PART II

STUDIES OF TECHNICAL IMPROVEMENTS

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Technical improvements in DTCP have been proposed by considering the organization's responsibilities and the level of technical capability required. With these improvements, DTCP will be better equipped with the tools necessary to provide assistance to local governments on urban problems. However, this study should be seen as merely a starting point for achieving technical improvements over the long term. The three important items discussed below should provide the foundation for DTCP's improvement program.

Improvement of Planning Techniques and Formulation of Manuals (Chapter 4)

As Thailand's leading city planning agency, DTCP is increasingly required to establish a more rational city planning process to be accepted by the various agencies concerned, not only by local governments but also by other central agencies involved in city planning and urban development. DTCP has been aware of the necessity of adopting appropriate analytic and planning techniques in the preparation of general plans. At this stage it seems important to establish a dtandardized city planning process by integrating and streamlining DTCP's current planning activities, and by preparing a set of manuals describing standardized procedures and techniques.

New Implementation Techniques (Chapter 5)

A well-prepared general plan has little practical meaning unless implementing measures are institutionalized. The term "implementation" in city planning, however, has two different meanings. One is the enforcement (e.g., land use control) of statutory plans and the other is the execution of project plans. A general plan by its very nature belongs to the former category, but the latter is recognized to be equally important for the strengthening of DTCP. Studies to identify methods to improve implementation techniques should consider the following:

1. Strengthening practical enforcement measures of land use control (e.g., zoning, building control) in response to urban problems.

2. Exploiting and coordinating all measures available for controlling and guiding urban development, including taxation, investment incentives, and land regulation.

3. Institutionalizing implementation measures for integrated urban area development and controlling urban sprawl by restricting infrastructure expansion.

Establishing a Common Database System (Chapter 6)

The city planning process requires various kinds of data and information. Plan preparation involves a series of activities to synthesize this planning information. DTCP currently collects a substantial amount of data in the planning process and these data should be efficiently stored and managed to utilize them effectively. Indeed, the establishment of a common database would play an important role in improving the rationality of city planning in Thailand.

4

IMPROVEMENT OF PLANNING TECHNIQUES AND THE FORMULATION OF MANUALS

4 IMPROVEMENT OF PLANNING TECHNIQUES AND THE FORMULATION OF MANUALS

4.1 Integrated City Planning Approach

The establishment of a standardized planning process to streamline DTCP's activities could significantly contribute to solving the problems identified in the preceding section. Almost all of DTCP's planners are aware of the appropriate techniques for data collection, analysis, and plan formulation, but many planners in the different divisions that participate in the preparation of general plans are not aware of the necessity of following a standardized process in the preparation of a general plan. The approach described in this section is intended to provide such a baseline planning process to aid in the standardization of DTCP's planning activities.

4.1.1 Objectives of an Integrated Approach

A city plan must be easy to understand if it is to form the basis of a societal consensus. Thus, the objectives, process, and methods used should be clear, and the plan should be expressed in quantitative terms to the extent possible. To prepare a persuasive city plan that can effectively promote the public welfare, it is vitally important to establish a standardized city planning system with technical methods and planning standards based on studies of actual physical and socioeconomic conditions.

To attain the above-mentioned objectives, the following measures should be implemented:

- standardization of plan contents to encompass an integrated physical plan, including both social and economic elements;
- clarification of the various steps in the planning process, with the output of each step and the necessary data clearly specified;
- standardization of the detailed analytical methods used at each step of the planning process;
- establishment of planning standards and guidelines for reference in analysis and planning;
- specification of common premises for establishing goals and objectives;
- improvement of coordination among planners in different sectors and with those in other agencies; and
- establishment of a common city planning database.

Each of these measures is considered below.

4.1.2 Standardization of Plan Making Activities

Based on various case studies for sectoral standardization, several suggestions for standardizing the process of preparing an integrated physical plan can be made.

Standard Contents

An integrated city plan consists of a land use plan, a transport facility plan, and a plan for other urban facilities. Together, these plans cover all planning fields. If necessary, district control plans and plans for urban development projects can be added as implementing measures. The target year is set approximately 20 years in the future, with an intermediate target year set 10 years ahead. The scale for presentation of the plan is usually from 1:10,000 to 1:25,000, depending on the size of the planning area.

An integrated physical plan includes the following:

Land Use Plan

- Location plan for urban areas and conservation areas.
- Designated land use (e.g., residential, commercial, industrial, or institutional) in urban areas.

Transport Facility Plan

- Road/street network plan.
- Location plan for road-related facilities.
- Plans for other transport facilities.

Plan for Other Urban Facilities

- Plan for parks and open space.
- Sewerage/drainage plan.
- Location plan for key facilities.

Standard Procedure

Figure 4-1 graphically illustrates the analysis and planning procedures for the preparation of an integrated physical plan.

Plan preparation starts with determination of the planning area. When a revision of an existing city plan is prepared, the existing planning area can be altered to reflect any recent expansion of the urbanized area. After the city planning area is determined, the map is updated. Based on the updated map, all necessary data are collected and existing conditions are analyzed. Conditions considered include the area's socioeconomy, land use, and urban facilities (including transportation facilities).

The planning process from the setting of goals and objectives to the determination of urban policies and future urban structure is a process that should involve elaboration of the city's future in quantitative terms. This process has frequently been based on the arbitrary judgments of planners or on uncertain planning standards. To increase rationality, a rigorous planning process should be established.

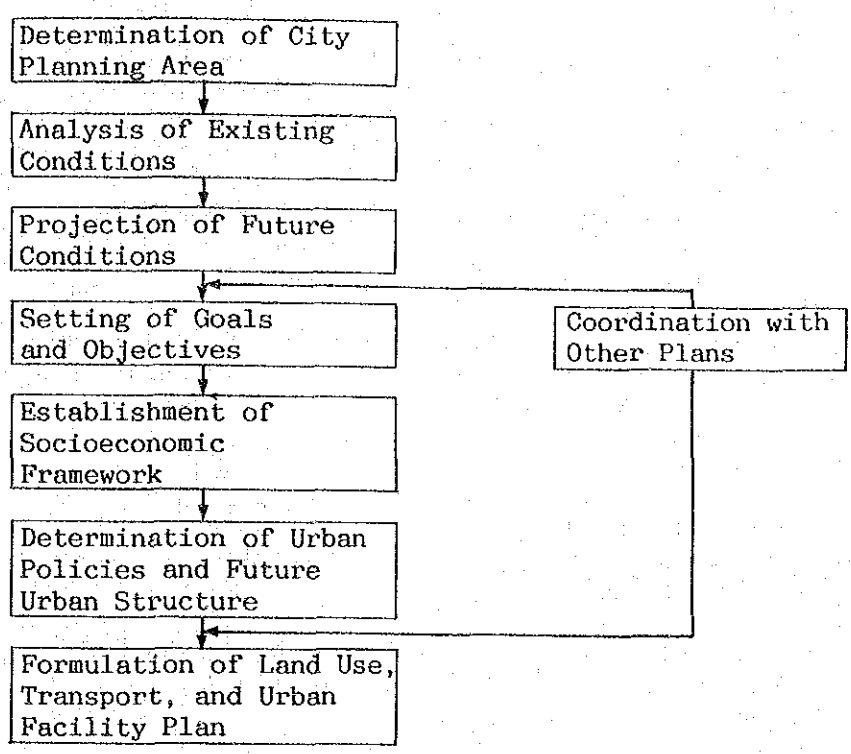

Fig. 4-1 ANALYSIS AND PLANNING PROCEDURE FOR INTEGRATED CITY PLANNING

Standard Output from Each Planning Step

Suggestions for the principal output of each planning step are summarized below.

Determination of City Planning Area

- Map showing boundary of city planning area (1:10,000 - 1:25,000)
- Documents precisely delineating boundary lines such as administrative boundaries, roads or other facilities, or natural features (e.g., a river)

Mapping

- General map of city planning area (1:10,000, 1:4,000)
- Land use map (1:10,000)
- Building use map (1:4,000)
- Administrative boundary and place name map (1:10,000)

Analysis of Existing Conditions

Socioeconomic System
- Population by zone
- Employment by sector and by zone

- Number of households by zone
- Number of establishments by sector and by zone
- Population growth trends in the planning area

Land Use System
- Population density by zone
- Land use classification
- Boundary of urbanized area
- Urbanization trends
- Relationship between population density and land use
- Relationship between employment distribution and land use
- Evaluation of urbanization potential by zone

Transport System
- Physical condition of transport facilities
- Traffic volume on main roads
- Utilization of other transport facilities
- Traffic accidents

Other Urban Facilities
- Physical conditions of facilities
- Utilization of facilities

Projection of Future Conditions

Socioeconomic System
- Total population
- Total employment by sector

Land Use System
- Land requirements by use
- Boundary of urbanized areas
- Population and density by zone
- Employment by sector and by zone

Transport System
- Traffic volume on main roads

Other Urban Facilities
- Demand for urban facilities

Typically, total population is first projected and then the projections are checked for reasonableness. After reasonable projections of total population are made, other variables can then be projected.

Setting of Goals and Objectives

- Main functions of the city
- Planning tasks required to achieve goals and objectives

Establishing the Socioeconomic Framework

- Total population
- Population by sex and by age group

- Number of households
- Total employment by sector

Determination of Urban Policies and Future Urban Structure

- Scale of future urban areas
- Policies for the location of future urban areas and conservation areas
- Policies for urban development and redevelopment
- Policies for the development of the transport system
- Policies for conservation of the natural environment and for the development of public open space
- Policies for improving the drainage and sewerage system and rivers
- Policies for the development of other urban facilities

Formulation of Land Use, Transport, and Other Urban Facility Plans

Land Use Plan
- Population and density by zone
- Employment by sector and by zone
- Areas by use
- Location plan for urban areas and conservation areas
- Designated land use in urban areas

Transport Plan
- Projected traffic volume on main roads
- Road/street network plan
- Location plan for road-related facilities
- Plans for other transport facilities.

Other Urban Facilities Plans
- Catchment area for drainage
- Sewage/drainage plan
- Plan for parks and open space
- Demand for key facilities
- Location plan for key facilities

Standardized analytical methods and planning standards are described in the sector manuals.

Standard Premises for Goals and Objectives

City planning goals and objectives might be established by considering the following:

- position and role of the city in the province or the nation;
- principal economic activities;
- special social considerations in planning (e.g., the existence of university, religious, or historic properties); and
- special natural characteristics.

Particular planning tasks depend on goals and objectives, but examples would include:

- strengthening of function as provincial capital;
- promotion of industrial activities;
- conservation of historic areas;
- prevention of floods; and
- reducing the population growth rate.

Coordination Among Sectors

Planners working in each of the sectors should share data and insights regarding socioeconomic variables, the distribution of population and employment, urban policies, and urban structure. And, of course, any plans and projects of mutual interest should be discussed, regardless of which agency is responsible for implementation. For example, agricultural development plans, road construction projects, and urban utility plans implemented by one agency would be of interest to other agencies.

Common Database

The detailed structure of a common database is described in one of the sector manuals. For the development of such a database, basic city planning data must be identified and collected periodically in standardized formats.

4.1.3 Development of a Manual for Integrated City Planning

The integrated city planning manual provides general guidelines for preparing an integrated physical plan, with the details left to the sector manuals. This manual describes the nature of city planning, summarizes the sector manuals, and addresses programming and evaluation issues.

The Nature of City Planning

The previous sections of this chapter introduced an integrated approach to city planning, with emphasis placed on the standardization of plan-making activities and the need for coordination among sectors. In addition, the timing of periodic revisions of plans is described.

Summary of Sectoral Manuals

The sectors are the following:

- mapping;
- socioeconomic analysis;
- land use planning;
- transport planning; and
- urban facilities planning.

Each sector manual considers the (a) substantive contents of work in the sector, (b) methods and procedures, (c) interrelationships among sectors, and (d) presentation of results.

Programming and Evaluation Issues

The programming and evaluation part of the integrated manual includes these elements:

- Programming of Work Plan;
- Preparation of Development Investment Program; and
- Evaluation of City Plan.

The programming of the work plan should be based on a standard assignment of sector tasks. The second element explains how to prepare an investment program, a package of interrelated projects within a defined planning area. The last element considers methods for evaluating an entire city plan as well as its component projects. Technically defensible project evaluations (feasibility studies) are vitally important for obtaining a social consensus for the development investment program.

Subjects for Further Studies

This integrated city planning manual, along with the sector manuals, was jointly produced by the Thai and Japanese study teams. It has been prepared under the severe time constraints of a JICA Study. The next step is to refine this manual and then have DTCP officially approve it. To refine the manual, it is recommended that the process proposed in the manual be applied in several trial cities.

4.2 Mapping

4.2.1 Proposed Improvements

Maps produced in the Mapping Division are principally used for the preparation and enforcement of general and specific plans. As a consequence, the maps must meet the requirements of the planning and engineering divisions for such plans. At present, however, the Map Division is limited in its capabilities for the reasons discussed in Chapter 3 (e.g., a shortage of modern equipment).

Clearly, a prerequisite for improving general and specific planning is to improve the maps that underlie the planning process. Such improvements in mapping are possible if the recommendations described below are implemented.

Streamlining the Mapping Process

The mapping and data collection process should be streamlined to address the problems of confusion, inaccuracy, and inefficiency.

Articulating Mapmaking Procedures

Articulated mapmaking procedures must be established in the Mapping Division to assure that all mapmaking activities can be systematized. The general procedures for mapmaking shown in Figure 4-2 are proposed.

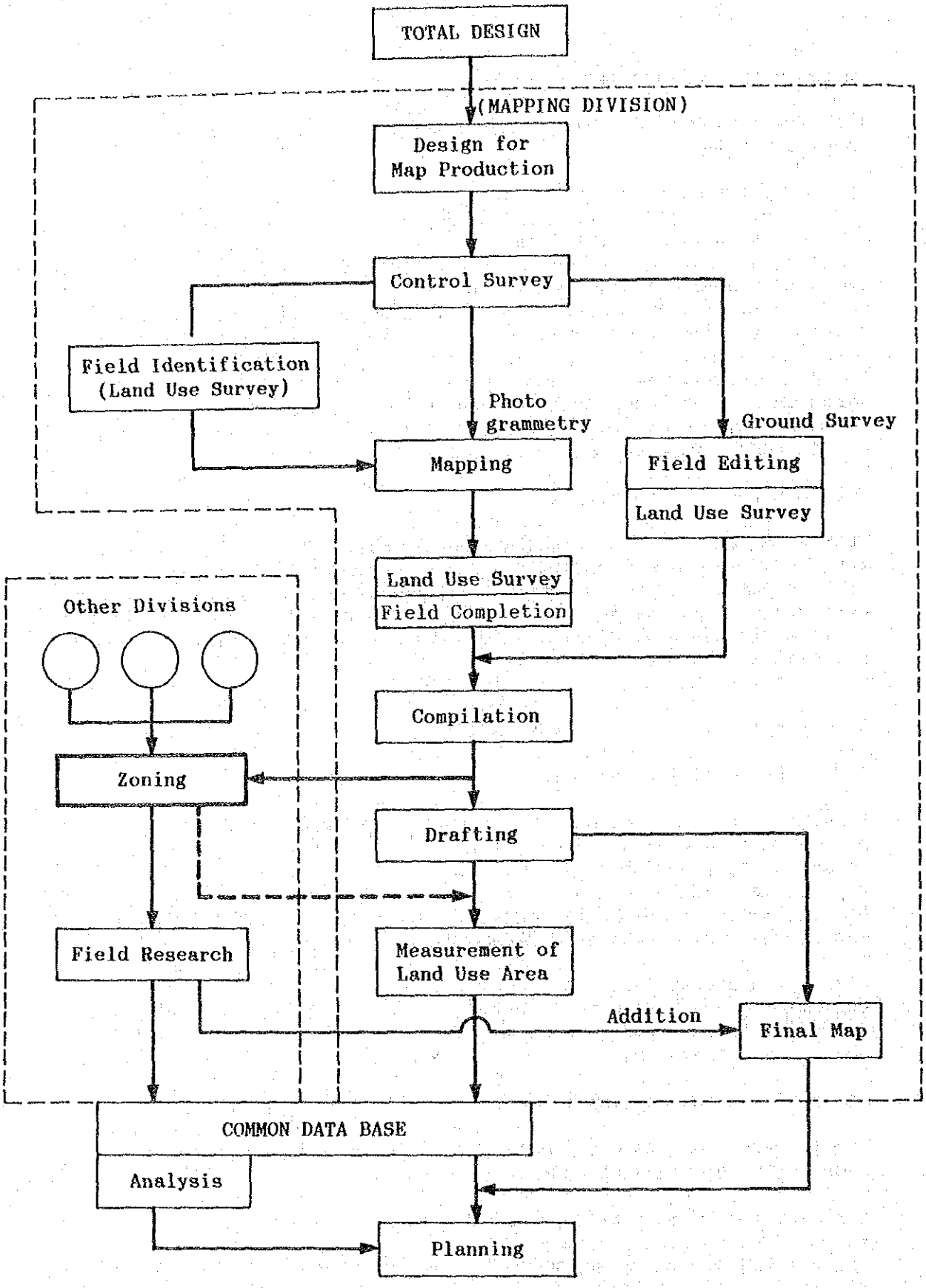

Fig. 4-2 GENERAL PROCEDURES PROPOSED FOR MAP PREPARATION

In addition, specific procedures for base map production using aerial photography and ground surveys are proposed in Figure 4-3.

Technical Improvements in Mapmaking

Need for Permanent Control Points

Improving the "control survey" is most crucial. Control surveys are conducted for orientation of aerial photographs (aerotriangulation) and for use as control points for field editing. In the case of non-aerial photographs, mapping procedures must be carried out in the field.

If horizontal and vertical control points have been clearly established in the planning area, subsequent surveys and editing can be conducted more efficiently. Unfortunately, control points have generally not been established. In field surveys conducted by DTCP, the coordinates used are assumed or guessed rather than definitively determined. Further, in many cases they are not cross-checked with the national control survey system. Field surveys are relatively costly and time-consuming and involve a large outlay of manpower. Moreover, DTCP has not established the necessary permanent monuments.

However, there are many advantages in having a recoverable network of control points available for future use. Therefore, it is proposed that monuments be established for use as control points. Also, it is recommended that computation systems of the required accuracy be developed.

New Equipment for Surveying and Data Processing

Improvements in surveying and data processing for mapmaking are principally dependent on the availability of new equipment. DTCP must be determined to make progress in acquiring the necessary equipment. In this study, it is recommended that personal computers be used for implementing the leveling net adjustment method.

Map Presentation

Maps should present planimetric features identifiable on, or interpretable from, aerial photographs. At a scale of 1:4000, planimetric features can be clearly shown and are readily recognizable. In addition, maps with such features as contour lines, spot elevations, and symbols identifying important facilities can provide more information for analysis of the topography of the planning area.

Maps should also show symbols if the nomers used are not well-known. Inked symbols, lineweights, letters, and numbers should be standardized.

Improving the Accuracy of Land Use Data

In addition to mapmaking, the Mapping Division is responsible for the compilation of land use statistics by area. Although this task is

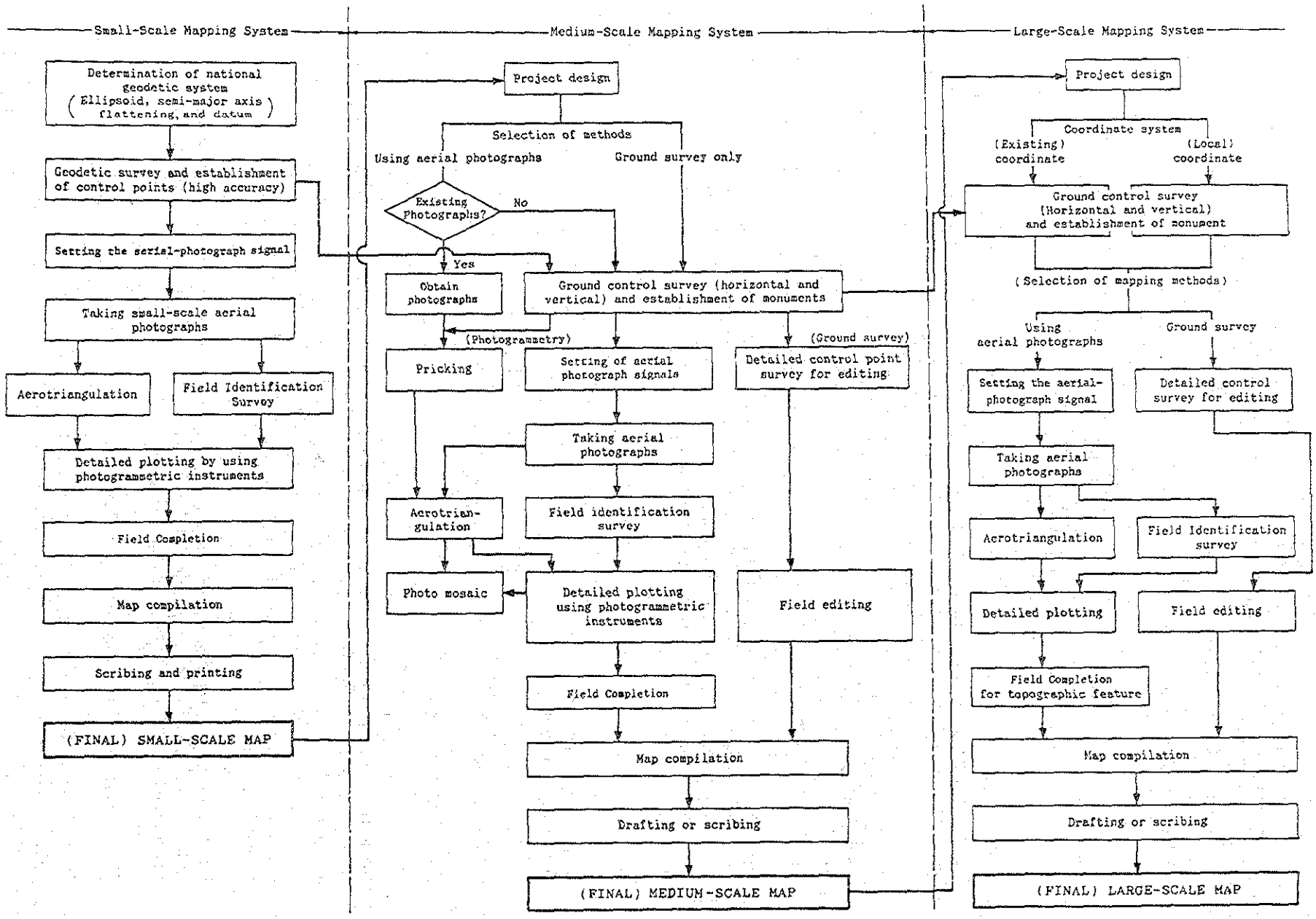

Fig. 4-3 PROPOSED METHOD FOR PREPARING BASE MAPS

quite time-consuming, it provides data that is indispensable for planning in the various sectors.

Improvement of the process for compiling land use data is crucial. Of course, there is significant potential for time (and cost) savings by reducing the hours required for this time-consuming task. However, more importantly, the quality of planning will improve if the database on which planning is based can be improved.

The methods for measuring (land use) areas on a map are as follows:

1) The area may be calculated by dividing the tract into triangles and rectangles.
2) The area of the tract may be traced with a planimeter.
3) The area may be estimated by making calculations based on the coordinates of the corner of a polygon tract.
4) The area may be estimated from the double meridian distance and the latitude of the sides of the tract.
5) Finally, a graphical collection method may be employed.

The Mapping Division is currently using methods 1), 2), and 5). Method 3) is the subject of a case study below. Appendix B-1 provides a review of methods 2), 3), and 5).

4.2.2 Summary of Case Studies

As shown in Table 4-1, several case studies were conducted to evaluate the proposed improvements in mapping procedures.

Table 4-1 CASE STUDY SITES AND MAPPING PROCEDURES EVALUATED

Mapping Procedures Evaluated	Case Study I			Case Study II	
	Lang Suan	Song Phi Nong	Krabinburi	Chiang Mai	Bangkok
Map making (Procedure)	Photogram-metric method	Ground survey method		Photogram-metric method	
(Engineering)			Control survey	Leveling net adjustment using personal computer; Map contents	Electronic total station
(Map presentation)	Map contents	Map contents		Map contents	Map contents
Data generation	Measuring land use areas (digital planimeter and digitizer)	Map contents		Measuring land use areas (digital planimeter and digitizer)	

• New equipment provided

Results of the Case Studies

The results of the case studies are reviewed in this section.

1. Improvement of Accuracy and Efficiency by the Provision of Modern Technical Equipment

   The modern equipment provided for the case studies (e.g., digital planimeters) proved to be helpful in improving map accuracy, saving time, and generally facilitating the mapmaking process. However, it does not necessarily follow that DTCP should be immediately provided with modern equipment. DTCP should program the procurement of such equipment taking into consideration the financial feasibility of each item. In other words, the costs and benefits should be carefully assessed, considering the degree of accuracy and time limitations.

2. Technical Improvements

   A control survey was recommended with the establishment of permanent monuments for ground surveys, making subsequent surveys (typically performed once every five years) more efficient. In the case studies, it was concluded that vertical coordinates should be placed every 200 to 300 meters or in the middle of important street or highway intersections. Regarding map presentation, base maps with a scale of 1/4000 should be improved to include index contours, lineweight symbols, and name labels in order to improve planning and analysis. Generally, the case studies showed that these technical improvements could be implemented without much difficulty; nevertheless the effects would be far-reaching.

Various technical aspects were evaluated in the case studies:

- Technical procedure improvements in mapmaking were evaluated through an assessment of photogrammetric and ground survey methods in Lang Suan and Chiang Mai.
- "Engineering improvements" in mapmaking were analyzed through an evaluation of a control survey, the "leveling net adjustment" method using personal computers, and an electronic station system in Krabinburi, Chiang Mai, and Bangkok.
- Map presentation techniques were assessed through an analysis of the contents of maps produced at the various case study sites.
- Improvements in measuring land use area were considered by evaluation of the use of such new equipment as the digital planimeter and digitizer.

4.2.3 Formulation of a Mapmaking Manual

A mapmaking manual has been prepared to meet user needs. The manual contains three chapters and two appendices.

Chapter 1 provides definitions and explains basic concepts.

Chapter 2 describes mapmaking procedures. DTCP's current approach to mapmaking involves the use of ground survey and photogrammetric methods. This chapter describes standards, basic measurements, and errors for each method.

Chapter 3 describes applied mapmaking technologies, especially methods for the measurement of ground distances and areas. This chapter also presents the case studies and discusses new tools such as the digitizer, plotter, and computer.

In addiation, the mapmaking manual features an appendix describing a method (utilizing FORTRAN) to convert map coordinates to ground coordinates and vice versa. Another appendix presents a method for making adjustments for traverses and conducting leveling (again, using FORTRAN). This method was tested in the Chiang Mai Case Study.

In summary, field surveys and photogrammetric procedures at DTCP have not fulfilled their functions due to a lack of new technologies for survey adjustment and data processing. The mapmaking manual was designed to fill these gaps by introducing methods such as analytical photogrammetry, digital mapping, new computation techniques for ground surveys, and a map information system.

4.3 Socioeconomic Analysis

4.3.1 Proposed Improvements

Proposed improvements in socioeconomic analysis cover the following areas:

- review of data items in field surveys;
- tabulation of data by sub-zone;
- establishment of standardized analysis methods; and
- introduction of a data management system.

Each area is discussed below.

Review of Data Items in Field Surveys

The following items were proposed for inclusion in field surveys:

- workplace (zones) for the employed population;
- place (zones) of schooling for pupils and students;
- average monthly salary paid by commercial and industrial establishment; and
- lot size of commercial and industrial establishments.

The first item provides information on the distribution of employment in the planning area. Both the first and second items provide information on commuting patterns. The third item is helpful in providing information on economic activities in the planning area. In order to link the city plan with the economic development plan, economic indicators such as industrial output and retail sales are indispensable. However, it is generally difficult to obtain such data directly through an interview survey. Therefore, it is advisable to attempt to find some relationship between salaries and these economic indicators. The last item to be included in field surveys will permit analysis of the relationship between commercial and industrial activities.

Tabulation of Data by Sub-Zone

To conduct city planning, it is important to combine socioeconomic data with land use information. Data tabulation by zone is necessary to achieve this purpose.

Factors to be considered in defining zones include:

- land use homogeneity;
- administrative unit;
- physical barriers (e.g., hills);
- local naming of area;
- ease of identification by local people; and
- future expansion of the urban area.

Establishment of Standardized Analysis Methods

Improvements in data collection and the introduction of computers should be accompanied by standardization in the analysis stage. Such standardization is integrated in the socioeconomic analysis manual.

Introduction of a Data Management System

A data management system should be introduced, not only to facilitate socioeconomic analysis, but also to establish a unified system of city planning. Computerization accentuates this need for standardization in city planning. The data to be collected, tabulation formats, analysis procedures, and final output should be more clearly defined.

4.3.2 Overview of Case Studies

Study Areas and Subjects

Taking the proposed technical improvement plan into consideration, case study sites and purposes were set as follows:

Tha Rua (Case Study I)

- to study the effects of 1) an addition of survey items; 2) data collection and tabulation by grid cell; and 3) computerization of data compilation for the household, commercial, and industrial surveys.

Tha Rua and Tha Mai (Case Study II)

- (Part 1) to study the feasibility of the proposed analytical methods by making use of the pilot database compiled in Case Study I (Tha Rua); and
- (Part 2) to study methods to the improve the pilot database, (Tha Mai).

Conclusions of Case Study I

Improvements in Data Collection Items

The increase in the number of survey items to include workplace, place of schooling, and monthly salary added a little to the time required for the survey. For workplace and place of schooling, there was a minor problem because there was no up-to-date base map to indicate the exact location of activities in each sampling unit. Regarding monthly salary, the owners of industrial commercial establishments were not fully cooperative in responding; however, the owners of industrial firms were more forthcoming since they were less likely to be family businesses.

Data Tabulation by Subzone

Zonal tabulation using a grid system requires an accurate map before carrying out the field survey. In Case Study I, the zonal data had to be revised because the final revised map prepared by the Mapping Division was substantially different from the one used at the initial grid formation stage.

When combining socioeconomic data with land use information, the maximum area of a zone within the built-up area of a small town might be approximately 10 hectares (nearly 300 m x 300 m). However, if there is a large scale facility such as a manufacturing factory (e.g., the Siam Cement Factory in the Tha Lan Planning Area) or an airfield (e.g., as in the Tha Mai Planning Area), it would be almost meaningless to divide these areas into grid cells (even larger ones) to collect population or employment data.

However, the grid system has the following advantages in the analysis of socioeconomic and physical conditions:

- it offers standardized data on population and employment densities, urbanization, development potential, and the distribution of various activities;
- it is easy to compare data from different time periods within the same zone; and
- it is convenient for computerization.

In the process of analysis, however, descriptions about administrative units (e.g., municipalities, sanitary districts) are required. If the data are collected by grid cell, adjustments are tedious to make. In addition, a grid cell straddling the boundary line of an administrative unit or a physical barrier can provide misleading

information.

In conclusion, zones should be delineated taking into consideration administrative boundaries, land use homogeneity, natural barriers, and the local naming of small zones. This will facilitate data collection. Even if the map used for the field survey is inaccurate, if it is correctly divided into administrative units, the collected data can be used without revision. And, after the zonal data are collected and put into the data file, the tabulation work is not difficult.

Socioeconomic Database

A proposal for a database management system is described in Chapter 6 of this report. In this section, two types of problems identified in Case Study I are described, one related to programming and the other to data processing.

Problems Related to Programming

- Program structure was poorly developed because a detailed program flow chart was not made.
- Although the dBASE III PLUS application is effective for developing a database, it is not effective for preparing a basic tabulation program.

Problems Related to Data Processing

- The processing time for tabulations using dBASE III PLUS is too long. Therefore, another programming language should be used.
- Regarding preparation of the original file, the maintenance of documents on data coding (e.g., revision records, final data) is insufficient.
- During the first two weeks of data processing, there was not enough equipment.

Conclusions of Case Study II

Analysis of Existing Conditions

The use of 500 m X 500 m grid cells to show the distribution of population and employment generally proved to be effective in spite of the problems mentioned above. It was apparent that workplace data is very important for understanding urban structure and land use. These data can be obtained from a household survey, but the results should be coordinated with the employment data obtained from the commercial survey, the industrial survey, and other surveys of social service facilities.

Projections

A lack of historical data for the study area itself made it difficult to make even simple trendline projections. Therefore, it was necessary to estimate past trends by considering the area of vacant

land in municipalities and sanitary districts. To apply simple economic methods, it would have been necessary to study both basic and non-basic industries and to collect related data and information. Unfortunately, it was impossible to apply the cohort survival method of population projection and the labor force balance method of employment projection because of a lack of migration data by sex and age group and a lack of data on economic production by sector.

Improving the Pilot Database

The fundamental structure of a database has been constructed. DTCP should refine and expand the database as the need arises.

After standardized data for the planning area are accumulated, the analytical methods described in the manual can be applied. However, due to current data limitations, projections of population and employment must now be made with very simple methods such as geometric growth models and simple economic models. The former could be applied to cities without special economic development projects and the latter to the cities with such projects.

4.3.3 Development of a Manual for Socioeconomic Analysis

Content of the Manual

The Socioeconomic Analysis Manual (Volume II) focuses on methods for analyzing and projecting population and employment. The existing distributions of population and employment as well projections for total population and employment are the basic data for land use planning. Generally, "socioeconomic analysis" refers to the analysis of various aspects of the social and economic conditions of an area. However, in this manual an emphasis was placed on physical planning rather than on social and economic development planning.

The main part of the manual is composed of three subparts:

- Data Collection and Compilation;
- Analysis of Existing Conditions; and
- Projection of Future Conditions.

Each part is divided into two sections, one focused on population and the other on economic activity including employment.

Principal Items Described in Each Section

The contents of each subpart of the manual are described below.

Data Collection and Compilation

The basic data for providing a comprehensive demographic and economic profile of the study area and its position in a wider context (e.g., the province, region, or nation) are enumerated. The data included information to be collected by field survey, available from local offices, and available at central government agencies. Standard compilation formats for the basic data are presented in this subpart

of the socioeconomic manual.

Analysis of Existing Conditions

Population. Accurately estimating the population growth trend of a study area is a fundamental task in city planning. Therefore, methods for estimating population trends are presented using the results of the case studies. Population distribution and population density are considered. Additional items explained include the age and sex structure of the population, labor force, household characteristics, and other demographic variables.

Economic Activity. The distribution of employment by economic sector can be estimated by comparing the results of household surveys, commercial surveys, industrial surveys, and surveys of social service facilities. It is necessary to consider which zones specialize in the commercial, industrial, or service sectors, and to discuss urban structure in connection with land use.

Preparation of a place of residence/workplace matrix is useful in understanding the commuting pattern of an area.

Other items explained in this subpart of the socioeconomic manual include:

- age-sex structure of the employed population;
- commercial activities;
- industrial activities;
- special economic activities;
- household income; and
- the economic position of the area in a wider geographic context.

Projection of Future Conditions

Basic projection methods for population and employment are explained. They include:

- arithmetic growth models;
- geometric growth models;
- ratio methods;
- Gomperz curve models;
- logistic curve models;
- simple economic methods;
- cohort-survival ratio methods;
- "constant supporting ratio" methods; and
- labor force demand and supply balance methods.

Each method requires different data and its applicability depends on the unique characteristics of the planning area. Therefore, the description of each method includes the necessary data and applicable cases.

Subjects for Further Studies to Improve Socioeconomic Analysis

To better understand existing conditions in a study area and to improve the accuracy of projections, further improvements in data collection are required. For example, data on migration by sex and age group should be collected. In addition, studies of basic and non-basic industries should be conducted. Also, trends in farmland utilization should be considered.

Several steps to improve the data management system should be taken. For example, an input-data validation routine should be added to the data input program. The data accumulated over time should be analyzed with SPSS, graphs should be drawn with LOTUS, and figures should be generated with BASIC and FORTRAN.

4.4 Land Use Planning

4.4.1 Proposed Improvements

There are three types of problems with land use planning in DTCP.

- a lack of standardized land use classifications;
- limited use of quantitative approaches; and
- a lack of appropriate land use control measures.

The first problem, a lack of standardized land use classifications, is a simple problem. The solution is to establish a standardized land use classification system and make every planner aware of it. The second problem, the limited use of quantitative approaches, is the most important technical issue. Quantitative analysis can provide a guiding tool for all implementation agencies and the private sector in preparing investment programs. And now, with Thai national urban policy aiming to decentralize urban development to regions away from Bangkok, new rational planning approaches, philosophies, and techniques are urgently needed. The third problem, a lack of appropriate land use control measures, is difficult to solve under the present legal framework of the general plan. It needs to be addressed through specific planning.

Thus, technical improvements in land use planning should focus on applying quantitative approaches to the evaluation of development potential and land use forecasting. One technique proposed is potential surface analysis (PSA), which uses a grid data system to analyze various factors related to specific sites and evaluates them with a complex scoring system to estimate development potential. Of course, this technique requires a large quantity of data and computer technology.

Regarding the forecasting of major land uses (e.g., residential, industrial, and commercial), DTCP does not yet use density standards in planning. However, the establishment of planning standards based on the size and characteristics of a community would facilitate land use forecasting and provide a common basis for comparison between cities. Forecasting of commercial and industrial uses requires a

consideration of industrial and urban policies at the national, regional, and provincial levels.

4.4.2 Summary of Land Use Planning

Case Study I (Chiang Mai)

The city of Chiang Mai serves as the administrative, business, and cultural center of its changwat as well as of the northern region. Chiang Mai's existing plan was prepared in 1984 and is now under revision. Because of the ready availability of data at the time of the study, the Chiang Mai Case Study dealt with the original (1984) planning area of approximately 100 square kilometers and an estimated population of 218,000 (1987). The planning area has since been expanded to 400 square kilometers.

Case Study II (Tha Rua/Tha Lan)

The Tha Rua/Tha Lan Case Study was conducted in an area covering two changwats about 130 kilometers north of Bangkok. The Tha Rua general plan area (18.37 square kilometers), is located in Changwat Phranakorn Si Ayutthaya and has a population of 26,000 (1987). The Tha Lan general plan area (20.66 square kilometers), also included in this case study, is located in Changwat Saraburi and has a population of 10,000 (1987). Major economic activities include the manufacturing of building materials such as cement, gypsum boards, and steel bars; agro processing; and distribution via rail, road, and river transport.

Study Issues

As mentioned above, the main subject of study was the application of quantitative approaches to land use planning analysis. Such applications can be applied to the demand side (land use) as well as the supply side. Development can be measured more objectively by scores (digital form) reflecting the views of several interested groups in order to guide, select, and allocate the optimum space and location to meet a specific demand. This technique can readily be applied when a microcomputer is available for information processing.

Case Study Findings

The PSA technique was applied in the two case studies. The results of the study showed that certain limitations exist in its application since it requires completion of several complex tasks prior to computer processing (e.g., fixing a suitable size for the grid cells, selection of factors, setting the range of measurement). Also, appropriate input information is not always available. Selection of the factors that determine the development potential of specific activities and the weightings that indicate magnitude of influence, should reflect the views of several planners and administrators. There are about 2,700 grid cells in the planning area for Case Study I (Chiang Mai) and 700 in the planning area for Case Study II (Tha Rua/Tha Lan). Since a number of such factors were used, the calculation of weighted scores was quite complicated. Such calculations are best done on a microcomputer.

The grid cells used in Chiang Mai were 200 m x 200 m. The map scale was 1:20,000. In Case Study II, population and employment data were collected and analyzed in grid cells of 500 m x 500 m, which were further divided into 250 m x 250 m grid cells for PSA on a map of the same scale. Grid size was determined based on the size of the planning area, time and budgetary constraints, personnel, and equipment availability.

A major benefit obtained from the case studies was the experience they provided local planners in applying quantitative approaches. Such techniques can now be applied to different steps of planning.

However, the two case studies were insufficient for judging the applicability of PSA in terms of impact on the efficiency, accuracy, and cost effectiveness of preparing land use plans. If microcomputers are not always available to local planners, the conventional overlay or sieve method may be more desirable.

Regarding land use forecasting, data such as housing type, plot size, density by income group, land and labor productivity by type of industry, and sales per capita and per unit of commercial floor area, should be collected. For the time being, the following figures could be used for reference.

- Residential Land

Low density	Less than 10 persons/rai
Medium density	From 10 to 20 persons/rai
High density	More than 20 persons/rai

- Industrial Land

Small and medium scale	16 workers/rai

- Commercial Land

10-15 sq. m. /per person

4.4.3 Development of Land Use Planning Manual

Characteristics of the Manual

A plan regulating land use is one of the principal parts of a general plan, as required by Section 17 of the Town Planning Act, 1975 (B.E. 2518). A land use plan should reflect future human and physical interactions and represent a concerted effort by a community to achieve desired land use goals and objectives. A land use plan guides development through the use of various regulatory and promotional measures intended to maintain and develop a better urban environment. The land use planning manual covers the technical procedures necessary for the land use planning element of the general plan. These

procedures include data analysis techniques, with the main emphasis placed on the use of quantitative methods in land use planning. The land use planning manual is composed of four sections:

- Preparatory Work;
- Analysis and Evaluation;
- Land Demand Projection; and
- Land Use Planning.

Major Topics Covered in the Land Use Planning Manual

Potential Surface Analysis (PSA)

PSA is discussed in detail since it is a relatively new technique for analyzing the development potential of an area. It is particularly useful for evaluating the suitability for development of various categories of activities. It is a rapid and efficient land use planning technique when a microcomputer is used.

Land Use Forecasting

The land use forecasting section deals with residential, industrial, and commercial land uses. To project the future level of activity in each category, a "planning framework" must be formulated. In the case studies, a "population frame" was established by selecting a reasonable growth rate for the planning period, and by adjusting projected manufacturing employment.

There are two approaches to the estimation of future urban land requirements. The first one is a macro approach that involves dividing a planning area into only two or three subareas based on population density. Criteria for area division have been proposed in the manual. The other, a micro approach, is to sum up the requirements for each category of land use. The micro approach deals with detailed information such as income, housing type, and plot size in the case of residential land use forecasting (as applied in Case Study I). If such detailed information is not available, the manual suggests alternative approaches. In any case, it is advisable to estimate future land demand using both the macro and micro methods.

Land Use Planning

The manual suggests various helpful considerations in establishing goals and objectives and formulating land use policy. Also, guidance is provided on density plans, layout plans, and the standard format for compilation of a draft plan.

Subjects for Further Studies to Improve the Land Use Planing Manual

In order to establish reasonable planning standards, the following information should be collected and analyzed:

- type of housing by income group;
- plot size by type;
- zonal distribution by income group;

- land and labor productivity by category of industry;
- employment per unit of investment in industrial and commercial projects; and
- sales per capita and per unit of commercial floor area.

4.5 Transport Planning

4.5.1 Proposed Technical Improvements

Three major categories of technical improvements were proposed to improve the transport planning component of general plans:

- improvement in data collection and compilation methods;
- introduction of quantitative demand forecasting techniques; and
- establishment of plan design and evaluation techniques.

The principal items of improvement within each of the above categories are summarized below.

Data Collection and Compilation

Lack of appropriate equipment for traffic observation was one of the major problems in data collection. Introduction of state-of-the-art traffic counters capable of identifying vehicle type, storing data magnetically, and transferring the data directly to a microcomputer via an interface, could improve the efficiency of traffic data collection and make it possible to continuously monitor traffic volumes and speeds. Congested areas and the capacity of road sections could then be identified.

Quantitative Demand Analysis

A four-step, traffic-zone-based approach was proposed to increase the accuracy of demand forecasting. The use of such a sophisticated modeling approach by DTCP had to be examined carefully since it is time consuming and requires a substantial amount of data as well as sophisticated computing equipment. It was concluded that simplified approaches would be required for smaller cities. The final transport planning manual provided guidelines for selecting appropriate transport planning techniues depending on the size of the city.

Plan Design and Evaluation

A transport system provides "physical communication channels" between and among land uses. The proposed technique quantifies the land use plan so that future travel demand can be expressed quantitatively. The results can be used to construct a transport network that is consistent with the estimated demand. An evaluation method was described to compare the different alternatives.

4.5.2 Summary of the Case Studies

Issues and Study Sites

The major objective of the transport planning case studies was to evaluate practical applications of proposed techniques. The case studies were designed to closely examine the effectiveness and the practicality of the newly introduced equipment, techniques, and methods. The final recommendations reflected the results of the case studies. The issues studied were chosen so as to cover the major areas of improvement proposed for the different stages of the planning process.

The case studies had to be conducted in accordance with the DTCP's statutory planning schedule. Although DTCP was prepared to make changes in its existing schedule, major modifications were not possible and the choice of study sites was dependent on DTCP's ongoing schedule. The relationship between the size of the sites and the cost and accuracy of the proposed methods also had to be considered. Taking these factors into account, Chiang Mai and Tha Mai were selected.

The study issues for each site are shown in Table 4-2.

Major Findings From the Chiang Mai Study

A summary of the quantitative travel demand analysis approach applied in Muang Chiang Mai has been presented in Appendix B-4 to show the data and methods required for such an analysis. The study also examined how this approach could be used in the evaluation of alternative transport networks.

The following summarizes the principal conclusions reached in the Case Study.

- The data required for this approach need to be properly collected and managed. In particular, the proper design of O-D surveys, traffic counts, and socioeconomic surveys is essential.
- The proposed quantitative approach is both feasible and desirable to achieve rational transport system planning in Thailand, especially in the larger cities, where rapid urban growth is taking place and transport problems are becoming more of a public concern.
- This approach, however, requires a great deal of quantitative data and it also demands additional skilled personnel and modern computer-based technology. Therefore, the application of this method must be justified in the appropriate context.

The remainder of this section elaborates the above conclusions.

Table 4-2 CASE STUDY CITIES AND TRANSPORT PLANNING STUDY ISSUES

City	Study Subjects
	CASE STUDY I
Chiang Mai (Phase I)	Quantitative Demand Analysis - Construction of O-D matrix from home interviews and car O-D survey (by using computer) - Estimation of O-D matrix from roadside survey data
	CASE STUDY II
Chiang Mai	Network Design and Evaluation - Forecasting of future trip ends and O-D patterns - Traffic simulation and network evaluation - Graphic presentation of desire line pattern and network volumes
Tha Mai	Data Collection and Compilation - Testing of traffic counters - Compilation and analysis of traffic data collected by automatic counter with magnetic storage medium compatible with microcomputer

Improvements in Data Management

Improvements should be made in the following areas:

- O-D surveys;
- traffic surveys;
- socioeconomic data collection;
- the zone system; and
- Q-V curves.

O-D surveys. Construction of a complete O-D matrix including external movements requires both a home interview survey and a cordon survey. In building a vehicle-trip matrix in passenger car units (PCUs), vehicle classification plays an important role. The surveys conducted at the Chiang Mai site were completed prior to this study and had different vehicle classification schemes. If the two types of surveys had been well coordinated, better results could have been obtained. A cordon survey requires only "inbound" trips to be surveyed, but the original survey interviewed "outbound" traffic as well, and this was

identified as redundant. The home interview survey, on the other hand, did not classify external zones, and therefore the movement of outbound trips was not properly recorded. In the construction of the O-D matrix, an irregular approach was taken to fully utilize all available data. In this study "outbound" trips from the cordon survey were used to estimate the internal-external elements of the O-D matrix obtained from the home interview survey. In the future, O-D surveys should be carefully designed to avoid this type of confusion. The original home interview survey covered only residential units and did not cover special uses such as military bases or university dormitories. The method of matrix adjustment with traffic counts was adequate to fill in the missing information, but a better result could have been attained if there had been a properly designed home interview survey. Finally, the various surveys should have concentrated on trips that had taken taken place at a specific time on a specific date. The original home interview survey was conducted by a group of 12 interviewers visiting households on different days. Thus, the trips recorded ranged over several days. In the future, one particular day should be specified and the roadside traffic counts should cover the peak hour of that same day so as to assure that the data collected are internally consistent.

Traffic Surveys. Counting stations should be chosen so that there is at least one counting station in each traffic zone. This would ensure traffic composition data for each zone, thereby increasing the accuracy of matrix adjustment. Traffic volume surveys should count the traffic volume in both directions and record them separately. These directional volumes are essential for the matrix adjustment process. Peak hour surveys must cover a sufficient length of time so that all peaks that occur during different times of the day throughout the traffic network are recorded. One section of road, for example, may have its peak from 7 to 8 am, while another may be from 8 to 9 am. In such an instance, the period from 7 to 9 am should be covered for all sections; the peak-hour traffic volume is then estimated by calculating the average volume during that period. The peak ratio--the ratio of peak hour traffic volume to 24-hour volume--is also important in the demand forecasting process. Vehicle occupancy rate can be used to convert the number of person trips into vehicle trips. In the Chiang Mai case study, most vehicle classes were covered except for buses (minibuses and standard buses). Vehicle occupancy rates are important to convert public transport trips into vehicle trips and it is recommended that any future survey cover these vehicle types.

Socioeconomic Data Collection. Socioeconomic data are usually collected and analyzed by DTCP's Research and Analysis Division. This division projects area-wide population and employment levels. The spatial distribution of population and employment are forecasted by DTCP's Comprehensive Planning Division. The importance of these forecasts for demand analysis and suggestions for possible improvements are summarized below. Existing population levels for each zone are used for the data expansion process and traffic production analysis. They are supplied to the Engineering Division classified by "enumeration districts." Since this zoning system cannot be used directly for traffic zones, a close coordination between the two divisions is required. Existing employment levels are

not known in the present system. The Research and Analysis Division, however, conducts a commercial and industrial establishment survey and it is possible to tabulate employment levels by traffic zone. This information is very important in travel demand analysis, particularly in the trip attraction modeling process. Classification by type of industry (i.e., primary, secondary, and tertiary) is recommended. At present, total car ownership within a city is available from car registration records, but distribution by study zone is not known. This can be estimated by using the results of the household interview survey along with the average income level of each zone. The information so derived can then be used to increase the accuracy of trip generation modeling. Levels of population by traffic zone are also essential for forecasting travel demand. Currently, no method of estimating the spatial distribution of population exists in DTCP. Therefore, the figures used in this study were obtained by a rather crude method of proportional allocation based on existing and future areas of residential land use and assumed densities. This process should be refined, probably by incorporating a land use allocation/forecasting model. The spatial distribution of future employment was not available for this study, but it is essential for the trip attraction forecast. Appropriate methods must be developed to estimate this information.

Improvement of Zone System. The zone system for the person trip survey in Chiang Mai was not adequate for network assignment. Many streets and road sections were used as zone boundaries and this proved to be inconvenient for the traffic assignment process. A better zone system must be developed through coordination with the socioeconomic and land use planning sectors. It is essential that these three sectors maintain internal consistency in analysis and planning, and this can be achieved only through the use of a common database. This requires a consistent zone system that is convenient for all sectors involved in a variety of interrelated planning activities.

Capacity Consideration and Q-V Curves. The study adopted conventional street capacities, which are used in the specification of general plans. The original source of this information is the Highway Capacity Manual of the U.S. Federal Highway Administration, and a Thai version (including Q-V curves) needs to be developed by accumulating traffic volume and speed data. The introduction of automatic counters with vehicle classification and speed measuring capabilities could achieve this objective, and this subject was studied in Tha Mai case study.

Applicability of the Quantitative Approach in DTCP

The proposed quantitative approach is feasible for the planning of transport systems in Thailand, especially for those cities where transport problems are a growing concern. These cities have a sufficiently large population and planning area, and a sufficiently complicated transport network. The argument of applicability, therefore, centers around the following three concerns: resource requirements; the criteria for cities where this method can be applied; and the need for simpler techniques for planning in smaller cities. These topics are discussed below.

Application of the proposed method requires a great deal of skilled manpower and modern computer technology. The time requirement worked out for the application of the proposed method for the Chiang Mai case study suggested that an increase in man-hours by 30% would be required compared to the existing labor allocation for field surveys and analyses, and that more than 80% of the effort (man-days) would be spent on the interview surveys and the construction of the O-D matrix. If this process were simplified, its use would become more economical. Therefore, any assessment of applicability must consider this point.

Planning for roads requires specification of right-of-way dimensions, and it is recommended that some form of quantitative approach be applied wherever possible. It is obvious, however, that smaller cities with one or two principal roads do not require computer-based traffic analyses. The origin and destination pattern of trips in these cities is simple and one may be able to assume that most of the traffic is centered along the main trunk lines passing through the city. A manual traffic assignment could be performed with reasonable accuracy for cities with two to three trunk lines. At the opposite extreme, in Bangkok, it is impossible to work out O-D patterns and to estimate traffic volume on the road network without a sophisticated method such as the one introduced in this study. From this "technical" point of view, a computer-based approach is required for medium to large cities with complicated road networks. An examination of road network patterns reveals that many of Thailand's regional cities are in this category.

The "administrative" viewpoint is also instructive. The most dominant urban transport problem in any city is traffic congestion. Smaller cities may face temporary traffic congestion due to stoppages resulting from road maintenance work or traffic accidents, but the need for a better road network may not become a serious public concern; there is no pressing demand on local authorities to take action to solve the problem. From this administrative point of view, the cities where traffic congestion is, or is becoming, a public issue will require the detailed quantitative approach.

Due to resource constraints, all cities may not use the method applied in the Chiang Mai case study, but simplified methods have been proposed, such as a road density approach or an O-D matrix estimation technique from traffic counts. Details of these can be found in the transport planning manual prepared in this study.

Findings From the Tha Rua Case Study

The results of the traffic counter experiment suggested that it could correctly identify vehicle type in 90% of the cases. The only difficulty arose when vehicle speeds were lower than 10 km/h; under these conditions, motorcycles were sometimes identified as passenger cars and vice versa, though the former type of mistake was more frequent. The tube detector was insensitive to motorcycles because of their light weight. This problem can be overcome, however, by increasing tube pressure. For this reason, and possibly for some other reasons, a PCU conversion of the machine count compared with the

manual count showed that the machines overestimate by about 5 to 8%. This error, however, appeared to be acceptable given the intended purposes. Furthermore, if the error is made consistently at different locations and at different times, perhaps the results can be systematically corrected with a fair degree of accuracy. However, this proposition would need to be tested.

Use of the classification counters could lead to three improvements in traffic data collection by DTCP:

- An automatic classification count would provide substantial savings in manpower, although it may take a few years to pay back the initial investment. [1]
- A continuous classification count would become possible, which would provide more information on the change in vehicle composition and PCU-converted traffic volume over time.
- Classified traffic volume counts and average traffic speed measurements could be performed simultaneously, thereby enabling the analyst to establish Q-V relations, which are vital for the improvement of network simulation and also for establishing existing congestion levels (i.e., calculation of V/C ratios).

4.5.3 Development of Transport Planning Manual

Contents of the Manual and Expected Readers

The transport planning manual prepared in this study is aimed at providing procedural guidelines and technical references for transport planning conducted in the preparation of the general plans. The planning activities defined within this manual closely correspond to the general-plan-related duties and responsibilities of the Engineering Division [2] of DTCP, their proposed provincial town planning offices, and local authorities. Since the planning horizon of general plans is usually 20 years, the transport component of a general plan proposes major transport arteries to strategically guide city development in preferable directions. The transport planning activities covered in the manual are those involved in the formulation and preparation of general plans.

Of course, the transport planning manual is one of several sectoral planning manuals. The volumes most relevant to this manual are the socioeconomic analysis, the land use planning, and the database management system manuals.

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[1] No detailed economic assessment was made.

[2] The Engineering Division of DTCP also has some responsibility for urban facilities planning and ad hoc street and traffic planning, two tasks not included in statutory general plans and therefore not addressed in the manual.

The transport planning manual is composed of nine parts:

Part 1: Introduction;
Part 2: Transport Planning Process;
Part 3: Transport and Traffic Surveys;
Part 4: Analysis of Existing Systems;
Part 5: Transport Demand Analysis;
Part 6: Alternative Approaches to Demand Analysis;
Part 7: Plan Synthesis - Guidelines for Better Plan Design;
Part 8: Evaluation of Transport Plans; and
Part 9: Note on Plan Revision.

The manual tries to incorporate as many practical examples and guiding standards as possible. The Chiang Mai case study [1], along with examples from other countries, were cited in the volume. These adopted planning guidelines, however, should be replaced with more appropriate ones worked out in continuing studies by DTCP and other authorities. Methods to establish these new guidelines are provided in the manual.

Fortunately, modern transport planning techniques are well-documented. [2] Therefore, the transport planning manual did not attempt to repeat this voluminous literature, but rather it emphasizes practical applications in Thai planning environments. However, some theoretical background is provided to assist the reader.

Simplified Approaches

In preparation of the transport planning manual, special attention was paid to the simplification of quantitative approaches. Due to resource constraints, all cities may not be able to employ the full-scale modeling method. Therefore, a variety of simplifications have been proposed for small- and medium-sized cities. One is O-D matrix estimation with roadside traffic volume counts; another is the use of rougher traffic zones and a "strategic transport network." More detailed explanations are presented in the manual. All the simplified approaches were selected for their practicality. Guidelines for choosing appropriate approaches in specific planning situations are given, but the final decisions are left to the planners who will be implementing these methods. Of course, their choices will depend on the unique characteristics of their cities as well as the resources available.

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[1] JICA (1988), Transport Planning in Chiang Mai, Working Paper, Applied Technology in City Planning, Japan International Cooperation Agency, and DTCP, MOI.

[2] See, e.g., Hutchingson, B.G. (1974), Principles of Urban Transport Systems Planning, New York, McGraw-Hill Book Company; JICA (1984), Comprehensive Urban Transportation Planning, Japan International Cooperation Agency.

Background of the Transport Planning Manual

Transport Planning as Statutory Planning

The transport plan component of the general plan is intended to reserve rights-of-way for transport facilities, mostly the road network. These rights-of-way are typically 60 to 80 meters wide in rural areas and 20 to 30 meters wide in cities. Once the general plan is enacted, the local authority can prohibit any development in an area reserved for the public road network. The plan is usually reviewed every five years.

The road network plan, in general, includes three kinds of improvement projects:

- cross-section redesign projects that do not change the total width of the roadway;
- projects to widen or realign the existing right-of-way; and

Each improvement project is identified by a unique numbering system, and the details of each project are described in a Ministerial Regulation. The project locations are shown on a map of a scale between 1:10,000 and 1:30,000. Local governments, assisted by DTCP, are required to select the exact locations of these rights-of-ways on a more detailed map and rank the priority of the various projects. In most cases, the local authorities finance the work out of their own budget.

Elements of Transport Planning Covered in the Manual

The elements of transport planning covered in the manual include:

a. Major Roads
   . Rural highways
   . Urban highways
     - primary distributors
     - district distributors
     - local distributors
     - access roads

b. Public Transport Network
   . Railway network
   . Bus routes

c. Transport Terminals
   . Airports
   . Railway stations
   . Bus/coach terminals
   . Truck terminals
   . Docks and seaports

d. Traffic Management Measures

People and goods move by passenger car, bus, truck, and train; walking and cycling are also important modes of transport. People and goods

moving on transport channels constitute "traffic," which collectively results in demand on the transport system. In this context, the transport system is the supply side. Higher capacities increase transport supply but they are costly to provide. On the other hand, lower capacities result in traffic congestion, which imposes a social cost on the urban community. Transport problems arise when transport capacity exceeds transport demand. This implies that one of the major aims of the transport plan is to assure a supply of sufficient capacity to accommodate transport demand. Thereby, a smooth flow of traffic on the transport network is secured and adequate accessibility and mobility provided. Since, increasing the supply of transport facilities involves substantial public expenditure, the efficiency of network management is also an important element of planning. In addition, traffic results in "externalities" such as air pollution from auto exhaust, noise and vibration, and traffic accidents. Thus, these adverse impacts on the urban environment should be considered in the preparation of transport plans.

Since the planning horizon of general plans is usually 20 years, the transport components considered are strategic ones that provide the basic structure of an urban area and guide its development. Transport planning details (e.g., intersection improvements, parking, traffic safety) become more important at the local level. Although these items are not fully covered in the manual, the transport planner should be aware of these aspects of transport planning in order to improve the overall efficiency of the transport system.

Suggestions for Further Studies to Improve the Transport Planning Manual

The transport planning manual is, by no means, complete. Further studies are required to improve the manual, particularly with regard to the following:

More Practical Methods and Guidelines. Due to time constraints, not all of the proposed methods and guidelines were examined thoroughly for practicality. A long term strategy to improve them through application to real planning situations is recommended. Including the results of these applications in future manuals will clarify the methods and procedures and make them more usable for local planners.

Accumulation of Data. The use of quantitative approaches in transport planning requires the accumulation of a database. Person trip surveys provide useful information for the analysis of travel behavior and permit comparisons among cities and countries, thereby providing the transport planner with insight in the preparation of transport systems plans; trip rates and mode choice behavior are the two main areas of concern. Trip generation rates by land use are helpful in analyzing vehicle travel demand in relation to population and car ownership. Q-V curves and "practical capacity" should be established based upon the unique road characteristics of Thai cities. Another suggestion is for the local authorities to collect the traffic volume at selected points on a regular basis (perhaps once a year) to monitor changes in traffic demand.

Road Density (Spacing) Standards. The road density approach is widely accepted in many countries for planning the street network in urban areas. For example, these standard densities have been worked out in Japan based on studies of the activity patterns of urban residents (e.g., average walking distance) and the spatial distribution of other types of urban facilities (e.g., parks). A similar study should be conducted to establish equivalent figures specific to Thai cities.

Exploration of the Potential of Grid Data. Detailed socioeconomic data by grid cell can be very helpful. Additional land use data such as type of land use and land price may also be tabulated and used in potential surface analysis. One way of using such data is in transport route selection and this is shown in the transport planning manual. Further study would bring useful insights to the road-network design process.

Additional Subjects. This manual covered all topics related to the preparation of general plans, concentrating on network planning as opposed to local area transport planning issues (e.g., street closure, intersection improvements, parking, and traffic safety measures). However, these topics are important concerns for local authorities and revisions of the transport planning manual should include these subjects.

4.6 Urban Facilities Planning

4.6.1 Proposed Improvements

Urban facilities planning covers some of the most essential aspects of a city: urban space, amenities, and utility services. Although urban facilities planning may be more important than land use planning, DTCP pays less attention to it. This tendency is explained by these factors:

- When city planning is initially introduced--and this is now the case for small- and medium-sized cities in Thailand--planners typically view land use control as the most important subject for the first plan, with emphasis on urban facilities planning to follow.
- Preparation and implementation of urban facilities plans are under the jurisdiction of other governmental agencies, which have the technical experience and budget for the planning and construction of urban facilities.
- In small towns and rural areas, urban facilities such as water and sewerage systems are not major concerns of local residents. Water is available everywhere from groundwater sources, creeks, or rivers, and sewerage is disposed in natural purification cycles.

Objectives of Urban Facilities Planning for the General Plan

It is predictable that the general plan will soon place more emphasis on urban facilities planning as increasing urbanization leads to an increasing demand for the upgrading of urban services. Major

objectives of the urban facilities planning component of a general plan are stated below.

- Examine the balance between demand and supply. A more reliable demand forecasting methodology should be developed since overestimation of demand results in investing too much and underestimation leads to inadequate facilities. Urban facility standards should be established by taking budgetary constraints and priorities into consideration.
- Establish a feedback system between land use planning and urban facilities planning. Urban facilities data is an important input in land use planning, and land use data is an important input in urban facilities planning. Therefore, a balanced solution must be sought with feedback between both systems.
- Redefine the scope of urban facilities planning in the general plan process and establish standard methods for urban facilities planning.

The urban facilities component of a general plan can range from a mere concept plan or master plan to a detailed design, depending on the level of progress on urban facility projects by implementing agencies.

Technical criteria or standards for examination of the urban facilities proposed by implementing agencies must be established. Urban facilities should be included in the formal city planning (general plan) process and administrative arrangements between DTCP and the implementing agencies must be worked out to facilitate coordination.

It is recognized that DTCP has confined its efforts to the field of city planning. The department has limited manpower and time available for the preparation of general plans. Accordingly, the technical improvements proposed in this study were made assuming the existing framework of planning activities at DTCP.

Urban Facilities Selected For Technical Improvements

Since DTCP emphasizes land use control and city planning, it focuses its efforts on the reservation or allocation of lands for urban facilities as opposed to the actual provision of services. Thus, parks are the most important urban facility for land use planners since open space demands large tracts of land and has a large impact on the quality of the urban environment.

As indicated, facilities are under the jurisdiction of other agencies that prepare and implement urban facility development plans and programs. Accordingly, DTCP's responsibility has been to coordinate urban facilities plans and programs to assure comprehensive planning. However, due either to a lack of technical staff or to budgetary constraints, local governments make special requests to DTCP for assistance in urban facilities planning (usually for drainage or sewerage facilities), regardless of whether the facilities are included in the general plan. As a consequence, the technical

improvements designed to help improve the current planning activities of DTCP are proposed in the areas of drainage/sewerage and parks/recreation.

DTCP's planning of drainage/sewerage and parks/recreation facilities have been on an ad hoc basis (at the request of local governments). Parks and recreation facilities are more likely to be considered in the process of land use planning, although it depends on the particular planners or engineers in charge.

It must be recognized that drainage/sewerage design, by its very nature, consumes a great amount of time and human resources, and therefore imposes a big burden on DTCP. Thus, the introduction of efficient design methods would be very helpful.

It must also be recognized that parks and recreation issues have been addressed in the land use planning process without the use of objective, analytical planning methods. Improved technical methods, such as potential surface analysis, can be helpful for rationalizing parks/recreation planning.
In light of the foregoing, the technical improvements proposed in the urban facilities planning manual have been formulated to standardize the planning of urban facilities centering on drainage/sewerage and parks/recreation areas.

Proposed Improvements

(1) Standardization of Urban Facilities Planning

Drainage/Sewerage. An orthodox planning procedure--including data collection, problem identification, and demand forecasting--is presented in the urban facilities planning manual.

Parks/Recreation Areas. Since there are currently no planning principles established for these facilities, a system of classifications and standards for parks development are presented.

Other Facilities. For DTCP's reference, general procedures and guidelines for the planning of other urban facilities such as water supply, electric power, and telecommunications systems are provided in the manual.

(2) Special Technical Methods

Drainage/Sewerage. A computer-assisted, sewer design method, which will considerably reduce manpower and resources, is presented.

Parks/Recreation areas. The PSA technique is proposed for use in the formulation of the optimum parks/recreation development plan.

4.6.2 Summary of Case Studies

As shown in Table 4-3, case studies were conducted to assess the feasibility of the proposed technical improvements.

Table 4-3 URBAN FACILITIES PLANNING CASE STUDIES

	Drainage/Sewerage	Parks/Recreation
Case Study I	Orthodox (general) planning procedure	System of classifications and standards
Case Study II	Computer-assisted design method	Potential surface analysis (PSA)

DRAINAGE/SEWERAGE

Case Study I (Orthodox Planning Process)

As described before, the Engineering Division of DTCP has already executed several technical studies for preparation of the drainage/sewerage component of general plans, usually at the request of local governments. Case Study I was conducted through application of an orthodox planning method with an attempt made to streamline the technical studies necessary for drainage/sewerage planning. The method is described in the urban facilities planning manual; analysis of present conditions, identification of problems, demand forecasting, goals/objectives, and systems proposals for drainage/sewerage are all considered.

The case study found that the establishment of clear technical procedures for planning urban facilities will raise the quality of planning. In addition, if planning activities are systematized, it was found that increased efficiency will result.

Case Study II (Computer-Assisted Design Method)

A computer-assisted design method was examined in Case Study II. Through the modification of software already in DTCP's possession, a sewer design program to calculate the optimal size and inclination of pipes, conduits, and their sections has been developed.

The principal findings of Case Study II can be summarized as follows:

- The sewer design is technically sound and proved to be appropriate especially in terms of accuracy in calculation.
- The program contributes to improved quality in the design process.
- As expected, the efficiency of design work was substantially increased compared to the manual calculation approach formerly used.

PARKS/RECREATION AREA

Case Study I (Classifications and Standards)

Principles for planning urban facilities have not been established by DTCP. Case Study I applied a general planning procedure for park facilities with the objective of establishing standardized planning principles in this field. All existing and planned parks were classified based on their function or character. The classified parks were standardized in terms of park area, service area, and number of persons served. In reality, DTCP has no planning standard; however, 1.8 rai/1,000 persons is considered as a goal for park development. Also, standards established by other agencies (e.g., BMA, NHA) are sometimes employed.

In the course of the case study, a propqosed system of park classifications and standards was developed taking into consideration standards established by BMA and NHA, as well as by developed countries. A plan for an integrated open space network consisting of playgrounds, neighborhood parks, district parks, city parks, and regional parks was mapped out through the application of the proposed system.

The most significant findings made in Case Study II were the following:

- The necessity of establishing standard planning procedures and principles was confirmed.
- It turned out that implementation of a park classification system is valuable in rationalizing open space planning.
- However, the appropriateness of the proposed system of park classifications and standards should be examined further. In particular, park demand and the financial capability of the Government should be considered.

In conclusion, this case study benefited DTCP by highlighting the urgent need to establish guidelines and standards for urban facilities. The material provided by the case study will be useful in future efforts in this area.

Case Study II (Potential Surface Analysis - PSA)

The practical application of PSA in city planning has been a major objective of DTCP. More general planning principles having been examined in Case Study I, analytical methods for measuring the development potential of parks were pursued in Case Study II through the application of PSA, with the goal to rationalize open space planning. The major factors considered in the analysis were population density, vacant urban area, existing parks, waterfront area, and road accessibility. PSA assigns a weighted value to each factor, based on questionnaire surveys distributed to the planners concerned.

The major findings of Case Study II are enumerated below:

- Generally, only obvious conclusions were reached from the potential surface analysis. For instance, it was concluded that locations near areas of high population density had high potential. Also, it was concluded that parks should be provided to accommodate the increasing population.
- However, PSA can still be of value since it provides quantitative information that helps planners objectively locate urban facilities.
- In addition, it may be possible to use PSA for research studies designed to provide planners with useful data for the preparation of general plans. For example, quantitative data pertaining to urban growth mechanisms and the distribution of land use and urban facilities can be provided.

4.6.3 Development of the Urban Facilities Planning Manual

It has been noted that DTCP is less experienced in urban facilities planning than the agencies responsible for urban facilities development. However, DTCP has an important role to play in urban facilities planning by coordinating and integrating these facilities into comprehensive planning. Urban facilities planning should be consistent with land use planning, avoiding locational discrepancies between the demand and supply of urban services. The sewer pipe network must share land with the road network. The location of treatment plants and sanitary landfill sites must take into account not only technical and engineering considerations but also the importance of maintaining harmony with existing land uses in the vicinity. These are only a few examples of cases that require coordination.

With emphasis placed on such coordination, the urban facilities planning manual was produced and examined during Case Studies I and II. However, this manual is still experimental in nature and should be revised to reflect Thai city planning practices. It is important to bear in mind that DTCP has not had much experience in urban facilities planning.

The urban facilities manual consists of two main parts:

Part I: Procedures and Guidelines presents standards and guidelines for use in data collection, problem identification, demand forecasting, specification of goals/objectives, and making recommendations and formulating plans.

Part II: Technical Reference includes important technical information that should be referred to whenever required.

5

NEW IMPLEMENTATION TECHNIQUES

5. NEW IMPLEMENTATION TECHNIQUES

5.1 Land Readjustment (L/R) Techniques

5.1.1 Introduction

The purpose of the Land Readjustment Project was to introduce land readjustment techniques to enhance urban development planning in Thailand. It is not uncommon for the adoption of a new system in a society to take at least a few years. The principal concern of this element of the study was to assist DTCP in its beginning efforts in implementing the land readjustment process.

First and foremost, it is essential that the staff of DTCP fully understand the land readjustment system that it is going to employ. Once DTCP has through theoretical and practical knowledge of the system, it can be adapted for use under the particular conditions that exist in Thailand. Thus, the JICA Study Team concentrated on providing both theoretical and practical knowledge of land readjustment techniques, which can give DTCP a good start toward the implementation of this system in Thailand.

This "technology transfer" was carried out by providing DTCP staff with a general introduction to the process of land readjustment, and by focusing on the details of the system of land readjustment practiced in Japan. In addition, an exploratory survey was conducted to seek possible ways to implement the land readjustment process in Thailand. All these activities were executed by DTCP with the assistance of the JICA Study Team. This section summarizes those activities.

5.1.2 Orientation

(1) Study Methods for Learning "Japanese Land Readjustment"

Throughout the study period, "Japanese Land Readjustment" was introduced and explained in various ways:

Technical Materials. At first, DTCP personnel studied available technical materials such as Introduction To Land Readjustment, a specially-prepared JICA textbook.

Seminars. Japanese L/R techniques were presented to DTCP at a seminar held jointly by the JICA Study Team and DTCP. This presentation explained the basic concepts of L/R to key DTCP officials.

Based on this preparatory work, DTCP then examined detailed information on L/R. For example, DTCP staff studied the Japanese Land Readjustment Law and listened to presentations on the law provided by the JICA Study Team. Also, DTCP staff studied land readjustment techniques in detail with technical manuals prepared by the JICA Study Team.

(2) Introduction to Japanese Land Readjustment

Land Readjustment Law

The L/R implementing procedure in Japan is based on the Japanese land readjustment law, which reflects Japan's unique socioeconomic and political conditions.

The L/R law in Japan regulates the technical and legal procedure of implementation of L/R projects.

- The law defines that L/R projects are of a public character, stating that the purpose is to promote the public welfare through improving living environments in urban areas.
- Generally, the Japanese constitution requires the public interest to take precedence over private rights. Accordingly, the implementation of L/R is supported by a legal enforcement mechanism that gives priority to the public interest, so long as adverse impacts on landowners are kept within a socially acceptable limit. Further, the public interest justifies government financial assistance to the project.
- In line with the public character of L/R, the law provides a legal basis for implementation of the project.
- The strict regulations governing both the organizational (e.g., management) and implementation aspects (e.g., financial and technical rules) of L/R set forth an administrative procedure through which the approval of government and individual participants are sought in order to secure the public interest and to protect individual rights.

The land readjustment procedure established in Japan is illustrated in Figure 5-1, with emphasis on the administrative procedure followed in the planning and design process. This administrative procedure includes two steps. First, the implementing organization is "legitimated" when the government approves the "action plan and implementation ordinance," which states the project's basic features. Replotting, a major concern of individual landowners, is then approved by the government (or association) during the course of project implementation.

Technical Procedure

A development plan, an action plan, a replotting design, and replotting plan must be prepared in the implementation of an L/R project. The items that each plan and design must contain are shown in Figure 5-1.

Standards and Guidelines

In order to formulate the plans required by Japan's L/R law, various standards and guidelines must be established:

- standards and guidelines for determining datum acreage;
- standards and guidelines for replotting design;
- standards and guidelines for land valuation;

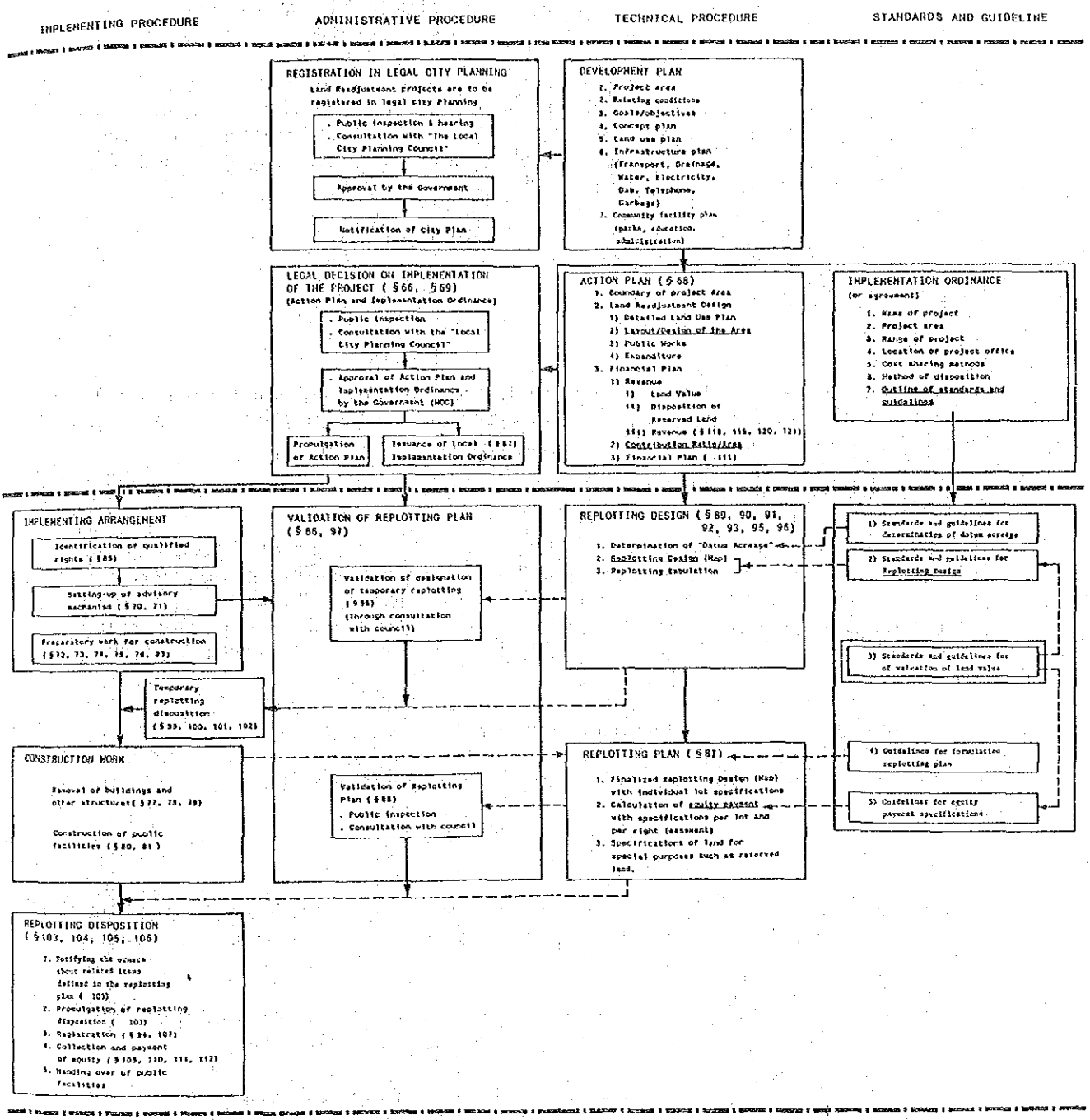


Fig. 5-1 THE LAND READJUSTMENT PROCEDURE STIPULATED BY THE JAPANESE L/R LAW

- guidelines for formulation of the replotting plan; and
- guidelines for equity payment specifications.

The technical manual for land readjustment presented by the JICA Study Team describes how to prepare development and action plans, as well as how to conduct replotting design. Standards and guidelines for land valuation, calculating "Street Value" and "Lot Land Value," and for replotting design are provided.

5.1.3 Land Readjustment "Application Exercise"

(1) Outline of the Exercise

Materials

The Laem Chabang New Town Development project was selected to provide materials for the exercise, having taken into consideration such factors as convenience in terms of database preparation.

Action Plan Preparation

The preparation of the action plan covered such study items as 1) setting up the boundary of the project area; 2) analysis of existing conditions; 3) land readjustment design; and 4) formulation of a financial plan. A decision was made to base the exercise on the first draft of the Laem Chabang specific plan prepared by DTCP. The dominant proposed land use for the project area is row house residential. The area devoted to public facilities, the cost of constructing public facilities and utilities, and unit land price before and after the project were all estimated to calculate the area of reserve land, and derivatively, the "contribution area" and "contribution ratio."

Replotting

Replotting consists of land valuation and replotting design. The technical procedure for these complicated tasks is shown in Figure 5-2.

Replotting was conducted following the technical procedures and manuals presented by the JICA Study Team. These included:

- texts for land valuation with examples of land valuation standards;
- guidelines for calculating street value and lot land value; and
- texts for replotting design with examples of standards and guidelines for replotting design.

A few observations regarding the replotting are in order:

- The replotting was designed on the basis of the action plan that was prepared.

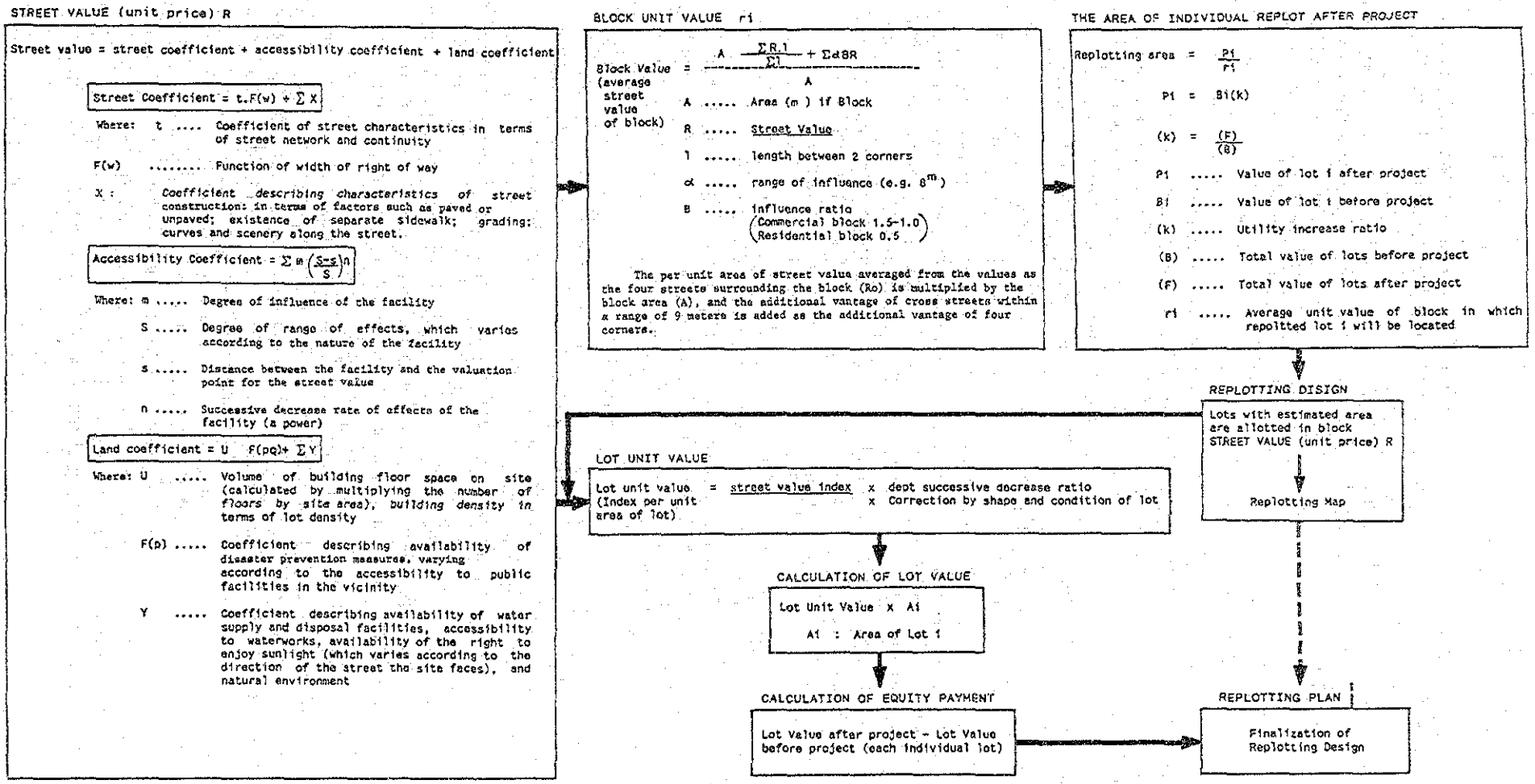


Fig. 5-2 LAND VALUATION FOR REPLOTTING

- The replotting was not necessarily consistent with the proposed land use (row house area) of the specific plan (lots were replotted one by one).
- The land information that was used was drawn from tax maps of the municipality and a cadastrial map that did not cover all of the project site.

Land Valuation

Among land valuation methods, the street value method was selected because it is logical and relatively easy to understand. At the outset, the data necessary for land valuation were prepared, including data on land use, urban facilities, and utilities. Then, street value indices were calculated using a calculation formula presented in the manuals. Finally, the land values of the lots themselves were calculated using the street values calculated in the previous step.

Replotting Design

Small areas containing 10 parcels of land were selected for the replotting design exercise. The major activities involved were 1) calculation of the replotting area; 2) placing the areas into the block designed in the action plan; and 3) calculation of equity. These activities were repeated to obtain a balanced replotting.

(2) Findings

Technical Difficulties of Preparing an Action Plan

The DTCP working group experienced some technical difficulties in preparing the action plan. A few of these difficulties are detailed below:

- Base maps and title deeds prepared by different agencies are inaccurate, sometimes by 20%. This inaccuracy resulted in difficulty in replotting design. A lack of information regarding property rights further complicated this task.
- Because the project area is mainly in a rural area, much required information was unavailable, which made it difficult to evaluate existing conditions.
- Because land speculation has been taking place in and around the project area, the unit land value was unpredictable, which created difficulties in the objective estimation of land value.

As with any kind of development planning in a developing country, the lack of a database (including, e.g., cadastrial maps and land title information) presents a major obstacle. However, such difficulties only underline the importance of the land readjustment project.

Underlying Aspects for Realization of the Project

The L/R study concluded that in return for a contribution of 20.9% of all land, land values would increase 125% (2,000 baht/wa to 4,500 baht/wa). Concurrently, property values would increase by 78%. Judging

from prior experience with land readjustment in Japan, Korea, Taiwan, and Indonesia, these estimates seem reasonable.

However, there are two important underlying issues that need to be addressed:

- *Acceptability of a 20% Contribution*. It is difficult to say with certainty what contribution ratio in land readjustment will be acceptable to landowners. Acceptability depends on the economic or development potential of the project site, the level of infrastructure services preferred, other development options, development purpose, lot size, and many other factors.

  The contribution ratio in a typical private subdivision development can be calculated to provide a reasonable reference for justifying a contribution ratio in land redevelopment planning. In such cases the contribution ratio is often as high as 50 percent. Thus, a ratio of 20 percent may well be considered acceptable by private landowners.

- *Land Value*. Another key issue is land value, which is critical in evaluation of the financial feasibility of land readjustment. As was previously mentioned, speculators have driven up land prices in the study area. Land prices after the current project will be as high as 1,800,000 baht/rai.

  The government will enforce specific plans with the socially justifiable purpose of providing affordable housing. However, the gap between the market price of land and workers' ability to pay has widened. Thus, if the government allows high land prices, the government's planning goals may be unattainable. However, if land prices are held down by government controls, land readjustment will not be as financially feasible.

Replotting and Land Use

Replotting, one of the important prerequisites of land readjustment, in principle involves the preservation of existing land rights in an improved environment. The implementation of a land use plan entails changes in existing land rights. In order to use the land readjustment process in the implementation of the specific plan for the Laem Chabang new town development, additional measures must be employed. Taking the above into account, the working group identified possible applications of land readjustment to the implementation of the specific plan for the new town. These included:

- collective replotting into blocks for land consolidation for row house construction (joint-venture project of landowners);
- replotting onto the row houses constructed (the land rights to be transferred to particular floors);
- construction of row houses in the block (with the approval of the landowners) through land readjustment, with the funds earned through sale of the houses to be delivered to the landowners as an equity payment for their land; and

- "ordinary replotting," as discussed below.

The Land Readjustment Project

An apartment house (or row house) district can be designated on the project site (see Figure 5-3). The lots of landowners who would like to develop apartments either individually if their land is large enough for constructing apartments, or jointly with others if their lands are small, can be transferred and replotted into the apartment house district. Similarly, the lots of those landowners who would like to continue farming can be replotted into a farmland district.

Ordinary Replotting

In recognition of high land prices and difficulties in enforcement, the land use plan must reflect reality. Private developments (either by landowners themselves or by private developers) should be accommodated to reach the highest and best use of the land. Thus, the land use plan component of a specific plan may be revised to facilitate various types of urban activities. In principle, then, ordinary replotting should be carried out based on existing land rights.

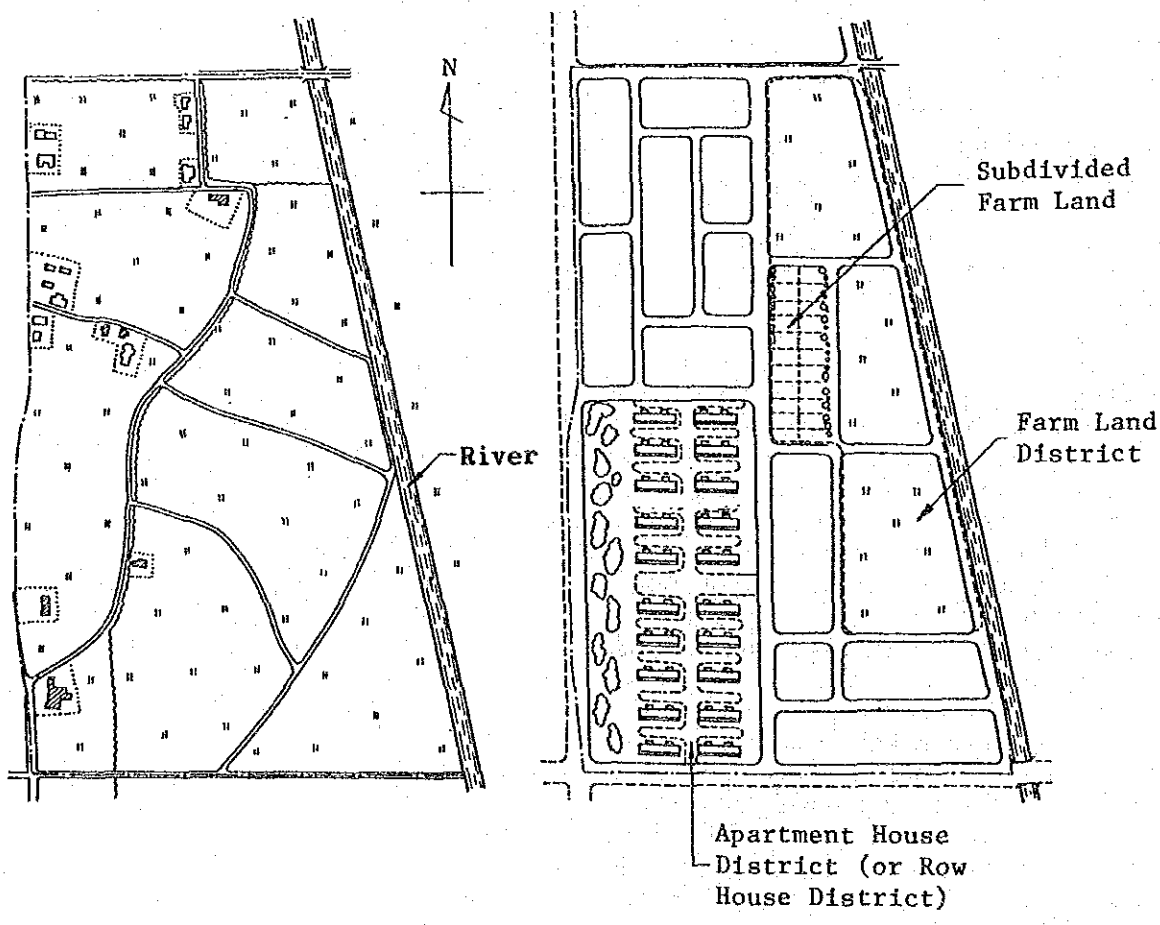


Fig. 5-3 THE LAND READJUSTMENT PROJECT

5.1.4 Preliminary Assessment of the Applicability of Land Readjustment

(1) Possible Applications

While the JICA Study Team provided their DTCP counterparts with detailed training in the land readjustment process, the working group carried out exploratory surveys seeking possible applications of the system in Thailand. It was discovered that in Thailand there is great interest in the L/R system, and in fact studies aimed at employment of the system have been conducted by several agencies.

Therefore, the working group first examined all materials and documents related to ongoing research into land readjustment. Second, they conducted extensive interviews with various concerned organizations such as the Asian Institute of Technology (Professor Ray W. ARCHER), Chulalongkorn University (Professor Manop BONGSADADT and Dr. Kiat CHIVAKUL), the National Institute of Development Administration (Director Phaibul CHANGRIEN and Pro. Grit PERMTANJIT), ESCAP (Mr. Mituhiko HOSAKA), National Housing Authority (Mr. Pree BURANASIRI, Mr. Chawalit RODRUNGRUANG, and JICA expert Mr. OTOMARU), NESDB (Dr. Utis KAOTHIEN), the Office for Urban Development under DOLA (Mr. Prasit GAJAKOTARA, Mr. Harold B. SEMTER), and the Bangkok Metropolitan Administration (JICA expert Mr. MATSUNAGA).

Through the exploratory surveys stated above, possible cases for application arose in which one or more L/R techniques appeared to be useful for overcoming implementation problems that the Thai government had been facing.

Conditions Favoring the Use of Land Readjustment

Conditions favoring the use of the land readjustment process in Thailand are presented below.

Substitute for Expropriation

At present, development projects in Thailand (including infrastructure improvement projects) are implemented solely through outright purchase or expropriation of land by the government. However, such public acquisition of land has virtually stopped for several reasons:

- Alleged Unfairness to Some Landowners

  Landowners who happen to own land near but not in the project area do not have their land taken, and they can enjoy significant benefits from the project at no cost. However, those whose lands are expropriated are only compensated with payments made by the government.

- Great Financial Burden Imposed by Land Value Appreciation

  Recently land prices have been increasing very rapidly in Thailand, and consequently the government has cut back on land

expropriation. As a result, project implementation has suffered.

- Opposition to Eviction

  Outright purchase or expropriation both necessitate eviction of people out of the project area. Not all people and landowners accept eviction and that hinders the smooth implementation of development projects. With land readjustment no one can be evicted against his will, and benefits accrued and cost incurred are distributed evenly among all landowners. Thus, land readjustment could be a viable substitute for the outright purchase or expropriation of land..

Social Consent for Projects

The outright purchase of land requires that the government persuade all landowners to sell, a rather lengthy process. However, land readjustment can provide a basis for social dialogue leading to a social consensus for a project.

Cost-Sharing

With land price appreciation contributing to the government's problems, more appropriate cost-sharing among local authorities, state enterprises, and the private sector was set as a policy goal of the urban and specific area development programs of the Sixth Plan. Land readjustment supports this policy since project costs are shared by landowners and private developers.

Integration

In order to improve the urban environment, a variety of development thrusts including road, flood control, sewerage, park, and housing projects have been planned and implemented. However these projects are usually carried out independently, resulting in increasing problems in implementation, especially in densely populated areas. To reduce these problems, integrated urban area development schemes combining projects from various sectors can be helpful.

Active Land Market

In response to Thailand's recent rapid economic growth, the country's housing and land markets have been active. In such a market environment, the implementation of innovative urban development measures such as land readjustment is more attractive.

Need to Improve Living Conditions

Thai planners are now emphasizing the qualitative aspects of urban development. In the past, the priority in urban development was put on providing sites to meet the great demand, but recently a higher priority has been placed on improving the quality of the living environment. The land readjustment process could contribute

substantially to this effort since it entails integrated development combining both site development and infrastructure improvements.

Possible Applications

Some cases suitable for the application of the land readjustment method in Thailand were identified, as shown in Figure 5-4. These cases utilized at least one Japanese land readjustment technique (see Figure 5-5).

Utilization of the L/R System for "Fair Land Acquisition"

All landowners who will benefit from the construction of a road project are required to sell some portion of their land to the government. Transferring portions of lots via the land readjustment process makes this possible, resulting in "fair land acquisition."

Utilization of the L/R system for "Enhancement of Donation"

"Donation" is an aspect of Thai infrastructure development. Even landowners who own land outside the project area (the right of way) can donate their land to the government through the technique of transferring lot portions via land readjustment.

Utilization of the L/R System for the "Consolidation of Government Land"

The government can buy land in advance in the vicinity of planned roads and consolidate these land parcels into one right of way for the road through the technique of land readjustment by transferring the location of existing lots.

Construction of an Access Road

Utilization of the L/R System for "Opening Up Pocket Land"

For access road construction, landowners evenly share costs and the land for the access road to open up "pocket land."

Real Estate Development

Utilization of the L/R System for the Consolidation of a Development Area

"Islands" of development area can be consolidated into one integrated development area through land readjustment. This approach is very useful when developers cannot purchase continuous land. Piecemeal development is avoided, thereby increasing the economic efficiency of capital investment.

Utilization of the L/R System for Accommodation of Existing Rights - Avoiding Eviction

Those who would prefer not to sell their land for a land development project, but who instead would like to stay in the project area, can

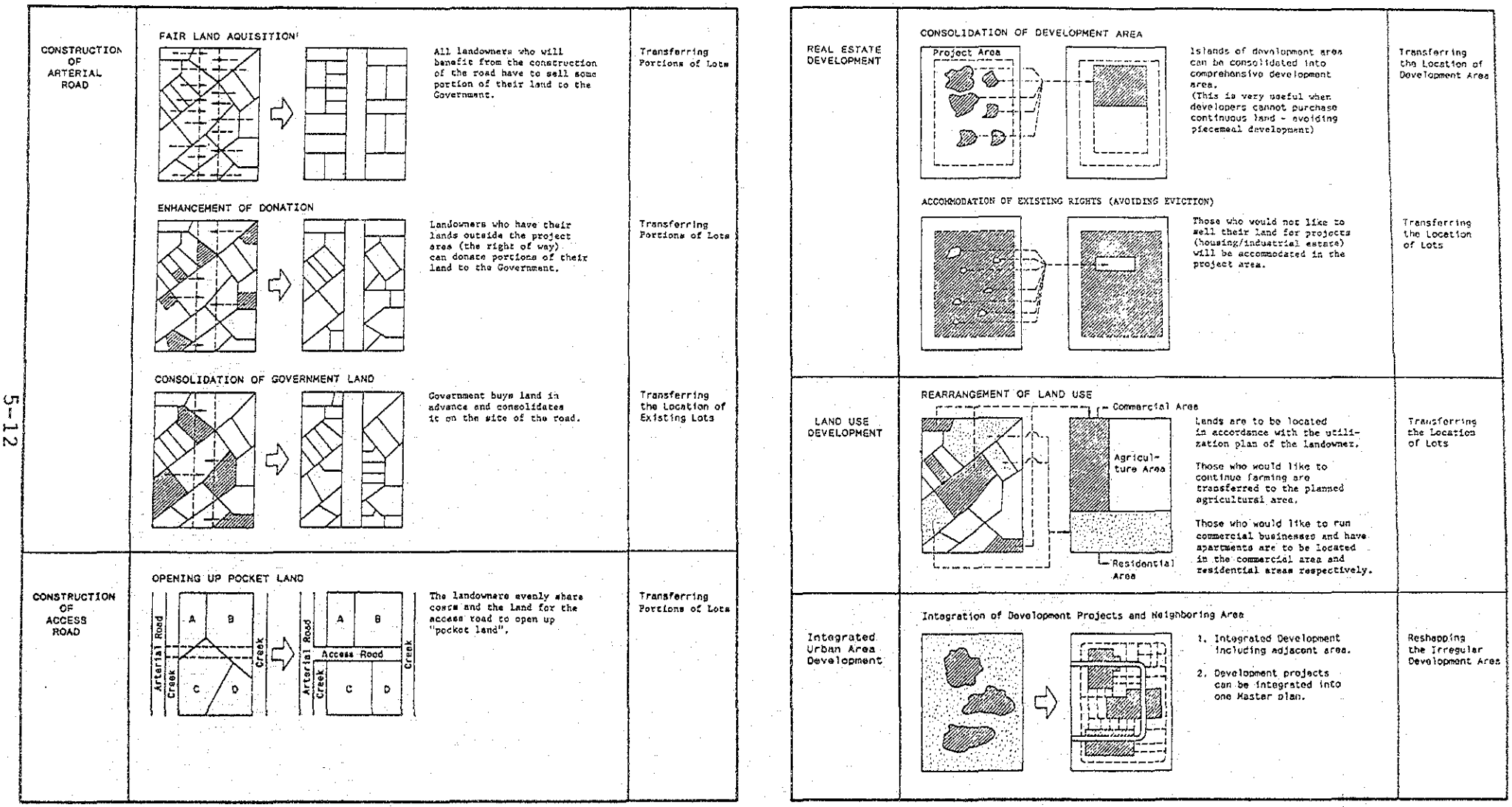


Fig. 5-4 POSSIBLE CASES FOR APPLICATION OF LAND READJUSTMENT TECHNIQUES

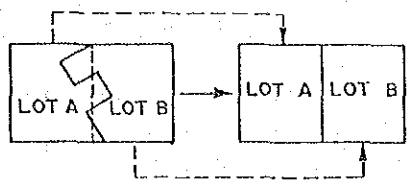
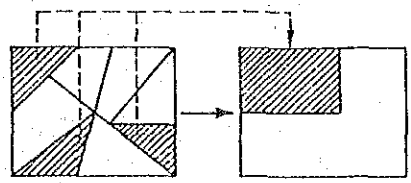
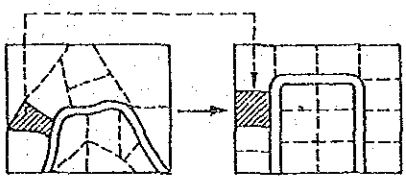
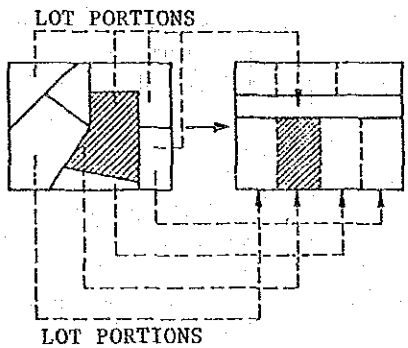
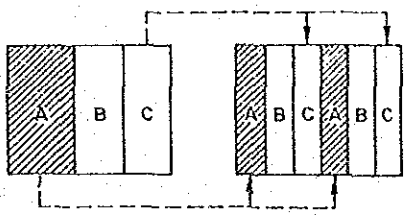
Rearrange the Existing Entitled Land		
Reshaping an irregular lot		Lots can be utilized more efficiently
Transferring the location of existing lots		Consolidating lots into one larger lot
		The location of existing lots are changed, accommodating the lots in a newly designed area.
Transferring portions of lots		Some portion of each lot is consolidated into one lot.
		One lot is divided *and transferred* to 2 locations.

Fig. 5-5 COMPONENTS OF LAND READJUSTMENT TECHNIQUES

be accommodated on the project site through the land readjustment process.

Land Use Development

Utilization of the L/R system for "Rearrangement of Land Use"

Through the land readjustment method, lands are located (or replotted) in accordance with the preferences of the landowners. Those who would like to continue farming are transferred to the planned agricultural area. Those who would like to run commercial businesses and have apartments are located in the commercial and residential areas respectively.

Integrated Urban Area Development

The L/R system can also be used to integrate development projects and the neighboring area. Integrated development including the area adjacent to the project site is possible through land readjustment. All development projects can be integrated into one master plan.

Additional cases for possible application of land readjustment in Thailand were suggested by JICA expert, Mr. MATSUNAGA (BMA). These include:

Road Improvement

Type 1 - Creating necessary space for trunk roads through roadside land readjustment.
Type 2 - Reorganizing the network of neighborhood roads (soi).

Other Infrastructure Improvement

Type 3 - Construction of flood control structures.
Type 4 - Upgrading the living conditions around a specific facility.
Type 5 - Preventing sprawl in suburban areas.
Type 6 - Slum improvement.

Housing

Type 7 - New town projects implemented by public authorities.
Type 8 - Coordinating private sector subdivision projects (consolidating lands for development).

Creation of New Space

Type 9 - New estates for industry and distribution centers.
Type 10 - Urban renewal, especially for opening up "pocket land" in built-up areas.
Type 11 - New town development (e.g., science cities).

(2) Exploration of Institutional Alternatives for Implementing Land Readjustment

In the exploratory surveys described above, institutional alternatives for implementing land readjustment in Thailand were identified. The options that appear worth considering are discussed below.

- *Establishing a New Thai Land Readjustment Law*

  The main purpose of a new Thai land readjustment law would be to legitimate the Land Readjustment Project as one pursuing the public interest and which would have the legal powers necessary for enforcement.

- *Amending the Thai Planning Act (1975)*

  Articles stipulating implementation of land readjustment have yet to be included in the Thai Planning Act. Such an amendment is recommended.

- *Legalization of Land Readjustment in General Plans Under the Thai Planning Act (1975)*

  Item (5) of Section 17 in Chapter 3 ("Preparation and Making of a General Plan") authorizes "policies, measures, and methods for the implementation of general plans." The land readjustment process, an implementation method, may be authorized under the Ministerial Regulation governing the enforcement of general plans.

- *Legalization under the Thai Planning Act - Specific Plan*

  Item (1)(J) of Section 28 in Chapter 5 ("Preparation and Making of a Specific Plan") provides authority for "other matters, as may be necessary, in accordance with the objectives of the specific plan." This language may be taken to permit land readjustment as one of the "other matters" consistent with the objectives of a specific plan.

- *Land Readjustment Through Other Existing Laws*

  It may also be possible to implement land readjustment through other existing laws, such as the Agricultural Land Reform Act of 1975 or the Land Development Act (B.E. 2528). Note that the Japanese Readjustment Law was derived from the Arable Land Readjustment Law. Before the enactment of the Japanese Land Readjustment Law, the City Planning Law authorized land readjustment to increase the utility of lots within legal city planning areas. The City Planning Law made reference to the land readjustment process provided for in the Arable Land Readjustment Law.

- *Negotiation Project within the Framework of the Existing Law*

  Khun Pree BURANASIRI, a Chief Architect at the National Housing Authority, has advised DTCP that although no law of has yet been enacted, the land readjustment process could be implemented by negotiation with landowners. The benefits of land readjustment could be stressed. The danger of waiting for state development, which in turn means expropriation, could also be emphasized.

  Similarly, Professor Ray W. ARCHER has stated that "a project could be based on the voluntary agreement and cooperation of a group of adjoining landowners who can see mutual benefit in joining together in a cooperative project. There are many pockets of near-urban vacant land in Bangkok that could provide a successful demonstration project. For example, when a group of adjoining landholdings are blocked from access to a public road by a canal, then a pooling land readjustment project could be undertaken to construct a bridge over the canal and to subdivide the land with the cost of the bridge being spread across all the landholdings benefiting."

- *Donation Project*

  According to Mr. BURANASIRI, cooperative development has been pursued for many years in Thailand in the form of the donation of lands for the construction of roads, schools, hospitals, bus terminals, temples, and other facilities. If a pilot or demonstration land readjustment project is to be implemented, such a project could benefit from Thailand's donation system.

Scenarios for Implementation

Two principal scenarios for the implementation of land readjustment in Thai society were identified and are considered below. These are summarized in Figure 5-6.

Pilot or Demonstration Project Approach

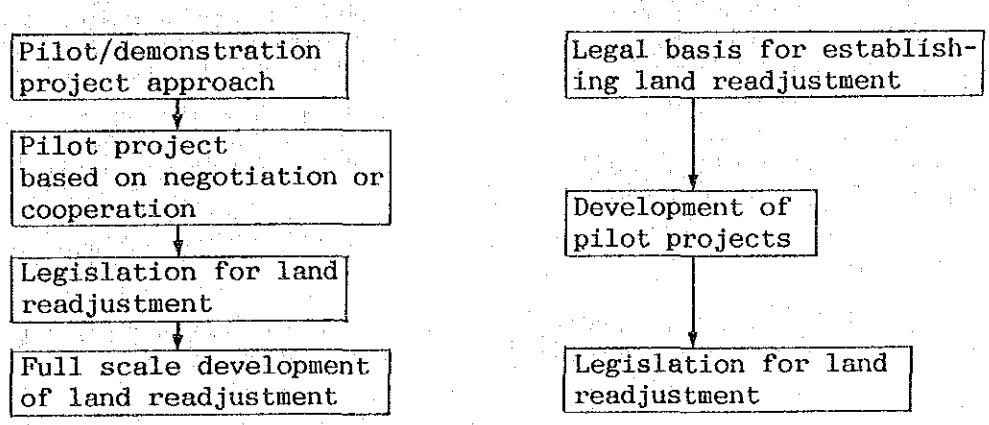
Even without a direct legal basis, a pilot or demonstration land readjustment project could be implemented on the basis of negotiation or cooperation as stated in the preceding section. If such a project proved successful, as it likely would, then the enactment of enabling legislation could be expected.

Starting with a Legal Basis for Land Readjustment

An alternative scenario involves first seeking a legal basis for land readjustment. This scenario is preferred to the pilot or demonstration project approach. Without a solid basis in law, a pilot project cannot be expected to demonstrate economic and social benefits to landowners and others.

Consider that in Japan land readjustment was not instituted until enactment of the arable land readjustment law. Building upon this *initial foundation, the land readjustment process was widely* implemented, ultimately leading to enactment of the the Japanese Land Readjustment Law. In Thailand, it seems worthwhile to try to find a legal basis for implementing land readjustment in specific planning or in the implementation of the agricultural land reform law (or similar laws).

Fig. 5-6 IMPLEMENTATION SCENARIOS



5.2 District Planning Techniques

5.2.1 Introduction

The purpose of this phase of the study was to enhance DTCP's capability to conduct district planning. District planning is understood in two ways. One is simply as a formulation of the district development or district improvement plan, while the second involves a detailed regulatory program to realize such a development or improvement plan. Thailand has had considerable experience with such plans, including an industrial estate plan prepared by IEAT, a housing estate plan prepared by NHA and private subdivision developers, and land-sharing projects planned by NHA. All of these development plans were mapped out on vacant land after either land expropriation or purchase, or after clearance of existing buildings and structures. These plans are then implemented with capital investment made by the implementing agency. Regarding regulatory programs, Thailand has had little experience in leading development and building activities with such control measures.

Thus, this part of the study focused on detailed regulatory plans, with a variety of control measures considered. However, a district development plan must first be prepared since control measures are adapted for realization of the district control plan. Therefore, the techniques discussed in this section cover district development plans as well as detailed district control plans.

5.2.2 General Aspects of District Planning Techniques

The regulatory controls underlying a district plan tend to be stricter than those underlying a general plan because district plans directly affect people's lives. For instance, rules on location and the shape and structure of buildings and properties are enforced. Accordingly, district plans are more likely to encounter objections and complaints from the people affected.

Building Agreements

District planning was derived from neighborhood building agreements that require neighborhood residents to observe rules and regulations imposed by themselves. Such voluntary self-restraint receives the support of the community since it improves the local environment, eventually leading to higher property values. As a result, many neighborhood residents actually prefer strict rules. Building agreements are often extended and developed into a control plan enforced by government authorities.

Special Development/Conservation Areas

District planning is also applied in special areas of national importance or of importance for development or conservation.

When rules and regulations governing development are enforced to implement national policies, the rationale is that the public interest should take precedence over private rights. However, development controls instituted in pursuit of national policies may restrict the property rights of individuals only within socially acceptable levels. Moreover, any adverse impact on individuals must be compensated for by the benefits from enforcement or by other means such as tax reductions or government subsidies.

The specific plans for Laem Chabang and Chiang Mai that DTCP is currently preparing fall under the category of special national interests. In particular, the Laem Chabang specific plan will provide housing for those working on industrial estates and the deep sea port, the latter of which is a national economic development project. The specific plan for Chiang Mai will contribute to preservation of the historic parts of that city, thereby enhancing the heritage of all Thais.

Measures to Implement or Supplement General Plans

In most countries, city planning consists of a pair of plans, one a master plan or general plan and the other a district plans. In such city planning systems, district plans are measures to supplement or implement the general plan, or both. In Japan, for instance, district plans supplement the so-called basic urban plans (similar to general plans in Thailand) by providing measures tailored to the unique requirements of the district composing the general plan.

While a general plan emphasizes the rationalization of city planning for the city as a whole from a broad point of view, a district plan typically aims at environmental improvements in geographically-limited areas from the viewpoint of the district. However, district plans are sometimes viewed as programs to implement the general plan.

In Thailand, district plans are absolutely essential for the implementation of general plans. The Thai Town Planning Act (1975) can only be implemented when specific plans have been enforced. If there is no specific plan, the law is essentially unenforceable.

5.2.3 District Planning "Application Exercises"

Applications of District Planning

(1) Voluntary Agreements for Maintaining and Improving the Neighborhood Environment

Voluntary neighborhood agreements often can be formalized into district control plans by the government. This approach is promising in high quality residential areas and resorts.

In high quality residential areas, almost all residents have a strong interest in maintaining their environment, and therefore neighborhood agreements to enforce rules and regulations to preserve the environment can easily be reached. This approach has been used in various subdivision developments in the Bangkok area. In a recently-developed subdivision, the buyers willingly signed contracts that stipulated very strict conditions for creating and maintaining a high quality environment. For instance, the buyers are not permitted to design their houses themselves. The developer has stressed homogeneity, uniformity, and harmony to create a unique community. All lots were sold immediately, indicating a strong demand for this approach.

Resort area residents, including hotel owners and developers, share a common interest in attracting more tourists. In pursuit of that objective, resort area residents are likely to cooperate in implementing programs for beautification and landscaping. Such programs can be embodied into an agreement resulting in a detailed control plan recognized by the government.

(2) Specific Areas To Be Developed or Conserved in Line with National Policy

Planning area residents may accept control plans based on an understanding of the national interest or the public interest of the region. As stated previously, the Laem Chabang new community development and the Chiang Mai historic preservation plan are in this category.

(3) General Application in Relation to a General Plan

Usually land use regulation is implemented through a city-wide (general) plan and building code. The city-wide plan (including

zoning) regulates land use at the scale of the entire city, while the building code regulates individual lots and structures. Unfortunately, with this regulatory scheme it has been difficult to achieve desirable environmental conditions at the district level. Thus, detailed district control plans are recommended. In such control plans, in addition to the control measures available in the existing general plan and building code, strict detailed measures to be applied on the agreement of planning area residents are included.

It should be noted that since general plans and building codes in Thailand are not combined, specific plans are sometimes saddled with the task of regulating land use and buildings to implement the general plan. Therefore, it is advisable that the general plan and building code be reviewed and modified to provide a comprehensive regulatory system for land use and buildings. District planning (or specific planning) could then be redefined in order to make it more effective.

The issues and study sites for the district planning application exercises are summarized in Table 5-1. Study areas were selected where there seemed a good possibility for the application of district planning.

Table 5-1 DISTRICT PLANNING APPLICATION EXERCISES

Subject	Issue	Study Area
Exercise I	District planning in a historic area	Old Chiang Mai
Exercise II	District planning in a resort	Jomtien, Pattaya

SUMMARY OF EXERCISE I (OLD CHIANG MAI)

Thailand has many scattered historic and cultural resources, including temples, pagodas, and other religious monuments. These sites attract a great number of tourists.

The preservation of Thailand's historic resources is of significant interest, both because of the country's high degree of respect for history and religion and because of the importance of tourism. Because of this national interest, it is probable that district planning rules and regulations to preserve historic resources would be supported by a majority of the people. Moreover, planning area residents and others concerned may be persuaded to accept district planning oriented toward historic preservation. The old section of Chiang Mai is clearly an important historic area in Thailand, and it is in serious need of conservation. It is likely that the technical

findings of the Chiang Mai study could be applied to other historic places in Thailand as a prototypical conservation method.

For Chiang Mai, a district conservation plan was first prepared. Then, it was translated into a detailed control plan.

District Preservation Plan

The technical procedure for plan preparation included 1) data collection and analysis of existing conditions; 2) setting of development goals and objectives; and 3) development of the conservation plan. All procedures are presented in the planning manual.

Analysis of Existing Conditions

The analysis of existing conditions is of great significance since it indicates which conditions need to be improved with implementation of the development plan. Socioeconomic, physical, and visual surveys were conducted to evaluate the existing built-up area. Existing buildings and spaces were graded in terms of importance, and the existing visual structure of the district was evaluated.

Development Goals

The Chiang Mai historic conservation project had two goals. One was to preserve historic and religious "monuments," such as temples, old buildings, and townscapes in the old city. The other was to promote tourism to revitalize the city and surrounding areas.

One of the principal reasons that Chiang Mai has been attracting tourists from all over the world is that Old Chiang Mai has retained the attractive characteristics of a city built in an earlier era. Thus, tourism and historic conservation are inextricably linked. For this reason, the district development plan was designed to preserve historic resources by enhancing the historic atmosphere created by such physical elements as temples, pagodas, and monuments, as well as houses and even fences built in the ancient style.

District Improvement Plan

Based on the evaluation of the existing built-up area and the development goals that were established, a district improvement plan was presented in the form of conservation and development policies for the areas identified. In particular, the areas were classified into four major categories:

- areas to be strictly preserved;
- areas to be preserved but not rehabilitated;
- areas in need of environmental improvements; and
- areas to be redeveloped for public purposes.

The improvement plan also includes a district facilities plan, covering access roads, pedestrian ways, open space and parks, as well as police station, museum, library, and cultural facilities.

Detailed District Control Plan

Administrative Procedure for Controlling Land Use and Buildings

The existing control system along with new regulatory procedures will be applied in order to bring about the district improvement plans.

Regarding the existing control system, under the Building Control Act and Bylaws, builders must apply to the municipality for a building permit. Through this process, the municipality can examine proposed buildings from the standpoint of consistency with building standards. Special requirements for district planning areas are to be added to the building code in the specific plan.

Regarding new regulatory procedures for controlling building activities in a planning district, we recommend a new procedure requiring notification of the "governor" of a municipality before any change affecting lots or building construction is implemented. The governor can then examine the building plan and check for harmony with the district's plan.

Control Measures

Various regulatory measures must be implemented to realize the proposed district improvement plan.

- A detailed zoning system should be applied in the district. It must be linked with the Building Control Act Bylaws, which should be used to enforce the zoning system's land use classification scheme.
- Building coverage ratios, building heights, as well as building design, color, and style are to be specifically regulated in the district planning area.
- To engage in building activities such as restoration, alteration, and demolition, one must apply to the municipality for permission.

Detailed Control Plan

A detailed control plan was formulated with the control measures enumerated above. Appropriate combinations of control measures were examined for solving the problems and realizing the development goals of each of the four categories of areas (as discussed in the District Improvement Plan section above).

The most important purpose of the detailed control plan was to maintain the atmosphere of an ancient religious city. To achieve this goal, key elements (e.g., roof style, fences, color) constituting the unique landscape were analyzed and incorporated in the control plan. And, for maintaining the skyline of the old city, building height regulations were included. In addition, building design guidelines were incorporated to require the Larna-Thai style or the typical northern style with ga-lae on top of gables. Also, creating and maintaining open space was considered of great importance.

SUMMARY OF EXERCISE II

Apart from historic sites, the potential of district planning seems to be higher in resort areas than for any other kind of area. Strict rules and regulations would likely be willingly accepted by the developers, landowners, and investors, all of whom desire orderly development, attractive landscapes, well-organized urban utility services (e.g., water supply and sewerage services), and an attractive natural environment. They know that these features will help attract both Thai and foreign tourists.

Pattaya is well known internationally as a tourist attraction. Recently, the development of tourist facilities has expanded to the southern part of Pattaya, where Jomtien is located. The local concern is how to orderly develop a resort area in harmony with natural conditions. In this respect, Jomtien could be very receptive to district planning for resort development.

A district planning exercise for resort areas was conducted. First, the image or character of the resort area to be developed through the district planning process was considered. Second, control measures were examined and incorporated into a district control plan.

Development Goals

Development goals were set for the Jomtien area through an analysis of existing conditions and a review of the Pattaya general plan and tourism development program. The general goal was establishment of a resort area that is harmonious with the existing seaside environment. Therefore, orderly development was stressed. Traffic congestion is to be minimized, and all development should be in harmony with the area's beautiful natural environment.

District Control Plan

The district control plan was formulated to guarantee orderly development consistent with the maintenance of environmental values. Therefore, a variety of control measures were considered, including height regulations, setback regulations, floor height standards, and regulations affecting building color, fencing, signboards, and vegetation. The following specific findings were made:

- The zoning classifications in the general plan should be subdivided into six categories to meet the district's diverse needs. The objective should be orderly development in terms of building type and the landscape.
- In order to retain a "resort atmosphere," building coverage ratios are very effective. They can prevent congested built-up areas. Also, they can create verdant open space, an important element in maintaining the attractiveness of a resort.
- Building height regulations are essential for preservation of the townscape. Building height can increase with distance from the beach.

- The color of buildings and fencing must be strictly controlled.

Concluding Comments

The exercises were not implemented to formulate actual district plans for particular places, but rather to assist DTCP in acquiring a district planning capability. During the exercises, however, it was suggested that there is a rather high possibility of applying district planning as a supplement to general planning, for promoting national policy in specific areas, or for assisting localities in improving their living environment.

During the course of this study, DTCP staff have learned both planning and control techniques from the JICA Study Team. It was shown that district development goals must be firmly established to justify regulations that adversely affect the property rights of individuals. Control techniques were studied from the viewpoint of their effectiveness for achieving district development. DTCP's staff have learned of a wide variety of land use and building control measures, and they have begun to master the technical basis underlying these measures. As a consequence, DTCP will be able to improve its specific planning process.

However, the public acceptance of control measures was not considered in the exercise. Only Bangkok and Chiang Mai have enforced control measures such as floor area ratios, building height regulations, and design controls. The public acceptance of control measures in other areas will depend on the government's persuasiveness in stressing the benefits of such measures, not only for society at large, but also for the individuals directly affected. DTCP is scheduled to enforce specific plans in Chiang Mai and Laem Chabang, for which the techniques and knowledge acquired during this study will be useful. In the future, the "social persuasion process" should be developed further.

6

PROPOSED DATABASE MANAGEMENT SYSTEM (DBMS)

6 DATABASE MANAGEMENT SYSTEM (DBMS)

6.1 Introduction

At present, DTCP has a variety of data management problems in the city planning process. As a result, some collected data are not effectively integrated into the plan making procedures. A plan is formulated based on a number of judgments, and it is important that those judgments be based on an internally consistent information system. Clearly, then, the establishment of an integrated data management system for city planning is an essential task for the improvement of the rationality and efficiency of the planning process. In order to meet this need, a Database Management System (DBMS) based on modern computer technology has been proposed. The proposed DBMS, however, does not consist of merely a computer (hardware) and electronically stored data. Rather, it is a "system" of processes that can serve the planner by meeting his information requirements for a variety of planning decisions.

It is recommended that a DBMS be promoted simultaneously in the following areas:

- standardization of data formats, processes, and software through the improvement of DTCP's internal information network;
- development of applications software, statistical processing, analytical models, and simulation techniques; and
- computer hardware improvements and the expansion of DTCP's computer network.

Concept of DBMS in City Planning

City planning activities require an internally consistent data management system. The first step toward the development of such a system is the standardization of the plan making process, with data collection and subsequent data processing tasks synchronized into a mutually reinforcing flow of activities. This concept is shown in Figure 6-1.

Database management aims at the establishment of a system of software to manage storage, retrieval, and the updating of the records in the database. In essence, the system is a highly structured "file" [1] that attempts to provide all the data allocated to certain subjects and allow programs to use only the required items of records. The concept of the DBMS as applied to the standardized city planning process is shown in Figure 6-2.

[1] "File" is a technical term used in computing to refer to a bundle of information stored within a computer system.

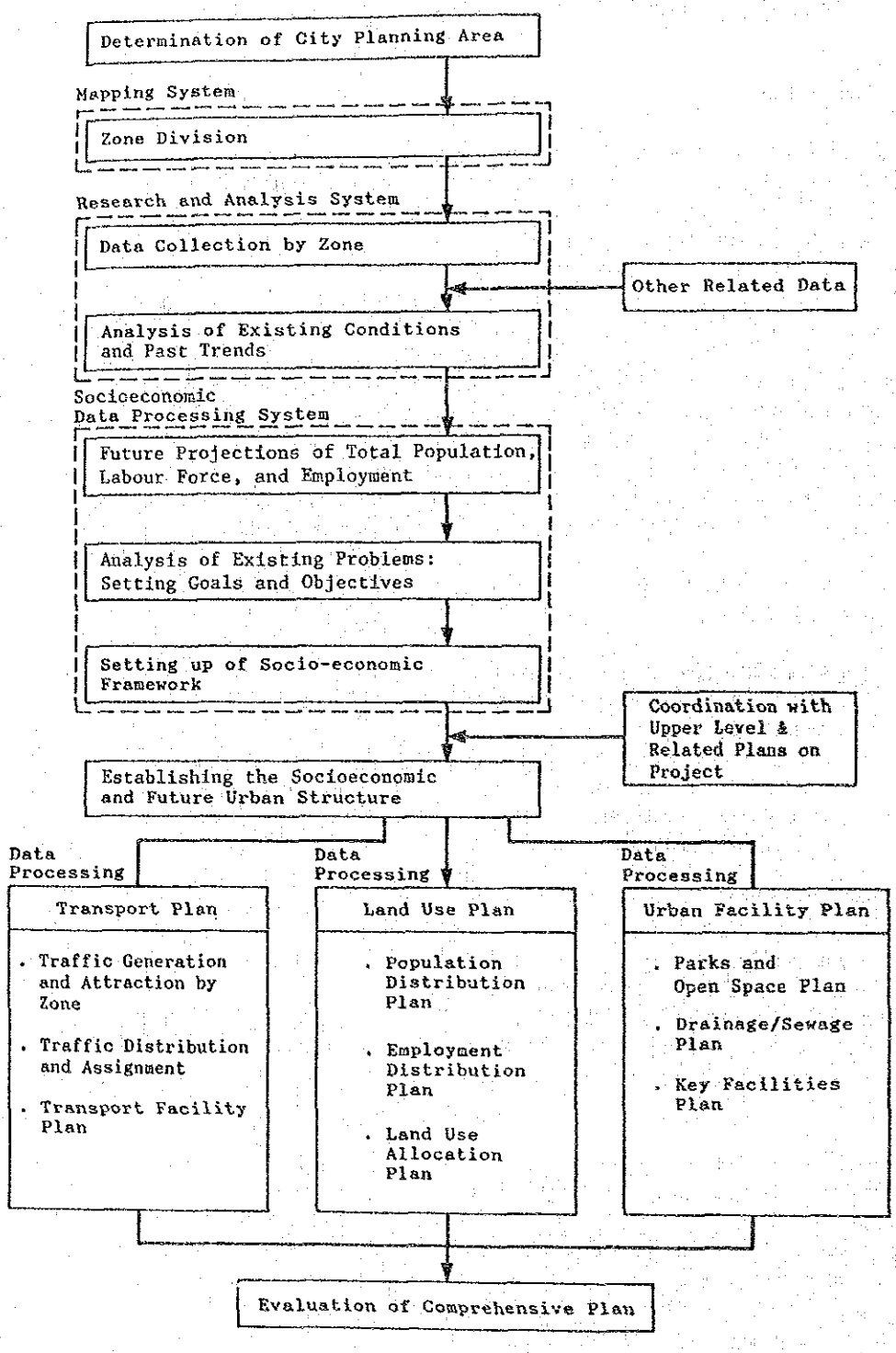


Fig. 6-1 STANDARD CITY PLANNING PROCEDURE SEEN AS A SUCCESSION OF DATA PROCESSING

6.2 Systems Design

Organization of Software System

The design of the DBMS must be considered in terms of data availability as well as the accuracy and efficiency of data processing. Both are vital to achieve a standardized city planning process. From the point of view of "computerization," a data processing system should include certain functions, such as statistical processing programs, analytical applications, and simulation programs. The organization of these software systems in the proposed DBMS is shown in Figure 6-3.

Definition of System Functions

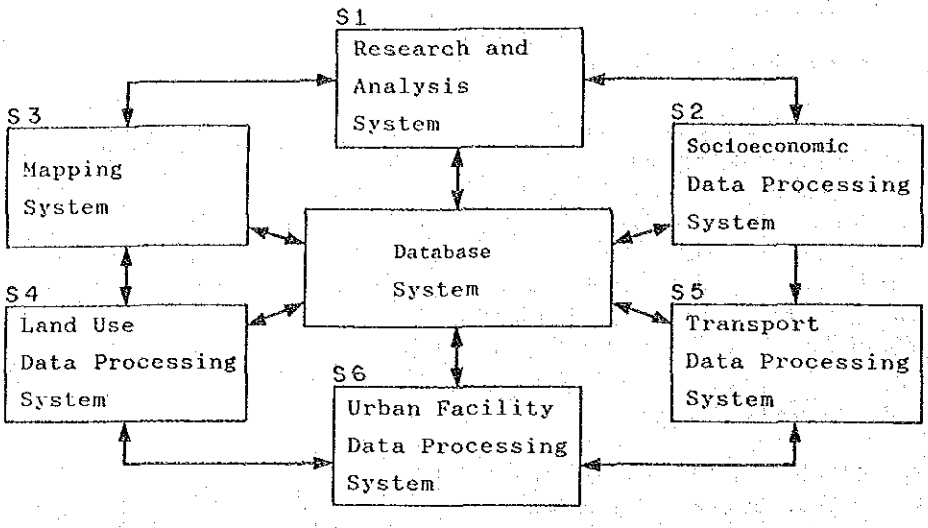
Depending on the concept of the DBMS and the systems design in response to city planning techniques, system functions can be defined as in Figure 6-4. However, these system functions are not only standardized by data item as is shown in a subsequent section, but they are also integrated into a consistent system of various functions. The DBMS must fulfill its functions within a complete system of integrated applications. Each function--data input, tabulation, analytical applications, and simulation--is considered briefly below.

Data Input System

The data collected in the field survey must be validated and encoded into the computer system. The data input function consists of various data checking and data updating programs capable of identifying incorrect values resulting from human as well as machine errors.

Basic Tabulation Programs

In the tabulation function, the data is processed in the form of tables, and the totals for a particular group or groups of data are calculated. The basic tabulation function is divided into six parts as shown in Figure 6-6.



* Data Base System - Data input, File Production, Data Research, Refference File, Data Conservation and Maintenance

Fig. 6-2 CONCEPT OF DBMS AS IT IS APPLIED TO CITY PLANNING

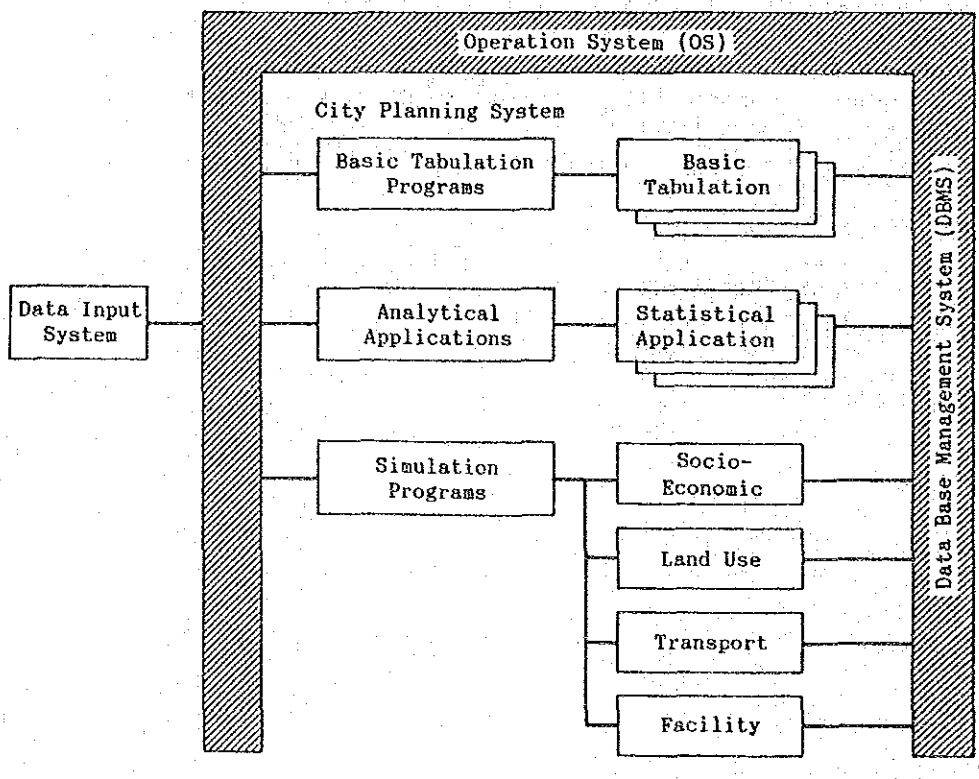


Fig. 6-3 BASIC ORGANIZATION OF SOFTWARE SYSTEM FOR THE PROPOSED DBMS

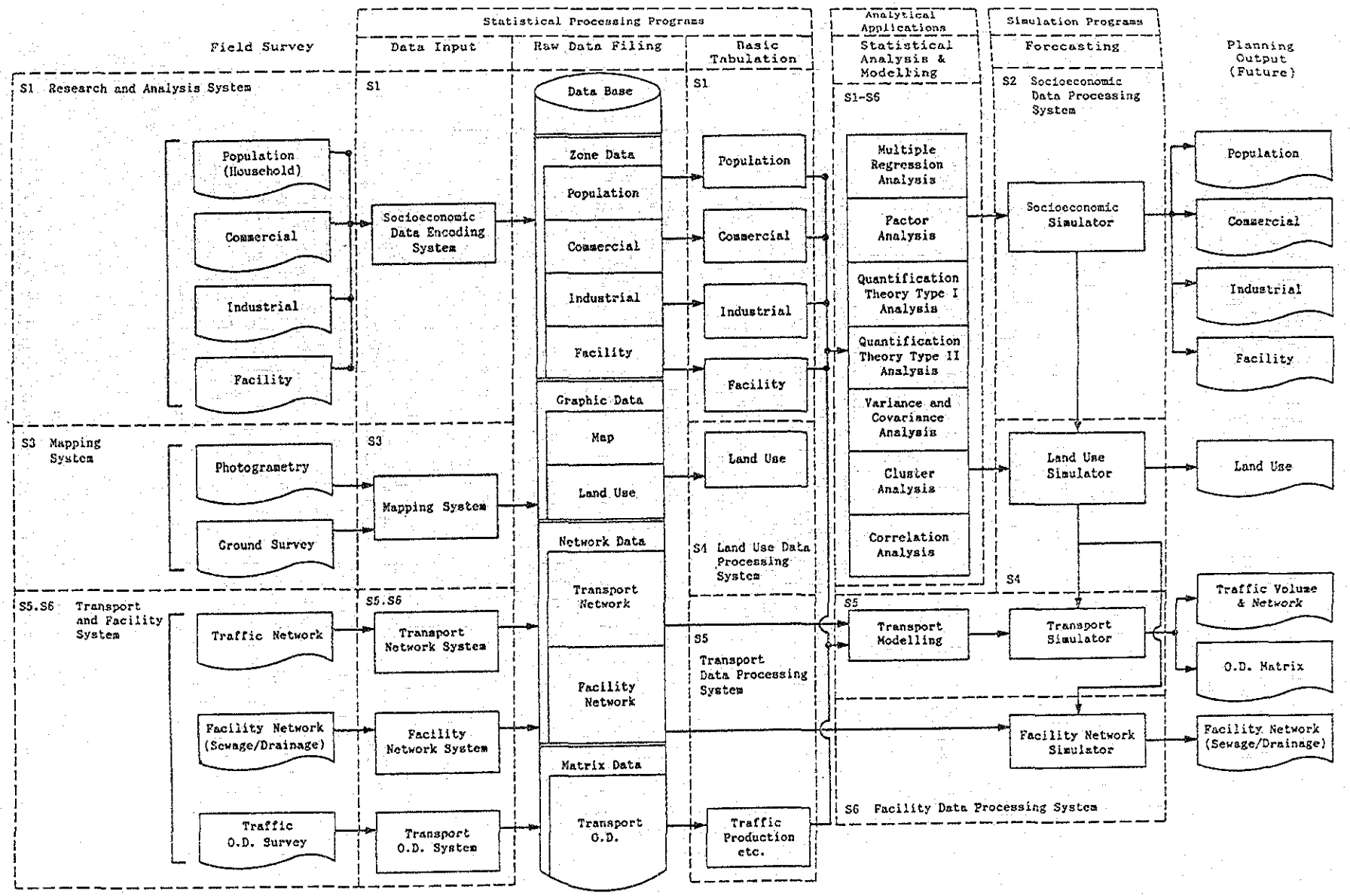


Fig. 6-4 STRUCTURE OF DATABASE MANAGEMENT SYSTEM (CITY PLANNING)

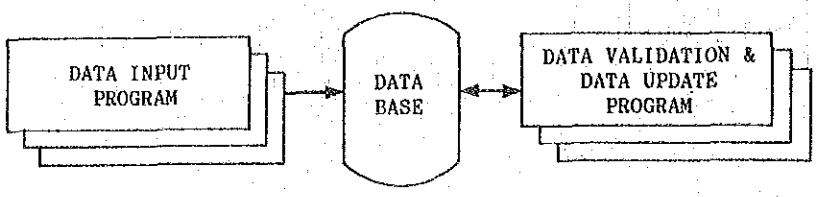


Fig. 6-5 DATA INPUT SYSTEM

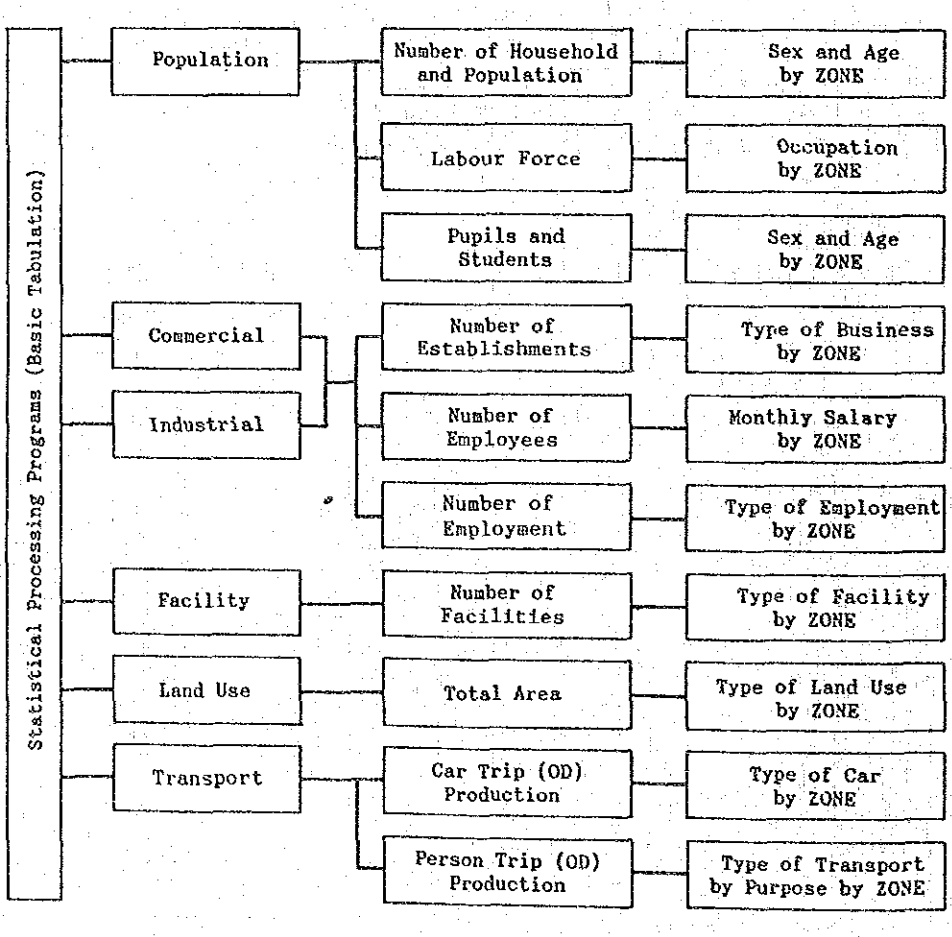


Fig. 6-6 SYSTEM OF BASIC TABULATION PROGRAMS

Analytical Applications System

The DBMS should have a statistical analysis program. Representative techniques are shown in Figure 6-7.

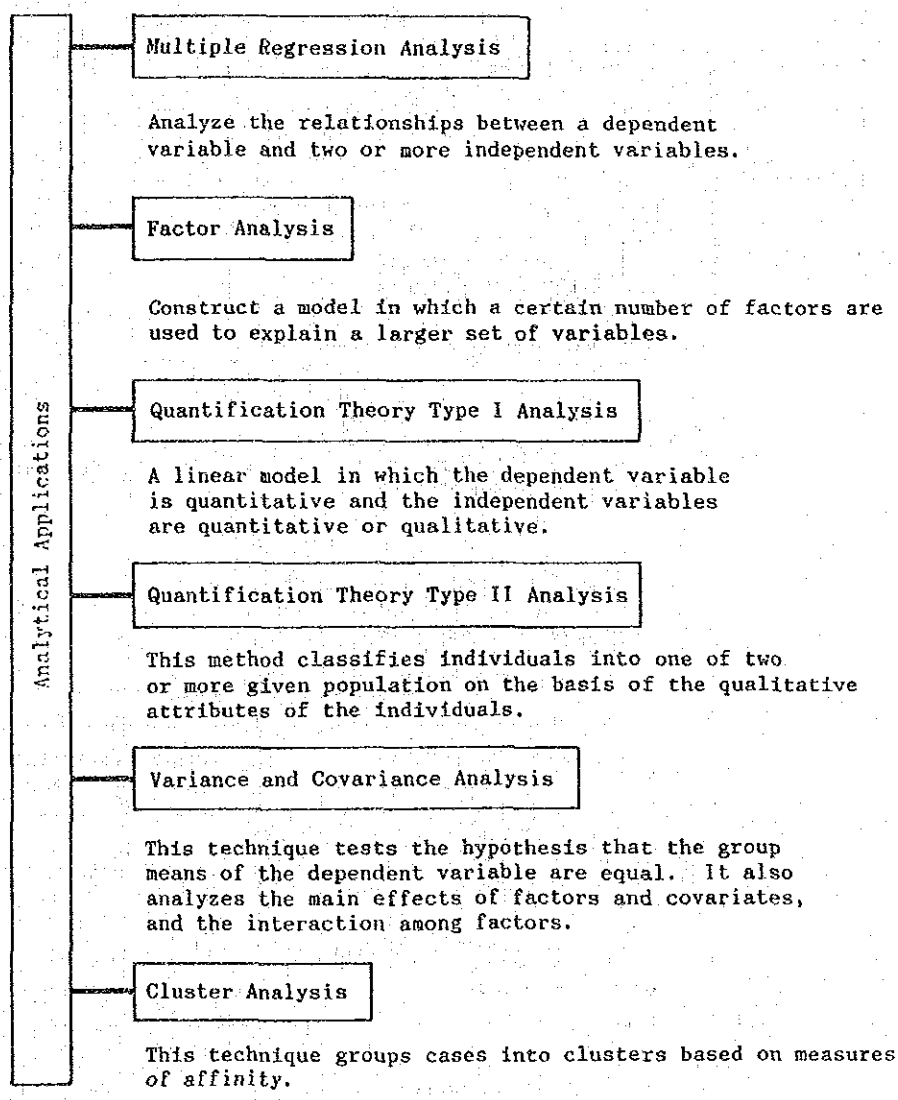


Fig. 6-7 EXAMPLE ANALYTICAL APPLICATION SYSTEM

Simulation Programs

Simulation models should be developed in accordance with the techniques of each planning sector. The basic structure of the d6
dsimulators for the relevant sectors are shown in Figure 6-8 through 6-12.

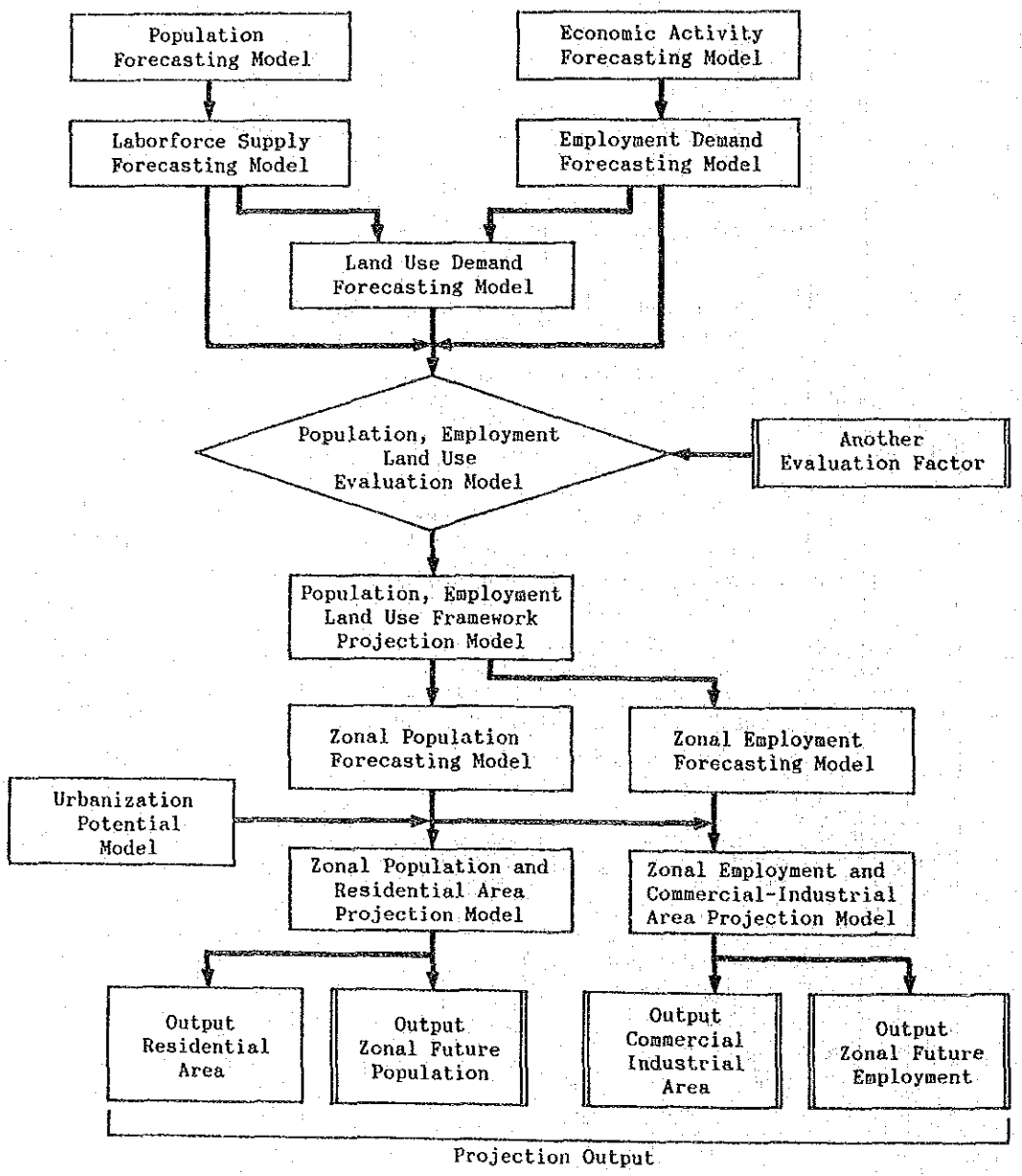


Fig. 6-8 SOCIOECONOMIC AND LAND USE SIMULATOR

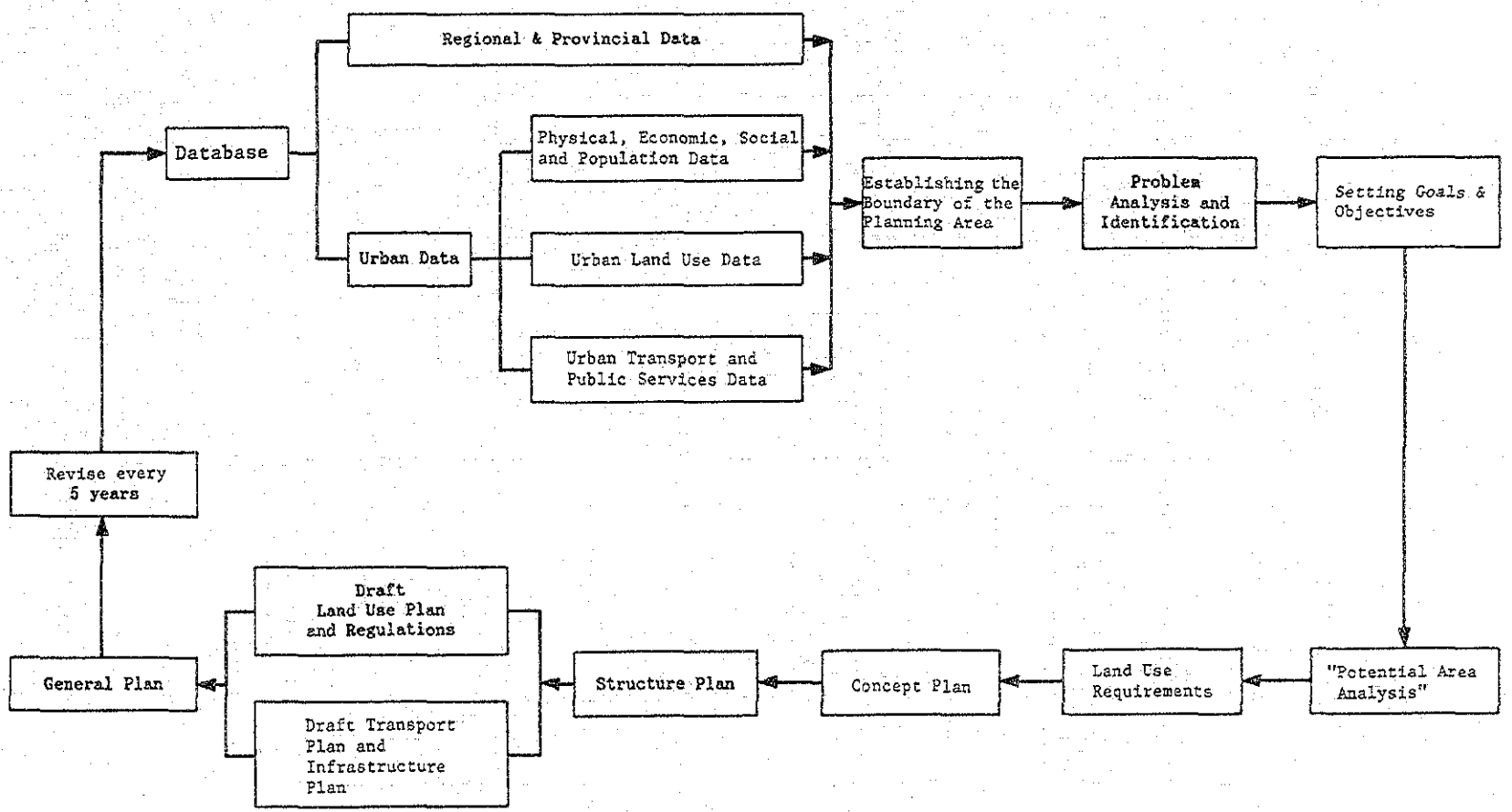


Fig. 6-9 LAND USE SIMULATOR

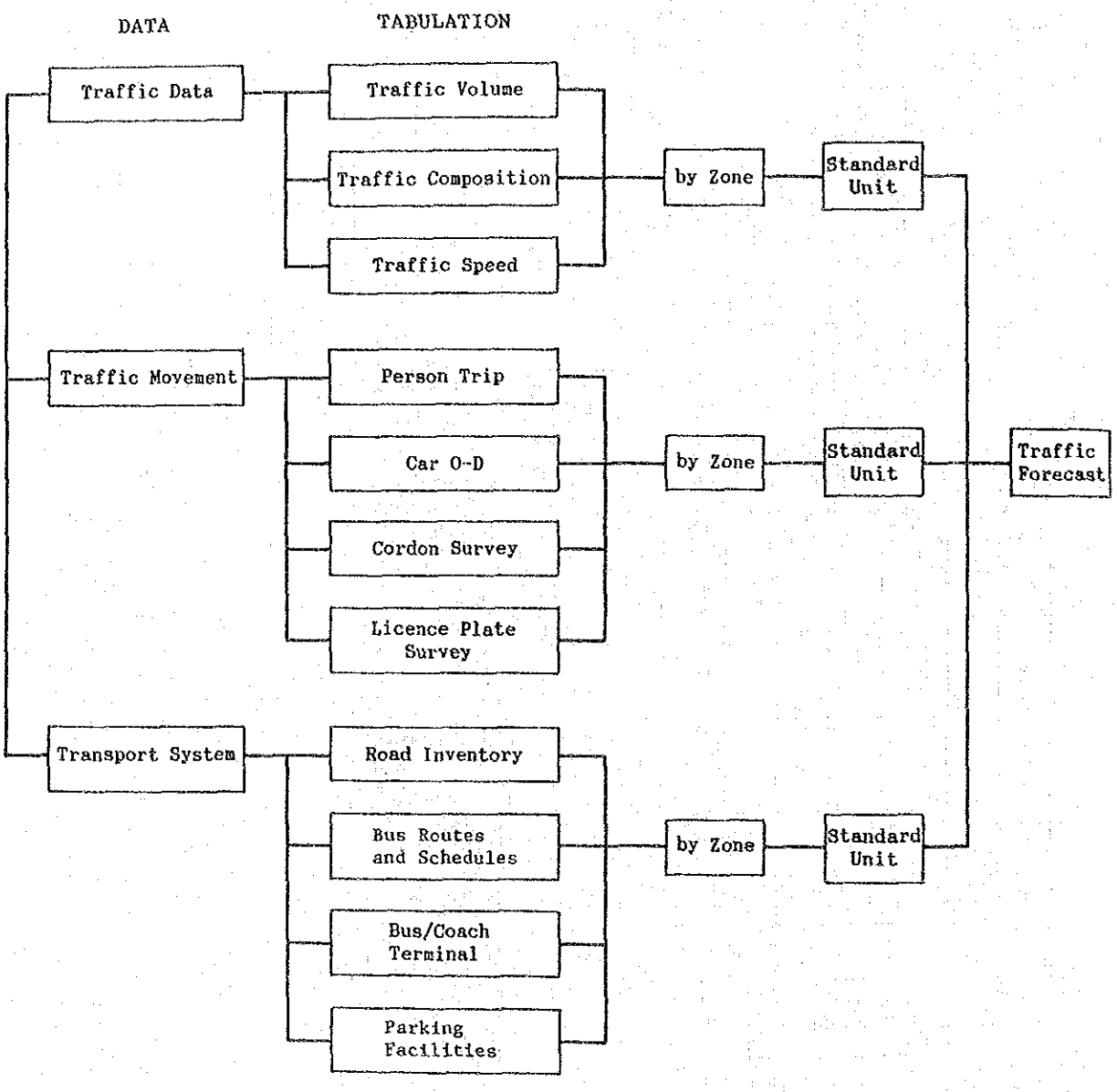


Fig. 6-10 TRANSPORTATION O-D SYSTEM

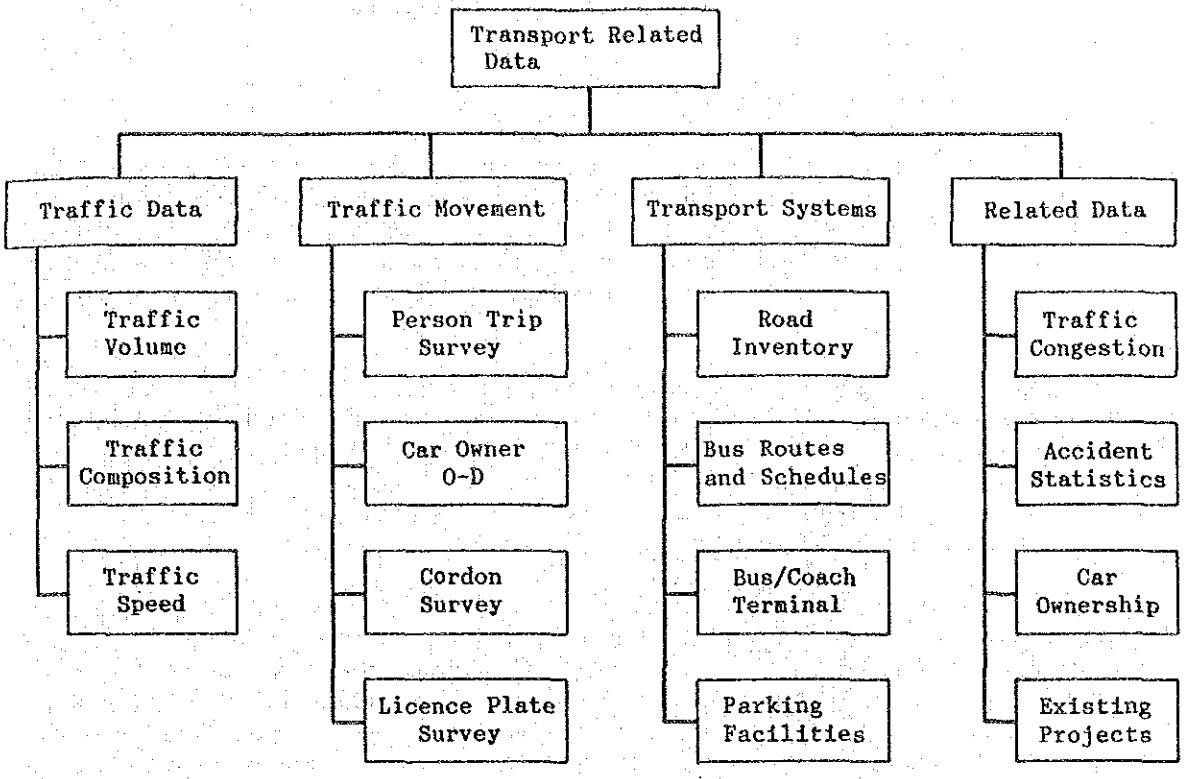


Fig. 6-11 TRANSPORTATION SIMULATOR

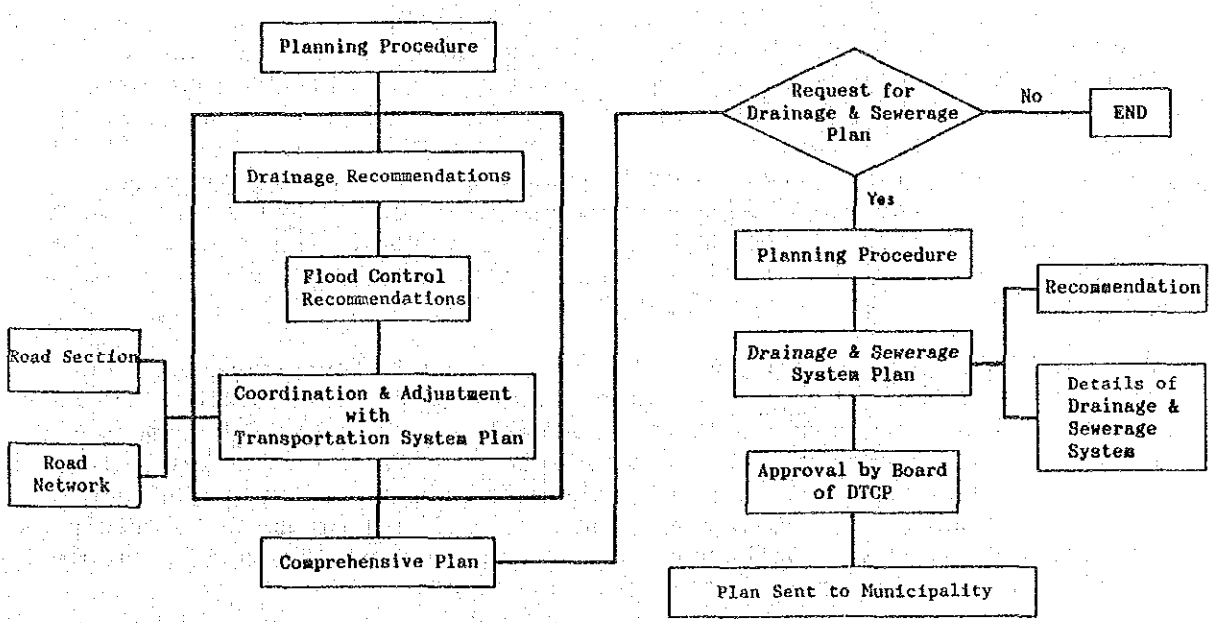


Fig. 6-12 DRAINAGE & SEWERAGE SIMULATOR

Input/Output Data Items

Data Processing Procedure

Figure 6-13 shows the proposed data processing structure for plan preparation. It provides a framework for the further development of a more practical procedure to conform to DTCP's actual planning environment. The whole process can be grouped into four principal parts: mapping, socioeconomic analysis, land use, and transportation systems.

The mapping system is the basic system from which various kinds of maps are produced. The work starts with the selection of a mapping method for a designated planning area. Either aerial photographs or a ground survey can be used. The system can then be used to produce a variety of maps. For example, a land use map can be produced and used to show zoning or to measure land use areas.

The *socioeconomic analysis* system is based on surveys of population and economic activities. Socioeconomic data along with land-use measurement data can be input into the computer to conduct basic tabulations (e.g., types of land use by zone; population tabulations by sex, age, and zone). These basic tabulations are used in the simulation process, which has three main modules: socioeconomic, land use, and transportation.

The socioeconomic simulator is employed to prepare population and employment projections. To make these estimations, various variables ("standard units") must be considered (e.g., sex ratio, school attendance ratio). Certain variables require consideration of both socioeconomic and areal unit data. Population density, for example, is derived from total population in a zone and the total area. Others, such as industrial land, which is calculated using the number of employees at various workplaces, require only one variable for estimation. These variables are very important for the estimation of land requirements in the land use simulator. The final output of the land use simulator is the area of land required for each activity (commercial use, industrial use, or residential use) in a predetermined target year. This output ensures that the increase in land area is consistent with the increases in population and urban activities. This increase in later allocated to appropriate locations, taking into consideration a variety of factors. A draft land use plan is ultimately formulated.

For the transport simulator, the conventional four-step transport modeling process (i.e., trip generation, trip distribution, modal split, and assignment) has been proposed. A number of transport plans can be simulated and evaluated along with the underlying land use plans. In addition, if more detailed analysis is required for a transport plan, it can be carried out by analysis of an O-D (origin-destination) survey. Although such an approach yields more reliable information, it is rather costly to implement.

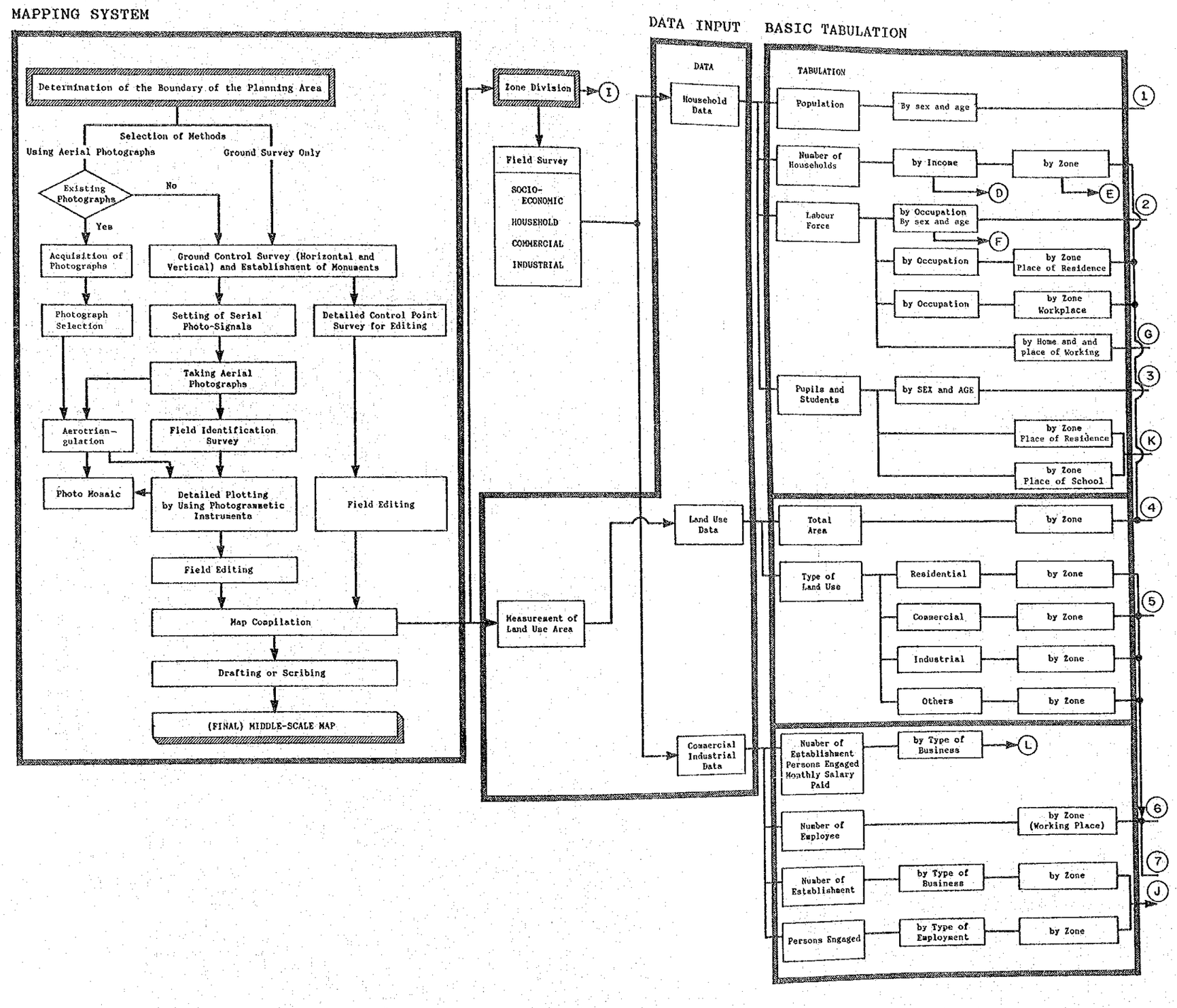


Fig. 6-13 STRUCTURE OF DATA PROCESSING

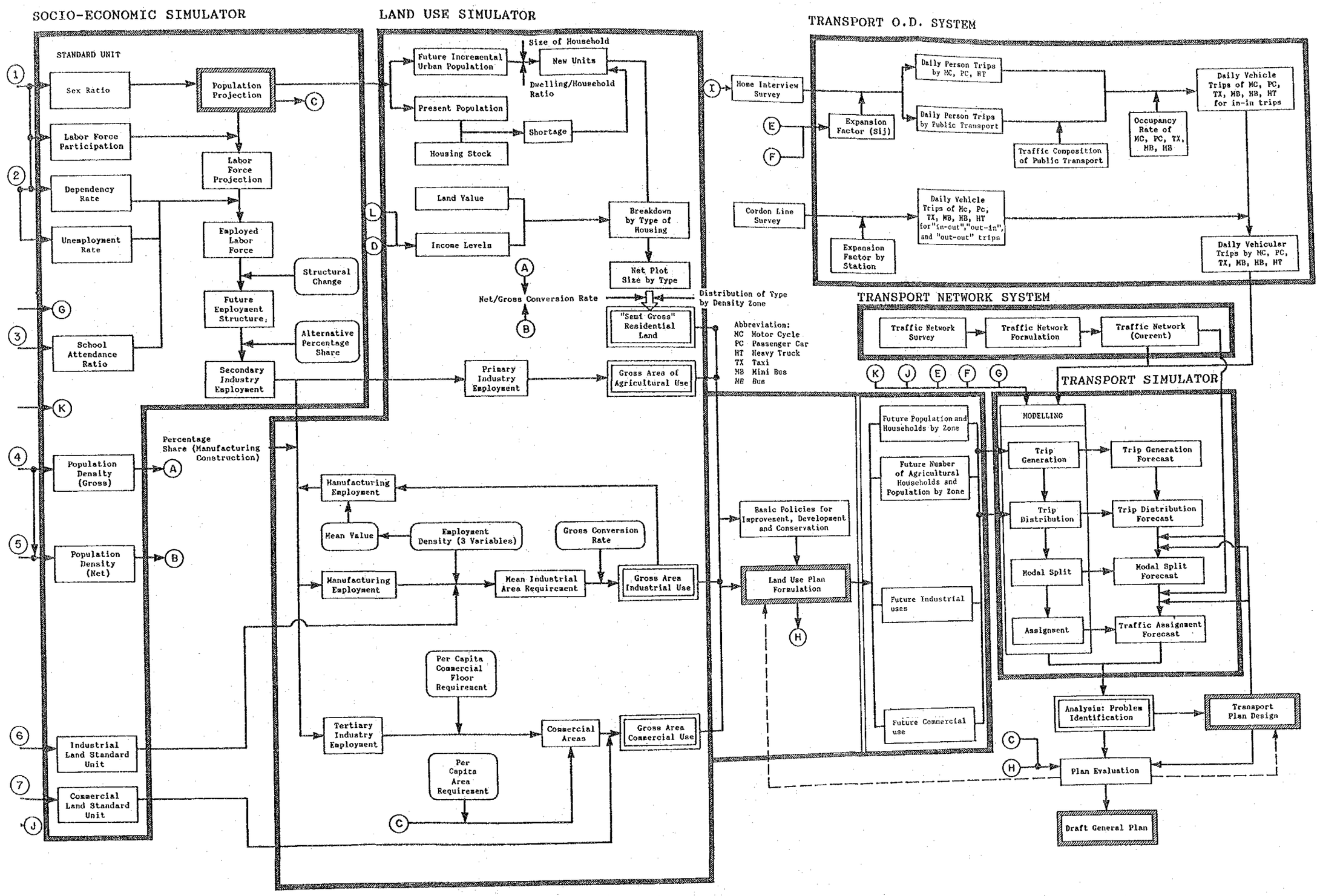


Fig. 6-13 STRUCTURE OF DATA PROCESSING (CONT.)

Specification of Data Items

The software system outlined requires specification of data items for implementation. Data items should be specified based on a review of current data items and the availability of existing data. In addition, identification of how the data items will be applied (program details) in each function must be considered. Also, data item specification must reflect city planning techniques.

Based on the case studies, a sample list of data items has been prepared and is shown in Table 6-1. However, data items should be specified together with the definition of zoning boundaries and the coding system.

6.3 Computer System Development

The computerized system should be developed progressively from the current "initial stage" toward an "intermediate stage" and ultimately to a "full-scale stage." The stages can be classified based on whether they employ off-line processing or on-line processing and whether they use batch processing or real-time processing.

The relation between the system development stage and the form of processing is shown in Figure 6-14.

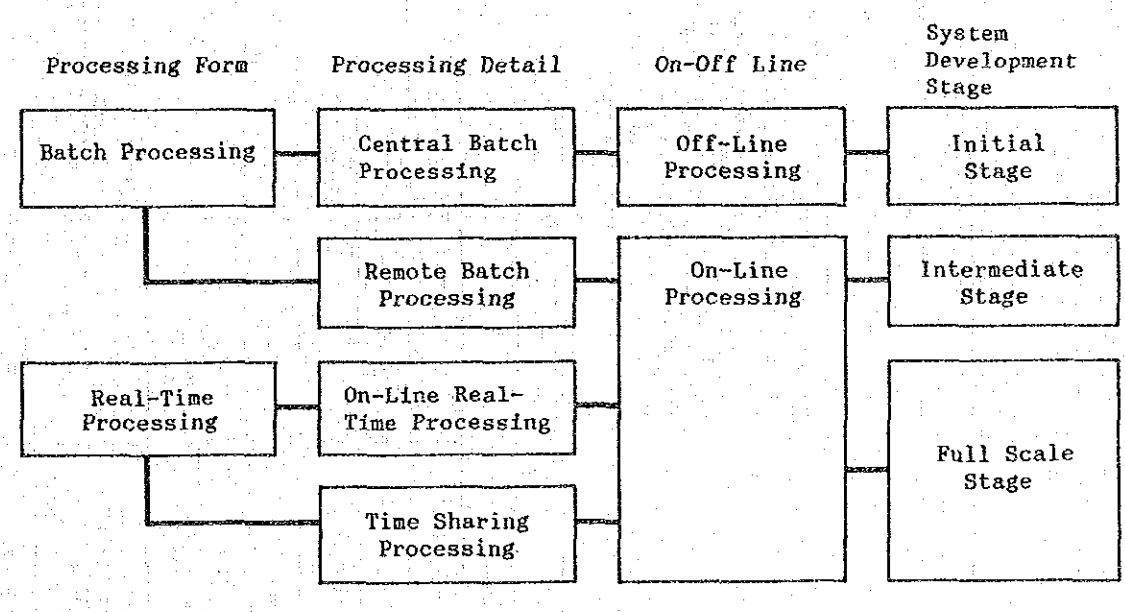


Fig. 6-14 SYTEM DEVELOPMENT STAGE

Table 6-1 DATA ITEM SPECIFICATION

	POPULATION		COMMERCIAL	INDUSTRIAL	LAND USE	
	R & A	ENG	R & A	R & A	MAP	LAND USE
Zone Code	Area Data No. Location L Code	Address	Area Data No. Location L Code	Area Data No. Location L Code		
Item	Type of Household		Duration of Business	Duration of Business	Residential Area	Preservation Area for Residential Purposes
		Number of People	Type of Commercial	Type of Industry		Low-Density Residential Area
		Number of Children under 5 Years of Age	Major Products	Major Products		Medium-Density Residential Area
		Number of Vehicles Owned	No. of Person: Family Male	No. of Person: Family Male		High-Density Residential Area
		Average Monthly Income of Family	Family Female	Family Female	Commercial Area	Commercial and High Density Residential Area
	Sex	Sex	Employee Male	Employee Male	Industrial Area	Industrial and Warehouse Area
	Age	Age	Employee Female	Employee Female		Specific Industrial Area
	Race		Age Group	Age Group	Religious Institution	Religious Institution Area
	Nationality				Educational Institution	Educational Institution Area
	Place of Birth		Place of Birth	Place of Birth	Recreational Area	Open Space for Recreation and Conservation of Environmental Quality
	Literacy				Warehouse Area	Warehouse Area
	School Grade Attending		Educational Level	Educational Level	Agriculture, Forest, Vacant Area, Livestock	Rural and Agricultural Area
	Occupation	Occupation				Preservation Area for Rural and Agricultural Purposes
	Place of School	Place of Work or School				Agricultural Land Reform Area
	Place of Work					Conservation of the Thai Identity, and Culture
	Monthly Salary		Total Salary per Month	Total Salary per Month	River, Canal	Open Space for Conservation of Environmental Quality and Fishery
	Move In				Government Area Institution Utility	Governmental Institution, Public Utility and Facility Area
	Move Out					
			Residence	Residence	Roads, Soys	
			Area	Area		

In order to advance its Database Management System, DTCP must move ahead to more sophisticated computer systems, as shown in Figure 6-15.

	Initial Stage	Intermediate Stage	Full Scale Stage
Information Network	Inside DTCP (Each Division)	Inside DTCP (New Information Network)	Expansion to Outside Information Network
Hardware	Microcomputer Off-Line Processing (Stand-Alone)	Microcomputer On-Line Processing (Intermediate-Size)	Host Computer On-Line Real Time Processing
Software (City Planning System)	Data Base System Standard Application	On-Line Data Base (I) Management System Specific Application	On-Line Data Base (II) Management System Specific Application & Outside Software
Operating Organization	Manager & System Engineer Programmer & Operator Coder & Keypuncher	Manager System Engineer Programmer & Operator Coder & Keypuncher	Manager System Engineer Programmer Operator Coder Keypuncher

Fig. 6-15 PROGRESSIVE DEVELOPMENT OF DATABASE MANAGEMENT SYSTEM

6.3.1 Initial Stage (Batch Processing)

Microcomputers will be used for batch processing initially, although ultimately more sophisticated computers will be introduced.

Batch processing is the processing of an individual program without interaction between the program and the user once the program has been read by computer. It involves collecting data into groups to be processed at one time.

Taking DTCP's existing situation into account, batch processing by microcomputer should be employed at the initial stage. This involves having each program connected directly to the disk files it uses. Figure 6-16 illustrates this initial concept of program structure.

During the Case Studies (I and II) conducted for this report, various practical programs were developed using the stand-alone microcomputer system that was made available to this study (see Figure 6-17). However, some problems were experienced in producing programs, particularly with regard to data availability and the accuracy and efficiency of data processing, and the specification of zoning boundaries. Therefore, the programs developed for the current system took these problems into account.

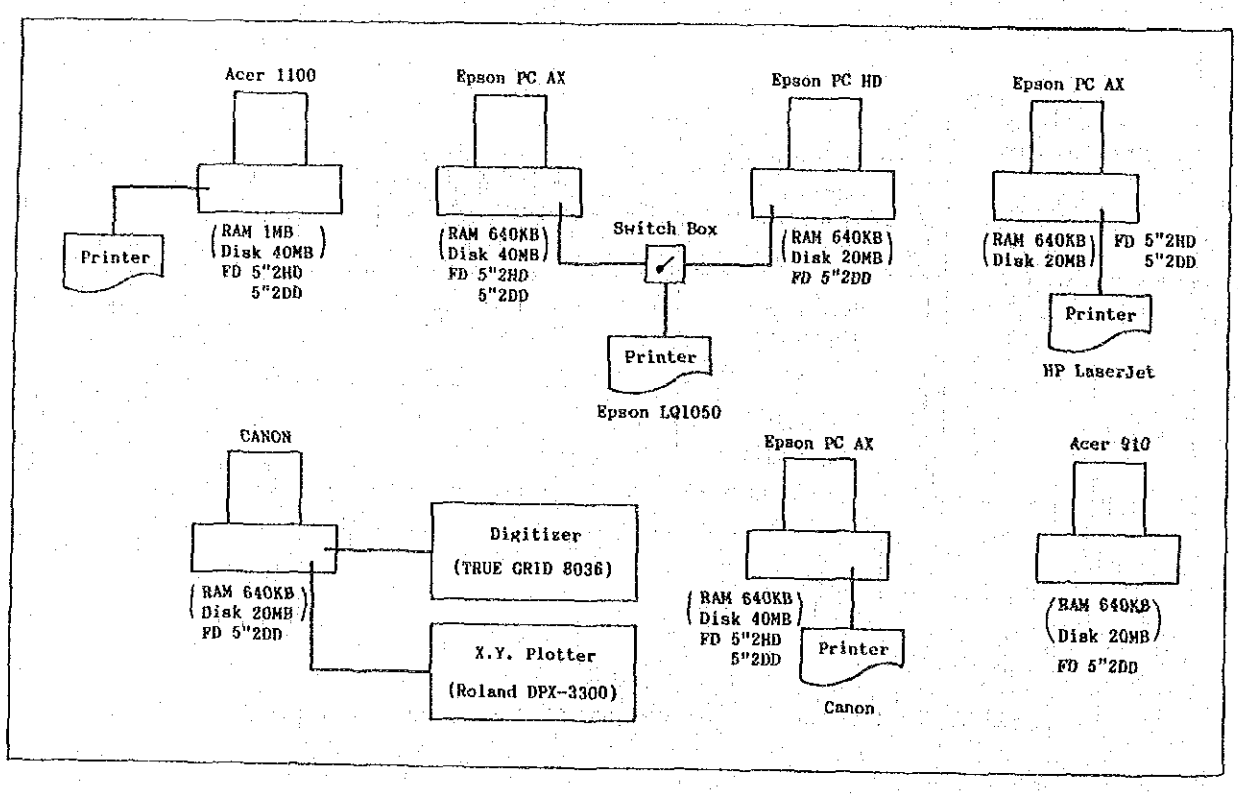


Fig. 6-17 MICROCOMPUTER STAND-ALONE SYSTEM

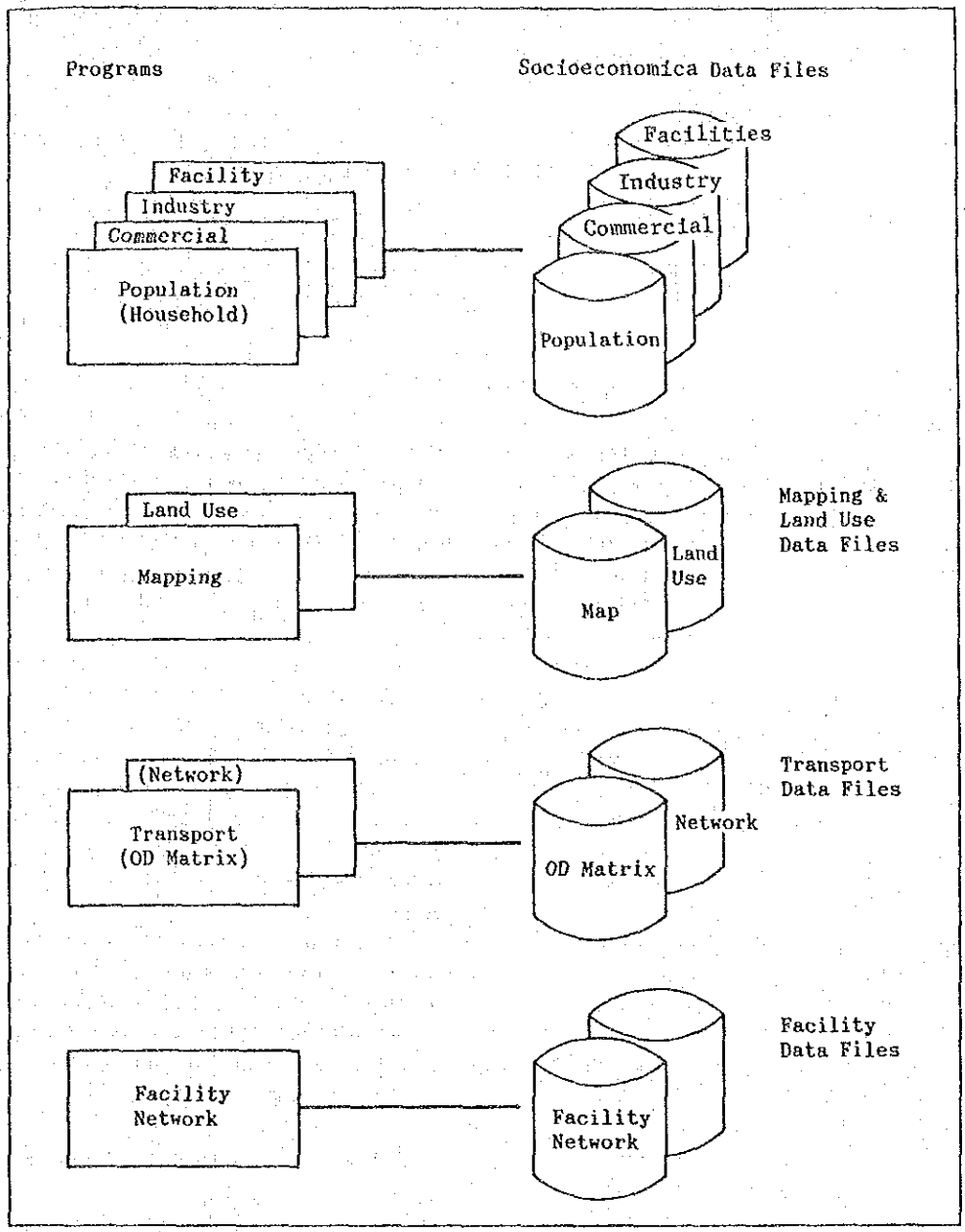


Fig. 6-16 FILE-LINKED PROGRAMS (INITIAL STAGE)

The progress achieved in preparing programs in the case studies is shown in Figure 6-18. At present, this system is not complete; it should be progressively improved as DTCP moves toward more advanced stages in the development of its computer system.

Fig. 6-18 PROGRAM PREPARATION STAGES

System Functions	Preparation Stage of Programs	Program Language	Date Contents
DATA INPUT			
Socioeconomic	Complete	dBASE III PLUS	INPUT-CHECK-UPDATE
Mapping	Complete	FORTRAN	NETTL..(Net Adjustment Program)
Transportation (Network)	Complete	FORTRAN	NETWORK INPUT-CHECK-UPDATE
Transportation (OD)	Complete	FORTRAN	OD MATRIX INPUT-CHECK-UPDATE
Facility	Not Started	-	-
BASIC TABULATION			
Population	Complete	LOTUS dBASE III PLUS	Household, population, labor force, and students
Commercial	Complete	LOTUS dBASE III PLUS	Establishments, and Employees
Industrial	Complete	LOTUS dBASE III PLUS	
Facility	Not Started	-	-
Land Use		BASIC	Land use
Transportation	Complete	FORTRAN	Car trips, person trips
ANALYTICAL APPLICATIONS			
Multiple Regression	Complete	C-Language	Connected - Socioeconomic
Factor	Not Started	-	-
Quantification (I)	Partially Complete	FORTRAN	Connected - Transportation
Quantification (II)	Partially Complete	FORTRAN	Connected - Transportation
Variance and Covariance	Not Started	-	-
Cluster	Not Started	-	-
Correlation	Partially Complete	-	-
SIMULATOR PROGRAMS			
Land Use	Partially Complete	BASIC	PSA - Potential Surface Analysis
Transport	Complete	FORTRAN	Demand, matrix, and network models
Facility	Partially Complete	LOTUS	Sewer Calculation Table

6.3.2 Intermediate Stage (On-Line Processing)

In response to technical advancements in city planning, the computer system should be upgraded in terms of data processing, with a more hierarchical data structure instituted to reduce the time required for processing. Moreover, such a system would standardize the data file and application programs.

Figure 6-19 shows a DBMS that controls all access to an integrated data set. In such a system, the programs must "look at" the data stored in files. The data on the disk can be changed or supplemented without requiring program changes, and the data can be viewed in different ways.

After the completion of an "initial stage system," DTCP should establish an internal information network to progress toward the intermediate stage, which requires a microcomputer. The software system for this stage should be developed in key areas such as statistical processing techniques (for large quantities of data), analytical modeling, and simulation modeling.

6.3.3 Full Scale Stage (Future System)

Remote batch processing is to be used on an on-line processing system in the intermediate stage. However, as the on-line computer applications are processed, new demands on the system will arise. Consequently, the data should be processed and output obtained as soon as it is generated; the system should respond immediately to any request for using data or programs. Such immediate processing of data is called real-time processing. At present, on-line processing usually means real-time processing.

At the intermediate stage, DTCP will have a complete data processing system with a DBMS that can guide, supervise, and assist city planners. This system, however, will ultimately be insufficient as DTCP implements city planning in an increased number of cities. Thus, a new computer center will be required in the full-scale stage (as shown in Figure 6-21).

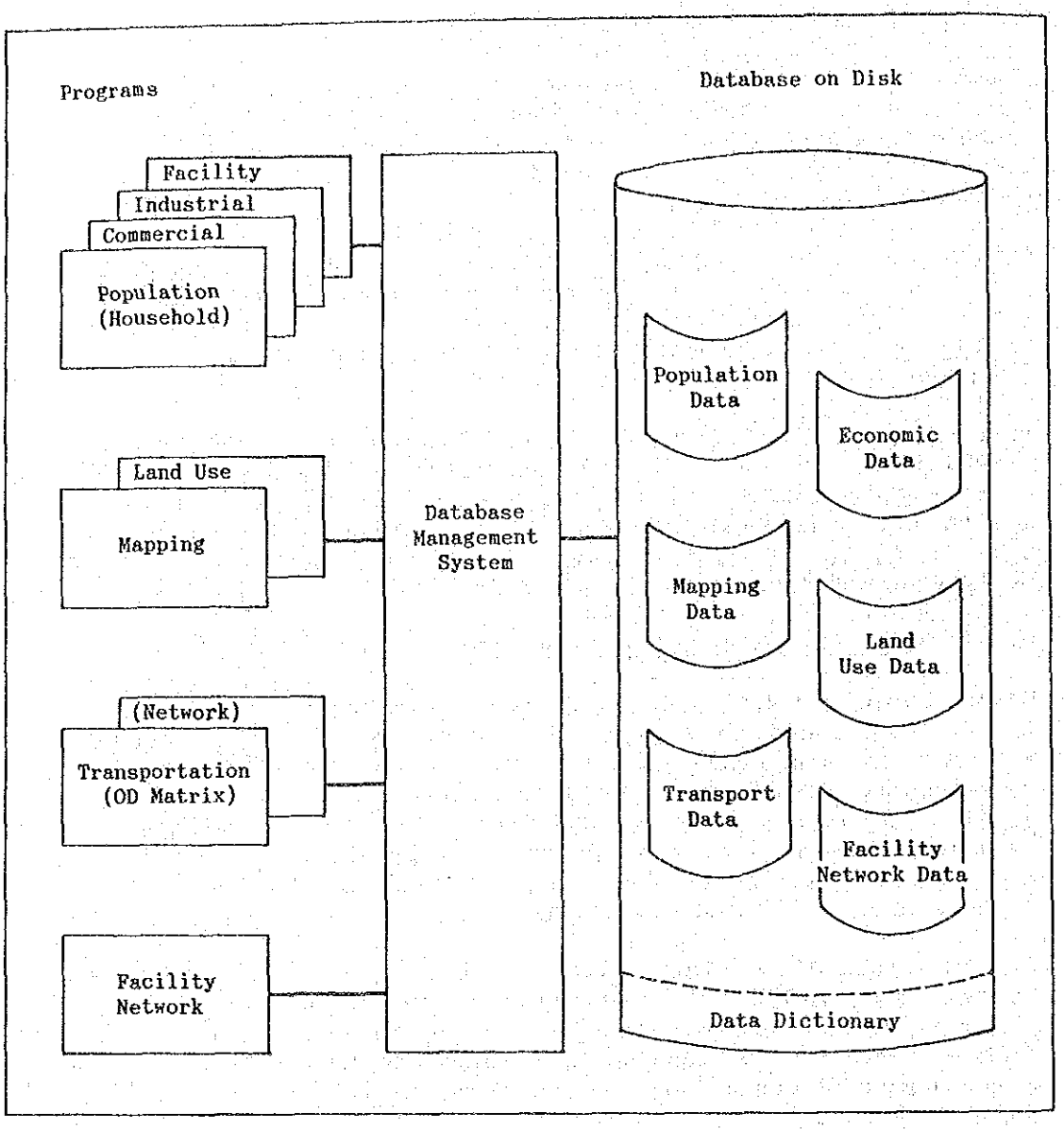


Fig. 6-19 PROGRESSIVE DEVELOPMENT OF DATABASE MANAGEMENT SYSTEM

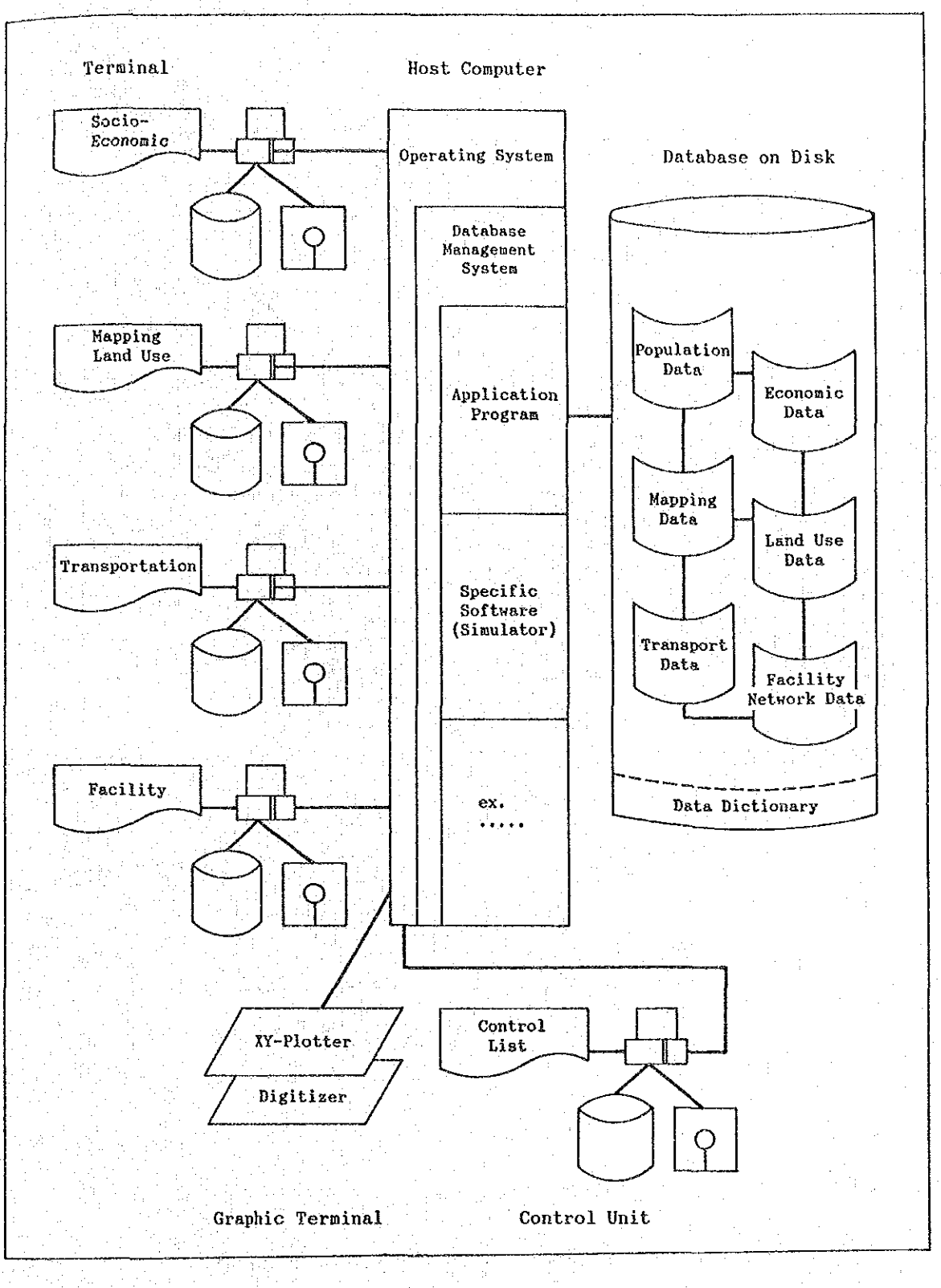


Fig. 6-20 REMOTE BATCH PROCESSING (INTERMEDIATE STAGE)

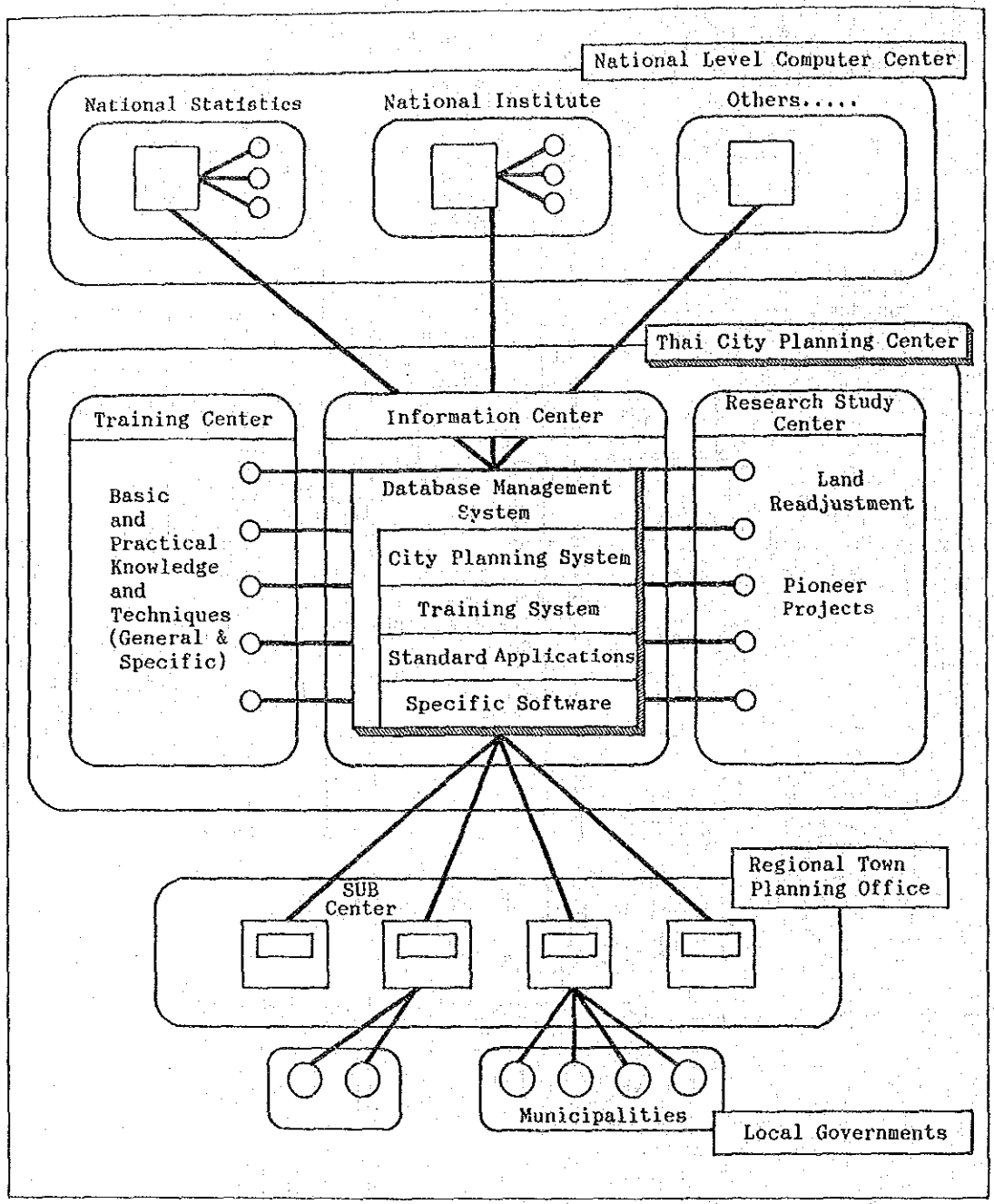


Fig. 6-21 FUTURE SYSTEM ("FULL-SCALE STAGE")