LAND USE FORECASTING MODEL

FOR THE

SAIGON METROPOLITAN AREA

PHASE I REPORT

May 23, 1972

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PREFACE

This report is based upon work conducted from February 7, 1972, to the present date. The project was initiated by Mr. Frank R. Pavich, Urban Advisor to the Vietnamese Ministry of Public Works and was carried out by a 3-man team from Daniel, Mann, Johnson, & Mendenhall and its joint venture partner William C. Rasmussen & Associates. Financing was provided by the United States Agency for International Development under contract AID 730-3429. Special thanks are owed for the support given the project by Mr. B. H. Tuan, Minister of Cabinet, and by other officials of the Public Works Ministry and the Director General of Reconstruction and Urban Planning, Republic of Vietnam. Suggestions by Mr. Doan Huu Khai, Director of Municipal and Rural Planning, were particularly helpful and confirmed the strategy of focusing on industrial and commercial land requirements.

I. JUSTIFICATION AND LIMITATIONS OF THE LAND-USE FORECASTING MODEL

Definitions

A "model", as used in the context of the present report, is a rational system of analysis through which known data is combined in such a way as to provide answers to a given set of questions. In this case, the questions to be answered by the model were defined as follows:

(1) What additional land will be needed for Saigon's expanding populace in the next thirty years?

(2) How will this land be used?

Income Basis

The model was to be constructed in such a way that it would tie together the three elements of population, economic base, and land-use. For this reason, it was decided to emphasize the forecasting of industrial and commercial land requirements, which are more dependent upon economic factors than either residential or institutional requirements. The first tendency is to reject such an approach on the grounds that industrial and commercial land together account for only about 1.5% of the present land use in the Saigon Metropolitan

Area (SMA), as compared to 11.1% for the two other major urban uses.[1/] On closer analysis, however, there are a number of compelling reasons for focusing on the land requirements of "business".

(1) They are the most difficult to predict. Residential requirements can be forecasted by simply applying assumed future density factors to existing population projections. Business requirements are dependent upon both the population level and per capita demand. The latter is based upon a variety of factors that require special analysis.

(2) Business - - particularly industry - - is the dynamic element in the growth of a city, even a capital city such as Saigon where the government is a major employer. Industrial exports to the hinterland and beyond should provide the basis for imports of foodstuffs and raw materials. Further, they should:(a) provide a major tax base from which to finance public infrastructure; (b) be a principal source of employment; (c) lead to the creation of new products and services in the community; and (d) result in the expansion of other activities within the community.

1/ The metropolitan area, as presently defined by American urban planning advisors, is a relatively large area of approximately 140,000 hectares. On the other hand, the heavily-populated Prefecture of Saigon has only 6,920 hectares, of which about 9% is industrial or commercial.

(3) It appears that, for the most part, people choose their places of residence in relation to their places of employment. Urban planners should therefore take estimated industrial land requirements, allocate these requirements spatially by considering what terrain is most hospitable to industrial development, and allocate residential land in relation to the chosen industrial locations.

In order to estimate industrial and commercial land requirements, then, it was necessary to have economic inputs for the model, in addition to the demographic inputs necessary for residential projections. It was felt that the fundamental basis for such inputs should be national income (gross national product minus depreciation), partly due to the widespread use of income and production statistics. The national income figure was scaled down to approximate gross income for the SMA, and the result was projected to the year 2000 using income and GNP growth rates from other studies. 2/

2/ A detailed presentation of the economic inputs, which are at present only rather crude estimates, is given in Chapter II.

Two Surveys and Which was Used

In projecting the industrial and commercial land-use requirements, it was necessary to have some basis for translating projected industrial and commercial demand into land-use requirements. It was therefore felt that two "land-use coefficients" were needed, one giving Saigon's average industrial production (in piasters) per hectare of industrial land, and a second giving the city's average commercial sales (in piasters) per hectare of commercial land. Further, it was felt that a special density factor was needed to indicate the average number of residents living on each hectare of residential land. This was termed the "residential land-use coefficient".

In order to obtain the desired information, a survey of about 900 Saigon businesses and residences was conducted. However, two sets of checks were made on the survey returns, and both showed some of the information collected to be of questionable validity for use in the model. It appears, first that closer attention was needed for the supervision of the surveyors. Second, it appears that most of the business respondents were extremely reluctant to give accurate information on their annual sales volumes.

TABLE 1

SAIGON METROPOLITAN AREA
LAND USE IN HECTARES
(1970)

	Industrial*	Commercial	Residential	Institutional	Agricultural	Undeveloped	Other	Total
1. Saigon Prefecture	376	269	2,080	1,035	1,568	560	1,024	6,920
2. Gia Dinh Province	1,780	283	7,003	4,411	51,846	9,566	1,315	76,204
3. Di An District (Bien Hoa Province)	434	16	714	1,341	4,687	874	145	8,211
4. Duc Tu District ** (Bien Hoa Province)	407	39	210	566	23,814	7,375	7,437	39,848
5. Lai Thieu District (Binh Duong Province)	40	7	336	266	3,082	2,676	126	6,533
TOTAL	3,037	614	10,361	7,619	84,997	21,051	10,047	137,716

* Includes utilities, transport, & storage. Without these, the industrial total is 1,548 ha., divided among the areas as follows: (1) 231, (2) 523, (3) 414, (4) 340, and (5) 40.

** Contains the Bien Hoa Industrial Park.

Another major shortcoming of the survey of businesses and residences was conceptual in nature. The survey was designed to get information on total business sales per hectare. After the survey was completed, it was realized that if the model were to be internally consistent and to yield meaningful results, the business coefficients should be composed of data on value-added (i.e., sales revenue minus cost of raw materials, components, and - in the case of trading firms - purchased inventory) per hectare. While a brief attempt was made to compute value-added coefficients from the data already collected (which included the volume of firms' purchased materials), it was finally decided that no survey of the scope conducted could result in coefficients sufficiently accurate to produce reasonable land-use forecasts. The results and analysis of this survey are found in appendix "B".

A new approach was therefore called for, and it was decided to arbitrarily create coefficients that would yield the desired results. This approach amounted to "tuning" the model so that its base-year output (land-use requirements for 1970) would be compatible with known data on existing land use in the metropolitan area. This known data was derived from a land-use survey initiated by Mr. Frank Pavich, urban planning advisor to the Directorate General of Reconstruction and Urban Planning, and recently brought to conclusion under his direction. This survey, results of which are given in Table 1, had been very carefully

checked, so it was felt that it provided a more accurate basis for computing the "land-use coefficients" than did the survey of businesses and residences conducted by the DMJM/ Rasmussen economic team. The coefficients finally used, then, are as follow :

INDUSTRIAL - .0500 hectares/$VN million

COMMERCIAL - .0070 hectares/$VN million

RESIDENTAL - .0026 hectares/resident

By discarding the other coefficient and relying upon data from Mr. Pavich's land-use survey, the accuracy of the model as a forecasting tool was greatly increased.

Experimental Nature of the Model

The model is experimental in two senses. First, it is not known that a similar model has been previously created. Second, it is designed so that experiments can be made by varying the economic and demographic inputs to test alternative assumptions regarding the growth of the city and to determine their land-use implications.

Also, the model itself is not perfect. While its primary value lies in producing a methodology for analyzing the factors that help determine a city's land requirements, that methodology is subject to improvement. But the model is a first step toward

a rational planning system, and it is hoped that it will evoke sufficient interest among Vietnamese officials for it to be perpetuated. In particular, it seems that one Vietnamese skilled in the practical use of the model (i.e, the actual computer operation) should always be available to test various planning assumptions as the need arises. Further, it seems that the model should be reviewed and updated periodically (perhaps every five years). Such a process would involve a comparison of earlier inputs (mainly population and income projections) with actual developments (e.g. reported growth in population and income). Corrections could then be made that would result in more accurate forecasts.

Finally, it should be noted that to construct a system such as the one described herein would normally be a process of several years. In addition to the periodic updating recommended for the model in the future, additional work is therefore needed in the near future.

II. DESCRIPTION OF THE MODEL AND ITS CONSTRUCTION

Mechanics of the Model

The basic model input was the metropolitan population projection contained in the Metcalf and Eddy study, Year 2000 Population Projections for Republic of Vietnam and Saigon Metropolitan Area.[1/] The same rates of population growth projected for the metropolitan area as a whole were, in the present analysis, applied to each of the 20 component districts. As is the case with the land-use outputs of the model, the population inputs were for the base year 1970 and the six forecast years 1975, 1980, 1985, 1990, 1995, and 2000. Both the Saigon Metropolitan Area totals and figures for the individual districts were given.

An income projection was fed into the model, and estimated levels of savings and taxes were then substracted from income to give an aggregate demand figure for the SMA for each five-year period. This aggregate demand was divided by population to produce aggregate per capita demand, which was in turn multiplied by the population projection for each individual district to produce aggregate district demand.

1/ This study was prepared by James E. Bogle AIP for Medcalf and Eddy March 1971 under Contract No. AID-VN-86.

Aggregate demand was next broken down into industrial and commercial demand on the basis of figures published by the National Institute of Satistics on the origin of national product.[1/] The industrial category was defined to include manufacturing, construction, utilities, and transportation, while commercial was defined to include wholesale, retail, financial, and other services. The industrial and commercial demand thus obtained for each district was next multiplied by two of the land-use coefficients given in Chapter I to yield industrial and commercial land-use forecasts. The third land-use coefficient was multiplied directly by projected district population to yield residential land-use forecasts. The above steps, graphically illustrated in Table 2, thus resulted in the desired model outputs. The mathematical computer model description is found in Appendix "A".

Assemptions[2/]

Naturally the construction of the model involved the making of a number of rather abstract assumptions relating to the inter-relationships of population, various economic factors, and land-use. Since these border on the philosophical, and

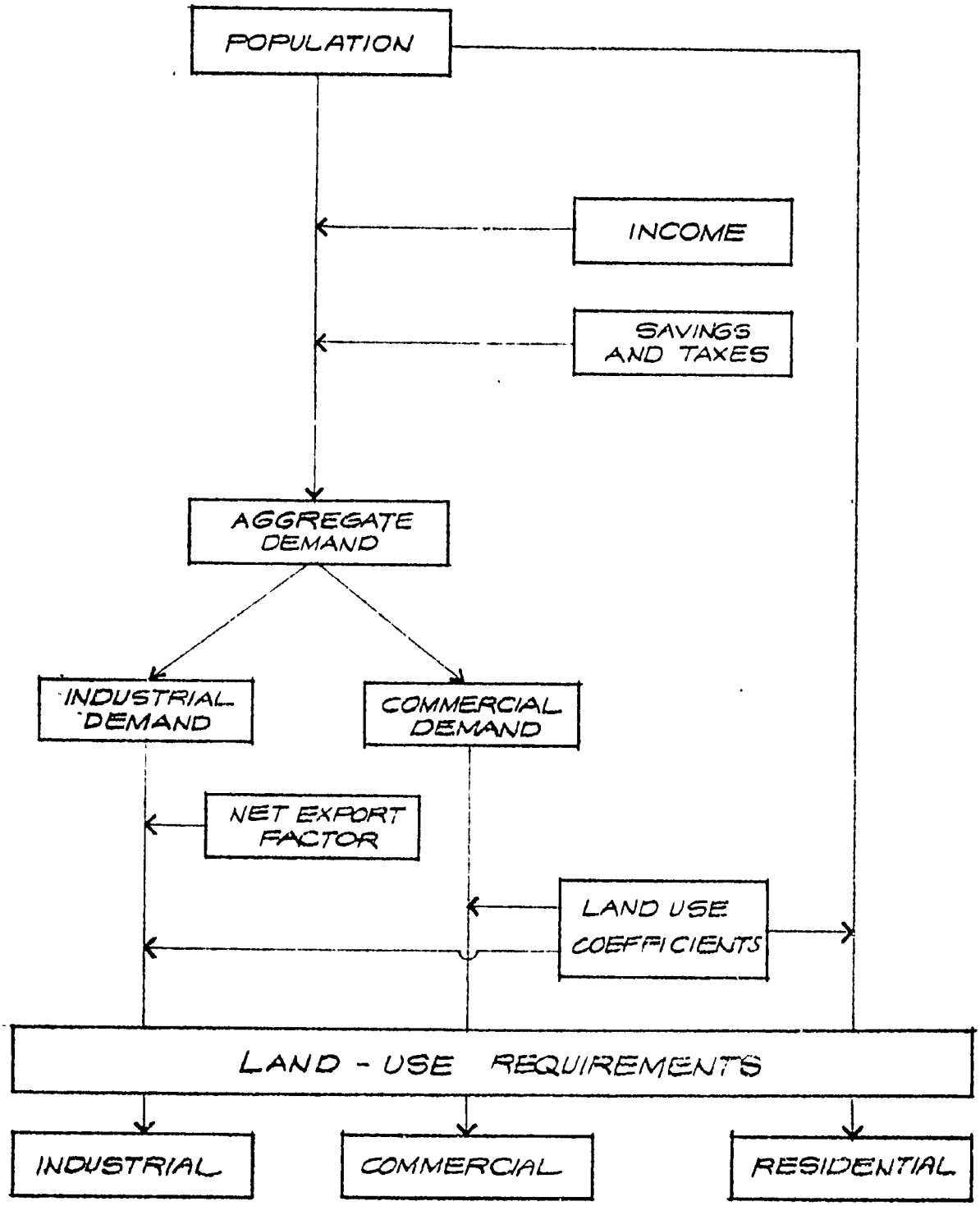
1/ See p. 268 of the Vietnam Statistical Yearbook - 1970.

2/ Many of the assumptions listed here are, admittedly, unrealistic; however, they were necessary in order to get the model operational in a short period of time.

TABLE-2

FLOW CHART

FOR LAND-USE DEMAND FORECASTING MODEL



since this is intended to be a fundamentally practical analysis, these assumptions will not be identified or discussed here. On the other hand the model contains a number of more concrete assumptions that are readily subject to identification and analytical scrutiny. Most of these, it is felt, are listed below.

1. It was assumed that the high rates of population increase predicted by the Metcalf and Eddy study would prevail. However, the computerized model can be readily re-run to test the land-use consequences of alternative population hypotheses.

2. It was assumed that the population growth rates projected for the area as a whole would apply equally well to each of the area's component districts.

3. It was assumed that each district's demand, and hence its industrial and commercial land-use requirements, would be proportional to the percentage of the area's population living in that district.

4. It was assumed that the economic inputs, while far from precise, were at least reasonable estimates of present and future economic conditions in the metropolitan area. These inputs can of course be changed in light of new or better economic data.

5. It was assumed that all commercial services provided within the SMA are consumed within the SMA. On the other hand, industrial demand was multiplied by a "net export factor" to account for supply and demand from outside the SMA.

6. It was assumed that businesses in Saigon are operating at 100% of capacity and have no excess land (i.e., a 10% increase in industrial demand should result in a 10% increase in industrial land requirements).

7. It was assumed that an increase in industrial exports [3/] to areas outside the SMA would not result in an ancillary increase in commercial services within the SMA (i.e., no "base-service multiplier" was introduced).

Accuracy of SMA and District Forecasts

Particularly because of assumptions # 2 and # 3 above, the base-year land-use outputs do not conform closely to existing patterns as reported from the recent land-use survey. Indeed, the use of the existing population distribution to allocate total SMA land-use among the individual districts is a major shortcoming of the present model; it should be corrected during "phase II". Conversely, the land-use requirements forecasted for the total SMA may be considered fairly

3/ Throughout the study, the word "exports" refers to sales outside the metropolitan area, whether they be to other areas in the Republic of Vietnam or to foreign countries.

accurate estimates, and a brief analysis of them is given in the chapter that follows.

First Population Inputs

Population inputs, as obtained from the Metcalf and Eddy publication previously cited, were as follows:

A. BASE (1970) POPULATIONS (Total: 3,690,484)

1. PREFECTURE OF SAIGON

a.	Dist. 1	-	115,500
b.	Dist. 2	-	185,700
c.	Dist. 3	-	322,200
d.	Dist. 4	-	204,600
e.	Dist. 5	-	278,700
f.	Dist. 6	-	218,200
g.	Dist. 7	-	51,200
h.	Dist. 8	-	210,600
i.	Dist. 9	-	22,800
j.	Dist. 10	-	251,400

2. GIA DINH PROVINCE

a.	Go Vap Dist.	-	416,500
b.	Tan Binh Dist.	-	402,400
c.	Hoc Mon Dist.	-	149,300
d.	Thu Duc Dist.	-	135,900
e.	Binh Chanh Dist.		63,100
f.	Nha Be Dist.	-	57,800

3. BINH DUONG PROVINCE

a. Lai Thieu Dist. * - 51,352

4. BIEN HOA PROVINCE

a. Di An Dist. * - 41,280

b. Duc Thu Dist. * - 297,852

B. POPULATION PROJECTION (ENTIRE SMA)

1. 1975 - 4,895,498

2. 1980 - 6,222,614

3. 1985 - 7,751,636

4. 1990 - 9,410,569

5. 1995 - 11,084,920

6. 2000 - 12,759,501.

Economic Inputs

The first-round economic inputs, whose derivation is described in the following section, were as follows:

A. INCOME ($VN billions)

1. 1970 - 180.8

2. 1975 - 246.5

3. 1980 - 332.9

4. 1985 - 449.6

5. 1990 - 630.6

6. 1995 - 884.4

7. 2000 - 1,240.4

* Base populations and projections for these 3 districts were provided by DMJM urban planner Fred P. Swiss.

B. SAVINGS & TAXES (As % OF INCOME)

1.	1970	-	21.6 *
2.	1975	-	21.6 *
3.	1980	-	24.0
4.	1985	-	28.6.
5.	1990	-	34.0
6.	1995	-	34.2
7.	2000	-	34.5

C. COMMERCE - INDUSTRY BREAKDOWN (% INDUSTRIAL)

1.	1970	-	43.7
2.	1975	-	46.2
3.	1980	-	48.7
4.	1985	-	51.2
5.	1990	-	53.7
6.	1990	-	56.2
7.	2000	-	58.7

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* These inputs were originally calculated as 9.3 (1970) and 21.2 (1975) and the first-round outputs of the model are, as a result, slightly erroneous. To compensate, first-round industrial and commercial land-use forecasts, as given in the next chapter, should be increased by 15%.

D. NET EXPORT FACTOR

1. 1970 - .50
2. 1975 - .60
3. 1980 - .70
4. 1985 - .80
5. 1990 - .90
6. 1995 - 1.00
7. 2000 - 1.10

Derivation of the Economic Inputs

A. INCOME PROJECTION

The Doxiadis report of January, 1965, projects an increase in Saigon's income from VN$ 32.3 billion in 1970 to VN$ 318.8 billion in the year 2000, for an increase of 987% in 30 years. This is equivalent to an average annual growth rate of 7.9%. The Joint Development Group, on the other hand, projects a GNP growth rate of 5.0% to about 1975 and about 6.0% thereafter. The Institute for Defense Analysis projects a growth in GNP from VN$ 848 billion to $VN 1347 billion over a 10-year period. This is a growth of 1.59 or 4.7% per annum. In the present case, it is most applicable to the period 1975-1985. The three projections can be integrated as follows:

5-yr. period ending	DOX	JDG	IDA	AVG.
1975	7.9	5.0	-	6.4
1980	7.9	6.0	4.7	6.2
1985	7.9	6.0	4.7	6.2
1990	7.9	6.0	-	7.0
1995	7.9	6.0	-	7.0
2000	7.9	6.0	-	7.0

The average growth rates thus obtained are not unrealistic. Impetus from the war may result in a high rate of growth for a few years, followed by a lower rate lasting as long as a decade while the economy adjusts to peacetime conditions and becomes more self-sufficient, followed by quite a high growth rate once increased domestic savings and investment occurs.

Having obtained growth rates that could be applied to SMA income (it was felt that growth rates for national or SMA income would not differ markedly from growth rates projected for GNP), it was necessary to estimate SMA income for the base year 1970. While the Doxiadis study estimated the SMA's portion of national income at 26.8% of the total,[4/] it was felt

4/ The Doxiadis study considered the SMA as being composed of only the Prefecture and Gia Dinh Province ; since then three more districts have been added, but it is felt that economic figures for the old (Doxiadis) SMA can be compared without adjustment to figures for the expanded SMA.

that because of Saigon's more dominant role today the percentage would be greater. In 1965 (the year of the Doxiadis estimate) the population of Saigon was 9.2% of the nation's total, but by 1970 it had increased to 11.0%. If Saigon's portion of the national income increased proportionally, it should have been about 32.0% of the total. Applying this percentage to a 1970 national income figure of $VN 565.1 billion (estimated from data provided by USAID), a base-year SMA income of $VN 180.8 billion was obtained. The projected rates of growth were then applied to this figure. It should be noted that the resulting estimates are for future real income and do not take inflation into account.

B. TAXES & SAVINGS

While this item is not quantitatively as significant as income, considerable detail is given on its derivation. Such detailed treatment can be justified (ex poste) on the basis that the rate of saving and taxation will be extremely important in determining the SMA's overall level of economic activity and its ability to finance urban infrastructure from public revenues.

For 1960 to 1970, the rate of domestic saving (often negative) averaged 1.9% of South Vietnam's GNP. Since national income is about 85% of GNP, and since there is no reason to believe that the rate of saving for Saigon differs from that of

the country as a whole, it may be assumed that from 1970 to 1975 Saigon will save about 2.2% of its income. Judging from the experience of other developing countries (viz., Korea), it is also reasonable to assume that the rate of savings will approximately double each five years and then level off at about 14% around 1990.

National internal tax collections increased as follows from 1966 to 1971 ($VN billions): 1966 - 12.2, 1967 - 17.2, 1968 - 19.3, 1969 - 27.3, 1970 - 37.3, 1971 - 49.1. Since about 89% of these collections were from the Saigon area, national tax collections from the SMA were estimated as follows:

	($VN billions)	(% increase)
1966	10.9	
1967	15.3	48.0
1968	17.2	12.4
1969	24.3	41.3
1970	33.2	26.8
1971	43.7	31.6

While the average rate of increase in Saigon's national taxes is thus 32%, this rate of growth should decrease to about 6% ot 7% per year, so that the growth of taxes just keeps

pace with that of income.[5] Saigon's national taxes were thus projected as follows:

($VN billions)

	Taxes (Saigon)	% of income (Saigon)
1970	33.2	18.36
1975	44.9	18.20
1980	60.6	18.20
1985	81.8	18.20
1990	114.8	18.20
1995	161.0	18.20
2000	225.8	18.20.

Added to the national taxes must be the Saigon and Gia Dinh municipal taxes,[6] which totalled $VN 1.943 billion in 1970, a 156% increase over the $VN 0.758 billion recorded in 1965. The municipal taxes are projected below on the basis of (1) a 156% increase every 5 years and (2) a constant (1.07) percentage of income.

5/ Information obtained from U.S. tax advisors in Vietnam indicates that the optimum rate of taxation is about 18.2% of income. Since Saigon's 1970 taxes exceeded this level, it appears that future increases in tax collections should focus on other areas of the country.

6/ Local taxes for the other three districts of the SMA have been omitted because the data were not readily available. It is not felt that this omission significantly affects the model's output.

	($VN billions)	
	(1)	(2)
1970	1.943	1.943
1975	3.031	2.638
1980	4.728	3.562
1985	7.376	4.811
1990	11.507	6.747
1995	17.951	9.463
2000	28.004	12.272
	74.540	42.436

Because of the heavy need for local infrastructure financing from now until the year 2000, the higher of the two projections - i.e., projection # 1 - was used. This schedule of taxation would result in municipal revenues of over $VN 250 billion ($US 600 million) over the next thirty years.

Adding together savings, national taxes, and municipal taxes, the following results were obtained:

(% of income)

	Savings	Natl. Taxes	Municipal Taxes	Total
1970	2.2	18.36	1.07	21.63
1971-75	2.2	18.20	1.23	21.63
1976-80	4.4	18.20	1.42	24.02
1981-85	8.8	18.20	1.64	28.64
1986-90	14.0	18.20	1.82	34.02
1991-95	14.0	18.20	2.03	34.23
1995-2000	14.0	18.20	2.26	34.46.

C. COMMERCE - INDUSTRY BREAKDOWN

From P. 268 of the 1970 NIS Statistical Bulletin, the following data was obtained:

($VN Millions)

	INDUSTRIAL	COMMERCIAL
1962	13.751	15.279
1963	15.129	16.539
1964	16.654	19.252
1965	21.022	22.952
1966	27.981	42.902
1967	33.674	67.430

The industrial percentage of the total is as follows:

1962	-	47.4
1963	-	47.8
1964	-	46.4
1965	-	47.8
1966	-	39.5
1967	-	33.3

The average of the six percentages is 43.7, and it was assumed that percentage was applicable to the year 1970. Further, it was assumed that the percentage of production arising from industry will increase by 2.5 percentage points during each five year period.

C. NET EXPORT FACTOR

On the basis of population and income projections for Saigon, the model was designed to project industrial demand for a number of five-year periods. However, there will be demand for Saigon's industrial output that arises outside the area and is hence independent of the number of people in Saigon or their level of income. If it were determined, for example, that large industrial firms sell 20% of their production outside the area and 80% inside, the level of internal demand should be multiplied by 1.25 or 1 + (20 ÷ 80).

On the other hand, some of the demand projected for Saigon's populace will be satisfied by industrial goods from outside the area. Since Saigon accounts for about 90% of South Vietnam's industrial production, it was assumed that most of the demand for products from outside the metropolitan area would be satisfied by imports from abroad. In computing the net export factor, it was necessary to subtract such imports from the level of Saigon's exports.

In estimating the net export factor for 1970, it was (a) assumed that Saigon's industrial firms sell 20% of their production outside the area and 80% inside. Next (b) it was estimated (hypothetically) that Saigon's industrial production

is $VN 60 billion per year.[7] Of this amount 20%, or $VN 15 billion, was assumed to be exported outside the area. (A survey by the DMJM/Rasmussen team of 24 large industrial firms revealed that they sold 32% of their production outside the metropolitan area, but this data was obtained too late to be used in the first computation of the net export factor.)

As a next step (c) it was determined from U.S. Government economic experts in Saigon that about 60% of South Vietnam's imports are manufactured goods consumed by the private sector in the Saigon area. Applying this percentage to 1970 imports of $VN 242 billion, the figure of $VN 145 billion was obtained.

In the final computation (d) it was assumed that total industrial demand from the Saigon Metropolitan Area is $VN200 billion.[8] Effective demand for industrial products from Saigon will thus be $VN 200 billion plus $VN 40 billion (exports, which are 25% of internal demand) minus $VN 145 billion (imports)= $VN 95 billion, or about 48% of the industrial demand projected.

7/ This figure appears to be fairly reasonable. As recommended later in this report, more work needs to be done with regard to estimating the level of industrial and other production in the Saigon Metropolitan Area.

8/ This is over twice as high as later estimates. Adjusting to the latter, which are felt to be more accurate, results in a 1970 net export factor of 0.40. In the next "run" of the model, this should be used as the base, 1970 factor rather than the first-round input of 0.50.

In actually determining the net export factors to be fed into the model the 48% was rounded off to 50% because of the rough nature of the computation. Further, the assumption was made that the net export factor would increase by about 10 percentage points each five years and result in a slight surplus (10%) in the year 2000. While such a progression of developments should be in line with the city's economic goals, it is, like most forecasting assumptions, rather arbitrary.

III. RESULTS AND RECOMMENDATIONS

The SMA Totals

The most significant results from the first run of the model are the projected land requirements for the entire Saigon Metropolitan Area. Tables 3 and 4 show these requirements in terms of absolute and incremental quantities, respectively, for the six quinquennial periods under consideration.

In Table 3, the industrial, commercial, and residential requirements are those projected by the model. Institutional requirements were not part of the model's output but were calculated by hand as increasing at half the rate of residential requirements (because of the heavy concentration of military and other institutional land that already exists in the SMA). The first four columns of the table represent the urban land requirements *per se*, which are projected as increasing from 20,361 hectares in 1970 to 77,765 hectares in the year 2000, an increase of 57,404 or 282%. The fourth column is labled as "other" and is composed roughly as follows: agricultural land - 72%; undeveloped land - 18%; roads, alleys, canals, etc.- 9%; utilities, transport, and storage - 1%. The 57,404 hectares projected increase in urban requirements will thus impinge upon the approximately 106,000 hectares of agricultural and undeveloped land in the area, resulting in about 50% loss to such non-urban allocations.

TABLE 3

LAND-USE REQUIREMENTS OF THE SAIGON METROPOLITAN AREA

(ABSOLUTE REQUIREMENTS IN HECTARES)

	INDUSTRIAL	COMMERCIAL	RESIDENTIAL	INSTITUTIONAL	OTHER	TOTAL
1970*	1,775	641	10,168	7,777	117,355	137,716
1975	2,647	717	13,492	9,021	111,839	137,716
1980	4,232	893	17,110	10,194	105,287	137,716
1985	6,511	1,087	21,362	11,417	97,339	137,716
1990	9,967	1,335	25,825	12,559	88,030	137,716
1995	16,148	1,761	30,448	13,689	75,670	137,716
2000	25,828	2,309	34,981	14,647	59,951	137,716

* The 1970 figures do not agree exactly with those given on page 5 because only preliminary data from the land-use survey was available at the time the model was first run. Also, the above table classifies utilities, transport, and storage as "other" rather then "industrial".

TABLE 4

LAND-USE REQUIREMENTS OF THE SAIGON METROPOLITAN AREA

(INCREMENTAL REQUIREMENTS IN HECTARES)

	INDUSTRIAL	COMMERCIAL	RESIDENTIAL	INSTITUTIONAL	TOTAL
1970-75	872	76	3,324	1,244	5,516
1975-80	1,585	176	3,618	1,173	6,552
1980-85	2,279	194	4,252	1,223	7,948
1985-90	3,456	248	4,463	1,142	9,309
1990-95	6,181	426	4,623	1,130	12,360
95-2000	9,680	548	4,533	958	15,719
TOTAL	24,053	1,668	24,813	6,870	57,404

Since geologists expect some 60,000 hectares of agricultural and undeveloped land in the SMA to be reclaimable for urban uses, the picture presented by the model is quite realistic.

Using the data from Table 3, a comparison can be made of land uses in 1970 and those projected for the year 2000. In percentage terms, these uses are as follows:

	1970	2000
Industrial	1.3	18.7
Commercial	0.5	1.7
Residential	7.4	25.4
Institutional	5.6	10.6
Other	85.2	43.6
	100.0	100.0

The above figures show that residential requirements should approximately triple over the next thirty years, keeping pace with the population growth projected by Bogle. If, however, it is deemed that the settlement pattern in Saigon is too dense (The Saigon Prefecture is reputed to be the most densely settled urban center in the world), and if remedial policies are adopted, the residential land-use requirement will increase accordingly. Institutional requirements, whose derivation has already been discussed, should approximately double.

The most surprising result of the model's first run is a projected 14-fold increase in industrial land requirements by the year 2000. One reason for this tremendous increase is the high magnitude of the industrial land-use coefficient, which is about seven times as great as that for the commercial land use. Also, the net export factor, as presently projected, results in an industrial land increase that is double what it would have been had the factor not been introduced. On the other hand, metropolitan areas in the industrialized countries of the world normally have about 5 hectares of industrial land for every 1000 in population. Thus an industrial city of 12.7 million persons (Saigon's projected population for the year 2000) should have about 63,500 hectares of industrial land. From this standpoint, the 25,828 hectares projected by the model does not appear unreasonable for Saigon.

The model projects a 260% increase in commercial land requirements. This projection may be somewhat low, since economic growth may result in land-extensive retail outlets with adjacent parking facilities. Also, the heavy growth projected for industry should tend to result in a greater increase in commercial services than is indicated by the projected increase in autonomous commercial demand.

The District Projections

As indicated earlier, the projections for individual districts are grossly inaccurate, principally because of the basic model's assumption that land uses are distributed among the twenty districts in proportion to each district's share of the total SMA population. The fallacy of this assumption, which was made for experimental purposes, is indicated in Table 5. For each type of land-use, columns A gives the 1970 land use as indicated by the model, while column B gives the actual land use as indicated by the recently-completed land-use survey. The third column in each case gives the actual land use as a multiple of the land use indicated by the model. Multiplying the year 1970 and 2000 model outputs by these figures results in the district land-use projections shown in Table 6. It is recommended that the year 2000 requirements be compared with the amount of land available for development in each district and the excess allocated in accordance with urban planning goals.

TABLE 5
1970 DISTRICT LAND-USE IN THE SAIGON METROPOLITAN AREA
(IN HECTARES)

DISTRICT*	INDUSTRIAL (A) MODEL	INDUSTRIAL (B) SURVEY	INDUSTRIAL B/A	COMMERCIAL (A) MODEL	COMMERCIAL (B) SURVEY	COMMERCIAL B/A	RESIDENTIAL (A) MODEL	RESIDENTIAL (B) SURVEY	RESIDENTIAL B/A
1.	56	6.67	.12	20	30.45	1.52	320	80.09	.25
2.	89	11.77	.13	32	47.72	1.49	512	82.76	.16
3.	155	6.13	.04	56	22.29	.40	887	247.01	.28
4.	99	28.09	.28	36	22.65	.63	565	161.54	.29
5.	134	24.28	.18	48	54.55	1.14	769	129.67	.17
6.	105	63.47	.60	38	31.02	.82	601	226.80	.38
7.	25	20.33	.81	9	3.93	.44	140	493.51	3.52
8.	101	32.79	.32	37	16.38	.44	581	240.31	.41
9.	11	3.86	.35	4	1.93	.48	63	106.00	1.68
10.	121	5.65	.05	43	20.24	.47	691	133.17	.19
11.	103	28.08	.27	37	18.14	.49	590	186.83	.32
G1.	193	135.89	.70	70	72.75	1.04	1107	1297.52	1.17
G2.	30	43.00	1.43	11	23.54	2.14	174	1068.89	6.14
G3.	28	29.48	1.05	10	15.32	1.52	160	521.45	3.26
G4.	65	217.90	3.35	24	77.88	3.24	375	1181.42	3.15
G5.	200	69.40	.35	72	67.81	.94	1149	1774.62	1.54
G6.	72	27.18	.38	26	25.37	.98	410	1159.11	2.83
B1.	25	40.30	1.61	9	7.36	.82	140	335.70	2.40
B2.	20	413.91	20.70	7	16.32	2.33	113	714.05	6.32
B3.	143	339.53	2.37	52	38.82	.75	821	2096.16	2.55
	1,775	1,543		641	614		10,168	12,237	

* Numbers 1 through 11 are for the districts of the Prefecture of Saigon. The codes for the other districts, also shown by the map on page 34, are as follows:

District Name	Code	District Name	Code	District Name	Code
Tan Binh	G1	Thu Duc	G4	Lai Thieu	B1
Binh Chanh	G2	Go Vap	G5	Di An	B2
Nha Be	G3	Hoc Mon	G6	Duc Tu	B3

SAIGON METROPOLITAN AREA

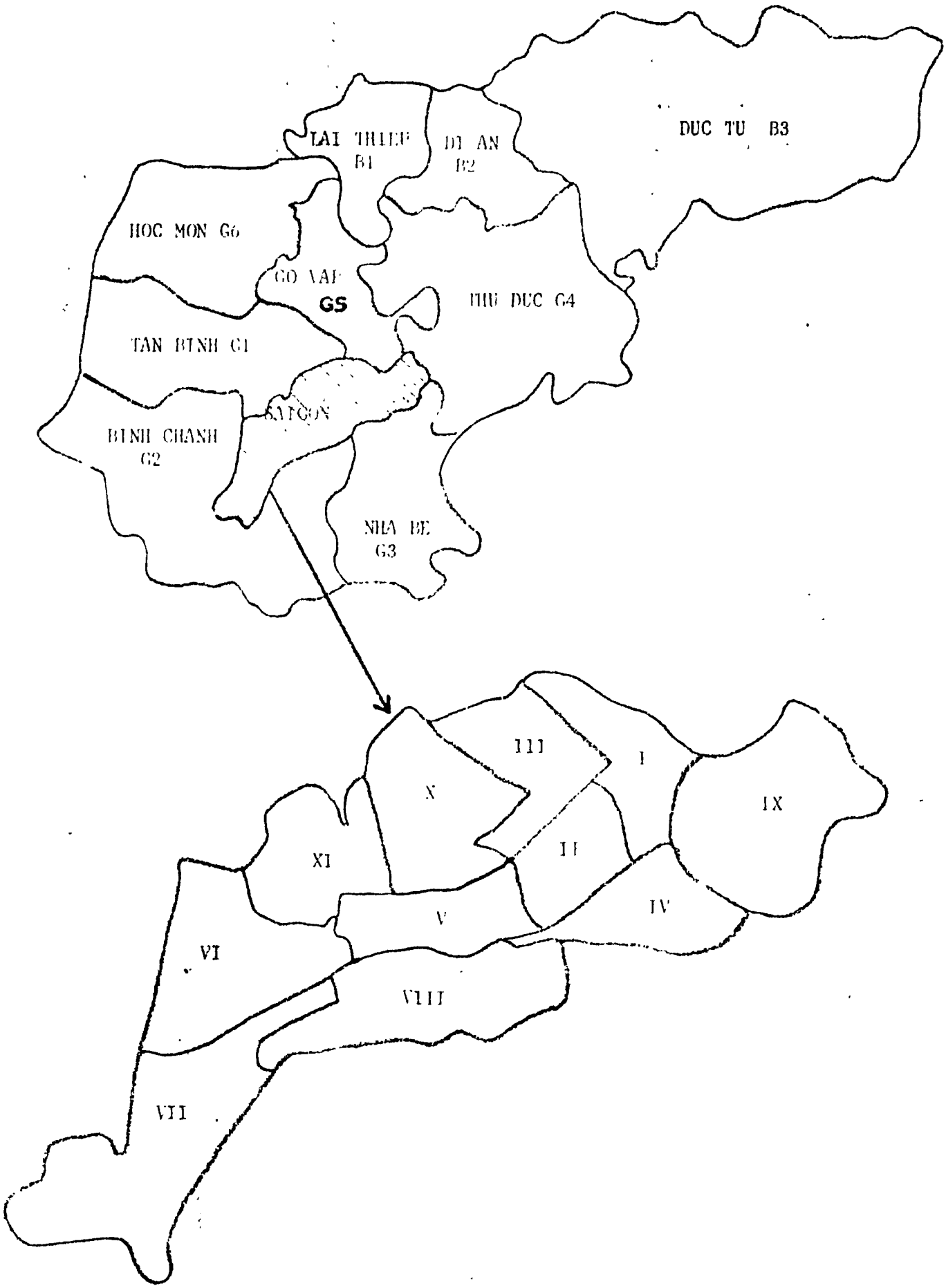

TABLE 6

DISTRICT LAND-USE PROJECTIONS
(IN HECTARES)

1970*	TOTAL	1	2	3	4	5	6	7	8	9	10	11	G1	G2	G3	G4	G5	G6	B1	B2	B3
INDUSTRIAL	1,547	7	12	6	28	24	63	20	33	4	6	28	136	43	29	218	69	27	40	414	340
COMMERCIAL	614	30	48	22	23	55	31	4	16	2	20	18	73	24	15	78	68	25	7	16	39
RESIDENTAL	12,238	80	83	247	162	130	227	494	240	106	133	187	1298	1069	521	1181	1775	1159	336	714	2096
TOTAL	14,399	117	143	275	213	209	321	518	289	112	159	233	1507	1136	565	1477	1912	1211	383	1144	2475

2000**	TOTAL	1	2	3	4	5	6	7	8	9	10	11	G1	G2	G3	G4	G5	G6	B1	B2	B3
INDUSTRIAL	22,279	97	169	90	402	353	915	285	473	54	88	405	1978	619	421	3169	1025	396	567	5917	4956
COMMERCIAL	2,212	109	174	81	81	200	112	14	58	7	74	66	263	85	55	275	246	91	25	58	140
RESIDENTAL	41,917	274	283	858	564	451	785	1677	820	348	452	650	4476	3604	2773	4035	6109	3990	1145	2402	7222
TOTAL	66,408	480	626	1029	1047	1004	1812	1978	1351	409	614	1121	6717	4306	2246	7479	7380	4477	1737	8277	12,318

* Obtained directly from land-use survey

** Obtained by multiplying model projection by factors from Table 5. Totals do not agree with those of Table 3, apparently because of rounding.

"Phase II" Recommendations

It is recommended that work on the orban planning model continue. The following are some or the specific tasks that should be accomplished:

A. Vietnamese officials should be given an on-the-spot demonstration of the computer operation used in making the land-use forecasts.

B. One or two Vietnamese technicians should be trained to carry out this computer operation themselves.

C. The various discrepancies that have become apparent from the first run of the model (e.g., 1970 land-use data that does not exactly match the final land-use survey results, two inaccurate tax and saving figures, wrong net export factor) should be corrected and revised forecast made.

D. The model should be run using alternative population projections.

E. An attempt should be made to use the model to determine what rate of population growth would result in an "optimum" urban pattern at some given future date.

F. The model should be refined so that it will produce accurate land-use projections for the individual districts of the metropolitan area. Such a step might involve the introduction of a separate set of land-use coefficients for each district, as well as independent population and income projections for each district.

G. The economic inputs of the model should be refined. In particular, it might be possible to introduce a "base-service" factor that would reflect the secondary effect that increased industrial exports should have on commercial activity. Also, instead of relying exclusively on GNP projections, it might be possible to create a sub-model that would project economic growth based on the level of public and private investment (including foreign aid).

Recommendations for Further Urban Planning Work in Saigon

A. A National Advisory Committee on Urban Planning and Regional Development should be created to guide further work in this area. The committee should consist of the Ministers of Economy, Planning, and Public Works. It should have a secretariat consisting of at least three capable Vietnamese professionals and three temporary American advisors.

B. An economic base study should be completed for Saigon. This study should analyze present industrial activity in Saigon and the probable future level of such activity. It should analyze the tax base for financing Saigon's public infrastructure requirements, and should define the relationship that exists between "basic industry" and "services" in Saigon.

C. A comprehensive land-use plan should be initiated. This plan would allocate future land requirements of the community according to sound urban planning criteria.

D. Consideration should be given to creating a Municipal Development Fund, possibly with assistance from an international lending agency. Such a fund could help alleviate the shortage of mortgage money, could handle special financing situations, and could create a reserve of land for future industrial and residential development.

E. Better economic statistics should be developed for the Saigon area.

APPENDIX "A"

SMA LAND USE MODEL

General Description

The purpose of this program is to compute land use requirements for the Saigon Metropolitan area (SMA) for the period from 1970 to the year 2000. The land use requirements are sub-divided into the three basic categories of Commercial, Industrial, and residential usage. These three categories are computed for each of the 20 districts within the defined Saigon Metropolitan Area in Addition to overall figures for the SMA.

A population projection for each district during the same period is computed and listed as one of the steps in the land use Calculations.

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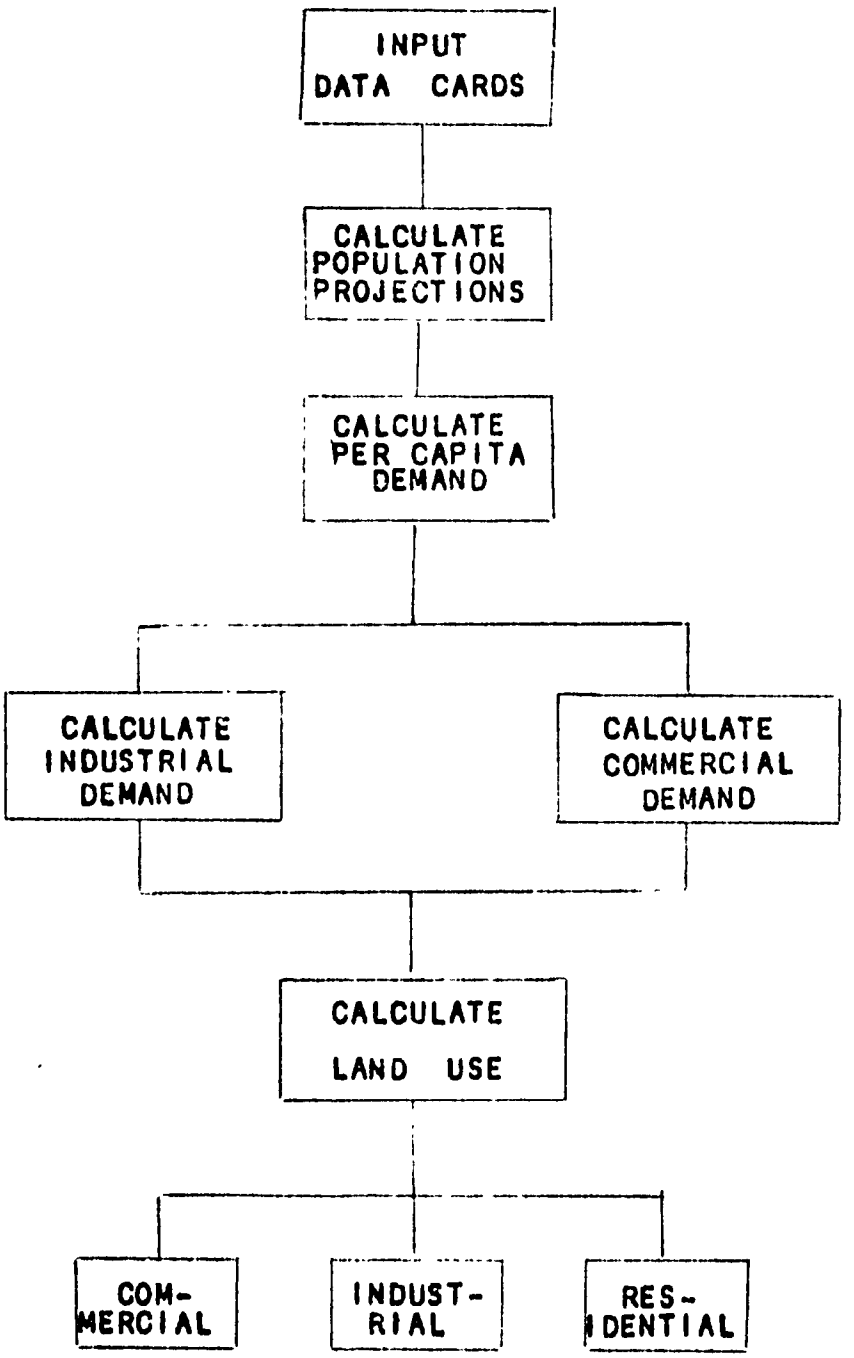
II.

FLOW CHART



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Calculations for Land Use Model

1. Population Projection

The purpose of this Calculation is to compute the population for each district given the 1970 base population figures and the rate of increase of population for each 5 year period. Total districts in the SMA is 20.

Definitions and Symbols:

Source:

Calculated

P = SMA population figure to year 2000

Pi = SMA population figure for (1) 5 year period

PDd = Each district population figure to year 2000

rdi = rate of increase of population 5 years district

Pdi = district 5 years population figure

A. Total District population (1) 5 year period

$$Pi = \sum_{d=1}^{d=20} Pdi \qquad d = \text{district, } i = 5 \text{ year period}$$

B. Population for (1) District for 5 year period.

$$Pdi = Pdi \ (rdi + 1)$$

C. Population for SMA and each District to the yr 2000

$$P = \sum_{i=1970}^{i=2000} pi$$

$$PDd = \sum_{i=1970}^{i=2000} Pdi$$

2. Saigon Metropolitan Area Demand Projection. (SMA)

The purpose of this calculation is to project demand figures for the SMA in five year increments to the year 2000 from the base year 1970.

Definitions and Symbols

ri = rate of increase of income/5 year

Ii = income for (1) SMA/5 year period

(S+T)i = Average rates of savings and taxes/5 years

D = Total demand for SMA to year 2000

Di = SMA Demand/5 year period

A. Demand projection for SMA

$$Di = (Ii + Ii\ Ri) - (S + T)i\ (Ii + Ii\ Ri)$$

$$Di = Ii\ (1 + Ri)(1 - (S+T)i)$$

$$D = \sum_{i=1970}^{i=2000} Ii\ (1+Ri)(1-(S+T)i)$$

3. Per Capita Demand

The purpose of this calculation is to produce a per capita demand figure for the SMA from the population and demand figures calculated previously for each 5 year period - (1970 - 2000).

Definitions and Symbols

PC = per capita income to year 2000

PCi = per capita demand figured/5 year period

Pi = SMA population figure/5 year period

Ii = SMA income figure/5 year period

A. Per Capita Demand for five year period

PCi = Ii/Pi

B. Per Capita Demand to year 2000

$$PC = \sum_{i=1970}^{i=2000} \frac{Ii}{Pi}$$

4. Industrial, Commercial Demand

The purpose of this calculation is to Split the aggregate SMA per capita demand projection into its industrial and commercial components by the use of a value added estimate and reduce the industrial demand by a factor for net exports.

Definitions and Symbols

Ni = Net export factor/5 year period

Vi = Value added estimate/5 year period

Ci = Per capita Commercial Demand/5 year period

Ii = Per capita Industrial Demand/5 year period

PC = aggregate SMA Demand/5 year period

A. Five year projections for SMA

Ci = Di (Vi) Commercial Demand

Ii = Di (1-Vi)(Ni) Industrial Demand

B. Total SMA Demand

$$C = \sum_{i=1970}^{i=2000} Di\ (Vi) \quad \text{Commercial}$$

$$I = \sum_{i=1970}^{i=2000} Di(1-Vi)(Ni) \quad \text{Industrial}$$

5. Land use Calculations

The purpose of this calculation is to compute the land use requirements for each district in five year increments from 1970 to the year 2000. In addition, the 5 year demand projections for each district will be calculated as an intermediate step using the per capita demand and district population figures previously calculated.

Definitions and Symbols

Idi = Industrial demand projections/5 yr period/district

Cdi = Commercial demand projection/5 yr period/district

Ii = Per capita industrial demand projection - SMA

Ci = Per capita Commercial demand projection - SMA

Pdi = District population projection/5 yr. period

Ac = Commercial land use coefficient

Ai = Industrial land use coefficient

Ar = Residential land use coefficient

LC = Land use requirements Commercial

LI = Land use requirements Industrial

LR = Land use requirements Residential

A. District Demand in Piasters

1. For one five year period/district.

Commercial = Cdi = (Ii)(Pdi)

Industrial = Idi = (Ci)(Pdi)

2. Total Demand for all 20 districts to the year 2000:

$$D = \sum_{d=1}^{d=20} \sum_{i=1970}^{i=2000} Cdi + Ddi$$

B. Land Use Requirements

a. For one five year period/district

1. Commercial

$$LCi = (Cdi)\left(\frac{1}{Ac}\right)$$

2. Industrial

$$LIi = (Idi)\frac{1}{A_I}$$

3. Residential

$$LR_i = (Pdi)\frac{1}{Ar}$$

b. Total Land Use to year 2000 for SMA

$$TL = \sum_{i=1970}^{1=2000} \sum_{d=1}^{d=20} LCi + LIi + LRi$$

MODEL INPUT PARAMETERS

UNITS

1. District Population Figures

-DDD-
Hundred
Thousand
Units

a. Base year figures

For each of the 20 districts a 1970 base year figure will be provided.

b. Rates of Increase/5 year period

-DDD-
percent
X 1000

For each of the (6) 5 year period to year 2000, a percentage rate of change based on the previous year's population will be provided.

2. SMA Income, Savings, and Taxes

a. SMA Income Base year figure.

-DDDDDDD-
Million piasters

An Income figure for the SMA for 1970 will be provided as the base year value.

b. SMA rates of Increase/5 year period

- DDDD - percent

X 1000

For each of the (6) 5 year periods to year 2000, a percentage rate of change based on the previous years income will be provided.

c. SMA rates of Savings and Taxes/5 year period

- DDD - percent

X 1000

For each of the (7) year period to year 2000, a percentage rate of change based on the previous years income will be provided.

3. SMA net export factors

-D.DD -

X 100

For each of the (7) year periods to year 2000, a factor for a rate of change based on the previous years demand will be provided.

4. Value added estimates

- DDD - percent

X 1000

For each of the (7) year periods to year 2000, a percentage rate division for industrial demand will be provided.

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APPENDIX "B"

SMA LAND DENSITY SURVEY

The purpose of this survey was to determine the existing land use densities in the Saigon prefecture for residential, industrial, and Commercial establishments. The annual sales figures for 1971 and the land area occupied by each business surveyed were recorded for industrial and Commercial establishments. Residential information included the number of occupants and the land area occupied by each residence surveyed. A total of three land use coefficients representing sales per square meter for Industrial and Commercial establishments and occupants per square meter for residences were computed from the information gathered during the survey. The coefficients were required as an input to the Saigon Metropolitan Area (SMA) land use forecasting model.

A. SURVEY METHODOLOGY

The personal interview technique was used to randomly survey a total of 900 businesses and residences in the 11 districts that are part of the Saigon Prefecture.

Figures I and II in Appendix "C" are samples of the questionaires used by the interviewers. The basic information required for each business interview consisted of the 1971 annual sales and purchase volume and the land area occupied. Essential information for residences was the number of occupants and the land area occupied.

Supporting and descriptive information such as the district number, the type of residence or business, the number of persons employed, type of employment, number of floors in the building, number of businesses in the building, and the owner's applicance assets were used to evaluate and to modulate the calculated results of the survey.

Further evaluation of the survey information was made by the use of a resurvey of selected establishments by a disinterested group not connected with the project. A second resurvey by members of the original team assigned to selected establishments surveyed by other team members, previously, was made to compare the authenticity of the information.

The survey was completed in three weeks using six Vietnamese interviewers. Approximately 425 commercial and 55 industrial establishments handling 80 different products were interviewed. A total of 410 residences were surveyed through a combination of door to door interviews and by the examination of the family book records maintained by each district.

1. Residential Scope and Results:

Six classifications of residences were used in the survey as follows:

NAME	DESCRIPTION
1. Villa	A single family detached residence surrounded by realatively large fenced and landscaped grounds.

2. **Compound-Housing** — A group of single family units, attached or detached, contained in a fenced or walled area.

3. **Small lot Housing** — A single family detached unit surrounded by a realatively small amount of usable land.

4. **Row Housing** — Attached single or multiple story common wall units constructed in a vertical direction with a single unit at the base.

5. **Apartments** — Multiple single family units with two or more units constructed in a horizontal and vertical direction.

6. **Condensed Housing** — Attached units constructed of tin sheeting, scrap wood, and paper arranged in an indiscriminate manner.

Table 1 below shows the percent distribution of the 6 types of housing surveyed compared to the percent distribution of the 6 types found in the Saigon Area as determined by the 1971 land use survey.*

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* DGRUP - Director General Reconstruction and Urban Planning

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Three out of six housing types show a close correlation between the two studies. Only small lot and condensed housing show a wide diversion. A possible explanation may be found in the interviewers' understanding of the definition of each.

TABLE 1

Housing Type	Survey Distribution	Distribution* in Prefecture
Villa	8.0	7.9
Compound Housing	1.0	0.5
Small Lot	13.1	1.0
Row	39.9	36.6
Apartment	5.1	1.6
Condensed	33.3	52.5

* DGRUP - Director General Reconstruction and Urban Planning.

Table 11 below shows the survey sampling distribution by district for the eleven districts in the Saigon prfecture. District 9 was excluded because of the realatively low population density and the rural nature of the area. The summary shows that the survey sampling probably was not performed in a random manner for the prefecture as compared with the 1971 land use survey. Only 3 districts show a comparative distribution of the number of units surveyed with the 1971 land use survey of all the residences in the prefecture.

TABLE II

Pref. District	Survey Distribution (%)	Distribution In Pref. (%)*
1	18.1	4.7
2	3.0	4.8
3	4.0	14.5
4	8.8	9.5
5	24.0	7.6
6	-0-	12.0
7	17.9	8.1
8	12.4	14.1
10	4.3	7.8
11	6.8	10.9

SURVEY COVERAGE BY DISTRICT

The result of this un-even sampling would produce a small amount of bias in the calculation of the number of residents per hectare for the prefecture as a whole. Causes of the problem lie in the difficulties of administrative control in a city wide survey of this type over a short time frame.

* DGRUP - 1971 land use survey.

Using the information gathered for 410 residential establishments a coefficient in units of occupants per hectare was computed for each. An arithmetical average was then computed for the whole Saigon Prefecture. The standard deviation of the whole sample was computed to evaluate the dispersion among the samples. The result showed a realatively small dispersion among the sample and hence a representative quantity of the average density per residence in the Saigon Prefecture. Numerical results are found below in Table III.

TABLE III

Density	Occupants/ Hectare	Standard Deviation	Avg. Variation
Residence Area Only	1570	10	1560 to 1580
For Prefecture	474	10	464 to 484

SURVEY POPULATION DENSITY

The total land area occupied by residences in the prefecture is 2088 hectares out of 6,920 hectares for the prefecture as a whole. Using this ratio to modulate the average of 1570 occupants per residence obtained from the survey, the average number of occupants per hectare for the whole prefecture is calculated as 464 to 484 as shown in Table III. This figure agrees closely with other population studies for the Saigon Prefecture.

A resurvey of residential establishments by a team of people other than the original survey group, found a very close correlation between original and resurvey results. This exercise lends further support to the calculated results.

2. Commercial and Industrial Results.

All 11 districts, with the exception of district nine, were included in the survey. Table IV shows the relative distribution for each district by percent of total establishments surveyed. A comparison of the distribution of establishments in the prefecture is made with the results of the 1971 land use survey.

TABLE IV

Prefecture District	Commercial (Survey)	Industrial (Survey)	Commercial (Land Use)*	Industrial (Land Use)*
1	27.1	8.3	7.9	3.0
2	6.8	1.6	13.5	6.9
3	12.3	8.3	11.6	5.2
4	11.1	3.3	7.3	3.6
5	18.6	18.3	19.4	20.7
6	0	5.0	10.2	17.5
7	9.6	11.6	1.1	3.7
8	6.6	30.0	7.8	11.4
10	5.2	3.3	10.9	7.5
11	3.1	10.0	9.8	20.5

* DGRUP - 1971 Land Use Survey.

SURVEY COVERAGE BY DISTRICT

While all districts were covered during the survey the sampling distribution is markedly different from the 1971 land use survey. The effect of this should be small on the results of the survey as the location of establishment by district is not considered significant for sale in the prefecture.

The ratio distribution of Commercial and Industrial establishments was found to compare favorably with the land use survey. The proportion appears to be in the range of 15 to 25 percent of all establishments are classified as industrial.

3. Methodology for the Commmercial and Industrial Land Use Coefficient:

The purpose of the survey of industrial and commercial establishment was to calculate a constant or coefficient for each activity which represents an average sales volume per hectare for the Saigon Prefecture. These constants were then used as an input to the Land Use forecast model.

The constant for each establishment interviewed was calculated using the following empirical equation.

A = Commercial or Industrial Land Use Coefficient in (Piasters/hectare).

S = 1971 sales volume (piasters).

T = Total land area occupied (meters).

F = Total area of one floor in the building (meters).

P = Total floor space occupied (meters).

N = Number of floors in the building.

P = Material purchases in 1971 (piasters).

$$A = \frac{S-P}{T \times \frac{P}{F} \times \frac{1}{N}}$$

The equation is used to calculate a coefficient for one establishment at a time. It is valid for each establishment under these condition:

a. Single or multiple businesses in the same building at one location.

b. A single business with multiple buildings at the same location

c. A single business with several locations.

In all 3 conditions, (P) may range from a partial floor usage to the total number (N) of floors in the building, (T) always equals the total land area (grounds around building plus building area) occupied, (N) is the total number of full floors in the building, (F) is the area of one full floor. (S) and (P) are self-explanatory. In condition (b), P, F, and N are set to I. In condition (c), P, F, and N are set to 1 and T equals the sum of the land areas for the multiple locations.

The coefficients for each business surveyed were calculated and a mean for the entire data set was computed along with the standard deviation as a measure of the dispersion of each coefficient about the mean. The results are summarized in Table V.

The standard deviation in Table V is a realatively small value compared with the average. Some considerations contributing to a variation in magnitude of separate coefficients are:

a. Businesses located in multiple story buildings with a sales volume that is comparable to single storied establishments.

b. Different types of businesses along with different magnitudes of sales volume and material purchases.

c. Different land use areas for similar types of businesses because of residential or other uses combines with the business.

TABLE V

Type	No. Surveyed	(Piasters/Hectare) x 10^6	
		Coefficient for Prefective	Std. Deviation
Industrial	55	23	9.79
Commercial	425	30	0.14

CALCULATED SURVEY RESULTS

The computed coefficients show that commercial establishments are more efficient at land use than industrial establishment, and the ratio of sales to land use area is more uniform.

4. Resurvey Results:

The information gathered during a second check on selected establishments covered during the initial survey showed such a wide variance from initial results in virtually every answer from every establishment resurveyed that the validity of the calculated answers are subject to question. This problem is present in all undeveloped countries where records are inadequate or non-existant and fear of tax reprisals are present. Phase II of the study will draw a comparison of survey results with income tax figures, for selected establishments, from the Director of Taxation.