THE ROLE OF INFRASTRUCTURE IN EMPLOYMENT GENERATION

by

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A housing program cannot build dwellings without infrastructure, and public utilities need a set of buildings and occupants to serve. Similarly, the employment generated by a housing program is the work for both the infrastructure and the dwellings. Not including the price of the site, the infrastructure typically amounts to 10-15 percent of the combined onsite and offsite costs of small low-cost dwellings. Options for capital-labor substitution are greater for infrastructure than for building, so its share of employment is a potentially greater range, say, 5-30 percent.

These assertions need support, and we shall begin that task with illustrative figures. As a base we can take a house of 35 M^2 floorspace built at an M^2 cost of U.S.$86. That comes to about $3,000 without offsite costs, fees, insurance, etc. For these about $500 is plausible, and so is another $500 for the builder's profits. That makes profits 12.5% of the dwelling's cost without the site, a realistic share that may, however, be disguised in various ways. We may think of the dwelling as having two rooms, a kitchen, and a toilet-washroom combination. Water is piped to the kitchen sink, a wash basin, a shower, and to the toilet that is connected to the public sewer system.

The house is on a 71 M^2 lot and its share of the infrastructure of the neighborhood comes to \$7 per M^2 or \$500. We assume that the terrain is flat and manageable. The breakdown of the costs is \$50 for the water connection, \$200 for the sewerage system, \$200 for streets and paths, and \$50 for electricity and other amenities. Trunk lines to distant centers are not included.

The distribution of costs, the share of labor in costs, and the distribution of employment in workmonths for this case can be seen in Table 1. The infrastructure accounts for 11 percent of costs and of employment. The combination of onsite, offsite, and indirect employment comes to 14.6 workmonths or \$1,830, meaning 41 percent of total costs. Unskilled wages are assumed to be \$100 monthly, but enough skilled workers and professionals are used to bring the average cost of a workmonth up to \$125. Onsite labor is 63.7 percent of the total, and of that one-seventh goes for the infrastructure. Assumed is a volume of around 100 units so that adequate efficiency may be attained and that overhead costs may be a low percentage.

Infrastructure may generate substantially more or less than 14 percent of onsite employment because of four major reasons:

1. Unusually labor-intensive or mechanized ways of excavating, grading, cement mixing, paving, etc. Relative cost of labor, capital, and fuel can usually explain the choice.

2. Nature of the terrain. In Tunis building infrastructure on land with a 2 percent slope costs 7 percent less than building it on flat land, but on land with a 15 percent slope it costs 55 percent more.

3. Infrastructure quality. Roads and pipes may vary in size and durability. Schools, health centers, markets, community centers, and sports facilities may conceivably be included.

Table 1

COST AND EMPLOYMENT DISTRIBUTION OF A HYPOTHETICAL
35 M^2 DWELLING ON 71 M^2 LOT

Dwelling Structure	Cost	%	Labor	Workmonths	%
Onsite Labor	1000	22.2	1000	8	54.8
Materials	2000	44.4			
Labor content of materials			500	4	27.4
Offsite costs	500	11.1			
Offsite Labor			200	1	6.8
Profits	500	11.1			
Total, Structure	4000	88.9	1700	13	89.0
Infrastructure					
Water system	50				
Sewerage system	200				
Roads & paths	200				
Other	50				
Labor content onsite			100	1.3	8.9
Offsite and materials			30	1.6	2.1
Total, Infrastructure	500	11.1	130	1.6	11.0
Total without raw land	4500	100.0	1830	14.6	100.0

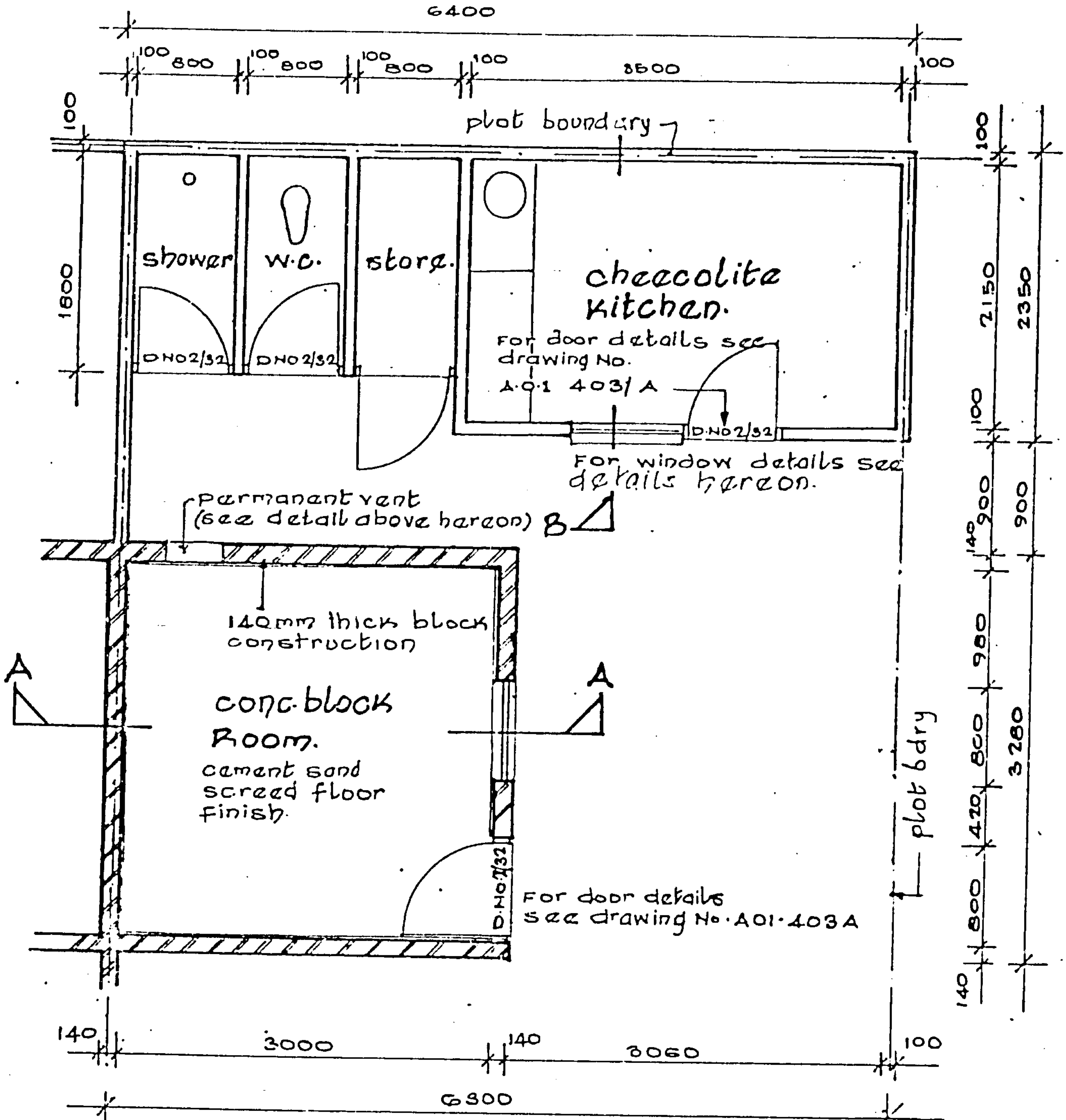
4. Dwelling size and quality. Except for changes in lot size, larger and more elaborate dwellings do not need much additional infrastructure. In general the share of infrastructure falls from 100 percent for pure sites and services projects to 5 percent for high quality houses.

The Dandora Community Development Project of Nairobi, Kenya, can illustrate the way dwelling costs can vary in the low-cost range. The wet core (2.72 M^2 of washroom and toilet) costs half as much as a 12 M^2 unit with a kitchen-sleeping room and one-third as much as the $2,000 cost of a 21 M^2 unit. The cost of the second room of a 9.3 M^2 is $70 per M^2. If the unit were to expand to 35 M^2 it would approximate the $3,000 onsite cost of our hypothetical example. The Dandora dwellings were laid out in a variety of patterns, and one of these is shown in the attached drawing. The specific costs were as follows:

	Type	Covered Area M^2	Cost/M^2	Cost	Cost of Addition
a.	Wet core	2.72	$240.4	$ 654	---
b.	One-room	11.85	115.5	1,369	$715
c.	Two-room	21.15	95.7	2,024	$655

We can now show how deviations from the basic pattern might interact. Suppose one-room 21 M^2 core houses are built on steep land with a 15 percent slope. At half the cost of a 35 M^2 unit, the dwellings generate only 6.5 workmonths of employment. With a 55 percent cost increase due to the slope, the infrastructure generates not 1.6 but 2.5 workmonths or 27.8 percent of the total. Obviously so many combinations of factors are possible that one cannot generalize about the share of infrastructure employment, except that it will be less than half whenever room building is included, whether carried on by contractors or owner occupants.

DANDORA COMMUNITY DEVELOPMENT PROJECT, NAIROBI, KENYA



FLOOR PLAN

SCALE 1:50

Table 2

COST OF WATER SYSTEM PER SQUARE METER OR LOT AND RELATIVE COST OF ROADS AND SEWERAGE DISPOSAL INFRASTRUCTURE AT SELECTED SITES

	Cost of Water System and Basis of Measurement (Excludes Trunk Lines)	Relative Sewerage Infrastructure Costs (Water = 100)	Relative Road and Street Costs, Earthwork (Water = 100)	Cost Ratio Roads/ Sewers
Tunis, Tunisia	US$/$M^2$ 1975 68 M^2 (10 HA)			
1. Level site	.93	468	382	.82
2. Slope of 2%	.93 (US$63/ lot)	387	382	.99
3. Slope of 15%	.93	470	1,024	2.18
Sfax, Tunisia				
4. Level site	.56	345	776	2.25
Mellassine, Tunisia	US$ per lot			
5. Slum upgrading	$136	92	135	1.47
Mexico City	US$/$M^2$ 1970 71 M^2 (1000 M^2)			
6. Av. terrain	.34	133	228	1.71
Medellin, Colombia	US$/$M^2$ 1979 77 M^2			
7. Av. terrain, V = 10	1.07	502	667	1.33
8. Volume = 100	.95	499	538	1.08
Nairobi, Kenya				
9. Dandora - I 1035 units on level site	US$/lot - 1977 $41.00 (lots = 99-139 M^2)	429	704	1.64
10. Kawangware, Squatter Upgrading	US$ - 1979 Cost of Project: $30,959	122	123	1.01

Table 3

PERCENTAGE DISTRIBUTION OF ONSITE, OFFSITE, AND INFRASTRUCTURE COSTS AT SELECTED SITES IN VARIOUS COUNTRIES

City	Onsite Costs, Dwelling Only (1)	Offsite; overhead, fees, profits, etc. (2)	Infrastructure without trunk lines (3)	Undeveloped site (4)
1. Mexico: 47.3 M^2 on 71 M^2 lot, 1970	55.5	18.5	8.1	18.0
Without site	(67.6)	(22.5)	(9.9)	--
Cost: US$1,581 (1970)				
Tunisia				
2. Rural US$6,265 (1977) on 70 M^2 lot	73.3	8.0	16.0	2.8
(Without site)	(75.4)	(8.2)	(16.4)	--
3. SNIT 476 US$8,235 on 86.4 M^2 lot	76.1	8.2	14.1	1.6
(without site)	(77.3)	(8.3)	(14.3)	--
4. SNIT GDRP US$8,678 (77) on 74 M^2 lot	75.8	8.6	14.4	1.1
(without site)	(76.7)	(8.7)	(14.6)	--
Kenya				
5. Dandora, expandable core housing on 120 M^2 lots sold for US$1,753 (1977) (without site)	(44.5)	(25.6)	(29.9)	--