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REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HOUSING BUILDING
PLANNING AND URBAN DEVELOPMENT (CIPTA KARYA)

MEDAN URBAN DEVELOPMENT, HOUSING, WATER SUPPLY AND SANITATION PROJECT

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TECHNICAL MEMORANDUM NO.40

HOUSING AND PLANNING NORMS AND STANDARDS

NOVEMBER 1979

ENGINEERING - SCIENCE, INC. • SINOTECH ENGINEERING CONSULTANTS, INC
A JOINT VENTURE
in association with
PADCO and P.T. DACREA

MEDAN URBAN DEVELOPMENT, HOUSING, WATER SUPPLY AND SANITATION PROJECT

Jln. Singamangaraja 1-3, P.O. Box 26, Phone 20716, Medan-Sumatra, Indonesia

Our ref.: 79/1211/MUDS/313

12 November 1979

Director General Cipta Karya
Ministry of Public Works
Jalan Pattimura 20
Kebayoran Baru
Jakarta Selatan

Subject: Technical Memorandum No. 40, Housing and Planning Norms and Standards

Dear Sir:

Attached are 20 copies of the subject Technical Memorandum for your information and review.

Yours faithfully,

ENGINEERING SCIENCE INC. MEDAN URBAN PROJECT INDONESIA

John M. McGill
Project Representative

C.C.: Ir. Ruslan Diwiryo, Director of City & Regional Planning
Ir. Susanto Mertodiningrat, Director of Sanitary Engineering
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SINOTECH - Taipei
DACREA - Jakarta

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LIST OF TECHNICAL MEMORANDA PREVIOUSLY SUBMITTED

Report No.	Title	Date Submitted
1.	Preliminary Site Selection Criteria for Perumnas Medan III, SSCH/LCH Project	March, 1979
2.	Work Plan for Water Supply and Sanitation Master Plans and Feasibility Studies	April, 1979
3.	Policy Issues for Project Guidance	March, 1979
4.	Drainage - Principal Rivers and Rainfall Analysis	May, 1979
5.	Preliminary Evaluation of Sunggal Water Treatment Plant	May, 1979
6.	Public Health Considerations	July, 1979
7.	The Present Drainage System	August, 1979
8.	Recommended Drilling Program	August, 1979
9.	Medan Household Income/Expenditures	August, 1979
10.	Existing Land Use in Medan	August, 1979
11.	The Regional Functions of Medan	August, 1979
12.	Existing Solid Wastes Systems and Projected Solid Wastes Characteristics	August, 1979
13.	Evaluation of Medan Master Plan	August, 1979
14.	Physical Constraints to Urbanization	August, 1979
15.	Development in Health Care in Medan	September, 1979
16.	Existing Water Supply Systems	September, 1979
17.	Developments in Education	October, 1979
18.	Existing Water Supply and Sanitation Systems	October, 1979
19.	Public Health and Environmental Aspects	October, 1979
20.	Alternative Solid Wastes Management Systems	October, 1979

LIST OF TECHNICAL MEMORANDA PREVIOUSLY SUBMITTED (CONTINUED)

Report No.	Title	Date Submitted
21	The Distributed Investment Strategy Plan (DISP)	October, 1979
22	Recommended Solid Wastes Management System	October, 1979
23	Recommended Drainage Management System	October, 1979
24	Alternative Water Supply Management Systems	November, 1979
25	Water, Wastewater, Stormwater and Solid Wastes Systems	November, 1979
26	Alternative Wastewater Management Systems	November, 1979
27	Design Criteria and Bases for Cost Estimates	November, 1979
28	Recommended Water Supply Management System	November, 1979
29	Recommended Wastewater Management System	November, 1979
30	Environmental Assessment	November, 1979
31	Finance	November, 1979
32	Groundwater Resources	November, 1979
33	The Existing Urban Situation	November, 1979
34	Sibolangit Springs	November, 1979
35	Distribution System Analysis	November, 1979
36	Surface Water Hydrology	November, 1979
37	Detailed Projections of Water and Waste Quantities	November, 1979
38	Organization for Water Supply and Sanitation	November, 1979
39	Background Notes on Medan's Housing Strategy	November, 1979

HOUSING AND PLANNING NORMS AND STANDARDS

1. PLANNING STANDARDS OF THE MEDAN MASTER PLAN

Residential areas in Medan under the Master Plan are planned on a hezagonal planning concept whereby basic neighborhood units comprising 5,000 to 10,000 people form the smallest components of the urban fabric. These neighborhood units are then joined together in a building block fashion to form larger planning and administrative areas for which urban services are provided on a progressive basis as populations and urban areas increase. Table 1 below shows the basic evolution of the concept.

TABLE 1

MEDAN MASTER PLAN NEIGHBORHOOD UNITS

	First Degree Neighbor-hood	Second Degree Neighbor-hood	Third Degree Neighbor-hood	Zone
Number of Units	1	3-7	15-35	60-140
Population	5,000-10,000	20,000-40,000	60,000-120,000	190,000-460,000

Source: Medan Master Plan, Vol. IV, 1976.

For each of the Master Plan neighborhoods, standards were developed for educational, health, public or community buildings, and religious facilities, and parks and open space. Under this system, as the urban area becomes more complex, the level of services increases. These standards have been summarized for Third Degree or greater neighborhoods in Table 2.

As shown in the Table 2, a community of 60,000 or greater requires a full complement of educational facilities ranging from kindergartens to high schools. This educational requirements results in a total per capita land requirement of 2.89 square metres if double shifts are used in elementary schools and 4.14 square metres if only single shifts are used. Based on these per capita land requirements for education, Medan's population requires a total of 324 hectares for schools.

TABLE 2

MEDAN MASTER PLAN STANDARDS FOR PUBLIC FACILITIES

Type of Facility	General Planning Standards (communities of 60,000 or more)	Gross Space Requirements per Person (m^2/person)
A. EDUCATION		
1. Kindergardens	500 m^2 per 80 students	0.50
2. Elementary	15,000 m^2 per 960 students (double shift)	1.25
3. Secondary	18,000 m^2 per 28,000 population	0.64
4. High School	20,000 m^2 per 40,000 population	0.50
5. Total Education		2.89
B. HEALTH		
1. Clinics	200 m^2 per 1,000 population	0.2
2. Health Centers	100 m^2 per 1,000 population	0.1
3. Small Hospitals	17 m^2 per 1,000 population	0.02
4. Total Health		0.32
C. RECREATION AND OPEN SPACE		
1. Neighborhood	7,000 m^2 per 1,000 population	7.0
2. 2nd Degree Neighborhood	3,000 m^2 per 1,000 population	3.0
3. 3rd/Degree Neighborhood	5,000 m^2 per 1,000 population	5.0
4. Total Recreation and Open Space		15.0
D. RELIGIOUS FACILITES		
1. Mosques	600 m^2 per 1,000 population	0.6
2. Churches	2,000 m^2 per 1,000 population	0.67
3. Temples and Others	1,000 m^2 per 1,000 population	0.67
4. Total Religious Facilities		1.94
E. PUBLIC BUILDINGS	200 m^2 per 1,000 population	0.20
F SHOPPING FACILITIES	2400 m^2 per 1,000 population	2.40
G. GRAND TOTAL ALL FACILITIES		22.75 m^2/person
H. PUBLIC FACILITIES OTHER THAN COMMERCIAL AND RELIGIOUS		18.41 m^2/person

SOURCE: Land Use Planning Standards from the Medan Master Plan.

Requirements for health facilities were determined similarly. For every first degree neighborhood, the master plan calls for a clinic to be designed on the standard of 200 square meters per 1,000 population or 0.2 square meters per person. Health centers (Puskesmas) are to be provided in second degree neighborhoods at a standard of 100 square meters per 1,000 population, while small hospitals would be provided at a standard of 150 square meters per 1,000 population*. Thus for an urban area of 60,000 or greater, a total of 0.32 square meters per person would be required for health facilities. This requirement results in a total land requirement of 36 hectares.

Shopping facilities for first and second degree neighborhoods were determined as follows. For every first degree neighborhood stalls for markets should be provided at a rate of 500 square meters per 1,000 population and shops at a standard of 1,000 square meters for 1,000 population. Second degree neighborhoods require that an additional 600 square meters per 1,000 population to be reserved for markets, shops and cinemas. Third degree neighborhoods under the master plan would have an additional land requirement of 300 square meters per 1,000 population for retail and commercial operations. These result in a total per capita requirement of 2.4 square meters and a total land requirement of 269 hectares for commercial uses.

Civic centers or public buildings were included in standards for each neighborhood to accommodate public meetings, celebrations and other large gatherings. The total requirement for all levels of neighborhoods is 200 per 1,000 population or 0.2 square meters per person. This results in a total land requirement of 22 hectares for a Third Degree Neighborhood.

The need for religious facilities was based to some extent on the religious make up of Medan. Thus, a total need of 1940 square meters per 1,000 population results and is divided into the following subcomponents:

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* The standards do not discuss minimum areas for each facility or minimum, or for that matter, maximum service areas for each level of facility.

1. Mosques, for all levels of worship, 600 square meters per 1,000 population

2. Churches, 2,000 square meters per 3,000 Christians

3. Temples, 1,000 square meters per 1,000 adherents.

Thus 1.94 square meters per person are required for communities of 60,000 or greater, or for Medan's 1979 population, a total of 217 hectares should be devoted to religious facilities.

The greatest land requirements for public facilities identified by the Master Plan are for recreational areas, parks and open space. Under the master plan standards, a neighborhood of 5,000 to 6,000 would require a total open space requirement of 7,000 square meters per thousand population allocated as follows:

1. Parks for all age groups, 3,000 square meters per 1,000 population

2. Playgrounds for school age children, 3,000 square meters per 1,000 population

3. Playgrounds for preschool children, 1,000 square meters per 1,000 population. Second degree neighborhoods, comprising 3-7 basic neighborhood units, would require and additional 3,000 square meters per 1,000 population, while third degree neighborhoods would be provided with addtional parks and open space at a standard of 5,000 square meters per 1,000 population. Thus under master plan proposals, the total city wide open space and park requirement is 1,682 hectares.

2. COMPARISON OF EXISTING PROVISIONS WITH MASTER PLAN PROPOSALS

The existing land areas devoted to public facilities in 1976 for six urbanized kecamatans of Medan were identified by analysis of land use maps prepared by the Department of Agraria. From this analysis, a total of 570 hectares has been developed as commercial, educational, health and religious facilities while 47 hectares is devoted to parks and recreational areas. Thus, these six kecamatans having a total population of 794,962 provide only 7.76 square meters per capita of public facilities, as compared with master plan standards of 22.75 square meters. (see Table 3).

TABLE 3

EXISTING PUBLIC FACILITIES IN SIX MEDAN KECAMATANS, 1976

Kecamatans	Commercial ha	Educational ha	Health ha	Religious ha	Parks & Recreation ha	Total Area ha	Total Population	Actual Standard m^2/person
Medan Kota	105.83	22.51	0.33	2.11	5.33	136.11	222,543	6.12
Medan Baru	88.89	11.93	8.68	5.44	20.77	135.71	117,517	11.55
Medan Barat	130.27	22.03	17.94	3.30	19.99	193.53	133,539	14,49
Medan Timur	58.26	23.72	8.25	2.08	0.77	98.08	177,441	5.53
Medan Denai	13.31	5.60	0.45	3.08	0.41	22.85	101,095	2.26
Sunggal	21.5	7.83	0.42	0.91	0.0	30.66	42,827	7.16
Totals	418.06	93.62	36.07	16.92	42.27	616.94	794,962	7.76
Existing Standards m^2/person	5.26	1.24	0.45	0.21	0.59	7.76		

Source : Land use map produced by Agraria Dept.

The only category of public facilities which is fully catered for by existing land use provisions in the six kecamatans is commercial facilities, which actually exceed master plan standards. This is largely due to the fact that these facilities are provided by private enterprises. The other public facilities which receive their support from public resources fall far below master plan standards. Thus when purely private commercial activities are subtracted from 1976 provisions, only 2.50 square meters per person of public facilities remains. This compares poorly with master plan standards for the same facilities of 18.41 square meters per capita.

The total land area which would be required for these six kecamatans to comply with master plan standards for public facilities is shown in Table 4. The total gap between master plan standards and the 1976 provisions in these kecamatans is 1,130 hectares, almost double the existing provisions.

This deficit in the provision of public use facilities is due to land acquisition difficulties and the lack of sufficient municipal budgetary provisions for development of these facilities. Public land acquisition procedures are complicated. Thus compulsory land acquisition procedures are almost never used to provide land for public uses.

High urban land prices further compound difficulties which Medan has in complying with master plan standards. Even a conservative estimate of urban land prices of Rp.2,000 per square meter demonstrates the difficulty with which Medan would have in meeting master plan standards for public facilities. A total of 23,000 million rupiahs would be required to provide the additional land for public facilities for these six kecamatans. This amounts to 5.3 times of the 1979-80 municipal and INPRES budgets and would cater for only 70 percent of the 1979 population.

The above analysis shows the overly ambitious scope of the master plan standards, and demonstrates the near impossibility of the municipal government to comply with those standards. The most excessive standard is the parks and recreational standard resulting in a total per capita land requirement of 15 square meters. Current provisions in the six kecamatans are only 0.59 square meters per person, however master plan standards call for an increase of more than 2,400 percent.

TABLE 4

TOTAL LAND AREAS REQUIRED BY MEDAN MASTER PLAN FOR PUBLIC FACILITIES IN SIX MEDAN KECAMATANS, 1976

Kecamatans	Commercial	Educational	Health	Religious	Parks & Recreation	Total	Amount Available	Deficit
	ha	ha	ha	ha	ha	ha	ha	ha
Medan Kota	51.83	64.31	7.12	32.49	333.81	489.56	136.11	353.45
Medan Baru	27.03	33.96	3.76	17.16	176.28	258.19	135.71	122.48
Medan Barat	30.71	38.59	4.27	19.50	200.31	293.38	193.53	99.85
Medan Timur	40.81	51.28	5.68	25.91	266.16	389.84	98.08	291.76
Medan Denai	23.25	29.22	3.24	14.76	151.64	222.11	22.85	199.26
Sunggal	9.85	12.38	1.37	6.25	64.24	94.09	30.66	63.43
Totals	183.48	229.74	25.44	116.07	1192.44	1747.17	616.94	1130.23

Impact which these standards have on the land required to develop housing and the costs associated with their development are further discussed in later sections.

3. PLANNING STANDARDS OF THE TATA KOTA

The Medan City Planning Department, the Tata Kota, has established guidelines for developing residential areas. These guidelines do not have the legal status of a building code or a planning act, but serve to restrict the type of structure which can be built in each of the five zones which it established. These guidelines are summarized in Table 5.

The guidelines attempt to cater for different income groups through providing a range of minimum plot sizes for each zone. The smallest, aimed at low income groups, is 75 square meters, while the largest is 500 square meters.

The Tata Kota has also established classifications of structures, permanent, semi-permanent, and temporary, which refer to building materials used in construction. Permanent structures are built with walls of stone, brick or concrete and roofs constructed of asbestos-cement or concrete, while semi-permanent structures are those having wooden walls and roofs of zinc. Semi-permanent structures are only permitted in zones D and E having minimum plot sizes of 100 and 75 square meters respectively. Temporary buildings are constructed of traditional materials such as bamboo, and thatch or salvage materials. Temporary materials are not allowed in any of the zones. Since over 79 percent of housing in Medan is construction from semi-permanent and temporary* materials, the bulk of Medan's households would not be able to comply with the planning guidelines.

Building functions are also restricted somewhat by the guidelines. For example, maissonettes are permitted in zones A, B, and C, while multi-storey buildings are only permitted in the first two zones. Offices which are attached to the house are allowed in the two zones with the largest plots, but offices built in rows are not. The latter is however allowed in the zone having the smallest plot sizes, i.e., zone E with plot sizes ranging from 75 to 100 square meters.

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* Source 1975 Kantor Sensus and Statistik Daerah Tingkat II Medan.

The primary problems which might be encountered with these functional restrictions by private housing developers and low income home owners are the building material restrictions in zones A, B, and C and the height restrictions in zones D and E. Permanent construction of single storey housing can increase building costs by more than 90 percent over the costs of semi-permanent construction. However housing built from wooden materials or other semi-permanent materials could provide shelter which is sufficiently durable to have a functional life which is equal to housing built from permanent construction materials. Finally, the inability of low income households occupying 75 square meter plots, i.e., zone E, to add floors severely limits their capacity to improve the quality of their housing by increasing floor area. Two storey construction in zone E would not have much of an impact on the environmental quality of a neighborhood, but would increase the number of housing options which low income households have.

Since the primary costs of infrastructure to a household result from the length water, sewerage and road networks provided along the front of the plot, reduction in plot frontages increases the efficiency with which infrastructure can be provided since more households share the same length of infrastructure. Thus using that criteria as a measure, the efficiencies of plot ratios of lengths to widths or frontages implied by the planning guidelines increases as plot sizes decrease. Zone A having the largest plots has a plot ratio of 1.25, while the 75 square meter Zones E plots have a ratio of 2.08.

The planning guidelines also restrict on-plot construction through setbacks and through providing maximum floor area ratios and gross building coverages. In all cases, the total percentage of the plot on which construction is permitted increases a plot sizes decrease recognizing the need to allow lower income household occupying smaller plots to build over a greater portion of the plot to satisfy their housing needs. However there are conflicts between the buildable areas allowed by the gross building coverages and the actual area of the plot remaining for construction after the area covered by setbacks is subtracted from the total plot area. For example, in zone E, the gross building coverage permitted is 80 percent of the plot area or 60 square meters.

However, when the area covered by front and side setbacks is subtracted from the plot area, only 28.5 square meters remains for building construction. Similar conflicts also exist between gross building coverages and setback restrictions in zones C and D.

The Tata Kota does not have similar planning guidelines for development of commercial or industrial areas. However, the Medan Industrial Estate has established building setbacks and other covenants restricting development within its boundaries, but these restrictions do not apply to other industrial areas.

In addition to the Tata Kota's planning guidelines, there are two other primary land classifications from the Building Department for urban areas in Medan: open areas and closed areas. Open areas which form the bulk of built areas of Medan excluding dense kampungs have setback restrictions of six meters on all sides of the plot. Furthermore, only 60 percent of the plot can be occupyied by building construction.

Closed areas are located primarily in the central areas of Medan in the downtown area of kota. Within closed areas the entire plot area except for a rear 1.5 meter setback, can be built upon. The 1.5 meter rear setback is reserved for a septic tank system. However, such an open area at the rear to the plot is grossly inadequate for the septic tank to function properly. A minimum area of 15 square meters is required for a septic tank system serving a family of six. Furthermore, since the septic tank is at the rear of the plot and there are no side setbacks, maintenance of the system is difficult. Hoses running from pumping trucks must run through the building to reach to septic tank.

Conflicts exist between the two systems in setbacks and built areas permitte. Furthermore the six meter setbacks required in "open" areas do not permit the smaller plot sizes allowed by the Tata Kota's planning guidelines. However, since no more "closed" areas are being planned, the system is largely in disuse.

4. CIRCULATION STANDARDS

The Medan Master Plan establishes a hierarchy of roads providing different road widths for different functions. (see Table 6). The hierarchy ranges from main roads designed for high speed through traffic

to fourth class roads aimed at local vehicular traffic within residential neighborhoods. However, the standards implied by the master plan do not take account of the pedestrian nature of much of Medan's population which does not have access to privately owned automobiles. The minimum road width proposed by the master plan is ten meters and is designed to have two paved vehicular lanes.

These master plan road standards unnecessarily increase the total land requirements and thereby the costs of developing housing for low income and middle income households. For example, if a combination of fourth class roads, having a minimum width of 10 meters and third class roads having widths of 14 meters are used to provide access to 75 square meter plots, 38 percent of the housing development must be devoted to circulation. By way of comparison, PERUMNAS housing projects generally have circulation standards of about 15 to 18 percent. Furthermore, these master plan road standards increase the land costs of developing low and middle income plots. The cost of 75 square meters plots increases from Rp. 126,476 to Rp. 173,112, an increase of 37 percent* when master plan standards are used instead of a system of footpaths and low vehicular intensity streets.

5. COSTS IMPLIED BY PLANNING STANDARDS

When all of these planning standards are combined to design a housing development, they result in costs which are beyond the reach of most households in Medan and which severely constrain the ability of the city government to provide urban services to all groups within the city. The combination of the master plan road standards, and open space and community facilities standards results in total land requirement for Zone D 100 square meter plots of 337 square meters and a total circulation requirement of 38 percent. (see Table 7). While the Tata Kota planning guidelines call for densities within zone D of 80 units per hectare, master plan standards through excessive circulation and open space requirements only permit development of densities of 30 units per hectare.

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* Standardized land costs of Rp.1,000 per square meter and community and open space standards of 5.3 square meters per person were used to determine land requirements.

These excessive master plan land requirements result in large infrastructure costs as well. As shown in Table 7 which summarizes the land requirements and infrastructure costs of the master plan standards, the costs of providing a 75 square meter plot at those standards with water supply, sewerage and paved roads with surface drains are roughly 750,000 rupiahs. When these infrastructure costs are combined with connection costs of water supply and electricity* and conservative estimates of land costs of 1,000 rupiahs per square meter, they total more than 1.3 million rupiahs. If this development cost was ammortized at 9 percent over 15 years, a household would have to have a minimum monthly income of 133,700 rupiahs to afford the mortgage payments. Thus fewer than 10 percent of Medan upper income households could afford even the smallest plot size permitted under the planning guidelines if the full costs of the development were paid by them.

Reduction in master plan standards has a significant impact on reducing development costs of low and middle income housing. Tables 8 and 9 show the impact which reductions in circulation standards and changes in plot ratios have on the costs of street and drainage networks and on water supply costs. For example, as shown in cases 2 and 3 of Table 8, the costs of streets and drainage networks using the planning guidelines plot ratios of 2.08 and street network consisting of five meter wide roads results in a total cost of streets and drains for a 75 square meter plot of 60,968 rupiahs. However, when plot ratios are increased to 3.00 by reducing plot frontages from 6 meters to 5 meters and a combination of five meter street and three meter footpaths are used to provide access, the cost of circulation and drainage drops to 39,286 rupiahs, a reduction in costs of 55 percent.

Similar, although less dramatic, savings can also be achieved in water supply costs per plot through the same techniques of increasing plot ratios and reducing circulation networks. Cases 2 and 3 of Table 9 illustrate that a 19 percent reduction in water supply costs can be achieved in this manner. The reason cost reductions are less substantial is due to the fact that the primary costs of water supply are incurred along the length of the front of the plot. Thus the plot ratio is the

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* Information about connection costs was supplied by the PAM Tirtanadi and the PLN.

major factor in the costs of water supply networks since it affects the length of the network.

6. PLANNING PRACTICES USED IN MEDAN

It is important to note that the Tata Kota and other planning officials have taken a flexible approach to planning standards such as the master plan standards in developing housing estates.

Although perhaps not representative of all projects approved by the Tata Kota, a proposed 108 hectare housing site along Jalan Balikpapan illustrates how master plan standards have been modified. Street right of ways within the development range between six meters and eleven meters while block lengths, as is common in Medan, exceed 200 meters. Since plot sizes average 345 square meters densities are in the range of 20 units per hectare. Open space and community facilities consume about 12 percent of the total site at a standard of 10 square meters per person. Road networks due to the long blocks and street widths consume an additional 16 percent of the site.

Earlier institutional housing projects financed by the BTN have similar standards which are lower than the master plan standards. Street widths range between 6 and 9 meters yielding a total cinculation component of the project's land use of about 12 percent. Recreational and community facilities occupy about 12 percent of the project area. Plot sizes however are larger than the project quoted above ranging from 420 to 980 square meters, while densities are only about 13 units per hectare.

While the above two projects are aimed at upper income groups, PERUMNAS projects seek to meet the housing needs of lower and middle income groups. As a result, standards in the Medan I and II projects are much lower than those in the projects shown above and than master plan standards. (see Table 10). Plot sizes in the Perumnas projects range from 60 to 200 square meters while densities range from 100 to 35 units per hectare. Access to plots is provided through several options such as combinations of pedestrian footpaths and low intensity pedestrian vehicular streets and six and eight meter wide streets. As a result circulation requirements as a percentage of the total site remain low ranging from 13 to 20 percent.

Open space and community facilities land use standards in both sites are considerably lower than master plan standards. In the Medan I site, they average 6.18 square meters per person, while in the Medan II site about 5.33 square meters per person is required. A progressive scale is used to determine the level of community facilities and open space provided in each site. However, the maximum provision aims at 7 square meters per person or 18 percent of site. At this level, a full complement of schools is provided as well as health facilities, markets, and shops, religious facilities and recreational open space.

Table 10 also presents estimates of infrastructure and land costs which result from the Perumnas standards. These costs were based on individual water supply, paved roads and footpaths and lined drains. In the earlier Medan I site, the infrastructure costs of the 90 square meter plots were about 98,870 rupiahs. When that cost is compared with the 750,000 rupiahs required to develop infrastructure for a 75 square meter plot using master plan standards, the impact which reduced standards have on project costs and the capacity of low income households to afford housing is clearly illustrated.

7. BUILDING REGULATIONS

The municipality of Medan established building regulations in 1941. These regulations are under the administration of the Dinas Bangunan*, and provide development control over all types of buildings in Medan. When the regulations were established, they were meant for a city of less than a quarter of its current population of over one million persons. Since then, Medan has experienced periods of rapid population growth, but the basic legislation has not been updated to meet current trends. As a result, many of the provisions are unenforceable.

The various articles of the building regulations deal with construction and demolition of buildings, building heights and room sizes, structural loading, building materials and public security. However, many of the provisions of these articles are overly restrictive and do not reflect changes in construction trends or the need to provide structures at costs affordable to Medan's population. For example, article 41 restricts

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* Since 1978, the issuance of building permits has been placed directly under the control of the Mayor's office.

TABLE 5

PLANNING STANDARDS FOR SUBDIVISION LAYOUTS

Housing Zone		A	B	C	D	E
Minimum Plot Size (m^2)		500	400	200	100	75
Gross Building Coverage	%	40 %	50 %	60 %	80 %	80 %
Floor Area Ratio		80 %	100 %	120 %	150 %	160 %
Minimum Frontage	m	20	15	12	8	6
Length	m	25	26.7	16.7	12.5	12.5
Plot Ratio		1.25	1.78	1.39	1.56	2.08
Front Set Back	m	12	10	5	5	3
Side Set Back	m	3	3	2	2	1.5
Rear Set Back	m	2	2	2	-	-
Buildable Area *	m^2	346	268	77.3	30.0	28.5
Maximum Allowable Densities						
Persons/Hectare		200	250	300	400	400
Unit/Hectare		20	25	40	80	80

* The buildable area shown is not part of the guidelines, but results when the area devoted to setbacks is subtracted from total plot area.

SOURCE: City Planning Department.

TABLE 6

HIERARCHY OF ROADS IN MEDAN MASTER PLAN

Type of Road	Total Number of Lanes	Width of Each Lane (m)	Minimum Road Width* (m)	Speed (KPH)	Function
1. MAIN ROAD	2 x 2	3.75	25	60	Designed for high speed through traffic
2. SECOND CLASS					
a. Industrial Areas	2 x 2	3.75	25	60	) Connects one functional
b. Housing Areas	1 x 2	3.75	15.5	50	) area with another such as housing with industry of commercial areas
3. THIRD CLASS					
a. Industrial Areas	1 x 2	3.75	15.5	50	Provides interval connec-
b. Commercial Areas	1 x 2	3.75	15.5	50	tions with functional
c. Housing Areas	1 x 2	3.00	14.0	50	areas
4. FOURTH CLASS	1 x 2	2.00 - 3.75	10.0 - 13.5	30	Provides Access to individual buildings

* Road width include 4 meter shoulders for the first three road classifications and three meter shoulders for the others.

SOURCE: Medan Master Plan.

TABLE 7

TOTAL LAND REQUIREMENTS AND INFRASTRUCTURE COSTS REQUIRED BY PLANNING STANDARDS FOR PRIVATE DEVELOPMENTS

House Type	Minimum Plot Size (m^2) [d]	Minimum Frontage (m) [d]	Ratio of Length to Width	Street Width (m) [b]	Maximum Block Length (m) [c]	Percent Circulation (%)	Open Space & Community Facilities (m^2/person) [d]	Total Land Requirement per Plot (m^2)	Density (Units/hectare)	Total Cost of Infrastructure per Plot (Rp) [e]	Total Connection Costs (Rp)	Cost of Undeveloped Land (Rp/m^2)	Total Cost of Land + Infrastructure (Rp)	Monthly Payment Required (9% over 15 years) (Rp)	Monthly Income Required to Afford Plot if 10% is spent (Rp)
A	500	20	1.25	10-14	100	26.9	18	834	12	1,411,763	254,895	1000	2,500,864	25,365	253,650
B	400	15	1.78	10-14	100	27.1	18	700	14	1,171,637	249,895	1000	2,121,080	21,513	215,130
C	200	12	1.39	10-14	100	32.9	18	461	22	990,732	237,385	1000	1,689,571	17,137	171,370
D	100	8	1.56	10-14	100	37.7	18	337	30	849,694	273,385	1000	1,459,676	14,805	148,050
E	75	6	2.08	10-14	100	37.7	18	297	34	748,444	237,385	1000	1,318,316	13,371	133,710

a. Planning guidelines from city planning department, Medan.
b. Medan Master Plan road standards consisting of third and fourth class roads.
c. Soeffat Standards.
d. Total requirements for open space, recreation, schools and health facilities required by Medan Master Plan standards for a community of 60,000 more.
e. Water supplies, sewers, paved roads, and lined drains.

TABLE 8

EFFECTS OF PLANNING REQUIREMENTS ON THE COSTS OF STREETS AND DRAINS

Case	Plot Size m^2	Plot Ratio[a]	Street Widths Primary m	Street Widths Secondary m	Percent Circulation %	Density Units/Ha	Total Costs of Streets Rp.	Total Costs of Drains Rp.	Total Streets and Drains Rp.	Monthly Payment Required[b] Rp.
1.	60	3.75	5	3	13.4	100	9,497	21,489	30,985	372
2.	75	2.08	5	5	20.8	78	25,697	35,272	60,968	618
3.	75	3.00	5	3	13.4	85	11,141	28,145	39,286	426
4.	100	1.56	5	5	20.8	62	31,265	41,831	73,096	877
5.	100	2.78	5	5	17.4	65	25,156	32,820	57,976	696
6.	200	1.39	5	5	17.3	36	44,710	58,156	102,867	1,235
7.	200	2.00	5	5	15.3	37	38,615	49,438	88,053	1,057

SOURCE: MUDS

a. Cases 2, 4, and 6 result from Tata Kota Planning Guidelines cases 3, 5, and 7 show the results of reducing plot frontages.

b. Total costs have been ammortized at 9 percent annual compound interest over 15 years.

TABLE 9

EFFECTS OF PLANNING REQUIREMENTS ON WATER SUPPLY COSTS PER PLOT

Case	Plot Size m^2	Plot Ratio[a]	Street Width Primary m	Street Width Secondary m	Percent Circulation %	Density Units/Ha	Total Cost of Water Supply per Plot Rp.	Monthly Payment Required[b] Rp.
1.	60	3.75	5	3	13.4	100	37,120	376
2.	75	2.08	5	5	20.8	78	51,948	527
3.	75	3.00	5	3	13.4	85	43,546	442
4.	100	1.56	5	5	20.8	62	64,724	556
5.	100	2.78	5	5	17.4	65	50,295	510
6.	200	1.39	5	5	17.3	36	89,984	912
7.	200	2.00	5	5	15.3	37	76,494	776

SOURCE: MUDS ANALYSIS

a. Cases 2, 4, and 6 result from Tata Kota Planning Guidelines while cases 3, 5, and 7 show the results of reducing frontages.

b. Total costs have been ammortized at 9 percent annual compound interest over 15 years.

TABLE 10

TOTAL LAND REQUIREMENTS, INFRASTRUCTURE COSTS AND AFFORDABLE INCOME FOR PERUMNAS HELVETIA (MEDAN I) AND MEDAN II PROJECTS

Project	Plot Size (m^2)	Minimum Frontage (m)	Ratio of Length to Width	Street Width (m)	Block Length (m)	Percent Circulation (%)	Open Space & Community Facilities (m^2/person)	Total Land Requirement per plot (m^2)	Density (Units/hectare)	Total Cost of Infrastructure per plot (Rp)	Connection Costs (Rp)	Cost of Undeveloped Land (Rp/m^2)	Total Cost of Land & Infrastructure (Rp)	Monthly Payment Required (9% over 15 years) (Rp)	Monthly Income to Afford Plot if 10% is Spent (Rp)	Percentile Income Group (%)
Halvetia (Medan I)	90	6	2.50	3 - 4	96	12.7	6.18	140	72	98,872	0	421	157,175	1,594	15,941	
	120	8	1.88	4 - 6	96	16.9	6.18	182	55	157,159	0	421	233,607	2,369	23,690	
	160	8	2.50	6 - 8	96	19.7	6.18	238	42	182,289	0	421	282,375	2,864	28,640	
	200	10	2.00	6 - 8	100	19.5	6.18	287	35	217,403	0	421	338,159	3,429	34,290	
Medan II	60	4	3.75	3 - 4	100	12.6	5.33	99	100	57,429	0	733	101,409	1,029	10,290	
	90	6	2.50	3 - 4	96	12.7	5.33	134	75	94,570	0	733	160,540	1,628	16,280	

1. Except for Medan II 60 m^2 plots which have access to communal standpipes, all other infrastructure includes individual water supply, paved roads, and lined drains.
2. Source of standards Perumnas.
3.

building heights to 16 meters or four floors. Such height restrictions are generally uneconomic for many types of commercial buildings such as hotels where lifts and building structure are not efficiently used in structures of just four floors. Article 51, which controls building materials, effectively prohibits 79 percent of Medan's housing from complying with the regulations by requiring all construction to be of only red brick.

The most serious deficiencies in the building regulations are in the lack of effective control over the effects on structures of caused by man-made and natural disasters such as fire and earthquakes. In the case of prevention of damage during earthquakes, the only provisions are that the supervisor in charge of issuing building permits can issue additional ad hoc instructions. Fire regulations, particularly for commercial and industrial are inadequate as there are only limited controls over fire exits, and building materials. Furthermore, there are no controls mentioned in the regulations over storage of flameable materials in dense areas.

8. PLANNING STANDARDS OF WATER SUPPLY AND SANITATION

The planning standards associated with different systems of water supply and sanitation are shown in Table 11. These planning standards are generally associated with plots sizes and environmental effects. For example, a septic tank in order to function properly requires at least 12 square meters of ground area and should be located at least 10 meters from a dwelling or well used for potable water supplies. These planning restrictions limit septic tanks to plots of 200 square meters or more. Pit latrines or individual MCK's however can be constructed in smaller areas, 0.64 square meters, and if they have water seal toilets attached can be used in relatively dense housing areas such as those having minimum plot sizes of 60 square meters.

The functioning of water supply systems are not as controlled by plot sizes as are sanitation systems. They can be installed in practically any sized plot. However, as previously shown, the costs of pipe borne water supply systems do increase with increases in plot size and plot frontages. Improvements in water supply systems, and for that matter, sanitation system, do have substantial impacts on environmental

quality of housing through reductions in health hazzards to individual households and through general improvement in the environment of surrounding areas. However, discussion of these impacts is outside the scope of this technical memorandum and are therefore covered elsewhere.

The difference in cost to individual households of these various systems and their attendant planning requirements is substantial.* For example, the total monthly cost of individual water supply is roughly Rp. 1,204, while the monthly costs of standpipes connected to municipal water supply are roughly Rp. 125. However, the quality of potable water supplies from both is the same if both systems are properly operated and maintained. The differences in cost between various sanitary systems is even greater. Sewerage systems with treatment facilities are estimated to cost a household of six persons roughly Rp. 2,044 per month. However, the MCK's which are being used in Perumnas housing projects are estimated to generate monthly costs of Rp. 708.

9. OTHER PLANNING AND HOUSING STANDARDS

The development of urban land is further complicated by regulations of the Department of Agraria. Under the Basic Agrarian Law, the Department of Agraria is responsible for registering land holdings. Under that authority, the Kotamadya Department of Agraria has been registering about 100 land holdings per month. However, since none of the actual registering is done in the Medan office, the process takes a minimum of 55 days. Parcels of land greater than 2,000 square meters must be registered by the Ministry of Home Affairs in Jakarta, a process which can take several months. While registration is not compulsory, it is required when obtaining a building permit, bank loan for construction and other procedures involving a government agency.

Fees for registration vary according to the type of land use, the type of land rights and the size of the holding. These fees can be substantial, and can act as a deterent to low income households registering their plots. For example, in a recent BTN housing project, the registration and land certificate fees for a 300 square meter plot are about Rp. 175,000, while the addition of a hipotek loan agreement can

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* This analysis of the costs of various water and sanitation systems is based on a household of six persons living on a 100 square meter plot

TABLE 11

PLANNING REQUIREMENTS FOR VARIOUS LEVELS OF INFRASTRUCTURE FOR A 100 SQUARE METER PLOT

Type of Service	Capital Cost per Household	Connection Cost per Household	Ammortization Cost of System + Connection Charge	Monthly Tariff for Household of Six	Total Monthly Cost	Planning Requirements	Environmental Assessment To Users	Environmental Assessment To Surrounding Areas
1. Individual House Water Supply	64,724	38,000	1041	162	1204	Must allow municipal supply to run in front or rear of plot. If rear, a 1.5 m easement on each adjoining plot is required for access during repairs. No building can be allowed on easement. Current setback requirements do not permit supply at rear of plot. Supply at front may cause temporary traffic problems but is more desireable.	If treated best source of water supply. If system is not well maintained and infiltration high can be source of water borne diseases.	None
2. Standpipes connected to Municipal Water Supply	7,000	-	71	54	125	Based on standard of 10 households per standpipe. Must reserve accessible land for public standpipes. Supply must be within easy access of houses served to encourage use. Maximum service radius should not exceed 100 meters. Maximum number of households per standpipe 20. An area of 25 m^2 is required for each standpipe. System requires vehicular access for maintenance.	If water is treated adequate source of water. Contamination can result from unclean containers used to carry water. If adequate drainage is not provided, health hazzards can result.	If adequate drainage is not provided surrounding can become muddy and source of pathegens particularly for small children. Standpipes should be metered or controlled in some other fashion to prevent excessive wasteage.
3. Standpipes Connected to Shallow Wells	3000 - 4000	-	41	-	41	Costs based on Perumnas standard of 10 households per standpipes. Planing standards are essentially the same as standpipes connected to municipal water supplies. However the wells should be higher than existing septic tanks or pit latrines and should be located 15 meters away from drain fields from septic tanks or pit latrines to avoid contamination.	Likely source of contamination due to polluted groundwater. Enclosure of wells combined with boiling water can provide adequate water supplies	Health hazzards to surrounding areas esaentially the same as above.

TABLE 11 (CONTINUED)

Type of Service	Capital Cost per Household	Connection Cost per Household	Ammortization Cost of System + Connection Charge	Monthly Tariff for Household of Six	Total Monthly Cost	Planning Requirements	Environmental Assessment To Users	Environmental Assessment To Surrounding Areas
4. Private Shallow Wells	-	-	-	-	-	Based on standards from Directorat Generale of Cipta Karya: The minimum distance between private shallow well and pit lattines, septic tanks etc., is 8 - 15 meters. Well construction as follows: - The depth of impermeable wells is 2.00 meters (minimum) from the ground surface. - The surface surrounding wells must be constructed with an impermeable floor of 1.2 m radius from the wall of wells. - Adequate drainage has to be constructed around the wells.	If adequate drainage is not provided health hazzards can result, spreading disease to the entire household.	None unless wells are shared by a large number of households.
5. Sewerage System with Treatment Facilities	179,000	-	1819	225	2044	Based on the preliminary results of sewerage system in MUDS Master Plan. An aerobic lagoon system requires a treatment plant for serving area 8,210 ha (31%) of Medan of 50 ha, other areas will us individual treatment plants.	None.	None, however incomplete treatment can allow pathegens to be discharged into potential water supplies or recreational areas.
6. Sewerage System Without Treatment Facilities	150,000	-	1516	225	1741	Based on the criterion standards which is made by Directorat Generale of Cipta Karya.	If lines become clogged, flooding can result causing health hazzards.	The system allows unreated sewage to be dumped into water courses and can result in severe health and environmental hazzards

TABLE 11 (CONTINUED)

Type of Service	Capital Cost per Household	Connection Cost per Household	Ammortization Cost of System + Connection Charge	Monthly Tariff for Household of Six	Total Monthly Cost	Planning Requirements	Environmental Assessment: To Users	Environmental Assessment: To Surrounding Areas
7. Septic Tanks a. S.T. with Drainfield	195,000	-	1978	225	2203	Based on technical guidance for low cost housing development of Directorate Generale of Cipta Karya. The minimum volume of septic chamber serving ten people is 1.5 m^3 while the minimum depth is 1 m. The chamber must be cleaned once a year. The minimum distance between a well used for water supply and septic tank must be 10 m. The conatruction of the drain field is as follows. It must have 2 galleys line consisting of perforated pipes for drainage the effluent from septic tank. - The minimum area for drain field is 12 m^2. - The minimum length of galleys is 20 m. - The minimum width is 60 cm and depth is 45 cm (mim.). - The spaces between two lines is 1.5 m. - The minimum drain pipe diameter is 4 inches.	None, unless effluent seeps into surrounding wells.	Due to poor design of many septic tanks, no treatment of effluent occurs, thus untreated effluent can be discharged directly into surface drains.
b. S.T. with Soakaway	195,000	-	1978	225	2203	The specifications of septic tank are the same as above, except the minimum size of the soakaway is 5 m in length 1 m wide 1.1 m depth.		

TABLE 11 (CONTINUED)

Type of Service	Capital Cost per Household	Connection Cost per Household	Ammortization Cost of System + Connection Charge	Monthly Tariff for Household of Six	Total Monthly Cost	Planning Requirements	Environmental Assessment To Users	Environmental Assessment To Surrounding Areas
8. Pit Latrines Water Seal Type	25,000	-	253	170	423	The recommended size of the vaults is 0.8 m x 0.8 m. The height of the shelters are only 1½ meters. The vaults must be at least 8-15 meters from a well.	If the water-seal is not good, flies can breed causing health hazzards.	If improperly constructed they can become a breeding ground for flies and can result in health hazzards, further untreated effluent can enter surface drains if pits are improperly constructed. Oders can also become a problem.
9. Pit Latrines without Water Seal	20,000	-	202	170	372	Essentially same as above. However the shelter and vault should be 20 meters from the house.	Frequently a breeding ground for flies, can also cause oders. If poorly constructed can contaminate surface wells and surface drainage.	Essentially the same as above.
10. MCK's Program	53,000	-	538	170	708	Based on standards from "building hygiene" from Directorat Generale of Cipta Karya. Every household that contains less than 6 people must have 1 bath room and 1 WC. If more than 6 people but equal to or less than 12 people, it must have 2 bathrooms and 2 WC's If one WC and one bath room are combined, the minimum floor area must be 3 m^2. If not combined, the WC must have a minimum floor area of 1 m^2 while the bathroom must be 2.5 m^2.	Problems are essentially same as above.	-

add a further Rp. 100,000 to the costs. These two together amount to six percent of the total project costs.

Development of new urban land within Medan is further complicated by restrictions on changing the use of agricultural land to urban uses. Before the use can be changed, and thus land acquired for either public or private project, the Governor of the province must seek approval from the Director General of Agraria of the Ministry of Home Affairs in Jakarta. As a result, unused agricultural land can lie vacant for long periods and cause temporary land shortages which further increase speculation in existing urban land.

As previously mentioned, the Bank Tabungan Negara (BTN) has provided housing finance for government and military workers. Since 1977, it has only been financing "Low Cost Housing", again for public employees. Since BTN financed housing is the only publicly financed housing other than Perumnas housing already discussed, standards for BTN housing plan an important role in shaping Medan's development. While these standards do not have legal status, since they are imposed by a financial organization as loan approval criteria, they do dictate an important component of planning policy.

BTN standards vary, however under its current low cost housing program, plot sizes have been a minimum of 300 square meters. Most recently in an attempt to reach lower income groups and to compensate for the high costs of land, BTN has been encouraging project developers to reduce plot sizes to 200 square meters. All BTN projects must contain a minimum of 50 plots, a constraint in developing smaller urban infill sites since projects must have minimum areas of at least two hectares. In practice, roughly 60 percent of BTN housing has been developed in projects containing more than 100 units necessitating larger sites on the urban perifery. Finally, BTN land price ceilings of about Rp. 3,000 per square meter, limit project development to areas outside the existing built area.

Housing standards in BTN projects vary, but generally have ranged between 40 to 90 square meters. While there is no firm policy regarding building materials, the house must be constructed from materials which will have a life greater than the mortgage loan period, currently 15 years.

Thus most BTN housing has utilized traditional construction materials such as brick, walls with concrete frames, construction standards which can be 90 percent more costly than the low cost housing standards used in Perumnas housing or in semi-permanent housing.

These BTN standards, along with income criteria, limit BTN, and thus all non-Perumnas housing finance to households having incomes greater than the 85th percentile of incomes. However, since most BTN housing is built to higher standards than BTN's minimum standards, most housing is only affordable to income groups above the 90th percentile of household incomes.

10. CONCLUSION

This brief analysis shows the importance of planning standards and the costs implied by decisions about different levels of standards of urban services. These become particularly important in developing housing projects for low income groups. Since local governments are unable to provide subsidies for low income groups over prolonged periods of time due to the very high costs of these subsidies, if housing is to be brought within the range of the budgets of low income groups, the standards which are used to design those projects must also be brought within affordability of those households. This can be done through careful analysis of the costs which are implied by these standards in project development and the impact which these costs will have on the households designated to live in those housing projects.

Planning standards and norms should also be evaluated in terms of a municipality's capacity to afford and enforce those standards. As shown, excessive open space standards can not be met by municipal budgets, nor can they be met by private developers. As a result, they become unenforceable and meaningless. From a social equity point of view, it is far better to provide a minimal level of urban services to all groups within the urban fabric, than it is to provide limited groups with high standards of urban services and the rest with none.

The lack of legal status of the Tata Kota's planning guidelines hampers their enforcement, and ultimately makes them less usefull as a tool for development control than they would be if they had legal status.

The lack of uniform planning legislation also results in conflicting regulations such as those of the Tata Kota and the Building Department.

Planning standard should be flexible so that they can be changed and possibly improved when conditions permit. While they should have legal status so that they can be enforced, the details of the planning legislation should be in the form of regulations which can be changed without major legislative changes. These regulations along with supporting legislation should be printed and available to developers.