Office of the National Economic and Social Development Board

BMR STUDY

Bangkok Metropolitan Region Development Study

INTERIM REPORT

August 1985

NESDB/USAID/IBRD/ADAB

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SUMMARY

1. The Interim Report summarizes the progress to date on the Bangkok Metropolitan Region Development Study. It describes a physical development and financing program for the transportation, water resources and housing sectors. Because major portions of the analysis are incomplete at this time, including the studies of land, housing finance, employment and finance, the program proposed here and the analysis which underlies it are very tentative.

2. Rough estimates of the investment required during the Sixth Plan Period total 103,000 million baht, of which roughly 48,000 million baht will come from public resources. 46,000 million baht is projected for the housing sector of which 39,000 million baht would be private. The transportation total of 40,500 million baht would include 5,000 million baht of private investment. 9,000 million baht allocated to water supply and nearly 6,700 million for flood control are not expected to include any private investment.

3. Bangkok is concluding a period of high population growth rates and entering a period of more moderate rates of growth which will, however, continue to yield large absolute increases in population. As a consequence of the effects of expanding economic and educational opportunities on migration, more than half of Thailand's urban population live in the BMR. Commerce and other indicia of urbanization are similarly concentrated in Bangkok.

4. The urbanized area has also been expanding rapidly from its relatively compact profile in 1974 but will in the future spread more slowly as undeveloped areas within the city fill in.

5. The regional housing stock and the number of households have doubled over the past decade while the population has increased by about 85 percent. Within the BMA, the area devoted to residential land use has increased at an average annual rate of 11 percent compared with 6.1 percent for households and housing units. New residential development is concentrated in the north-south belt which extends from Bang Khen to Muang Samut Prakan, excluding the older core areas such as Pomprab, Patumwan, Bangrak, Dusit and Thonburi. Similarly, slum development by the informal sector is moving out from the inner core to the suburbs where land is less expensive and more available.

6. Industrial expansion has been primarily in the north and northeast although moderate expansion occurred on the wastern side of the river in Ratburana, Pasicharoen, Bangkuntien and Nongkaem. The inner core showed declining amounts of land devoted to industry. The main factor determining future industrial land use patterns will be the location of

infrastructure. Land prices may also be important. Rapid increases in commercial land use occurred in the central area and in Phyathai, Bangrak and the innermost areas of Phrakanong and Bangkapi.

7. These development patterns have been the unplanned consequence of the widespread construction of primary roads and highways without attendant local roads. This lack of a developed network has forced urban expansion into ribbons along the major transportation arterials.

8. The population of the BMR increased from 6.8 million in 1980 to 8.0 million in 1985. 1990 population will be about 9.0 million, increasing to 11.3 million in 2000. Recent patterns of growth will continue in the near future with current high growth amphoes continuing to get the bulk of future development.

9. In the transportation sector, the analysis thus far has been mostly confined to the STTR Study Area and particularly to the problems of inadequate public transport, an incomplete road hierarchy, uncoordinated public investment policies and congestion.

10. Inadequate public transport is the result of an aging and not always safe bus system for which demand nevertheless exceeds capacity, in part because fares have been set at artificially low rates. The fact that the BMTA is unable to set realistic rates makes replacement of buses uneconomic without capital subsidies even if purchase credit at 4% is available. The BMTA is therefore unable to operate within the prescribed rate ceiling while providing a service of sufficient quality, frequency and coverage to satisfy demand.

11. Leaving aside this fundamental difficulty, some improvements in service could result from a staged privatization of BMTA routes, the construction of segregated busways, the extension of express services and improved management. The effective implementation of these changes will only be possible if the current BMTA procurement plans are modified to reduce the number of new buses to be procured in order to make room for increased privatization.

12. The road hierarchy is incomplete at all levels, including missing links in the primary system, but is most severe at the secondary, distributor and access levels. These deficiencies increase journey distances and congestion.

13. The lack of coordination in transportation planning results from the fact that investment proposals for buses, rail systems, freight distribution, expressways and roads originate in a variety of government agencies and state enterprises. There is no overall transportation strategy for the BMR in the light of which such proposals can be evaluated.

14. Congestion, particularly in the central area of Bangkok, is caused by the fact that traffic demand at peak hours exceeds road space, resulting in long trip times and slow average speeds. Road space in the most congested areas cannot possibly keep up with potential effective demand from private vehicles within realistic budget constraints, in part because public investment in roads subsidizes demand. The Second Stage Expressway will increase the potential for central area congestion. Projected increases in motor vehicle ownership, particularly of private cars, will also enhance potential demand. Demand is reduced somewhat by congestion, pollution and other effects of demand, so that at some level of inconvenience, traffic volumes reach a natural limit. This level, however, is not acceptable, because the city operates too inefficiently at the consequent traffic speeds.

15. Therefore, some means of managing demand is required. A variety of measures were examined and rejected. Land use controls cannot yet be used to control traffic volumes because they will not be sufficiently enforced. Parking controls cannot be used to control traffic volumes because there is too large a surplus of spaces. Some demand reduction measures such as school buses fail because they reduce demand only from one segment of the market. Suppressed demand from other segments will expand to fill any road space vacated by such efforts. Metering systems were rejected because the use of electronic identification and recording devices is considered impractical in Bangkok at the present time. Car pools require highly regular commuting patterns; the members of the pool should live and work close to each other and should all start and finish work at the same time every day; conditions in Bangkok are not favorable; car pools are most successful when there is an incentive such as exemption from parking fees or road tools, but there is no opportunity for this in Bangkok. Staggered working hours are not proposed because in Bangkok working hours are already widely staggered and journey distances are often long. If further staggering were possible, which is far from certain, given the high traffic volumes over the whole day, it would probably have little impact. Higher and differential fuel taxes and vehicle licensing fees and rationing systems were also examined and rejected.

16. The conclusion is that in the congested areas demand for road space must be reduced by selling the right to use it in the form of tolls. Proposed here is a Traffic Improvement Program (TRIP) which reduces demand and generates revenues by collecting 10-60 baht tolls from vehicles entering the defined congested area (roughly, the area bounded by Silom, Wittayu, Sri Ayuthaya and the Chao Phraya River. Users will not be willing to accept such fees unless the proceeds are used to increase the efficiency of transportation within the congested areas. The revenue generated by TRIP would therefore be used for roughly 8,000 million baht in projects including a proposed Lat Phrao-Phet Kasem mass transit line and nine bridge and road projects.

17. Reduction of realized demand for road space will allow improvements to bus services by reducing congestion and freeing road space for segregated busways. This will increase the use of buses, lower their operating costs, improve safety and, therefore, increase the number of people who can be transported into and out of the inner area.

18. In the event TRIP is not approved or implemented during the Sixth Plan period, a basic program of improvements which assumes a level of funding equal to 125 percent of the level in the 1980-84 period has been proposed. This program will require a budget of 40,500 million baht during the Sixth Plan period of which 14,500 million baht is public. 13,100 million baht of public investment is required for the STTR study area, leaving 1,400 million baht for investment in the outer areas. Detailed analyses of project proposals for these parts of the region have yet to be analyzed although truck terminals and town road systems (for Nakhon Pathom, Samut Sakhon, and Pathum Thani) and a number of highway projects have been advanced by other agencies. Detailed consideration of these proposals is deferred to the final report.

19. Implementation of TRIP would permit a 22,500 million baht program, which is about twice the 1980-84 investment level. The difference in costs between the basic program and a programs which includes TRIP would be entirely borne by the intended beneficiaries of the schemes.

20. In the water resources sector the primary problems are flooding, inadequate water supply and quality, and land subsidence. These problems are interrelated because the extraction of ground water in areas where the piped supply is inadequate accelerates land subsidence which in turn aggravates flooding problems by inhibiting drainage and lowering flood barriers. On the other hand, the management of river flows to achieve flood protection objectives can seasonally reduce the supply and quality of water available to BMR treatment facilities.

21. Unfortunately the most serious land subsidence and flooding problems are geographically focused in the areas where most of the region's people and businesses are located and where new growth is most likely to occur. This area is mostly on the eastern side of the Chao Phraya River and includes all of Bangkok's core area. Most previous, current, and planned flood protection projects concentrate on this region where the econonic returns on investment are highest. The strategy has been to construct the outer flood dike to give protection to 1,400 Km^2 of the metropolitan area, and then to develop local drainage and flood barriers within the outer dike on the eastern side. A western bypass canal has also been proposed as a means of reducing river levels in the Chao Phraya and, more importantly, providing a drainage channel for core areas on the western side of the river.

22. The overall program for flood protection includes five projects: Phase I of the City Core project (which has a 1986-90 construction period); the eastern suburban project (1988-2000); the West Bank Bypass (1986-94); river bank diking (1987-91); and improvements in Samut Prakan Province (1986-90). The total capital costs of these projects is estimated to be 25,800 million baht of which 6,700 million baht will be expended during the Sixth Plan period. No private sector investment is expected.

23. If land subsidence is not controlled, much of the public investment in flood protection could be lost as dikes sink and drainage to the sea becomes increasingly contra-gravity. No capital outlays are required except to the extent that the expansion of piped water supply into areas where subsidence is a problem is an essential part of a successful program to reduce legal and illegal groundwater extraction. From an administrative standpoint, the Department of Mineral Resources is charged with a phased enforcement of statutory restrictions on groundwater utilization.

24. The water supply problem is greatly aggravated by the fact that 40 percent of treated water is lost in the system. Rehabilitation or replacement of existing lines is therefore an important part of the proposed program. The Sixth Plan objective is to reduce losses to 30 percent. Other elements of the program include: construction of a pumping station at Sam Lae; expansion of the Bang Khen and Samsen treatment plants; installation of 34.6 km of transmission mains, 90 km of trunk mains, and 920 km of secondary and service mains. In addition the Phase I Stage II project which is currently underway will provide service to 150 km^2, primarily in areas with critical land subsidence problems. In areas out the BMA, PWA is planning to rehabilitate the existing distribution system of the 2 waterworks in Patum Thani in order to reduce water leakage. It also plans to rehabilitate the existing underground wells to raise their production. No improvement plan is envisaged at the moment for water supply systems in Nakorn Pathom and Samut Sakorn.

25. The total estimated cost of proposed water supply projects is 10,350 million baht of which 9,000 million baht are scheduled for the Sixth Plan period. No private sector investment in water supply is expected.

26. In the housing sector, substandard housing and related infrastructure have been identified as an important problem. Between 1974 and 1984 the number of households living in slums and squatter settlements increased from 104,000 to 152,000 but the percentage of all households in such areas declined from 23.5 percent to 18.5 percent. At the same time, the share of the large-scale developer has increased from 4.2 to 14.9 percent and the public sector share has risen from 2.1 to 9.1

percent. Houseownership increased rapidly, more than doubling between 1970 and 1980. In spite of these signs of expanding affordability of housing, an increasing number of household cannot afford unsubsidized formal sector shelter.

27. A second problem is the inefficient allocation of public housing resources. Public housing programs other than slum-upgrading have primarily benefitted middle-income households because it has not proven possible for the NHA to enforce its income eligibility standards. GHB credit programs were not intended to and do not concentrate on low-income households although a significant number of such households manage to qualify for GHB loans.

28. A third problem has been the inadequate supply of developable land. For land to be developed it must be served by infrastructure. But the price of land increases radically once infrastructure is installed unless the amount of serviced land on the market approximates the demand. In Thailand, even serviced land tends to be kept off the market so it would be difficult, within realistic budget constraints, for government to provide enough serviced land to reduce market prices. To relieve this problem, government should accompany its infrastructure programs with anti-speculation taxes or land consolidation schemes to encourage in-fill development.

29. Private formal and informal development will continue to provide roughly 85 percent of new dwellings in the BMR, with the formal sector increasing its share as long as real incomes continue to rise. The primary role of the public shelter should be to encourage these trends by investment in residential infrastructure, reducing development standards and providing positive or negative incentives for development by owners of serviced property.

30. The housing sector analysis is largely incomplete at this point because results from the housing finance and land studies are not yet available. It is assumed in the Interim Report that NHA will continue its housing construction programs at the rate of 10,000 units p.a. and that the BMA will accept half the responsibility for funding the slum-upgrading program. On this basis, the capital investment of 46,600 million baht required for Sixth Plan period housing development will come mostly (85 percent) from private sources, with the balance to be received almost entirely from the NHA.

31. Revenues to finance this program are proposed to come in a decreasing proportion from central government tax receipts and increasingly from user charges collected by local governments and state enterprises and from local government taxes. Tax efficiency improvements are anticipated to triple municipal revenues to 5,550 million baht during

the plan period. New revenue sources are expected to add as much as 25,650 million baht of which about half is attributable to TRIP and other highway tolls. Other new revenues will come from fees and taxes on the transfer of real property, house and rent taxes, development fees, a flood protection fee on benefitting properties, an increased vehicle registration fee and a business tax surcharge.

CONTENTS

	Page
Summary	i
List of Tables	
List of Figures	
List of Abbreviations	
Introduction	1
Chapter 1 Recent Growth Patterns	3
1.1 Gross Historical Trends	3
1.2 Development Patterns	4
1.3 Residential Development	6
1.4 Industrial Land Use	7
1.5 Commercial Land Use	7
1.6 Summary	7
Chapter 2 Population and Employment Projections	9
2.1 Population	9
2.2 Employment	11
2.3 Conclusions	13
Chapter 3 Transportation	17
3.1 Problems	17
3.2 Proposed Development Strategy	32
3.3 Development Guidelines	33
3.4 Proposed Projects	33
3.5 Investment Requirements	52
3.6 Conclusions	53
Chapter 4 Water Resources	55
4.1 Problems	55
4.2 Proposed Development Strategy	64
4.3 Policy Guidelines	64
4.4 Proposed Projects	65
4.5 Conclusions	73
Chapter 5 Housing	75
5.1 Problems	75
5.2 Proposed Development Strategy	82
5.3 Development Guidelines	82
5.4 Program Proposals	84
5.5 Conclusions	86

	Page
Chapter 6 Sources of Finance	87
6.1 Background	87
6.2 Measures to Increase Revenue	91
6.3 Distribution of Financing Responsibilities	94
6.4 Conclusions	
Chapter 7 Preliminary Investment Analysis	100
7.1 Introduction	100
7.2 Preliminary Results	101
7.3 Information Sources and Assumptions	103
7.4 Issues	104
Chapter 8 Issues	123
8.1 Principles and Assumptions	123
8.2 Projections	123
8.3 Structure	124
8.4 Issues Remaining	126
Annex 1	130

List of Tables

		Page
2.1	BMR Population Projections 1980-2000	12
2.2	BMR Employment Forecast, 1985-2000	16
3.1	Average Traffic Speeds and Vehicle - Kilometers of Travel	27
3.2	Growth Projections 1984-2001	18
3.3	Peak Period Traffic Growth to Central Area	19
3.4	Investments Proposed by DOH, 1985-1991	36
3.5	Summary of Agency Investment in STTR Area	52
3.6	Summary of Agency Investment in BMR	52
4.1	Flood Characteristics 1964-1984	56
4.2	Characteristics of Water Services	63
4.3	Flood Protection Proposals	65
5.1	Housing Census Summary Bangkok Metropolitan Region	76
5.2	Housing Stock by Type of Housing Projects in BMA 1974-1984	77
5.3	Housing Stock by Type of Housing Units in BMA 1974-1984	77
5.4	Number Private Housing Projects in 1974-1984	78
5.5	The Changes in Slum Development in BMA	79
6.1	Growth of Income and Population Selected Asian Countries	87
6.2	Revenue Projections for the Sixth Plan Period	95.
7.1	Total Capital Investment Program	107
7.2	Foreign and Local Components: Capital Improvements Program	108
7.3	Principal Sources of Fund for Total Capital Investment Program	109
7.4	Disbursement of Total Capital Investment by Main Sources	110

List of Tables

		Page
7.5	Responsibility for Total Capital Expenditure by Agency	111
7.6	Government Foreign Loan Drawdown Schedule	112
7.7	Government Repayment of Foreign Loan and Interest	113
7.8	Flood Control Investment Program	114
7.9	Water Supply Investment Program	115
7.10	Transport Sector Projects	116
7.11	Transport Sector Investment Program	117
7.12	Transportation Sector Program Agency Source of Funds and Responsibility for Expenditures	118
7.13	Housing Sector Investment Program	119
7.14	Financial Data Availability for Each of the Sectors	120
7.15	Investment Demand and Public Resource Supply	121
7.16	Investment Analysis Data Requirements	122
Annex 1		
1-A	Forecast Value of 1985 Value Added by Sector	130
1-B	BMR Employment Forecast, 1985-2000	131-134

List of Figures

		Page
1.1	Bangkok Population Growth: 1953-1983	3
1.2	BMR Growth 1974-1984	5
2.1	Absolute Population Change by District 1980-2000	16A
2.2	Population Density and Growth Rate by District 1980-1990	16B
2.3	Population Density and Growth Rate by District 1990-2000	16C
3.1	Primary Roads	22
3.2	Secondary Road: Area 1 (Central)	24
3.3	Secondary Roads: Area 2 (Northwest)	25
3.4	Secondary Roads: Area 3 (Northeast)	26
3.5	Secondary Roads: Area 4 (Southeast)	27
3.6	Secondary Roads: Area 5 (Southwest)	28
3.7	Investment Program: Roads, Highways and Bridges	35
3.7A	Highway Investment Options	35A
3.8	Busway and Rail Mass Transit Option	40
3.9	Toll Zone	49
4.1	Water Supply Serviced Area	62
4.2	Flood Protection: Existing	67
4.3	Flood Protection: Future Plan	68
8.1	Likely Development Bangkok Metropolitan Region	125
8.2	Corridor Development Bangkok Metropolitan Region	127

LIST OF ABBREVIATIONS

BB	Budget Bureau
BCD	Building Control Division
BMA	Bangkok Metropolitan Administration
BMR	Bangkok Metropolitan Region
BMTA	Bangkok Mass Transit Authority
CCSD	Construction Control and Supervision Division
CIPO	Centre for Integrated Plan and Operation
CMD	Construction and Maintenance Division
CPD	City Planning Division
DD	Design Division
DOH	Department of Highways
DLT	Department of Land Transport
DPP	Department of Policy and Planning
DPW	Department of Public Works
DTCP	Department of Town and Country Planning
ETA	Expressway and Rapid Transit Authority of Thailand
ETO	Express Transportation Organization of Thailand
HD	Harbour Department
MOC	Ministry of Communications
MOF	Ministry of Finance
MOI	Ministry of Interior
MPB	Metropolitan Police Bureau
MSTE	Ministry of Science, Technology and Energy
MWA	Metropolitan Waterworks Authority
NESDB	National Economic and Social Development Board
NHA	National Housing Authority
NSC	National Safety Council
NSO	National Statistics Office
NWRC	National Water Resources Committee
OCMRT	Office of the Committee for the Management of Road Traffic
OFP	Office of Fiscal Policy
ONEB	Office of the National Environmental Board
OPM	Office of the Prime Minister
OPP	Office of Policy and Planning
OPS	Office of Permanent Secretary, BMA
PD	Police Department
PWA	Provincial Waterworks Authority
PWD	Public Works Department
RWLD	Right of Way and Land Division
SRT	State Railway of Thailand
TD	Treasury Department
TED	Traffic Engineering Division
TPD	Traffic Police Division

ATC	Area Traffic Control
BMT	Bus Mass Transit
LRT	Light Rail Transit
MTS	Mass Transit System (heavy-rail)
SSES	Second Stage Expressway System

INTRODUCTION

This Interim Report on the Bangkok Region Development Study summarizes those portions of the analysis completed to date and describes an emerging congruence of various sectoral development frameworks. The resultant physical development concept is presented in Chapter 8. The basic demographic and economic analyses comprise Chapters 1 and 2. They show a slowing rate of growth of population and households as a consequence of declines in both fertility and net migration. Nevertheless, in absolute terms, Bangkok will continue to grow fairly rapidly during the Sixth Plan period. Employment projections, and therefore population projections, are made somewhat uncertain by current economic difficulties which could dramatically affect the region.

Chapters 3, 4 and 5 are summaries of more detailed analyses prepared by sectoral teams and their consultants in three critical areas: transportation, water resources, and housing. It is here that the similarity of the development assumptions underlying each of the sectors becomes apparent, with the development of the road network emerging as the most important local determinant of development distribution, constrained more generally by the limits of flood protection facilities on the eastern side of the Chao Phraya. Although not a significant limit in the past, water supply may become moderately important if restrictions on ground water extraction are better enforced because such restrictions will compel reliance on public water supplies. At the current level of generality of the study, there do not appear to be major inconsistencies among the various sectors. Accordingly, the remaining sectoral work will emphasize a more detailed consideration of the physical development schemes and the population and economic projections.

Chapters 6 and 7 assess the financial and macro-economic implications of the physical development proposals. This analysis is necessarily tentative at this time, both because of uncertainties in the infrastructure schemes and because much of the financial and economic analysis remains to be done. Nevertheless, the discussion in those chapters serves to establish orders of magnitude of costs and to raise a host of issues concerning the financing of the program. It is these issues which will be the focus of the balance of the study.

Finally, Chapters 9 and 10 attempt to assess the issues which require further investigation prior to the preparation of the final report and present a number of recommendations for the future conduct of the study.

The purpose of the interim report is to offer tentative answers to the four major questions proposed in the original Terms of Reference for the BMR study developed jointly by the World Bank and the NESDB. Those four questions were presented as follows:

1. Over the next five to fifteen years, what will be the magnitude and composition of the growth of the BMR in terms of population and economic activity?

2. Within the BMR, where is growth likely to occur? How will the new growth of population be distributed? How will employment in manufacturing, commerce, and services be distributed? How will public and private development costs vary by location within the BMR?

3. Given the magnitude and distribution of growth, what sectoral investments should have priority, with particular reference to the urban transport, housing, water supply and flood protection network?

4. How will it be possible to pay for the priority investments and other committed projects? How should institutions be designed to coordinate the investments and service provision?

Comprehensive planning for Bangkok has been going on more or less continuously since the late 1950's when the first general plan was prepared. Neither that plan nor any of its successors has ever been formally adopted or implemented. These plans have assumed that development should be controlled through the regulation of land use. However, there does not appear to have been much agreement among either policy-makers or citizens concerning the need for zoning or related controls. For this reason, the approach taken here emphasizes the use of public investment in infrastructure to guide development. That this is feasible is demonstrated by the recent pattern of development in the region. Nevertheless, some modest regulatory impositions may be required for the proposed plan to succeed. The regulation of groundwater extraction and restrictions on development in certain critical flood areas are prominent examples.

Particularly in view of the concentration in this study on financing, a major concern has been the recent trends in the national economy. It now appears that at least the early years of the Sixth Plan period will be marked by slower growth than have recent years. The preliminary examination of the effects of slower growth on the BMR has led to important policy assumptions in the interim report. In general, the notion adopted here is that those people and businesses who can be shown to directly benefit from public services and facilities will pay an increasing share of the costs of such services. The effects of this shift on particular categories of households will be an important topic of the final report.

Chapter 1

RECENT GROWTH PATTERNS

1.1 Gross Historical Trends

Bangkok is concluding a period of high rates of growth of population and entering a period of more moderate rates of growth which will, however, continue to yield large absolute increases in population. The urbanized area has also been expanding rapidly but should in the future grow more slowly.

In 1782, when Bangkok became the capitol of Thailand, it is estimated to have had a population of approximately 400,000 and an urbanized area of 3.5 square kilometers. In the next century and one half, the city's population increased slowly to reach 890,000 in 1937 and one million in 1953. As shown in Figure 1.1, growth since then has been extremely rapid as a consequence primarily of high fertility and migration rates. Population has increased during the period 1937-1983 by more than 500 percent to its current total of more than 5 million. Even more dramatically, the urbanized area has increased to more than 500 square kilometers.

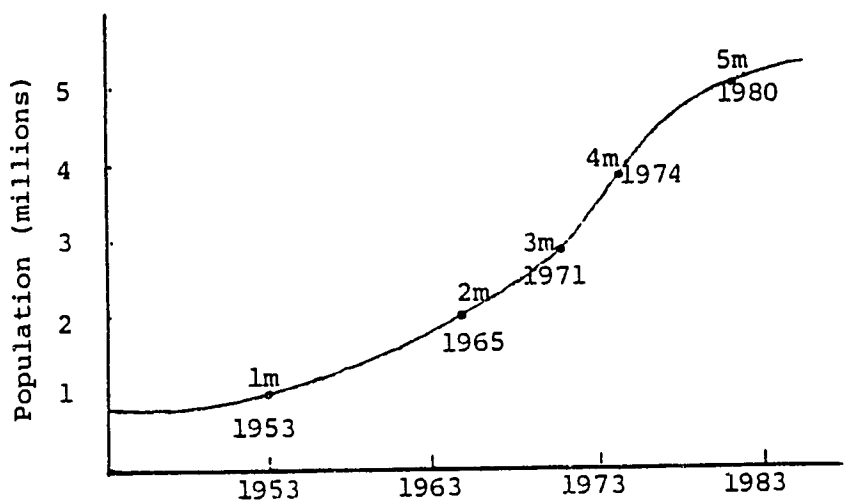


Figure 1.1: Bangkok Population Growth: 1953-1983

As a consequence, more than half the urban population of Thailand and 10 percent of the total population live in the Bangkok Metropolitan Region. Some indication of the primacy of the capitol in the development of the country can be seen from the following:

* In 1983, 32 percent of gross domestic output was generated in Bangkok and about half of value added;

* 38 percent of Thailand's industrial firms are located in the BMA and about 45 percent in the BMR.

* More than 90 percent of the country's imports and exports pass through the Port of Bangkok;

* Per capita incomes are about 2.5 times the national average;

* Electricity consumption is roughly 5 times the national per capita mean;

* Per capita motor vehicle registrations and telephone connections are 3.5 and 5.4 times the national averages.

* The population of the Bangkok urbanized area is about 30 times larger than that of the Chiang Mai area. It was about 23 times larger in 1950.

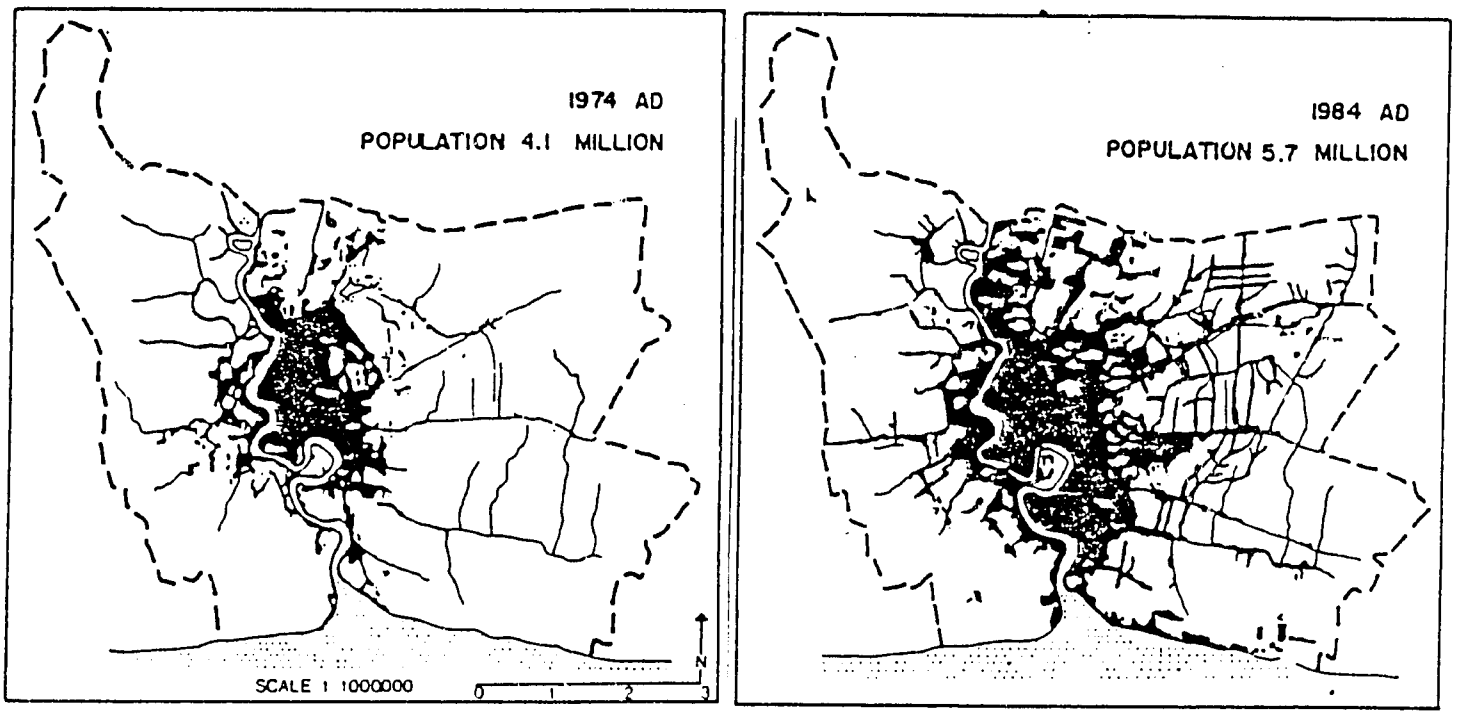
These indicators are consequences primarily of the fact that Thailand's increasing industrialization has been concentrated in Bangkok. The employment opportunities created by this modernization of the economy have been the primary inducement for migration from rural areas, particularly the North East. The extent of this change in the structure of the national economy is shown by the fact that the share of agriculture in overall output declined from 40 percent in 1960 to 25 percent in 1980 while industry was increasing from 19 to 29 percent and services rose from 41 to 46 percent. A second important attraction has been the relative quality of education in Bangkok, particularly at the university level.

1.2. Development Patterns

Aerial photographic surveys of the Bangkok region done in 1974 and 1984 provide a detailed record of the type, quantity and distribution of

development during the decade. Even at the scale shown in Figure 1.2, dramatic changes are observable.

Figure 1.2: BMR Growth 1974-84



The contrasting form of the two images illustrates what has been often noted about Bangkok's development -- it has increasingly been determined by the location of roads. From a relatively compact and dense city with a fairly clear profile, Bangkok has grown spindly, and without much regard for the efficient use of public resources. Large vacant areas lie among thin ribbons of development along major roads around the older dense core.

While it is common to blame the absence of land use controls for this spurt of inefficient development, that theory cannot, without more, explain the compact 1974 profile which developed in a similar regulatory environment. Perhaps a more credible explanation can be constructed on the coincidence of three trends during the decade ending in 1984. Firstly, population, employment, households and commercial development all increased at rates which radically exceeded historic trends. Secondly, the quality, quantity and extensiveness of public and private transportation improved greatly as BMTA and private transport companies expanded and as rising real household incomes encouraged private ownership of motorcycles and cars. Thirdly, road development emphasized the construction of major roads and highways with very little attention to secondary and lower level roads.

Thus, what appears to have happened is that an unprecedented increase in population combined with rising incomes and effective demand to create a huge market for residential, commercial and industrial facilities. These facilities could only be located along roads which, given the emphasis on major arteries, meant outward expansion along radial highways. From the standpoint of private developers and their customers, this sort of development has been economical because the cost of the far-flung infrastructure necessary to service it has, for the most part, not been borne by them.

1.3 Residential Development

As described in Chapter 6, the housing stock of the region has doubled over the past decade while population has increased by about 85 percent. However, the number of BMR households has also doubled as household size has decreased. Both the housing stock and the number of households grew at a 6.1 percent rate during that period.

The location of new housing is also changing. Both slum/squatter housing and new formal sector construction are increasing fastest in the north-south belt which extends from Bang Khen to Muang Samut Prakan. These trends are expected to continue through the Sixth Plan period. The general development pattern coincides with the planned development of infrastructure described in Chapter 4 and 5.

Between 1968 and 1979, residential area in the BMA increased from 41.5 to 114.3 square kilometers, an annual growth rate of 11%, higher than the rate of population growth. This high rate of consumption of land is due to both to the increase in population and the relocation of population from high density areas to areas of lower densities. That this development has been mostly outwards is indicated by the fact that the gross density of the urbanized area declined from about 55,000 persons/km^2 in 1970 to 10,000 persons/km^2 in 1979.

Declines in residential land use occurred in the old densely populated areas - Pomprab, Patumwan, Bangrak and Dusit, on the Bangkok side, and in Thonburi district on the Thonburi side. Increases in residential use occurred in all directions, but the main thrust of expansion was in the direction of Bangkapi, Bangkhen, and Minburi in the north, Muang Samut Prakan and Phrakanong to the south and east of the BMA. Lesser development occurred in Latkrabang and Nongchok in the same direction. However, increases in residential land use on the Thonburi side were also substantial - e.g. Nongkhaem, Bangkuntien and Pasicharoen. Since 1980, with the improvement in the urban road network, it is possible that residential land use has been increasing more evenly in the fringe area of the BMA.

Similarly, slum development by the informal sector is moving out from the inner core, where many slums have been converted to more profitable uses, to the suburbs where land is less expensive and more available.

1.4 Industrial Land Use

Total industrial land use increased 7.6% between 1968-70. This is slightly below the rate of growth of manufacturing production and slightly above that of manufacturing employment. The main thrust of industrial land use expansion is in Latkrabang, Minburi and Bangkapi in the north and northeast. However, the old industrial areas on the Thonburi side also expanded. Ratburana, Pasicharoen, Bangkuntien, and Nongkhaem showed expanded industrial land use, while such uses diminished in Thonburi, Klongsan and Bangkok Noi.

Reduction in industrial land use on the Bangkok (eastern) side has been small in absolute terms, but represents a large proportional change.

The land requirements of modern industry are generally greater than that of the small scale industries which make up much of the BMA industrial sector. It can be expected that industrial land use in the central areas will stabilize if not decline, while increasing amounts of land will be converted to such uses in certain suburban areas, particularly those served by major transportation arteries.

The main factor determining future industrial land use patterns will be the location of infrastructure. It is possible, although it remains to be demonstrated, that land prices will be a limiting factor.

1.5 Commercial Land Use

Overall, land devoted to commerce and banking increased by 4%, compared with increases in output and employment of 4% in commerce and 12% in banking. Thus, some intensification of land use must be underway, as well as an extensive expansion of business activities.

Rapid increases in commercial land use occurred in the central area on the Bangkok side and in Phyathai, Bangrak, and the innermost areas of Phrakanong and Bangkapi. On the Thonburi side, rapid increases also occurred, but the absolute area of the land involved is still fairly small.

1.6 Summary

The development pattern described in general terms above has been virtually unplanned. Although the construction of roads has been the most important determinant of the spatial orientation of development of all kinds, there has been little apparent attempt by the agencies responsible for road design and construction to assess or evaluate the growth-inducing effects of planned projects. Nor do these agencies seem to have paid much attention to the various proposed general plans for the region, none of which, in any case, has ever been approved. From that standpoint, development has been arbitrary.

From the point of view of the development entrepreneur, of course, there is nothing at all casual about the location of new construction. Market considerations which apply equally to residential, commercial and industrial projects require immediate access to roads. Consequently, a highway built for the purpose of connecting Bangkok with distant points becomes an unintended ribbon of development. Soon, of course, the people and businesses occupying the ribbon come to expect water, telephone, bus flood protection and other public services.

The rapidly growing regional and national economies have allowed such growth to be accommodated over the past decade without regard for marginal costs. But recently imposed fiscal restraints require a more careful look at the opportunities for using public sector investments in infrastructure to guide future development to those parts of the region where it can be most efficiently serviced.

Chapter 2

POPULATION AND EMPLOYMENT PROJECTIONS

This chapter summarises population and employment projections for the BMR[1/] and the spatial distribution of population by amphoe from 1980 to 2000. Detailed distributions of employment by amphoe will be provided in the final report.

2.1 Population

2.1.1 Methodology

The cohort component method was used to project population by changwat and the curve fitting and varied ratio methods are used to project population by small area (amphoe and tambon in the BMA and amphoe in five surrounding changwats). Information on the amount of developable land, the location of infrastructure and known housing projects has been used to cross check with the projections and to adjust the projections where appropriate. Projections will be revised to incorporate new developments such as the flood control areas east of the city and projections of employment locations as the study proceeds.

2.1.2 Assumptions

2.1.2.1 Mortality

The expectation of life at birth by sex is used to determine the survival ratios by sex and age from the West Model life table. The infant mortality rates (by changwat) are estimated indirectly from the 1980 Population Census and adjusted to make them compatible with the results of the Survey of Population Change, 1974-1976. Since the five surrounding changwats have about the same infant mortality rates, all somewhat higher than those of Bangkok Metropolis, only two sets of life expectancy at birth are assumed: one for the Bangkok Metropolitan Area, and one for the other five changwats.

Between 1985-2000, the life expectancy at birth is assumed to increase every five year phase, but at a decreasing rate, and differences between sex to gradually diminish.

2.1.2.2 Fertility

The Own Children Method is used to estimate total fertility rates and age specific fertility rates for each changwat within the BMR. These rates are derived from the 1980 Population Census. The Survey of Population Change 1974-1976 and the Contraceptive Prevalence Survey 1984 served as guideline in adjusting the estimates.

1/ Bangkok Metropolitan Area plus Nonthaburi, Samut Prakan, Nakhon Pathom, Pathum Thani and Samut Sakhon

The total fertility rate for each changwat is assumed to decline at a decreasing rate and to be constant after it reaches the level 1.6 for the BMA and 1.7 for the rest of the BMR.

Different sets of assumptions concerning the total fertility rate have been used in the test run to project total population; however, only slight variations result from the different impacts. This might be due to the fact that the total fertility rates in the region are very low, approaching replacement levels. Therefore, the changes in the rates over the next ten to fifteen years under various assumptions, can not be much different from each other. For this reason, only one set of total fertility rates and age specific fertility rates for each changwat are assumed.

2.1.2.3 Migration

The base year (1980) migration rates by sex and age for each changwat within BMR are calculated from the 1980 Population Census. Two alternative assumptions are made regarding the migration trends:

(i) Net migration over the next fifteen years will occur at a lower rate than in the past. According to this assumption, net migrants into BMR would increase by five percent every five year phase and migration trends within BMR would be redistributed away from BMA and Samut Prakarn. The shares of net migration into these two changwats would decline five percent every five year phase.

(ii) Net migrants into the region will increase about the same rate as in the past (1965-1980). In this case the net migrants into BMR would increase ten percent every five year phase and the migration within the region would be the same as specified in alternative A.

The first of these alternative assumptions reflects government policy to reduce migration to the BMA and to redistribute population and economic activities into other cities and regions. In any case, migration rates computed from the 1970 and 1980 Population Census show a slow down in migration rates into the region, especially in the BMA and Samut Prakarn. Population data presented in this section are in accordance with Migration Assumption A.

2.1.3 Population Projections 1980-2000

The population of the BMR 1/ was estimated to be approximately 6.8 million in 1980 2/, or about 13 percent of the

1/ Bangkok Metropolitan area including Nonthaburi, Samut Prakan, Nakhon Pathom, Pathum Thani and Samut Sakhon.

2/ Benchmark data in accordance with 1980 Population Census, adjusted to make compatible with revised population estimates (Revised estimates of 1980 Population of Thailand, NSO, 1983.

national total. By 1985, BMR population had increased to approximately 8.0 million; it is projected to increase to about 9.0 million in 1990, and 11.3 million by 2000. These represent growth rates of approximately 2.9% (1980-85), 2.5% (85-90), 2.1% (90-95), and 1.8% 95-2000. (Table 2.1). The general patterns of urban development indicated in Chapter 1 are expected to continue, with the bulk of new growth occuring in fast growing and transitional areas to the east and northeast of central Bangkok. See Figure 2.1. Between 1985 and 2000, the population of the combined areas of Yan Nawa, Dusit, Huai Khwang, Phra Khanong, Bang Khen, Bang Kapi, Muang Samut Prakarn and Phra Pradaeng, for example, are expected to grow by some 1.8 million and account for about 50% of total BMR growth. This is likely to place considerable pressure on proposed flood protection zones and may require government intervention in the form of infrastructure planning and other control and incentive mechanisms, including the encouragement of development in the surrounding provincial centers in such a manner as to promote high levels of self containment.

An examination of current and projected densities of amphoes for which high and low growth rates are forecast shows that although the densities of the high growth amphoes will nearly double on average, they will remain at relatively low levels. For example, Amphoe Pom Prap Sattru Phai, a slow growing district, had a 1985 density of 90,000 persons per square kilometer. That density is expected to increase to 95,386 persons/km^2 by 2000. Bang Kapi, which will add more population than any other BMR amphoe over this period had a 1980 density of 2170 persons which will increase to only 4778 persons/km^2 in 2000. This compares with a mean density of the urbanized portion of the BMR of about 10,000 persons/km^2.

2.2 Employment Projections

A fundamental aim of the BMR study is to provide the planning basis necessary to accommodate economic activity in the region. At this point in the study, only changwat level forecasts have been completed in the employment study so a good deal of additional analysis will be required.

Summary results of employment forecasts include:

BMA: Agriculture is forecast to decline. Manufacturing is also forcast to decline in absolute terms, though it will still account for around 200,000 jobs by the year 2000. In contrast, growth of employment is forecast for all other sectors, which are, broadly speaking, "service" activities. Total employment is expected to reach 2.5 million by the end of the forecast period, compared with the figure of 2.0 million from the 1980 population Census.

Samut Prakarn: As in the case of Bangkok, agriculture is forecast to decline as a result of further urban expansion encroaching on

TABLE 2.1

	Population 1000's					Rate Growth %				Distribution of Population %					% of Population Growth				Density: Person 1000 Sq. Km.		
	1980	1985	1990	1995	2000	90-85	85-90	90-95	95-2000	1980	1985	1990	1995	2000	80-85	85-90	90-2000	1985-2000	1985	1990	2000
BMA																					
1. Pra Nakhon	114.9	108.4	107.9	109.6	109.6	-1.2	-0.1	0.3	-	1.7	1.4	1.2	1.1	1.0	-0.6	-0.1	0.1	n.a	19.5	19.5	19.8
2. Pom Prap Sattru Phai	177.7	172.0	174.9	181.1	184.2	-0.7	0.3	0.7	0.3	2.6	2.2	1.9	1.8	1.6	-0.5	0.3	0.4	0.4	89.0	90.6	95.4
3. Pathum Wan	215.5	206.6	213.7	225.7	233.9	-0.8	0.7	1.1	0.7	3.1	2.6	2.4	2.2	2.1	-0.8	0.6	0.9	0.8	24.7	25.5	28.0
4. Samphan Thawong	72.6	69.8	70.7	72.8	73.7	-0.7	0.3	0.6	0.2	1.1	0.9	0.8	0.7	0.6	-0.2	0.1	0.1	0.1	49.3	49.9	52.1
5. Bang Rak	121.8	137.7	153.1	165.7	174.1	2.5	2.2	1.6	1.0	1.8	1.7	1.7	1.6	1.5	1.5	1.4	0.9	1.1	24.9	27.7	31.5
6. Yan Nava	362.3	422.7	400.6	533.4	582.8	3.1	2.6	2.1	1.8	5.3	5.3	5.2	5.3	5.1	5.6	5.2	4.5	4.7	11.5	13.0	15.8
7. Dusit	446.3	503.5	562.4	622.7	681.9	2.4	2.2	2.1	1.9	6.5	6.3	6.2	6.1	5.0	5.3	5.3	5.3	5.3	22.7	25.3	30.7
8. Phaya Thai	401.6	529.4	565.7	592.0	610.4	1.9	1.3	0.9	0.6	7.0	6.6	6.3	5.8	5.4	4.4	3.3	2.0	2.4	31.7	33.9	36.6
9. Huai Khwang	192.1	233.4	275.3	315.5	358.6	4.0	3.4	2.8	2.5	2.8	2.9	3.0	3.1	3.2	3.8	3.6	3.7	3.7	10.3	12.1	15.8
10. Phra Khanong	498.4	587.1	675.6	760.7	839.9	3.3	2.5	2.4	2.0	7.3	7.4	7.5	7.5	7.4	8.2	8.0	7.2	7.5	4.1	4.7	5.9
11. Bang Khen	367.4	491.8	609.8	710.3	808.9	6.0	4.4	3.1	2.6	5.3	6.2	6.7	7.0	7.2	11.5	10.7	8.8	9.4	2.5	3.6	4.8
12. Bangkapi	244.0	377.4	497.9	604.0	710.1	9.1	5.7	3.9	3.3	3.5	4.7	5.5	6.0	6.3	12.3	10.9	9.4	9.9	2.5	3.3	4.8
13. Nong Chok	47.9	52.4	56.3	60.4	64.7	1.8	1.5	1.4	1.4	0.7	0.7	0.6	0.6	0.6	0.4	0.3	0.4	0.4	0.2	0.2	0.3
14. Min Buri	52.8	61.8	71.3	82.0	93.9	3.2	2.9	2.8	2.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.0	0.9	0.4	0.4	0.5
15. Lat Krabang	40.7	47.8	55.3	63.6	73.1	3.3	2.9	2.8	2.8	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.7	0.4	0.4	0.6
16. Thonburi	248.6	268.5	284.9	297.8	307.9	1.6	1.2	0.9	0.7	3.6	3.4	3.1	2.9	2.7	1.8	1.6	1.0	11.2	31.1	33.0	35.7
17. Klong San	133.7	139.8	144.6	148.1	149.8	0.9	0.7	0.5	0.2	1.9	1.8	1.6	1.4	1.3	0.6	0.4	0.2	0.3	23.1	23.9	24.8
18. Bangkok Noi	334.4	302.8	406.1	424.6	438.9	1.6	1.2	0.9	0.7	5.2	4.8	4.5	4.2	3.9	2.6	2.1	1.4	1.7	16.4	17.4	18.8
19. Bangkok Yai	96.1	104.2	111.4	117.8	123.3	1.6	1.9	1.1	0.9	1.4	1.3	1.2	1.2	1.1	0.7	0.6	0.5	0.6	16.9	18.0	20.0
20. Bang Khun Thian	193.8	234.1	276.6	319.2	360.1	3.9	3.4	2.9	2.4	2.8	2.9	3.1	3.1	3.2	3.7	3.8	3.7	3.7	1.3	1.5	2.0
21. Phasi Charoen	176.7	202.8	240.4	267.5	293.5	3.5	2.8	2.2	1.9	2.6	2.4	2.7	2.6	2.6	3.1	2.8	2.3	2.5	3.9	4.5	5.4
22. Taling Chan	640	78.1	94.2	113.2	135.7	4.1	3.8	3.7	3.7	0.9	1.0	1.0	1.1	1.2	1.3	1.5	1.8	1.7	1.0	1.2	1.7
23. Rat Burana	100.9	131.9	153.4	172.2	190.1	3.9	3.1	2.3	2.0	1.6	1.7	1.7	1.7	1.7	2.1	1.9	1.5	1.7	3.1	3.6	4.4
24. Nong Khaem	40.5	52.8	67.5	84.4	102.9	5.5	5.1	4.6	4.0	0.6	0.7	0.7	0.8	0.9	1.1	1.3	1.6	1.5	1.1	1.4	2.1
SUB-TOTAL	4852.6	5603.8	6349.5	7044.3	7702.1	2.9	2.5	2.1	1.8	70.7	70.5	70.1	69.2	68.0	69.4	67.4	59.5	62.2			
Nakhon Pathom																					
25. Muang Nakhon Pathom	192.3	218.9	246.7	277.3	309.7	2.6	2.4	2.4	2.2	2.8	2.7	2.7	2.7	2.7	2.5	2.5	2.8	2.7	0.4	0.5	0.6
26. Nakhon Chaisri	82.7	89.1	95.1	101.2	107.1	1.5	1.3	1.3	1.1	1.2	1.1	1.0	1.0	0.9	0.6	0.5	0.5	0.5	0.3	0.3	0.3
27. Sam Phran	84.0	93.4	102.9	113.2	123.7	2.2	2.0	1.9	1.8	1.2	1.2	1.1	1.1	1.1	0.9	0.9	0.9	0.9	0.4	0.4	0.5
28. San Len	78.5	83.3	87.0	88.9	89.8	1.2	0.9	0.5	1.5	1.1	1.0	1.0	0.9	0.8	0.5	0.3	0.4	0.4	0.2	0.2	0.2
29. Kamphaeng Saen	75.2	81.0	87.3	95.8	99.1	1.5	1.5	1.9	0.7	1.1	1.0	1.0	0.9	0.9	0.5	0.6	0.5	0.5	0.2	0.2	0.3
30. Don Tom	32.2	37.1	42.4	47.5	52.5	2.9	2.7	2.3	2.0	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.4	0.5	0.2	0.3	0.3
Nontha Buri																					
31. Muang Nontha Buri	169.6	212.2	258.2	317.2	391.2	4.6	4.0	4.2	4.3	2.5	2.7	2.8	3.1	3.5	3.9	4.1	5.9	5.3	2.8	3.4	5.1
32. Bang Wa Thong	35.7	39.4	42.4	45.4	49.0	2.0	1.5	1.4	1.6	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4
33. Pak Kret	78.0	95.5	115.0	139.5	167.9	4.1	3.8	3.9	3.8	1.1	1.2	1.3	1.4	1.5	1.6	1.8	2.3	2.1	1.1	1.3	1.9
34. Bang Kruai	44.9	51.5	57.9	65.3	73.0	2.8	2.4	2.5	2.3	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.9	1.0	1.2
35. Bang Yai	28.8	30.5	33.0	34.9	37.3	1.1	1.6	1.1	1.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.4
36. Sai Noi	25.6	28.8	31.7	35.0	39.0	2.4	1.9	2.0	2.2	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.2
Pathum Thani																					
37. Muang Pathum Thani	61.6	70.6	80.7	92.3	106.9	2.8	2.7	2.7	3.0	0.9	0.9	0.9	0.9	0.9	0.8	0.9	1.2	1.1	0.6	0.7	0.9
38. Sam Khok	30.0	32.8	35.5	38.2	44.1	1.8	1.6	1.5	1.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.4	0.3	0.3	0.4	0.4
39. Lat Lum Kae	28.6	31.6	34.8	38.2	42.2	2.1	1.9	1.9	2.0	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2
40. Thanyaburi	69.9	74.3	81.9	113.6	141.9	4.4	4.3	4.3	4.6	0.9	0.9	1.0	1.1	1.3	1.3	1.6	2.2	2.0	0.7	0.8	1.3
41. Lam Luk Ka	50.3	59.7	70.7	84.0	100.9	3.5	3.5	3.5	3.8	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.3	1.2	0.2	0.2	0.3
42. Khlong Luang	69.5	86.8	108.0	134.5	168.9	4.6	4.5	4.5	4.7	1.0	1.1	1.2	1.3	1.5	1.6	1.9	2.7	2.4	0.3	0.4	0.6
43. Nang Sua	32.2	37.1	42.7	49.2	57.4	2.9	2.8	2.9	3.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.6	0.1	0.1	0.1
Samut Prakarn																					
44. Muang Samut Prakarn	236.0	288.3	340.0	411.2	490.0	4.1	3.8	3.4	3.6	3.4	3.6	3.8	4.1	4.3	4.8	5.4	6.3	6.0	1.0	1.2	1.7
45. Pra Pradaeng	148.5	182.6	222.2	267.6	315.3	4.2	4.0	3.6	3.6	2.2	2.3	2.4	2.6	2.8	3.2	3.6	4.1	3.9	2.8	3.4	4.9
46. Bang Phli	71.9	84.7	98.7	114.4	130.7	3.4	3.1	3.0	2.7	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.4	1.4	0.3	0.3	0.4
47. Bang Bo	46.4	50.2	53.4	56.3	58.9	1.6	1.3	1.1	0.9	0.7	0.6	0.6	0.6	0.5	0.4	0.3	0.2	0.3	0.2	0.2	0.3
Samut Sakorn																					
48. Muang Samut Sakorn	125.6	141.8	161.0	182.1	210.4	2.6	2.5	2.5	2.9	1.8	1.8	1.8	1.8	1.9	1.5	1.5	2.2	2.0	0.3	0.4	0.5
49. Krathum Baen	59.0	69.9	83.1	99.0	119.6	3.5	3.5	3.6	3.9	0.9	0.9	0.9	1.0	1.1	1.0	1.2	1.6	1.5	0.5	0.6	0.9
50. San Phaeo	71.4	75.5	79.8	86.0	92.9	1.1	1.1	1.5	1.6	1.0	0.9	0.9	0.9	0.8	0.4	0.4	0.6	0.5	0.3	0.3	0.3
SUB-TOTAL	2018.6	2349.6	2710.1	3124.8	3625.7	3.1	2.9	2.9	3.0	29.3	29.5	29.9	30.8	32.0	30.6	32.8	40.4	37.8			
TOTAL	6871.2	7953.4	9059.6	10169.1	11327.8	3.0	2.5	2.3	2.2	100%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0			

agricultural land. Manufacturing employment continues to increase. Other sectors increasing their employment are electricity, transport, trade, banking and public administration. Service employment is forecast to show a decline.

Total employment by 2000 is forecast to be approximately 311,000; this is an increase compared with the 1980 Population Census figure of about 221,000.

Nonthaburi: Total employment is forecast to be approximately 35,000 by the year 2000, and quite evenly spread between agriculture, manufacturing and the other industries. However, when compared with the 1980 Population Census figure of 169,001 the total employment forecast shows a dramatic fall.

The difference can be attributed to the reduction in agricultural employment and also lower levels of employment in other sectors. The most likely cause of the divergence is the fact that the Population Census is a residence-based total, while the forecast is derived from value added, which is counted at the work place. Further work will be necessary to reconcile the difference between the two sources.

Pathumtani: Forecasts show continued growth in agricultural employment. However, manufacturing employment also increases rapidly to become the largest employment sector by the year 2000. The trade sector is also forecast to expand rapidly. Total employment is just under 200,000 by 2000, an increase of 20 percent from the 1980 Population Census figure of 167,000.

Samutsakorn: The forecast shows a rapid decline in agricultural employment -- a reflection of the problems faced by the fishing industry in the province. Manufacturing and trade are forecast to become the major sources of employment on account of its proximity to Bangkok and "spill over" effects.

Nakornpatom: Agricultural employment is forecast to decline, while the manufacturing sector continues to expand. Other sectors are also forecast to offer increasing employment. However, the discrepancy when compared with 1980 Population Census is considerable. By the year 2000 the forecast showed total employment of only 137,008, while the 1980 Census indicated employment of 279,000. Comparing only non-agricultural employment, the 1980 Census figure was 107,000, while the forecast for 2000 is only 35,000.

2.3 Conclusions

2.3.1 Population

In preparation for the final report, several potential inconsistencies need to be resolved. Firstly, neither of the Changwat level population projections agree with the small area projections,

although the projections based upon the 5 percent migration assumption are close. Secondly, consistency among these projections and the population assumptions of each of the sectors should be checked by the population team. Thirdly, the amphoe level projections of population and employment (when they become available) should be compared to determine their agreement. Finally, the sieve analysis prepared by the NHA should be compared with the population and employment figures to determine whether the proposed development scheme will require any changes in the projections of population distribution.

Ideally, population projections should be in a range limited by: (1) the population and distribution of population if present policies and trends continue; and (2) projections based on the proposed scheme. Some discussion of the local and national circumstances which might affect actual future population growth and distribution would also be helpful.

2.3.2 Employment

The analysis completed to date provide a preliminary basis for consideration of technical policies for the fringe areas of BMR. However, more comprehensive analysis is required, and more data are being analyzed regarding employment and output relationships at more disaggregated levels. The current lack of corresponding output and employment data is a major handicap.

In addition, these projections should be interpreted in the context of a national economy in which the structure of production has shifted much more rapidly than the structure of employment. That is, while industrial and service output has been increasing much more rapidly than agricultural output, the share of the labor force working in agriculture has decreased only marginally.

In any case, the analysis of available data suggests that the data base is not adequate to support an elaborate theoretical framework. In this respect, the econometric modelling work is considered to utilize the data quite fully. However, modifications to the present model specification might be useful to explore alternative relationships.

The assumptions to be used in the forecasting exercise are of crucial importance to achieve overall integration of the study and comments on the assumptions and the adjustments made to obtain the forecast are invited.

Future work will include:

- Preparation of small area employment forecasts, using a provincial employment/location distribution matrix.
- Review of output forecasting equations.

- Review of output-employment equations, to be disaggregated at the province level.

- The employment sector needs to be clearly coordinated with the population sector (amongst others) and particular attention needs to be given to fulfilling the original TOR. Further, detailed tabulation of existing (1985) employment distribution/job opportunities and past trends by small area need to be prepared and related to population distribution i.e. potential work force.

- Distributions of employment and economic activity for each of the planning years must be undertaken and alternative methods used, and their results compared. If an interactive land use (population) and employment model is not utilized, trip tables from the transport sector may provide a useful starting point. The results should be carefully compared with population distribution.

- Land use analysis and trends require detailed spatial tabulations and should be related if possible to jobs/employment.

TABLE 2.2

BMR EMPLOYMENT FORECAST, 1985-2000

SECTOR	Employment x 1000				Distribution %				Rate of change%				% of Growth			
	1985	1990	1995	2000	1985	1990	1995	2000	85-90	90-95	95-20	85-20	85-90	90-95	95-20	85-20
Agriculture	130.8	139.7	155.8	176.6	11.3	10.0	8.9	7.7	1.32%	2.20%	2.53%	2.02%	3.8%	4.6%	3.9%	4.1%
Mining																
Manufacturing	409.4	453.3	477.8	487.8	35.4	32.6	27.4	21.4	2.05%	1.05%	.41%	1.17%	18.9%	6.9%	1.9%	7.0%
Construction	89.2	122.3	163.6	215.0	7.7	8.8	9.4	9.4	6.51%	5.99%	5.61%	6.04%	14.2%	11.7%	9.6%	11.2%
Electricity	17.6	22.4	28.1	35.4	1.5	1.6	1.6	1.6	4.94%	4.63%	4.72%	4.76%	2.1%	1.6%	1.3%	1.6%
Transport	101.3	123.7	183.3	298.0	8.7	8.9	10.5	13.1	4.07%	8.18%	10.20%	7.45%	9.6%	16.9%	21.4%	17.5%
Banking	84.3	88.9	93.7	99.9	7.3	6.4	5.4	4.4	1.06%	1.05%	1.28%	1.13%	2.0%	1.4%	1.1%	1.4%
Services	325.2	440.0	640.5	966.7	28.1	31.7	36.8	42.4	6.23%	7.79%	1.08%	7.53%	49.4%	56.9%	60.8%	57.2%
TOTAL	1158.0	1390.3	1742.9	2279.4	100%	100%	100%	100%	3.72%	4.62%	5.51%	4.61%	100%	100%	100%	100%

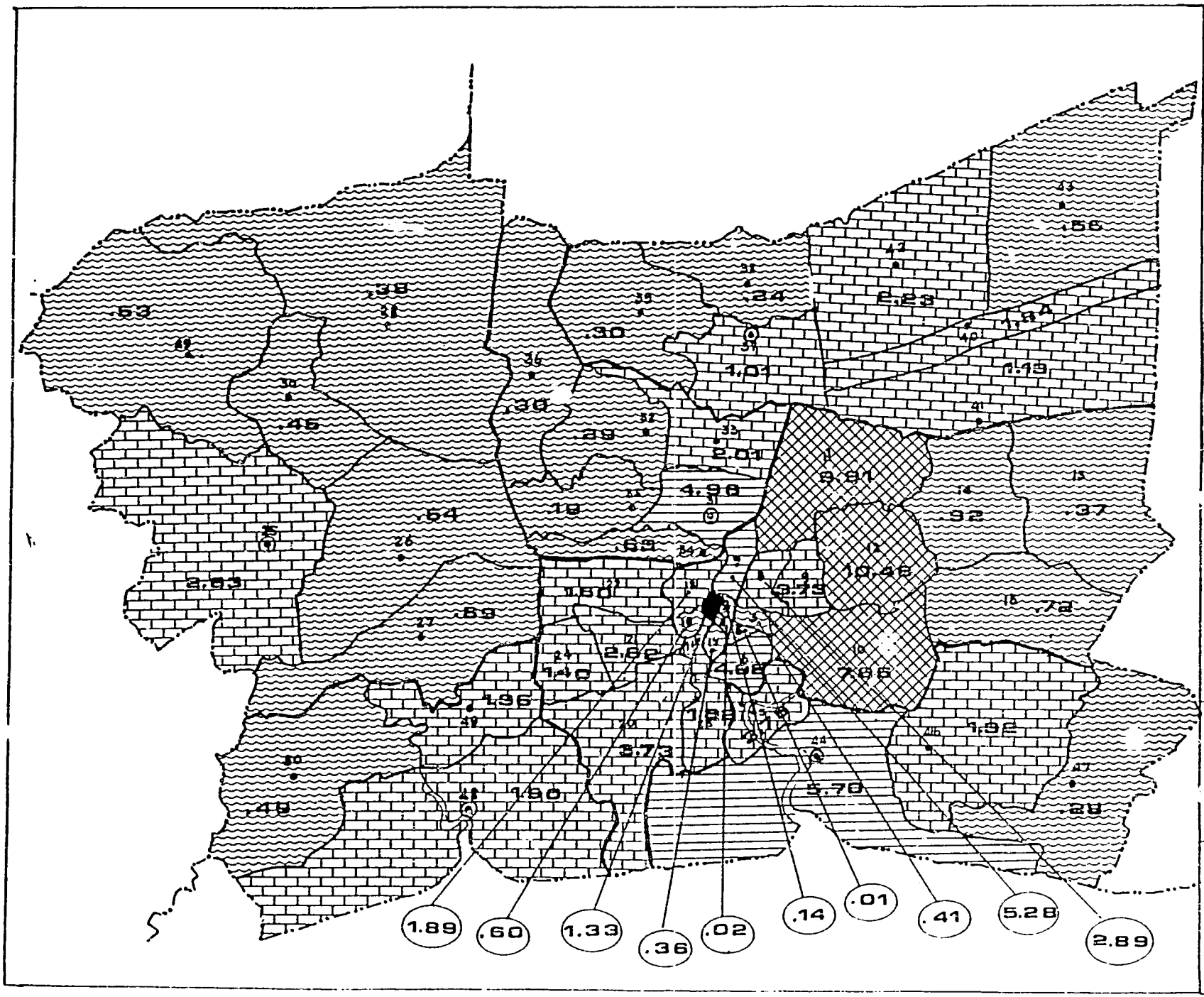


Figure 2.1
Absolute Population Change
BY DISTRICT 1980-2000

AMPHOE CODE

1. PHRA NAKHON	26. NAKHON CHAISI
2. PUM PRAP SATTRU PHAI	27. SAM PHRAN
3. PATHUM WAN	28. BANG LAN
4. SAMPHANTHAWONG	29. NAKHONKHAO SALA
5. BANG RAK	30. DON TUM
6. YAN NAWA	31. MUANG NONTHA BURI
7. DUSIT	32. BANG BUA THONG
8. PHAYA THAI	33. PAK KRET
9. HUAI KHWANG	34. BANG KHUAI
10. PHRA KHANONG	35. BANG TAI
11. BANG KHEN	36. SAI NOI
12. BANG KAPI	37. MUANG PATHUM THANI
13. HONG CHOA	38. SAM KHOA
14. MIN BURI	39. LAT LUM KAEW
15. LAT KRA BANG	40. THANYABURI
16. CHON BURI	41. LAM LUK KA
17. KHLONG SAN	42. KHLONG LUANG
18. BANGKOK NOI	43. HONG SUA
19. BANGKOK YAI	44. MUANG SAMUT PRAKAN
20. BANG KHUN THIAN	45. PHRA PRADAENG
21. PHASI CHAROEN	46. BANG PLI
22. THALING CHAN	47. BANG BO
23. NAT BURANA	48. MUANG SAMUT SAKHON
24. HONG KHAEN	49. PRATHUM RATCHA
25. PUANG NAKHON PATHOM	50. SAM PRAO

LEGEND

- BOUNDARY OF THE BMR REGION
- BOUNDARY OF CHANGWAT
- BOUNDARY OF AMPHOE
- LOCATION OF AMPHOE MUANG
- LOCATION OF OTHER AMPHOE

- >6.50 %
- 4.01 - 6.50 %
- 1.00 - 4.00 %
- 0.00 - 1.00 %
- - 0.11 %

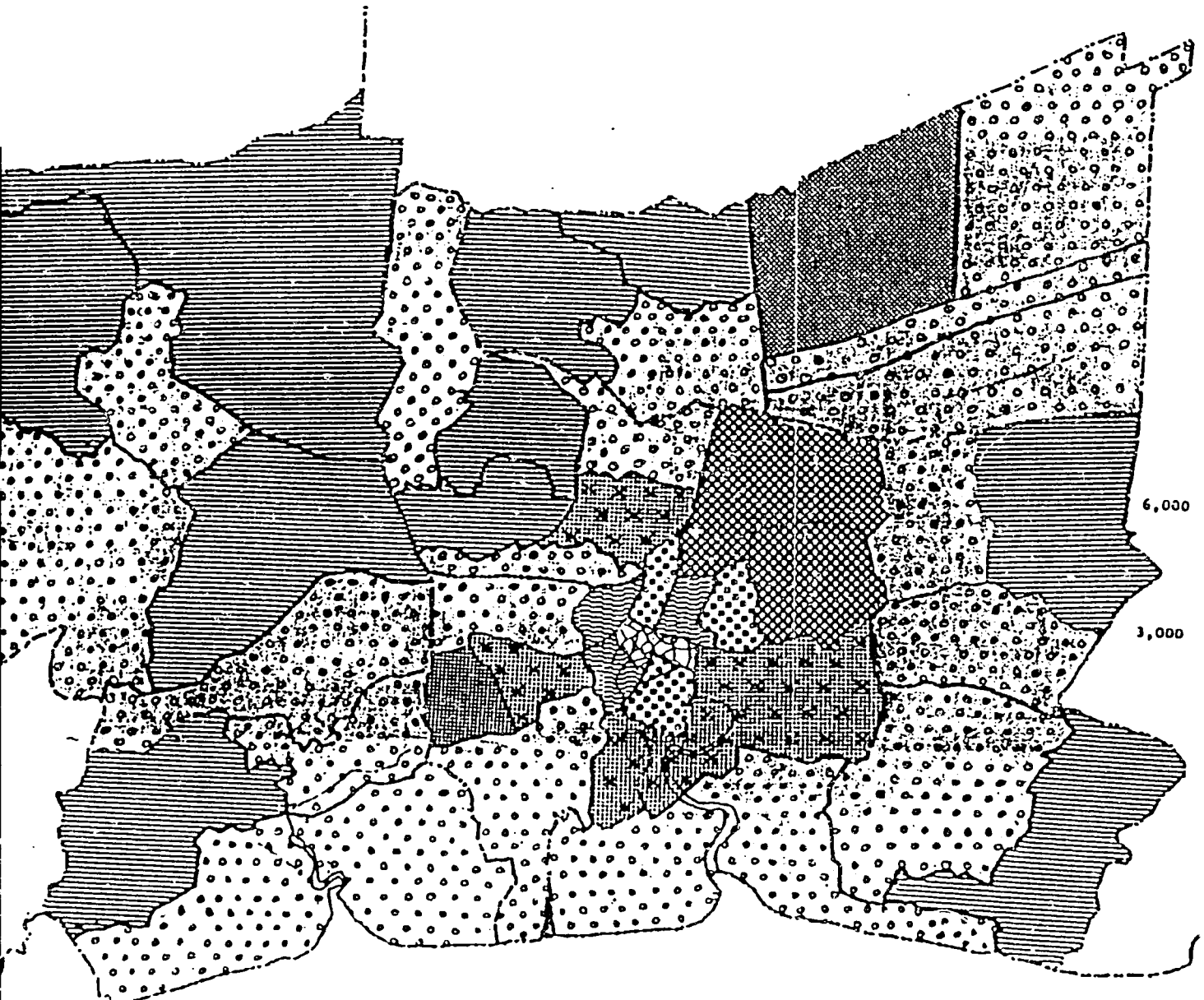
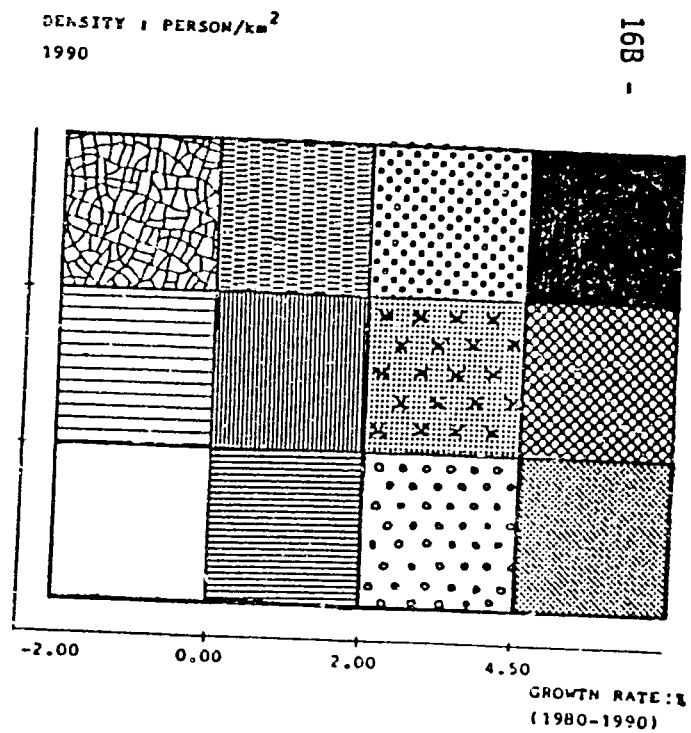


Figure 2.2

POPULATION DENSITY AND GROWTH RATE BY DISTRICT IN BMR REGION 1980-1990



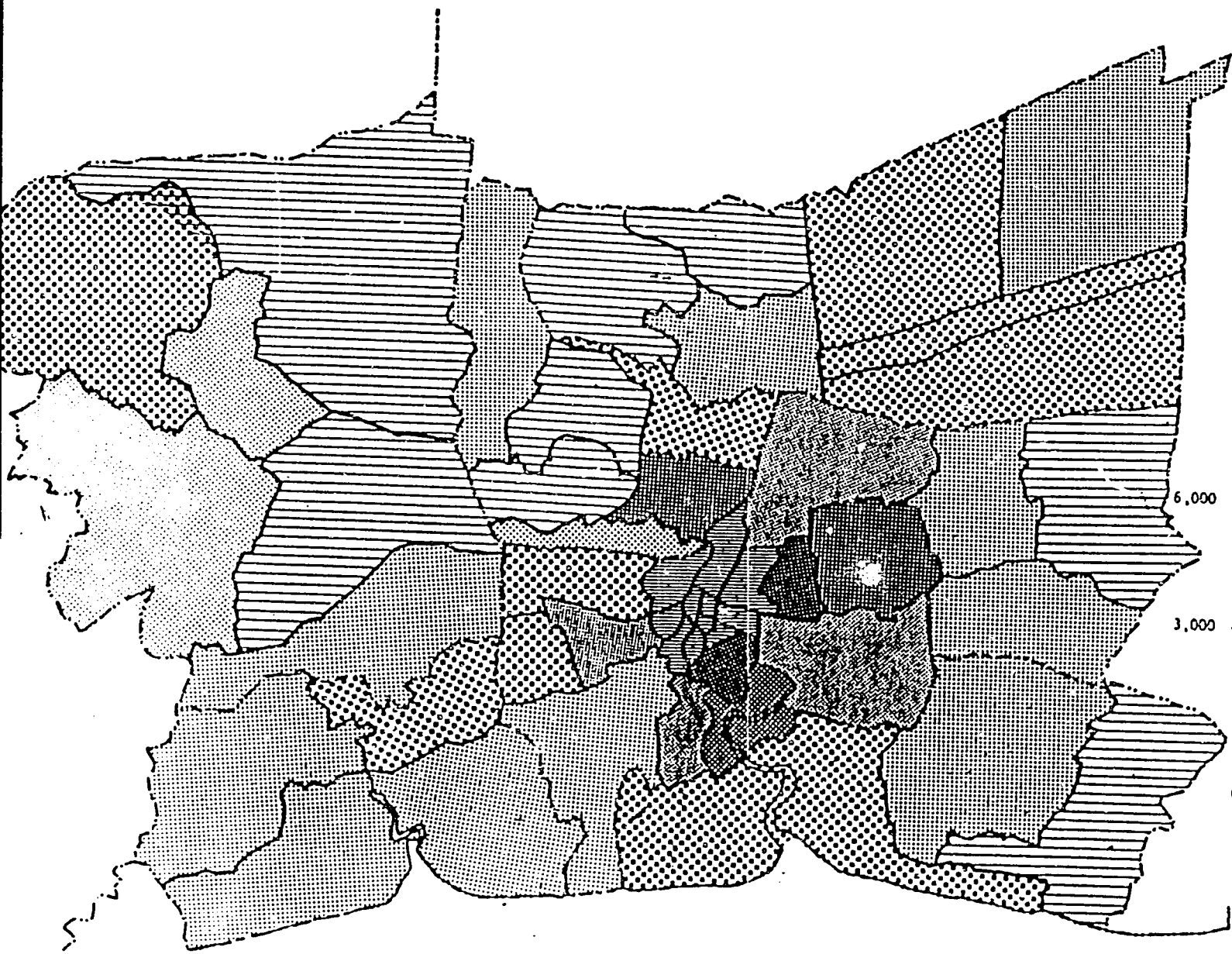
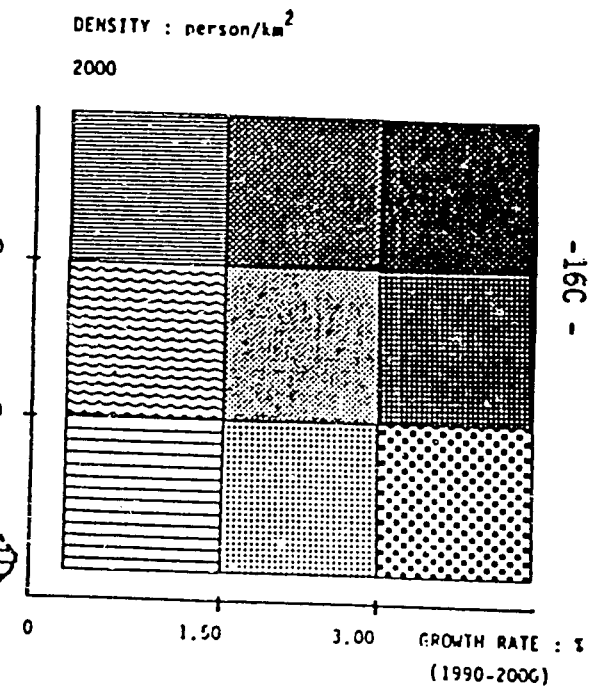


Figure 2.3

POPULATION DENSITY AND GROWTH RATE

BY DISTRICT IN BMR REGION 1990-2000



Chapter 3

TRANSPORTATION

Transportation problems in the BMR have been the subject of a recently initiated study by Asian Engineering Consultants, Ltd for NESDB[1]. That analysis was in turn based substantially on work done to date by HFA in connection with the Short Term Urban Transport Review as presented in their Preliminary and Principal Findings Reports. Most of the discussion which follows is derived from those sources.

3.1 Problems

The principle transportation problems in the BMR have been identified as follows:

3.1.1 Congestion. Particularly in the central area of Bangkok, traffic demand at peak hours exceeds roadspace, resulting in long trip times and slow average speeds.

Congestion occurs over a wide area and for long periods throughout the day particularly in the BMA core area and on the principal routes leading to and from the core. Traffic counts from the Rama IV junction show volume fluctuations of only 15% (9,250 vehicles per hour to 10,750 vehicles per hour) between 8:00 a.m. and 7:00 p.m.. The sharp peaking of traffic flows in the morning and evening which is characteristic of small cities is not found in central Bangkok. Rather, traffic volumes build up gradually during the day, typically resulting in somewhat worse delays in the afternoon than in the morning. Table 3.1 shows the effect of this pattern on trip times in the core area.

TABLE 3.1

Average Traffic Speeds and Vehicle-Kilometers of Travel

Section	Morning		Midday		Evening	
	veh-km /hr	average speed km/hr	veh-km /hr	average speed km/hr	veh-km /hr	average speed km/hr
A. One-way System	27250	16.3	30500	16.5	34700	11.8
B. One-way System	39950	12.1	38950	19.5	36100	10.0
C. Chinatown	10900	15.1	13250	13.4	13250	16.4
D. New central Area	12600	17.5	12750	14.9	13600	16.7
TOTAL	90700	14.9	95450	15.8	97650	13.0

Source: HFA survey, February 1985

[1]See the Bangkok Metropolitan Region Transport Sector Study. AEC. August, 1985.

The average vehicle speeds are thought to be close to the limit of acceptability for many vehicle users. Thus, a good deal of demand for use of the congested area road space is being suppressed; that is, travelers are foregoing trips to and from the congested area. In addition, because the road space is being used at rates so close to capacity, relatively trivial events can reduce traffic speeds to unacceptable levels for long periods of time.

The BMR study, like the STTR analysis, assumes the construction of the Second Stage Expressway System. The completion of this project is expected to attract a large increase in traffic to the central area which will exacerbate congestion there. Although access improvements can help to reduce this effect, a substantial net increase to central area traffic must be anticipated.

Finally, the demand for road space throughout the region will be enhanced by increased vehicle ownership. Table 3.2 shows growth rate projections for the central area and for the STTR study area.

TABLE 3.2

Growth Projections
1984-2001

	Central Area	STTR Study Area
Population	9.1% (0.51%)	54.0% (2.57%)
Employment	21.8% (1.16%)	76.1% (3.39%)
Cars	106.7% (4.36%)	347.4% (7.60%)
Mortorcycles	-1.8% (-0.11%)	44.0% (2.17%)

Source: HFA, July, 1985 (Numbers in parens are average annual rates)

As a consequence of these trends, the demand for peak period road space is expected to increase greatly during the period 1984 to 2000 as shown in Table 3.3.

TABLE 3.3

Peak Period Traffic Growth (person-trips) to Central Area

	1984	2001	% growth
Cars	104,400	281,000	169
Motorcycles	40,800	47,900	17
Public transport passenger trips	390,400	466,800	20
TOTAL	535,600	795,700	49

Source: HFA, July, 1985

It is important to note that most of this additional demand will not be realized under current or foreseeable transportation system conditions because even small traffic volume increases will aggravate congestion and therefore suppress demand.

3.1.2 Inadequate Public Transport. Buses in Bangkok are frequently over-crowded and unsafe.

In 1984, there were, on an average weekday, 6.3 million passengers on public transport. Some 68 percent used large buses (mainly BMTA), 22 percent used minibuses and about 10 percent used taxis and tuk-tuks.

HFA forecast that, by 1991, demand for public transport will reach 8.7 million person trips per day, (37 percent more than in 1984) and will reach at least 10.1 million by the year 2001 (60 percent more than in 1984).

If this demand is to be carried by the existing modes of transport - buses, minibuses, taxis and tuk-tuks - then large increases in fleet sizes and carrying capacity will be required.

Even with heavy investment in rail mass transit, a first line could not be in service before 1992; large buses will therefore remain the back-bone of Bangkok's public transport system throughout the period of the Sixth National Plan.

In the longer term, even with the three heavy-rail lines proposed by ETA, model tests indicate that the number of bus passengers will increase. Mass transit would carry only 40 percent of trips; many transit passengers would use buses to travel to or from the station; the remaining 60 percent of trips would depend entirely on buses, taxis and tuk-tuks.

Despite the fact that traffic queues in Bangkok consist mainly of private vehicles, over two thirds of person trips are made by public transport. Over the day this amounts to more than five million trips. Although there are three times more mini-buses than BMTA buses, BMTA continues to be the dominant passenger carrier, with approximately 85 percent of trips to and from the Central Area.

BMTA operates under two major external constraints imposed upon it directly or indirectly by government. Firstly, BMTA has an operating loss of more than 2 million baht per day, with accumulated losses of over 6 billion baht and total liabilities in excess of 4 billion baht. A basic factor in this financial problem is government control of bus fares, which prevents BMTA from raising fares and re-establishing itself on a financially viable basis. Without this control, BMTA and other bus companies could be profitable.

Secondly, BMTA buses suffer from severe congestion because they must compete with private cars for roadspace. Traffic delays lead to long and irregular journey times for passengers, under-utilization of equipment and high operating costs for BMTA and other operators. Bangkok already has an extensive network of bus lanes (over 100 kilometers) which should benefit BMTA buses. However, while contra-flow bus lanes work moderately well, with-flow lanes are now ineffective due to lack of enforcement. Public transport in Bangkok must be fully segregated from other traffic if it is to function effectively.

3.1.3 Incomplete Road Hierarchy. The network of roads throughout the BMR is incomplete, increasing trip times and distances and encouraging inefficient development patterns. Bangkok's road network has developed over the years with little planning or control. This has resulted in a lack of coherent structure and rationale to the network and very inefficient traffic operation, leading to several problems:

- There is no hierarchy which concentrates through-traffic on primary and secondary roads and local traffic on distributor and access roads; all roads appear to serve all traffic functions;

- There is a shortage of distributor and access roads, which leads to overloading of primary and secondary roads with local traffic;

- Sparseness of the network in some areas and lack of connections between primary and secondary roads leads to excessive journey times and costs, due to the long detours often necessary;

- Land acquisition problems have prevented the completion of several connection links which would enhance network continuity and coherence, e.g., Sukhumvit Soi 55;

- Lack of development control adjacent to major new roads such as Ratchadapisek prevents them functioning effectively. Some more particular analysis of problems at each level of the hierarchy will help to demonstrate the extensiveness of the problem.

3.1.3.1 Primary Roads

Figure 3.1 shows the roads identified as primaries, together with a number of suggestions for new links. There are borderline difficulties in identifying road hierarchies, because definitions are not precise, but the network in Figure 3.1 is believed to carry (or would if the proposed links were complete) a large part of the longer distance movements in the area.

The network in Figure 3.1 includes the newly approved part of the Second Stage Expressway System, the proposed Outer Ring Road and the whole of Ratchada Phisek Road. This system contains nine existing radials, two rings and four routes across the city centre, two north south and two east-west.

The primary network contains two conspicuous gaps, namely in the northwest and northeast, where there are no radials. The northwestern area contained 414,000 people in 1984 and will reach 775,000 by the year 2001. The northeastern area contained 188,000 people in 1984 and will reach 261,000 in 2001; this area has parts within 4-5 kms of the city center but has been little developed, presumably because of poor accessibility. New radial primary roads are required in these areas.

In the absence of the Second Stage Expressway, there is another major gap to the south, which the expressway will partly fill. Ratchada Phisek Road lacks two sections - in the north and between Sukhumvit and Rama IV - and the Outer Ring Road exists only on the western side of the city. Rama VI is a weak radial to the north since the route is incomplete. It could be partly superseded by the extension of the Second Stage Expressway.

3.1.3.2 Secondary Roads

In urban areas, it is usually desirable to space secondaries at intervals of about 2-4 kms, which means that the area bounded by secondary (or primary) roads lies in the range 4-16 sq. kms, and this area is "drained" by distributor roads at about 1 km spacing. If the intervals are greater than this, vehicles have to travel longer distances on distributors, which are designed for only moderate speeds.

To examine the structure of Bangkok's secondary roads, the city is divided into five areas: first, the area within

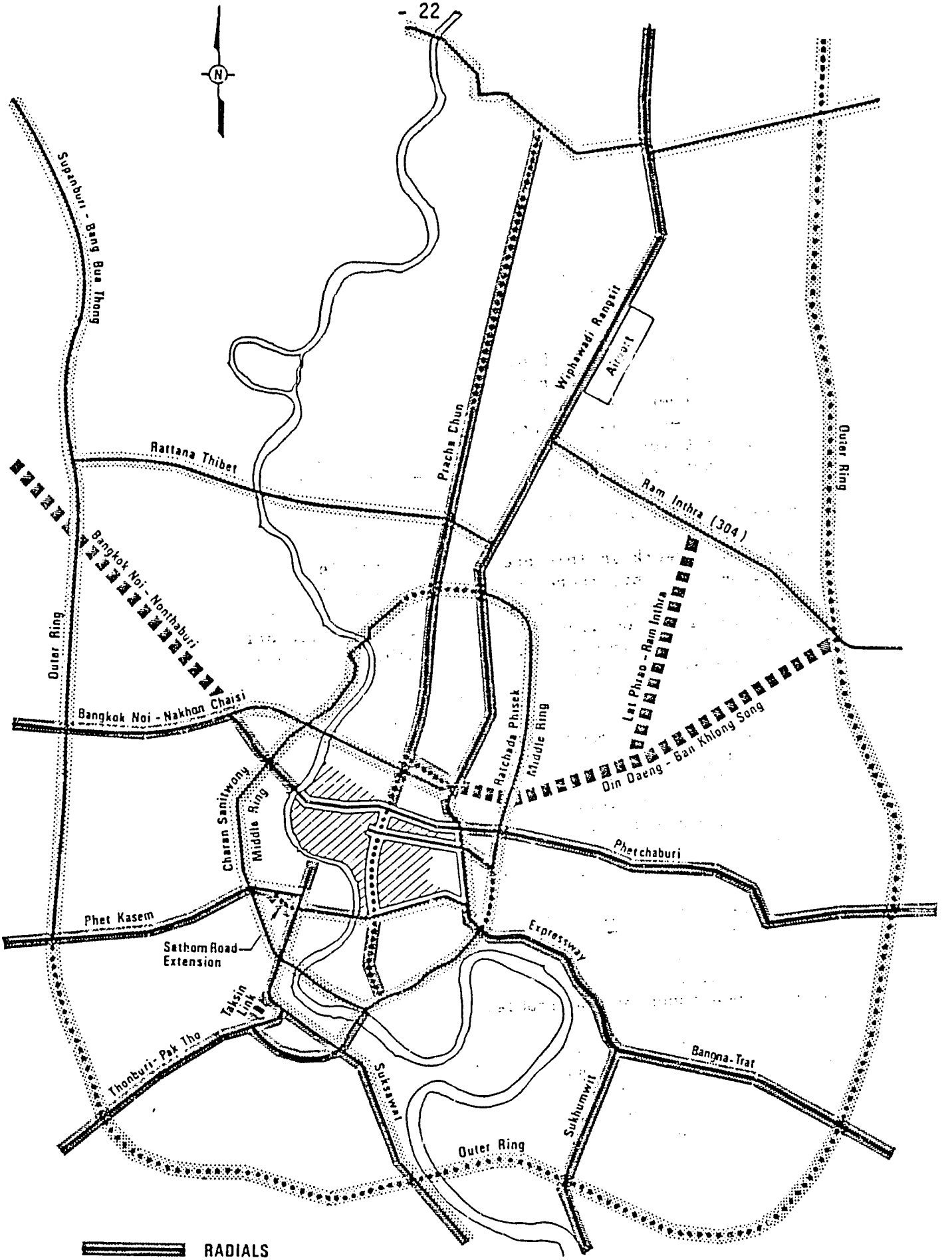


Figure 3.1 PRIMARY ROADS

HFA JULY 1985

Ratchada Phisek Road, and then the four corners outside. These areas are shown on Figures 4.2 - 4.6. The figures show the primaries and secondaries and also the principal distributor roads. It would not be possible to identify all distributor roads without undertaking extensive fieldwork.

- Areas within Ratchada Phisek Road (Figure 3.2)

The secondary network in this area is quite complete, but there are some weaknesses. Firstly, there is a peripheral area in the north where the network is thin. A cross-link between Lat Phrao Road and Wongsawang Road is an obvious "missing link, particularly in view of the reconstruction of Rama VI bridge. Another East-West route is suggested to connect Phahol Yothin Road along Khlong Bang Sue to Lat Phrao Road. Secondly, more river crossings are desirable, in particular at Trahan Road, at Siphaya-Ladya roads and, although it is difficult to see a suitable alignment, at Phrannock Road (Thonburi). The latter crossing would be a considerable asset to traffic entering the city center from Thonburi and would relieve Phrapinklao and Memorial bridges, but it would lead traffic through the historic part of the city and might therefore be unacceptable. Lack of river crossings clearly adds much traffic to already busy roads and junctions, raises transport costs and inhibits development on the Thonburi side.

Thirdly, some of the secondary roads are of very low quality for such a role: in particular, the various small roads from the south, across Sathorn Road through to Rama IV, which, though used as secondary roads, are quite unsuitable and offer little possibility of improvement; new roads are desirable.

Finally, the Makkasan area presents on awkward "hole" in the network, forcing traffic on to Rathchprarop Road and Soi Asoke, two notorious congestion spots. A secondary connection along side the expressway from Din Daeng Road to Withayu Road is therefore included, and also a link between Din Daeng Road and Phetchburi Road.

- Northwest Area (Figure 3.3)

There are no secondary roads on the Thonburi side, and the areas to the north and south of Nonthaburi bridge road are too large to be developed properly without secondary roads; indeed, the need for a primary radial in the southern part has already been noted.

- Northeast Area (Figure 3.4)

This area is similarly lacking in secondary roads and the need for a new primary has been noted. BMA proposals include four new roads, one of which is classified as a primary road along most of its length.

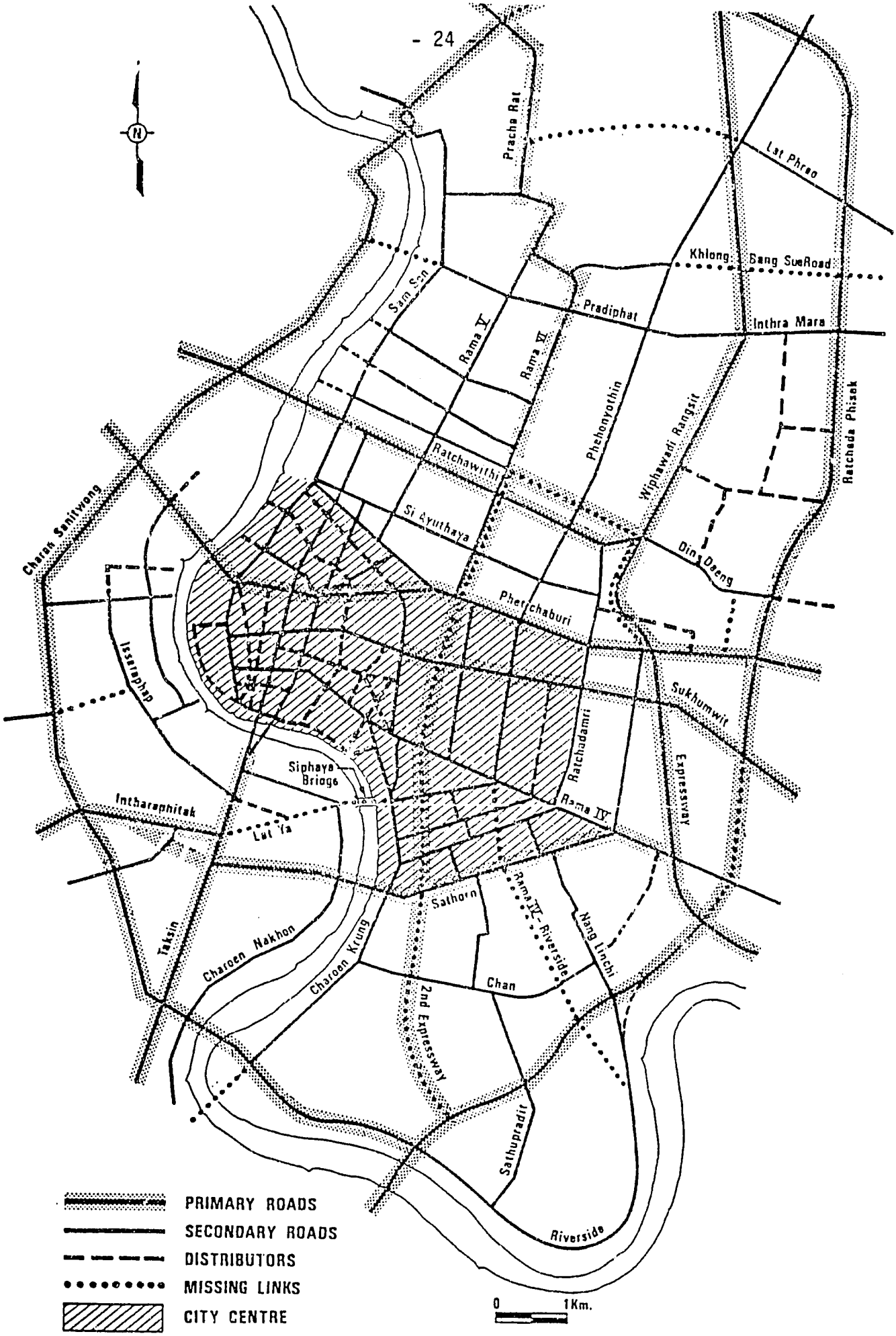


Figure 3.2 SECONDARY ROADS: AREA 1 (CENTRAL)

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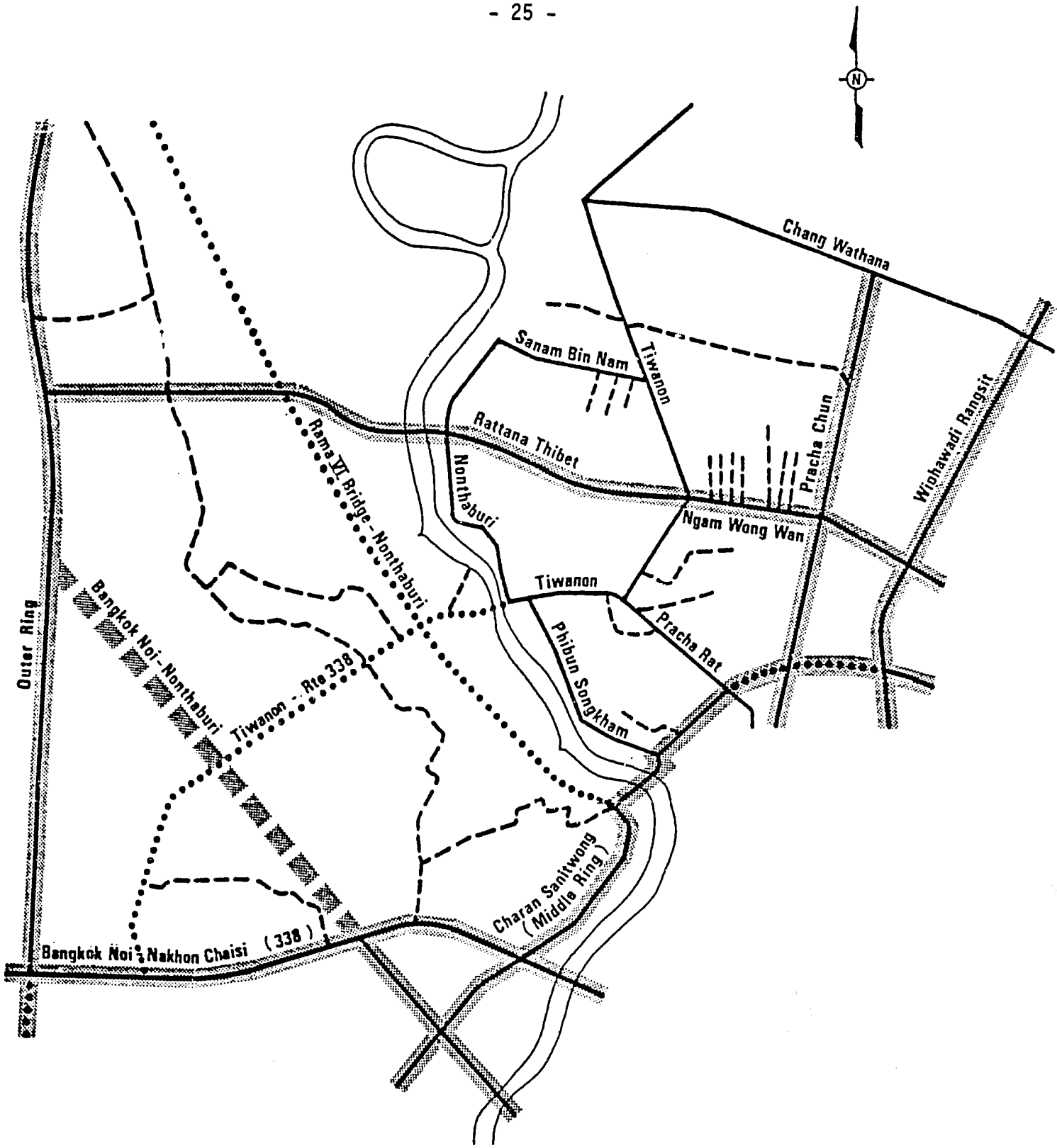
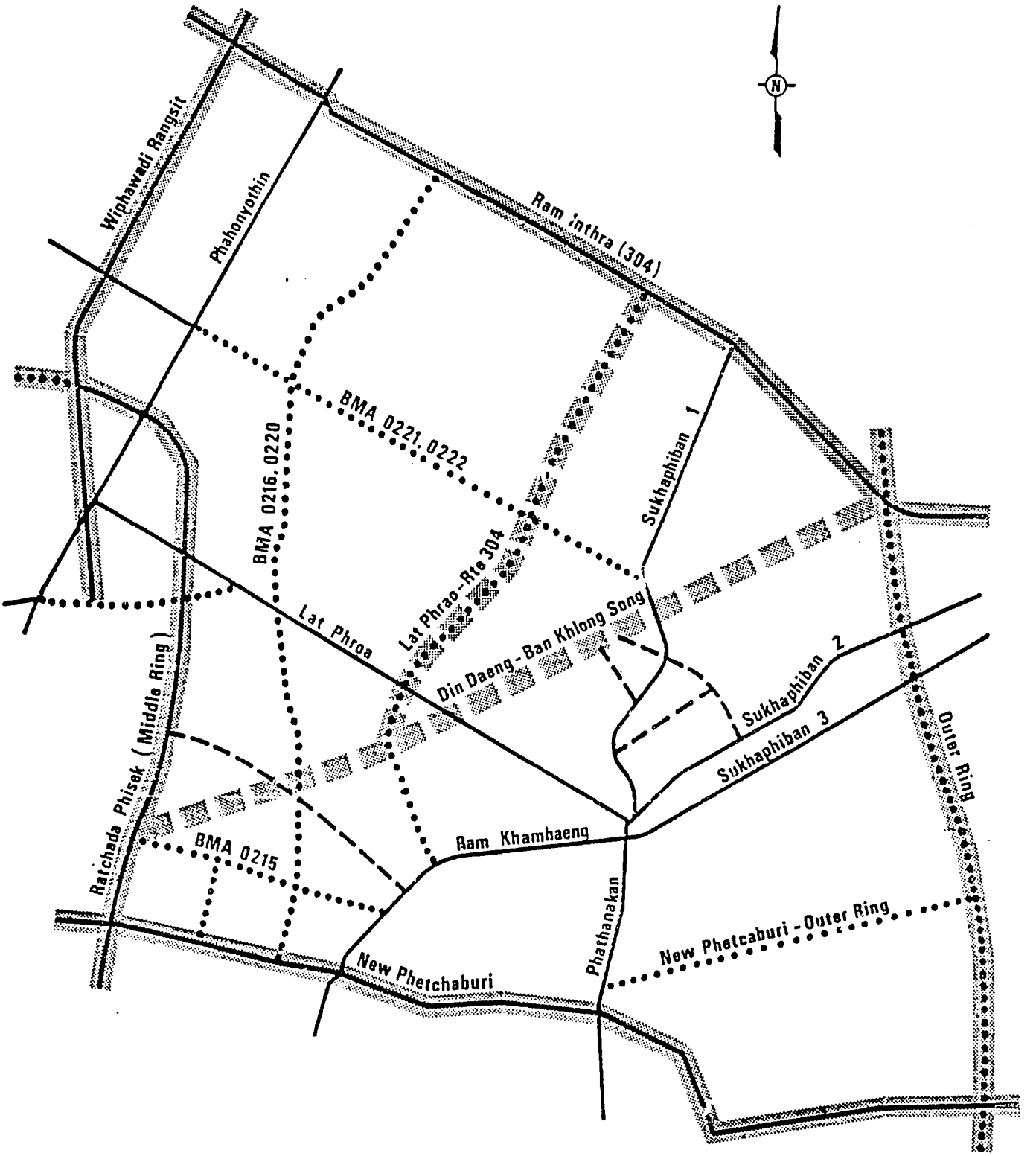


PRIMARY ROADS
SECONDARY ROADS
DISTRIBUTORS
MISSING PRIMARY ROADS
OTHER MISSING LINKS

0 1Km.

Figure 3.3 SECONDARY ROADS : AREA 2 (NORTHWEST)

HFA JULY 1985



PRIMARY ROADS
SECONDARY ROADS
DISTRIBUTORS
OTHER MISSING LINKS
MISSING PRIMARY ROADS

0 1Km.

Figure 3.4 SECONDARY ROADS : AREA 3 (NORTHEAST)

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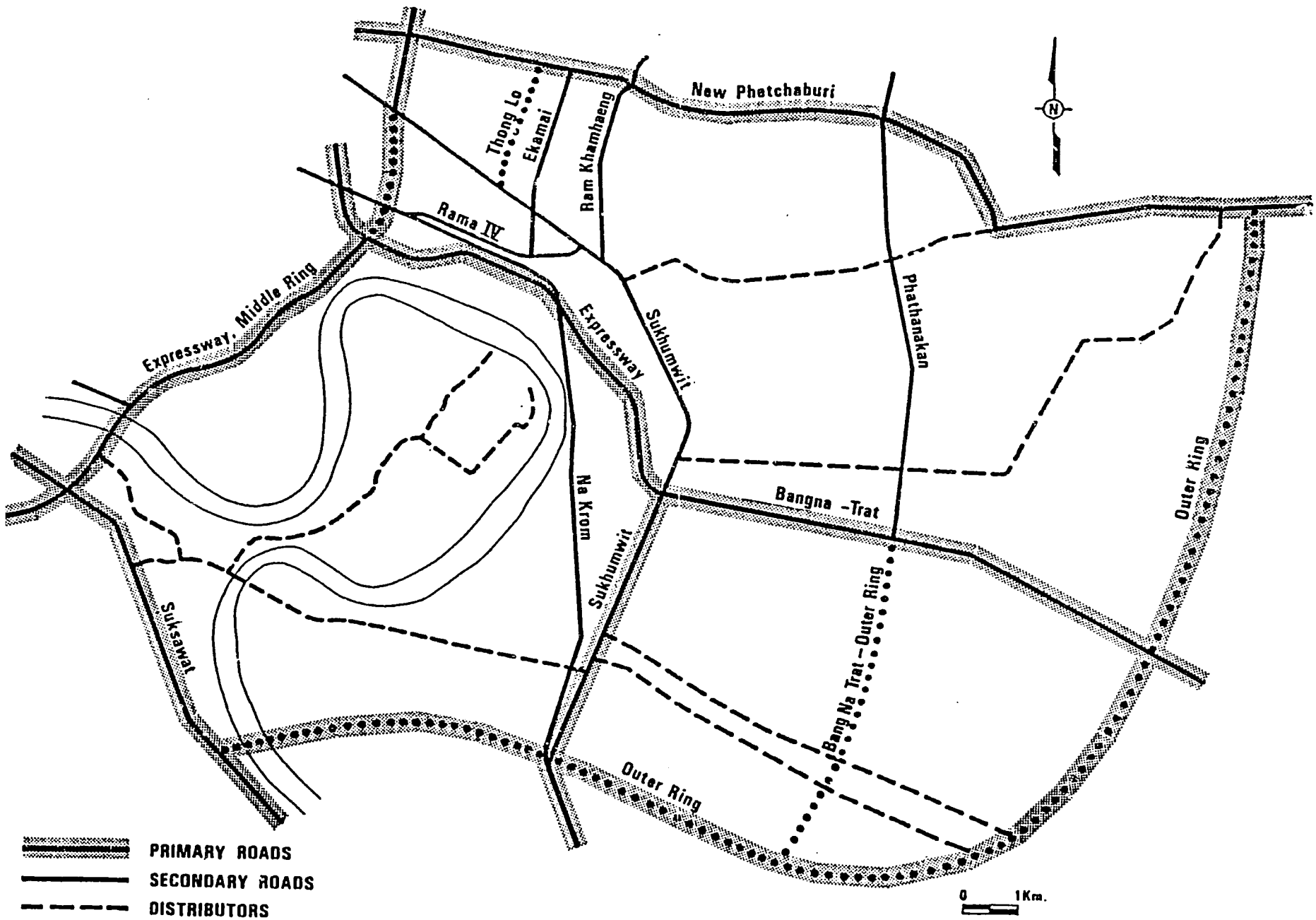

Figure 3.5 SECONDARY ROADS : AREA 4 (SOUTHEAST)

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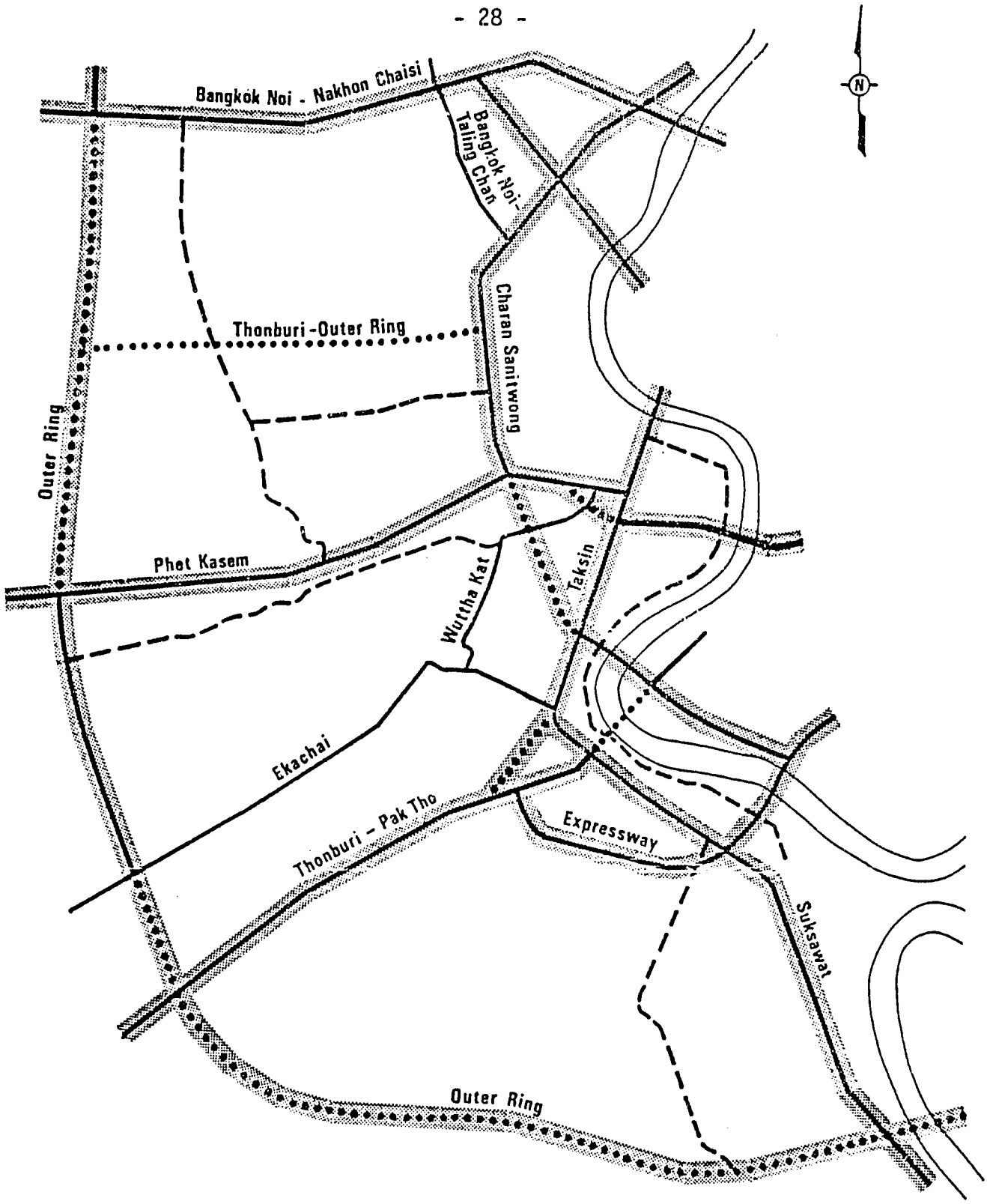
JULY 1985



PRIMARY ROADS
SECONDARY ROADS
DISTRIBUTORS
MISSING LINKS

0 1Km.

Figure 3.6 SECONDARY ROADS : AREA 5 (SOUTHWEST)

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- Southeast Area (Figure 3.5)

This area is better served but there are quite long distances along the proposed Outer Ring Road without secondary road connections. There is a clear opportunity (and need) to extend Soi 55 north to New Petchburi Road.

- Southwest Area (Figure 3.6)

The area due west of Chinatown is devoid of secondary roads and the area to the south needs a secondary road in the radial direction.

In sum, outside Ratchada Phisek Road, the secondary road system is very undeveloped. In most parts of the city there are large areas untouched by main roads. There are, in fact, ten such areas larger than 16 sq. kms., which was suggested above as the maximum area to be left without secondary roads. The provision of more secondary roads represents an important claim on the transport budget.

3.1.3.3 Distributor Roads

A detailed review of distributor (and access roads) lies beyond the scope of this study. These roads, however, contain numerous serious deficiencies which, when accumulated, may be regarded as strategic faults in the system. There is an extreme shortage - possibly unparallelled in other cities - of distributor roads. Access roads are strung together without adequate connections to the main roads, with the result that a large proportion of residential and commercial "blocks" have only a single access point to the main road network. Examples of such areas include:

- The Sukhumvit-Asoke-Petchburi-Ekkamai block. Exit from the north is barred - though not insuperably - by a khlong. Few residents have a feasible exit from the block on more than one side.

- The Taksin-Dao Kanong-Wuthakat-Thoet Thai block, recently divided by the construction of Ratchada Phisek Road. Three khlongs run across the block but they have been bridged in places.

- The Lat Phrao-Ratchada Phisek-Inthrarama-Viphawadi Rangsit block. A khlong also runs across this block. There is one through-road.

These patterns come about because the design and construction of minor roads is largely left to land developers. In order to gain access to a vacant plot of land, a developer will add a section of road to the existing network. Other developers may continue the process, adding sections in the direction that suits them, and eventually the resulting street or streets may be taken over by the local authority. By that time the pattern has been determined.

This method of developing streets, apart from being inefficient in the use of land, leads to a neglect of distributor roads. Private developers will provide access roads but not distributor roads. Elaborate networks of access roads thus evolve with no planning of distributor roads, which therefore do not emerge except by chance or subsequent rationalization.

The consequences of this lack of distributor roads are several. Excessive traffic is forced on to access roads, causing small-scale congestion and environmental nuisance. Traffic is also forced to travel longer distances on the main roads, travelling around blocks instead of through them. This creates additional traffic, much of it on the main roads; and much of it turning traffic at junctions.

The lack of distributor facilities increases the total volume of traffic, and in particular the volume on main roads and at main junctions. It is not easy to judge the magnitude of these adverse consequences, but some 10-15 percent of main road traffic could be thus attributed, and an even larger percentage of traffic at main junctions.

3.1.3.4 Access Roads

A road network is a continuous system of roadways on which it should be possible to drive from any point to any other point. In a city it is normal for all buildings, premises and other sites of activity to be directly connected to the road network, thus giving mutual accessibility between all places of activity. This is the basic function of an urban road network, but in Bangkok some sites of actual or potential activity within the built-up area are not connected to the network.

The lack of access roads, which is itself sometimes due to a lack of distributor roads, causes land to be left undeveloped, or developed inefficiently, while other, more accessible locations are developed instead, even though inherently less suitable. In Bangkok, large areas of land have been neglected near to the city centre - e.g. south of Chan Road, east of Ratchada Phisek Road, and west of Taksin Road - while ribbon development has proceeded for miles along all the main radial roads.

3.1.3.5 Roads to Service New Development

The expanding urban areas should be provided with proper street networks before they are developed. Otherwise there will be a repetition of past experience: potentially suitable land will be neglected for lack of access, inefficient and inconvenient street patterns will evolve, and undesirable ribbon development along main roads will continue.

The size of the task, however, is formidable. An expansion of the city by nearly one-half in seventeen years will strain resources. The provision of basic streets, therefore, should be regarded as an essential need with a major claim on the investment budget.

In addition, road systems in BMR population centers outside the BMA require upgrading and expansion to guide and service growth in those areas. Muangs Nakhon Pathom, Pathumthani, and Samut Sakhon have been the subject of initial road needs assessments by the Ministry of Interior (Office of Town and Country Planning) as part of their Town Plan process. BMR consultants will provide a more comprehensive assessment of these needs in their final report.

3.1.4 Uncoordinated Public Investment Policies. Investment proposals for buses, rail systems, freight distribution, expressways and roads originate in a variety of government agencies and state enterprises. There is no overall transportation strategy for the BMR in the light of which such proposals can be evaluated.

Some indication of the complexity of current institutional arrangements for transportaion in the BMR are given by Figure 3.7.

There are several fundamental problems with the present institutional arrangements:

(a) There appears to be considerable overlap in the formal functions of various agencies e.g. DPW and PWD; OCMRT and TED.

(b) Urban transport responsibilities at the national level are divided between two key ministries: MOC and MOI.

(c) Despite the involvement of many agencies, there are several major institutional gaps in the sequence of policy-planning-implementation-operations:

- While NESDB sets urban transport policies within a national context in the Five Year Plan, there is no clear mechanism to ensure that the policies are implemented.

- Although there are two land use/transport planning agencies, (DTCP and CPD), there are no agreed long-term and short-term transport plans and no mechanism to ensure their implementation.

- Six agencies have responsibilities for planning roads in Bangkok: DTCP, CPD, DOH, ETA, DPW, PWD, but no single agency has overall responsibility for road network planning. Consequently, each agency conducts its own planning on a more or less independent basis.

- No single agency is responsible for evaluating and co-ordinating all substantial transport proposals on consistent basis and for ensuring: (i) they conform with agreed policies and plans and (ii) they are feasible within the financial resources available.

This leads to major difficulties with project implementation due to:

- Overlapping and ill-defined agency responsibilities, and the difficulties of obtaining high-level agreement from several agencies for even minor schemes.

- Complex administrative and committee procedures.

- Separation of responsibilities for planning, design and implementation, particularly for traffic management schemes.

- Lack of agreed transport and traffic policies and plans.

- Lack of clear links between project planning and financial resources

- Shortage of suitably qualified and experienced professional staff to implement projects.

3.1.5 Deterioration of Existing Investment. There has been a tendency in some areas to forego maintenance of existing facilities in favor of new facilities investment. Deterioration of fly-overs in the BMA are one important example of this.

3.1.6 Unsustainable Reliance on Subsidies. Declining central government resources will make continued reliance upon transportation subsidies untenable.

3.1.7 Economic and Demographic Centralization. The BMA has attracted population and commercial activity in part because urban services are not priced at their real value. This has inhibited the development of population and employment centers in other parts of the BMR.

3.2 Proposed Development Strategy

Given the problems described above, the following priorities should guide investment decisions with respect to the various categories of transportation projects:

1) First priority should be given to four kinds of projects:

a) The maintenance and rehabilitation of existing roads, highways and bridges to protect assets and the completion of projects already underway;

b) Improvements to the bus system;

c) Improving the road network, primarily in the BMA, through the construction of distributor & access roads in a manner which will concentrate development in already urbanized areas;

d) Developing an institutional arrangement and technical capacity to evaluate transportation project proposals and financing schemes.

2) Second priority should be given to the construction of suburban roads in Nakhon Pathom, Nonthaburi, Pathumthani, Samut Prakan and Samut Sakhon, in accordance with their Town Plans;

3) Third priority should be given to the construction of suburban roads on the periphery of Bangkok in order to promote more efficient use of urban land and to try to limit future ribbon development;

4) Finally, remaining resources should be allocated to investment in new highway, railway or waterway facilities where capacity problems are anticipated by 1991.

3.3 Development Guidelines

Transportation policy objectives during the Sixth Plan period should include the following:

1) to increase cost recovery for transportation investment and operating expenses through increased tolls, vehicle taxes and public transit charges.

2) to use road and other transportation facility construction to influence the location of development in order to increase the efficiency of public investment in infrastructure and services.

3) to eliminate SRT and BMTA operating deficits in the BMR;

4) to identify the main elements of a Freight and Truck Management Plan to serve as a framework for investment in truck and container terminals, and to guide changes to truck regulations; and

5) to establish the institutional and technical means of evaluating proposed transportation projects against an overall development plan for the BMR.

3.4 Proposed Projects

Proposed transportation projects are of four main types:

* Road construction, improvement, and maintenance, including the construction of bridges and extension of the expressway system;

* Construction of mass transit facilities including segregated busways and an elevated rail line;

* Other bus transport, including the purchase of new buses by the BMTA and private operators; and

* The institution of demand management in Bangkok's central area.

Other, capital projects will include improvements required to implement the TRIP scheme and the construction of truck terminals. The proposed locations and characteristics of the most important of these projects are described below.

3.4.1 Road, highway and bridge construction.

Proposed projects for roads, highways and bridges are shown for the STTR Study Area in Table 3.4 and figure 3.7 and for the BMR in Figure 3.7A. Projects have not been selected for the balance of the region, but investments proposed by the Department of Highways are displayed in Table 3.4 which includes projects within the STTR area.

In addition, projects to expand the road network in regional towns have been advanced by staff of the Ministry of Interior. These projects have yet to be evaluated by the BMR study group but will be discussed in the final report.

The STTR Study Area projects were selected for inclusion here from among proposals advanced by a various agencies by a process which involved comparing the economic return predicted for each project and considering its relationship to other proposed infrastructure, particularly flood protection and water supply, to eliminate roads which would be inconsistent with other development constraints. Where needed to meet development objectives, other proposals have been initiated by the consultants. This analysis will be extended to the BMR as a whole in the final report.

3.4.2 Mass Transit Facilities

The STTR consultants examined four mass transit and two mainline railway options.

A mass transit feasibility study was completed in 1979 and recommended a heavy-rail system comprising three lines (Rama, Sathorn and Memorial), totalling 54 km. The scheme is sponsored by ETA. Nearly all the system would be elevated and depots would be located at Bang Sue (Rama Line) and at Din Daeng (Sathorn Line), adjacent to Ratchada Phisek.

In view of the high total cost, ETA proposes a Phase 1 system comprising the Rama Line plus the northern section of the Sathorn Line, a total of 34 km.

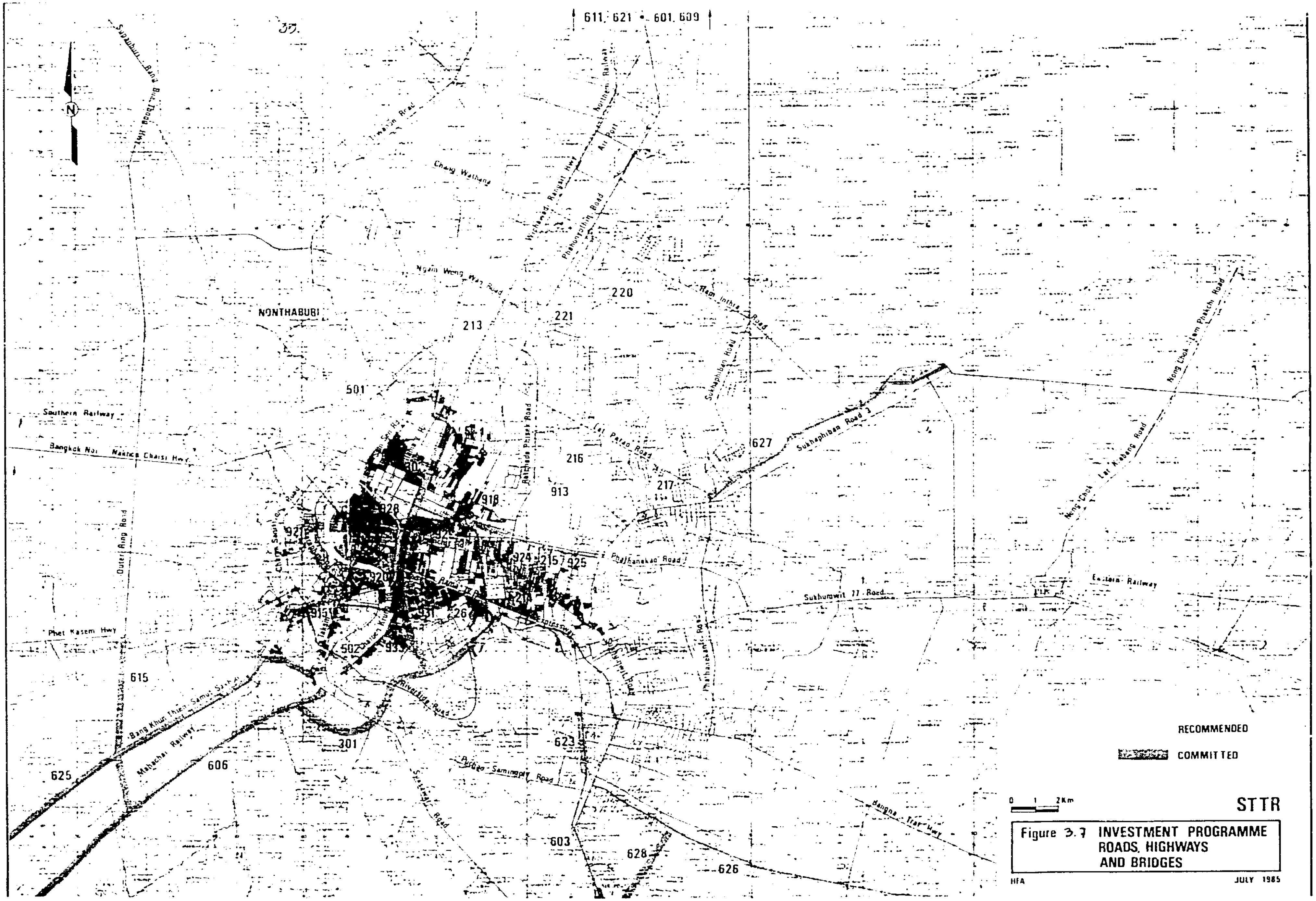


Figure 3.7 INVESTMENT PROGRAMME ROADS, HIGHWAYS AND BRIDGES

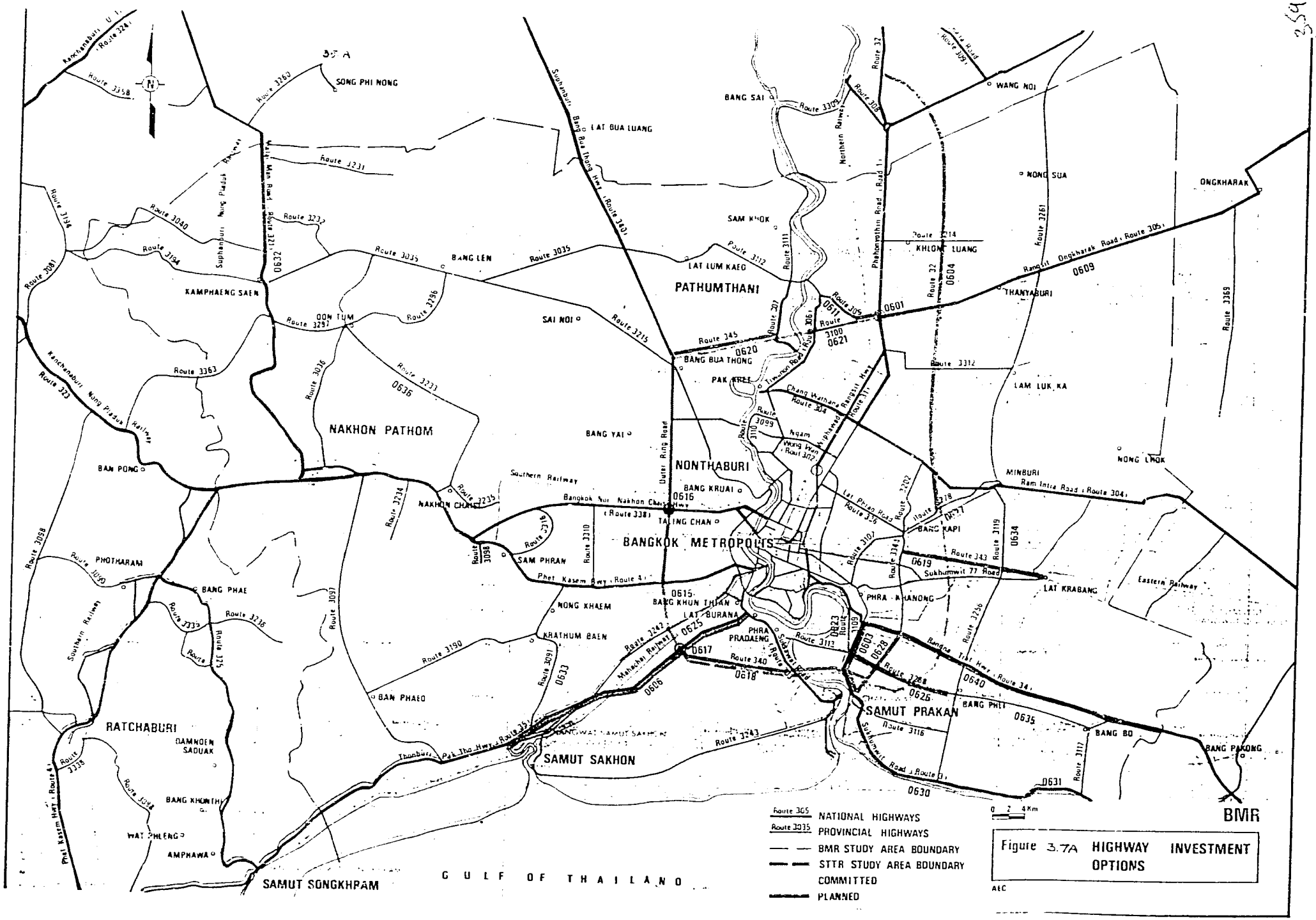


Figure 3.7A HIGHWAY INVESTMENT OPTIONS

AEC

TABLE 3.4

Investments Proposed by DOH 1985-91

million Baht (1981 prices)

No.	Project Name	Description	Degree of Commitment	State of Preparation	Proposed Investment							
					1985	1986	1987	1988	1989	1990	1991	Total
0601	Interchange at Rangsit (Rt. 1)	Improvement from intersection	On-going	Under construction	25.0	64.0	61.0					150.0
0602	Interchange at Wiphawadee Intersection at Phahonyothin Rd.	Improvement from intersection	On-going	Under construction	15.7	34.3						50.0
0603	Bang Na-Samut Prakan (Rt. 3)	Widening to 6 lanes, 9.0 km	Planned				20.0	70.0	60.0			150.0
0604	Rt. 3278-Bang Pain (Rt. 32)	New Construction, 54 km	Planned				100.0	300.0	300.0	300.0		1000.0
	Bang Na-Bang Pa-kong (BMR) (RT. 34)	Reconstruction, 54 km	On-going	Under construction	65.1							65.1
0606	Thonburi-Samut Sakhon (Rt. 35)	Improvement to 4 lanes, 28 km	On-going	Under construction	55.0	156.0	200.0	69.0				480.0
0607	Prapadaeng-Bang Plakot (Rt. 303)	Widening to 4 lanes, 8.8 km	On-going	Under construction	59.8							59.8
0608	Laksi-Rt. 3202 (Rt. 304)	Widening to 4 lanes, 6.8 km	On-going	Under construction	38.5							38.5
0609	Rangsit-Ongkharak (Rt. 305)	Reconstruction, 43 km	On-going	Under construction	9.8	11.5	14.5					35.8
0610	Pak Kret-Rt. 3100 (Rt. 306)	Widening to 4 lanes, 9.0 km	On-going	Under construction	24.3							24.3
0611	Rangsit-Bang Phun (Rt. 306)	Widening to 2-4 lanes, 10 km	On-going	Under construction	32.0	112.0	59.0					203.0
0612	Rt. 306-Pathum thani (Rt. 307)	Reconstruction, 11 km	On-going	Under construction	36.5	21.4						57.9
0613	Overpass at CharunSanit Wong (Rt. 338)	Improvement from intersection	On-going	Under construction	17.7							17.7
0614	Rt. 338-Rt. 4 (Rt. 340)	New Construction, 8.0 km	On-going	Under construction	55.0	149.3						204.3
0615	Rt. 4 - Rt. 35 (Rt.340)	New Construction, 7.0 km	On-going	Under construction	90.0	95.0	125.0					310.0
0616	Interchange at Rt. 338 (Rt. 340)	Improvement from intersection	Planned			12.0	58.0					70.0

Table 3.4 (cont.)

million Baht (1984 prices)

No.	Project Name	Description	Degree of Commitment	State of Preparation	Proposed Investment							
					1985	1986	1987	1988	1989	1990	1991	Total
0617	Interchange at Rt. 35 (Rt. 340)	New Construction	Planned			9.0	41.0					50.0
0618	Rt. 35-Rt. 3344 (Rt. 340)	New construction, 24 km	Planned							100.0	200.0	300.0
0619	Klongton-Lat Kra-Bang (Rt. 343)	New construction, 20 km	Planned						100.0	150.0	150.0	400.0
0620	Nonthaburi Bridge Bang Bua Thong (Rt. 345)	New construction, 10 km	Planned			13.0	40.0	17.0				70.0
0621	Rt. 306-Rt. 306 (Rt. 3100)	Reconstruction, 5.3 km	Committed		3.6	18.0	3.4					25.0
0622	Sanphawut-Bang Na (Rt. 3102)	Widening to 4 lanes, 2 km	Committed		16.5	33.5						50.0
0623	Klong Toei-Chorakhe Noi (Rt.3109)	Reconstruction, 4.2 km	On-going	Under construction	12.0	12.0	11.0					35.0
0624	Nonthaburi-Sanambinnum (Rt.3110)	Widening to 4 lanes, 8.3 km	On-going	Under construction	61.0	115.2						176.2
0625	Bang Khun Thian-Samut Sakhon (Rt. 3242)	Reconstruction, 12 km	Committed		15.8	143.0	35.2					194.0
0626	Sam Rong-Bang Plee (Rt.3268)	Widening to 2-4 lanes, 12 km	Planned					32.5	50.0	37.5		120.0
0627	Bangkapi-Minburi (Rt. 3278)	Widening to 4 lanes, 9.3 km	Committed		23.3	104.0	126.0					253.3
0628	Rt. 3268-Rt. 3 (Rt. 3344)	New construction, 5.0 km	Committed		4.9	22.2	22.2					49.3
0629	Rt. 34-Rt. 3 (Second Stage) (Rt. 3344)	Second carriage-way construction, 9.7 km	Planned							30.0	70.0	100.0
0630	Samut Prakan-Bang Tamru (Rt. 3)	Widening to 4 lanes	On-going	Under construction	58.0	112.0						170.0
0631	Bang Tamru- Bang Pakong (Rt. 3)	Reconstruction	Committed	Under construction	39.5	71.4	78.7					189.6

Table 3.4 (cont.)

million Baht (1984 prices)

No.	Project Name	Description	Degree of Commitment	State of Preparation	Proposed Investment							
					1985	1986	1987	1988	1989	1990	1991	Total
0632	Nakhon Pathom-Suphan Buri (50% in BMR) (Rt. 321)	Rehabilitation	Committed		9.5	37.5	39.0					86.0
0633	Rt. 4-Rt. 35 (Samut Sakhon) (Rt. 3091)	Reconstruction	Committed		17.5	74.5	59.7					151.7
0634	Hinburi-Lat Krabang (Rt. 3119)	Reconstruction	Committed		14.5	95.2	18.3					128.0
0635	Bang Phli-Bang Bo (Rt. 3268)	Reconstruction	Committed		7.1	42.0	20.9					70.0
0636	Nakhon Chaisi-Don Tum (Rt. 3233)	Upgrading to paved road	Committed		2.5	45.9	5.4					53.8
0637	Nakhon Pathom-Rt. 3035 (Rt. 3036)	Upgrading to paved road	On-going	Under Construction	53.1							53.1
0638	Rt. 321-Bang Luang (Rt. 3231)	Upgrading to paved road	On-going	Under Construction	11.4							11.4
0639	Luk Kae-Nong Kham (50% in BMR) (Rt. 3363)	Upgrading to paved road	Committed		10.6	8.8						19.4
0640	Bang Na-Bang Pakong (3rd carriageway) (75% in BMR) (Rt. 34)	New Construction	Planned					75	150	150		375.0
	TOTAL PROPOSED INVESTMENT				885.2	1612.7	1138.3	563.5	660.0	767.5	420.0	6047.2

ETA tried to attract the private sector to finance, build and operate the system on a concession basis, but the attempt failed due to the unwillingness of the private sector to accept the risks involved and the project's anticipated poor financial return.

In view of Bangkok's urgent need for a good mass transit system, and the high cost of the heavy-rail option, the consultants were encouraged to seek a cheaper alternative that would be likely to recover a higher proportion of its costs.

The bus mass transit concept was developed for Bangkok from experience in Brazil and other countries. Various alternatives were examined before a system was defined for testing.

Most of the system would consist of at-grade, segregated busways, with four flyovers at junctions, along the centre of existing roads. The proposed network is shown in Figure 3.8.

Bus mass transit could accommodate anticipated passenger volumes in the year 2001 on all corridors except in the north and the southwest. The scope for light-rail transit to serve these high-demand corridors was therefore examined. An elevated light-rail line was defined and incorporated in the test network.

The bus and light-rail option consists of:

- 34 km of segregated busways
- 55 km of on-street bus lanes
- 19 km light-rail line.

Cabinet's decision to build the Loop of the Second Stage Expressway offers an opportunity to provide high quality bus transit on two main corridors. To accommodate the full demand, segregated facilities would be required, including access priority at toll booths, segregated busways along the expressway and bus-only ramps at exits to avoid queues of private vehicles.

A 42 meter right-of-way would be required, assuming that dual-three lanes are provided for general traffic. Unfortunately, this cannot be accommodated on the proposed Rama VI alignment due to lack of space at the Sam Sen water treatment plant near the interchange between the northern and eastern arms of the SES.

Furthermore, in view of the close spacing of ramps in the Central Area between Petchaburi Road and Sathorn Road, and the anticipated difficulties in accommodating general traffic, it would not be possible to insert additional bus-only ramps. Without priority ramps for egress in the Central Area, the case for line-haul segregation is weakened, and the system would no longer meet the high level of service required.

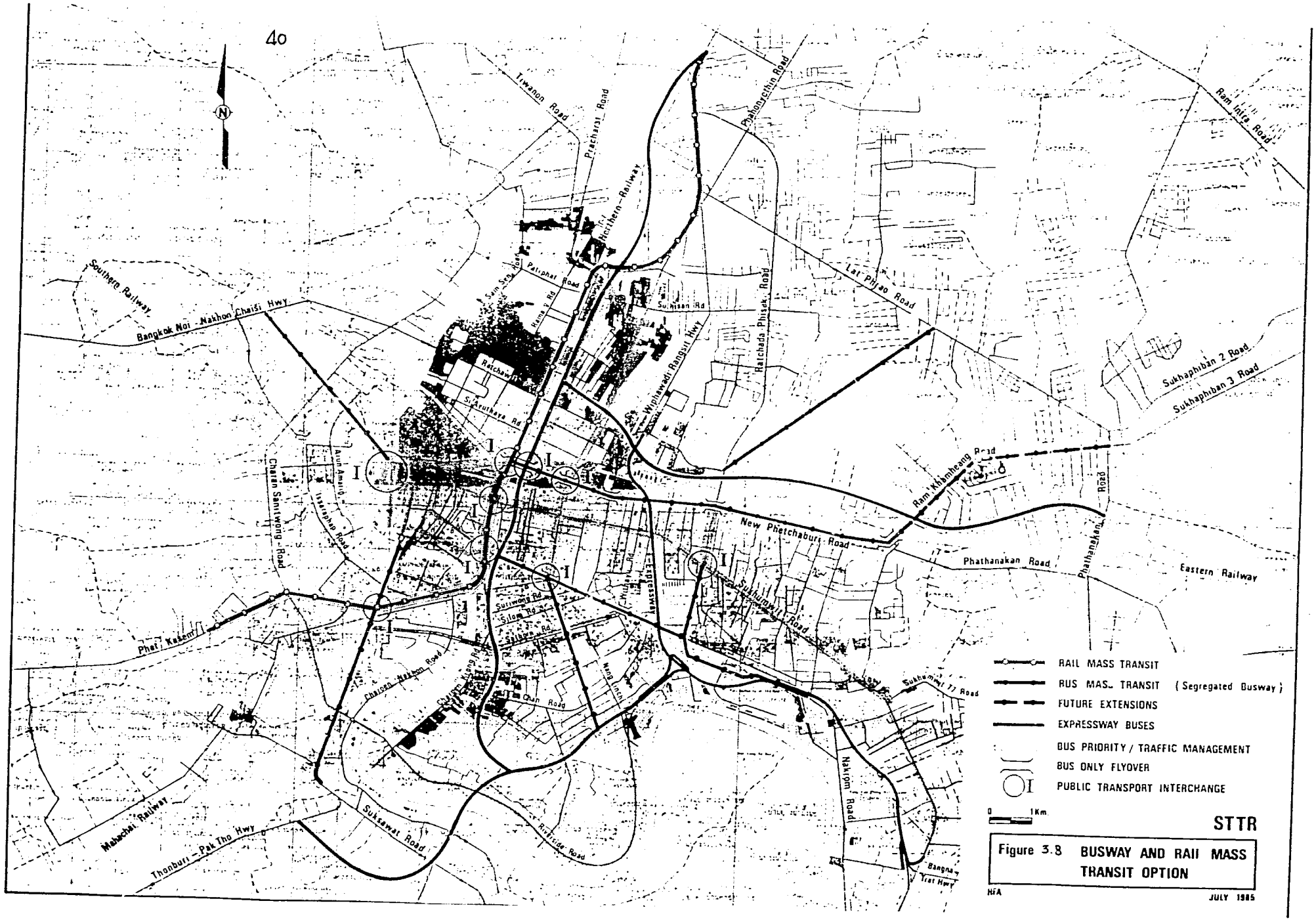


Figure 3.8 BUSWAY AND RAIL MASS TRANSIT OPTION

Segregation of bus transit on SES along the Rama VI alignment was therefore rejected. However, the SRT Northern Line provides an alternative alignment for SES, and this was briefly examined. If ETA were to be allowed to construct SES on SRT land, then SRT might expect the mainline track to be elevated, as proposed by them in 1984. A dual-three lane expressway, plus elevated mainline track, plus bus or rail mass transit would require a total right-of-way of close to 50 meters. The SRT right-of-way is variable, but is only 40 meters between Chitlada Palace and the 10-storey buildings of the hospital opposite, making this option infeasible.

A mass transit system centered on buses running on segregated facilities along the expressway system was therefore rejected. It is, however, recommended that an extensive system of semi-express bus services should be allowed to operate, with general traffic, on the expressways.

Following consideration and rejection of realigning SES along the SRT Northern Line right-of-way rather than along Rama VI, a bus and rail mass transit option was developed making maximum use of existing SRT land.

This option incorporates a single rail mass transit line along the Northern Line right-of-way running from north of Bang Sue to Bangkok Railway Station, along Khlong Krung Kasem, crossing the Chao Phaya River on a new road/rail bridge linking Siphaya Road with Somdej Chaophraya Road, along Charoen Rat Road (where the railway ran until about 10 years ago), through Wongwienyai Railway Station and along Phet Kasem Road.

Phet Kasem Road is selected in preference to Taksin Road since passengers in the Taksin Road vicinity will have access to bus services using the expressways.

The entire 21 km rail line would be elevated in order to segregate services from ground-level congestion and so provide a high level of service.

With this option, the opportunity would be taken to elevate the mainline railway at the same time, thus bringing benefits to mainline passenger and freight services, and to road traffic which would no longer be delayed at level crossings.

A feasibility study published in 1984 proposed that 10 km of the Northern and Eastern Lines should be elevated in order to eliminate delays to road traffic at 10 at-grade crossings and to improve SRT operations. This scheme could be implemented independently, or in association with mass transit, as described above.

BMR consultants have examined the full Second Stage Expressway System, with and without associated road improvements; the

full ETA First Stage Mass Transit System; an ambitious bus transit system including one light rail line; and a large program of other road improvements. All were tested under favorable assumptions inasmuch as they were tested alone without competition for traffic from other new schemes. The first three were tested under the high demand conditions of the year 2001.

The SE extension shows a good economic return and would be financially viable, possibly at the present toll level but certainly if the toll were increased in proportion to the increased length of trips that could be made on the system.

The First Stage Mass Transit System is capable of attracting an enormous number of passengers at a low fare and the benefits to public transport passengers would be very large. Unfortunately the costs of building and operating the system are also very large and the economic return would be poor. Financially the system might cover its operating costs and depreciation at a 2-baht fare but without giving any return on the enormous capital investment. The prospects of breaking even financially depend crucially on obtaining finance at a very low rate of interest. Even at 4 percent though, the system will almost certainly not break even if it is faced with competition from buses on expressways.

The bus transit system, being less costly than rail transit, offers a good economic return in conjunction with the Expressway System. The LRT line, however, did not perform well in the test, being unable to compete effectively with semi-express buses. At the same time, the number of public transport passengers in the northern and western corridors placed impossible demands on the busways, and in practice the express services would become embroiled in congestion on the expressways.

It was concluded that the only solution in these very busy corridors was a fast, high-capacity system, i.e. a heavy rail line. The Sam Sen section of the Rama Line and the Ratchda Phisek section of the Sathorn Line considered in the First Stage Mass Transit proposal are not well located to meet the demand in the northern corridor. The Lat Phrao-Phet Kasem option had a better alignment along the SRT line to the north, which is in the right place for the demand, is straight and terminates in the center of the city. It was decided to test a new rail line on this alignment and to incorporate an elevated SRT track with the mass transit line.

There is also an opportunity to extend this line across the river to serve the busy Phet Kasem corridor, using the old railway right of way with a bridge off Siphaya. This would enable the transit trains to run through the center and avoid terminal problems at Bangkok Station.

3.4.3 Bus Transportation

3.4.2.1 Fleet expansion option

In additon to the bus mass transit options described above, the consultants considered the option of expanding the existing bus fleet.

Towards the end of 1984, BMTA issued an open, international tender for the provision of "Management Services and Investment to Improve the Operations of the Bangkok Mass Transit Authority".

Five international consortia submitted bids in January 1985. The five bids are for the sale (with supplier-credit) of buses, facilities, equipment and technical assistance. None of the bids provides for investment by the consortium in BMTA or establishment of a joint-venture company. Given the scale of the tender, and BMTA's operating environment, the credit agencies will almost certainly require guarantees from the Royal Thai Government for the loans to finance the project.

The bus tender is one of the largest transport projects to be considered at the present time. It consists basically of three parts: new buses, new bus facilities and technical assistance.

Because of the large capital investment requirements of this project, the financial outcome clearly depends critically on the cost of capital. If the capital cannot be obtained at very low interest, there is little hope of breaking even. It must also be remembered that the number of passengers was predicted using favorable assumptions, in particular the "prohibition" of buses from the expressways. If the expressways are built and buses can use them, the number of passengers on mass transit, even though large, is unlikely to be large enough to make the system financially viable.

With regard to the physical investments, some discussion of the investment value of these proposals is required:

3.4.3.2 Buses for replacement. Buses are bought either as replacements or as additions to the fleet. The right time to replace an old bus is a complex matter which can be determined only with a good knowledge of both the types of vehicle and the particular vehicles in question. A good idea of the position can be obtained, however, however, simply from a knowledge of the ages of the vehicles, which can be summarized as follows:

1640 aged 5 years, rented by BMTA
2500 aged 6-8 years
950 older buses mostly non-operational

The normal life of the standard sort of buses used by BMTA is eight years, and BMTA buses are subjected to abnormally hard service. Rehabilitation, however, can extend the life of a vehicle by about four years.

If the tender is approved, the first buses will not arrive for about a year, so the above ages need to be advanced by one year. The new buses will then arrive in installments over a period of 4-5 years. It is clear that, by normal standards, the entire BMTA-owned

fleet will soon be due for replacement, and by the end of the proposed contract all the rented buses too will be due, apart from some that may have been rehabilitated.

3.4.3.3 Additional buses. When a bus is bought as an addition to the fleet, there should be a reasonable expectation that its use will lead to additional revenue sufficient to cover the long-term average cost of the vehicle and its operation. If a number of buses are bought, the same test should be satisfied by each one.

It is not known, probably not even by BMTA, how many of the proposed new buses are intended as fleet additions. BMTA (or Bangkok) needs more buses but, in view of the fact that the BMTA fleet is losing money, apparently on every route, it is difficult to justify financially the purchase of more buses. Normally, a bus monopoly can only justify a fleet expansion if the additional buses, by enabling a better service to be given, lead to an increase in passengers and fare receipts sufficient to cover the cost of the extra buses. Given the 2-baht fare, on which most routes are currently making a loss, it is difficult to see additional buses recovering their costs.

It is possible that the deployment of more buses will permit, by virtue of less crowding, the collection of a higher percentage of fares on both the new buses and the old, and that new passengers will also be generated by the increased frequency of service, resulting in a profit on the investment. But this is very uncertain.

So it is not clear that it is reasonable to expect profits on new BMTA buses. The organization is required to supply certain specific services in terms of routes and frequencies, which can only be done with a sufficient number of buses. On this criterion, more buses are clearly needed. But the organization is also required to cover its costs, and on this criterion it may be impossible to justify more buses at the present fare level.

This simply demonstrates, in our view, the irreconcilable demands made on BMTA and the impossible situation in which the management are placed. Until the Authority is given consistent objectives, it will be difficult to say whether investment in new buses is justified or not.

3.4.4 Demand Management

The argument in favor of demand management can be summarized as follows:

a. Road space in the most congested areas cannot possibly keep up with potential effective demand for private vehicles within realistic budget constraints.

b. Land use controls cannot yet be used to control traffic volumes because they will not be sufficiently enforced.

c. Parking controls cannot be used to control traffic volumes because there is too large a surplus of spaces.

d. Demand is reduced somewhat by congestion, pollution and other effects of demand, so that at some level of inconvenience, traffic volumes reach a natural limit.

e. This level, however, is not acceptable, because the city operates too inefficiently at the consequent traffic speeds.

f. Therefore, in the congested areas demand for road space must be reduced by selling the right to use it in the form of tolls.

g. Users will not be willing to accept such fees unless the proceeds are used to increase the efficiency of transportation within the congested areas.

h. Reduction of the level of realized demand for road space by private vehicles will allow segregated busways and more efficient bus flows generally. It will also allow the establishment of higher quality bus services. This will increase the use of buses and lower their operating costs.

i. Revenues from the demand management program will permit expansion of both road and public transport facilities in and to the congested area.

A number of options for demand management were considered and rejected, including the following:

Higher fuel tax: would affect all traffic, throughout the country and at all times; the tax would have to be raised by a very large amount to affect congestion; this would be inefficient, inequitable and certainly unacceptable;

Differential Fuel Tax: i.e. charging higher tax in Bangkok than elsewhere; this implies a graduated tax declining as one goes farther away from Bangkok; since a very high tax would be required in Bangkok, to be effective, the area affected by the graduation would be very large, and the objections to the system would still be overwhelming;

Higher Vehicle Licence fees: This would be even less effective than fuel tax, having no impact on traffic except to the extent that people were forced to give up car ownership, and it would be inefficient and inequitable. Again, the increase in fees would have to be very large to have any real impact on congestion;

Forms of Rationing: e.g. odd-even number plate system, or restricted trips into the congested area. These systems are considered impractical in Bangkok, also inefficient and inequitable;

Metering Systems: While these systems are theoretically efficient, effective and equitable, the use of electronic identification and recording devices is considered impractical in Bangkok at the present time;

Car Pool Systems: Car pools require highly regular commuting patterns; the members of the pool should live and work close to each other and should all start and finish work at the same time every day; conditions in Bangkok are not favorable; car pools are most successful when there is an incentive such as exemption from parking fees or road tolls, but there is no opportunity for this in Bangkok;

Staggered Working Hours: This solution is effective where working hours are highly uniform and where journeys are short, i.e. in smaller cities. In Bangkok, working hours are already widely staggered and journey distances are often long. If further staggering were possible, which is far from certain, given the high traffic volumes over the whole day, it would probably have little impact on traffic congestion.

Parking Controls

Conditions in Bangkok are highly unfavorable to the introduction of parking controls as a means of controlling the volume of traffic entering the congested center. The main reasons are as follows:

- The existence of a substantial amount of surplus parking space means that a relatively large amount would need to be taken out of use before there was any impact on demand;

- The proportion of residents parking is very high, especially on the streets; this would need to be safeguarded by means of reservation schemes which would be difficult and costly to administer and would take years to implement;

- More than half the available parking space is off-street, mostly in private ownership, and is rapidly increasing; at present there is no means of controlling this space and there would be great practical and political difficulties in trying to do so;

- It would also be difficult to stop people parking on the street in minor roads and sois where they cause no serious obstruction; the policy would be difficult to understand and, if understood, difficult to accept;

- Even if parking controls were effective, there would be a problem of increased through traffic; as soon as congestion was eased in the Central Area, traffic would start crossing the area rather than by-passing it.

Provision of School Buses

BMTA is experimenting with specially marked buses for school children and private door-to-door school buses are available for those who can afford them. Such additonal use of school buses in lieu of private vehicles as might result from subsidies would be compensated for by other vehicle-users who would replace those who no longer drove their children to school.

Cordon and Area Licencing

Cordon licensing was conceived as a congestion tax: one pays the tax for using congested roads because, in such places and at such times, road space is by definition scarce. It has been highly effective in Singapore and in 1979 was seriously proposed for Bangkok.

Area licensing is similar but requires a licence for driving within the prescribed areas rather than for merely entering the area; it is more difficult to enforce and more restrictive to the inhabitants of the area. Both methods, however, are effective in combating congestion, can be varied between different times of day, leave motorists free to use their cars when they please, if they are prepared to pay, and are simple to understand and administer.

Their principal disadvantage is that they bring little benefit to the users of the area. They leave nearly all motorists worse off than before. It can be shown that most of the motorists who buy a licence are worse off because the price is higher (and has to be higher) than the value of the congestion savings that they receive. Only the very rich motorist, who attaches little value to the money he has to pay, is in a position to consider himself better off than before. The motorists who decide not to buy a license but to take public transport or not make the trip, are nearly all worse off than before, because they are forced into an inferior choice; although, if the relief of congestion leads to a marked improvement in bus services, some marginal motorists may find themselves slightly better off on the bus than they were in their car. Reduction in noise and air pollution would have some value.

As for public transport passengers, the users of buses will benefit but the users of mass transit, if there is a mass transit system, will be little affected except possibly from more crowding. The effects of business in the area are likely to be mixed; those that serve middle income groups will probably lose customers while those that serve lower income groups may gain; but in any case their gains and losses will be offset by those to businesses outside the area.

There are undoubtedly large benefits from such schemes but they take the form of marginal tax gains spread invisibly over the whole country, or perhaps higher expenditure, depending on how government disposes of the licence revenues. These benefits are probably not perceived whereas the disbenefits to the users of the area are clearly seen.

To avoid the difficulties described above, the consultants have proposed a Traffic Improvement Program (TRIP) which is designed both to reduce demand for road space and to generate resources for transportation improvements in the congested area. In effect, it is an extension of the expressway toll system which is already in effect. The proposed toll zone is shown in Figure 3.9.

The proposed zone requires 20 inbound toll points, all of which have been surveyed in order to establish the feasibility of installing the necessary checkpoints. These toll points are additional to the expressway toll plazas. Tolls would be collected on the inbound direction only; drivers travelling out of the TRIP Zone would not pay a toll.

Tickets would be sold in advance by authorized retailers (sales booths, garages, post offices, etc.) Daily and monthly tickets would be available; weekly books of tickets would be sold, consisting of seven daily tickets. In order to use a ticket, the puchaser would need to detach it from the book and attach it to the windshield of the vehicle inside a plastic holder. Motorcyclists would carry the ticket in a holder on their left arm (as is commonly done by skiers on ski lifts) motorcycles would use the nearside lane only at toll points.

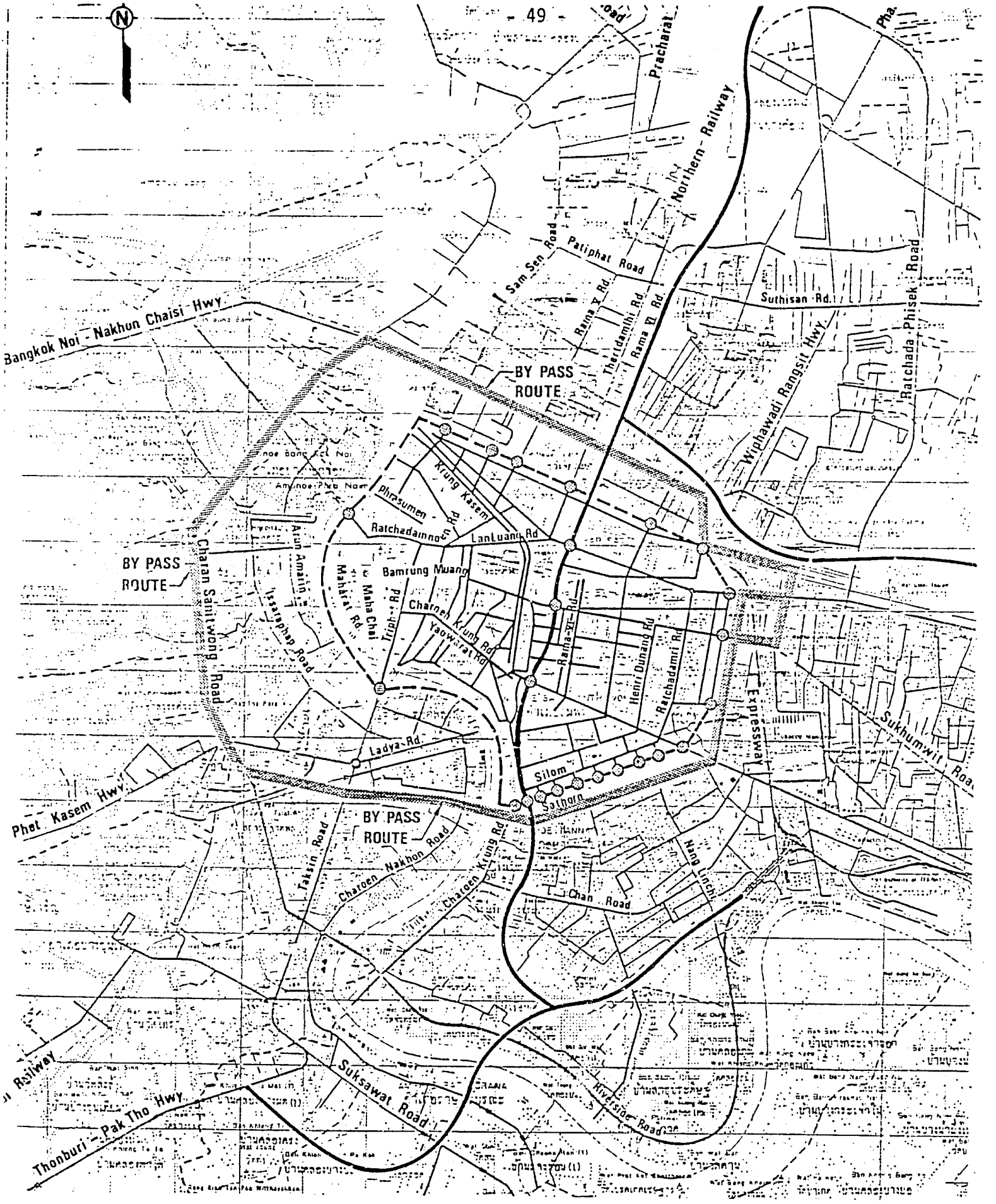
Tickets would also be available at a much higher price at the toll points on entry to the TRIP zone. The intention, however, is that the great majority of road users would obtain their tickets before reaching the toll point, in order to minimize delays in passing through. At the toll points, tickets would be obtainable only in one lane.

TRIP tickets would be inspected on passage through the toll points, which would be manned by a force of wardens, supported by traffic police. Each lane through the toll point would be manned by a warden and would be designed to oblige vehicles to slow down to the speed at which the warden could perform his or her duty.

The precise design and location of the toll points is important, as they must not constitute an additional cause of congestion. Each toll point should be designed with a convenient lay-by or side street into which vehicles may be directed if, for any reason, they cannot be promptly dealt with. Any such vehicle likely to cause delay should be immediately taken out of the traffic stream and parked in the lay-by until it can be attended to.

Inspection of toll tickets would necessarily be cursory, as with ordinary vehicle licences. As a check against forgery, therefore, small random samples of tickets should be exchanged at the toll points, and the vehicle numbers noted, in order that the tickets may be properly examined later and the retail outlet traced if necessary.

Toll points should normally be placed, therefore, at a distance before the junction such that the road between the toll point



EXPRESSWAY

TOLL POINT (Inbound only)

BY-PASS ROUTE

0 1Km.

Figure 3.9 TOLL ZONE

HFA

JULY 1986

and the junction can just hold sufficient traffic to allow the green phase of the signals to be fully used.

Existing road space will be somewhat reduced by the need to provide toll booths and islands for enforcement personnel and thus the traffic capacity of the road will be reduced. However, provided that the traffic capacity of the toll point is greater than or equal to that of the next downstream junction, there should be little overall change in traffic delays. One effect of the scheme will be to reduce traffic volumes from today's levels and consequently less capacity will be needed.

Observations have been made of the time necessary to pay tolls on the expressways in Bangkok, where all vehicles must pay. Maximum vehicle throughput is about 600 vehicles per hour, with vehicles taking about 6 seconds on average to enter and clear the booth.

Drivers will be strongly encourgaged to purchase TRIP toll tickets in advance in order to maximise traffic flow at toll points. For those who wish to pay at the toll points, an average of 8 seconds would be required to enter and clear the booth. For vehicles displaying a prepurchased ticket, an average of 3 seconds would be required to enter and clear the toll point i.e. a flow of 1200 vehicles per hour per lane.

We have compared the capacities of the twenty proposed toll points with the peak hourly traffic flows on these roads in 1984, and are satisfied that with appropriate engineering design, the toll points can function satisfactorily.

Clearly the impact of TRIP on the volume of traffic will depend on the level of the tolls. At the present time, a toll of 30 baht per car seems reasonable, with 40 baht for a bus and 10 baht for a motorcycle. Regular buses would pay under a contract and would not need to be inspected. Tickets bought at the toll point, rather than beforehand, would cost considerably more (e.g. 60 baht for a car) in order to encourage the maximum amount of prepurchase.

It is estimated that tolls of 30 baht per car (with equivalents for other vehicles) would yield over 2,000 million baht per annum if charged between 6 am and 7 pm. A 24-hour toll would produce over 2.5 billion baht. Receipts from vehicles arriving via the expressways would be credited to ETA. The remainder, after payment of expenses, would be due to the TRIP Fund.

It is estimated from traffic counts that nearly 400,000 vehicles enter the zone during a normal 12-hour day, of which cars represent 36 percent, taxis 20 percent and motorcycles 24 percent. When a road is running at or close to capacity, as is the case for main roads in central Bangkok over much of the day, a small change in traffic flow (up or down) gives rise to a relatively large change in speed and travel time. A 10 percent reduction in the traffic volume (in pcu's) might reduce traffic delay by an average of about 10 minutes per trip to the

area. It is tentatively estimated that a 30 baht toll per car (with equivalent tolls for other vehicles) might reduce the number of cars entering by about 20 percent, and total traffic by about 10 percent, but the actual impact would depend critically on the quality of public transport at the time. It is important that steps be taken to radically improve the bus services before such a scheme is introduced.

3.4.5 Truck Terminals

Major investment in freight distribution facilities is planned or under way, although there does not appear to be a coherent freight distribution policy for BMR. Planned investments include four truck terminals and a container freight station (CFS) at Bang Sue.

A feasibility study by JICA recommended construction of four terminals on the periphery of Bangkok. The Department of Land Transport (DLT) subsequently signed contracts with private developers for construction and operation of two terminals: one at Rangsit, to the north of Bangkok, and one to the west at Bang Kae. The contracts, signed in 1985, allow two years for construction of each terminal.

It is understood that agreement in principle has been reached between DLT and a developer for a third terminal (at Bang Na) but the fourth terminal (at Yannawa) has not attracted adequate interest form the private sector and is not being pursued.

The key questions to be addressed are:

(a) what actions will be required to encourage sufficient use of the two committed terminals to enable them to be financially viable?

(b) What is the most appropriate package of policies and schemes (i.e. Truck Management Plan) whereby cargo can be distributed efficiently within BMR, given the constraints imposed by the road system and other traffic demands?

(c) How should the two committed truck terminals function within this Truck Management Plan?

(d) Should government proceed quickly with one or two additional terminals to complete the proposed system, or should additional terminals be postponed until experience is gained with the two committed projects?

A container freight station (CFS) at Bang Sue has been planned for some years. The CFS would be linked to Sattahip and Laem Chabang ports by the new railway line serving the Eastern Seaboard.

Plans for the Bang Sue CFS to be financed by the World Bank have been dropped, and the Ministry of Communications now proposes to privatize CFS in conjunction with Sattahip Port.

The CFS gives rise to the following issues:

- An increase in rail freight traffic between the Eastern Seaboard and Bang Sue could aggravate problems with at-grade road crossings in Bangkok;

- The CFS, insofar as it will generate demand for truck movements, should be seen as an integral component of an overall Truck Management Plan.

3.5 Investment Requirements

The method used to estimate the likely BMR transport budget for 1987-91 is to use investment over the past five years (1980-84) as a benchmark and to consider alternative budget levels relative to that benchmark. The basic assumption is that 125% of the prior level will be available during the Sixth Plan period.

Investment in urban transport by all agencies in the STTR area is summarized in Table 3.5. Over the five year period 1980-84, investment was 10,537 million baht.

Table 3.5: Summary of Agency Investments in STTR Area (Million Baht)

Agency	Total 1980-84
OCMRT	84
BMA	3,103
ETA	2,790
DPW	1,536
DOH	2,867
SRT	157
TOTAL	10,537

The corresponding figures for BMR (including the STTR area) are given in Table 3.6:

Table 3.6: Summary of Agency Investments in BMR (million baht)

Agency	Total 1980-84
OCMRT	84
BMA	3,103
ETA	2,790
DPW	1,602
DOH	3,724
SRT	157
Changwats (1)	147
TOTAL	11,607

Assuming that the available budget for transport in BMR under the Sixth National Plan will be 125 percent of investment made in 1980-84, the target budget for the BMR transport sector 1987-91 will be 14,500 million baht.

The STTR Basic Investment Programme includes 13,100 million baht of government investment, tentatively leaving 1,400 million for investment in the outer areas of BMR.

If the proposed demand management program were approved, the additional revenues would be used to add the following projcts to the basic program described above.

	Million Baht
. ETA	
912-Lat Phrao-Phet Kasem Road mass transit line	5,339
. BMA	
218-Lat Phrao Road-Ram Intra Road (Southeast)	540
219-Lat Phrao Road-Ram Intra Road (Northeast)	368
222-Phahonyothin Road-Sukhapiban 1 (Centre)	163
919-Khlong Bang Sue Road	494
Sub-total	1,565
. DPW	
502-New Krungthep Bridge (net additional cost)	433
. DOH	
620-Route 345: Nonthaburi Bridge-Bang Bua Thong	57
626-Route 3268: Sam Rong-Bang Plee	96
914-Bangkok Noi-Nonthaburi	387
Sub-total	540
. TRIP	
970-Implementation of TRIP toll facilities	50

Net Budget Addition 7,927 million baht

3.6 Conclusions

The need to explore possible areas of conflict between the transportation sector and other parts of the analysis was discussed in

Chapter 2. To do this, it will be necessary that the particular growth implications of the transportation scheme be developed at least to the amphoe level. This should then be contrasted with the assumptions of the population and employment projections, and with the amphoe level growth implications of the water resources schemes.

A second area of difficulty for each of the sector analyses which is, however, particularly acute for transportation is that major investment decisions are being made or considered in the course of the study. For example, requests for approval have recently been made for rail mass transit, BMTA bus procurement, ring roads and truck terminals. Approval of any of these projects could have important physical and financial implications for the investment program proposed for the BMR. Thus, the final report may require substantial adjustments to take into account intervening government actions.

Chapter 4

WATER RESOURCES

4.1 Problems

The primary problems in the water resources sector are the following:

- Flooding caused by local overflow of the Chao Phraya, cross-country flows of run-off from the North and local rainfall in excess of current drainage capacity.

- Subsidence of land due to extraction of groundwater at a rate which exceeds natural recharge.

- Inadequate water supply, caused by water losses in existing distribution systems, informal residential development, and rapid growth in residential and commercial demand in unserviced areas.

- Low water quality levels in the Chao Phraya, particularly during the dry season and in the Tha Chin year around, as a consequence of residential and industrial effluents and sea water infiltration.

These problems have been considered in a number of recent studies. The analysis presented here is derived largely from the interim sector report submitted by CIPO staff, the Water Resources Sector Status Report (June 1985) prepared by John Ritchie under contract to the World Bank, and the Bangkok Flood Control Draft Final Report prepared by Binnie and Partners and Coopers and Lybrand for the Asian Development Bank.

4.1.1 Flooding

The Chao Phraya River drains most of the North and Central Regions of Thailand into the Gulf of Thailand. The total drainage area is 178,000 km^2, one third of Thailand's land mass. Four main tributaries - the Ping, Wang, Yom and Nan - drain the northern hills and valleys into the upper plain of the Central Valley. These tributaries have all combined, by the time Nakhon Sawan is reached, to form the Chao Phraya River, with a drainage area at this point of 110,000 km^2.

Bangkok is located near the mouth of the river where the Central Valley, actually an alluvial plain, meets the Gulf. Over much of this deltaic plain the ground levels are from 1 meter to 3 meters above mean sea level (m MSL) with only a few relatively small and isolated areas being several meters higher. Within the BMR, ground levels average less than 2 m MSL. Average ground level in Bangkok is less than 1.5 m MSL and is as low as 0 m MSL in some locations. This means that much of Bangkok's drainage system is below mean sea level.

The rivers of the Central Valley, most importantly the Chao Phraya and the Tha Chin, overflow their banks as a consequence of the combination of high seasonal rainfall, especially in September and October, with high tides. In Bangkok, the Chao Phraya river flow capacity varies between 2000 m^3/second on the flood tide and 3000 m^3/second on the ebb tide. Similarly, monthly average river flow rates, measured at Bangsai range from 100 m^3/second in March and April to 1750 m^3/second in October. The maximum monthly mean flow during the years 1965-82 was 4,145 m^3/second (in October).

The dramatic effects of the convergence of tides and river flows can be temporarily exacerbated by trade winds and winds generated by storms and by local rainfall in Bangkok. More permanent effects have resulted from enhanced upstream run-off and siltation caused by deforestation of the Chao Phraya watershed. In addition, increased urbanization has contributed locally to floods by reducing the amount of ground exposed for absorption and, perhaps more importantly, reducing the area in which standing water can be stored without damage to property. In some cases, buildings, road beds, railroads and the like act as impediments to run-off of flood waters.

As a consequence of all of these factors floods have been common in Bangkok in recent years. Table 4.1 displays quantitative characteristics of major floods since 1964.

TABLE 4.1

Flood Characteristics 1964-1984

Year	Chao Phraya River Barrage discharge m^3s	Interval days	Memorial Bridge, BKK river level, m MSL
1964	3475	36	1.75
1975	3977	15	2.05 (1.92)*
1978	3769	8	2.05 (1.87)
1980	3897	28	1.99 (1.75)
1982	1000	No record	1.70 (1.50)
1983	3370	14	2.13 (1.93)

Average annual maximum 2200 m^3 s] at Chao Phraya River barrage
Bankfull discharge 3500 m^3 x]

Source: Binnie and Partners 1985

In three of the flood years shown in this table, annual rainfall was within ten percent of average annual rainfall for Bangkok.

The western and central parts of the Bangkok Metropolitan Region were affected by overland flow from the flood overspill of the Chao Phraya and Tha Chin River systems. The Tha Chin direct catchment contributed much flow to that river. Rainfall run-off in the lower basin compounded the problem. Gravity drainage was impeded by the high river levels and tide levels, and pumping capacity and internal drainage efficiency were insufficient to cope with the rainfall run-off. Additionally, much overland flow originated in the regions east of Bangkok, gravitating towards the subsidence depression in the urban area. About 350 km^2 were seriously flooded, in some areas for up to three months or more. The total area of flooding was much greater.

Flooding has a number of effects, in safety and health risks, in physical damage and repair or replacement costs, economic losses, environmental damage and social and individual disruption and inconvenience.

All sectors of the community run risks to safety and health in times of flood either directly from flood waters or from the side effects of flood disrupting, polluting or damaging water supply, sanitation, drainage, environmental conditions, residential or working accommodations, communications and public services.

Residential, business, industrial and agricultural properties suffer damage if invaded by flood water, depending on the depth and duration of flood water involved and the structures, equipment, contents, crops and so on affected.

Public utilities and services - water supply, drainage, electricity, telecommunication, transport and highways - can all be affected by flooding. The effect may be a temporary suspension of the service, physical damage requiring repair or replacement, or a drop in demand for the services in the flooded areas for various reasons - temporary impracticality of use, for example. These effects result in extra costs for repair and replacement and possible loss of revenue.

Economic losses arise from travel disruption due to flooding; delay or inability to get to work; inability to carry out business in flood conditions; the need to obtain alternatives to flooded accommodation, and so on.

All the recent floods in Bangkok have led to flood damage costs and losses reckoned in many hundreds or in thousands of million baht. The NSO quick survey of 1983 flood damage costs in much of the Bangkok Metropolitan Region showed a total damage and economic loss of Baht 6,600 million, of which 10% was government sector loss and the rest private (residential, business, industrial and agricultural). More detailed surveys of limited areas on the east and west banks since the NSO survey show that the total costs of physical damage and economic losses must have been considerably higher than the NSO figure.

4.1.2. Land Subsidence

The Office of National Environment Board was assigned to coordinate the study of land subsidence problem in the BMA during 1978-81. The major conclusion from this undertaking was that land subsidence in Bangkok is caused by excessive use of groundwater beyond its natural safe yield. As a consequence, the future groundwater reserve will not be of the quantity and quality suitable for use apart from the serious problems that land subsidence has already caused.

It has been estimated that the natural ground subsidence rate is about 0.01 metre per year. In more than 1000 km^2 of the Bangkok area, particularly on the east bank, this subsidence has been accelerated greatly by over-pumping of groundwater from aquifers deep below the city at rates greater than the natural recharge rate of the aquifers. Consequent reduction of water pressure within the alluvial deposits has increased the effective consolidation pressure from overlying soils, in strata both above and below the aquifers, and speeded up the natural consolidation process. This process is substantially irreversible. The reduction or elimination of overpumping of groundwater will decelerate the rate of subsidence but it will take some years to reduce the subsidence rate to anything approaching the original natural rate. In recent years ground surface subsidence rates of up to 0.15 metres per year have been reported. With at least one area of Bangkok down to a ground level of roughly MSL and still sinking, present flood barriers are subsiding and large parts of the drainage systems are dropping below river levels. There are major risks of inundation by high flows in the river, by high tides and by heavy local rainfall (unable to drain naturally to the sea or to the river because of high river or sea levels) unless existing flood protection and surface water drainage systems are upgraded and extended.

Because of rapid urbanization, the area served by the water supply distribution system using surface water supplies has not kept pace. Increased public private and industrial ground water abstractions beyond the safe yield of the deep aquifer underlying the Bangkok area have accelerated land subsidence in the deltaic plain. About 1,000 km^2 of the ground is subsiding rapidly. The centre of the subsidence area is located on the east (Bangkok) bank of the river, where the groundwater quality is better than on the west (Thonburi) bank. This subsidence has reached such proportions since its onset in the late 1950's that it has altered the drainage characteristics of Bangkok markedly. The subsided land surface is in various places below normal high water level in the tidal river, and in some instances below mean tide level, so that natural drainage from these places can only take place during the low water half of the tidal cycle. Rainfall occurring during normal tidal high water periods can therefore cause local flooding due to runoff ponding unless pumps are in operation to assist evacuation of the water to higher parts of the drainage system leading to the river or the sea. Gravity drainage on the east bank now tends to be towards the shallow depression formed by the subsidence, encouraging accumulation of flow from the eastern and

northern areas outside the urban areas as well as from the river. The risk of serious flooding has therefore increased for the urban areas in times of heavy rainfall, with even greater risks of flooding when drainage out of the areas is inhibited by high external water levels in the river or sea.

The Metropolitan Waterworks Authority (MWA) serves an area of over 3,000 km^2, comprising the BMA area, Samut Prakan Province and Nonthaburi Province. Two-thirds of the 7 million population is served by piped water distribution; the remainder depend on wells, canals, rainwater or water vendors. The MWA abstracts approximately 25 m^3/s of water from the river upstream of Bangkok, which abstraction is expected to double during the next 15 years as the water supply distribution system expands. Current groundwater abstraction by the MWA and private wells is at least 1.4 million cubic metres per day of which little more than 0.4 million cubic metres per day is used for MWA purposes. The safe rate of groundwater abstraction to arrest land subsidence due to overpumping is estimated at about 0.8 million cubic metres per day. It is planned to phase out the MWA wells by the end of this decade as the surface water piped supply system is expanded and to reduce private well abstraction to within the safe limit. However, the 1.4 million cubic metres per day abstraction quoted above is the legal licensed total; it is acknowledged that unlicensed abstractions probably add 50% to that total and these are less easy to control.

It has to be noted that the MWA predictions of unfulfilled demand in the central distribution system area in 5 years time, and over the following 10 years, is between 0.3 million and 0.4 million cubic metres per day. This unfulfilled demand figure is based on MWA estimates of effective per capita demand at the consumption point, and not on the gross amount of water required to be produced by MWA when distribution losses are considered. It can be taken as representing the water requirements from sources other than the MWA, such as continued private groundwater abstraction. This demand is about half the accepted safe limit for land subsidence control of 0.6 to 0.8 million cubic metres per day groundwater abstraction. Over the whole MWA supply area the unfulfilled demand at the consumption point is around 0.6 million cubic metres per day (plus or minus 10%) between 5 and 15 years from now, which again, even it it is all obtained from groundwater, is a tolerable abstraction figure. However, the current admitted unlicensed groundwater abstraction of over half a million cubic metres per day, in addition to official abstractions, may not be fully taken into account. If the unlicensed abstraction continues in the future to any significant degree there is still a risk that total groundwater abstractions will run above tolerable limits for full land subsidence control.

The ONEB had recommended various measures to prevent and control the groundwater and land subsidence crisis which were adopted by the Council of Ministers in principle on 15 March, 1983. The salient points in its recommendation are as follows:

(1) Lands in the Bangkok Metropolis, Nonthaburi, Patum Thani and Samut Prakarn have been classified by the ONEB into 3 critical zones that are subject to control (Details appear in Diagram I) as follows:

- Critical zone No. 1 comprises areas with land subsidence rates over 10 cms./year and/or groundwater levels depleting quickly. These are Bangkhen, Pra Khanong, Bangkapi, Huay Kwang, Phra Pradaeng districts and Maung district of Samut Prakarn province, including the community and industrial zone around Minburi, Lard Krabang and Bang Plee districts.

- Critical zone No. 2 includes areas with land subsidence rates of 5-10 cms./year and/or groundwater levels depleting moderately quickly. These are Dusit, Phyathai, Patumwan, Bangkok and Yannawa districts.

- Critical zone No. 3 includes areas with land subsidence rates of less than 5 cms./year and/or groundwater levels depleting moderately. These are the areas in the rest of Bangkok, plus, Nonthaburi, Patum Thani and Samut Prakarn.

Proposed measures described below are aimed at preventing land in the BMA and Samut Prakarn from subsiding more than 50 cms. from the present level as well as at first stabilizing groundwater levels in the 3 critical zones and then raising it from 1988 onwards.

4.1.3. Water Supply

Provision of water supply in the BMR's 6 provinces is the responsibility of various public enterprises and local authorities as follows:

The Bangkok Metropolitan Area (Bangkok Metropolis plus Samut Prakarn and Nonthaburi), covering the area of 3,080 sq. km., is served by water supply systems of the Metropolitan Waterworks Authority (MWA). The MWA network comprises 2 major systems; the central system and 7 independent systems. Serving the inner city area, the central system comprises water treatment plants in Bang Khen, Samsen and Thonburi as well as groundwater under the control of 10 MWA district offices. The outlying areas, on the other hand, have separate and independent systems in Minburi, Lard Krabang, Nong Chok, Bang Plee, Bang Buathong, Bang Yai and Sai Noi, using mainly groundwater.

The current MWA operations and expansion program basically follow the the 1970 MWA Master Plan that was revised in 1983 in response to changing circumstances, especially the increasing demands for piped water and land subsidence. The revised Master Plan covers the period to the year 2000

Patum Thani comprises 2 large service areas: Patum Thani municipality and Prachathipat sanitary district. The Provincial Waterworks Authority (PWA) runs the water supply systems in these 2 areas.

Nakorn Pathom has its own local waterworks systems operated by concessionaires under technical supervision of the Public Works Department. The 3 concessioned water supply systems are Nakorn Pathom Waterworks, Sampran Sanitary District Waterworks and Kampaengsan Sanitary District Waterworks.

Samut Sakorn has one water supply system operated by PWA. The distribution network includes Tambon Ta Chalom and Bangkok Yaprak. Three other systems operated by concessionaires are Samut Sakorn Municipality Waterworks, Ban Praew Sanitary District Waterworks and Kratumban Sanitary District Waterworks.

Table 4.2 and Figure 4.1 show the extent of coverage of current formal water supply systems. It is apparent from that data that only slightly more than half the BMR population receives its water from such sources. Even in the more developed area (the BMA plus Changwats Samut Prakan and Nonthaburi) more than a third of the population use wells surface water, water vendors or other sources.

There are several explanations for the lack of coverage of water supply systems in developed parts of the BMR. Most importantly, more than 800,000 people, or about one-third of the unserved population live in slums and squatter settlements to which water service has not been extended. Secondly, about 40 percent of distributed water is lost in the distribution system or otherwise unaccounted for, which means the supply is inadequate to meet demand. Finally, a substantial number of households rely on wells, legally or illegally, either because piped water is unavailable to them or because it is cheaper. In any case, the need to control land subsidence limits the extent to which either public or private users can rely upon ground water. On the other hand, the increasing pollution of surface water makes that source more expensive to treat.

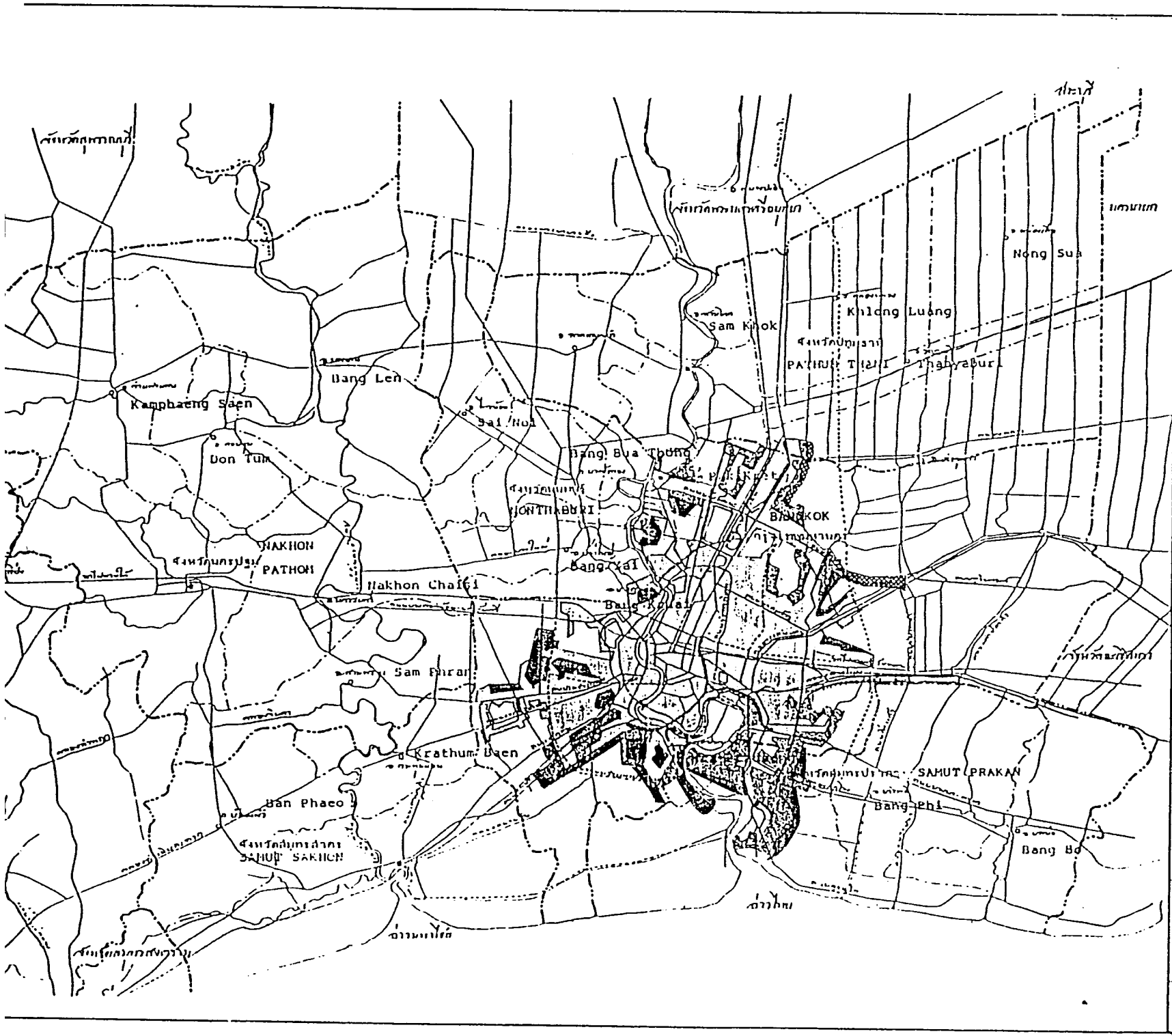


Figure 4.1

WATER SUPPLY

SERVICED AREA

EXISTING

Stage I Phase II (1985)

Future Plan

Stage II Phase IA 1985-89

Stage II Phase IB 1988-91

Stage II Phase II 1994

มาตราส่วน

ก.ม.

เขตจังหวัด
Changwat Boundary

เขตอำเภอ
Amphoe Boundary

ที่ตั้งจังหวัด
Location of Changwat

ที่ตั้งอำเภอ
Location of Amphoe

ระบบทางด่วน
Express Way

แผนที่ กรุงเทพมหานครและปริมณฑล

BANGKOK METROPOLITAN REGION

กองวางแผนภาค
REGIONAL PLANNING DIVISION, NESDB

TABLE 4.2

Characteristics of Water Services

	BMA + Samut Prakarn Nonthaburi	Prathum Thani	Nakorn Pathom	Samut Sakorn
1. Area served (sq.km.)	400.00	9.10	9.28	7.90
2. Number of customers	536,183	2,201	8,139	8,813
3. Population served	4,300,000	10,800	43,239	43,350
4. Total population in 1985 (mill.)	6.67	0.393	0.603	0.287
5. Total production (cubic metre per day)	2,149,00	8,106	29,280	23,328
6. Source of water	Chao Phraya River and ground water	ground water	ground water	ground water
7. Nature of operator	MWA	2 systems by PWA	3 concessionary water supply systems	1 system by PWA+3 concessionary water supply systems

Source: CIPO

In the outlying communities of the BMR, where responsibility for water systems is shared among the Provincial Waterworks Authority (PWA) and concessionary water suppliers, systems expansion has apparently been inhibited by disputes between PWA and local authorities concerning the transfer of concessionary systems to PWA.

4.1.4 Water Quality

The condition of the water in Chao Phraya and Tha Chin Rivers is the result of effluent released from the domestic, industrial and agricultural areas in the upper and middle part of the rivers. The effluent includes wastes from cattle and fish farming along the river-banks and water flora such as hyacinths and Java weed.

The quality of water in the Chao Phraya becomes critical in the dry season in the stretch approximately 15 to 50 kilometers from the river mouth where the quantity of dissolved oxygen drops to 0.5-1.0 mg/l (standard level = 2 mg/l). The dissolved oxygen level is expected to

drop even lower and the polluted area to expand. The quantity of Coliform bacteria is also very high. In the dry season, saline water infiltrates as far upstream as the Bangkok Bridge, approximately 40 kilometers from the river mouth. At that point the salinity ratio may reach 1/1000.

The quality of the water in the Tha Chin River is critically low nearly year round from 20-60 kilometers from the river mouth. Dissolved oxygen levels there reach 0.2-1.0 mg/l. Toxic substances can be found in the upper part of the river with a mercury density of 1-2 micrograms per litre. The infiltration of saline water reaches 27 kilometers from the river mouth at a salinity ratio of 1/1000.

Toxic substances in the water supply come primarily from industrial discharges and from pesticides used in agricultural areas which drain into rivers which water systems use as sources.

4.2 Proposed Development Strategy

Given the problems described above, the following priorities should guide investment decisions for the various categories of water resources projects:

(1) because most existing and future development, at least through the year 2000, will be concentrated within the Eastern Flood Dike, both water supply and flood protection investments in that area should have the highest priority.

(2) protection of existing investment should have priority over new investment in general, except insofar as the first priority applies. That is, existing residential, commercial and industrial development should be protected before areas planned for new development.

4.3 Policy Guidelines

Given the problems identified above, the policy objectives in the water resources sector for the Sixth Plan period should include the following:

. To provide flood protection to those areas of the BMR where the most damage can be prevented for the least cost. These areas will be primarily on the Eastern side of the Chao Phraya River in the BMR and Samut Prakan.

. To reduce ground water extraction by both public and private users to a level below the natural acquifer recharge rate.

. To reduce losses in the water system from 40 percent to 30 percent by the end of the Sixth Plan period.

. To increase water production capacity by 0.5 cubic meters per day.

. To expand the distribution system to serve already developed areas, particularly in areas where groundwater extraction is a problem, and to serve newly developing areas in a manner consistent with the development of the transportation network.

. To provide water service to slums which are approved for upgrading.

. To establish and enforce agricultural and industrial effluent and waste controls, watershed management, and residential solid waste and sewerage disposal systems and regulations.

. To establish the institutional and technical means of evaluating proposed water resources projects against an overall development plan for the BMR.

4.4 Proposed Projects

The proposed projects in the water resources sector are of three main types:

. Flood protection projects on the Eastern side of the Chao Phraya, including the core area dike and the outer dike.

. Water supply expansion including Phases 1A and 1B of Stage II of the Third Bangkok Water Supply Project.

. Planning and regulatory measures designed to minimize the negative consequences of development on water resources.

4.4.1 Flood Protection

The proposed flood protection program is one of a number of technically feasible approaches to flooding problems in the BMR. If completed it would protect 1,400 square kilometers of Metropolitan Bangkok and it vicinity, including the most populous and fastest growing areas of the BMR. A total of five projects are proposed as follows:

TABLE 4.3

Flood Protection Proposals

Priority Package	Construction Period
City Core Phase I	1986 - 1990
Eastern Suburban Bangkok	1987 - 2000
West Bank Bypass	1986 - 1994
River Bank Dyking	1987 - 1991
Samut Prakan Province	1986 - 1990

Related projects on which work will not begin until after the Sixth Plan period include Phase II of the City Core project, the West Bank Drainage Works, and a second Eastern Suburban Project.

A comprehensive scheme to protect the whole area needing flood protection and drainage control has not been prepared. The east bank polder, constructed to its present standard since the 1983 flood, can form an intermediate stage in the implementation of a comprehensive long-term high standard flood control scheme allowing for land subsidence (See Figure 4.2).

The Bangkok City Core project, protecting 94 km^2 of the city centre against 100 year return period river levels and 2 year return period local rainfalls, allowing for land subsidence over 10 years, is at tender document stage and could be implemented rapidly to form part of the comprehensive flood control scheme (See Figure 4.3). The project is economically justified.

The East Suburban Bangkok project for similarly protecting a further 260 km^2 is at an advanced stage of design and can be incorporated into the comprehensive scheme in the near future after final detailed design.

Projects for other areas of the east bank are under construction or are approaching design stage. Options for various river control alternatives are being studied.

Further studies are under way to investigate flood control options in the west bank area but these are not at a sufficiently advanced stage to determine the optimum engineering solution to the west bank flooding problem.

It is necessary for the practical and economic operation of any comprehensive flood control scheme, and particularly for the constituent projects on the east bank, that the land subsidence allowances made in the designs are not exceeded. It is essential that the land subsidence control programme planned to take place over the next few years be effective and on time. Reduction of groundwater usage to below the levels at which it induces land subsidence must be attained and within as short a time as possible, as the rate of subsidence will take several years to decline to an acceptable figure after the reduction of groundwater pumping.

The absence of effective planning controls on land use and development is causing difficulties in preserving the capabilities of the existing drainage and flood abatement facilities and is increasing the risk of flooding. Development beyond the limit of surface water supply networks is increasing the demand for groundwater as an alternative. Without effective planning controls the complexities and cost of flood control will increase.

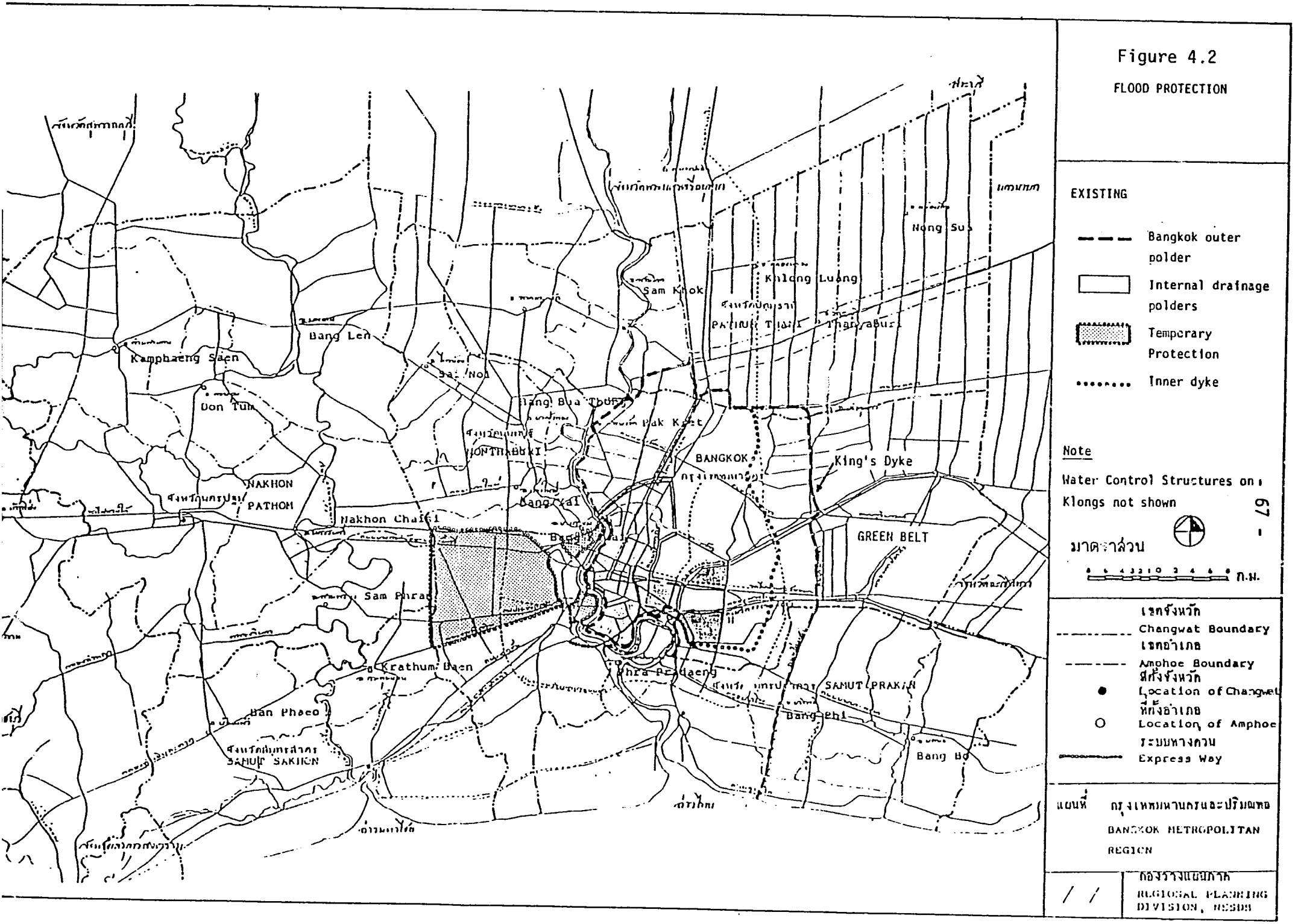


Figure 4.2
FLOOD PROTECTION
EXISTING
Bangkok outer polder
Internal drainage polders
Temporary Protection
Inner dyke
Note
Water Control Structures on Klongs not shown
มาตราส่วน
ก.ม.
เขตจังหวัด
Changwat Boundary
เขตอำเภอ
Amphoe Boundary
ที่ตั้งจังหวัด
Location of Changwat
ที่ตั้งอำเภอ
Location of Amphoe
ระบบทางด่วน
Express Way
แผนที่ กรุงเทพมหานครและปริมณฑล
BANGKOK METROPOLITAN REGION
กองร่างแผนภาค
REGIONAL PLANNING DIVISION, NESDB
Nong Su
Khlong Luang
Sam Krok
Bang Len
Kamphaeng Saen
Don Tum
Bang Bua Thong
Pak Kret
NONTHABURI
BANGKOK
King's Dyke
NAKHON PATHOM
Nakhon Chaisi
Bang Yai
GREEN BELT
Sam Phran
Krathum Baen
Phra Pradaeng
SAMUT PRAKAN
Ban Phaeo
SAMUT SAKHON
Bang Phli
Bang Bo

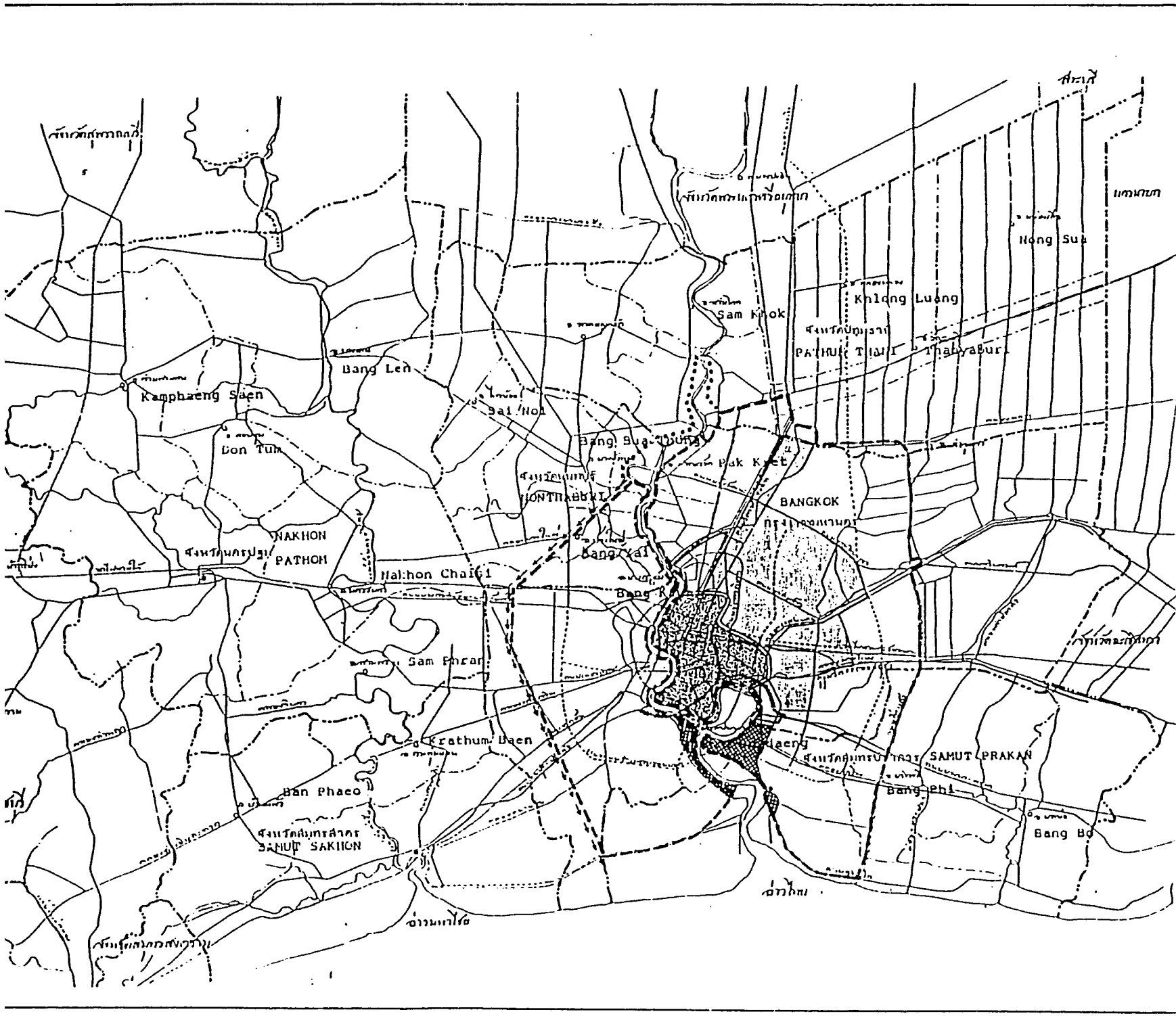


Figure 4.3

FLOOD PROTECTION

Future Plan

Longterm plan

- City Core
- Eastern Suburban Bangkok
- West Bank Bypass
- River dyking extention
- Samut Prakan works

Priority

- City Core phase
- Easter Suburban

Note

Water Control Structures on Klongs not shown

มาตราส่วน 1 : 68

ก.ม.

- เขตจังหวัด — Changwat Boundary
- เขตอำเภอ — Amphoe Boundary
- ที่ตั้งจังหวัด — Location of Changwat
- ที่ตั้งอำเภอ — Location of Amphoe
- ระบบทางด่วน — Express Way

แผนที่ กรุงเทพมหานครและปริมณฑล

BANGKOK METROPOLITAN REGION

/ /

กองวางแผนภาค

REGIONAL PLANNING DIVISION, NESDB

On the basis of the available information, and assuming that land subsidence control and land use/development control will be implemented within the near future, it appears feasible for approximately 1400 km^2 of metropolitan Bangkok and its vicinity to be given an economical long-term high standard protection against flooding.

The area concerned is expected to have a population approaching 8 million by the year 2000 AD and the potential benefits of protection to amount to over Baht 6,000 million at January 1985 prices.

The priority flood control need is the exclusion from the area to be protected of river overspill and flow overland from elsewhere. This suggests the construction of a permanent long-term high standard flood barrier round the boundary of the area, which would provide external flood defence for all the area from the outset, and infill with staged internal drainage facilities later on in parallel, depending on the complexities of the work and the resources available.

The main alternative to the outer flood defence and internal infill option is to build up the area given permanent long-term high standard flood control (both for flood protection and internal drainage) piecemeal, starting from the more densely populated center and working outwards.

The outer flood defence and infill alternative would have the advantage of providing the maximum area and number of people with a significant amount of high standard flood protection from the outset, although high standard internal drainage would come at a later stage for most of the area. The alternative of working outwards from the center would be easier to stage to suit resources, and would provide a high standard flood control for the sub-area the stage protected. It would mean however that the rest of the area outside the completed sub-areas would suffer increasing risk of flooding and greater need of temporary and emergency flood alleviation measures.

The existing east bank flood control system follows the principle of the outer flood defence and infill alternative. It can be upgraded to a long-term high standard flood control system on the east bank with the City Core project a possible first stage infill for both flood protection and internal drainage.

The City Core project could also be a first stage in the alternative option of working outwards from the center to provide long-term high standard flood control.

One possible flood control system proposed here as a feasible combination of various projects and studies examined would consist of two main polders, one on the east bank protecting 950 km^2 and one on the west bank protecting 450 km^2. Within each main polder would be subsidiary internal drainage polders with associated improved drainage systems, water level and flow control structures and pumping

installations. The internal polders would be designed to deal with local rainfall of at least 2 years return period without significant harmful flooding.

The boundaries of the main polders would be formed of riverside flood barriers (embankments, flood walls, water control structures at waterway crossings) to protect against 100 year return period river levels with freeboard for waves and wind, and similar inland flood barriers to protect against river overspills and overland flows. The east bank main polder inland boundary would be based on the existing King's Dyke.

The riverside flood barriers would be extended upstream to the Bangsai region to confine river flows from the Chao Phraya and Noi Rivers confluence within the river channel or its immediate vicinity. These extensions would utilize existing embankments where feasible.

A west bank flood relief bypass of 48 km length and up to 1000 m^3/s capacity would be provided from Pak Kret to the coastal margin, the bypass route forming the inland boundary of the west bank main polder. The bypass embankments would be at the same crest level as the riverside flood protection barrier at the intake. Intake, outfall, waterway crossing, road and rail crossing structures would be provided as necessary.

The net effects of the overall proposal on flood river levels through Bangkok would be expected to be small.

All the constituent elements of the proposal would be assumed to include appropriate design allowances for land subsidence to the extent expected after the planned implementation of the land subsidence control program.

The proposal envisages early completion of the main polder boundaries, bypass and riverside flood barrier extension, with internal drainage facilities starting staged development in parallel with, and continuing after, construction of the main polder boundaries. It would be feasible for the bypass and flanking embankments to be constructed in stages if necessary.

The City Core project would be a suitable early part of the construction, as it is ready for implementation and offers protection to an important part of the city with 2 1/2 million inhabitants. It would form a significant length of east bank riverside flood protection and several of the east bank internal drainage polders.

The East Suburban Bangkok project first stage could follow soon after the start of the City Core project, as this would complete much of the long-term high standard flood control work required for the east bank.

Existing works and small projects could be incorporated into the overall scheme and upgraded as and when necessary.

4.4.2 Water-Supply and Water Quality

Current Expansion Program for Water Production

BMA. MWA has implemented 2 expansion projects under the revised MWA Master Plan since 1975. These are Phase I Stage I and Phase II Stage I Projects which resulted in increased capacities of the Bang Khen Water Treatment Plant to 1.6 million cmd and of Sam Sen and Thonburi Water Treatment Plants to 0.7 million cmd each. Currently, it is implementing the Phase I Stage II of the expansion of water supply and distribution project (1985-88) aiming to increase the service area by 150 sq.km. and to reduce water leakage to 30% by 1988. The total expenditure is estimated to be 8,905.2 million baht excluding interest during construction, to be spent on the following activities;

- Construction of a raw-water pumping station at Sam Lae with installed abstraction capacity of 2,970,000 cmd;

- Expansion of treatment facilities at Bang Khen Water Treatment Plant and Samsen Water Treatment Plant to raise production capacity by 400,000 and 1,000,000, respectively.

- Installation of about 34.6 km of transmission main, 2.3 m. diameter.

- Installation of about 90 km of trunk mains.

- Installation of 920 km of secondary mains and service mains.

The additional service area of 150 sq.km under the Phase I Stage II Project is directed mainly to the areas where the land subsidence problem is classified as critical zone No. 1 and 2. These areas cover eastern Bangkok and industrial estates in Samut Prakarn

In the areas outside the BMA, PWA is planning to rehabilitate the existing distribution system of the 2 waterworks in Patum Thani with an aim to reduce water leakage. It also plans to rehabililate the existing underground wells to raise the production. No improvement plan is envisaged at the moment for water supply systems in Nakorn Pathom and Samut Sakorn.

4.4.2.1 Proposed Programs for the Sixth Plan

BMA Since the current phase of the second stage of the expansion program (1985-88) for Bangkok Metropolis, Nonthaburi and Samut Prakarn will extend through part of the Sixth Plan (1987-91), new

projects expected to be included in the Plan will include only Phase II of the Stage II water supply project (1988-91). Under the present demand trends and considering the absorptive capability of responsible agencies, the scope of the Phase II project should include the expansion of treatment facilities at Bang Khen Water Treatment PLlant to raise production capacity by 400,000 and to bring the total capacity by 1991 to 3.2 million cmd. This is expected to satisfy the piped-water demand. The population to be covered by the water supply service are expected to be 6.4 million or 95 percent of the total population in the service area or 78% of total population in the three provinces.

The water supply program during the Sixth Plan is likely to be carried out by the MWA which is a public enterprise. Its investment will be financed by concessionary loans, from MWA's own surplus and from government contributions where appropriate.

Outside the BMA, the following programs are proposed:

- Patum Thani: PWA is planning to undertake expansion of the water supply and distribution program under the Sixth Plan (1988-91) to raise production capacity to meet the demand of population in Patum Thani. The areas to be covered by the program include the areas on both sides of the Chao Phraya river, Klong Luang sanitary district, the new campus of Thammasart University, Bangkok College and the Asian Institute of Technology campuses, industrial areas, and housing development estates. The feasibility study's terms of reference will include an assessment of various options and potentials of water sources as well as the feasibility of merging water supply systems in Patum Thani municipality and Prachatipat sanitary district.

- Samut Sakorn. PWA is planning be increase the production capacity of Samut Sakorn waterworks by 300 cmd as well as the rehabilitate the existing system to provide sufficient piped water in the area for the next 10 years.

As for waterworks in Samut Sakorn municipality, Ban Klaew and Kratumban sanitary districts which belong to respective local authorities, no expansion or rehabilitation is currently planned until agreement is reached with the PWA.

- Nakorn Pathom. The 3 waterworks in the province, namely, Nakorn Pathom Waterworks, Sampran Waterworks and Kampaengsan Waterworks which are under private concession have no expansion nor rehabilitation plan because of the transfer of ownership problem to PWA as well.

4.4.3 Land Subsidence

No capital projects are required to control land subsidence. Recent steps taken to control groundwater extraction include:

a. NESDB and concerned agencies are assigned to take measures to ensure the availability of adequate amounts of surface water to MWA and the private sector by 1986 in order to make reliance on groundwater unnecessary.

b. MWA is to expedite the implementation of its projects under the Master Plan as well as local projects in the outlying districts within BMR. Priority will be given to projects in the critical zone No. 1 and 2.

c. MWA will phase out its groundwater utilization in critical Zone No. 1 by 1987.

d. The Department of Mineral Resources has been enforcing the Groundwater Act B.E. 1977 to control private groundwater utilization. The aim is to phase out private groundwater extraction in several phases; upto 1987, an increase of not more than 5% per year; 1988-92, a reduction of 5% per year; 1993-97, a reduction of 10% per year; and no increase from 1998 onwards.

e. The tariff for groundwater will be adjusted to the same level as for piped water.

f. The Town Planning Office is to improve the land utilization plan in the BMR by taking into account the land subsistence critical zones and groundwater critical areas.

g. The BMR, Armed Force Survey Department and ONEB are assigned to undertake a survey on groundwater levels and reserves and on the degree of land subsidence and ground layer contraction.

In addition to the above, the Council of Ministers has also given the directive on 15 November 1983 that the "Groundwater Committee of DMR undertake to collect groundwater tariffs on private use of groundwater for commercial and industrial purposes as well as household purposes where water supply service is available".

DMR later proposed to issue Ministerial Regulations under the authority of the Groundwater Act B.E. 2520 specifying rates on groundwater use including allowances and exemptions for holders of groundwater permits in certain categories. The Ministerial Regulation was adopted by the Council of Ministers on 17 July 1984 with the additional observation that "rates for groundwater use in areas where MWA service is already in accessible should be higher than the water supply tariff. In addition, Ministerial Regulation No. 4 (B.E. 2527), which has been effective since February 1985, contains the following salient points:

(1) For areas that have access to MWA service the tariff on groundwater extracted is 1 baht per cm. from all users.

(2) For areas that have no access to MWA service, exemptions are granted in the case where groundwater extraction for commercial or consumption use is below 25 cmd. In the case of groundwater extraction in excess of 25 cmd, exemption is granted only for commercial use for the first 25 cm of daily use.

Additional measures proposed to be undertaken during the Sixth Plan are:

(1) Assessment of the groundwater reserve position and project future utilization levels;

(2) Identify the cause and assess the degree of land subsidence at present as well as in the future;

(3) Assess demand for water supply in industry, agriculture and household consumption.

4.5 Conclusions

A much more detailed analysis of the implications of the flood protection, water supply, water quality and land subsidence recommendations on the carrying capacity of land will be needed prior to the final BMR report. In part this will be important to ensure that the spatial and quantitative growth implications of projects proposed for this sector do not conflict with those of the transportation sector. With respect to any particular amphoe, that is, the question is whether the water supply and flood protection facilities will accommodate the growth which is likely to be induced by transportation improvements which will serve that district.

A second possible difficulty which warrants further analysis is the regulation of groundwater extraction. This is partly a technical problem because no precise correlation between the quantity of extraction and the rate or duration of subsidence has ever been established. There is some evidence that the rate of subsidence is lessening but measurement difficulties make this conclusion uncertain at best. Because the very large past and future investments in flood protection facilities will be rendered ineffective by continuing subsidence, an argument can be made for imposing severe limits on groundwater extraction at least until it is clear that subsidence has stopped. At this point, the technical problem becomes an administrative one and the question becomes what can be done to increase the effectiveness of restrictions on extraction. This question should be answered in the final sectoral report on water resources.

Chapter 5

HOUSING

The housing sector analysis derives primarily from a series of studies prepared by the Centre for Housing and Human Settlement Studies at the National Housing Authority. Such census information as is available is summarized in Table 5.1.

5.1 Problems

5.1.1 Substandard housing and infrastructure.

In recent years, both the quality and quantity of housing have increased dramatically. During the decade from 1974 to 1984, the number of dwelling in the BMR increased from 441,000 to 801,000 (81.5%). Thus the supply of housing increased at an annual rate of about 6.1% which is virtually identical to the rate of increase of households. This is primarily attributable to the rapid expansion of private residential development. During that period, the percentage of households living in slum and squatter settlements declined from 23.6% to 18.5%. However, the absolute number of such units increased from 104,300 to 152,000. The number of people living in slums increased from 890,000 to 1.1 million and the number of slums increased from 784 to 1003 although nearly 200 slums were wholly or partially cleared.

Government policy is currently to upgrade and grant some form of tenure to the occupants of such areas unless the underlying land is needed for other public purposes. In cases where the land is privately owned, secure tenure has generally not been provided. To date, slum-upgrading has been subsidized by the central government, but it is unlikely that this source will be sufficient without contributions from the BMA to sustain a significant slum program.

The manner in which the housing stock is being developed has changed dramatically. As shown in Table 5.2, NHA's supply study revealed that units in "private housing projects" increased from 4.2 to 14.9 percent of the housing stock in the decade ending in 1984. The increase in this category corresponds roughly to the decrease in the small-scale developments tabulated in the "individual buildings" category. This may indicate an increasing formalization of the housing market, an impression which is enhanced by the increase in the market share of public housing from 2.1 percent to 9.1 percent. The low-income informal sector, including klong houses and slum and squatter settlements, declined from 28.6 percent of the stock to 21.1 percent.

TABLE 5.1
Housing Census Summary
Bangkok Metropolitan Region

	1970	1980
Total population (a)	4,520,447	6,644,425
Housing Census		
Population of private households	4,410,440	6,455,320
Number of households	743,971	1,261,784
Households living in fixed quarters (b)	732,441	1,233,632
Tenure		
Unknown	847	31,629
Renters and rent-free tenants	388,524	457,331
Dwelling owner - unknown	36,922	64,566
private	270,708	307,736
government	80,894	85,028
Owners and hire purchasers	343,070	771,554
Land owner - unknown	13,431	28,405
houseowner	181,396	512,244
other (private or government)	149,241	233,011
Building materials of dwelling		
Unknown	4,796	43,696
Local or re-used	112,720	82,442
Cement, brick, wood, or combination	614,935	1,261,586
Water Supply		
Unknown	3,008	27,770
Other than piped or well water	211,246	245,019
Piped inside house	330,695	702,018
Piped outside house	96,284	96,570
Public well	22,751	55,683
Private well	69,507	133,256
Electrical lighting in the house	497,944	1,260,302
Flush toilet		
Private	32,498	161,059
Public	4,131	9,927
Toilet facilities unknown	13,920	23,691

(a) Institutional population plus population of private households
(b) Houses, duplexes, row houses, apartments, rooms; excluding households reports in unknown, other not specified, boats, and mobile quarters

Note: Totals for certain indicators do not add up to the total numbers of households in 1980, due to tabulation errors in published census reports.

Source: National Housing Authority, 1985

TABLE 5.2

Housing Stock by Type of Housing Projects in BMA
1974 and 1984

Type of Housing Project	Number of Units 1974	Number of Units 1984	Percent 1974	Percent 1984
1. Shophouse projects	3,684	10,798	0.83	1.30
2. Private housing projects	18,686	122,487	4.24	14.88
3. Land-Subdivision projects	18,835	46,388	4.27	5.64
4. Individual buildings	242,351	353,860	54.93	42.99
5. Klong Houses	21,868	21,592	4.96	2.62
6. Public Housing projects				
- NHA	9,377	47,882	2.13	5.82
- Non NHA	not available	26,826	-	3.26
7. Slum and squatter type settlements	104,323	152,211	23.64	18.5
8. Others	22,060	41,160	5.00	5.00
Total	441,194	823,204	100	100

The composition of the housing stock is also changing in significant ways. Table 5.3 shows an increasing tendency towards the relatively high density forms, especially apartments, at the expense of detached units. This development is consistent both with declining household size on the

TABLE 5.3
Housing Stock by Type of Housing Units in BMA
1974 and 1984

Type of Housing Unit	Number of Units 1974	Number of Units 1984	Percent 1974	Percent 1984
1. Shop houses	134,436	244,945	30.47	29.76
2. Detached houses	165,327	263,626	37.47	32.02
3. Semi-detached houses	588	5,503	0.13	0.67
4. Terraced houses or Town houses	8,208	44,896	1.86	5.45
5. Walk up apartments	6,250	70,863	1.43	8.61
6. Slum houses	104,325	152,211	23.64	18.49
TOTAL	441,194	823,204	100	100

demand side and increasing land costs in the supply equation. It may also reflect the increasing public sector share in housing production noted above, although that is not clear from existing data.

In spite of the increased densities and the addition of more than 60,000 apartments to the supply, homeownership has increased. Comparison of the 1970 and 1980 Housing Censuses (Table 5.1) shows that homeowner households comprised 63 percent of all households reporting either rental or ownership tenures. Households reporting ownership of the land under their houses increased even more dramatically.

TABLE 5.4

NUMBER PRIVATE HOUSING PROJECTS IN 1974 AND 1984

Districts	No. of Private Housing Projects in 1974	No. of Housing Projects in 1984	No. of Increase in Housing Projects	No. of 1974 Housing Projects expanded by 1984
1. Prahankhon	-	-	-	-
2. Pomprap	-	-	-	-
3. Patumwan	-	-	-	-
4. Sampantawong	-	-	-	-
5. Bangrak	1	5	4	-
6. Yannawa	3	30	27	1
7. Dusit	7	34	27	3
8. Phayathai	11	25	14	2
9. Huaikwang	22	57	35	7
10. Phrakhanong	57	177	120	19
11. Bangkhen	35	141	106	21
12. Bangkapi	63	245	182	48
13. Minburi	-	6	6	-
14. Latkrabang	-	5	5	-
15. Nongchok	-	-	-	-
16. Thonburi	-	-	-	-
17. Khlongsan	-	-	-	-
18. Bangkoknoi	5	22	17	-
19 Bangkokyai	-	3	3	-
20. Bangkhunthian	2	29	27	-
21. Phasicharoen	5	35	30	-
22. Ratburana	3	17	14	-
23 Talingchan	-	19	19	-
24 Nongkhaem	-	7	7	-
TOTAL	214	857	643	101

Similarly, Table 5.5 shows the changes in slum development within the BMA.

TABLE 5.5

District	No. of Slums 1974	No. of Slums 1984	Increase 1974	Increase 1984	Eliminated 1974	Eliminated 1984	Area Comparison No. of slums by 1984 Area Increase	Area Reduced	Legend
1. Prahankhon	12	14	4		2		6	2	Slums in 1974 and existing in 1984
2. Pomprap	10	9	-		1		-	-	
3. Patumwan	17	15	-		2		-	1	
4. Sampantawong	11	10	-		1		-	-	
5. Bangrak	2	2	2		2		-	-	
6. Yannawa	91	102	20		9		3	11	Slums evicted by 1984
7. Dusit	77	73	15		19		13	18	
8. Phayathai	60	46	8		22		4	3	
9. Huaikwang	43	44	14		13		-	6	Newly formed slums in 10 years period
10. Phrakhanong	121	138	39		22		8	29	
11. Bangkhen	81	118	43		6		2	10	
12. Bangkapi	29	48	27		8		-	4	
13. Minburi	3	5	2		-		-	-	
14. Latkrabang	-	-	-		-		-	-	
15. Nongchok	-	-	-		-		-	-	
16. Thonburi	21	22	3		2		2	2	
17. Khlongsan	36	35	1		2		1	1	
18. Bangkoknoi	64	72	32		24		4	3	
19 Bangkokyai	30	52	26		4		1	-	
20. Bangkhunthian	11	34	25		2		-	3	
21. Phasicharoen	13	53	42		2		-	-	
22. Ratburana	35	70	39		4		2	10	
23 Talingchan	1	14	13		-		-	-	
24 Nongkhaem	12	27	21		6		1	2	
TOTAL	780	1003	376		153		103	46	

While these sources give only a general idea of the trends because they do not indicate numbers of units as opposed to projects, the picture they paint is familiar from the analysis in Chapters 1-3. The Bangkhen, Bangkapi, Prakanong, Dusit, and Yanawa Amphoe emerge as the center of development activity. On the Western side of the river, Bangkok Noi, Phasicharoen, Taling Chan and Bang Khun Thian complete the high growth ring around the densely developed urban core. No data are available for areas outside the BMA. For the foreseeable future, the problem of slums cannot be solved by clearing them, although that may be required in some instances where such development obstructs drainage canals or is on property needed for compelling public purposes. The fundamental problem is that a declining but still large proportion of urban households cannot afford any other available housing solution.

5.1.2 Inefficient Allocation of Public Housing Resources

Central government interventions in the housing market, primarily through the National Housing Authority and the Government Housing Bank, have benefitted primarily middle-income households. Although NHA regulations require sales of most of its units to "low-income" households, in practice it has proven impossible to accurately determine the household income of applicants. Since most NHA units constructed to date have been sold at below market prices, there is a considerable incentive for applicant households to report incomes that make them eligible.

In addition, there is little institutional incentive for NHA to enforce income restrictions. Pressure from the government and from NHA's lenders have led it to pursue cost recovery from its clients somewhat more vigorously than in the past. As a consequence, NHA is looking for clients who are likely to make regular payments on their debt. So the typical NHA client is fast-becoming the middle-income government or corporate employee who, if the government is to reduce its role in the housing market, ought to be the client of private developers.

5.1.3 Inadequate Supply of Developable Land

Within the BMR, the effective supply of land is limited by natural phenomena such as flooding and by government intervention in the development process in the form of land use regulation. Most importantly, the supply of developable land is constrained by the availability of infrastructure, especially roads.

From the demand side, unsurprisingly, scarcity has fostered attempts to use land more efficiently primarily through increased density of development. Such development makes more efficient use of both land and infrastructure, at least until the maximum capacity of existing facilities is reached.

Like all commodities, land and improvements to land can be used by businesses, governments and individuals as a store of wealth. For most middle-income households in the BMR, the purchase of a house is by far their most substantial investment. In part this seems to be because real estate is a market in which the return on investment is seen to be relatively independent of the specialized knowledge of the invester and his or her economic power.

Moreover, in Thailand there are not many alternative investment options for households with only modest capital. In addition, of course, the ownership of land and a dwelling provides for many people a sense of physical security, privacy, and control over their own lives which, although difficult to articulate, appears to be a powerful source of demand for housing.

There is some evidence that the historic fragmentation of land ownership in the BMR also inhibits the land market because it makes the assembly of a usable site difficult. Thus, some parts of urbanized Bangkok seem to have remained undeveloped because no one owner in the area controls enough contiguous developable sites to permit a commercially viable development or because the cost of assembling such a site is prohibitive.

When infrastructure is first provided to real property, the market price for that land normally increases. The greatest increase usually comes from the construction of roads (which antedates other installations). The installation of water and electric utilities typically has a more moderate price effect. The value of these effects depends upon the quantity of land so served compared with the demand for land in that market. Thus, if roads are constructed to serve a greater quantity of land than is required by the demand, the price increment should be reduced, assuming that all of the land served is simultaneously on the market. In the Bangkok region, many property owners appear to be little influenced by short-term price fluctuations and prefer to hold their property off the market. The relatively low level of property tax in Bangkok, compared with historic rates of appreciation in property values, makes such an investment strategy inexpensive.

To overcome this difficulty, several approaches are possible. Most obviously, the government could continue to construct more and more infrastructure until enough willing sellers were served to ensure an adequate supply. However, since the whole point of expanding supply is to reduce prices, the greater the supply the less the incentive to sell there would be for any particular owner to enter the market. So this might prove to be a very expensive strategy. Alternatively, the construction of infrastructure could be accompanied by an increased property tax assessment. This would have the effect of penalizing property owners who fail to develop land serviced by infrastructure. Given the inefficiency of current property taxes in Thailand, the likely usefulness of this approach would require close analysis. Finally, a

public or private agency could assist the owners of contiguous properties which are not individually developable to reach agreement among themselves and with the suppliers of infrastructure on joint development of their land. Unlike anti-speculative taxes, this strategy has the advantage of rewarding property owners for appropriate development rather than punishing them for the failure to develop. However, the scale at which such land consolidation schemes could be implemented requires further analysis.

5.2 Proposed Development Strategy

Given the housing sector problems described above, the following principles should guide public policy and programs:

. public investment in the housing sector should be primarily in the form of infrastructure development; and in amounts sufficient to moderate land prices.

. priority should be given to tax and other methods of promoting development of serviced land with the aim of increasing the efficiency of use of the infrastructure and reducing developed land costs.

5.3 Development Guidelines

Unlike transportation, water supply and flood protection, the housing sector has attracted only a limited participation by the public sector. Indeed, there is some doubt about the effectiveness of direct government participation in housing production in the BMR.

Currently, public housing programs take three forms:

. Slum-upgrading, sites and services, core house and finished house developments, designed, developed and financed by the National Housing Authority on sites which the NHA acquires;

. New units developed or financed by Government agencies and state enterprises other than NHA for their own employees;

Home purchase loans provided by the Government Housing Bank.

The primary justifications for these programs has been that: (1) long-term mortgage credit will not be available to most prospective home purchasers unless it is provided by the public sector; and (2) even with such financing, urban poor households do not have incomes adequate to purchase unsubsidized housing that meets minimum health and safety standards.

With respect to the income capacity of the urban poor, the question is complicated by the great difficulty encountered by the NHA in

determining household incomes. In general, it has not been possible to restrict eligibility for NHA-developed housing to low-income households. Moreover, as central government subsidies available to the NHA have declined, income eligibility restrictions have been administratively de-emphasized in favor of credit-worthiness standards. That is, the NHA is understandably concerned more with full cost recovery than with targeting the benefits of its program to the poor. The NHA is inhibited in this attempt by unnecessarily high costs caused by over-staffing. The Authority's status as a public enterprise and other factors appear to make staff reductions unlikely in the foreseeable future.

The NHA is in a position not unlike that of the BMTA. On the one hand, they have been asked to become self-supporting. But they are unable to take the actions necessary to create an efficient operation. This situation is worsened by the fact that legal and political restrictions on land acquisition by state enterprises have resulted in per unit land prices well above those paid by private developers. Finally, although some of NHA's recent developments have been profitable, its overall financial condition is made tenuous by the losses incurred on previous projects for which on-going central government subsidies were expected but may not be available. Thus, it is difficult for NHA to operate as a private developer. On the other hand, its inability to effectively limit its programs to low-income households makes it difficult to justify public subsidies which are, in any case, less available for budget reasons.

The NHA's slum-upgrading program is something of an exception to this general problem. Although the program has no income eligibility standards, it is generally thought (albeit without much evidence) that most of the occupants of slums have incomes below the median because households with higher incomes usually will not choose to live in such areas. In addition, slum up-grading is comparatively inexpensive on a per unit basis. Thus, subsidy requirements are modest and the benefits are relatively well-targetted.

As executed in Thailand, however, slum-upgrading is a purely infrastructural, as opposed to housing, program. In Bangkok, the installation of residential-serving infrastructure is normally a municipal function. It is arguable, therefore, that although shallowly subsidized slum-upgrading efforts should be continued, they should be financed and administered by the BMA rather than the NHA. This was the situation when the program began in Thailand. Given its acquired expertise in slum-upgrading, a privatized NHA might be hired as a contractor to execute slum projects on behalf of the BMA but this might be best left to a competitive procurement process.

The construction and financing of housing by government agencies and state enterprises for their employees is merely a form of enhanced compensation. While it is beyond the scope of this study to consider issues of employee compensation, it would almost certainly be fairer and more efficient to increase salaries than to provide housing benefits.

The home purchase loan program administered by the Government Housing Bank has been much more efficient than the NHA's housing production programs. The Bank has earned profits in each recent year although high interest rates are currently constraining volume. Centralization is also a problem as the GHB has only one branch so its regional, much less national, coverage is very limited.

5.4 Program Proposals

The preceeding analysis suggests that a combination of formal and informal private sector development has and will continue to provide more than 90 percent of the dwellings required for BMR. The most important role of the public sector is, therefore, to encourage the creation of markets for land, housing and capital which provide affordable options to households at all income levels.

The NHA has proposed a Sixth Plan program for the BMR which confines public activity in the housing sector primarily to the construction of infrastructure, the reduction of selected building standards, measures to increase the supply of land and the provision of financing for slum dwellers. In particular, the NHA proposals are as follows:

5.4.1 The public sector should stimulate the formal private sector to expand its production towards lower income groups. If this can be accomplished, it will reduce the demand for public housing and will permit the public sector to focus on the lowest income households. Incentives to stimulate the private sector to expand its production towards lower income groups might include the adjustment of residential development standards.

Standards required for land development should be reduced consistent with the payment capacity of the poor. Similarly, requirements should not be rigid for land subdivision, to allow private developers the flexibility to tailor projects to the specific needs of low-income families. Construction standards which permit maximum density, mitigated building coverage ratio requirements, and more flexible building-to-building arrangements will make it possible for developers to construct extra units.

5.4.2 The government should stimulate low-income consumers to maximize their own investment in housing in order to reduce subsidies. This can be achieved through improving security of tenure and introducing a loan-scheme for home improvement.

5.4.3 In slum upgrading programs, there is a need for complementary tenure upgrading programs. The present government-sponsored program is limited to negotiating with public and private landlords for permission to enter their land for physical (infrastructure) and socio-economic upgrading; long term tenure security is not obtained. This is because NHA has little to offer to landlords in exchange for tenure.

Recent pilot projects by NHA have demonstrated that security of tenure can be achieved through land-sharing, which is a compromise solution between land-owners and dwellers. Land-owners can have a portion of their land for development, while the slum dwellers can remain in the area.

5.4.4 A loan scheme should be introduced in the slum areas where long term security of tenure is achieved. Financial institutions may not want to participate because of overhead costs and the perception that low-income borrowers are not creditworthy, but this need should be addressed. Another alternative should be the establishment of a Credit Union or Savings and Loan Association in slum areas.

5.4.5 A public land readjustment or land pooling demonstration project should be initiated. This will enable an increase in land supply by rationalizing all land holdings in a designated area and providing them with necessary infrastructure. After the readjustment, a portion of the newly serviced lots will be transferred to the (public) developers as a payment for the cost of planning and infrastructure. The owner will receive a smaller but more valuable plot.

In a land-readjustment scheme, government participation is required in the form of infrastructure development. This permits public agencies to ensure the consistency of local infrastructure with broader development plans. Implementation must reconcile the interests of all parties involved, which may differ from one land-owner to the other.

This concept should be adopted in the peripheral area of Bangkok where there is a strong demand for housing sites and in-filling can be thereby encouraged.

5.4.6 The most important requirement for land development is accessibility. Selectively providing infrastructure to various locations will benefit private developers and land-owners while some measure of cost-recovery can be achieved by applying land-readjustment schemes. Selective provision of infrastructure can direct private investment and in fact encourage private developers to comply with governmental policy. To ensure the cooperation of the private sector in the land-readjustment schemes the government can withhold the provision of infrastructure from those land owners who obstruct the policy or the scheme. The strategy is therefore a supplementary measure, proposed to support other schemes.

5.4.7 Land legislation such as zoning and power of eminent domain should be enacted to prevent withholding of land for speculative purposes. Taxes should be levied on idle or underutilized land to discourage speculation. In order to generate funds for further development, development taxes should be levied.

5.5 Conclusions

Two critical elements of the housing analysis have yet to be completed. A study of the land market is expected to provide valuable information about the effect of infrastructure on land prices and the residential carrying capacity of land within the BMR.[1] This latter analysis should be done at the amphoe level to permit integration with the work from other sectors.

Secondly, an analysis of housing finance will provide estimates of investment requirements for the Sixth Plan period and an assessment of resources that might be available to meet these requirements. This study is critical to the formulation of recommendations for the allocation of financing responsibility among government agencies and between the public and private sectors.

In the absence of these analyses, it has not been possible to define with much precision the issues which require concentrated attention during the balance of the study period. Obviously, one important issue is the future status of NHA. If it is to be privatized, one consequence would be that public sector involvement in the production of new subsidized housing would end. Some calculation of the effect of such a development on the housing market generally and low-income households in particular should be attempted.

Thirdly, the final housing sectoral report should include a realistic analysis of effective demand for housing. The issue to be addressed is the extent to which the least expensive unsubsidized units on the housing market can be made affordable through plausible financing schemes to low-income households. That is, we must ask how far down the income scale is the limit of effective demand and what policies can lower that limit in an unsubsidized market.

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[1] The physical planning work which has been undertaken to date provides good basis for more detailed analysis and further work by NHA, including detailed assessment of development capacity utilizing population and employment projections provided by other sectors.

Chapter 6

SOURCES OF FINANCE

6.1 Background

The national economy grew rapidly during the 1960's and 1970's, averaging annual increases in GDP of 8.4 percent and 7.2 percent respectively during those decades. Table 6.1 shows Thailand's growth rate compared with those of other Asian countries. In the first half of the 1980's growth has slowed gradually to an estimated rate of 4-5 percent for 1985. Projections for the Sixth Plan period are at about that level as well.

TABLE 6.1

Growth of Income and Population
Selected Asian Countries

	Per capita income 1980 (US$)	Per capita income growth, 1960-80 (%)	GDP growth (%)		Population growth	
			1960-70	1970-1980	1960-70	1970-80
Thailand	670	4.7	8.4	7.2	3.0	2.5
Indonesia	430	4.0	3.9	7.6	2.0	2.3
Philippines	690	2.8	5.1	6.3	3.0	2.7
Korea	1,520	7.0	8.6	9.5	2.5	1.7
Malaysia	1,620	4.3	6.5	7.8	2.8	2.4
Middle income oil importers	1,580	4.1	5.8	5.6	2.4	2.3

Source: World Development Report, 1982, World Bank

6.1.1 Central Government

Increases in the budget deficit have been equally traumatic. From 13,370 million baht in 1977, the deficit increased to 47,000 million baht in 1982. Although at the beginning of the 5th Plan period in 1982, the government had adopted a deficit target of 22,000 million baht. Budget deficits in 1983 and 1984 continued to be high at 39,000 million baht and 42,000 million baht, respectively in spite of measures introduced to restrain spending. Deficits during the Sixth Plan period are expected to average around 35,000 million baht.

A substantial portion of the deficit is the result of rapid increases in grants and subsidies. In 1979, central government's subsidies to all forms of local government and public enterprises

amounted to 3,997 million baht, 49 percent of which went to local governments and 51 percent to public enterprises. This amount rose to 7,688 million baht in 1981, representing an increase of 38.7 percent p.a. Public enterprises' share grew at 65.9 percent p.a. while local government's increased by only 3.3 percent p.a. during that period.

Under the Fifth Plan, the government in pursuing the dispersion of economic benefits and activities and the reduction of subsidies to public enterprises and debt service, has been increasing subsidies to local governments by about 10.7 percent p.a. whereas support to public enterprises has been dropping at about 16.6 percent p.a. The overall subsidies to both local governments and public enterprises have been dropping at a rate of 7.0 percent p.a.

To finance the continuing budget deficits, the government has resorted to domestic borrowing which grew from 13,666 million baht in 1977 to 30,000 million baht in 1984, an increase of 22.7% p.a. on average. As a consequence, domestic debt obligations multiplied by 3 times during the same period. When taking into account external debt obligations, the government total debt outstanding grew from 77,646 million baht in 1978 to 249,082 million baht in 1984 representing an increase of 21.44 percent p.a.

The proportion of the government expenditure devoted to repayment of debt has also increased rapidly, from 9.3 percent in 1977 to 17.4 percent in 1984. Debt repayment is projected to increase to 23.3 percent of expenditure in 1986 and to an average of 26.6 percent during the Sixth Plan. Off-setting decreases in the share of the budget devoted to development projects will be one consequence of this trend. From 43 percent in 1981, the proportion is expected to decline to 36.3 percent in 1986.

Growth in the national budget has been fairly robust in recent years. From 161,000 million baht in 1982, the budget increased at an average rate of 11 percent through 1985 to 209,000 million baht. The 1985-86 budget will show what is planned to be a temporary slowing of growth, an increase of 4 percent to 218,000 million baht. Through the Sixth Plan budget increases are expected to average roughly 11 percent per annum. An examination of that portion of the budget allocated to development projects, however, reveals a less promising situation. From roughly 67,500 million baht in 1982, the development budget has increased by only slightly more than 4% per annum through the current year. Projections through 1988 are for increases averaging only 1.4 percent because revenues which would otherwise be available for development projects will be required for loan amortization. Between 1988 and 1989, the development budget is expected to jump by 24 percent followed by more moderate increases (3.5 and 12.9 percent, respectively) in the final two years of the Sixth Plan when debt service demands are scheduled to slacken. The implications of this schedule on the timing of investment could be severe given the front-loaded nature of some of the investment schemes being proposed. Moreover, only about 10 percent of the development budget will be available for new projects.

The development needs of Thailand as a whole and the BMR in particular will not slow correspondingly, of course. In fact, increased investment will likely be required to sustain the growth required to keep employment at acceptable levels. If such investment is not to come from central government borrowing, other sources must be considered. It must also be asked whether, in view of competing regional development needs, the BMR should continue to take a disproportionate share of the national development budget. The answer to this question should depend in part, at least, on the capacity of the residents of each region to absorb additional financing burdens in the form of new taxes (or more efficient old taxes), user fees, and the like. The most obvious indicator of this capacity is household income levels.

As the economy has grown, national per capita incomes have increased from an average of 2,102 baht per annum in 1961 to 6,931 in 1983. Incomes are much higher in Bangkok than in other parts of the country. In 1983, the mean per capita income in Bangkok was 19,611 baht per annum compared with 10,265 baht, 5,490 baht, 4,504 baht, and 2,792 baht in the Central, South, North and Northeast regions, respectively. This disparity has two implications for regional development. Most importantly, the residents of the BMR have a greater capacity to pay for development than other citizens. Secondly, Bangkok will continue to attract migrants from other regions. Migration will in turn have two consequences: (1) there will continue to be an excess of unskilled laborers who will sustain an active informal sector; and (2) wage increases in manufacturing and services will be moderate, although large regional variations will continue to favor Bangkok wage-earners.

Given this background, one requirement for an investment strategy for the BMR would appear to be increased use of local taxes, particulary on businesses and residential properties which benefit from public infrastructure investment, and on user fees. Secondly, to avoid merely substituting local government debt for central government debt, more private investment in development should be sought.

Attainment of the first of these objectives will be somewhat complicated by the complexity of the institutional arrangements in the BMR.

Administrative responsibility for the development of the Bangkok Metropolitan Region is divided among the central government, the Bangkok Metropolitan Administration, 5 Changwat Administrative Organizations, 8 municipalities, 39 sanitary districts and more than a dozen state enterprises. While the specialization and decentralization implied by this array of agencies is not intrinsically undesirable, two problems have emerged with respect to development financing:

(1) a lack of coordination of investment programs among government agencies and enterprises for projects in the BMR; and

(2) an inappropriate distribution of responsibility for financing development projects.

The objective of this chapter is to summarize the information which has been collected to date on the sources of finance for BMR development in order to provide a basis for preliminary discussions of the magnitude of development investment likely to be available during the Sixth Plan period and its sources under current and proposed financing schemes.

6.1.2 State Enterprises

The majority of public enterprises continue to suffer losses and therefore depend on central government subsidies. The capital investments of these enterprises have been declining because service charges are typically set too low to recapture actual costs which, in turn, tend to be increased by operational inefficiencies.

There are 5 public enterprises providing basic services within the BMR, namely, the Metropolitan Waterworks Authority (MWA), the Expressway and Rapid Transit Authority of Thailand (ETA), the Bangkok Mass Transit Authority (BMTA), the State Railway of Thailand (SRT) and the National Housing Authority (NHA). Both the NHA and the SRT provide services beyond the boundaries of the BMR as well.

In 1984, these 5 public enterprises earned a total of 9,727 million baht in revenue and incurred 11,003 million baht in operating and nonoperating expenditures and 2,761 million baht in capital investments. There was an operating loss of 1,276 million baht. The growth rates between 1979 and 1984 averaged 18.7 percent for revenue, and 18.9 percent for expenditure while capital expenditure dropped 1.1 percent, operating losses, incurred mainly by BMTA, SRT and MWA, have grown by 27.5 percent p.a. or about 680 million baht since 1979. Compared with the overall performance of public enterprises receiving subsidies and grants from central government, which in 1984 amounted to around 3,328 million baht, the 5 BMR-serving public enterprises faired poorly in that they failed to remit any profits to the government while the others provided 5,797 million baht in remittances. These BMR enterprises required sizeable subsidies (1,054 million baht in 1984).

In 1979, total investment of the 5 public enterprises amounted to 3,272 million baht. If SRT investment, which was mainly incurred in the construction of railway lines in Eastern Seaboard is excluded, total investment expenditure was 2,711 million baht, due mainly to the expansion programme of MWA and expressway construction by ETA. The figure has since dropped and was about 1,524 million baht in 1984. The total investment expenditure during 1979-84 of 16,037 million baht was financed by: internal cash surpluses of state enterprises (4.5 percent); loans (64.9 percent); government budget (28.4 percent); and others (2 percent).

For the Sixth Plan, it is estimted that state enterprises will have revenues of about 15,600 million baht per annum. The BMTA, MWA, NHA and ETA anticipate revenues of 4,957 million baht (approximtely 990 million baht per annum).

6.1.3 Local Governments

In 1983, the 53 local governments in the region received a total of 5,183.9 million baht in revenue, an increase of 1,511.5 million baht from 1979. The average rate of increase (9 percent per annum) slightly exceeded growth in GDP and per capita income but the yield of 100 baht per capita per annum remains low.

Also in 1983, local governments spent 4,850.6 million baht, up 1,200.4 million baht from 1979 for a growth rate during that period of 8 percent per annum. The net effect has been that combined local government surpluses increased from about 2.4 percent of revenues to 9.2 percent. Local government budget surpluses are required in Thailand.

Capital expenditures were roughly 30 percent of total expenditures in 1983. Capital spending increased at a lower rate (7 percent per annum) than administrative outlay (8.5 percent).

Over the period of the Sixth Plan, the aggregate development budget of BMR local governments is projected at 21,600 million baht or an average of 4,320 million baht per annum. Capital expenditures are expected to total 12,200 million baht (2,440 million baht per annum). Of this, about 500-900 million baht per annum will be available for new projects.

An overwhelming share of these consolidated figures is attributable to the BMA. In 1983, BMA receipts were 4,556.7 million baht (88 percent of the BMR total) and expenditures were 4,324 million baht (89 percent). Moreover, the BMA's receipts and expenditures increased more rapidly (11 percent and 10 percent per annum, respectively) than those of local governments in the balance of the region (4 percent). BMA capital expenditure, however, increased at a lower rate (6 percent per annum) than in the balance of the BMR. Nevertheless, capital investment in the balance of the BMR is only about 20 percent of regular revenues.

6.2 Measures to Increase Revenue

It is apparent that some increase over current trends in investment in the BMR is desirable during the Sixth Plan. In any case, declining central government development revenues will require greater local government, state enterprise and private sector contributions.

6.2.1 Real Property Taxes

The ministries of Finance and Interior are currently considering various means of enhancing local revenue collections. Among

the approaches under consideration are improvements to the land development tax and the house and rent tax.

In 1983, BMR local governments collected 151.8 million baht in land development taxes. The effeciency of this tax is limited by under-assessments of property values by large and variable amounts. This is partly the consequence of the fact that there has been no reassessment since 1978. In addition, only 60-70 percent of those taxpayers who are required by law to pay do so. In addition to reducing revenues, non-enforcement compounds the inequities created by infrequent revaluations and threatens to erode the credibility of the tax system. A proposed reassessment in 1986, which will be introduced in three steps to avoid sudden large increases for property owners, will add an estimated 110-120 million baht to revenues.

1983 local government receipts from the house and rent tax were 637.2 million baht. Revenues increased at an average annual rate of 21 percent in the five years to 1983, making it the most important local tax revenue generator (43.5 percent of local tax receipts). Almost 92 percent of the house and rent tax are collected by the BMA.

The house and rent tax suffers from weaknesses which are analagous to those mentioned above for the land development tax. That is, the rental values of taxed properties are set much too low and 30-35 percent of the eligible taxpayers fail to pay. A number of steps are being taken to improve this situation, with the hoped for outcome that current revenues will be doubled by the first year of the Sixth Plan to about 1,000 million baht per annum.

In addition, owner-occupied units are exempt from the house and rent tax. This means that roughly 50 percent of all dwellings are exempt from the tax. While the effects of this exemption on the allocation of tax burdens have not been studied it seems likely that the impact is regressive. It also contravenes the principle that the beneficiaries of municipal infrastructure and services should pay for them. In any case, elimination of the exemption might yield revenues of 500-700 million baht annually in the BMR.

6.2.2 Title Transfer Taxes

Transfer fees, stamp taxes, and "income" taxes are all imposed by the central government on real property transactions, at the rates of 2 percent, 0.5 percent and 5-10 percent of land value respectively. 1983 revenues from these sources totalled 1,903.6 million baht, including 1,211.6 million baht from fees, 51.9 million baht from stamp duties and 639.8 million baht from income taxes. Transfer of revenues from this source to local governments in exchange for reductions in the grants which the national government has provided to localities is a recommended step towards decentralization of development financing.

6.2.3 Vehicle Taxes

In the five years to 1983, vehicle ownership in Thailand increased at an average annual rate of 21 percent to a total of about 3 million. About 38 percent of all vehicles, including more than 80 percent of all passenger cars, are registered in Bangkok. Public investment in roads to service these vehicles is on the order of 10,000 million baht per annum. Average annual expenditures of less than 4,000 million baht in the BMR are expected to more than double during the Sixth Plan period.

The central government currently collects fuel taxes and motor vehicle registration fees which in 1983 provided 12,000 and 2,000 million baht, respectively. About half the fuel tax revenues was used for non-transportation improvements, leaving a total of 8,000 million baht in vehicle taxes for road improvements.

Vehicle owners pay between 0.27 and 11.09 baht per vehicle per day in registration fees, compared, e.g., with Singapore rates 2 to 9 times higher. Proposed here is a surcharge of 1,000 baht per vehicle per annum, the revenues from which would be used for road network construction.

6.2.4 Surcharges

Surcharge taxes could be an important source of revenue of which the surcharge on business taxes will provide the largest part. Business have benefitted a great deal from pulbic investment but the proposed surcharge will produce a number of undesirable effects. The additional surcharges are deemed necessary under the present conditions. Revenues can then be allocated to local governments or agencies involved.

6.2.5 Flood Protection Charge

The 1983 floods are estimated to have caused more than 6,000 million baht in damage in the BMR. Over the next three decades, on the order of 30,000 million baht will need to be invested in flood protection schemes to eliminate the most serious flood problems. It has been proposed that a property tax be assessed on protected properties. Anticipated revenues would exceed 300 million baht by the fifth year of the program.

6.2.6 Congested Area and Highway Tolls

To provide the additional revenues required to fund core area transportation infrastructure and to reduce the effective demand for core area road space, it has been proposed that a congested area toll be introduced. In addition, tolls have been proposed for improved highway such as the Nakorn Chaisri-Pinklao route. Revenues from such schemes will be around 2,500 million baht.

6.2.7 Development Fees

Under recent market conditions the installation of roads and other infrastructure has caused the value of adjacent properties to increase as much as two hundred times.

- Because carrying costs are low, many property owners are content to keep serviced land off the market.

- To discourage such speculative ownership and to finance more utilities a land use surcharge should be imposed on properties serviced by installed infrastructure.

In sum, the new revenue measures described above might generate on the order of 7,600 million baht per annum during the Sixth Plan. Table 6.2 summarizes revenues projected from these and existing sources and from increased efficiency in collections.

6.3 Distribution of Financing Responsibilities

The final report will need to directly address the question of how the responsibility for financing the BMR development program should be allocated. While no attempt has been made yet to analyze particular programs and institutions from this standpoint, the following general principles should inform that analysis:

The consultants retained to consider this matter have so far developed only a theoretical framework. With respect to the distinction between public and private financing, the general principles identified by the consultants include the following:

* The production of private goods should be the function of the private sector while public goods should be produced by the public sector. The distinction is drawn as follows: "When goods and services are such that the benefits derived from them accrue only to individuals who are willing to pay for them, and that once they are supplied to these individuals the same physical quantity cannot be secured by others, these goods and services are technically identified as private goods. Goods and services that must be consumed by all once they are provided regardless whether or not individuals are paying for them are called public goods."[1]

* Privatization should be favored where it will increase pricing efficiency. That is, where privatization will resulting users or beneficiaries paying the costs of goods and services, it should be encouraged.[2]

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[1]Kraiyudht Dhiratayakmat "Financing Urban Infrastructure: Interim Report, August, 1985.

[2]Varakorn Samakoses "An Interim Report. Urban Public Finance Sector: Privatization", July, 1985.

Table 6.2

Revenue Projections for the Sixth Plan Period

I.	Central Government*		107,300
	Central Budget	70,000	
	Foreign Loans	37,000	
	Foreign Grants	300	
II.	State Enterprises**	5,000	5,000
III.	BMK Local Governments		8,050
	Existing Resources	2,500	
	Local Tax Efficiency Improvements		
	Land Development Tax	550	
	House and Rent Tax	5,000	
IV.	New Revenue Sources***		25,650
	Fee and Income Tax from Property Sale	6,500	
	House and Rent Tax	1,500	
	Fee on Special Development	N.A.	
	Flood Protection Fee	300	
	Vehicle Registration Fee	3,000	
	Trip and Road Tolls	12,750	
	Surcharge from Business Tax	1,600	

*Relate to communications transport and utility sectors nationwide. Excludes housing sector.

**For four State enterprises.

***Preliminary Estimate, various measures can be implemented in the first, third and fifth year of the Plan period.

* Privatization should be favored when it will result in increased competition among alternative providers of goods or services if such increased competition will improve quality or reduce prices.[1]

For those activities which remain in the public sector, decisions about the level of government which should take responsibility for any particular function should be guided by the following:

* In general, the cost of public functions should be borne by those who benefit from or use them. This can be accomplished through a variety of tarriff, fee, licensing and other direct charges.

* For some functions, identifying users and beneficiaries may be impractical and therefore indirect assessment through general taxation may be appropriate. Similarly, the provision of a service such as education may be deemed of benefit to society as a whole and thus an appropriate object of taxation.

* The level of government responsible for any service should be the most geographically restricted unit that includes all of the direct beneficiaries and all of those who must pay for the service. Thus, whenever the costs and benefits of any public service are confined to the residents or businesses within a municipality, that jurisdiction should be responsible for financing and administering the service.

* Public programs implemented in a given municipality may substantially benefit the residents of adjacent local governmental districts (or to impose costs on them or public investments may be of the nature that they should be undertaken jointly or simultaneously by adjoining governmental units. In such cases the coordination of or investment in these projects should be the responsibility of the central government when these projects have been approved or recommended by the central government.

* With respect to the allocation of general tax burdens, the varying ability of residents to pay may need to be taken into account.

6.4 Conclusions

The studies of the allocation of financing, development and administrative functions for urban services and facilities are very incomplete at this time. The application of the theoretical principles

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[1] Ibid.

to each of the transportation, water resources, and housing functions discussed above will require detailed analyses of existing and proposed arrangements in accordance with the terms of reference for those studies. At least the following will be required:

6.4.1 Privatization

*For each of the privatization schemes recommended in the privatization interim report, a detailed supporting analysis is needed which applies the theoretical principles to the particular context of the privatized function. For example, it is asserted in the consultant's report on privatization that "through change of government rules and regulations together with the change in role of NHA and market forces, demand for housing of the urban poor will be fully satisfied by the private sector." This assertion needs to be backed by a rigorous quantitative assessment of effective demand by low-income households, the role of the informal sector, the effect of privatization on housing quality, the availability of financing to poor have purchasers and the like.

*A detailed specification of the changes in public policies and institutional arrangements which would be required to achieve successful privatization should be provided in the final report.

*A projection of the revenue and cost implications of privatization for each function should be provided at the earliest possible date.

6.4.2 Allocation of Government Responsibilities

*A detailed analysis of the current arrangements for providing transportation, water supply, flood protection, sewerage and housing.

*An application of the allocation principles developed to date to each of the current arrangements to determine what changes should be recommended. This analysis should include an identification of beneficiaries, users and those who bear the costs of each service or facility.

*An assessment of the current and projected capacity of relevant government entities to finance the services and facilities for which there should be responsible.

*A detailed description of the changes required to implement the recommendations.

Chapter 7

PRELIMINARY INVESTMENT ANALYSIS

7.1 Introduction

7.1.1 The overall objectives for the investment analysis of the Bangkok Metropolitan Region Development Plan (BMRDP) are as follows:

(a) to integrate into a comprehensive capital program each of the sectoral studies based upon common definitions and assumptions and upon an explicit ranking of proposed projects in view of their economic productivity and other relevant considerations;

(b) to analyse possible sources of revenue including taxes, user fees, commercial loans and other sources from the standpoint of fiscal power, equity and administrative feasibility;

(c) to prepare an allocation of financing responsibility for elements of the physical development plans on the basis of that allocation and the analysis in (b) above, to propose a financial program for the BMR physical program; and

(d) to calculate the effect of the proposed financing scheme on Thailand's debt service ratio and other macro-economic variables.

7.1.2. At this stage in the formulation of the BMRDP, interest is largely on bringing the sector investment programs together and establishing orders of magnitude estimates for key basic questions over the Sixth Plan period, such as:

* What is the likely total capital investment cost of the sector programs and hence the BMR investment program as a whole?

* What is the likely foreign component capital cost of the program, and how does this vary between the sector investment programs?

* What is the likely annual flow of capital expenditure, for total investment and for its foreign exchange component?

* What are the likely principal sources of funds, ranging from the private sector, central and local government budgets, state enterprises to foreign grants and loans?

* What is the likely allocation of responsibility between agencies for capital investment expenditure?

* What is the government's likely foreign debt servicing requirements for the program?

Presented here are the results of a preliminary investment analysis. We first outline the investment program for the BMR program as a whole and then for each of the sectors (water, transportation and housing). Information sources and assumptions for the estimates are discussed after presentation of the preliminary results. It should be noted that the estimates provided are indicative and subject to change as each of the Sector Studies proceed (especially since they are at very different stages of completion) and are more closely harmonised, particularly regarding the integration of the infrastructure development projects in a physical planning context.

The uncertainty concerning the status of several of the projects and the indicative nature of many of the estimates put forward, preclude any subsequent analysis at this Interim Report stage in areas such as ranking of projects, comparision of alternative sources of revenues and assessment of the impact of the program on the country's debt service level. Those matters are accordingly reserved for the draft final report.

7.2 Preliminary Results

7.2.1 Overall BMR Development Program (Tables 7.1 to 7.7)

The capital investment program for the BMR program could be of the order of Baht 130,000 million, at 1985 prices. Some 80% (Baht 103,000m) of this capital cost could be spent during the Sixth Plan period, 1987 - 1991. Average annual capital expenditure throughout this period could be around Baht 21,000 million.

The capital investment for each sector for the Sixth Plan period could be as follows:

Housing	45
Transportation	40
Water	15
	100% = Baht 103,000 million

Table 7.1 provides further information; setting out the capital investment needs for each of the sectors, the main projects within the sectors and the capital requirements for each year of the Sixth Plan period.

As Table 7.2 shows, the foreign component cost of the total capital program for 1987 - 1991 could be around 37% (Baht 38,000m). By sector it could be as follows:

Housing	7.0	
Transportation	21.0	
Water	9.5	
	37.5%	= Baht 38,000 million

Foreign capital expenditure would average around 21% p.a. of this total for years one to four of the Sixth Plan period.

The principal sources of funds for the initial capital investment (Baht 103,000m) during 1987 to 1991 could be the private sector at 50% and then foreign loans and grants at 30%. Central government could be expected to provide just over 10% and local government less than 4% of initial capital investment, as shown at Table 7.3. Table 7.4 presents disbursement of capital funds by source on an annual basis, 1987 to 1991.

Responsibility for capital investment expenditure (again, over 1987 to 1991) could be borne as follows:

Central government	16.6
BMA	5.5
ETA	13.3
MWA	7.8
NHA	6.5
BMTA	7.0
Private sector	43.1
Foreign grant	0.2
	100% = Baht 103,000 million

If state enterprise projects were to be excluded (since they are expected to be self-financing), this would imply public sector capital investment of nearly Baht 23,000 million (see Table 7.5).

Government foreign loan drawdown could be:

1987	20.7
1988	21.0
1989	17.5
1990	24.3
1991	16.5
	100% = Baht 31,000 million

Central government could account for 18%, state enterprises 75% and BMA for 7% of foreign loans drawdown. Table 7.6 disaggregates foreign loan drawdown by sector, by year and by main category of public sector authority.

As Table 7.7 shows, government repayment of foreign loan and interest for the BMR program could total Baht 63,235 million (with 51% being interest). For capital investment within the Sixth Plan period, total government foreign debt service could be around Baht 32,000 million, with nearly 70% being interest charges. The incidence of debt servicing within the public sector (again for 1987 to 1991) could be:

Central government	
principal	6.9
interest	15.1
State enterprises	
principal	20.7
interest	47.5
BMA	
principal	3.2
interest	6.6
	100% = Baht 31,733 million

7.2 Sectoral Proposals

7.2.2 Water Sector

Infrastructure development projects in the water sector have been classified as flood control projects and water supply projects.

Table 7.8 presents the capital investment program for the flood control project. The main points to highlight are:

- total project capital cost of Baht 25,800 million
- capital expenditure in Sixth Plan period of Baht 6,700 million
- capital expenditure averages some Baht 1,200 p.a. 1987 to 1991
- foreign component of capital costs of Baht 4,200 million or 63% of the total for the Sixth Plan period.

If the City Core Phase I project were to be implemented alone during the Sixth Plan period, capital investment costs would be just below Baht 1,800 million (i.e. nearly four times less than the capital cost of the overall flood control project).

Table 7.9 shows the capital investment requirements for the Third and Fourth Bangkok Water Supply projects. The key data are:

- total projects capital cost of Baht 10,350 million
- capital expenditure in Sixth Plan period of Baht 9,000 million
- capital expenditure peaks in the years 1987 and 1988 at nearly Baht 3,000 million p.a., declines significantly to around Baht 1,500 million p.a. for 1989 and 1990, and then falls to less than Baht 100 million for 1991
- foreign component of capital costs, Baht 5,600 million or 62% of the total for the Sixth Plan period.

7.2.3 Transportation Sector

The basic transportation sector program is made up of 61 projects. The main project categories are: roads and bridges, expressways, traffic control management, public transport, private transport, truck terminals, road rehabilitation, and technical assistance (see Table 7.10).

As Table 7.11 shows:

- total project capital cost of Baht 47,000 million
- capital expenditure in Sixth Plan period of Baht 40,500 million
- annual capital expenditure fluctuates between Baht 7,200 million to Baht 9,300 million throughout the Sixth Plan period
- foreign component of capital costs of Baht 21,500 million or 53% of the total for the Sixth Plan period.

Table 7.12 presents the transportation sector capital investment program in terms of sources of fudns and responsibility for capital investment for each of the five years to 1991. Central government could be responsible for capital expenditure of Baht 12,300 million, with Baht 5,600 million being funded from its own sources. State enterprises could be responsible for capital expenditure of Baht 20,900 million, with funding from own sources of less than Baht 500 million (with the balance being predominantly funded from foreign loans).

7.2.4 Housing Sector

The housing sector investment program consists of public and private sector high, middle and low income housing along with public sector slum upgrading projects.

As Table 7.13 shows:

- total capital expenditure in the Sixth Plan period of Baht 46,600 million
- foreign component of capital costs of Baht 7,000 million or 15% of capital expenditure for the Sixth Plan period
- private sector funding could total Baht 39,300 million or nearly 85% of the program, with the greater part of the balance being funded by the state enterprise (NHA)
- program components by capital expenditure could be,

high income housing	28.3	
middle income housing	51.3	
low income housing	18.9	
slum upgrading	1.5	
	100%	= Baht 46,640 million

7.3 Information Sources and Assumptions

For the preparation of this Interim Report, it was originally anticipated that each of the Sector Studies would be sufficiently complete to provide basic financial data on each of their main projects. The results presented above have been based as far as possible on the Interim Reports of each of the Sector Studies supplemented where required through the holding of interviews with members of the Sector Studies consulting teams. The status of confirmed financial data available from each of the Sector Studies has been summarised broadly at Table 7.14. It can be seen that there has been a shortage of confirmed data, which in turn has resulted in our adopting a range of working assumptions largely based on the interviews.

All prices have been converted to 1985 prices. Considerable further work has yet to be carried out on arriving at a common set of definitions and assumptions for the sector projects.

7.3.1 Transportation Sector

For the transportation investment program, the 125% budget level of capital expenditure on transportation 1980 to 1984 was adopted, rather than the Sector consultants scenario of a 200% budget level. The 125% budget level is believed to be the more realistic scenario, given the prevailing austere national budget climate and the need to introduce the TRIP toll to fund the 200% budget level.

The following assumptions were adopted:

- foreign exchange component of total capital investment is 53%

- investment for DOH and DPW projects is the responsibility of central government

- state enterprise projects are at full cost-recovery, hence no central government subsidy has been provided for

- BMA loans for road projects are the responsibility of central government.

7.3.2 Water Sector

For the water supply projects, it was assumed that stated government equity represented a subsidy, and hence was funded from central government budget. Since no data were available on the Phase II Stage II water supply projects, these have been excluded from the preliminary investment analysis.

For the flood control projects, the estimates provided in the recently completed Bangkok Flood Control Management Project were used. All main aspects of the overall flood control program were included, but indications are that the City Core Phase I component is the most likely option to be implemented. It was assumed that the responsibility for capital investment would be shared equally between central and local government.

7.3.3 Housin Sector

27. The following assumptions were made:

- foreign exchange component of total capital investment is 15%

- NHA is responsible for the construction of 3,000 middle and 7,000 low income housing units each year

- slum upgrading is financed equally from central and local government budgets

- NHA's sources of funds are

  65% foreign loan
  15% domestic loan
  20% internally generated

7.4 Issues

Three principal issues arise from the preliminary analysis:

* Firstly, what is the possible impact of the BMR investment program outlined on the financial resources that might be available?

* Secondly, what further work at the individual sector study level must be completed for the investment analysis to proceed?

* Thirdly, what is the structure and timing of the subsequent investment analysis?

In order to arrive at a first indication of the possible balance between investment demand under the BMR development program and public sector resource supply for the Sixth Plan period, we have brought together at Table 7.15 broadly comparable data from Chapter 6 (Financial Resources) and from the preliminary investment analyses presented earlier in this chapter. It should be emphasized once again that both sets of data are indicative only and subject to reestimation. Moreover, it is highly likely that fund availability has been over-estimated to a significant extent. This is largely because of differences in geographical and sector definitions. For instance, fund availability from central government and foreign loans and grants relate to the national level and not to the BMR level. Similarly, fund availability for infrastructure from central government and foreign loans and grants relate to communications, transport and utilities, rather than the narrower definition of infrastructure for BMR (transport and water resources).

There are several observations of note from the indicative data presented at Table 7.15:

- the public sector funded component of the investment program for the BMR development program could account for nearly 25% of the total funds available from the national development budget, from the four state enterprises and from the BMA,

- the demand for funds from the central government for the BMR program could account for around 15 percent of the budget available nationally,

- investment demand for foreign laons for BMRDP could be 50 percent higher than that available under the national development budget,

- the foreign grant component of BMRDP could present some 5 percent of the foreign loans available nationally,

- state enterprise financing of the BMRDP could be of the order of 35 percent of anticipated revenues of the four public enterprises other than SRT,

- for projects to be funded from BMA, the demand for and supply of finance could balance.

Substantial further work at the individual sector study level requires to be completed before proceeding with the refinement and extension of the investment analysis. This principally concerns:

(a) resolving the uncertainly surrounding the status of projects. There is a need for each of the sector studies to define a set of project configuration options, along with priorities being accorded for each option and for projects within each option; and

(b) producing basic financial data for each project; the specification of which has been given at Table 7.16.

The suggested sequence and timing of the main investigations to be carrried out for required investment analysis is:

* Establish investment project data bank as the basis for producing the comprehensive capital program. Rank projects within and between sectors in economic terms. Prepare economic framework for the analysis of financial resource mobilization (September).

* Determine comprehensive capital program options. Set out main alternative financing responsibilities (October).

* Produce main permutations of capital program and allocation of financing responsbilities. Calculate effects of investment program and financing schemes on national economy (November).

* Refine results. Prepare for BMRDP seminar (December).

Table 7.1

TOTAL CAPITAL IMPROVEMENTS PROGRAM

Unit: million Baht
1985 constant prices

Sector and Project	Total Project	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
Water Resources									
City Core Phase I	1,850	1,762	88	728	716	254	64		
City Core Phase II	1,850	88						88	1,762
Eastern Sub Urban Bangkok	12,150	2,550		510	510	510	510	510	9,600
West Bank Bypass	3,530	1,754	100	205	105	110	667	667	1,676
River Bank Dyking	420	420		13	35	95	144	133	
West Bank Drainage	6,000	126						126	5,874
Total Flood Control Project	25,800	6,700	188	1,456	1,366	969	1,385	1,524	18,912
Water Supply -PhII St 1A	7,737	6,408	1,329	2,584	3,142	640	41		
-PhII St 1B	2,614	2,614			194	1,008	1,311	100	
Total Water Supply	10,350	9,022	1,329	2,584	3,336	1,649	1,352	100	0
Total Water Resources	36,150	15,722	1,517	4,040	4,702	2,618	2,737	1,624	18,912
Transportation									
Roads and Bridges	18,748	12,151	666	2,382	2,553	2,505	2,898	1,813	5,931
Expressways	12,530	12,530	0	2,559	1,914	2,000	3,491	2,566	0
Traffic Controls Management	357	357	0	142	80	65	53	17	0
Public Transport	8,770	8,770	0	1,631	1,890	2,241	1,548	1,470	0
Private Transport	5,000	5,000	0	1,000	1,000	1,000	1,000	1,000	0
Truck Terminals	125	125	0	125	0	0	0	0	0
Technical Assistance	205	205	0	41	41	41	41	41	0
Total in BMA	45,735	39,138	666	7,880	7,468	7,852	9,031	6,907	5,931
Road Rehabilitation for BMR	1,400	1,400		280	280	280	280	280	
Total Transportation	47,135	40,538	666	8,160	7,748	8,132	9,311	7,187	5,931
Housing									
High income	8,800	8,800	0	1,760	1,760	1,760	1,760	1,760	0
Middle income	23,935	23,935	0	4,787	4,787	4,787	4,787	4,787	0
Low income	13,200	13,200	0	2,640	2,640	2,640	2,640	2,640	0
Slum Upgrading	705	705	0	141	141	141	141	141	0
Total Housing	46,640	46,640	0	9,328	9,328	9,328	9,328	9,328	0
Total Investment Programme	129,925	102,700	2,183	21,528	21,778	20,078	21,376	18,139	24,843

Table 7.2

FOREIGN AND LOCAL COMPONENTS:

Capital Improvemnets Program

Unit: million Baht
1985 constant prices

	Total Project	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
Foreign Component									
Water Supply	6,339	5,606	734	1,548	2,070	1,082	876	30	
Flood Control	16,254	4,221	118	917	861	610	873	960	11,915
Transportation	24,982	21,485	353	4,325	4,106	4,310	4,735	3,809	3,143
Housing	6,996	6,996	0	1,399	1,399	1,399	1,399	1,399	0
Total foreign component	54,571	38,308	1,205	8,190	8,436	7,401	8,082	6,197	15,058
Local Component									
Water Supply	4,011	3,416	595	1,036	1,267	567	476	70	
Flood Control	9,546	2,479	70	539	505	359	512	564	6,997
Transportation	22,153	19,053	313	3,035	3,642	3,822	4,376	3,378	2,788
Housing	39,644	39,644	0	7,929	7,929	7,929	7,929	7,929	0
Total local component	75,355	64,592	978	13,339	13,343	12,677	13,294	11,940	9,785
Total Investment	129,926	102,900	2,183	21,528	21,778	20,078	21,376	18,139	24,843
Average Foreign component	42.00%	37.23%							
Average Local component	58.00%	62.77%							

Table 7.3

Principal Sources of Fund for Total Capital Investment Program

Unit: million Baht
1985 constant prices

Source of Fund	Total	RIG	BMA	EIA	MHA	Private	Domestic Loan	Foreign Loan OECF	Foreign Loan Others	Foreign Grant
Water Supply	9,021	1,011					2,404	1,873	3,732	
Flood Control	6,700	1,340	1,340						4,020	
Transportation	40,538	8,607	2,000	459		12,325		15,191	1,750	206
Housing	46,640	352	352		1,331	39,281	998		4,326	
Total	102,700	11,310	3,692	459	1,331	51,606	3,402	17,064	13,828	206
Percentage	100.00	10.99	3.59	0.45	1.29	50.15	3.31	16.58	13.44	0.20

Table 7.4

Disbursement of Total Capital Investment by Main Sources

Unit: million Baht
1985 constant prices

Source	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
RTG	11,313		2,546	2,722	2,617	1,841	1,587	
BMA	3,670		866	844	685	683	612	
ETA	459				227	232		
MWA	0							
MHA	1,330		266	266	266	266	266	
BMTA	0							
Private	51,605		10,421	10,296	10,296	10,296	10,294	
Domestic Loan	3,404		948	1,086	581	531	259	
OECF	17,064		3,711	3,256	2,457	4,596	3,044	
Other Foreign Loan	13,828		2,729	3,267	2,908	2,890	2,035	
Foreign Grant	206		41	41	41	41	41	
Total	102,900		21,529	21,778	20,078	21,376	18,139	0

Table 7.5

Responsibility for Total Capital Expenditure by Agency

Unit: million Baht
1985 constant prices

Responsibility for Capital Investment	Total	RTG	BMA	ETA	MWA	MHA	BMIA	Private	Foreign Grant
Water Supply	9,[illegible]21	1,011			8,010				
Flood Control	6,700	3,350	3,350						
Transportation	40,539	12,313	1,960	13,735			7,200	5,125	205
Housing	46,640	352	352			6,655		39,281	
Total	102,900	17,026	5,662	13,735	8,010	6,655	7,200	44,406	205
Percentage	100.00	16.55	5.50	13.35	7.78	6.47	7.00	43.15	0.20

Table 7.6

Government Foreign Loan Drawdown Schedule

Unit: million Baht
1985 constant prices

Authority	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
Central Government								
OECF								
Transportation	1,915		221	240	432	650	372	
Other Foreign Loan								
Transportation	1,751		373	436	399	318	225	
Flood Control	2,010		437	410	291	416	457	
Sub total Central Government	5,676		1,031	1,086	1,121	1,384	1,054	
State Enterprise								
OECF								
Transportation	13,276		2,559	2,093	2,006	3,946	2,672	
Water Supplies	1,873		931	923	19			
Other Foreign Loan								
Water Supplies	3,732		617	1,147	1,062	875	30	
Housing	4,325		865	865	865	865	865	
Sub total State Enterprise	23,206		4,972	5,028	3,953	5,686	3,567	
BMA								
Other Foreign Loan								
Flood Control	2,010		437	410	291	416	457	
Total Foreign Loan	30,892		6,440	6,523	5,364	7,485	5,079	

Table 7.7

Government Repayment of Foreign Loan and Interest

Unit: million Baht
1985 constant prices

Authority	Total	Total 1987-2001	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Central Government																	
Principal	5,676	2,200	0	0	0	0	0	188	188	188	188	188	252	252	252	252	252
Interest	6,566	4,780	45	138	229	321	411	453	433	414	395	375	356	335	313	292	270
Sub total	12,242	6,979	45	138	229	321	411	641	621	602	583	563	608	587	565	544	522
State Enterprise																	
Principal	23,206	6,553	0	0	0	0	0	403	403	403	403	403	908	908	908	908	908
Interest	23,103	15,088	137	430	720	1,012	1,263	1,356	1,315	1,273	1,232	1,191	1,150	1,091	1,032	973	914
Sub total	46,309	21,642	137	430	720	1,012	1,263	1,759	1,718	1,676	1,635	1,594	2,057	1,998	1,939	1,880	1,822
BMA																	
Principal	2,010	1,005	0	0	0	0	0	101	101	101	101	101	101	101	101	101	101
Interest	2,674	2,107	22	66	102	138	183	206	196	185	175	165	155	144	134	124	113
Sub total	4,684	3,112	22	66	102	138	183	307	296	286	276	265	255	245	234	224	214
Total Principal	30,892	9,758	0	0	0	0	0	691	691	691	691	691	1,260	1,260	1,260	1,260	1,260
Total Interest	32,343	21,975	205	634	1,051	1,471	1,857	2,015	1,944	1,873	1,802	1,731	1,660	1,569	1,479	1,388	1,297
Total Debt Service	63,235	31,733	205	634	1,051	1,471	1,857	2,706	2,635	2,564	2,493	2,422	2,920	2,830	2,739	2,648	2,557

Table 7.8

Flood Control Investment Programme

Unit: million Baht
1985 constant prices

Project		Total Project	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
City Core Phase I		1850	1762	88	723	716	254	64		
City Core Phase II		1850	88						88	1762
Eastern Sub Urban Bangkok		12150	2550		510	510	510	510	510	9600
West Bank Bypass		3530	1754	100	205	105	110	667	667	1676
River Bank Dyking		420	420		13	35	95	144	133	
West Bank Drainage		6000	126						126	5874
Total Investment		25800	6700	188	1456	1366	969	1385	1524	18912
Foreign component	63.00%	16254	4221	118.44	917.28	860.58	610.47	872.55	960.12	11914.56
Local component	37.00%	9546	2477	69.56	538.72	505.42	358.53	512.45	563.88	6997.44
Total	100.00%	25800	6700	188	1456	1366	969	1385	1524	18912
Source of Funds										
Foreign loan	60.00%	15480	4020	112.8	873.6	819.6	581.4	831	914.4	11347.2
Central Government	20.00%	5160	1340	37.6	291.2	273.2	193.8	277	304.8	3782.4
BMA	20.00%	5160	1340	37.6	291.2	273.2	193.8	277	304.8	3782.4
Total	100.00%	25800	6700	188	1456	1366	969	1385	1524	18912
Responsibility for Capital Investment										
Central Government	50.00%	12900	3350	94	728	683	484.5	692.5	762	9456
BMA	50.00%	12900	3350	94	728	683	484.5	692.5	762	9456
Total	100.00%	25800	6700	188	1456	1366	969	1385	1524	18912

Table 7.9

Water Supply Investment Program

Unit: million Baht
1985 constant prices

	Total Project	Total 6th Plan	1985	1986	1987	1988	1989	1990	1991
Third Bangkok Water Supply Project (Stage II Phase IA)									
OECF	2,303	1,873	7	423	931	923	19	0	0
ADB	2,361	2,056	10	295	617	1,011	400	28	0
Govt. Equity	865	731	3	130	288	360	78	5	0
Syndicated loan	2,209	1,747	78	383	748	849	143	7	0
Sub total	7,737	6,408	98	1,231	2,584	3,142	640	41	0
Fourth Bangkok Water Supply Project (Stage II Phase IB)									
OECF	0	0	0	0	0	0	0	0	0
ADB	1,676	1,676	0	0	0	136	662	848	30
Govt. Equity	280	280	0	0	0	21	108	140	11
Syndicated loan	658	658	0	0	0	37	238	324	59
Sub total	2,614	2,614	0	0	0	194	1,008	1,311	100
Total	10,350	9,021	98	1,231	2,584	3,336	1,649	1,352	100
Foreign Component	6,339	5,606	16	717	1,548	2,070	1,082	876	30
Local Component	4,011	3,416	81	514	1,036	1,267	567	476	69
Total Water Supply	10,350	9,021	98	1,231	2,584	3,336	1,649	1,352	100
Source of Funds									
OECF	2,303	1,873	7	423	931	923	19	0	0
ADB	4,037	3,732	10	295	617	1,147	1,062	876	30
Govt. Equity	1,145	1,011	3	130	288	381	186	145	11
Syndicated loan	2,866	2,404	78	383	748	806	381	331	59
Total	10,350	9,021	98	1,231	2,584	3,336	1,649	1,352	100
Responsibility for Capital Investment									
Govt. Equity (RTG)	1,145	1,011	3	130	288	381	186	145	11
MWA	9,206	8,010	95	1,101	2,296	2,956	1,462	1,207	89
Total Investment Sharing	10,350	9,021	98	1,231	2,584	3,336	1,649	1,352	100

Table 7.10

Transport Sector Projects

Unit: million Baht
1985 constant prices

Project Number	Project Name	Agency	Source of Fund	Total Project	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
224	Siphaya Road-Suriwong Road	BMA	BMA	185	185					165	20	
226	Khlong Chong Nonsri	BMA	BMA	1,188	1,188			495	495	100	98	
918	Wiphawadi Rangsit Hwy-Withayu Road	BMA	BMA	111	111					50	61	
721	Charan Sanitwong Road-Issaraphap Road	BMA	BMA	114	114					75	39	
214	Ratchada Phisek: Sukhumwit-Rama IV	BMA	BMA	423	130	205	92	46				
924	New Phetchaburi Road-Din Daeng Extension	BMA	BMA	100	100					59	41	
216	Ekamai Road-Lat Phrao Road	BMA	BMA	555	316	237	140	118	58			
925	Extension of Sukhumwit Soi 55	BMA	BMA	35	23	12	20	3				
215	Ratchada Phisek: Ram Khamhaeng Road	BMA	BMA	270	200	70	140	60				
220	Lat Phrao Road-Ram Intra Road	BMA	BMA	361	361			83	84	86	128	
213	Ratchada Phisek: Route 31-Route 301	BMA	BMA	1,675	1,675		582	436	436	221		
937	Distributor and Access Road	BMA	BMA	2,500	2,500		500	500	500	500	500	
603	Route 3: Bang Na-Samut Prakan	DOH	RIG	74	74		14	49	11			
623	Route3107: Klong Tei-Chalakea Noi	DOH	RIG	11	11		11					
621	Route3100: Route 306	DOH	RIG	3	3		3					
626	Route3268: Sam Rong-Bang Plee	DOH	RIG	96	96			26	40	30		
615	Route 340: Route 4-Route 35	DOH	RIG	125	125		125					
221	Phahonyothin Road-Sukhaphiban I (West)	DOH	BMA	190	161	29	90	71				
611	Route 306: Rangsit-Bangphun	DOH	RIG	57	57		57					
627	Route3278: Bangkapi-Minburi	DOH	RIG	76	76		76					
607	Route 305: Rangsit-Ongkharak	DOH	RIG	15	15		15					
513	Din Daeng-Ban Khoing Song	DOH	RIG	2,396	1,191			162	216	275	448	1,205
606	Route 35: Thanburi-Samut Sakhon	DOH	RIG	108	108		80	28				
217	Ram Khamhaeng Road-Lat Phrao Road	DOH	BMA	204	173	31	96	77				
628	Route3344: Route3268-Route3	DOH	RIG	43	43		43					
625	Route3242: Rang Khun Thian-Samut Sakhon	DOH	RIG	14	14		14					
601	Route 1: Rangsit Interchange	DOH	RIG	61	61		61					
502	Krungthep Bridge	DPW	UN	100	100		50	50				
501	Rama VI Bridge and Approaches	DPW	OECF	970	970		88	87	160	320	315	
715	Sathorn Road Extension	DPW	RIG	335	335		75	78	92	70		
920	Siphaya Bridge	DPW	RIG	510	510		8	25	180	240	57	
927	San Saeb Collector/Distributor	ETA	OECF	256	256			33		223		
306	2nd Stage Expressway-Eastern Extension	ETA	OECF	2,968	315				155	160		2,653
933	Chan Road Access	ETA	BMA	95	95			83	6	6		
305	2nd Stage Expressway-Northern Extension	ETA	OECF	2,217	144				72	72		2,073
931	Sasthorn-Siphaya Collector/Distributor	ETA	OECF	212	212					106	106	
928	Expressway Ramps Lan Luang/Phisanulok	ETA	OECF	183	183			63		120		
302	Second Stage Expressway	ETA	COM.L	11,615	11,615		1,644	1,714	2,000	3,491	2,566	
301	First Stage Expressway	ETA	OECF	915	915		915					
107	Rama VI	OCHRI	UN	7	7		7					
107	Rama IV Extension (Silom to Sukhumwit)	OCHRI	UN	25	25		25					
108	Silom/Suriwong Area	OCHRI	UN	10	10			10				
116	Phanphar	OCHRI	UN	10	10						10	
113	Area Traffic Control	OCHRI	BMA	150	150		110	40				
114	Victory Monument	OCHRI	BMA	45	45				45			
939	Charoen Muang Road Area Improvement	OCHRI	RIG	15	15					8	7	
111	Prachathipathai	OCHRI	UN	15	15					15		
110	Bangkok Noi-Thalingchan	OCHRI	UN	30	30			30				
115	Klong Tan	OCHRI	UN	20	20				20			
112	Thonburi Big Circle Area	OCHRI	UN	30	30					30		
701	BMTA Management Service and Investment	BMTA	PVT	7,200	7,200		1,440	1,440	1,440	1,440	1,440	
910	Bus Mass Transit -Busways	ETA	UN	1,189	1,189		122	327	614	108	18	
910	Bus Mass Transit -Bus Priorities	OCHRI	UN	381	381		69	113	187		12	
950	Bus Investment by Private Operators	PVT	PVT	5,000	5,000		1,000	1,000	1,000	1,000	1,000	
802	Phuthamonthon Truck Terminal	PVT	PVT	50	50		50					
801	Rangsit Truck Terminal	PVT	PVT	75	75		75					
960	BMA Technical Assistance	BMA	UN	40	40		8	8	8	8	8	
961	DLT Technical Assistance	DLT	UN	40	40		8	8	8	8	8	
963	NESDB Technical Assistance	NESDB	UN	25	25		5	5	5	5	5	
962	IDRI Technical Assistance	IDRI	UN	75	75		15	15	15	15	15	
964	IDRI Education and Training	IDRI	UN	25	25		5	5	5	5	5	
	BMR Rehabilitation	DOH	RIG	1,400	1,400		280	280	280	280	280	
Total				47,135	40,538	666	8,169	7,740	8,132	9,311	7,187	5,931

Table 7.11

Transport Sector Investment Program

Unit: million Baht
1985 constant prices

		Total Project	Total 6th Plan	Prior 1987	1987	1988	1989	1990	1991	After 1991
Investment by Type of Activities										
Roads and Bridges		18,748	12,151	666	2,302	2,553	2,505	2,898	1,813	5,931
Espressways		12,530	12,530	0	2,359	1,714	2,000	3,491	2,566	0
Traffic Controls Management		357	357	0	142	80	65	53	17	0
Public Transport		8,770	8,770	0	1,631	1,880	2,241	1,548	1,470	0
Private Transports		5,000	5,000	0	1,000	1,000	1,000	1,000	1,000	0
Truck Terminals		125	125	0	125	0	0	0	0	0
Technical Assistance		205	205	0	41	41	41	41	41	0
BMR Rehabilitation		1,400	1,400		280	280	280	280	280	
Total Investment Program		47,135	40,538	666	8,160	7,748	8,132	9,311	7,187	5,931
Foreign - Material	47.00%	22,153	19,053	313	3,835	3,642	3,822	4,376	3,378	2,788
- Labor	6.00%	2,828	2,432	40	490	465	488	559	431	356
Total foreign component	53.00%	24,982	21,485	353	4,325	4,106	4,310	4,935	3,809	3,143
Local - Material	23.00%	10,841	9,324	153	1,877	1,782	1,870	2,142	1,653	1,364
- Labor	24.00%	11,312	9,729	160	1,958	1,860	1,952	2,235	1,725	1,423
Total local component	47.00%	22,153	19,053	313	3,835	3,642	3,822	4,376	3,378	2,788
Total	100.00%	47,135	40,538	666	8,160	7,748	8,132	9,311	7,187	5,931

Table 7.12

Transportation Sector Program, Agency Source of Funds and Responsibility for Expenditure

Agency Source of Funds

Unit : million Baht
1985 constant prices

Agency	Investment Plan Total	1987	1988	1989	1990	1991	Source of Funds Total	RTG	BMA	UECF	IBRD&ADB ETA	Bilateral	Private
BMA	6,951	1,482	1,729	1,581	1,264	895	6,951	3,310	1,850			1,791	
BMTA	7,200	1,440	1,440	1,440	1,440	1,440	7,200						7,200
DLT	40	8	8	8	8	8	40					40	
DOH	3,520	967	693	547	585	728	3,520	3,520					
DPW	1,915	221	240	432	650	372	1,915			1,915			
ETA	14,924	2,681	2,420	2,847	4,286	2,690	14,924	1,189		13,276	459		
NESDB	25	5	5	5	5	5	25					25	
OCMRT	738	211	193	252	53	29	738	588	150				
PRIVATE	5,125	1,125	1,000	1,000	1,000	1,000	5,125						5,125
TDRI	100	20	20	20	20	20	100					100	
Total	40,538	8,160	7,748	8,132	9,311	7,187	40,538	8,607	2,000	15,191	459	1,956	12,325

Agency Responsibility for Expenditure

Unit : million Baht
1985 constant prices

Agency	Investment Plan Total	1987	1988	1989	1990	1991	Responsibility of Capital Investment Total	RTG	BMA	ETA	BMTA	Private	Foreign Grant
BMA	6,951	1,482	1,729	1,581	1,264	895	6,951	5,061	1,850				40
BMTA	7,200	1,440	1,440	1,440	1,440	1,440	7,200				7,200		
DLT	40	8	8	8	8	8	40						40
DOH	3,520	967	693	547	585	728	3,520	3,520					
DPW	1,915	221	240	432	650	372	1,915	1,915					
ETA	14,924	2,681	2,420	2,847	4,286	2,690	14,924	1,189		13,735			
NESDB	25	5	5	5	5	5	25						25
OCMRT	738	211	193	252	53	29	738	588	150				
PRIVATE	5,125	1,125	1,000	1,000	1,000	1,000	5,125					5,125	
TDRI	100	20	20	20	20	20	100						100
Total	40,538	8,160	7,748	8,132	9,311	7,187	40,538	12,273	2,000	13,735	7,200	5,125	205

Table 7.13

Housing Sector Investment Program

Unit: million Baht
1985 constant prices

Project	Total 6th Plan	1987	1988	1989	1990	1991
High income housing	13,200	2,640	2,640	2,640	2,640	2,640
Private	13,200	2,640	2,640	2,640	2,640	2,640
NHA						
Middle income housing	23,936	4,787	4,787	4,787	4,787	4,787
Private	21,131	4,226	4,226	4,226	4,226	4,226
NHA	2,805	561	561	561	561	561
Low-income housing	8,800	1,760	1,760	1,760	1,760	1,760
Private	4,950	990	990	990	990	990
NHA	3,850	770	770	770	770	770
Slum upgrading	704	141	141	141	141	141
BMA 50%	352	70	70	70	70	70
NHA-RTG 50%	352	70	70	70	70	70
Total	46,640	9,328	9,328	9,328	9,328	9,328
Foreign component	6,996	1,399	1,399	1,399	1,399	1,399
Local component	39,644	7,929	7,929	7,929	7,929	7,929
Total	46,640	9,328	9,328	9,328	9,328	9,328
Source of funds						
Private	39,281	7,856	7,856	7,856	7,856	7,856
RTG	352	70	70	70	70	70
BMA	352	70	70	70	70	70
NHA-Foreign loan 65%	4,326	865	865	865	865	865
-Domestic loan 15%	998	200	200	200	200	200
-Agency fund 20%	1,331	266	266	266	266	266
Total	46,640	9,328	9,328	9,328	9,328	9,328
Agency Responsibility for Expenditure						
Private	39,281	7,856	7,856	7,856	7,856	7,856
RTG	352	70	70	70	70	70
BMA	352	70	70	70	70	70
NHA	6,655	1,331	1,331	1,331	1,331	1,331
Total	46,640	9,328	9,328	9,328	9,328	9,328

Table 7.14

Financial Data Availability for Each of the Sectors

Financial Data	Sector		
	Transportation	Water	Housing
Capital cost	✓	✓	X
Source of funds	✓	✓	X
Annual capital expenditure	✓	✓	X
Foreign and local exchange component	X	✓	X
Agency responsibility	X	X	X
Operating costs	X	X	X
Cost recovery mechanisms	X	X	X

✓ Available

X Not Available

Table 7.15

Investment Demand and Public Resource Supply

	Investment Demand For BMR Program*	Public Sector Resource Supply
Central Government	11,300	70,000**
Foreign Loans	30,892	37,000**
Foreign Grants	206	300**
State Enterprises	1,790	5,000***
BMR Local Governments	3,700	8,050
New Revenue Sources	---	25,650

(Preliminary estimates)

*Excludes private sector.

**Relates to communications, transport and utility sectors nationwide excludes housing.

***For four state enterprises.

Baht '000,000's
1985 prices

Table 7.16

Investment Analysis Data Requirements

1. List all projects with brief name/description/sector
2. Draw up grid plan for Bangkok Metropolitan region
3. Locate each project on grid, specify project location grid axis
4. Code all projects, to include sector and location
5. State start and finish years for project construction
6. Give total capital cost for each project at constant 1985 prices in Baht (use B28 to US DLRS 1 for exchange rate, take account of 1984 devaluation).
7. State total annual operating costs and revenues of projects at constant 1985 prices to year 2001
8. Specify local and foreign capital and operating cost components of project
9. List capital funding basis for project
10. List cost recovery measures for project
11. Specify project priority within sector program
12. State dependencies and linkages between projects within sector plan
13. State stage of development of project:
    - defined
    - feasibility study underway/completed
    - preliminary engineering design underway/completed
    - detailed design underway/completed
    - tenders underway/prepared
    - construction underway/completed
14. Provide cashflow analysis of projects
15. Specify for each project
    - base cost year
    - inflation rates
    - contingency allowances
    - capital cost definition
    - operating cost definition
    - sources and terms of finance (eg internal funds, government grants and loans, commercial loans, external sources)
16. State government agency authority, differentiating between state enterprise and central and local government agency, responsible for project:
    - design
    - construction
    - management/operation
17. State nature of private sector participation.
18. List agency investment plans and budgets for 1987-1991

Chapter 8

ISSUES

This study does not attempt to analyze all public and private activities in the Bangkok Metropolitan Region. Rather, if focuses on the following issues:

- What will be the physical distribution of BMR growth of population, housing and employment during the Sixth Five Year Plan?

- What is the most cost effective way to provide flood protection, water supply, and transportation services and facilities required for the projected growth?

- How can the private sector be caused to provide affordable housing to Bangkok's current and future residents?

- What is the most efficient and equitable means of financing the required investment program?

8.1 Principles and Assumptions

The analysis of these issues has been guided by a number of general principles and assumptions, including the following:

- The national macro-economic outlook for the Sixth Plan period makes it unlikely that the central government will have the resources to sustain substantial real increases in expenditures on infrastructure in the BMR.

- The volume of rural-to-urban migration which has contributed so greatly to Bangkok's growth cannot be much affected by governmental regulation but will rather respond to perceived differences in economic and educational opportunities.

- Within the BMR, the location decisions of households, businesses and others can be influenced by public policies and actions, particularly when all major public actors have the same locational objectives.

8.2 Projections

The discussion of historic and projected growth indicated that although growth rates in population, households and wage-earners will all continue to slow as both fertility and migration rates moderate, the region's growth in absolute terms is expected to continue at a pace similar to that during the Fifth Plan:

The population of the region is projected to increase from approximately 8.0 million in 1985 to 8.4 million in 1987 and 9.5 million in 1991. Between 1987 and 1991, the population is projected to increase

by about 1.2 million. This increment in population will add some 235,000 new households to the region and perhaps 500,000 new job opportunities. Some 320,000 new housing units will be required to house them and to replace units lost from the current stock through deterioration or removal.

Based on the projections, it can be expected that:

. Roughly 50% of the regional population growth will be in the Bangkok Changwat although the rate of growth there will be the lowest of any Changwat in the region except Nakhon Pathom.

. Most of the regional growth is expectged to occur in 8 amphoe running from Bang Khen in the north to Muang Samut Prakan in the south around the old core of Bangkok and predominately on the eastern side of the river. These amphoes lie along existing and planned transportation corridors and within the outer flood protection dyke. By year 2000, about 60 percent of BMR population will live in these amphoes. Somewhat less, but still significant growth is projected for the amphoe on the western side of the core, including Muang Nonthaburi, Bangkok Noi, Taling Chan, Phasi Charoen, and Bang Khun Thian. Of the regional towns, Muang Nakorn Pathom will have the most significant growth.

. Employment opportunities are also decentralizing to some extent as businesses construct new facilities along major highways. Manufacturing employment in particular decreased by 2.4% during the period 1978-82, while increasing in Pathum Thani, Nakhon Pathom, Samut Sakhon and Samut Prakan and there trends can be expected to continue.

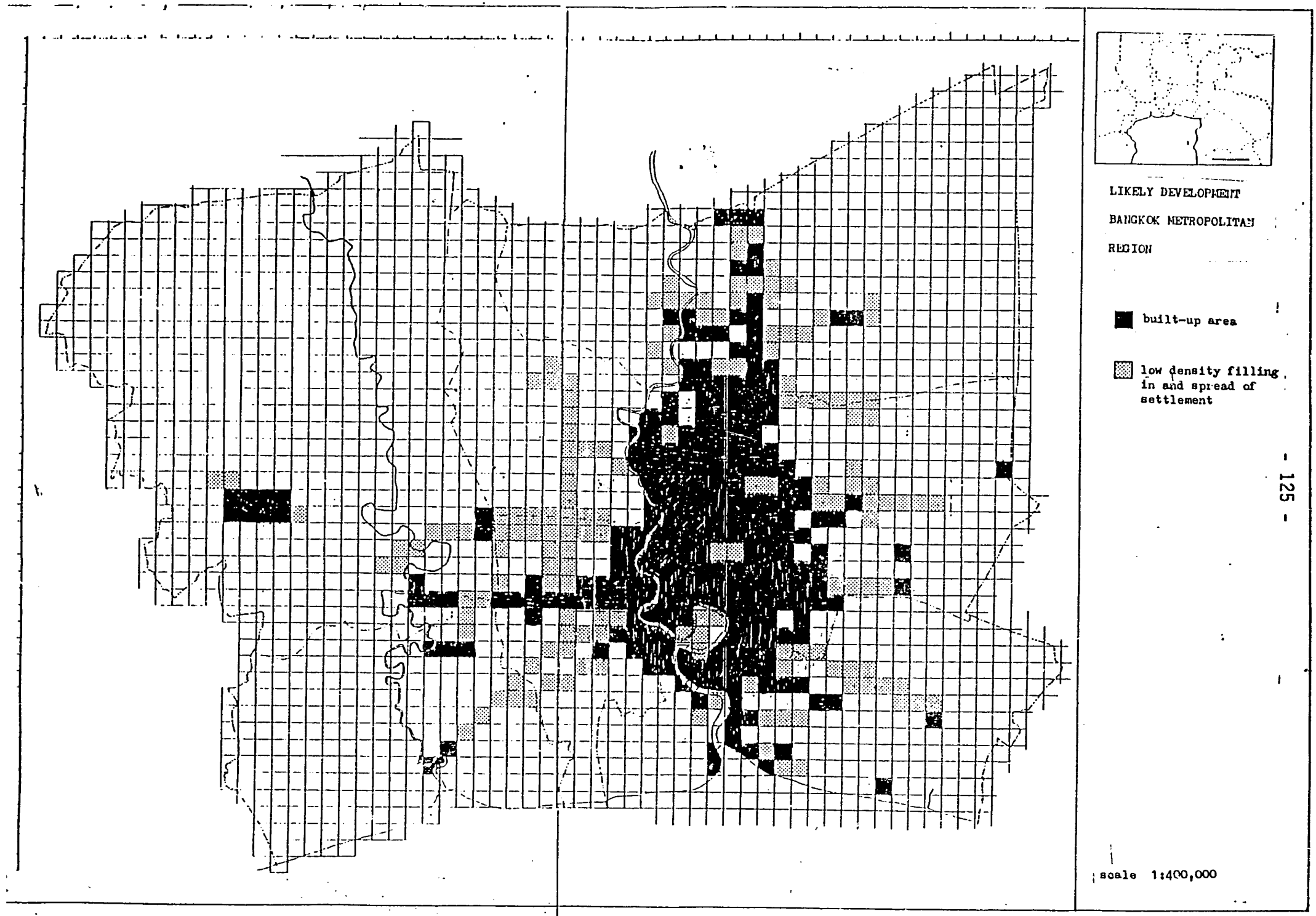
8.3 Structure

The Bangkok Structure Plan, which was meant to provide the basis for land use regulation in most of the region, contemplated a concentric pattern of development with an inner, densely developed core surrounded by a large ring devoted to agriculture and open space. This green belt was thought to be important not merely for aesthetic purposes and to preserve agricultural land, but also to provide an unobstructed channel for flood waters which leave the Chao Phraya north of Bangkok or which originate outside the river from more local rainfall and flow south to the Gulf of Thailand.

In spite of this plan, which has yet to be ratified/enforced, development continues along the radial spokes formed by major transportation arteries which extend outwards from the city center and, in some cases cross the designated green belt.

Preliminary analysis of existing land use, suitability of land for urban development, accessibility and agricultural potential has been undertaken. In the absence of strong and effective government regulatory measures and intervention in the development process the existing forces that are shaping the region will continue (See Figure 8.1). However,

Figure 8.1


LIKELY DEVELOPMENT
BANGKOK METROPOLITAN
REGION
built-up area
low density filling in and spread of settlement
scale 1:400,000

government in pursuing a policy of "guided development" can influence, significantly, the direction of growth and the longer term structure of BMA, particulary through implementation of a coordinated infrastructure investment program. In this regard, the implementation of the sectoral investment programs of BMR, particularly the transport sector will contribute substantially to the rationalization of the existing pattern of development in the short term.

There is no obvious deficiency in the carrying capacity of existing urbanized areas with respect to projected increases in population and economic activity. That is, the new housing units required through 1991 and the commercial, industrial, educational and other activities required 99 service that population can all be accommodated by: (1) increasing the density of already developed land; (2) developing available in-fill sites; and (3) extending development to areas contiguous to already developed areas within the outer flood dike.

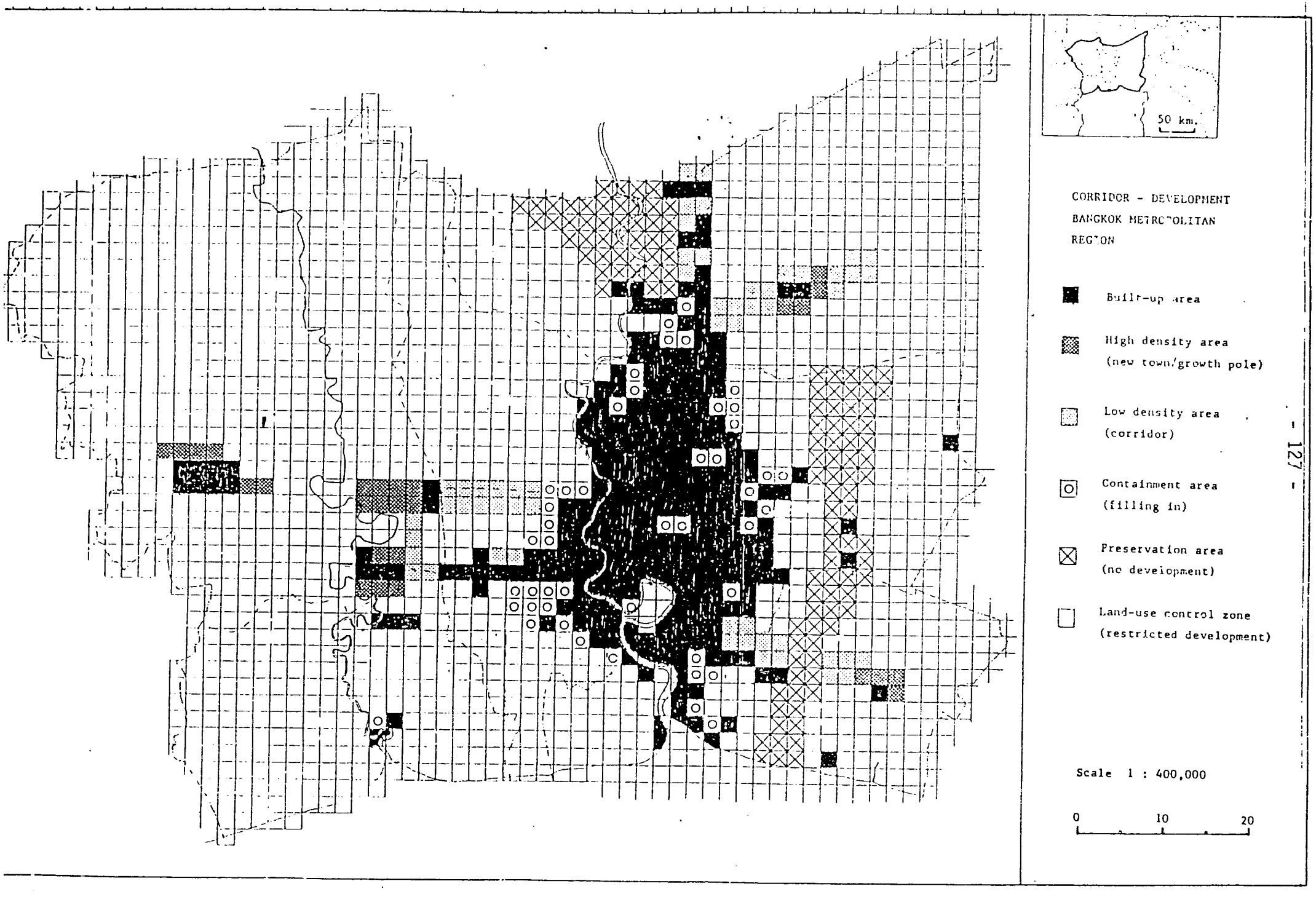
From a spatial standpoint, then, future regional development will emphasize increasing density in the BMA and in regional towns. Some development will continue to occur along major roads outside these urbanized areas unless the Bangkok Structure Plan can be rigorously enforced but such development should not be encouraged or supported by public investment. Given this moderate level of intervention in the development process under the Sixth Plan the form of BMA in the longer term may not be drastically different from Figure 8.2.

8.4 Issues Remaining

The preceeding chapters suggests a number of issues worth further attention in the final report. In some cases these issues can be resolved with further data collection or analysis. In other cases, the issue emerges clearly from the work done to date and must be resolved by a policy choice. Both kinds of issue are described below:

(1) The outer flood dike has established a line of protection against external flood waters which will protect the great majority of existing development. However, there is a fair amount of existing development outside of the planned dike for which conditions may be worsened by its construction. Moreover, in the absence of public intervention, new development will continue in areas for which no flood protection is planned. A series of questions are raised by these facts. Most importantly, since land use regulation has not so far been a viable means of discouraging development, are there other methods which will be more effective? For example, would the provision of public flood insurance only within the protected area discourage development in other places? Suppose it were required that the title to property in unprotected areas be inscribed with a warning to subsequent purchasers, or that developers in such areas were required to pay a "development fee" which would be used for eventual extension of the protected area. Should private diking outside the protected area be encouraged, discouraged or regulated? Should renewed efforts be made to regulate land use?

Figure 8.2


50 km.
CORRIDOR - DEVELOPMENT
BANGKOK METROPOLITAN
REGION
Built-up area
High density area
(new town/growth pole)
Low density area
(corridor)
Containment area
(filling in)
Preservation area
(no development)
Land-use control zone
(restricted development)
Scale 1 : 400,000
0
10
20

(2) What has been the price history of developable land in the BMR? Have land prices increased faster or slower than incomes and general inflation?

(3) What will be the effect of the proposed improvements on property values and housing costs? For example, when roads and other infrastructure are provided to any particular site, its value will normally increase. But if services are provided to enough sites to exceed the concurrent effective demand, the average price of serviced sites may decrease. What will be the effect of the proposed transportation, water supply and flood protection schemes on BMR property values and housing prices?

(4) What impact have land prices had on the development pattern of BMR? What will be the effect of proposed infrastructure on informal housing development? The aerial photographic surveys show that the general tendency has been for squatter development to move progressively outward from the city core as the inner areas become more developed and more valuable. Will such improvements as the outer flood protection dike accelerate the outward migration of slums by increasing the land price differential between inner and outer areas? Should public actions be taken to influence the future location of informal housing? If so, what actions are most likely to be effective?

(5) What will be the effects of the proposed infrastructure financing schemes on investment and employment? To what extent can the investment program be modified to increase its employment generation effects?

(6) What will be the effect of the continued construction of flood protection dikes and related improvements on the location of industrial, commercial and residential development? What will be the total additional tax burden on protected land? What will happen to land prices?

(7) Within the flood protected area, assuming the ADB plan for flood protection and the BMR study transportation program proposals are fully implemented, will there be any protected areas which remain unserved by roads by 1991?

(8) If, as the housing team has suggested, the construction of flood protection barriers will increase the price of land within those barriers and force informal low-cost development on to unprotected and therefore cheaper land, should this tendency be resisted? If so, how?

(9) Do the current and proposed tax systems encourage or discourage the development of vacant, serviced land? What feasible changes in tax policy might bring more land in serviced areas on to the market?

(10) How much new land needs to be commercially, industrially and residentially developed to accommodate projected growth during the Sixth Plan period? How does this compare with the current and projected supply

of serviced land? Will the proposed infrastructure programs from the transportation and water resources sectors be sufficient to accommodate this growth?

(11) What will be the financial effects of the proposed financing schemes on BMR households? Will the effects be progressive or regressive? How will low-income households be affected?

(12) How sensitive is the analysis summarized in the interim report to macro-economic variables? For example, real GDP growth rates are forecast at 5 percent per annum during the Sixth Plan. What would be the effect on migration, employment generation, household incomes and project revenues of GDP growth rates of say 8 percent and 2 percent?

These questions, and those raised in Chapters 2 through 5 and in Chapter 8 will guide the work for the balance of the study.

Annex 1

Table 1-A Forecast Value of 1985 Value Added by Sector

	1972 Prices			Forecast Growth Rates		
	1984	Growth %	1985	1986-90	1991-95	1996-2000
Agriculture	84,297	3.50	87,247	.02	.02	.02
Mining	5,166	17.04	6,046	.015	.015	.015
Manufacturing	76,944	6.49	81,937	.05	.05	.05
Construction	16,650	104.54	17,406	.035	.035	.035
Electricity	8,141	110.79	9,019	.08	.08	.08
Transport	24,945	7.11	26,718	.05	.05	.05
Trade	57,974	5.26	61,023	.05	.05	.05
Banking	26,856	110.80	29,756	.08	.08	.08
Dwelling	5,385	4.00	5,600	.03	.03	.03
Public Admin.	15,301	5.54	16,148	.04	.04	.04
Services	41,904	6.69	44,707	.05	.05	.05
Total	363,563	6.01				

Table 1-B

BMR EMPLOYMENT FORECAST, 1985-2000
VALUE ADDED FORECAST
Whole Kingdom

Area Sector	1985	1990	1995	2000
Agriculture	87,247	96,327.74	106,353.6	117,423.0
Mining	6,046	6,513.259	7,016.630	7,558.903
Manufacturing	81,937	204,574.7	133,466.7	170,341.1
Construction	17,406	20,672.87	24,552.88	29,161.12
Electricity	9,019	13,251.87	19,471.34	28,609.79
Transport	26,718	34,099.69	43,520.81	55,544.80
Trade	61,023	77,882.53	99,400.04	126,862.4
Banking	29,756	43,721.33	64,240.97	94,391.06
Dwelling	5,600	6,491.935	7,525.932	8,724.618
Public Admin.	16,148	19,646.51	23,902.98	29,081.64
Services	44,707	57,058.72	72,822.99	92,942.64
TOTAL	385,607	480,241.1	602,274.9	760,641.1

BMR EMPLOYMENT FORECAST, 1985-2000

Area Sector	BMR 1985	1990	1995	2000
Agriculture	5,144.537	5,295.022	5,460.893	5,643.753
Mining	119.4127	147.3744	174.9453	202.0953
Manufacturing	58,772.30	71,697.44	82,734.60	91,362.18
Construction	9,622.470	12,216.26	15,308.53	18,992.83
Electricity	3,046.618	4,476.482	6,577.420	9,664.388
Transport	14,060.40	16,732.52	22,924.37	33,608.40
Trade	19,526.55	27,785.89	38,700.47	53,003.87
Banking	21,355.37	30,400.34	42,897.24	60,466.14
Dwelling	3,313.283	3,941.843	4,599.476	5,290.812
Public Admin.	5,103.664	5,712.306	6,714.516	8,195.562
Services	22,467.34	28,537.39	37,972.25	51,701.56
TOTAL	162,532.0	206,942.9	264,064.7	338,131.6

Table 1-C

BMR EMPLOYMENT FORECAST, 1985-2000, BANGKOK METROPOLIS

Sector	1985	1990	1995	2000
Agriculture	3,826	2,411	1,518	956
Mining				
Manufacturing	270,775	266,208	243,920	209,025
Construction	86,424	119,039	159,751	210,430
Electricity	7,706	8,613	9,018	9,005
Transport	98,512	119,141	178,321	294,187
Trade	143,209	223,294	340,114	507,619
Banking	81,014	83,453	85,335	87,298
Dwelling				
Public Admin.	145,545	158,419	188,353	239,916
Services	314,489	424,612	622,438	948,546
TOTAL	1,151,500	1,405,190	1,828,770	2,506,982

BMR EMPLOYMENT FORECAST, 1985-2000, SAMUTPRAKARN

Sector	1985	1990	1995	2000
Agriculture	18,188	12,819	8,249	4,524
Mining				
Manufacturing	89,112	114,704	137,555	157,586
Construction	919	860	803	748
Electricity	7,466	9,923	13,104	16,886
Transport	815	1,318	1,469	1,141
Trade	35,850	55,555	82,480	119,109
Banking	1,298	2,228	3,594	5,632
Dwelling				
Public Admin.	734	1,083	1,473	1.900
Services	4,298	6,248	6,248	3,788
TOTAL	158,679	204,739	254,975	311,314

Table 1-C (Cont.)

BMR EMPLOYMENT FORECAST, 1985-2000, NONTHABURI

Sector	1985	1990	1995	2000
Agriculture	7,557	7,926	8,326	8,758
Mining				
Manufacturing	3,253	3,535	3,947	4,534
Construction	777	1,074	1,457	1,948
Electricity	119	188	827	2,810
Transport	546	895	1,054	947
Trade	1,813	2,697	4,275	6,864
Banking	553	962	1,542	2,383
Dwelling				
Public Admin.	962	1,447	1.908	2,303
Services	1,974	2,880	3,788	4,660
TOTAL	17,555	21,603	27,123	35,207

BMR EMPLOYMENT FORECAST, 1985-2000, PATUMTANI

Sector	1985	1990	1995	2000
Agriculture	32,886	41,092	49,868	59,176
Mining				
Manufacturing	34,557	51,953	69,955	88,134
Construction	60	82	106	131
Electricity	734	1,074	1,352	1,511
Transport	165	267	288	203
Trade	13,001	19,924	27,623	36,131
Banking	390	744	1,340	2,329
Dwelling				
Public Admin.	669	985	1,325	1,680
Services	1,124	1,577	2,061	2,573
TOTAL	83,587	117,697	153,919	191,869

Table 1-C (Cont.)

BMR EMPLOYMENT FORECAST, 1985-2000, SAMUTSAKORN

Sector	1985	1990	1995	2000
Agriculture	13,510	5,761	2,196	679
Mining				
Manufacturing	5,868	8,615	11,700	15,166
Construction	595	729	902	1,124
Electricity	904	1,592	2,377	3,254
Transport	285	473	523	389
Trade	3,763	6,317	11,016	18,876
Banking	396	640	1,006	1,565
Dwelling				
Public Admin.	341	467	630	840
Services	1,103	1,603	2,031	2,337
TOTAL	26,765	26,196	32,383	44,231

BMR EMPLOYMENT FORECAST, 1985-2000, NAKORNPATOM

Sector	1985	1990	1995	2000
Agriculture	54,841	69,700	85,606	102,461
Mining				
Manufacturing	5,870	8,254	10,758	13,358
Construction	438	491	556	635
Electricity	711	1,054	1,462	1,956
Transport	997	1,575	1,665	1,116
Trade	4,801	6,112	7,320	8,357
Banking	661	880	911	661
Dwelling				
Public Admin.	1,741	2,322	2,998	3,788
Services	2,247	3,103	3,974	4,835
TOTAL	72,307	93,490	115,250	137,168