFING	547,35	16.42	167.52	128.4513	49.6844
FLOORING	191,12	5.73	88.15	60.6506	32.9476
4. CARPENTRY	983,46	29.50	110.64	48.9872	46.6433
5. PAINTING	—	—	—	—	—
6. PLUMBING	231,27	6.94	39.03	21.0881	20.0791
7. ELECTRICAL	271,83	8.15	35.68	44,7203	28.3869
TOTAL	3334,05	100.00	950.56	727.2781	298.9057

1 US$ = 284.50 SOLES

TABLE A 8

LIMA 198..

DWELLING - BREAKDOWNS

LOCAL PLAN

FIRM B V : 50 — ..0

COMPONENT	x	q	p	ϕ
1. SITE PREPARATION	.7130	0.0553	1.0503	.6805
2. EXCAVATION	.7125	9.4500	1.0503	.7091
3. THE SHELL	.4061	2.9774	1.0503	.4010
FOUNDATIONS	.3563	12.0266	1.0503	.3549
WALLS	.5063	2.4506	1.0503	.4990
ROOFING	.3061	2.5854	1.0503	.3019
FLOORING	.4613	1.8408	1.0503	.4532
4. CARPENTRY	.1125	1.0502	1.0503	.1098
5. PAINTING	—	—	—	—
6. PLUMBING	.1688	1.0502	1.0503	.1647
7. ELECTRICAL	.1313	1.5754	1.0503	.1287
TOTAL	.2851	2.4330	1.0503	.2810

W_u = 263.23 Soles / hour

W_s = 276.47 Soles / hour

TABLE A 9

DWELLING - BREAKDOWNS

MINISTERIO DE VIVIENDA V: 100 - 1000

LIMA 1980

POSTS - PLAN

COMPONENT	CT	%	W	NU	NS
1. SITE PREPARATION	4.59	0.25	4.36	2.6545	2.6545
2 EXCAVATION	47.91	2.55	13.70	16.4289	0.7393
3. THE SHELL	1083.76	57.80	248.38	172.0121	131.6990
4. CARPENTRY	299.88	16.00	30.79	18.7473	18.7473
5. PAINTING	67.60	3.60	33.80	8.0821	32.3285
6. PLUMBING	241.51	12.88	55.55	33.8230	33.823
7. ELECTRICAL	129.70	6.92	32.43	7.0305	28.1210
TOTAL	1874.95	100.00	418.91	258.7784	248.1153

1 UB = 196.80 Soles

TABLE A 10

DWELLING - BREAKDOWNS
MINISTERIO DE VIVIENDA V: 100 - 1000

LIMA 1980
POSTS - PLAN

COMPONENT	τ	q	p	q'
1. SITE PREPARATION	0.9500	1.0000	1.0638	0.9214
2. EXCAVATION	0.2859	22.2222	1.0638	0.2851
3. THE SHELL	0.2292	1.3061	1.0638	0.2230
4. CARPENTRY	0.1027	1.0000	1.0638	0.0995
5. PAINTING	0.5000	0.2500	1.0638	0.4757
6. PLUMBING	0.2300	1.0000	1.0638	0.2229
7. ELECTRICAL	0.2500	0.3853	1.0638	0.2390
TOTAL	0.2234	1.0430	1.0638	0.2166

W_u = 156.63 soles / hour * III - 1979
W_s = 166.63 soles / hour * III - 1979

TABLE A 11

DWELLING - BREAKDOWNS
MINISTERIO DE VIVIENDA V: 100 - 1000

LIMA 1980
LOCAL PLAN

COMPONENT	C_t	%	W	N_H	N_S
1. SITE PREPARATION	6.10	0.27	5.80	3.5260	3.5260
2. EXCAVATION	63.63	2.85	18.19	21.8000	0.9810
3. THE SHELL	1439.44	64.43	329.90	241.4626	184.870
FOUNDATIONS	468.75	20.98	83.09	76.4666	25.7707
WALLS	280.26	12.55	95.33	28.5960	85.6150
ROOFING	537.62	24.06	91.85	109.6200	28.2826
FLOORING	152.81	6.84	59.63	26.7800	45.2000
4. CARPENTRY	353.58	15.83	36.30	22.0868	22.0868
5. PAINTING	—	—	—	—	—
6. PLUMBING	241.51	10.81	55.55	33.7900	33.7900
7. ELECTRICAL	129.70	5.81	32.43	10.6923	27.7498
	2233.96	100.00	478.17	333.3577	273.0042

1 US$ = 196.80

TABLE A 12

DWELLING- BREAKDOWNS — LIMA 1980

MINISTERIO DE VIVIENDA V: 100 - 1000 — LOCAL PLAN

COMPONENT	r	q	p	q'
1. SITE PREPARATION	0.9508	1.0000	1.0638	0.9219
2. EXCAVATION	0.2859	22.2222	1.0638	0.2851
3. THE SHELL	0.2292	1.3061	1.0638	0.2230
FOUNDATIONS	0.1773	2.9672	1.0638	0.1745
WALLS	0.3401	0.3340	1.0638	0.3246
ROOFING	0.1708	3.8760	1.0638	0.1686
FLOORING	0.3902	0.5925	1.0638	0.3752
4. CARPENTRY	0.1027	1.0000	1.0638	0.0995
5. PAINTING	—	—	—	—
6. PLUMBING	0.2300	1.0000	1.0638	0.2229
7. ELECTRICAL	0.2500	0.3853	1.0638	0.2390
TOTAL	0.2140	1.2211	1.0638	0.200[illegible]

Wu = 156.63 Soles / hour * 1979

Ws = 166.63 Soles / hour * 1979

Table A-13 The Employment Generator Ø by Component for the Standard Floor Plan (Posts)

Volume: 1-10 Units

Component	Colombo, Sri Lanka	Rawalpindi, Pakistan	Lusaka, Zambia	Nairobi, Kenya	Medellín, Colombia	Tunis, Tunisia	Average
1. Site preparation	.659	--	--	--	.655	--	.657
2. Excavation and Trenching	--	--	.695	.736	.371	--	.601
3. The Shell	.107	.121	.108	.315	.131	.264	.174
4. Carpentry	.110	.088	.122	.086	.040	.199[1]	.089[2]
5. Painting	.226	.130	.340	.255	.173	--	.225
6. Plumbing	.051	.088	.165	.164	.074	.184	.121
7. Electrical	.114	.128	.187	.098	.189	--	.143
8. Total	.101	0.121	.143	.279	.125	.246	.169

Note: 1. For Tunisia, 4 includes 5 and 7.
2. Omits Tunisia.

TABLE 14. EXPANDABLE HOUSE: SPECIFICATIONS : [illegible]

COMPONENT	UNIT	QUANTITY
1. Site Preparation		
2. Excavation, Trenching		
a. Holes 5' deep for six posts 20"x20" = 83.3 cubic feet.	cu.ft.	83.3
b. Trenches for the walls of fence and house = 78.0 cubic feet.	cu.ft.	78.0
3. The Shell: Walls, Ceiling, Floors		
a. Reinforced concrete collar beams and posts 6"x6".	cu.ft.	70.6
b. Roof panels	sq.ft.	226.0
c. Standard concrete, 15 pounds per cubic foot	cu.ft.	88.3
d. Lightweight concrete, 10 pounds pounds per cubic foot	cu.ft.	144.8
e. Bricks or blocks with holes for the housewalls, 9'2" high 50'4" long	sq.ft.	462.9
f. Concrete block fence 6"x 3'3" front 6"x 6'7"	sq.ft.	193.8
g. Partitions, hollow blocks	sq.ft.	215.3
h. Cement floor 4½", base 2"	sq.ft.	226.0
i. Plastering: Ceilings 205 sq.ft; walls --all interior and only the facade outside, 915 sq.ft. Bathroom excluded.	sq.ft.	1,120
4. Carpentry		
a. Formwork, shuttering, frames, window sills.		
b. Frames for windows, openings, and doors.		8
c. Casement window 3'3" high 3'3" wide		1
d. Window panes	sq.ft.	16.1
e. Garden door, 35½"x 79"	sq.ft.	19.5
f. 4 interior doors	sq.ft.	75.5
5. Painting		
a. Oil paint on doors, windows	sq.ft.	237
b. Whitewash	sq.ft.	1119.5
6. Plumbing		
a. Sink, sideboard, faucet and drain		1
b. Turkish toilet, tank, and drain 20 liters		1
c. Galvanized pipes	ft.	34.5
d. Two appropriate valves		
e. Cement pipes for sewage (to septic tank)	ft.	12
f. Recess for water meter.		1
7. Electrical		
a. Lights, wiring, switches, plugs		

TABLE A 15.

LOGEMENT EVOLUTIF

Devis Estimatif (tel que soumis avec proposition)

Poste	U	Q	Prix Unitaire (D.)	Somme (D.)	Ordre d'importance du poste dépens
1. Fouilles en puits jusqu'à 2m. de profondeur environ - 6 poteaux @ 0,65 x 0,65 x 2,00 = 5,07m^3	m^3	5	2,7	13,5	25
2. Fouilles en rigoles - sous mur de cloture; 0,25 x 0,15 x 23,10 = 0,87 - sous murs de maison; 0,45 x 0,25 x 17,90 = 2,13	m^3	3	2,4	7,2	33
3. Gros béton (dosé à 250 kgs/m^3) - 6 poteaux @ 0,65 x 0,65 x 1,08 = 2,73 - cloture; 0,25 x 0,08 x 23,10 = 0,46 - murs maison; 0,45 x 0,10 x 17,90 = 0,81	m^3	4	16,5	66,0	7
4. Béton de propreté (dosé à 175 kgs/m^3) de 0,05 d'épaisseur - sous murs maison 0,45 x 13,65	m^2	6	1,5	9,0	29
5. Béton armé (en fondations et élévation) - chainage infér. murs maison; 0,35 x 0,25 x 17,90 = 1,6 - semelle sous cloture; 0,25 x 0,07 x 23,10 = 0,4 - 6 poteaux @ 0,25 x 0,25 x 2,80 = 0,2 - chainage super. murs maison; 0,25 x 0,25 x 24,0 = 1,3	m^3	3,7	70,0	259,0	2
6. Planchers (hourdis ou Rector)	m^2	21	10,0	210,0	4
7. Remplissage des mûrs (brique creuse à 12 trous à plat; de 0,25) 2,80 de hauteur sur 15,35 ml	m^2	43	5,5	236,5	3
8. Mur de cloture (en agglo. 10/20/40) sur 1m de hauteur et 27 ml environ	m^2	27	4,0	108,0	6
9. Cloison (brique creuse à 6 trous; de 0,10)	m^2	20	2,8	56,0	9
10. Hérisson de 0,15 (en blocage)	m^2	21	1,4	29,4	14
11. Forme de hérisson de 0,06 d'épaisseur	m^2	21	2,2	46,2	10
12. Chape en ciment bouchardé	m^2	21	1,8	37,8	11
13. Enduit (sur plafonds et murs) - plafonds; 21m^2 - murs; (2,90 x 31,0 = 90) x 2 = 180	m^2	200	1,4	280,0	1
14. Cadres de menuiseries (avec pose)	U	8	2,2	17,6	22
15. Regard intérieur (0,35 x 0,35)	U	1	20,0	20,0	21
16. Regard de visite extérieur (0,40 x 0,40)	U	1	30,0	30,0	13
			Sous-total:	1.426,20	

Table A-15 (cont'd)

Poste	U	Q	Prix Unitaire (D.)	Somme (D.)	Ordre d'importance du poste de dépense
			Sous-total: (report)	1.426,20	
1. Buse en ciment (Ø 150), pour évacuation eaux usées	ml	8	3,3	26,4	17
2. Gargouille (poterie de Nabeul)	U	1	1,5	1,5	38
3. Appuis de fenêtre en ciment	ml	2,2	3,8	8,36	30
4. Evacuation de l'évier (en plomb de 40)	ml	2	4,0	8,0	31
5. Tuyau galvanisé de 15/21 pour alimentation en eau potable	ml	10	2,5	25,0	19
6. Tuyau galvanisé de 12/17 (même destination)	ml	4	2,0	8,0	31
7. Robinet de puisage de 12 (pour toilettes)	U	1	3,5	3,5	36
8. Robinet d'arrêt en cuivre, de 15	U	1	4,0	4,0	34
9. Pose évier en granito,et robinet	U	1	28,0	28,0	15
10. Toilettes à la turque (en granito)	U	1	10,0	10,0	28
11. Chasse d'eau (20 litres), avec tuyau	U	1	12,0	12,0	26
12. Point lumineux électrique,et interrupteur	U	3	7,5	22,5	20
13. Prise courant électrique	U	2	6,0	12,0	26
14. Niche pour compteur d'eau (en brique creuse)	U	1	14,0	14,0	24
Menuiserie					
1. Porte de jardin 0,90 x 2,00 =	m^2	1,80	15,0	27,0	16
2. Porte isoplane de 34m/m 4 portes @ (0,85 x 2,10 =) 1,75	m^2	7	16,0	112,0	5
3. Croisée de fenêtre 1 m. de hauteur sur 2,30 ml	m^2	2,3	15,0	34,5	12
4. Peinture à l'huile de lin (sur boiseries) portes (2 faces) 2 x 7 = 14m² . ébénisterie des portes et fenêtres; environ 8m²	m^2	22	0,7	15,4	23
5. Badigeon à la chaux allunée (sur tous enduits)	m^2	200	0,13	26,0	18
6. Badigeon sur terrasse	m^2	21	0,1	2,1	37
7. Vitres en verre demi-double	m^2	1,5	2,6	3,9	35
8. Forme de pente (sur terrasse)	m^2	21	2,8	58,8	8
TOTAL				389.16	

TABLE A-16. NUCLEO BASICO

Tabla _____ Casa tipo: _____ Ciudad: _____ V: _____

COMPONENTES	UNID.	METRADO	PRECIO UNIT.	COSTO TOTAL	COSTO GRAL.
1. Preparación del lugar					
Trazo y replanteo	ES.	1.00			
Movimiento de tierra					
2. Excavación de zanjas					
Para cimientos	M3	10.90			
Eliminación de material excedente	M3	14.30			
3. Fundaciones					
Cimientos concreto 1 00 KG/CM2 con 30% de piedra grande	M3	8.55			
Encofrado sobrecimientos	M2	14.40			
Sobrecimiento concreto 100 KG/CM2 con 20% de piedra mediana	M3	1.35			
Concreto columnas 175 KG/CM2	M3	1.70			
Encofrado columnas	M2	18.50			
Acero columnas	KG	179.00			
4. Muros					
Muros de ladrilo de arcilla asentados con mortero 1/4	M2	61.00			
solaqueado en muros	M2	122.00			
Zócalo de cemento pul.	M2	9.30			

Tabla _____ Casa tipo: _____ Ciudad: _____ V: _____

COMPONENTES	UNID.	METRADO	PRECIO UNIT.	COSTO TOTAL	COSTO GRAL.
5. Techo					
Concreto vigas y dinteles 175 KG/CM2	M3	1.70			
Encofrado vigas y dinteles	M2	12.00			
Acero vigas y dinteles	KG	138.00			
Concreto losas 175 KG/CM2	M3	.10			
Encofrado losas	M2	1.00			
Acero losas	KG	3.30			
Concreto aligerado 175 KG/CM2	M3	2.50			
Encofrado aligerado	M2	25.00			
Acero aligerado	KG	107.00			
Bloques de arcilla de 15X30X30 aligerado	UN.	234.00			
Cobertura de techo con torta de barro	M2	33.20			
6. Piso					
Falso piso concreto 1/10 cemento hormigón de 3 plg. de espesor	M2	37.00			
Acabado del piso con pasta 1/2 de 1.5 cm.	M2	37.00			
Contrazócalo de cemento pulido de 10 cm. de alt.	ML	29.40			
Contrazócalo de cemento pulido de 15 cm. de alt.	ML	29.20			
Gradas	ML	1.80			

Tabla _____ Casa tipo: _____ Ciudad: _____ V: _____

COMPONENTES	UNID.	METRADO	PRECIO UNIT.	COSTO TOTAL	COSTO GRAL.
7. Pintura	M2				
8. Grifo de riego	ES	1.00			
Inodoro blanco tanque bajo incl. accesorios internos asiento pernos anclaje	UN.	1.00			
Punto de agua fría incluido tuberías, accesorios, montante, etc. desde el medidor sin incluirlo	PT.	1.00			
Punto de desagüe, incluido tuberías, accesorios, ventilación, montante etc Hasta la conexión domiciliaria sin incluirla	PT.	5.00			
Ducha cromada de cabeza giratoria incl. llaves y brazo cromado	UN.	1.00			
Lavatorio blanco 20X1X6 1 llave cromada 1/2 desague tapón cadena, trampa plomo soportes etc.	UN.	1.00			
Lavadero de ropas s.e.	UN.	1.00			
Losa de concreto para cocina de 0.50 m. de ancho incluido apoyos y acabados sin mayolica	ML	1.85			
Colocación de aparatos sanitarios incluidos abastos especificados	UN	4.00			
Papelera de loza blanca de 6X6 con eje (1), gancho de loza (1), jabonera (1), barra para cortina de ducha (1)					

Tabla _____ Casa tipo: _____ Ciudad: _____ V: _____

COMPONENTES	UNID.	METRADO	PRECIO UNIT.	COSTO TOTAL	COSTO GRAL.
9. Instalación eléctrica					
Instalación de tomacorrientes	UN.	3.00			
Instalación de caja rectangular de 4X2 1/4 X1 7/8 plg. de profundidad incluido tapa	PT.	6.00			
Instalación de tablero de distribución incluido alimentación desde el medidor	UN.	1.00			
Centros de alumbrado	PT.	4.00			
Braquetes	PT.	2.00			
Salida para cocina	PT.	1.00			
Salida tomacorriente con toma de tierra	PT.	2.00			
10. Carpintería y trabajo metálico					
Puerta de madera segun diseño	M2	5.60			
Ventanade madera con hoja	M2	5.90			
Ventana de madera	M2	0.30			
Vidrios semidobles	M2	68.20			
Bisagras de fierro 3 1/2"	UN	9.00			
Cerrojo de fierro de 3"	UN	2.00			
Chapa para puerta de sobreponer 1 golpe cilindro exterior llave exterior y seguro interior	UN	1.00			