A PROJECT FOR UPGRADING THE CADAstral SYSTEM IN THAILAND

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PART 1

ABSTRACT

This paper describes a programme directed towards accelerating the issue of title deeds to all landholders and improving the cadastral system in Thailand. Following preparatory investigations, the World Bank and the Australian Development Assistance Bureau (ADAB) have been approached to give assistance during an initial five-year implementation phase. The programme aims to complete the issue of title deeds within 20 years. The Royal Thai Government (RTG), which initiated the programme, is giving it a high priority because it expects the increased security of tenure to lead to improved farming methods, increased agricultural productivity and other socio-economic benefits.

Under the proposed programme, the Department of Lands will produce a new cadastral mapping series at 1:4000, based on rectified photomaps. Control will be on the UTM system, related to the geodetic networks. Title deeds will be issued for all privately-owned land parcels which lack them, and State-owned parcels will be brought onto the register. Surveying and adjudication methods will be similar to the present procedures for title deed surveys, but new technology will be phased in during the project, where it can avoid bottlenecks. The programme also encompasses an urban mapping project, decentralisation of Land Offices, development of the National Valuation Authority, a programme of technical aid, education and training, provision of additional buildings and some increases in staffing levels.

INTRODUCTION

Land Problems

Of the privately occupied land in Thailand, only 15 per cent is held by title deed, while a further 52 per cent is held under certificates of utilisation. The remaining one-third is undocumented. It has been estimated that, with the present rate of progress, it will take nearly 100 years to complete the conversion of all private land to title deeds. In Thailand the number of court cases related to land boundary disputes is high: in 1981 there were over 12,000. Other problems are related to the number of parallel systems and procedures. Control for cadastral surveying is based on 29 local coordinate systems each covering one or more of the provinces. These use Cassini–Soldner coordinates and are not directly related to the national geodetic network and its UTM coordinate system. There are three main types of documentation for landowners: title deeds and two forms of certificate of utilisation. Three forms of cadastral survey are used for title deeds, leading to a 1:4000 cadastral map series. All records for land held by title deed are in the provincial Land Offices. Surveys for one form of certificate of utilisation are based on unrectified photographs at a scale of approximately 1:5000, which form a second series of cadastral maps. The other form of certificate of utilisation is based only on a simple survey, with no maps. Certificates of utilisation are kept not in the provincial, but in district Land Offices. In urban areas many cadastral plans are 30–50 years old. They have not been kept up to date, many are torn and

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illegible, and some are lost. A related problem is in land valuation, where there is
an urgent need not only for reference maps, but for a national valuation service to
assist in the efficient functioning of government agencies and in more efficient
collection of taxes.

Besides these problems which will be addressed directly in the project, there
are many land-related problems in which the solution should be substantially
assisted by an improved cadastral system. The problems stem from the
unprecedented rapid economic development in Thailand during the past two
decades, accompanied by an annual increase of 4 per cent in the area under
cultivation and, consequently, a shortage of additional land suitable for
agriculture. The problems, which affect both rural and urban sectors, include
inappropriate land use classification, increasing numbers of landless, increasing
numbers of tenants especially in rural areas, illegal cultivation in RTG reserves, a
high rate of squatter settlement, and increasing soil erosion and general
environmental degradation.

The World Bank has noted that security of tenure can be a major incentive for
on-farm investment and improve the access to institutional credit, leading to
increased agricultural productivity; it also encourages conservation and sustained
yield maintenance.

Components of the Programme

The programme will be carried out by the Department of Lands, a long
established department of the Ministry of the Interior. The implementation phase
will concentrate on building up the capabilities of the Department through
introduction of improved methods, provision of new buildings and modern
technology, overseas technical aid, and a modest increase in manpower. The new
systems will cover Thailand province by province, with high priority given to
provinces designated as poverty areas, and where there is a high proportion of
undocumented land.

The programme will include the following components:

(1) establishment of major and minor control networks based on the geodetic
UTM reference system, to supersede the existing 29 cadastral coordinate
systems;

(2) cadastral mapping at a scale of 1 : 4000 based on rectified photomaps and
incorporating all land parcels. In villages or other areas where land parcels
are small, the mapping will be at scales of 1 : 2000 or 1 : 1000;

(3) a programme of survey, adjudication and issuing of title deeds for land held
by certificates of utilisation and undocumented land. The programme will
cover the whole country within 20 years;

(4) development of the National Valuation Authority to undertake the task of
collecting and disseminating land valuation maps and information. The aim
is to provide complete and reliable information on land and building values,
to assist government to achieve greater efficiency in tax collection;

(5) production of urban cadastral mapping based on rectified photomaps
generally at a scale of 1 : 1000, but at 1 : 500 where appropriate. The
objective is to replace existing maps which are out of date, incomplete and illegible;

(6) a programme of technical aid and training including short and medium term visits by overseas experts and short, medium and longer term training visits to overseas countries by Department staff;

(7) decentralisation of land titles from each Land Office to the relevant district Land Offices;

(8) an organisation, management and operations review, to investigate possible overcentralisation and to ensure that the Department of Lands can bear the burden of its increased responsibilities in the 1980s and 1990s; and

(9) a building programme including new buildings in Bangkok, upgrading district Land Offices where necessary and provision of strong rooms for safe storage of documents.

The Project

The possibility of obtaining World Bank assistance for a land titles project in Thailand was first discussed by officials of the Royal Thai Government (RTG) and World Bank in 1981. A project identification mission visited Thailand in November of that year, sponsored jointly by the World Bank and the Australian Development Assistance Bureau (ADAB). The mission's brief identified the major components of the project. Further discussions followed in 1982, and a project preparation team worked in Thailand from December 1982 to February 1983, assisting the Department of Lands in preparing a proposal to the World Bank. The four-man team, two consultants in surveying, one in valuation and one in economics, was sponsored by ADAB. The proposal was submitted in February 1983 and was immediately analysed by an assessment team of World Bank experts, assisted by consultants. It is expected that the World Bank decision will be known early in 1984.

The proposal seeks World Bank assistance for the five-year implementation period of a programme scheduled to run for 20 years. The estimate of costs is in excess of $100 million (U.S. dollars) though this may be reduced somewhat by agreement between the parties. It is a general rule that the recipient country contributes more than 50 per cent of the costs. In this case it is also expected that ADAB will make a substantial contribution, covering particularly the costs of technical aid, including expert advisors.

The proposal, which is the result of very close consultation between the World Bank, ADAB, the Department of Lands and their consultants, embodies a firm philosophy on the type of aid needed. The main aim is institution building in which the capabilities of the Department are enhanced so that it is able to undertake the required task on its own. This is in marked contrast to the "RIRO" syndrome (Rush in—Rush out) which has frequently marked foreign aid projects in the past. In a typical RIRO project a task is accomplished, efficiently, but there is a minimum of consultation and little or no transfer of expertise or technology.

The project has also been carefully designed so as not to replace the existing system by an unknown new one, but instead to shift resources to one of the existing sets of procedures. Modifications will then be made during the
implementation phase. The legal framework has been left unchanged and only the minimum amount of new technology has been introduced, in processes where it is needed to overcome bottlenecks. It is considered that introducing completely new procedures, new legislation and new technology, all at once, would be a blueprint for disaster.

BACKGROUND

Physical Features

Thailand has an area of 513,000 square kilometres. It can be divided into four regions, as shown in Figure 1. The flat, fertile Central Region contains the valleys of the Chao Phraya and other rivers and is an important rice growing area. This region is largely responsible for the fact that Thailand is second only to the U.S. as an exporter of rice. It is bounded on the west, north and east by mountains. The Northern Region includes a greater proportion of forest-covered mountains, with fertile valleys between them. Like the Central Region, the North-eastern Region comprises a large plain surrounded by mountains, but in this case the rainfall is lower and more variable, affecting the agricultural production. The Southern Region, comprising part of the long narrow peninsula connecting Thailand to Malaysia, is well watered but largely covered by jungle.

In all, approximately half of Thailand’s area is flat land, and it is worth noting that most agricultural land and practically all urban areas are in this flat portion.

Agriculture

Thailand has a population of 47.8 million, 82.5 per cent of which is located in rural areas. Of the urban population, the majority (63 per cent) live in the main city, Bangkok. The agricultural sector currently employs over half of the labour force, contributes nearly 30 per cent of gross domestic product and accounts for 60 per cent of exports. Agriculture production grew at an average rate of 5 per cent in the decades 1960–80. This was accompanied by an expansion in the area of cultivated land, particularly into areas legally classified as forest reserves. The increases in production and in cultivated area are both slowing down. It is likely that future production growth will have to depend more on yield improvement and increasing cropping intensity.

Department of Lands

Property law governing dealings in private land is contained in the Civil and Commercial Code (1932). However, the Land Code (1954) contains the main legal provisions covering tenure and administration of land. Under this Code the Department of Lands is responsible for all cadastral surveys, including subdivision, for maintaining the land registers and for issuing land title documents.

The Department of Lands, with headquarters in Bangkok, has provincial Land Offices in all 73 provinces (changwats) and district Land Offices in the 674 districts (amphurs). Its staff totals more than 11,000, not including casual field staff. Of the total, 3,000 are surveyors who hold either a three-year or a five-year qualification from a technical college. There are only about 20 university graduates in engineering or surveying, though the Department employs over 500 law graduates.
Fig. 1. Thailand. Location and Regions.
TABLE I. Land ownership in Thailand.

<table>
<thead>
<tr>
<th>A. State Land</th>
<th>Million Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Land (administered by Royal Forestry Dept.)</td>
<td>26.0</td>
</tr>
<tr>
<td>Government Real Estate (Treasury Dept.)</td>
<td>1.7</td>
</tr>
<tr>
<td>Public domain (Dept. of Lands)</td>
<td>3.0</td>
</tr>
<tr>
<td>Other</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total State Land</strong></td>
<td><strong>31.2</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Private Land</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Held under title deed</td>
<td>3.0</td>
</tr>
<tr>
<td>Certificate of utilisation</td>
<td>10.5</td>
</tr>
<tr>
<td>Undocumented</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Total Private Land</strong></td>
<td><strong>20.1</strong></td>
</tr>
</tbody>
</table>

**Land Holdings**

Analysis of land holdings in Thailand (Table I) indicates that over 60 per cent of all land is held by the State. A large proportion of this (83 per cent) is Forest Land, administered by the Royal Forestry Department. This land is not included in the present project.

The remaining State Land is used by various government agencies, or for educational, military, local government or other purposes. It is intended, as part of the present project, to bring all these parcels of land into the registers.

Private land can be divided into three categories:

1. land held by title deed (NS4) (15 per cent). Title deeds are based on a full survey and adjudication;

2. land held by certificates of utilisation (NS3 and NS3K) (52 per cent). Although in some circumstances these are negotiable documents and can be used for mortgages, they have limited legal standing. The plan consists of a sketch based on rudimentary survey (NS3); or identification of boundaries on an unrectified photograph (NS3K); and

3. undocumented land (33 per cent). Some of this land is held on the basis of pre-emptive or claim certificates; some without any documentation, though the occupiers may have a legal claim to the land.

During the project, all these parcels of land will be brought onto the registers, surveyed and adjudicated where necessary, and title deeds issued.

**The Existing Cadastral System**

Since many of the procedures adopted in the project are modifications of existing procedures, it is relevant to review the existing system.

**Land Offices**

As stated, the two major forms of documents, which are both negotiable and can be registered, are title deeds and certificates of utilisation. All transfers and
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dealings of land titles for a province are carried out and recorded in the provincial Land Office. In a similar manner, all transactions concerning certificates of utilisation are carried out in the district Land Offices. There is no common index or reference which connects the two registers, even though the provincial and district registers cover the same areas. This problem of having two unconnected registration systems is one of the problems in the Thai cadastral system. However, many titles cover land in urban areas near the provincial Land Office, whereas most certificates of utilisation are in rural areas near the district Land Offices.

Within each provincial and district Land Office, there are various indexes and records supporting the registration system, in addition to the actual title documents, as follows:

1. a proprietorship index showing the proprietors of all land titles or certificates, listed alphabetically in the province or district;
2. a dealing file for each parcel, consolidating all dealing documents from initial adjudication onwards, in chronological order;
3. a survey file giving all survey and subdivision information for each parcel; and
4. a series of official cadastral plans covering the province or district.

Within the above system, conveyancing operates relatively smoothly and efficiently. In general, most transactions can be completed in less than a day unless they are dependent upon cadastral surveys.

Control for Cadastral Mapping

As in most cadastral systems, one of the major problems in implementation is the work and effort involved in carrying out the associated cadastral surveying and mapping. In this regard, the Department has developed a range of different cadastral survey procedures over the years to meet its needs. There is no private cadastral survey profession in Thailand, all cadastral surveys being the sole responsibility of the Department of Lands.

The geodetic control network and basic topographic mapping in Thailand is the responsibility of the Royal Thai Survey Department (RTSD), which traces its origin to a small unit established in 1873 by King Rama V. The first order control network consists at present of 362 triangulation stations together with 200 first order traverse stations. The network includes 66 Laplace astronomic stations, 60 Doppler satellite stations and a large number of gravity stations. The geodetic coordinates are based on a 1975 adjustment. The RTSD has also surveyed a large number of second and third order stations as control for topographic mapping.

The geodetic control was established on the pattern of the Survey of India geodetic network. It was made up of geodetic chains which formed a grid, with areas inside the grid which were not covered. Generally the chains ran along the mountain ridges. This was unfortunate as it meant that geodetic control was generally not available on the flat plains, where the centres of population and agricultural activity were located, and where the major activity for the Land Titling project will occur. For mapping, the RTSD uses the Universal Transverse Mercator projection which covers Thailand with two zones. The country is
covered by basic topographic mapping at 1:50,000, with 830 maps on a 15' × 15' format. Some topographic mapping is carried out at 1:25,000 and 1:12,500 in urban areas.

Since 1903, the Department of Lands has been carrying out cadastral surveying and mapping for land titles. At that date, there was no overall geodetic network in existence so a set of local systems was established, similar to the system in New Zealand. These systems are still used for cadastral mapping. There are 29 local systems, each with its local origin and each covering one or more of the 72 provinces. Initially, the origins chosen were prominent local points but in systems established later, an intersection of geographical graticule lines was selected for the origin. The systems are based nominally on Spherical Rectangular (Cassini) coordinates.

The control for cadastral surveying was extended from each origin by traverse loops measured with theodolite and steel tape. Control stations consisting of buried, numbered concrete blocks are placed about every 500 m. Azimuth control is determined by solar observations about every 10 km. Loop was added onto loop so that, even though the traversing was to a good standard, serious errors accumulated. The theoretical formulae are available to transform the local spherical rectangular coordinates to UTM on the national system. But the resulting positions are not reliable because of discrepancies in the positions and, particularly, the accumulation of traverse errors. Position discrepancies of up to 80 m are common.

**Cadastral Surveys—General**

Thailand has continually re-assessed the performance of its cadastral survey system over the years and where the system has been found wanting, it has been flexible enough to change direction accordingly. The primary objective has always been to meet the needs of its people and its developing economy. As mentioned, the Department of Lands first commenced carrying out cadastral surveys for land titles in 1903, using fully computational ground survey techniques based on coordinated traverse networks observed with theodolites and chains. From 1954, surveys for land titles were classified as first and second class cadastral surveys. The first class surveys were based on the existing computational techniques. The second class surveys were introduced to speed up the process of issuing land titles. These surveys use graphical techniques in conjunction with coordinated traverses. In 1962, the use of rectified aerial photomaps at a scale of 1:4000 was adopted for use with second class surveys to further increase productivity. Since 1967, the Department of Lands has computed all first class surveys in Bangkok on a central computer, with all derived plans being prepared by a computer-driven flatbed plotter.

Surveys for NS3 certificates of utilisation were introduced in 1954 and were based on simple, isolated tape surveys. To increase the output of certificates of utilisation, the system of NS3K certificates was introduced in 1972. These certificates are based on unrectified aerial photomaps at an approximate scale of 1:5000. This system has been so successful that the Department of Lands has adjudicated, surveyed and issued over 7 million NS3K certificates for land parcels in the last ten years—a number approximately equal to the total number of land parcels in Australia.
One of the most important aspects of the land tenure system in Thailand concerns the use and possession of land in order to retain ownership or legal interests. Consequently, the physical boundaries of parcels in general define the legal boundaries, following the "general boundary" approach. Based on this fundamental principle, the use of aerial photography has proved very successful and has permitted Thailand to introduce a successful land registration system for much of the country. The following is a description of the various cadastral survey methods adopted by the Department of Lands.

Fig. 2. Cadastral map for Land Titles based on First Class Surveys, and plotted by computer—Scale 1:4000 (reduced). Large circles indicate stations of tape traverse.
Cadastral Surveys for Land Titles (NS4)

As stated previously, there are two categories of cadastral surveys for land titles: first and second class. The majority of existing first class surveys are in urban areas. Most individual surveys for subdivisions in urban areas, including Bangkok, are first class surveys. At present first class surveys comprise only about 10 per cent of systematic surveys for land titles. These systematic surveys are usually carried out in areas where sufficient cadastral control can be provided.

Present methods for systematic cadastral surveys are relevant to the land titling project. They are usually undertaken in rural areas where it is intended to issue titles for at least 800 parcels. The field work is carried out by teams of surveyors and adjudicators based in Bangkok. Once a decision is made to prepare cadastral maps for the issue of land titles, an announcement is made in the Royal Gazette 12 months in advance. Notices are posted in the respective districts and villages 30 days before the survey.

The procedure for producing systematic first class surveys is as follows:

(a) boundaries are adjudicated, adjudication documents are signed by all adjoining owners and numbered concrete blocks (100 mm × 500 mm) are placed at each corner;

(b) all boundary corners are surveyed by radiation from the control traverse using theodolite and chain;

(c) all calculations are checked in the field. The final calculation is done in Bangkok, where the cadastral map is plotted by computer (see Figure 2); and

(d) the final plan is checked in the field; certificates of title are prepared and issued by a temporary field office set up for the systematic survey.

Second class surveys comprise approximately 90 per cent of systematic surveys for land titles. Within this class, approximately 80 per cent are based on rectified photomaps at 1 : 4000 in rural areas and 20 per cent on traverse and tape surveys at 1 : 1000 in village and urban areas. The survey process based on rectified photomaps is as follows:

(a) photography is flown at 2,300 m altitude with a wide angle camera, resulting in a photo scale of 1 : 15,000. The photography is flown with 2 km between flight lines, and 80 per cent end lap and 42 per cent side lap. No signalisation of boundaries or other control points is carried out in the field;

(b) four horizontal control points are determined by ground methods from the cadastral control. Occasionally, photogrammetric control is determined using aerotriangulation techniques—the Department owns the necessary equipment and has access to an efficient block adjustment program for this purpose;

(c) rectified photomaps are prepared at 1 : 4000 on a 500 mm × 500 mm format, representing 2 km × 2 km on the ground. It should be noted that virtually all the legally developed land in Thailand is relatively flat and is consequently ideally suited to the use of rectified photomaps (see Figure 3); and
(d) the photomaps are used only for issuing land titles in those areas where the physical boundaries of each parcel are clearly visible on the photograph. In such cases, the adjudication process and marking of corners is as described previously. Boundaries are measured, but angles are not measured. In the presence of all adjoining owners, the boundaries are marked on the photomap and on a transparent overlay. Corners and corner numbers are also marked on the photomap. Areas are determined graphically.

In locations where the boundaries are not visible from the photomap, the surveys are carried out based on the co-ordinated traverses, but only tapes and optical squares are used—sometimes only the tape is used and the triangle survey method is adopted. The cadastral map is plotted at 1:1000 to 1:4000, depending on the size of parcels and amount of detail. Areas are calculated graphically. Individual surveys for updating the cadastral maps of land titles are carried out at the provincial Land Office. These offices usually have a large staff of surveyors who are mainly involved in performing surveys for the subdivision of land and the redefinition of boundaries.

In general one survey field party, consisting of two surveyors, one adjudicator and support staff, can survey second class surveys of 150 parcels per month for seven or eight months per year.

Cadastral Surveys for Certificates of Utilisation

The issuing of certificates of utilisation (NS3) was phased out after 1972 in favour of the photogrammetric methods used for NS3K certificates. Adjudication of boundaries, measurement of boundaries (not angles), marking of corners and the preparation of certificates, however, were the same as the process for issuing NS3K documents. The major difference was that the boundaries of NS3 parcels were not charted or plotted on any overall plan; each parcel was measured in isolation. Along with NS3K documents and maps, all documents relating to NS3 certificates are kept in district Land Offices, as distinct from land titles, which are kept in provincial Land Offices.

The vast majority of NS3K certificates are issued as a result of systematic survey. Approximately 80 per cent of such certificates are issued on the basis of an enlarged aerial photograph at an approximate scale of 1:5000—the same photography is used as for the issue of land titles. Each photomap covers an area of 2 km × 2 km, which can be located on the 1:50,000 topographic map series. As with land titles, the method is only used where boundaries are plainly evident on the photograph (see Figure 3). These systematic surveys are performed similarly to surveys for land titles. One difference is that it is the landholder’s responsibility to mark boundary corners with wooden stakes or posts. In rice paddy areas the farmers rarely mark the corners, since they accept the dyke as the boundary. To them it is significant that they have seen the surveyor measure the boundary and mark the boundary on a transparent overlay of the photomap. Approximate areas are determined graphically.

In 20 per cent of cases where boundaries are not visible on the photomap (usually in villages), isolated ground surveys are carried out using tape methods only. The surveys are not based on any control. These surveys are related to the photomap by comparison of details on photographs and on the ground to get
position and shape of parcels. No theodolites or compasses are used; the map is simply built up by measured triangles. All other procedures are as previously described. In the village areas, posts are usually placed at corners unless a physical monument already exists. These isolated surveys are plotted on transparent sheets, which are attached to the 1 : 5000 photomap on which the parcels are located.

_Cadastral Surveys for Government Land_

For Government land, all the survey methods previously described have been used to issue documents, the one major difference being that all corners are
permanently marked with concrete posts. These documents are kept in either district or provincial Land Offices, depending on which survey method was used to prepare them.

The previously described cadastral survey methods generally relate to rural and village areas. The larger urban areas, and particularly Bangkok, have developed particular problems. Even though subdivisions have been carefully surveyed and recorded in these urban areas, they have generally not been charted on the cadastral maps. These are now 30–50 years old, in the case of Bangkok. The map series are also incomplete and often damaged or illegible. The Royal Thai Government recognises that a comprehensive series of urban cadastral maps is an essential requirement for compiling land tax rolls, and for orderly land use planning and land administration. Such a map series is also necessary for the Department of Lands as the basis of the title registration system. Availability of such maps will in turn improve the conveyancing system and assist the land market.

(to be continued)