



***PHILIPPINES-AUSTRALIA LAND
ADMINISTRATION AND MANAGEMENT
PROJECT***

**CADASTRAL SURVEYS,
LAND PARCEL MAPPING,
LAND RECORDS DATABASE,
&
ONE STOP SHOP
AS PART OF ACTIVITY 21**

DECEMBER 2002

REPORT C10

**Philippines Australia - Land Administration & Management Project
Prototype Implementation Office I
Province of Leyte**

TABLE OF CONTENTS

1 Executive Summary	1
1.1 Objective and Scope of Prototype 1	1
1.2 The Project Area	2
1.3 Defective Surveys	2
1.4 Recommendations	2
2 Cadastral Surveys	6
2.1 Existing Cadastral Survey Operations	6
2.2 Cadastral Survey Project Key Activities	8
2.3 Output Documents of Cadastral Projects	10
2.4 Problems and Issues related to Cadastral Project Documents	11
2.5 Cadastral Survey Tendering System	12
2.5.1 Objectives in Procurement of Cadastral Surveyors	12
2.5.1 Procurement Process for Cadastral Surveyors	12
2.6 Potential Issues for Review	13
2.7 Cadastral Surveying by Contract vs. Administration	14
2.7.1 Overriding Concerns:	14
2.7.2 Issues Related to Administration and Private Contract Projects	15
2.7.3 Field Innovations Supporting Cadastral Surveys.	19
2.8 Procedural guidelines for validating old cadastral projects	20
2.8.1 The Value of Validating Old Surveys	20
2.8.2 Office Preparation	21
2.8.3 Conduct of Preliminary Validation	21
2.8.4 Final Validation Survey	22
2.9 Survey Records	23
2.10 International Review of Alternate Survey Options	23
2.11 Evaluation of GPS Trial for Cadastral Surveys	23
2.12 EDM Bases and Equipment Calibration	23
2.13 Records Management	23
2.14 Defective Surveys	23
3 Cadastral Index Maps (CIM)	23
3.1 CIM Formate	23
3.2 Manual Drafting	23
3.3 Digital CIM	23
3.4 Scanning and Vectorising	23
3.5 Quality Assurance (QA)	23
3.6 Orthophoto Maps	23
3.7 CIM Manual	23
3.8 Land Records Database	23
3.9 Geographic Information System (GIS)	23
3.10 Lessons Learned	23
4 Training and Workshops	23
5 One Stop Shop (OSS)	23
5.1 The OSS Development	23
5.2 Implications for LAM Program	23
5.3 Issues in Developing OSS Operations:	23
5.4 Activity Steps for OSS Development	23
5.5 Workshops	23
5.6 Document Tracking	23
6 Linkage Development in Support of LAMP	23
7 CIM and Cadastral Unit Costs	23
7.1 CIM Unit Costs Methodologies	23
7.1.1 CIM sheets on barangay boundaries	23
7.1.2 Technology used	23
7.1.3 Calculation	38
7.2 Cadastral Survey Costs by Administration	38
7.3 Cadastral Surveys by Contract	40

8 Major Concerns	23
9 Recommendations	23
Annex 1 International View of Alternate Survey Options	23
1 Introduction	23
2 Survey Methods Identified	49
2.1 Traversing	23
2.2 GPS	23
2.3 Orthophoto Maps and Imagery	23
2.4 Alternate Methods Requiring Dense Control	23
2.5 Recommended Alternate Cadastral Methods	23
2.6 The LAMP Partnership Building Seminar and Workshop	23
2.7 CIM by Alternate Methods	23
2.8 Examples of Alternate Survey Methods	23
Annex 2 Evaluation of GPS Trial for Cadastral Surveys	59
1 Evaluation of GPS Trial for Cadastral Surveys	23
1.2 Pilot Overview	23
1.2.1 Pilot Aims	23
1.2.2 Techniques to be Tested	23
1.2.3 Proposed Methodology	23
1.2.4 Proposed Evaluation	23
1.3 Conduct of Pilot	23
1.3.1 Field Inspection & Selection of Points	23
1.3.2 Initial GPS Results	23
1.3.3 Final GPS Results	23
1.3.4 Costing	23
1.4 Conclusions	23
1.5 Results	23
Annex 3 CIM Formate	69
1.1 Cadastral Index Map (CIM)	23
1.2 CIM Scale and Numbering	23
1.3 CIM Parcel Lot Numbering	72
Annex 4 Adviser Terms of Reference	23

1 Executive Summary

This report is an integrated report covering the Terms of Reference for the International Land Parcel Mapping and the National Survey and Mapping Advisers.

*Also see **PA-LAMP Cadastral Survey & Mapping Report of June 2002 for Prototype 1 Leyte.***

Considering the way in which this report is written and that it mainly deals with concerns and recommendations for LAM Program, the recommendations need to be read in conjunction with the entire report.

1.1 Objective and Scope of Prototype 1

The objective of this prototype is to assist in the development, training, testing and documenting of procedures and methods for mapping land parcels prior to land titling, during systematic land titling and at the time of land registration in order to support the overall first time issuing of land titles.

These are main types of production activities:

- *Cadastral surveys of untitled lands and the production of cadastral maps;*
- *CIM and making of cross indexes to control duplicate land titles and for other administrative purposes;*
- *Testing of systematic titling processes;*
- *Issuance of titles;*
- *Integration of the new records into the ROD, streamlining of land registry operations to maintain quality of land register documents and better exchange of land information between related agencies of government.*

In addition, there is a strategic process of developing a national plan for improved management of land ownership related records. This will be based on the lessons learnt from this Prototype, and also from the urban activities in Quezon City in the Prototype 2, and will also link with the implementation of the BOO Project.

The project followed a Bridging Project that instigated the procedures that are in place, but these would be modified and tested to obtain standard tested procedures that would be suitable to implement throughout the Philippines in Rural and Urban situations.

1.2 The Project Area

The CIM produced within the project area is listed in the table below.

Municipality	Total No. of Brgys	Total No. of CIM	Total No. of CCIM	Total No. of Parcels Plotted
San Miguel	21	65	21	3,750
Dagami	48	49	47	9,741
Palo	10	25	29	3,567
Pastrana	26	32	29	4,356
Alang-Alang	14	27	40	1,793
Sta. Fe	-	-	-	-
Total	119	198	166	23,207

The CIM unit has been productive as seen by the above table and can be considered a success in "Hand Drawing" of CIM.

1.3 Defective Surveys

The project must be aware of the problems found with cadastral surveys within the prototype area, the table below gives an indication of what is to be expected if the same situation is to occur in other areas within the Philippines. Investigations must occur before surveys are accepted for titling.

MUNICIPALITY	NO. BRGYS.	DEFECTIVE BRGYS	STATUS	% DEFECTIVE
Sta. Fe	20	20	For re-survey due to non-conformity of lots as reflected on the CIM with that on the ground (80% not monumented).	100%
Palo	35	13	For validation.	37%
Pastrana	29	28	For re-survey due to defective control.	97%
Dagami	65	1		1.6%
Alang-Alang	54	Nil	For political boundary delineation.	Nil
San Miguel	21	Nil	Completely surveyed.	Nil

1.4 Recommendations

The main recommendations for the LAM Program are:

- The way in which the metes and bound are presented in any documentation and survey plans be changed to the international convention, ie 265°35' not N85 35E for modern equipment read 265°35' and N85 35E needs to be

calculated. This is a left over from the period early last century where some horizontal circles in the instrument (transits) were by quadrant;

- *A specialist consultant be engaged to review the academic sector and recommend changes into the curriculum so that the new graduates have a more in-depth knowledge of modern and relevant survey methodologies, this is vital for the future LAM Program;*
- *A governing body established similar to the various Surveyors Boards' found in the various states in Australia, that has teeth that will ensure that the surveying profession adheres to its code of conduct and its registered surveyors comply with the laws related to cadastral surveys and maintain their competence in all aspects of surveying with rigorous Continued Professional Development and to ostracize those who flaunt the laws and professional conduct;*
- *Thought be given that when LAM Program starts, the project buys many total stations and trains perspective small practitioners to use the equipment correctly. Then allow these small practitioners to participate in the bid even though they don't have the equipment that is specified in the bid documents, and allow them to rent or rent purchase them at a lower cost (due to bulk buying). In this way it is possible to upgrade the professions capabilities;*
- *Intensive program to ensure that the records management system of all agencies is standardised and that the valuable records do not deteriorate any further so that they may be used when required and easily found;*
- *Implement a Standard Cadastral Map Sheet;*
- *The verti-plan storage system should be introduced ie specially designed map storage cabinets;*
- *All survey field notes need to be bound with hard covers and either plastic or metal fastener and Duplicate copies need to be filed separately;*
- *The survey division should start updating land classification maps.*
- *Produce consolidated land classification maps by province;*
- *This information should be incorporated in the LAMP database so that titling will not occur in timberlands;*
- *Surveys Division research and obtain copies of all civil and military reservations;*
- *PIOI, CENRO, and the DENR Survey Division needs well defined supervision activities that ensure that there is no overlapping of activities and that all activities are succinct;*
- *Survey equipment needs to be updated to Total Stations,. Regional Offices must have extra equipment for critical needs and intensive training in their use and their applications in survey and mapping;*

- *Project Engineers and Party Chiefs of must be trained in the fundamentals of operation planning and project management with direct application to cadastral surveying functions;*
- *Organise a technical supervision group in the survey division of DENR to supervise project operations and to periodically make comprehensive evaluation of performance relative to project plans and resources;*
- *Institute a process documentation and evaluation system for cadastral surveys. Check deficiencies at an early stage;*
- *Make supervisors and or project managers accountable for deficiencies in project operations;*
- *Survey contracts need clauses that make them null and void if the contractors do not conform with the personnel and equipment as stated in their bid documents;*
- *A strong system of field verification and evaluation during project execution must be developed and applied;*
- *Provide a reasonable period for post project liability for the survey contractor;*
- *The implementation of the LAM Program needs to synchronize the cadastral survey system with land titling and registration operations;*
- *Suitable and accessible EDM bases, to recognized world standards, should be established within each region;*
- *Tribrach testers should be purchased and installed within each region and should be accessible to the general surveying community;*
- *As shown in section 2.14 the LAM Program should not accept the cadastral surveys but t investigate them first before even contemplating using the data for titling;*
- *Issues in Developing OSS Operations:*
 - *Defining the specific activity structure of OSS integrating mandates that are related to the LAM Program;*
 - *Formulate the activities of participating agencies;*
 - *Placing operating elements in the OSS to supervise execution of functional linkages;*
 - *Issue administrative guidelines defining the function and responsibilities of OSS operations;*
 - *Defining and issue directives to serve as specific guidelines for subordinates of participating agencies to take prompt action and cooperate in the service delivery for clients of the LAM project;*
 - *Developing a continuing in house training component to address competency/skill requirements for inter-agency related activities in LAMP;*

- *Activity Steps for OSS Development:*
 - *Synchronising program policy development of participating agencies:*
 - *Study land related programmes and projects of participating agencies to identify potential integration of activities. The national budget document may be analysed in connection with studies of the implementing land administration projects;*
 - *Study specific projects areas of the participating agencies and identify any conflicts and areas of complementation;*
 - *Formulate MOA's with participating agencies detailing their responsibilities and commitments;*
 - *Formulate a framework for cooperation in project implementation:*
 - *Study project components and activities to clarify linkages and duplicate services;*
 - *Transfer responsibilities to OSS with participating agency representatives with the OSS providing the key action linkages;*
 - *Issue directives from agency heads for compliance at project operations level.*
- *Formulate financial linkages:*
 - *Interlink financial planning between the agencies where there are dealings through the OSS;*
- *Design and implement HRD programmes for project management and operations administration. Specific linkages with both LGU's and NGO's need to be incorporated:*
 - *Formulate a 5 year HRD plan for both technical and management operations;*
 - *Synchronise the training modules for future requirements in project implementation in both cadastral surveys and land titling;*

The main recommendations for the existing operations are:

- *Survey software is procured (eg Geocomp or Civilcad) so that the prototype and DENR Surveys Division will be capable of analysing and utilising the survey data that is collected electronically;*
- *Additional time is allocated to a specialist (International or National) who has experience with Geocomp or Civilcad software especially in the cadastral environment; to train both the prototype staff and DENR Surveys Division in use of and monitoring the proceedings whilst the new contracts for surveys are being conducted. Without this monitoring and training the likelihood of the new cadastral surveys contracts will fail. The contracted consultants performing the surveys will be the only ones aware of how to manipulate and verify data captured in the field;*

- *Allocated time given to an International Consultant to review DENR Administrative Order No 98-12 and to rewrite the order into act, regulations and recommended guidelines and practices, prior to the commencement of the LAM Program. This should be done in consultation with the GEP and a parliamentary draftsman so as the wording of the new laws (if redrafted) is succinct;*
- *Further studies to identify if the surveying profession and community are acceptable to low accuracy surveys for low value rural lands when first titled.*
- *Time allocated for a study using a good quality digital camera for the archiving of documents and survey plans instead of scanning. This method was used for the survey plans on the AusAID funded SIISLAP project in the Solomon Islands with great success. This process is cheap and very fast, also it will only require one visit to the agency (except for data that is updated) and a digital image will be available for the encoding of data into the database and its verification;*

2 Cadastral Surveys

Unfortunately, the actual cadastral surveys for the titling of land parcels have not been ongoing due to the failure of the bid of last May; hence, no surveys have been undertaken whilst either of the International and National advisers has been active in the project. New bids were conducted in November and it is expected that they will commence in January 2003.

The execution of cadastral surveys is designed to achieve the following:

- To provide graphical information ie maps, which containing the land parcels shape and position in respect to other parcels for the adjudication and titling purposes;
- To obtain textual data dealing with landownership, metes and bounds, and information of adjoining landowners;
- To capture other land related information for administration purposes, ie isolated surveys.

2.1 Existing Cadastral Survey Operations

Categories of Cadastral Survey Projects are:

- **Municipal Cadastral Projects** This is a survey project that covers the entire municipality and composed of many barangays. It entails establishing municipal project control, and surveys of the municipality and barangay political boundaries;
- **Barangay Module Project** This project may include one or more barangays to be surveyed, including the political boundaries;
- **Public Land Subdivision Projects** This project may involve a portion or the entire municipality. This happens when funds are allocated; and the execution is that of a normal cadastral project. This is implemented when public lands are settled and the land claimants, as a community, decide to

have their claims formally surveyed, so the land adjudication process for titling can proceed;

- **Government Subdivision Survey Project** This project is similar to the Public Land Subdivision Project and undertaken the same way, but usually the area covered is smaller.

2.2 Cadastral Survey Project Key Activities

Activity	Purpose	Outcome
Posting of Public Notice and Information Dissemination	<ul style="list-style-type: none"> To ensure that the local officials and landowners residing in the project area or elsewhere are informed of the implementation of a cadastral survey project starting at a certain date 	<ul style="list-style-type: none"> Public awareness Readiness to cooperate in the project execution
Reconnaissance and establishment of Cadastral Project Reference Control	<ul style="list-style-type: none"> To provide a Survey Reference Network for the execution of lot surveys in the entire project area 	<ul style="list-style-type: none"> Acceptable density or distribution of geodetic control in the project area
Survey Notification and Sketching (SNS)	<ul style="list-style-type: none"> To obtain a graphical indication of the parcel to be surveyed. To document the agreement of parcel boundaries by adjoining landowners. 	<ul style="list-style-type: none"> An SNS Sketch showing the parcels and the adjoining claimants. Claimants and adjoining owners sign the SNS to indicate agreed parcel boundaries. A preliminary list of claimants is compiled at this stage
Monumentation of Lot Corners	<ul style="list-style-type: none"> To provide fixed and acceptable boundary marks of lot corners, which will be measured, and surveyed at a later date 	<ul style="list-style-type: none"> Lot corners marks established as agreed by the adjoining owners
Lot Surveys	<ul style="list-style-type: none"> To obtain position, area, and metes and bounds of the parcel for plotting and titling purposes. 	<ul style="list-style-type: none"> Cadastral Maps Cadastral Index Maps Metes and Bounds Validated data for the list of claimants
Survey Computation	<ul style="list-style-type: none"> To determine position, area, and metes and bounds of the parcel for plotting and titling purposes 	<ul style="list-style-type: none"> Traverse Computation Sheets Lot Computation Sheets Control Computations Computations for adjustment of the old surveys
Drafting of Land Parcels	<ul style="list-style-type: none"> To produce a cadastral map containing all relevant information of the land parcels and neighbouring natural features 	<ul style="list-style-type: none"> Cadastral Map Sheets Cadastral Index Maps Land use maps Barangay Boundary Maps Municipal Boundary Maps Project Consolidated Maps
Final Preparation of Survey Returns	<ul style="list-style-type: none"> To obtain the cadastral survey maps, computations and list of landowners per Barangay 	<ul style="list-style-type: none"> Transmittal letter Cadastral Maps List of Claimants Traverse Computation Books Lot Data Computation Books

Activity	Purpose	Outcome
		<ul style="list-style-type: none">• Adjustment of Old Surveys• Survey Control Computations• Barangay Base Maps
Political Boundary Surveys	<ul style="list-style-type: none">• To establish permanent marks on the Municipal, City and Barangay boundaries	<ul style="list-style-type: none">• Political boundary monuments• Political boundaries• Political Boundary Maps

2.3 Output Documents of Cadastral Projects

Document Prepared	Submitted To	Comments
Field Notes <ul style="list-style-type: none"> Control Survey Field Notes Traverse Notes 	Regional Surveys Division, DENR	<ul style="list-style-type: none"> Mostly hardcover bound but loosely packaged with some pages easily detached for frequent use Some are soft cover bound and are subject to damage Not all pages are properly filled out and cleanliness is a problem
Traverse Computation Sheets	Regional Surveys Division, DENR	<ul style="list-style-type: none"> These are either hard covered or soft covered, with some loosely tied with a tendency to be detached
Lot Data Computation Sheets	Regional Surveys Division, DENR	<ul style="list-style-type: none"> These are either hard covered or soft covered with some loosely tied and with a tendency to detach
Old Survey Adjustment computations	Regional Surveys Division, DENR	<ul style="list-style-type: none"> These are either hard covered or soft covered with some loosely tied with a tendency to detach
Solar Observation Computation Sheets	Regional Surveys Division, DENR	<ul style="list-style-type: none"> Only used when there is a need for azimuth checks in long traverses
Barangay Boundary and Index Map	Regional Surveys Division, DENR	<ul style="list-style-type: none"> This are on 54 by 54 cm drafting film, at a average scale of a 1:8000, usually no standardisation of drafting layout
Cadastral Map Sheets	Regional Surveys Division, DENR	<ul style="list-style-type: none"> These are 54 by 54 drafting film maps. Generally similar in outlook but will vary in lettering size for some detail depending on the office or contractor
Sepia Copy for each CM Sheet	Regional Surveys Division, DENR	<ul style="list-style-type: none"> This is submitted after the approval of the survey
15 blue print copies for each cadastral map sheet	Regional Surveys Division, DENR	<ul style="list-style-type: none"> This is submitted after the approval of the survey
Lot Description Form, 15 copies each	Regional Surveys Division, DENR	<ul style="list-style-type: none"> This is submitted after the approval of the survey
Operation Land Transfer overlays when directed per contract	Regional Surveys Division, DENR	<ul style="list-style-type: none"> In the period of Operation Land Transfer operated by DAR
Land Use Map with lot description forms	Regional Surveys Division, DENR	<ul style="list-style-type: none"> In the period of Operation Land Transfer operated by DAR
Municipal Boundary and Index Map	Regional Surveys Division, DENR	<ul style="list-style-type: none"> Cadastral Survey of the entire municipality
Consolidated Map	Regional Surveys Division, DENR	<ul style="list-style-type: none"> Barangay or Municipality. scale depends on their size
List of Claimants (both numerical and alphabetical lists)	Regional Surveys Division, DENR	<ul style="list-style-type: none"> To clarify the inventory of landownership claims of all lots in project
Geodetic Engineer Certificate	Regional Surveys Division, DENR	<ul style="list-style-type: none"> For administrative purposes
Public Notice	Posted on Public Places	<ul style="list-style-type: none"> For administrative purposes
Transmittal Letter	DENR	<ul style="list-style-type: none"> For records and administrative purpose
Barangays/Mayor's certificate	DENR	<ul style="list-style-type: none"> A clearance form to contractor for completing a phase of the contract

2.4 Problems and Issues related to Cadastral Project Documents

Problem Area	Observation / Implication	Recommendations
Non-Standard quality of drafting of Cadastral Maps Barangay Boundary Index Maps and Consolidated Maps, etc.	<ul style="list-style-type: none"> Map format, lettering, legend and information found outside the graticule are not standardised 	<ul style="list-style-type: none"> Implement a standard that is acceptable A sample Standard Cadastral Map Sheet shall be issued to the Geodetic Engineer and practitioners
Filing of maps	<ul style="list-style-type: none"> Map Sheets are normally filed horizontally in batches with metal fasteners which allows the maps to be easily torn or rolled in bundles 	<ul style="list-style-type: none"> The verti-plan storage system should be introduced ie specially designed map storage cabinets
Survey Field Notes	<ul style="list-style-type: none"> Are bound with thin covers and subject to tearing 	<ul style="list-style-type: none"> All survey field notes need to be bound with hard covers and either plastic or metal fastener
Security of Survey Records	<ul style="list-style-type: none"> All survey records submitted are in batches by barangay Both originals and duplicates are sent at one time, and being accepted and stored by the survey records clerk. 	<ul style="list-style-type: none"> Duplicate copies need to be filed separately Verifiers must have their own records safe boxes
List of Claimants, Traverse Computation Sheets and Lot Data Sheets	<ul style="list-style-type: none"> Most of these are loosely bound in soft covers, which allows easy tearing Data recording must be clean and legible 	<ul style="list-style-type: none"> Staff needs orientation in proper recording and binding of records.
Land Classification Maps	<ul style="list-style-type: none"> The Surveys Division does not have complete updated copies of LC maps There is a tendency to accept the L.C. boundary as submitted by the survey contractor Titles can still be issued for lots inside timberlands 	<ul style="list-style-type: none"> The survey division should start updating land classification maps. Produce consolidated land classification maps by province. This information should be incorporated in the LAMP database so that titling will not occur in timberlands
Civil and military reservations	<ul style="list-style-type: none"> Copies of the issued proclamations are not available in the survey division. Titles may be issued for lots inside civil and military reservations. 	<ul style="list-style-type: none"> Surveys Division research and obtain copies of all civil and military reservations.
Signatories on Map Sheets and other survey records	<ul style="list-style-type: none"> Often the CM sheet does not bear the name and signature of both the Cadastral Contractor and Chief of Party. The verifiers, computation personnel and cartographers may have their signature on the map sheets but not their printed names 	<ul style="list-style-type: none"> Ensure that all cadastral maps bear the names and signatures of the cadastral contractor and chief of party Staff in both government and private organisations who sign map sheets must have their full names printed below their signatures
Sketch Map Sheet	<ul style="list-style-type: none"> Sketch Map Sheet are not submitted to survey division but to the CENRO 	<ul style="list-style-type: none"> Submitted only to the Surveys Division for the verification of lot boundaries.

2.5 Cadastral Survey Tendering System

2.5.1 Objectives in Procurement of Cadastral Surveyors

To utilize the developed capability and technical resources of the private contractors;

To hasten the execution of cadastral projects in support of systematic adjudication and land titling;

2.5.1 Procurement Process for Cadastral Surveyors

Contracting cadastral surveys under LAMP strictly follows the technical and administrative guidelines issued and approved by World Bank. This is intended to ensure speedy, transparent and anomaly free process of acquiring the services of private contractors. The way that the bid documents were structured only allowed contractors with modern equipment and the acquired experience in these projects over the past five years to tender for the contract.

The previous bidding of nine modules in Pastrana was a failure. The modules were reopened for bidding in November of this year. The only difference from the previous documents is a slight modification in the bidder qualification requirements.

A World Bank representative held a one day workshop on the bidding process and documentation. The GE President of Region VIII and some private contractors objected to the qualifications for the five year period because few contractors would qualify due to very few cadastral projects being issued over that time.

The pre-bidding conference, which was held on 14th November, was only 4 days prior to the first bidding which was held on 18th November, with only one working day between. The issue was raised that only a small number of bidders participating due to time constraints. Bidding dates were 18th and 26-27th of November.

2.6 Potential Issues for Review

Item	Observation/Implication	Recommendations
Survey Project Scope: ie (Barangay Module vs Municipal Cadastral Project)	<ul style="list-style-type: none"> • Small barangay Modules allows small contractors but raises the problem of requiring intra barangay survey conformity and their adjustment. This would require more support service operators in CRS, Adjudication, field verification, monitoring and evaluation and project supervision; • Entire municipal projects attracts larger contractors but require extensive field supervision to avoid defective projects 	<ul style="list-style-type: none"> • Start training field adjudicators and verifiers to complement the survey teams; • PIO1, CENRO, and the DENR Survey Division needs well defined supervision activities that ensure that there is no overlapping of activities and that all activities are succinct.
Qualification of Bidder and Party Chief	<ul style="list-style-type: none"> • The 3 - 5 yr. experience requirement for party chief and bidder in cadastral surveys is a reasonable requirement, but due to the limited or inactive cadastral surveying market over the last 5 to 10 years. Therefore there maybe a shortage of qualified practitioners for the LAM Program. 	<ul style="list-style-type: none"> • The experience requirement can be supplemented with training in project planning and management in cadastral projects for geodetic engineers, who have at least 2 year experience in cadastral projects; • The former cadastral project party chiefs of DENR/BLM, and the former BLM surveys division chiefs are technically qualified and have experience in supervising cadastral projects
Prequalification vs post bidding evaluation and qualifications	<ul style="list-style-type: none"> • If numbers of projects are small and there are many potential bidders a post evaluation is reasonable but this raises the issue of adverse or favoured evaluation of either the winning bidder or the next lowest bidders. There is a tendency for the runner up in the bid to find ways of influencing the panel that there are certain aspects of the preferred bidder that may disqualify them. This is probable in LAM Program for a winning bidder to be disqualified and a non-winner to be qualified. Post bidding evaluation is a closed-door affair and subject to suspicion. 	<ul style="list-style-type: none"> • Prequalification and evaluation of potential bidders has the least chance for manipulation; • When the process is public and transparent the bidder is announced after the proceedings, therefore no adverse proceedings can occur.
Bid Security requirement for each project instead of each bidder for one project	<ul style="list-style-type: none"> • Requiring a bid security for each project entails securing a bid security for each project tended for. Small contractors are at a disadvantage; • Where small contractors secure bid securities for all projects, the number of bidders for other project being tendered is decreased. Competition is diminished and bid costs are usually higher. 	<ul style="list-style-type: none"> • Allow a bidder to secure only as many bid securities as the prequalification rules allow, ie if the bidder has equipment and personnel for two projects, then they can post only two securities and if that bidder is successful in securing two contracts then they are automatically disqualified for the remaining bids. In this way the small contractor can compete better with larger contractors.
Lowest Bid Criteria	<ul style="list-style-type: none"> • Sometimes the lowest bid is a disadvantage to government. The government estimate must be based on previous contracts and allow for a reasonable inflationary index. Very low bids can result in defective surveys. 	<ul style="list-style-type: none"> • Government estimates should be realistic; • Sliding cost scale of + or -5% of the government estimate should be maintained and all bids outside of this scale be rejected.

2.7 Cadastral Surveying by Contract vs. Administration

2.7.1 Overriding Concerns:

The Cadastral Survey Project under LAMP has 4 (four) key objectives:

- Prompt completion of the Cadastral Surveys and synchronise this with the implementation of the Systematic Land Titling and Registration Activities;
- To produce Cadastral Survey Records and Maps in conformity with Best International Practice;
- To achieve cadastral surveys at reasonable costs;
- To develop cadastral survey services that is acceptable to the community and is sustainable.

To achieve these objectives the planning process is critical. It demands rational decision making on the land administration system to implement projects effectively. The stumbling block in past has been the government budget and fund allocation system. This is more critical in administration projects. Low annual fund allocation resulted in Municipal Cadastral Projects on going and uncompleted for more than two decades. Examples are: Guian Cadastre of Eastern Samar, Palo Cadastre of 1979 in Leyte and Calbayog City of 1979 in Samar. Such overextended projects are anomalous, and the government is seen as insensitive to the public and is considered as inefficient and ineffective in finalising the projects. This results in high survey costs due to the extensive accumulation of administrative overheads. This has caused slow local economic growth.

The existence of the overextended cadastral administration projects is a reflection of the weak land administration mechanism and bureaucratic decision making. This makes opportunities in the development of social, technological and economic fields weak.

2.7.2 Issues Related to Administration and Private Contract Projects

2.7.2.1 Administration Projects

Issues	Observation	Recommendations
<ul style="list-style-type: none"> Annual fund allocation is not appropriate to serve effective cadastral operations 	<ul style="list-style-type: none"> Funds for personnel services are too limited; project management cannot hire critical staff to supplement project operations; Funds for consumables are limited for efficient field activities. 	<ul style="list-style-type: none"> Let project engineers/ party chiefs prepare realistic and comprehensive project operation plans that will be approved by management and strictly followed; Funding for personnel services and operation consumables need to be synchronized with the field activities.
<ul style="list-style-type: none"> Inappropriate expertise and skill requirements at the survey party level 	<ul style="list-style-type: none"> Often the Geodetic Engineers do not have the required skilled instrument men, computation personnel and, cartographers, etc. This can cause a delay in the final products. 	<ul style="list-style-type: none"> Strict composition of skilled personnel has to be provided with survey teams. Personnel performance, evaluation and training components need to be strengthened.
<ul style="list-style-type: none"> Lack of acceptable survey equipment 	<ul style="list-style-type: none"> Transits are normally found in the survey parties, which are old and prone to malfunction. 	<ul style="list-style-type: none"> Survey equipment needs to be updated to Total Stations, Regional Offices must have extra equipment for critical needs
<ul style="list-style-type: none"> Planning and supervision in the field is poor; Project management skills of project engineers and party chiefs is poor 	<ul style="list-style-type: none"> The field supervisors are not doing the planning and coordination of every day tasks because of their lack of knowledge in these fields 	<ul style="list-style-type: none"> Project Engineers and Party Chiefs of must be trained in the fundamentals of operation planning and project management with direct application to cadastral surveying functions.
<ul style="list-style-type: none"> Weak Regional Office supervision of the project 	<ul style="list-style-type: none"> DENR including CENROs' and PENROs' which have multi-sectoral responsibilities in land, forestry, environment mining and research; the situation is ineffective. In the LAM Program's expanded cadastral survey program this situation will be tragic. 	<ul style="list-style-type: none"> Organise a technical supervision group in the survey division of DENR to supervise project operations and to periodically make comprehensive evaluation of performance relative to project plans and resources.
<ul style="list-style-type: none"> Weak Monitoring and Evaluation System 	<ul style="list-style-type: none"> Monitoring and evaluation must relate to the approved cadastral projects' plan. This is not happening because of the absence a project plan or the inability of DENR to evaluate properly the progress of the project 	<ul style="list-style-type: none"> Institute a process documentation and evaluation system for cadastral surveys. Check deficiencies at an early stage.
<ul style="list-style-type: none"> Inability of management to provide corrective measures 	<ul style="list-style-type: none"> Problems identified relating to casual or contractual staff funding and other resources are often not addressed in due course 	<ul style="list-style-type: none"> Make supervisors and or project managers accountable for deficiencies in project operations

Issues	Observation	Recommendations
<ul style="list-style-type: none">• Cadastral Project Engineers are not skilled in the use of EDM's and Total Stations. They also are not knowledgeable in the conversion and transformation of cadastral surveys onto the PRS92 datum	<ul style="list-style-type: none">• The failure to adopt and adapt to new technology.	<ul style="list-style-type: none">• Modern instruments have to be acquired and intensive training in their use and their applications in survey and mapping

2.7.2.2 Private Contract Projects

Issues	Observation	Recommendations
<ul style="list-style-type: none"> Capacity in the administrative and technical supervision of private contracts Existence of “dummy” survey contractors and project personnel Post project liability for survey contractors Interfacing procurement of private contractors with the developed administrative capability and the systematic land registration activities 	<ul style="list-style-type: none"> Normally private survey contractors have the resources and capability to execute cadastral projects speedily but without effective supervision at the field level, they tend to apply shortcuts which often result in defective surveys. Testimonies to these are the projects in PIO1 eg Sta. Fe, Pastrana and perhaps half of Palo. Dagami has some barangays surveyed without their external boundaries not conforming to one another. Other regions may have the same or worse situations. Some financiers and large survey contractors use qualified GE’s as “dummy” contractors. Often these arrangements result in abandoned projects. Sometimes, defective projects are discovered only after the contractor has been paid The programming of cadastral surveys don’t necessarily serve the immediate requirement for systematic land titling and registration 	<ul style="list-style-type: none"> Contracts need clauses that make them null and void if the contractors do not conform with the personnel and equipment as stated in their bid documents; The government through their agent must have the power to sanction any contractor who does not adhere to the contract; A strong system of field verification and evaluation during project execution must be developed and applied; Project timeframes should be more liberal so that hasty completion of works is avoided. Make the use of independent verifiers; Strengthen monitoring and evaluation; Make sanctions as effective deterrents to be impressed on potentials contractors and their “dummies” Impose a strong field verification and evaluation using reliable and honest verifiers; Provide a reasonable period for post project liability for the contractor The implementation of the LAM Program needs to synchronize the cadastral survey system with land titling and registration operations.

2.7.2.3 Comparison between Private Contract and Administrative Cadastral Projects

Item	Administration	Private Contractors
Organisation	<ul style="list-style-type: none"> Recruitment is hampered by Civil Service Regulations, Bureaucratic Red Tapes and Limited Funding 	<ul style="list-style-type: none"> Better organized in terms of skilled and experienced personnel due to their better capacity to recruit promptly without bureaucratic red tape. Salaries are greater.
Equipment	<ul style="list-style-type: none"> Most are outmoded and not in pace with new technological development 	<ul style="list-style-type: none"> Business competition in the country forces them to adapt new technologies relatively quicker than government agencies
Financing	<ul style="list-style-type: none"> Greatly hampered by budgeting and auditing regulations; Poor project planning and management results in inadequate resource mobilization 	<ul style="list-style-type: none"> Regular contractors provide better project financing
Skills / Expertise	<ul style="list-style-type: none"> In the mobilisation and assignment of skills that government is at disadvantage 	<ul style="list-style-type: none"> Easily mobilise the correct skills
Track Record	<ul style="list-style-type: none"> Project are slow in completion; Very limited defectives projects given that a good complement in organization and prompt resource requirements for the projects; Administrative project can be completed on time. 	<ul style="list-style-type: none"> Projects are completed over a short period; There are many abandoned projects; There are many defective projects.
Cost of Projects	<ul style="list-style-type: none"> No reliable information on this aspect Over extended administrative projects tend to be very costly 	<ul style="list-style-type: none"> Abandoned and defective projects contributes to high survey costs
Supervision	<ul style="list-style-type: none"> Limited 	<ul style="list-style-type: none"> Critical
Sustainability 1 Financial 2 Administration and Management	<ol style="list-style-type: none"> Limited due to budget and auditing constraints Limited 	<ol style="list-style-type: none"> Contract process makes it sustainable Moderate

2.7.2.4 The Macal-piay Project Experience

The Macal-piay cadastral survey experience presents a very limited picture for the evaluation of a private survey contracts. While it is true that the project was completed, it lacked the extensiveness of the whole municipal cadastre with many phases of surveying activity experience. The coverage of Macal-piay was only for a single barangay with no political boundary surveys and the establishment of a cadastral project control.

Macal-piay was also the first experience with the application of the support activities in CRS, SNS, Adjudication and field verification. The Macal-piay project of a single barangay succeeded because of the administrative support from PIO1. The logistics required in this project from the contractor was minimal.

With future expanded cadastral operations, a whole range of input requirements from project resources, expertise, administrative supervision and local government responses will have to be tested. These could not be adequately tested and evaluated in the Macal-piay Contract Survey Project.

2.7.3 Field Innovations Supporting Cadastral Surveys.

These support activities in CRS, SNS, Field Adjudication and Verification serve as a quality check in the operations of the cadastral project. They address the weaknesses of the old cadastral survey process.

2.7.3.1 Customer Relations Services

CRS activity is designed to generate an understanding and appreciation of the objectives for the cadastral surveys. It provides the preparatory steps in mobilizing landowners to cooperate with the cadastral surveyors so that their lands are correctly monumented. The field adjudicators assist the landowners and the adjoining lot owners to agree on their common boundaries and in turn be correctly monumented. The CRS task is information, education and communication in the LAMP objectives, ie facilitates acceptance of the project at the field level.

2.7.3.2 Field Adjudicators

Identification of the correct landowner or claimant on the ground seems simple, but mistakes have occurred due to inability to obtain all information required. Claimants of land maybe:

- actual owner;
- an heir;
- occupant cultivator;
- agrarian reform beneficiary;
- tenant;
- overseer or administrator;
- or just a potential land grabber where the actual owners are not present.

The claimant or owner has to be identified properly. The adjudicator must be trained in this task, due to the survey leading to registration. The adjudicator also must be capable of settling minor disputes in land claims as well as lot boundary definition through mediation.

2.7.3.3 Survey Notification and Sketching (SNS)

The sketching and notification in the old cadastral survey process was a simple graphical freehand sketch of a parcel of land without measurements. Often lots are not oriented properly and the shape of the parcel was different than on the ground. Corner marks were not identified, which will lead to incorrect connections to lot corners.

The new SNS addresses these common problems. The preparation of SNS sheet is such that errors in incorrect connections to lot corners are practically eliminated. The process involves the measurement of the boundaries, identification of prominent physical features such as buildings relative to the boundaries. The SNS also bears the signatures of adjoining owners, adjudicator and Geodetic Engineer. The SNS sheet can be a legal document and part of the public records. Instructions in SNS preparation are documented.

2.7.3.4 Field Verification

The cadastral surveying process has three major steps:

- Field measurements and data collection;
- Processing of data into cadastral maps and lot information.
- Verification and approval.

The DENR management conducts office verification and approval while the first two tasks are the responsibility of the contractor. Errors are usually produced in the field measurements and data collection.

PIO1 is focusing on field verification to address the key sources of survey errors. The field verifiers are technically trained and experienced personnel who understand the field process and the usual source of mistakes and errors in surveys. Field verifiers function is that of inspectors for the cadastral field process and identifies errors at the source.

2.8 Procedural guidelines for validating old cadastral projects

2.8.1 The Value of Validating Old Surveys

To provide a QA on the old surveys that are subject to systematic titling, these were verified to be surveyed correctly by DENR. This has reference to observations and past experience that many old cadastral projects which were approved were improperly surveyed if not totally defective.

- Determine whether an old cadastral survey project requires correction or resurvey when there are reports of deficiencies in the survey.
- Determine whether an old surveys and political boundary data conform to existing adjoining projects currently being implemented or to be implemented in the future.
- Provide data for management decisions whether an old survey with deficiencies shall be considered for resurvey by contract.

- Determine whether adjoining or common lots to adjoining survey traverses were properly surveyed.
- Determine the correct position of lots abutting rivers, creeks, lakes or sea.

2.8.2 Office Preparation

2.8.2.1 Data Research

- Obtain a copy of the following cadastral survey records of the areas planned to be validated:
 - Barangay boundary index map
 - Cadastral map
 - List of claimants
 - Survey control data
- Obtain data from CENRO and PENRO on titled properties:
- Obtain data from Surveys Division on approved isolated surveys, subdivisions and amalgamation surveys.
- Check and validate the adoption or rejection of old approved surveys and titled properties within the approved cadastral survey map.
- Obtain a copy of the Land Classification Maps from CENRO, PENRO or DENR.
- Check the adaptation or projection of the land classification boundaries on the approved cadastral maps.
- Obtain a copy of the list of DAR related surveys and EPs and CLOAs issued from the DAR Regional offices.
- Investigate the background and related information on old surveyed lots which were not adopted in the cadastral survey.
- Check for the extent of water bodies within the cadastral map.

2.8.2.2 Data Analysis:

- Identify lots along adjoining traverses where common points were possibly measured from adjoining surveys.
- Evaluate when the rivers, creeks and roads vary in width and identify the surveyed lots immediately adjoining.

2.8.3 Conduct of Preliminary Validation

- Identify lots and owners (refer to list of claimants).
- Notify lot owner and adjoining owners.
- Locate lot corner boundaries in consultation with the owner and adjoining owners.

- Determine from the owners and adjoining owners whether the corners referred to are the same as originally surveyed. Note down discrepancies of information and verify their validity.
- Measure the boundaries using compass tapes or other methods
- Compare graphical results with the lot boundaries on the cadastral map.
- Record any discrepancies, and confirm the discrepancies with the owner and adjoining owners
- Document the findings in a report. The report will contain the percentage of defective lot surveys. Include recommendations based on the findings.

Note: Survey blunders will surface when a project is totally defective especially when the survey control and/or traverse are defective. There is no need for final validation, and the project can be declared defective and requires resurvey.

2.8.4 Final Validation Survey

When old cadastral projects appear to be correct but have accuracy levels near and below the acceptable closures, a final verification survey needs to be conducted.

2.8.4.1 Key Areas for Validation:

- Check lots along common boundaries of adjoining surveys;
- Check lots along common boundaries of barangays, municipalities and or cities;
- Check position of lots along either side of water and roads boundaries.

2.8.4.2 Activity Process for Final Verification Surveys:

- Notify lot owners of the validation scheduled; a minimum of five lots per day are to be undertaken;
- Start traverse from a reliable reference mark or control point and radiate the lot corners;
- Determine from the owners and adjoining owners whether the corners referred to are the same as originally surveyed. Note down discrepancies of information and verify their validity;
- Compare graphical results with the lot boundaries on the cadastral map;
- Compute the lot corners coordinates and compare them with original coordinates. Common difference shall result if survey is correct or there will be large variations if the survey is incorrect;
- During the validation survey gather relevant data about the lot owners/claimants which should coincide with the original list of claimants. Further investigation should be conducted if the owner/claimant is different;

- Submit a report on the validation results on a lot basis and then make recommendations.

2.9 Survey Records

The system of recomputing bearings/azimuths from eg 265° 25' to N85 25E is prone to typographical and conversion errors and should be abolished and cardinal bearings introduced.

Thought should be given to using a good quality digital camera for the archiving of documents and survey plans instead of scanning. This method was used for the survey plans in the Solomon Islands on the AusAID funded SIISLAP project with great success. This process is cheap and very fast.

Note if the survey plans are to be used for digitisation then an investigation should proceed to see if there are any differences in scanned and photographed (digital) products.

2.10 International Review of Alternate Survey Options

A study on International alternate survey approaches has been undertaken, see **Annex 1**

2.11 Evaluation of GPS Trial for Cadastral Surveys

See **Annex 2**

2.12 EDM Bases and Equipment Calibration

The existing EDM base at the University of the Philippines is inadequate for the proper calibration of modern EDM equipment and is not accessible to the broad surveying community across the entire country. Given the capabilities of modern survey equipment there is the need to properly and regularly calibrate EDMs over a 1 kilometre (7 pillar) base and a cyclic error base.

The optical plummet of a tribrach is critical for the centring of instruments, targets and antennae over ground marks. They must be kept in a state of adjustment and should be checked regularly. The best method of checking is with a tribrach tester.

It is recommended that:

- Suitable and accessible EDM bases, to recognized world standards, should be established within each region.
- Tribrach testers should be purchased and installed within each region and should be accessible to the general surveying community.

2.13 Records Management

Development in survey records management has not improved over the last 30 years or more, in fact the production of new records every year has caused greater pressure on records administrators to keep pace in storing, handling and servicing the public with information. Inefficiency, neglect and sometimes irresponsibility has caused the loss, destruction and deterioration of records. It seems that agency managers do not appreciate the importance of a well managed records system. This is reflected by the following conditions:

- Lack of budget to operate records administration;
- Inadequate space for records;
- Poor technically trained personnel in records management units;

- Lack of equipment and materials for records maintenance and reconstruction.

DENR

The inspection of the survey records in both Region 8 and NCR has the following common observations:

- Space used is too small for the volume of records in place, elevated racks and stands to the ceiling are fully stacked, small passageways are sometimes filled with records that are bound or bundled into sacs.



- The methodology of storage especially the survey plans leads to plans being folded, rolled and just pushed into what space is available, this leads to fast deterioration and defacing;
- There is no complete inventory of records;
- Deteriorating records are left to rot;
- Reconstruction of missing and deteriorating records needs to be prioritised;
- Training of records personnel is required;
- The records system lacks budget, equipment, materials, space and personnel;
- Inefficient records servicing is common especially when improperly kept and do not have an inventory;
- Significant volume of records are missing;
- Security copy of NCR records are kept in the same location;
- Filing system of maps and plans leaves much to be desired;

- Most records have no duplicate copies stored in another location, which poses a complete loss in case of fire.

DAR

The DAR survey records are limited compared to DENR. Basically they are mostly copies of surveys of lands covered by CARP, emancipation patents and political boundary surveys by LBM. The survey data is being transformed and projected into a spatial framework bounded by barangay and municipal boundaries to produce municipal and provincial index maps. The spatial data also includes CLOA's, land use information and surveyed lots under voluntary offer to sell and compulsory acquisition.

Note the system is primarily a LIS which can be incorporated into a GIS at a later stage; DAR at the time of interview had no data within the pilot area.

LRA

The records were sighted in LRA, and there is an attempt to have the records section updated, but this is only for records that are alive and then it is more cosmetic than anything else for the records are just put in more durable covers.



Yet where the older documents are archived, they are treated the same as elsewhere and just bundled up and deposited haphazardly where there is room.



It is unacceptable that records that are a countries heritage are treated in this fashion.

2.14 Defective Surveys

The table below shows the actual cadastral surveys within of barangays found to be defective within the project municipalities.

MUNICIPALITY	NO. BRGYs.	DEFECTIVE BRGYs	STATUS	% DEFECTIVE
Sta. Fe	20	20	For re-survey due to non-conformity of lots as reflected on the CIM with that on the ground (80% not monumented).	100%
Palo	35	13	For validation.	37%
Pastrana	29	28	For re-survey due to defective control.	97%
Dagami	65	1		1.6%
Alang-Alang	54	Nil	For political boundary delineation.	Nil
San Miguel	21	Nil	Completely surveyed.	Nil

As seen by the above table the **project must be aware** of what can happen with cadastral surveys. Not all of the above have been accepted as being correct by DENR, but no assurances can be taken if the survey is approved. By the personal experience of the Survey and Mapping Adviser who was a former Director of DENR, is to be aware! ***The LAM Program should not just accept what is taken as granted but to investigate the surveys before even contemplating acceptance and using the original data for titling no matter what the circumstances.***

3 Cadastral Index Maps (CIM)

There has been a remarkable improvement in the way that the CIM unit carries out the tasks allocated to them, given that the prototype is expanding in many directions and they must keep up with the expansion to enable all other sectors of the titling process to proceed smoothly. The unit is to be commended, considering the production problems encountered in the first two quarters of 2002.

The CIM unit not only produces CIM, consolidated barangay maps, scanning images for internal use and archiving, but also manages the database. This is an extremely important aspect of the whole titling system for database produces all textural information that the other units require so that the titling process can proceed. The resources that have been allocated tho the land records database is insufficient.

The following Table lists the CIM and Consolidated CIM (full barangay) production since inception of the Bridging Loan. Note that all CIM prior to May have been redrawn on the correct formate, so in essence the unit have produced 335 CIM but only 198 are usable due to the old formate and the CIM not crossing political boundaries.

CIM & Consolidated CIM Production prior May 2002 (Based on Old Forms)				
Municipality	Total No. of Brgys	Total No. of CIM	Total No. of CCIM	Total No. of Parcels Plotted
Pastrana	16	90		2,284
Palo	5	47		1,986
Total	11	137		4,270
CIM & Consolidated CIM Production as of November 2002 (Based on New Forms)				
Municipality	Total No. of Brgys	Total No. of CIM	Total No. of CCIM	Total No. of Parcels Plotted
San Miguel	21	65	21	3,750
Dagami	48	49	47	9,741
Palo	10	25	29	3,567
Pastrana	26	32	29	4,356
Alang-Alang	14	27	40	1,793
Sta. Fe	-	-	-	-
Total	119	198	166	23,207

3.1 CIM Formate

On every available occasion, the CIM formate was presented at workshops and the only problem that has been encountered is the use of the CIM. Once explained that the CIM is only an administrative map of land parcels that ties the parcel to the data in the database. Also is not the intention that the CIM will replace the projection maps held by the various agencies and supply technical information relating to the parcel boundaries; it was accepted.

See **Annex 3** for CIM formate.

3.2 Manual Drafting

The CIM section of PIO1 have demonstrated that they are well versed in the production of hand drawn CIM and can produce CIM for all requirements of the project within the required time frame of activities.

The unit has taken the initiative to ensure that extra personnel have been employed to enable the unit to respond to project demands.

3.3 Digital CIM

At the writing of this report the software MapInfo has not been purchase by the project; hence no digital CIM has been produced. It is envisaged that this task will be started in 2003 when

the National Survey and Mapping Adviser will be available to further train the staff in the use of the software and implement the first digital CIM.

3.4 Scanning and Vectorising

The project recently purchased a DesKan express large format scanner and Provec 3.5, which is software for editing, vectorisation and transformation of the raster data produced by the scanner. This scanner will scan up to A0 but in A4 strips. Some testing has been performed to ascertain the best resolution for scanning of all maps produced and the archiving of survey plans. The scanner head also fits into a separate A4 cradle so that normal A4 scanning can be performed.

The equipment when installed had only one hardware/software key, this makes the full utilisation of the package less than desirable. Either scanning or manipulation of the data can proceed separately, but not at the same instance. The project has undertaken to purchase another key so that scanning and data manipulation can be done simultaneously on separate computers, thus make best use of the package.

There is a need to investigate other software that is compatible in price to undertake the manipulation of the scanned data; this will amount to a saving of \$US1000 per unit if the equipment is recommended to be used in the LAM Program.

There has been a training course performed by the suppliers, of three days duration. All CIM were trained in the operation of the scanner but only two were chosen for the Provec training due to the limited computer knowledge of the other CIM unit personnel.

The scanning of CIM and consolidated plans has commenced, but no survey plans have yet been scanned for archiving or OSS purposes.

3.5 Quality Assurance (QA)

The incorporation of a vigorous QA system has been introduced in the CIM production. At every major point of CIM production QA has been incorporated, these are:

- on completion of the base sheet;
- on the completion of the plotting of lots, cadastral lot numbers and geographical features;
- on the completion of Unique Parcel Identifiers (UPI);
- on the completion of the Preliminary CIM;
- on the completion of the final CIM.

The QA is being applied and the results after some teething problems are commendable.

3.6 Orthophoto Maps

NAMRIA the contracted agency by the project to produce the orthophoto maps have not been able to meet their commitment in the delivery of the orthophoto maps. There is no firm commitment to when these will be completed, hence the International TA will be terminated at the end of 2002 but has been requested to return for one month in 2003 for the training of the staff in the production of CIM utilising orthophoto maps.

NAMRIA have commenced producing orthophoto maps, but it unknown when the full compliment will be delivered so that the further training and studies can commence.

3.7 CIM Manual

The CIM manual is constantly being updated with updated methodologies of CIM production and minor amendments to clarify certain points of production or additional points that will enable the unit to perform all tasks without TA involvement.

The manual consists of a main manual and attachments which deal with the various methodologies tested and used in CIM production.

The sections are:

- Procedure Manual For Urban and Rural CIM Production by Manual Drafting, this section contains a small section on the production from orthophoto maps the index is listed below:

1 Introduction

- 1.1 Manual Revision and Use*
- 1.2 PA-LAMP Objectives*
- 1.3 Cadastral Index Maps (CIM)*
 - 1.3.1 CIM Scale and Numbering*
 - 1.3.2 CIM Parcel (Lot) Numbering*

2 Agency Records Search

- 2.1 Background*
 - 2.1.1 Urban data Sources*
 - 2.1.2 Rural data Sources*
- 2.2 Transaction File Notification to ROD, DENR, LRA BIR, and LGU*
- 2.3 Records Search Process and CrossIndex Database*
 - 2.3.1 Assessor's Office Tax Map Records*
 - 2.3.2 Search DENR, LRA and CENRO Records*
 - 2.3.3 Search of ROD Records*
 - 2.3.4 Survey Plan Collation (Urban)*

3 Storage of Plans and Records

4 Orthophoto Map

5 Satellite Imagery

6 CIM Survey Control

7 CIM Compilation Procedures

- 7.1 Compilation of a CIM*
- 7.2 CIM Base Preparation.*
 - 7.2.1 Drafting Specification Standard*
 - 7.2.2 Drafting Film*
 - 7.2.3 Minimum Drafting Equipment*
 - 7.2.4 Standard of Detail*
 - 7.2.5 Urban:*
 - 7.2.6 Rural:*
 - 7.2.7 Shape and Size of CIM Sheet.*
- 7.3 Survey Control*

- 7.3.1 *Existing Surveys*
- 7.3.2 *GPS Surveys*
- 7.4 *CIM Population*
 - 7.4.1 *Manual Drafting*
 - 7.4.2 *Digitising*
 - 7.4.3 *Scanning, Vectorisation and Rubber Sheeting ie (transformation)*
- 7.5 *Edge Matching with Adjoining Map*

8 CIM Parcel Numbering

- 8.1 *Adding the CIM Lot Number to the Map*
 - 8.1.1 *Urban*
 - 8.1.2 *Rural*
 - 8.1.3 *Rules for assigning Unique Parcel Identifiers (UPI) within a CIM*
- 8.2 *Adding the CIM Lot Number (UPI) to the CrossIndex Database*

9 Transactions Occurring During CIM Compilation

10 Quality Assurance of CIM

11 CIM Production Control

Appendix 1 Dimensions of Cadastral Index Map Sheet

Appendix 2 Procedure Manual for Urban and Rural CIM Production by Manual Drafting

Appendix 3 Procedure Manual for Urban and Rural CIM Production by Digitising

Appendix 4 Database Procedures Manual

Appendix 5 PA-LAMP CIM Sheet Corners

Appendix 6 CIM Numbering

Appendix 7 QA Forms

Appendix 8 CIM CONTROL REGISTER

There are intended sections for:

- GIS, ie heads up digitising and the GIS system itself;
- Procedure Manual for Urban and Rural CIM Production by Digitisation.
- Scanning;
- Vectorising;
- Database;
- And any other method to be trialled.

Note the methodologies listed above have not been tested due to either the lack of equipment or software. The database section will be completed at a later stage by the Systems Analyst of PIO2.

3.8 Land Records Database

The database has been completed to a stage where all data from the various government departments can and is being encoded. Data is produced for both CRS and SAT activities by queering the database and producing reports.

The main concern with the data is the physical entering of data, at present there are too few computers and staff to keep up with the demand let alone verify the data being encoded is correct.

The actual coding of the database software has recently been investigated and the database needs some rewriting. This will not affect the data input forms as designed, only the way in which the program performs behind the scene. The defects are related to structure and search methodology. This deficiency will be attended to by the Systems Analyst supervised by the Land Records Adviser of PIO2. It should be noted that PIO1 did not have an analyst and the software was developed by an in-house analyst from DENR head office based on the design by the Land Parcel Mapping Adviser.

There will be a need to add a few features to the database in the near future, these are:

- Strata titles;
- Lease arrangements;
- Archiving of redundant titles and other data for historic purposes;
- Inclusions of survey plan tables so that customers from the OSS can search wide survey plans. Note the plans are in the database but not as a separate relational table.

In essence the Adviser is pleased that the database is functional and producing the desired results.

There are some major concerns with respect to ROD: even though the prototype is located in the same building, there is reluctance by ROD to have their records accessed by project staff. The project was required to contract outside personnel at a great cost to copy the index cards by hand. This has on major downfall, the information requires verifying and once again there will be large cost to the project if ROD does not allow staff to access the records.

3.9 Geographic Information System (GIS)

The development of a GIS as the graphical interface to the land records database will be undertaken in 2003 due to PIO1 not being able to procure the software, ie MapInfo. PA-LAMP has undertaken to purchase the software, but this will not arrive until early to mid December and there will be no time available for the International Adviser to design and implement a GIS into the PIO. The National Land Tenure Statistics Adviser will undertake this task.

At the writing of this report, the software MapInfo has not been purchased by the project; hence, no digital CIM has been produced. It is envisaged that this task will be started in 2003 when the Adviser will be available to further train the staff in the use of the software and produce digital CIM.

3.10 Lessons Learned

- A large number of base sheets were pre-drafted on a previous design: *solution only prepare new base sheets when required;*
- The CIM register sheet was not being completed at the correct stages and not being entered in the database: *solution complete the sheet at the time required;*
- The use of photocopies for enlargement or reduction of survey plans when drafting: *solution use the pantograph for these operations;*

- There are problems in delineating political boundaries especially when they have not been defined by survey: there is no *solution to this, it is not a CIM problem, just plot the boundary as described by the barangay or municipal authorities;*
- Drafting of lots from two different original surveys that are not on the same datum and not connected to the same adjoining control marks, therefore introducing overlaps and gaps. *Solution: this problem should be sorted out by the cadastral survey section by examining and verifying the original surveys and if necessary do connections in the field to rectify the problem;*
- Problems have been encountered with the UPI numbering: solution use the newly designed UPI sheet and physically cross off the numbers on the sheet when they are inserted onto the CIM sheet;
- Some lots don't have survey lot numbers or the lot numbers are completely different from the surrounding lot numbers. This occurs mainly along water frontages or adjoining forest lands *solution: do an investigation on the lots concerned for they maybe illegally added or just an error in the original survey plan;*
- Problems with allotting UPI on adjoining sheets; *solution follow the procedure set out in the manual and ensure that the adjoining sheets have been inspected prior to allocating the UPI;*
- Numbering of new subdivisions and amalgamated (consolidated) surveys, *solution: retire the original UPI and allocate the next highest UPI, as per the manual;*
- Confusion with the naming of cadastral plans when scanned, *solution: eg Cad 820D_1_6 where the 802 is the project number, D is contract and the omission when by administration, 1 is the case number and 6 is the sheet number;*
- Land records database, no systems analysis available for the database management, *solution: the PIO2 systems analysis will be available when problems occur and will be attending to the database along with the International Land Records Adviser. They will be making periodic visits to the prototype to assess the database and associated problems;*
- Lack of human resources for the land records database, *solution both personnel and equipment has been addressed and is being procured;*
- Unobtainable deadlines for the verifying and encoding of data into the database, *solution: only more personnel and equipment can alleviate this problem;*
- Some wrong encoding in the database, *solution: verification and set field standards for encoding of data;*

4 Training and Workshops

The following table sets out the various training and workshops given.

Workshop/Training	Subject	Attendees
Pantograph Operations (informal)	The use of the pantograph in CIM production.	CIM staff
Lessons Learned quarter	CIM lessons learned	CIM staff
DesKan Large format scanner	The use of the DesKan scanner for the reproduction of scanned images.	CIM staff
Provec Vectorisation and Transformation Package	The use of the Provec software in vectorisation and transformation of scanned images	Selected CIM staff
GIS/LIS concepts	An understanding of the concepts of GIS and LIS	All prototype staff
Introduction to GIS	Introduction and hands on for basic GIS operation	CIM, OSS front desk and selected survey staff
OSS	Introduction to PA-LAMP and its procedures	Key agency and prototype staff
OSS	Consensus workshop	Key agency and prototype staff
LAMP Partnership Building	LAMP concepts, PIO1 activities and alternative approaches to land titling practiced in other countries	Regional Geodetic Engineering Profession, Regional DENR Surveys Personnel and selected Private Practitioners

5 One Stop Shop (OSS)

5.1 The OSS Development

The concept of a One Stop Shop is still shrouded in a mirage of high expectations. PIO1 can be optimistic, but most participating agencies are sceptical if not indifferent. There are indications that the other agencies are not fully cooperating.

Developing a working structure for the OSS is hindered due to the various interests of the other agencies, ie by people who have a poor appreciation of the greater impact of LAMP on national economic welfare and the imminent threat that LAMP holds over the agencies and their staff.

LAMP management has to develop and operationalise, the required authority structure of the OSS. The planning shall carefully develop a logical sequence of shared responsibilities and delegate authority from the participating agencies. Specific authority directives from the central top management relative to specific coordinative actions in the OSS need to be prepared and issued for compliance by the regional and lower level supervisors and operators in the participating agencies.

The present OSS is being hindered by the existing legal framework which directs the actions to be taken while the responsibility still lies with the respective participating agencies.

PIO1 has serious problems in fully operationalising the OSS. Significantly it has successfully formulated the operating framework for a land database in conjunction with the developed Cadastral Index Map (CIM) which can easily be replicated throughout the Philippines. The gathering of source documents and the encoding in the database is still a major concern. The CIM and database is now servicing the CRS and SAT operations in land titling activities. The OSS is unable to supply all the services that could be offered to the public at this time.

The OSS is still a concept on the verge of reality. It has the physical structure, an office building to launch operations. The main function is referrals to participating agencies. The front desk manned by interagency representatives provides a physical presence for the client and the means of tracking any transactions that are presented to the front desk.

5.2 Implications for LAM Program

LAMP is essentially a social, institutional and administrative reform package, designed to break through a maze of entrenched and diffused land administration system. This system is shielded by a complex legal and bureaucratic framework generally manned by people with canalized visions of their respective agency importance and validity. LAMP is facing a formidable wall of indifference to change. Any attempt to break down this wall needs a forging of visionary action directions focused on addressing weaknesses within the system. Realities on the ground have to be confronted and using strategic cooptation processes build up acceptance both from the top echelon of management and project level participants. Central to this approach is wielding of a strong political will of the central government decision makers. This is supported by consensus building efforts that are not only informational and educational in nature but rather by confrontational advocacy.

The OSS is the door to transparent interaction between the government and its clients and is a major step in introducing reform, if the system allows it to survive.

5.3 Issues in Developing OSS Operations:

- Defining the specific activity structure of OSS integrating mandates that are related to the LAM Program;
- Formulate the activities of participating agencies;
- Placing operating elements in the OSS to supervise execution of functional linkages;
- Issue administrative guidelines defining the function and responsibilities of OSS operations;
- Defining and issue directives to serve as specific guidelines for subordinates of participating agencies to take prompt action and cooperate in the service delivery for clients of the LAM project;
- Developing a continuing in house training component to address competency/skill requirements for inter-agency related activities in LAMP.

5.4 Activity Steps for OSS Development

While working inside existing legal and institutional frameworks strategic directions have to be explored. Activity focus will have to be formulated with these directions:

- Synchronising program policy development of participating agencies:
 - Study land related programmes and projects of participating agencies to identify potential integration of activities. The national budget document may be analysed in connection with studies of the implementing land administration projects;
 - Study specific projects areas of the participating agencies and identify any conflicts and areas of complementation;
 - Formulate MOA's with participating agencies detailing their responsibilities and commitments.
- Formulate a framework for cooperation in project implementation:
 - Study project components and activities to clarify linkages and duplicate services;
 - Transfer responsibilities to OSS with participating agency representatives with the OSS providing the key action linkages;
 - Issue directives from agency heads for compliance at project operations level.
- Formulate financial linkages:
 - Interlink financial planning between the agencies where there are dealings through the OSS;
- Design and implement HRD programmes for project management and operations administration. Specific linkages with both LGU's and NGO's need to be incorporated:
 - Formulate a 5 year HRD plan for both technical and management operations;
 - Synchronise the training modules for future requirements in project implementation in both cadastral surveys and land titling;

5.5 Workshops

Both the International and National advisers have attended and presented at two OSS workshops where the stakeholders were present, see **Section 4 Training and Workshops**.

5.6 Document Tracking

Document tracking software has been developed and installed at the OSS front desk, and is currently being utilised. CENRO and ROD are not linked to the OSS computer system at this time, but there are plans to connect both agencies in the near future when the equipment is available.

6 Linkage Development in Support of LAMP

PIO1 is communicating with the local GEP Region VIII, on issues relating to LAMP, the issues are:

- Role of local GEP in the Cadastral Survey Program;
- Developing the capability of local GEP potential for survey contracts with LAMP;
- Upgrading the technical competency of local GEs;
- Training programs in coordination with local colleges and universities.

Discussions have been held with the rural bankers of Region VIII. Their concerns were for the speedy issuance of land titles, because in 5 years untitled lands can no longer be used as collateral for bank loans. They expressed willingness to support the cadastral survey and titling program of LAMP.

Some issues raised are:

- Area and level of cooperation that will be mutually beneficial for LAMP and the NGO's;
- Concern about LAM Program not proceeding;
- How fast titles can be issued over the next five years, is it sustainability and will it cover the entire Region VIII, Eastern Visayas.

7 CIM and Cadastral Unit Costs

This is a first attempt at an approach to estimate unit costs of preparing a Preliminary CIM (ie the cost per CIM). The Preliminary CIM will be validated before it is considered a final CIM – no final CIM had been prepared at the time of this initial calculation. This estimation is based on an “average CIM” but it should be noted that CIM will vary considerably in the number and size of parcels mapped. Similarly there will be differences in the time required to find copies of Cadastral Survey Maps for initial tracing, and for quality assurance (checking of lot numbers and coordinates etc) of plotted information.

7.1 CIM Unit Costs Methodologies

The CIM costs were prepared by M&E.

Different estimates of time to complete CIM tracing, lettering etc:

In discussions with the 7 cartographers drafting CIM at the time of the calculation it was estimated that if they were only drafting CIM then they could produce 4 CIM each per week, the remaining 3 persons in the CIM section support these 7 in quality assurance (QA), verification and research. Taking these additional persons into account the average output for the unit of 10 persons (assuming no other work, staff absences from illness, training courses or workshops) would be 28 CIM per week or 2.8 CIM per person per week. This is equivalent to 14.3 person-hours per CIM. It should be noted that this estimate includes support to those drafting the CIM (including QA, verification and research) but not time required to prepare for tracing – including collecting cadastral surveys from DENR, copying and joining maps (estimated to be another 4 person-hours per CIM). The total preparation time using this method of calculation is 18.3 person-hours per CIM.

Table 1: CIM unit output

Month	No. of CIM	No. of Lots	No. of Brgy.
June	26	3420	14
July	62	6164	34
August	34	2776	16
September	32	5693	23
October	11	1465	10
November	33	3706	22
Total	198	23224	119

Using the above figures, the average number of lots per CIM was 117. On this basis, one person working full-time would complete 1.1 CIM per person day or 5.5 CIM per person-week. Again on the basis of the unit of 7 cartographers and 3 support persons the average output for the unit of 10 persons (assuming no other work, staff absences from illness, training courses or workshops) would be 38.5 CIM per week or 3.85 CIM per person. This is equivalent to 10.3 person-hours per CIM tracing and with the additional pre-tracing preparation (4 hours/CIM) a total of 14.3 person-hours per CIM.

A final calculation can be simply based on the above table (Table 1). If we assume an average of 20 working days per month (allowing for public holidays and fiestas etc), the 198 CIM have been completed in 180 days of the 10 person unit (1800 person days or 14,400 person-hours). This equates to 73 hours per CIM. This estimate, unlike the earlier estimates above is the actual output of the CIM unit and allows for the other activities that unit personnel are required to undertake (this includes the drafting of Consolidated CIM based on Barangay boundaries rather than standard grids and any other tasks they are required to perform from time to time).

7.1.1 CIM sheets on barangay boundaries

Many of the current CIM completed by the unit cover lengths of barangay boundary - as barangays in the project area are quite small in size relative to the area covered in a typical rural CIM. In such cases, the lots in the area outside the barangay are left unplotted (that part of the CIM is left blank). When CIM is used as a standard tool in land administration, all the area of the map should be covered with lots (not just the area within a selected barangay). This results in a smaller number of lots per CIM and faster CIM completion time than would otherwise be the case for future CIM production.

7.1.2 Technology used

The above time estimates are based on manual tracing techniques for CIM production. However, in future, the CIM unit will scan in boundary information and prepare CIM using GIS software and large format plotters. Unit cost calculations will therefore need to be repeated.

7.1.3 Calculation

As the major cost in CIM preparation is labour, it is important not to underestimate it. The following calculation therefore uses an average of the first and third estimates (the second estimate is believed to be too optimistic) – 45.5 person-hours per CIM.

The cost of equipment is calculated based on a depreciation rate equivalent to 20% per annum. For the time taken to prepare 1 CIM this is equivalent to 0.33% of the value.

The following draft calculation may be modified if more accurate estimates of resources used in CIM preparation can be determined.

Activity/Resources	Unit	Unit cost (PHP)	Total Quantity	Total Cost (PHP)
Personnel				
Labour time (cartographer) ¹	Hours	54.4	45.5	2475.2
Drafting materials				
Drafting film (0.581m of a 10m)	Metres	360	0.58	208.8
Tracing paper (0.581m of 10m)	Metres	64	0.58	37.12
Drafting equipment (depreciation cost)				
Drafting pen & ink etc set	Set	17500	0.0072	126
Triangular scale	Ruler	300	0.0072	2.16
45 deg triangular ruler	Ruler	50	0.0072	0.36
30 deg triangular ruler	Ruler	50	0.0072	0.36
T square	Square	100	0.0072	0.72
French curve	Piece	50	0.0072	0.36
Cutter	Piece	40	0.0072	0.288
Drawing instrument set	Set	200	0.0072	1.44
Drafting table	Table	10381	0.0072	74.7432
Office chair	Chair	2950	0.0072	21.24
TOTAL				2948.79
Unit cost per CIM (rounded up to the next 100)				3000
Unit cost (of CIM preparation) per lot				25
Unit cost (of CIM preparation) per barangay (rounded up to the next 100)				5900

Notes:

- Depreciation based on time used per CIM (at equivalent rate of 20% pa) - over 45.5 hours = 0.72% or 0.0072
- Assumes 240 working days or 1920 hours pa

7.2 Cadastral Survey Costs by Administration

The following table shows the indicative cost of one survey performed by administration. The costs would have been less if the survey equipment was not rented and therefore a depreciation and maintenance cost would replace it, but the cost per lot or hectare would not change that dramatically.

There needs to be more than one module completed to be able to obtain good reliable figures for this type of survey.

¹ Based on wage of PHP 8709 per month, and 20 working days (8 hours) per month.

Libertad Pilot

Item	Qty	Rate	Days	Months	Cost PHP
Travel Expenses Per Diem	12	200	90		216000
Office Equipment:					
Drafting Table	1	10381			10381
Triangular Scale	3	300			900
45 deg. X 45 deg. Triangular Ruler	3	50			150
30 deg. X 30 deg. Triangular Ruler	3	50			150
T-Square	1	100			100
Protractor	2	94			188
Other Drawing Instruments	8	200			1600
Personnel Gear					
Rain boots	12	360			4320
Raincoats	12	400			4800
Backpack	14	680			9520
Umbrellas	2	145			290
Salaries					
Chief, Surveys Unit (Engineer 3)	1	17200		0.5	8600
Geodetic Engineer 2	1	14098		4	56392
Survey Verifier	2	8709		4	69672
Surveyor	2	7606		4	60848
Survey Cartographer	1	8709		4	34836
Utility Worker	6	6309		4	151416
Survey Computations	2	6309		4	50472
Supplies					
Materials for Monuments	1600	10			16000
Drafting Film	1	3600			3600
Technical Pen Ink	8	50			400
Traverse Computation Sheet	1	380			380
Lot Data Computation Sheet	1	380			380
Field Notes	5	380			1900
Survey Envelope	500	6			3100
Field Equipment:					
50 Meters Steel Tape	2	780			1560
Vehicle Rental, per Month	1	2500	83		207500
Total Station Rental	2	800	51		81600
Administration and Supervision					10000
Total Cost					1007055
Cost per Lot	726				1387.13
Cost per Hectare	611				1648.21

Note: the costs do not include the other service units such as SAT and CRS, and their auxiliary staff, per diems and vehicle expenses etc.

7.3 Cadastral Surveys by Contract

The survey of one barangay by contract is also not a good identifier of costs. It should be noted that the majority of the cost in this contract is associated with the verification, adjudication and CRS activities; the per diem is half the contractual cost.

In told there is P403,000 just for the support staff!

Macalpiay Pilot:

Item	Qty	Rate	Days	Months	Cost PHP
Contract Price					180290
Travel Expenses Per Diem	6	200	75		90000
Project staff					
Survey Verifier	2	8707		3	52242
Adjudicator	2	10505		3	63030
Clerk	1	7606		3	22818
Barangay Representatives	2	300		3	1800
Local CRS	2	3000		3	18000
CRS Assistant	1	10535		3	31605
SAT Leader/Survey Supervisor	1	17200		3	51600
Vehicle Rental	1	1500	48		72000
Total Cost					583385
Cost per Lots	172				3392
Cost per Hectare	148				3942

8 Major Concerns

- Surveys Division under the Regional Director of DENR does not have the experience with electronic data for verification and acceptance of electronically produced surveys. TA should be available for consultation and software for both PIO1 and the surveys division
- One of the main concerns is; will the public and the surveying profession accept the introduction of low accuracy surveys for initial titling of land. Land that is situated along roads is of a greater value that those that have no dedicated access and therefore more valuable. In these cases the land parcels can be three times the value of back lots. At the seminar/workshop for partner building held in PIO1, the GEP and government departments were requested to give feedback on the proposed methodology for low cost surveys and if they would be acceptable. Unfortunately in the workshop held on the second day this was not addressed even when the participants were again asked to give their opinions upon the matter. See **Annex 1** for details of the presentation.
- *DENR Administrative Order No. 98-12* should be replaced. A recompilation of the Order and a more flexible approach to types of valid cadastral surveys be introduced, and is separated into:
 - Survey Act;
 - Survey Regulations;
 - Recommended Guidelines and Practices. It is in this section that how a survey should be conducted and presented;

9 Recommendations

The main recommendations for the LAM Program are:

- *The way in which the metes and bound are presented in any documentation and survey plans be changed to the international convention, ie 265°35' not N85 35E for modern equipment read 265°35' and N85 35E needs to be calculated. This is a left over from the period early last century where some horizontal circles in the instrument (transits) were by quadrant;*
- *A specialist consultant be engaged to review the academic sector and recommend changes into the curriculum so that the new graduates have a more in-depth knowledge of modern and relevant survey methodologies, this is vital for the future LAM Program;*
- *A governing body established similar to the various Surveyors Boards' found in the various states in Australia, that has teeth that will ensure that the surveying profession adheres to its code of conduct and its registered surveyors comply with the laws related to cadastral surveys and maintain their competence in all aspects of surveying with rigorous Continued Professional Development and to ostracize those who flaunt the laws and professional conduct;*
- *Thought be given that when LAM Program starts, the project buys many total stations and trains perspective small practitioners to use the equipment correctly. Then allow these small practitioners to participate in the bid even though they don't have the equipment that is specified in the bid documents, and allow them to rent or rent purchase them at a lower cost (due to bulk buying). In this way it is possible to upgrade the professions capabilities;*
- *Intensive program to ensure that the records management system of all agencies is standardised and that the valuable records do not deteriorate any further so that they may be used when required and easily found;*
- *Implement a Standard Cadastral Map Sheet that is acceptable;*
- *The verti-plan storage system should be introduced ie specially designed map storage cabinets;*
- *All survey field notes need to be bound with hard covers and either plastic or metal fastener and Duplicate copies need to be filed separately;*
- *The survey division should start updating land classification maps.*
- *Produce consolidated land classification maps by province;*
- *This information should be incorporated in the LAMP database so that titling will not occur in timberlands;*
- *Surveys Division research and obtain copies of all civil and military reservations;*
- *PIO1, CENRO, and the DENR Survey Division needs well defined supervision activities that ensure that there is no overlapping of activities and that all activities are succinct;*
- *Survey equipment needs to be updated to Total Stations,. Regional Offices must have extra equipment for critical needs and intensive training in their use and their applications in survey and mapping;*

- *Project Engineers and Party Chiefs must be trained in the fundamentals of operation planning and project management with direct application to cadastral surveying functions;*
- *Organise a technical supervision group in the survey division of DENR to supervise project operations and to periodically make comprehensive evaluation of performance relative to project plans and resources;*
- *Institute a process documentation and evaluation system for cadastral surveys. Check deficiencies at an early stage;*
- *Make supervisors and or project managers accountable for deficiencies in project operations;*
- *Survey contracts need clauses that make them null and void if the contractors do not conform with the personnel and equipment as stated in their bid documents;*
- *A strong system of field verification and evaluation during project execution must be developed and applied;*
- *Provide a reasonable period for post project liability for the survey contractor;*
- *The implementation of the LAM Program needs to synchronize the cadastral survey system with land titling and registration operations;*
- *Suitable and accessible EDM bases, to recognized world standards, should be established within each region;*
- *Tribrach testers should be purchased and installed within each region and should be accessible to the general surveying community;*
- *As shown in section 2.14 the LAM Program should not accept the cadastral surveys but to investigate them first before even contemplating using the data for titling;*
- *Issues in Developing OSS Operations:*
 - *Defining the specific activity structure of OSS integrating mandates that are related to the LAM Program;*
 - *Formulate the activities of participating agencies;*
 - *Placing operating elements in the OSS to supervise execution of functional linkages;*
 - *Issue administrative guidelines defining the function and responsibilities of OSS operations;*
 - *Defining and issue directives to serve as specific guidelines for subordinates of participating agencies to take prompt action and cooperate in the service delivery for clients of the LAM project;*
 - *Developing a continuing in house training component to address competency/skill requirements for inter-agency related activities in LAMP.*
- *Activity Steps for OSS Development:*
 - *Synchronising program policy development of participating agencies:*

- *Study land related programmes and projects of participating agencies to identify potential integration of activities. The national budget document may be analysed in connection with studies of the implementing land administration projects;*
- *Study specific projects areas of the participating agencies and identify any conflicts and areas of complementation;*
- *Formulate MOA's with participating agencies detailing their responsibilities and commitments;*
- *Formulate a framework for cooperation in project implementation;*
- *Study project components and activities to clarify linkages and duplicate services;*
- *Transfer responsibilities to OSS with participating agency representatives with the OSS providing the key action linkages;*
- *Issue directives from agency heads for compliance at project operations level.*
- *Formulate financial linkages:*
 - *Interlink financial planning between the agencies where there are dealings through the OSS;*
- *Design and implement HRD programmes for project management and operations administration. Specific linkages with both LGU's and NGO's need to be incorporated:*
 - *Formulate a 5 year HRD plan for both technical and management operations;*
 - *Synchronise the training modules for future requirements in project implementation in both cadastral surveys and land titling;*

The main recommendations for the existing operations are:

- *Survey software is procured (eg Geocomp or Civilcad) so that the prototype and DENR Surveys Division will be capable of analysing and utilising the survey data that is collected electronically;*
- *Additional time is allocated to a specialist (International or National) who has experience with Geocomp or Civilcad software especially in the cadastral environment; to train both the prototype staff and DENR Surveys Division in use of and monitoring the proceedings whilst the new contracts for surveys are being conducted. Without this monitoring and training the likelihood of the new cadastral surveys contracts will fail. The contracted consultants performing the surveys will be the only ones aware of how to manipulate and verify data captured in the field;*
- *Allocated time given to an International Consultant to review DENR Administrative Order No 98-12 and to rewrite the order into act, regulations and recommended guidelines and practices, prior to the commencement of the LAM Program. This should be done in consultation with the GEP and a parliamentary draftsman so as the wording of the new laws (if redrafted) is succinct;*
- *Further studies to identify if the surveying profession and community are acceptable to low accuracy surveys for low value rural lands when first titled.*

- *Time allocated for a study using a good quality digital camera for the archiving of documents and survey plans instead of scanning. This method was used for the survey plans on the AusAID funded SIISLAP project in the Solomon Islands with great success. This process is cheap and very fast, also it will only require one visit to the agency (except for data that is updated) and a digital image will be available for the encoding of data into the database and its verification;*

Annex 1 International View of Alternate Survey Options

1 Introduction

As part of the TOR the advisers were required to investigate what was happening in other countries that have or are implementing reform in land issues. This section of the report will deal with the findings of that study with respect to alternate methods of cadastral surveying to support low cost land titling.

The countries studied were:

- *Thailand;*
- *Laos;*
- *Indonesia.*

Of the three countries only Indonesia has chosen to maintain full survey accuracies in initial land titling. Both Laos and Thailand use the majority of the alternate methods presented in this annex with the exception of digital imagery and digital orthophoto maps.

All countries use GPS, but only in certain environments within Indonesia due to the accuracy requirements. GPS is viable in the rural sector of the Philippines especially in open areas and with the addition of traversing where needed and incorporating the other recommended alternate methods listed can easily satisfy the future low accuracy titling requirements, if adopted.

The addition of digital surveys is a methodology that needs to be tested. By using a computer in the field and the orthophoto image the boundaries should be easily identified in open areas and the survey, plan production (ie cadastral and CIM) can be produced at the time of adjudication.

In urban areas it is **recommended** that only full surveys are performed especially in major cities where the land prices are extremely high.

The following 3 **Articles** were taken from the ***Laos Ministerial Direction on Cadastral Surveying and Cadastral Mapping***.

Article 20 Procedure for Re-establishment

On receipt of an application for the re-establishment of a boundary the chief of the concerned Office of Land shall instruct a surveyor to make a survey of the land parcel which is the subject of the application and gather all the relevant evidence.

All available relevant evidence shall then be collected from the Land Registration System and a survey made of the subject land parcel.

The surveyor shall meet with land use right holders, adjacent land use right holders and village officials to gather further evidence. The surveyor shall assess the evidence using the following order of importance and make a decision.

1. *Recorded agreement between adjacent land use right holders;*
2. *Natural features;*
3. *Monuments;*
4. *Survey markers;*
5. *Occupations;*

6. *Measurements.*

Article 21 ***Inconsistency between Monuments and Measurements***

If a dispute regarding the position of boundary markers and a part of a building, wall, fence or other boundary structure is notified to the chief of the Land Office at the District level or the Office of Land at the Province/Prefecture/Special Zone level the chief shall appoint a responsible person to carry out the following actions:

1. *Collect all information relevant to the concerned land parcels from the Land Registration System.*
2. *Make a survey of the concerned land parcels including the measurement of the external boundaries of the parcel and record the measurements between any boundary marks found.*
3. *By inquiry and use of original information, including the Survey Field Notes and any photomap used in systematic registration if available, determine whether the building, wall, fence or other structure existed at first time registration.*

If the part of a building, wall, fence or other boundary structure is proved to have existed at first time registration then the position of the boundary markers shall be disregarded and a new position for the boundary shall be surveyed.

If the part of a building, wall, fence or other boundary structure is proved to have been constructed after first time registration the responsible person shall attempt to reach an agreement between the concerned land use right land use right holders. If no agreement can be reached the concerned land use right land use right holders shall be advised of their right to have the matter brought before the court.

Where a new position for a boundary is agreed and surveyed no amendment shall be made to the Land Registration System until all affected existing land titles have been presented to the Office of Land at the Province/Prefecture/Special Zone/ level for cancellation.

Article 22 ***Subdivision or Consolidation of Land Parcels with Land Title***

- *Land parcel subdivision is dividing land into new land parcels*
- *Land parcel consolidation is combining two or more land parcels into one new land parcel*
- *An application for subdivision shall be lodged with the chief of the concerned Office of Land in accordance with the regulation on the Land Parcel Registration System.*
- *After an application for subdivision or consolidation has been made in the correct manner, the chief of the Office of Land at the Province/Prefecture/Special Zone level will coordinate with the Land Office at the District concerned and will carry out the following activities:*
 1. *Confirm the existing boundaries and boundary markers of the land parcel or land parcels;*
 2. *Place boundary markers at the corners of any new land parcel boundaries and remove any unnecessary boundary markers.*
 3. *Measure the positions of any new boundary markers;*
 4. *Replace any missing boundary markers on the corners of the affected land parcel or parcels;*

5. *Prepare a new Survey Field Notes for each land parcel. Update the Cadastral Map and assign new parcel numbers to all new land parcels.*

From the above articles it can be seen that main factor in boundary definition in Laos is **the agreed position by the parcel owner and adjacent owners** and that:

- The actual surveyed measurements are the least important means of identifying land parcel boundaries;
- The survey plan is the *Survey Field Notes* which is basically the SNS used on this project;
- The “*cadastral survey*” is **only** for the construction of the cadastral map and CIM, and **not the legal identifies of the boundaries.**

This then allows for low accuracy boundary definition and recognises the agreed boundaries over all other methodologies, and this must be the basis of any future rapid and cost efficient land titling within the rural sector in the Philippines.

2 Survey Methods Identified

Survey methods identified for surveys can be:

METHOD	Australia	Thailand (84-03)	Laos (95-03)	Indonesia (94-00)
Traversing:				
• Transit and chain	-	-	-	-
• Theodolite and EDM	X	X	-	X
• Semi Total Station	X	-	-	X
• Total Station	X	X	X	X
• Stadia	-	-	-	-
GPS (including data logger):				
• Point Position	-	-	-	-
• Differential Phase ²	X	-	-	-
• Differential Code	-	-	-	-
Alternate (requiring dense control)				
• Optical square and chain offset	-	X	X	-
• Chaining by two Distances	-	X	X	-
Orthophoto & Imagery				
• Hard copy, ie Photo/imagery interpretation (office and field)	-	X	X	-
• Digital copy, ie Photo/imagery interpretation (office and field)	X	-	-	-

² Differential phase used for the survey control in all projects

2.1 Traversing

There are five identified methods of traversing by the use of an angle measuring instrument and using a distance measuring device, these are discussed in the following table.

METHOD	DISADVANTAGES	ADVANTAGES	RECOMMENDATIONS
Transit and Chain	<ul style="list-style-type: none"> • Outdated technology; • Cumbersome to use; • Not overly accurate; • Commonly out of alignment; • Survey teams are generally large adding extra cost. 	<ul style="list-style-type: none"> • Commonly found in the Philippines; • Cheap to purchase; • The technical skill of the operators is generally low. 	Convince the surveying profession to upgrade the profession to use modern technology that is more accurate and to discourage their use within the project, NOT RECOMMENDED.
Stadia	<ul style="list-style-type: none"> • Inaccurate over long lines; • Outdated technology; • Usually requires either slide rule or tables to reduce results; • Survey teams are generally large adding extra cost; • Cumbersome and time consuming. 	<ul style="list-style-type: none"> • Little equipment required; • The technical skill of the operators is generally low. 	Discourage the use within the project due to the method being cumbersome and time consuming. NOT RECOMMENDED
Theodolite and EDM	<ul style="list-style-type: none"> • Outdated technology; • Requires either an attachment to the top of the theodolite or is a separate unit; • Requires more team members due to extra equipment to carry; • Survey teams are generally larger adding extra cost 	<ul style="list-style-type: none"> • More advanced than a transit and chain; • Accuracy is better than a transit and chain; • EDM measures longer distances hence traverse lines can be longer; • Quicker than the last two methods; • Requires periodical servicing and calibration • The technical skill of the operators is usually low. 	If calibrated and used correctly is the cheapest form of modern technology. Suggested that the use of this type of equipment be accepted only if the following types are not available.
Semi-Total Station	<ul style="list-style-type: none"> • Outdated technology; • Manual recording methods; • The technical skill of the operator is more advanced. 	<ul style="list-style-type: none"> • Relatively fast operation; • Measuring device is part of the theodolite; • Less computations to obtain results due to either measuring horizontal distances or working directly in coordinates; • Reasonably priced; • Survey teams are usually small. 	This type of equipment is considered better than all those above but does not have the recording capabilities of the total station.
Total Station	<ul style="list-style-type: none"> • Cost is higher than other types of equipment (note: the cost would be the equivalent to theodolites and semi total stations when first released); • Highly trained personnel; • Requires computers. 	<ul style="list-style-type: none"> • All observations are electronically recorded; • Interface with computer and software for computation of results and graphical presentation; • Extremely accurate if used correctly; • Very fast if used correctly; • Survey teams are usually small. 	Preferred option when doing cadastral surveys by traversing. RECOMMENDED

2.2 GPS

METHOD	DISADVANTAGES	ADVANTAGES	RECOMMENDATIONS
Point Positioning	<ul style="list-style-type: none"> • Very low accuracy (5-10m) even with Selective Availability (SA) switched off; • SA could be reactivated at any time; • Need to make a number of observations; • Skill level is higher than traversing methods. 	<ul style="list-style-type: none"> • Quick & efficient; • Low cost of receivers; • Easily used; • Survey teams can consist of one; • All weather capability; • No need for intervisibility between points. 	<ul style="list-style-type: none"> • Not recommended for titling purposes due to the very low accuracy and unreliability of the method.
Differential Code	<ul style="list-style-type: none"> • Low accuracy (50-100cm); • Less accurate than current survey standards in DENR AO98-12; • Unsuitable under heavy tree cover see Annex 2 for results; • Data requires post-processing; • Requires skilled field operators; • Requires highly skilled data processors; • Extensive training required. 	<ul style="list-style-type: none"> • Does not require dense or particularly close geodetic control; • Short occupation times; • Relatively quick; • Efficient; • Small team requirement of one or two; • Relatively easy to use; • No need for intervisibility between points • All weather capability; • Processing simpler than for Differential Phase techniques, but still requires training; • Can use medium cost GPS receivers. 	<ul style="list-style-type: none"> • If lower accuracy boundary definition is accepted, it is a possible viable alternative to the use of photomaps and the two low accuracy survey methods, particularly in open areas. (Still subject to results of pilot test to determine the acceptable level of tree cover).
Differential Phase (Relative Positioning)	<ul style="list-style-type: none"> • Slow in areas with some obstructions, the more obstructions, then the slower the survey; • Not possible in areas with many obstructions – heavy tree cover; • Requires geodetic network to be densified to second order standards at about 5-10 km spacing; • Most methods require post processing; • Requires skilled field operators; • Requires highly skilled personnel for data processing; • Post processing can be difficult & tedious when poor data is recorded; • Extensive training required; • Expensive equipment. 	<ul style="list-style-type: none"> • High accuracy; • Very suitable in open areas where it is quite quick, especially if RTK or Rapid Static is used; • All weather capability; • No need for intervisibility between points; • Small team requirement ie can be done by one or two member team. 	<ul style="list-style-type: none"> • Recommended as an alternative to Total Stations in areas with minimal tree cover, in such areas it would be more efficient, as tree cover increases it becomes less efficient and eventually not possible; • Requires lower density of geodetic control than total station traversing, eg 5-7 km rather than 1-2km for rural areas.

2.3 Orthophoto Maps and Imagery

METHOD	DISADVANTAGES	ADVANTAGES	RECOMMENDATIONS
Overall Imagery and Orthophoto	<ul style="list-style-type: none"> • Overall high cost, typically \$300-400 per sheet (which may cover an average of around 150 rural parcels); • Requires cloud free period to obtain good data; • Procurement time is lengthy; • Requires extensive GPS control, aerotriangulation and DTM for rectification; • Requires interpretation skills; • Not useful in timbered areas for small parcel identification. 	<ul style="list-style-type: none"> • All parcel detail is visible, ie buildings, fences and other occupation that is not obscured by vegetation; • Relatively easy method of survey and CIM production and can be built in the field and or office depending on urban or rural situation; • Requires only one person; • Little training required; • Most efficient for large land areas. 	
Hardcopy Imagery	<ul style="list-style-type: none"> • See overall section; • Satellite imagery resolution not sufficient for urban areas. • See overall section 	<ul style="list-style-type: none"> • See overall section; • Cadastral surveys and CIM can be built in the field for rural areas • See overall section; • Surveys and CIM can be built in the field for rural areas; • In urban areas little field verification is required. 	Satellite imagery yet to be tested
Orthophoto			Test has only been done on two orthophoto maps that have been procured outside of NAMRIA (note the resolution was not of a good quality). This method has been used successfully in both Thailand and Laos, and would be ideal for both urban and rural areas within the Philippines especially in urban areas where there has not been an official cadastral survey.
Digital Imagery	<ul style="list-style-type: none"> • See overall section; • Very large image files; • Requires computers; • Requires more highly skilled personnel. 	<ul style="list-style-type: none"> • See overall section; • Surveys and CIM can be built in the field; • GIS/digital model can be easily produced; • Individual lot survey plans can be digitally produced. 	Requires testing in rural areas. In use in developed countries for large property identification, ie Australia
Orthophoto	<ul style="list-style-type: none"> • See overall section; • Very large image files; • Requires computers; • Requires more highly skilled personnel. 	<ul style="list-style-type: none"> • See overall section; • Surveys and CIM can be built in the field; • GIS/digital model can be easily produced; • Individual lot survey plans can be digitally produced. 	Requires testing in both urban and rural areas

2.4 Alternate Methods Requiring Dense Control

The methods below require extensive survey control to make them viable. All methods assume that there is a controlled straight line and measurements are made along the line as well as the alternate method described.

METHOD	DISADVANTAGES	ADVANTAGES	RECOMMENDATIONS
Optical square and chain offsets	<ul style="list-style-type: none"> • Low accuracy; • Manual method. 	<ul style="list-style-type: none"> • Simple; • Quick; • Cheap; • Requires few people; • Skill level low. 	<ul style="list-style-type: none"> • Recommended for use in low accuracy surveys
Two distance connections	<ul style="list-style-type: none"> • Low accuracy; • Manual method. 	<ul style="list-style-type: none"> • Simple; • Quick; • Requires few people; • Cheap; • Skill level low. 	<ul style="list-style-type: none"> • Recommended for use in low accuracy surveys

2.5 Recommended Alternate Cadastral Methods

The recommended practices for cadastral surveys are:

METHOD	Team	Accuracy	Cost	Survey Control Required	Training / Skill Level
Traversing:					
• Theodolite and EDME	2-4	H	H	M	H
• Semi Total Station	2-4	H	H	M	H
• Total Station	2-4	H	H	M	H
GPS (including data logger):					
• Differential Phase	1-4	H	H	L	H
• Differential Code	1-3	M	M	L	H
Alternate (requiring dense control)					
• Optical square and chain offset	3	M	L	H	L
• Chaining by two Distances	3	M	L	H	L
Orthophoto & Imagery					
• Hard copy, ie Photo/imagery interpretation (office and field)	1-3	L	M	L	L
• Digital copy, ie Photo/imagery interpretation (office and field)	1-3	L	M	L	L

Note: it is recommended that the project supply the survey equipment (ie total stations) and train the operators in their use. In this way it would ensure that the best equipment is used and also technology transfer is achieved, another benefit would be the exposure of the survey profession to modern technology and hopefully this will give them the motive to move away from the transit and chain.

It must be remembered that there are various circumstances that dictate what methodology will be used when surveying and these are:

- Terrain;
- Vegetation cover;
- Budget for new equipment;
- Education level of staff;
- Value of the land, ie rural which is usually low and urban which is usually high;
- Accuracy requirements.

2.6 The LAMP Partnership Building Seminar and Workshop

The above slides were presented at a works shop in Leyte in November. The main aim was to introduce the GEP and various government agencies that have not attended previous seminars to what LAMP is intending to achieve at this time. All the national counterparts presented what there section was actually doing.

The second day was where the International Advisers presented on the implications of the overseas studies. The presentations started on the legal side, and then followed by what the cadastral surveys could do outside of the present laws, ie surveys by alternate methods. This was followed by the impact that the alternate cadastral methods would have on any control requirements.

A workshop was held in the afternoon after the presentations and the participants were requested to address all the different points that the advisers mentioned in the morning session. Unfortunately this was not done so no feedback is available. Discussions with the LAMP Executive Deputy Director took place after the seminar closed and he mentioned that he didn't expect the participants to broach the subject but it will be done at a later date.

2.7 CIM by Alternate Methods

Alternate CIM methodology was also in the presentation

CIM Method	DISADVANTAGES	ADVANTAGES
Manual (building from survey plans)	<ul style="list-style-type: none"> • Slow depending on materials available for compilation; • Not feasible without control; • Survey plans are not always at the CIM scale, ie survey plans can vary in the scale for representation of the complete survey and this usually depends on the area the survey covers. 	<ul style="list-style-type: none"> • Low technology; • Minimal training; • Basic Materials and equipment needs.
AutoCAD / Microstation (Digitising)	<ul style="list-style-type: none"> • Expensive to purchase; • Requires computers; • Requires control of some description; • AutoCAD works on a plane system; • Highly qualified operators. 	<ul style="list-style-type: none"> • Capability of producing the entire CIM within the computer environment; • Can be imported into a GIS; • Easily updated.
Scanning and Vectorising	<ul style="list-style-type: none"> • Expensive to purchase; • Requires computers; • Vectorising requires skilled operators. 	<ul style="list-style-type: none"> • Produces a digital model; • Can transform existing data onto a new datum; • Added advantage of archiving data.
GPS (Processed Data) (ie using the same electronic data that was used in the construction of the cadastral maps)	<ul style="list-style-type: none"> • Depending on the equipment cost can be high; • Highly skilled personnel required if using the data in computerised environment; • Requires computers and specialised survey software. 	<ul style="list-style-type: none"> • Can be built digitally; • Relatively quick to produce; • Field data can be digitally manipulated within the software environment and CIM automatically produced.
Total Station (ie using the same electronic data that was used in the construction of the cadastral maps)	<ul style="list-style-type: none"> • High cost of equipment and traversing; • Requires computers and specialised survey software; • Requires highly trained personnel. 	<ul style="list-style-type: none"> • Can be built digitally; • Field data can be digitally manipulated within the software environment and CIM automatically produced; • Relatively quick and accurate.

CIM Method	DISADVANTAGES	ADVANTAGES
Orthophoto Map (office interpretation)	<ul style="list-style-type: none"> • High cost of orthophoto map production and associated control; • Not the same scale in urban areas where the parcels are small • Requires light tables; • Photo interpretation skills required. 	<ul style="list-style-type: none"> • Easy to produce, simple technology; • Usually the same scale as the CIM; • On the datum of the project. • The added advantage of seeing what is on the ground; • Low training requirement; • Low chance of significant errors.
MapInfo (Heads Up Digitising)	<ul style="list-style-type: none"> • Requires a digital image, ie either orthophoto, satellite or scanned survey plans; • Requires computers and software; • Requires highly trained personnel; • Not yet tested. 	<ul style="list-style-type: none"> • Capability of producing the entire CIM within the computer environment; • Seamless map that can be used as the base for a GIS; • Fast, efficient and easily updated; • Direct link to the textual database of land records; • Ideal for front desk of OSS as a GIS; • Not yet tested. • Not yet tested
Satellite Imagery	<ul style="list-style-type: none"> • Not suitable for urban areas • High cost of imagery; • Not yet tested. 	
Others survey methods as depicted in survey methods	<ul style="list-style-type: none"> • Not a congenial environment for drafting (field) 	<ul style="list-style-type: none"> • Can be done in the field at the same time as the survey; • Simple and efficient.

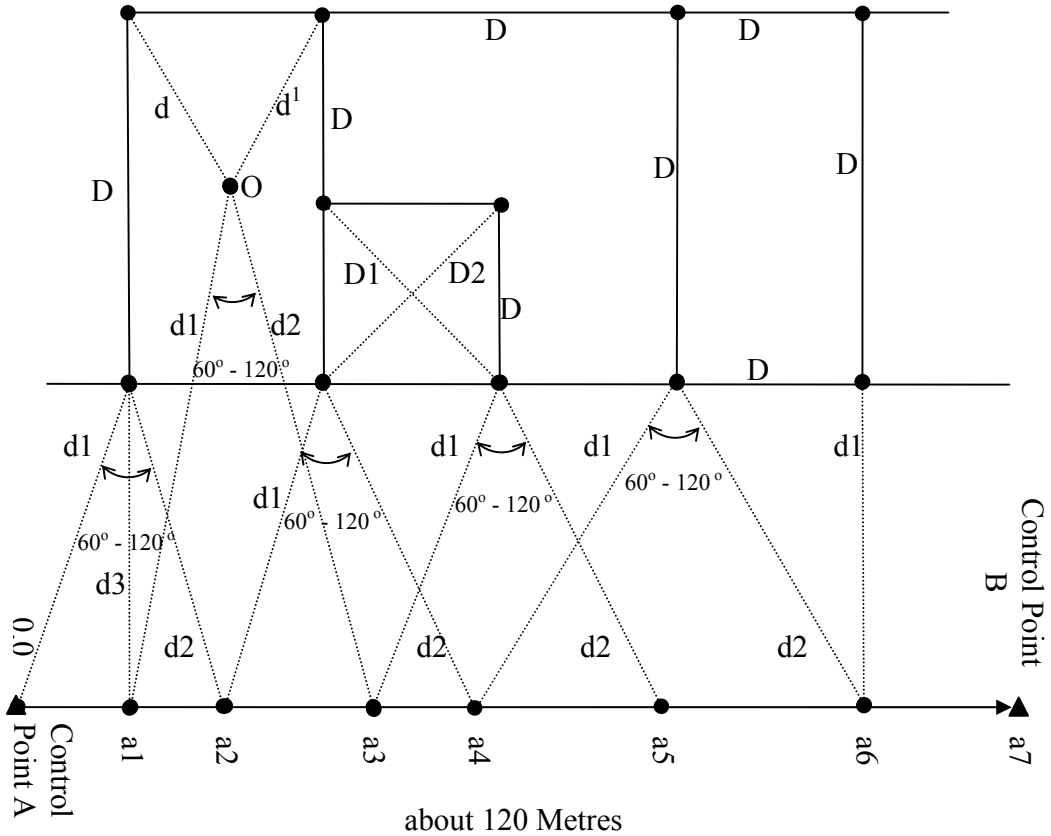
2.8 Examples of Alternate Survey Methods

In both the square offset and two distance methods control is required at each end of the baseline, this can be established by either GPS or Total Station. The baselines should not be longer than about 120 metres.

When observing ie measuring by either method, the running distance will be noted along the line where the distance will be measured from. The measurement to the boundary mark or fence etc on either side of the baseline should have either an “L” or “F” recorded behind the distance to signify which side of the baseline the measurement was taken.

When using the square offset method, an optical square should be used.

The following diagram shows all the alternate measuring methods where no instruments apart from an optical square for square off distances measurement.



WHERE:

A & B are control stations

a1 - a7 are running distances along the base line between the control points

d, d1 & d2 are distances from base line to boundary corner

60° - 120° are the offset angles

O is an offset point

d1 & d2 are distances to offset point

D1 & D2 are distances from offset point to boundary corner

D1 and D2 are diagonals of the land parcel

D are measured distances

Annex 2 Evaluation of GPS Trial for Cadastral Surveys

1 Evaluation of GPS Trial for Cadastral Surveys

This section of the report was prepared by the International Survey Control Adviser whom was stationed at PIO1 and whose expertise was required to evaluate the trial of GPS surveys for low accuracy cadastral surveys.

A “GPS Survey Evaluation” pilot investigation was conducted in the Barangay of Macalpiay, Pastrana during October and November 2002.

Low precision GPS survey techniques offer an alternative technique for the survey of lot boundaries for the issuance of titles in rural areas where land values are comparatively low. In such areas, it is difficult to justify the cost of high precision surveys. Low precision GPS techniques involve the post processing of “code data” recorded at a base station and at the roving receiver occupying the points to be coordinated. The technique is often referred to as “differential code GPS” or sometimes just as “differential GPS” in contrast to high precision GPS by post processing of recorded phase data (“differential phase GPS” or “relative positioning”).

Experience in other jurisdictions has shown that differential code GPS can produce reliable results at the 0.5m – 1.0m level from three independent observations of quite short duration such as 30 seconds. Tests were conducted in Lao People’s Democratic Republic on the Lao Land Titling Project in 1998. On that trial, it was found that for 97% of the points, the mean eastings and northings were within 1.0m of the values derived from high precision fast static differential phase observations. (*Survey Control in Rural Villages - Lao PDR Land Titling Project, June 1998*)

1.2 Pilot Overview

1.2.1 Pilot Aims

The aims of the pilot were:

- *“To test alternative survey techniques that have the potential to produce more efficient and cost effective boundary definition in the support of issuance of titles in rural areas.”*

1.2.2 Techniques to be Tested

The techniques to be tested on the pilot were:

- *“High precision and low precision GPS under different satellite visibility conditions (variable tree canopy)”*

1.2.3 Proposed Methodology

The proposed methodology is summarized below:

Field inspection to determine approx tree canopy (above 15 degrees elevation) on boundary monuments and plotting on maps.

Selection of suitable points for GPS observations

GPS observations on selected boundary monuments with:

- *Light tree canopy (0-25% cover)*
- *Moderate tree canopy (26-50% cover)*

Using the following GPS techniques:

- *High precision phase (fast static)*
- *Low precision code (differential)*

Processing of GPS data.

Results to be compared and also with existing survey data to determine:

- *appropriateness of each techniques under variable tree canopy*
- *accuracies obtainable from differential GPS*

1.2.4 Proposed Evaluation

The proposed evaluation was to consider the following:

- *Comparison of capabilities of high and low precision GPS and comparison with conventional survey data.*
- *Comparison of costing.*

1.3 Conduct of Pilot

The pilot was conducted by PIO1 survey staff under the supervision of Eng. Oliver Ong, with advice and suggestions from the Adviser.

1.3.1 Field Inspection & Selection of Points

From the initial inspection it was evident that the tree canopy is very dense throughout all of Macalpiay, being a coconut growing area. The most open sites are along and close to the provincial road which passes through the barangay and along which the residential development has occurred.

Given that GPS techniques are relatively straight forward and results easy to obtain in open areas it was decided that the area was suitable to test GPS under variable tree canopy conditions.

The survey teams attempted to locate all boundary monuments in Macalpiay and for those that were located; they made an assessment of the percentage tree canopy above an elevation of 15 degrees. The reconnaissance was completed by 22nd October and a selection of suitable points made by Eng. Ong and the Adviser, from the information indicated on the maps.

It had been intended to concentrate on points with tree canopy up to 50% and also to try to observe all corners of selected allotments. It soon became apparent that a combination of missing monuments and the heavy tree canopy would make the selection of any allotments with all points recovered and up to 50% tree canopy virtually impossible. Accordingly a number of points were selected with tree canopy between 50% and 100%, knowing that it was most unlikely that reasonable high precision (fast static) GPS observations would be possible.

Points selected were essentially corners of lots fronting the provincial road.

1.3.2 Initial GPS Results

The GPS observations were made using PIO1's two Leica SR520 dual frequency P-code receivers. When using these receivers, both code and phase data is recorded. The observations for differential code were of approximately one minute duration using a one second recording rate. The differential results were obtained by processing the data using the "code only" option in the Leica SKI-Pro software.

It was not until 19th November that the Adviser was able to review the adjustment of the fast static GPS observations carried out by Eng. Ong. After acceptance of the adjustment, Eng. Ong prepared a summary of the results showing comparisons between the various fast static and differential results together with the coordinates from the cadastral survey of Macalpiay.

The Adviser was able to review the summary on 22nd November. The results were cause for serious concern. The following was noted:

- *Large differences between the fast static coordinates and the cadastral coordinates for most of the points with up to 50% tree canopy, and especially those with less than 25% tree canopy.*
- *Two points had the same cadastral coordinates.*
- *Large differences between pairs of differential coordinates on three points*

Eng. Ong was asked to review a number of matters and undertake some additional observations as follows:

- *To check all the cadastral coordinates.*
- *Two more fast static observations at 11 points and check the tree canopy indicated in the summary.*
- *To check the tree canopy at three points where good agreement was obtained but tree canopy shown as greater than 50%.*
- *Two more differential observations at three points with very large differences between the pair of differential coordinates.*
- *Two more differential observations at another 19 points.*

1.3.3 Final GPS Results

Final results were submitted to the Adviser on 29th November. A copy of the results and comparisons is to be found at the end of this Annex. The results have been split into three groups on the basis of the percentage of tree canopy.

- *Three points: MAC-6, 9 & 25 have particularly large differences between the two pairs of differential observations.*
- *For MAC-6, the differences suggest that the wrong point may have been occupied on one occasion.*
- *These points have been excluded from further analysis.*

0-25% Tree Canopy

Ten points were observed in this category.

- *Good agreement between the pairs of differential observations.*
 - *All differences in E & N are less than 1.0m.*
- *Very good agreement between the mean differential values and the adjusted fast static values.*
 - *All differences in E & N are less than 0.4m.*
- *Very large differences between the adjusted fast static observations and the cadastral coordinates on 8 of the 10 points.*
 - *The differences are not consistent.*

The results suggest some major inconsistencies in the cadastral coordinates

25-50% Tree Canopy

17 points were observed in this category.

- *Good agreement between 12 of the pairs of differential observations.*
 - *For the 12 points, all differences in E & N are less than 1.0m.*
 - *Other 5 points; 1.0m < differences < 2.0m*
- *Good agreement between most of the mean differential values and the adjusted fast static values.*
 - *8 of 9 differences in E & N are less than 1.0m.*
 - *Other point; 1.0m < differences < 2.0m*
- *LYT-62 had existing fast static coordinates which were used for the cadastral survey.*
- *No reasonable fast static results on 8 points.*

- *Good agreement between some of the adjusted fast static values and cadastral coordinates.*
 - *5 of 8 differences in E & N are less than 0.3m.*
 - *1 point; 0.3m < differences < 0.5m*
 - *Other 2 points; 1.0m < differences < 2.0m*

Over 50% Tree Canopy

There is little consistency in the results for this category.

1.3.4 Costing

As at 2nd December, PIO1 had not provided any data on costing of the operations on the pilot study. To this time all emphasis had been on producing some satisfactory results from the GPS operations. This data is needed to prepare a comparison of the cost of using the two GPS techniques against the cost of conventional survey.

It is recommended that:

- *PIO1 prepare the costing information for the pilot study and compare the costs for both code and phase GPS techniques for points with up to 25% tree canopy with the cost of the cadastral survey, consider the cost per boundary corner and lot, in addition prepare a comparison of the times these operations would take.*

1.4 Conclusions

Considering the above analysis some limited conclusions can be drawn.

There are very significant variations between some of the cadastral coordinates and GPS values, however the differential code GPS and differential phase GPS values show good agreement. These variations, between the cadastral and GPS values, are evident for most of the points with minimal tree canopy. Accordingly, serious questions arise as to the quality of the cadastral coordinates. It is suggested that investigations are needed into the cadastral coordinates. It may be necessary to conduct some independent traversing to verify the coordinates.

It is recommended that:

- *Investigations are conducted to determine the quality of the cadastral coordinates in Macalpiay.*

Conclusions will therefore be limited to a comparison between the fast static and differential GPS observations. Any recommendations made are subject to satisfactory resolution of the cadastral coordinate problem.

0-25% Tree Canopy

The excellent agreement between the fast static and differential coordinates suggests that under 0-25% tree canopy, the mean of two differential code observations should produce

results within 0.5m (in eastings and northings) of the value that would be obtained using high precision GPS techniques.

It is recommended that:

- *Subject to resolution of the cadastral coordinate problem in Macalpiay, differential code GPS is considered as a suitable technique for low accuracy surveys in rural areas with tree canopy less than 25%, where accuracies at the 0.5–1.0m level are considered appropriate.*
- *If differential techniques are to be adopted, then a minimum of two independent observations are required for each point and the difference between the independent observations should not exceed 1.0m.*

25-50% Tree Canopy

Although a fairly limited sample of only 6 points, the results suggest that where the difference between the two pairs of differential coordinates are less than 1.0m, taking the mean value should produce results within 1.0m (in eastings and northings) of the value that would be obtained using high precision GPS techniques.

The sample size suggests that further tests should be made under these conditions.

The other point worth noting is that the Leica SR520 receivers used for the pilot test provide no indication of the amount of code data that has been collected. Therefore it is quite possible that insufficient code data has been recorded at some points. This could be checked after processing, by viewing the processing “Log File”. Additional information about the quality of the differential processing may be obtained by viewing the “Residuals”.

It is recommended that:

- *Further investigations should be conducted into the suitability of differential code GPS in areas where tree canopy is between 25-50%, using receivers that enable the operator to determine how much code data has been recorded.*

Over 50% Tree Canopy

It is very difficult to draw any conclusions other than that the use of GPS is risky with over 50% tree canopy without further investigations. Bearing in mind the comments about the Leica receivers in the previous paragraph, it may be possible to obtain satisfactory results if some quality control measures were used in the field to ensure that sufficient data is collected. This option could be explored using receivers that may be purchased in future, specifically for differential code observations.

It is recommended that:

- *At this stage differential code GPS techniques are not used for surveys in areas with greater than 50% tree canopy.*
- *In the event that future investigations prove that differential code GPS is suitable for survey in areas with tree canopy between 25-50% it may be*

appropriate to consider further investigations into suitability for areas with tree canopy greater than 50%.

1.5 Results

Macalpiay GPS Pilot Results

Point	% Tree Coverage	Differential Obs. 1		Differential Obs. 2		ΔE	ΔN	Mean Differential		Fast Static Obs.		ΔE	ΔN	Cadastral Coordinates		F/S GPS - Cad.			
		Easting	Northing	Easting	Northing			Easting	Northing	Easting	Northing			Easting	Northing	Easting	Northing	ΔE	ΔN
MAC-2	0-25%	482929.19	1229937.38	482929.76	1229937.82	-0.57	-0.44	482929.48	1229937.60	482929.50	1229937.48	-0.03	0.12	482929.40	1229937.53	0.10	-0.05		
MAC-14	0-25%	483393.27	1229955.80	483392.95	1229956.62	0.32	-0.82	483393.11	1229956.21	483393.18	1229956.00	-0.07	0.21	483393.53	1229957.07	-0.35	-1.07		
MAC-15	0-25%	483401.73	1229955.68	483401.42	1229956.31	0.31	-0.63	483401.58	1229956.00	483401.75	1229955.83	-0.18	0.17	483403.30	1229957.52	-1.55	-1.69		
MAC-29	0-25%	483762.64	1229966.09	483762.28	1229966.08	0.36	0.01	483762.46	1229966.09	483762.40	1229965.92	0.06	0.17	483762.41	1229969.38	-0.01	-3.46		
MAC-30	0-25%	483741.67	1229953.23	483741.54	1229953.41	0.13	-0.18	483741.61	1229953.32	483741.44	1229953.11	0.16	0.21	483741.88	1229953.71	-0.44	-0.60		
MAC-31	0-25%	483752.27	1229953.69	483752.26	1229953.55	0.01	0.14	483752.27	1229953.62	483752.29	1229953.24	-0.02	0.38	483752.28	1229954.06	0.01	-0.82		
MAC-32	0-25%	483761.92	1229954.17	483761.93	1229953.89	-0.01	0.28	483761.93	1229954.03	483762.03	1229953.80	-0.11	0.23	483762.03	1229954.67	0.00	-0.87		
MAC-34	0-25%	483823.45	1229940.94	483822.80	1229941.56	0.65	-0.62	483823.13	1229941.25	483823.28	1229941.08	-0.16	0.17	483823.24	1229941.77	0.04	-0.69		
MAC-35	0-25%	483831.79	1229941.47	483832.31	1229941.11	-0.52	0.36	483832.05	1229941.29	483832.06	1229941.14	-0.01	0.15	483831.80	1229942.01	0.26	-0.87		
MAC-45	0-25%	483766.46	1229955.86	483766.52	1229955.49	-0.06	0.37	483766.49	1229955.68	483766.69	1229955.46	-0.20	0.22	483767.00	1229955.20	-0.31	0.26		
LYT-62	25-50%	482898.85	1229938.46	482900.00	1229937.28	-1.15	1.18	482899.43	1229937.87	482900.63	1229937.96	-1.21	-0.09	482900.63	1229937.96	0.00	0.00		
MAC-1	25-50%	482912.83	1229937.82	482914.42	1229937.64	-1.59	0.18	482913.63	1229937.73	482913.62	1229937.80	0.01	-0.07	482913.71	1229937.84	-0.09	-0.04		
MAC-3	25-50%	482944.37	1229937.55	482944.92	1229937.68	-0.55	-0.13	482944.65	1229937.62	NA	NA	NA	NA	482945.39	1229937.59	NA	NA		
MAC-4	25-50%	482961.58	1229936.06	482961.82	1229936.78	-0.24	-0.72	482961.70	1229936.42	482962.06	1229936.53	-0.36	-0.11	482962.03	1229936.62	0.03	-0.09		
MAC-5	25-50%	482901.90	1229889.95	482901.89	1229891.07	0.01	-1.12	482901.90	1229890.51	NA	NA	NA	NA	482902.30	1229889.75	NA	NA		
MAC-11	25-50%	483413.20	1229980.73	483413.19	1229980.07	0.01	0.66	483413.20	1229980.40	483413.51	1229979.85	-0.31	0.55	483413.71	1229979.90	-0.20	-0.05		
MAC-13	25-50%	483412.76	1229969.09	483412.80	1229969.67	-0.04	-0.58	483412.78	1229969.38	483412.71	1229969.27	0.07	0.11	483412.90	1229969.35	-0.19	-0.08		
MAC-17	25-50%	483575.55	1229940.11	483575.92	1229939.93	-0.37	0.18	483575.74	1229940.02	483575.49	1229939.56	0.24	0.46	483575.86	1229939.60	-0.37	-0.04		
MAC-18	25-50%	483588.45	1229940.14	483589.30	1229939.96	-0.85	0.18	483588.88	1229940.05	483589.82	1229940.58	-0.95	-0.53	483590.11	1229940.68	-0.29	-0.10		
MAC-26	25-50%	483742.59	1229980.83	483742.50	1229980.53	0.09	0.30	483742.55	1229980.68	NA	NA	NA	NA	483742.91	1229981.34	NA	NA		
MAC-27	25-50%	483752.34	1229980.36	483752.53	1229981.12	-0.19	-0.76	483752.44	1229980.74	NA	NA	NA	NA	483752.33	1229981.73	NA	NA		
MAC-33	25-50%	483815.23	1229941.25	483815.63	1229940.41	-0.40	0.84	483815.43	1229940.83	NA	NA	NA	NA	483815.17	1229941.30	NA	NA		
MAC-36	25-50%	483832.99	1229930.28	483833.08	1229930.46	-0.09	-0.18	483833.04	1229930.37	NA	NA	NA	NA	483833.38	1229928.52	NA	NA		
MAC-38	25-50%	483814.93	1229930.06	483813.90	1229930.77	1.03	-0.71	483814.42	1229930.42	483814.80	1229929.76	-0.38	0.66	483815.13	1229928.22	-0.33	1.54		
MAC-39	25-50%	483758.16	1229886.28	483758.90	1229886.86	-0.74	-0.58	483758.53	1229886.57	NA	NA	NA	NA	483758.78	1229885.50	NA	NA		
MAC-40	25-50%	483771.10	1229888.17	483771.26	1229888.77	-0.16	-0.60	483771.18	1229888.47	483771.12	1229888.28	0.06	0.19	483771.59	1229886.40	-0.47	1.88		
MAC-43	25-50%	483836.19	1229882.90	483836.09	1229884.78	0.10	-1.88	483836.14	1229883.84	NA	NA	NA	NA	483837.13	1229883.26	NA	NA		

Philippines - Australia Land Administration and Management Project

Point	% Tree Coverage	Differential Obs. 1		Differential Obs. 2		ΔE	ΔN	Mean Differential		Fast Static Obs.		ΔE	ΔN	Cadastral Coordinates		F/S GPS - Cad.			
		Easting	Northing	Easting	Northing			Easting	Northing	Easting	Northing			Easting	Northing	Easting	Northing	ΔE	ΔN
MAC-7	50-75%	482931.26	1229890.36	482932.00	1229890.13	-0.74	0.23	482931.63	1229890.25	482931.90	1229890.51	-0.27	-0.26	482934.49	1229893.27	-2.59	-2.76		
MAC-10	50-75%	483393.91	1229979.58	483394.07	1229979.34	-0.16	0.24	483393.99	1229979.46	NA	NA	NA	NA	483394.05	1229978.81	NA	NA		
MAC-16	50-75%	483567.86	1229941.11	483567.48	1229940.49	0.38	0.62	483567.67	1229940.80	NA	NA	NA	NA	483567.45	1229940.70	NA	NA		
MAC-19	50-75%	483563.65	1229905.03	483561.96	1229905.18	1.69	-0.15	483562.81	1229905.11	NA	NA	NA	NA	483564.23	1229904.96	NA	NA		
MAC-21	50-75%	483591.56	1229910.20	483592.30	1229910.54	-0.74	-0.34	483591.93	1229910.37	NA	NA	NA	NA	483592.53	1229910.46	NA	NA		
MAC-22	50-75%	483752.37	1230001.46	483751.96	1230001.58	0.41	-0.12	483752.17	1230001.52	NA	NA	NA	NA	483752.03	1230000.31	NA	NA		
MAC-23	50-75%	483768.53	1229996.64	483769.99	1229996.82	-1.46	-0.18	483769.26	1229996.73	NA	NA	NA	NA	483768.51	1229995.89	NA	NA		
MAC-24	50-75%	483807.53	1229982.37	483807.59	1229984.60	-0.06	-2.23	483807.56	1229983.49	483807.15	1229983.53	0.41	-0.04	483807.49	1229985.42	-0.34	-1.89		
MAC-25	50-75%	483828.21	1229975.22	483819.86	1229976.67	8.35	-1.45	483824.04	1229975.95	483826.06	1229975.78	-2.02	0.16	483826.74	1229980.25	-0.68	-4.47		
MAC-28	50-75%	483752.96	1229965.92	483752.01	1229965.88	0.95	0.04	483752.49	1229965.90	483752.64	1229966.03	-0.16	-0.13	483752.90	1229970.02	-0.26	-3.99		
MAC-41	50-75%	483764.03	1229872.71	483762.79	1229872.88	1.24	-0.17	483763.41	1229872.80	483762.35	1229872.43	1.06	0.36	483762.99	1229870.42	-0.64	2.01		
MAC-42	50-75%	483772.95	1229873.57	483772.59	1229875.20	0.36	-1.63	483772.77	1229874.39	NA	NA	NA	NA	483772.95	1229872.56	NA	NA		
MAC-44	50-75%	483849.87	1229892.91	483849.84	1229892.87	0.03	0.04	483849.86	1229892.89	483849.84	1229893.05	0.01	-0.16	483850.23	1229891.67	-0.39	1.38		
MAC-6	75-100%	482820.19	1229896.20	482918.68	1229883.61	-98.49	12.59	482869.44	1229889.91	NA	NA	NA	NA	482915.14	1229891.15	NA	NA		
MAC-8	75-100%	482949.94	1229892.35	482947.91	1229893.38	2.03	-1.03	482948.93	1229892.87	482948.39	1229892.96	0.53	-0.09	482950.24	1229894.99	-1.85	-2.03		
MAC-9	75-100%	482968.29	1229895.29	482961.11	1229900.34	7.18	-5.05	482964.70	1229897.82	482966.72	1229896.14	-2.02	1.68	482966.66	1229896.78	0.06	-0.64		
MAC-20	75-100%	483576.99	1229907.97	483576.24	1229907.38	0.75	0.59	483576.62	1229907.68	NA	NA	NA	NA	483578.94	1229906.32	NA	NA		
MAC-37	75-100%	483823.72	1229930.48	483821.62	1229930.68	2.10	-0.20	483822.67	1229930.58	483824.04	1229929.58	-1.37	1.00	483824.38	1229928.02	-0.34	1.56		

Annex 3 CIM Formate

1.1 Cadastral Index Maps (CIM)

- The CIM is a map series that covers all cadastral related information. The CIM shows the cadastral information as spatial (graphical) index only, ie a working map. The CIM is not a legal identifier of land and does not replace the land records such as Certificate of Title and survey plans. It is used to manage and control the lands records process by providing a means of identifying individual land parcels and the associated land records ie titles and survey plans etc.

1.2 CIM Scale and Numbering

All CIM will have a unique number, in this manner a CIM location and scale can be identified by the CIM number.

The base cadastral map within the Philippines is 1:4000 and depending on the location, ie Rural or Urban, the scale can be either one of the following:

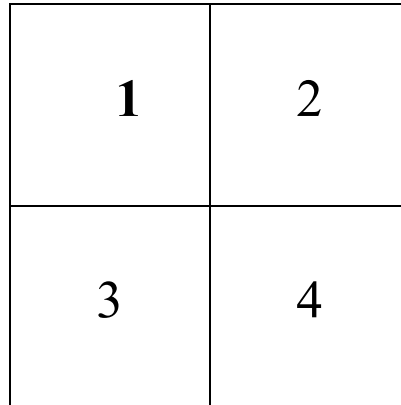
- *1:4000;*
- *1:2000;*
- *1:1000;*
- *1:500.*

Basically the CIM will be numbered by the geographical coordinates of the bottom left corner of the base 1:4000 map sheet and then broken down into 1:2000, 1:1000 and 1:500 sheet numbers.

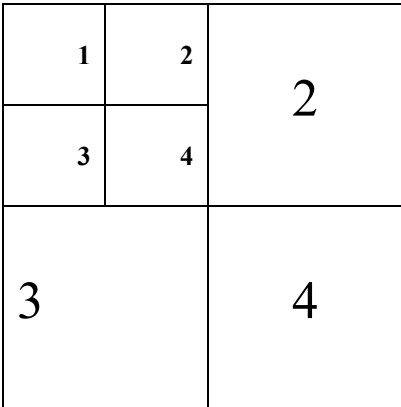
Below is a schematic drawing of a standard 1:4000



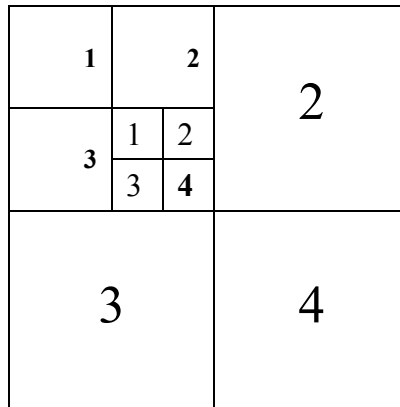
This can be broken down into 4 by 1:2000 map sheets



This can be broken down into 4 by 1:1000 map sheets



This can be broken down into 4 by 1:500 map sheets



14°30'
121°15'

The bottom left corner of the 1:4000 map sheet is defined by Latitude eg 14°30' and Longitude of 121°15'.

The CIM numbering can now be the degrees and minutes of that sheet corner. Considering that the Philippines longitude extends for only 5° the digit for 100 degrees longitude can be eliminated, leaving 4 significant numbers that can define the corner of the 1:4000 CIM, ie 14302115.

To enable the 1:2000 sheet numbering ie sheet 1 in this case an extra digit is required, 143021151 indicates this sheet. To enable the 1:1000 map sheet to be shown and extra digit is added ie 1430211514. To enable the 1:500 map sheet to be shown an extra digit is shown ie 14302115144.

Using the example shown above, if only the 1:4000 sheet is referred to then the CIM number would be 14302115000, if the 1:2000 sheet is referred to the CIM number would be 14302115100. If the 1:1000 sheet were referred to the CIM number would be 14302115140. If the 1:500 sheet were referred to the CIM number would be 14302115144.

This then becomes a unique CIM numbering system and by this number any sheet can be located geographically with ease.

Each CIM will be a specified size, ie the area shown within the CIM will depend on the scale of the CIM, being:

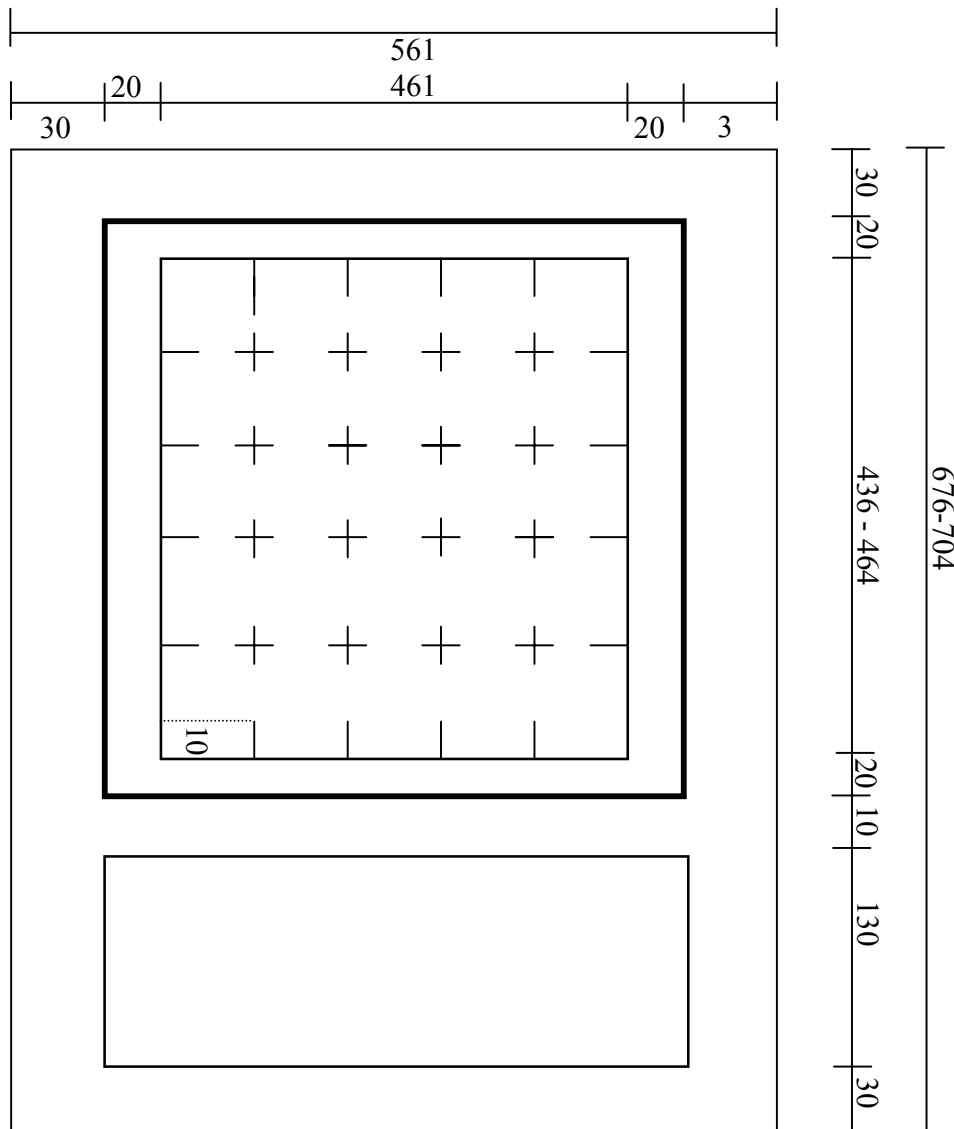
- 1:4000, the map sheet will be 1' (one minute) of arc of latitude and longitude.
- 1:2000, the map sheet will be 30" (thirty seconds) of arc of latitude and longitude.
- 1:1000, the map sheet will be 15" (fifteen seconds) of arc of latitude and longitude.
- 1:500, the map sheet will be 7.5" (seven and a half seconds) of arc of latitude and longitude.

1.3 CIM Parcel (Lot) Numbering

Every parcel of land with or without a title will be shown on the CIM and given a Unique Parcel Identifier (UPI) ie a unique number that is not repeated within the CIM where that parcel occurs. A Cross Index Database (CrossIndex) will maintain an up to date reference of each parcel of land on any CIM, with respect to all the relevant information held by other participating agencies dealing with that parcel.

Dimensions of Cadastral Index Map Sheet

Dimensions are in millimetres



Annex 4 Adviser Terms of Reference

TERMS OF REFERENCE

INTERNATIONAL LAND PARCEL MAPPING ADVISER

Second Part of Long Term Assignment (2001/2002)

The PA-LAMP foreshadows a potential 15-20 year program to improve land administration in the Philippines. It is a strategic GOP initiative which aims to support an efficient land market and alleviate the present low level of confidence in the system of formal land registration and the lack of tenure security.

The **Goal** of AusAID assistance, through support of the TA program, is *to assist the GOP to improve the effectiveness, transparency and efficiency of land administration to achieve the resultant flow of economic and social benefits in the Philippines.*

The **Purpose** of the TA program is *to assist the GOP to establish structures and operating procedures for a long term program to reform the land administration system in the Philippines.*

The Land Parcel Mapping adviser to the LAMP Project will work at both Prototype 1 (Leyte) and 2 (Quezon City). The exact timings will be determined month by month depending on the work needs. It is expected that slightly more time will be spent at prototype 2.

The adviser will report to the TA team leader. The Land Parcel mapping adviser will work closely with Project counterparts at each Project site.

The approach at all times will provide the Project with best practice, a safe working situation and be Gender sensitive. The adviser will cooperate with the members of the Quality Assurance Panel whose job it is to verify that TA outputs are of a suitable standard and completeness. To this end, the adviser shall maintain an up to date work plan and have regular review meetings with counterparts on progress, issues and changes to the plan. A monthly report will be submitted to the team leader.

This TOR addresses the second 6 months of the assignment. Since the photomaps to be supplied by NAMRIA are late the third assignment (in 2003) will be delayed start until such photomaps are available.

The International land parcel mapping adviser will be responsible for completing the following work no later than 31 December 2002 (reference is the PDD and the work to be completed is described as Deliverables 21 and 22 in the AusAid – AMC contract):

1. The task in prototype 1 is to assist in the identification of options for improved survey and mapping methods to produce land parcel descriptions that are appropriate to support land titling. In particular, methods for producing the initial CIM based on existing records, updating the CIM from new surveys, producing cadastral maps from new surveys, and parcel descriptions on survey plans and other survey documents. The options considered may not necessarily be strictly

available under the existing laws in the country but need to be studied so that the planned activity to prepare a new land administration code may have guidance on the type of methods that the new legal framework should accommodate and the flexibility needed for efficient and timely mass land titling. The options will be described in terms of activities, resources, unit costs, staff skill levels required, organisation arrangements and operational convenience, these descriptions having been obtained from overseas experience. The advantages and disadvantages of each option shall be listed and a preliminary evaluation concluded, as it might apply to the Philippines. A range of stakeholders are to be involved in the evaluation, including the LMB and the private sector. Provide report on findings and recommendations.

2. The task in prototype 2 is to assist in the identification of options for better operations of mapping, and the testing and evaluation of options against agreed criteria. To include potential changes to the map product design (mapping system adopted etc), sources of base data, linkage to the textual database, update of the maps, security of the maps. The options should not be limited by existing regulations and laws, which may restrict current practices as these, could be changed for future operations. The evaluation should draw on experience in the project and overseas experience. A range of stakeholders are to be involved in the evaluation, including the LMB and the private sector. Provide report on findings and recommendations.
3. The CIM are to be fundamental to the identification of fake, duplicate and missing titles in the Quezon City pilot area and the processes should be integrated with other prototype processes. The integration of the CIM into the OSS and the ROD is a key task in order for the quality of the records to be sustained into the future. The approach will involve community groups in all stages of the work in addition to the PIO2 agencies.
4. A pilot test of a GIS (geographic information system) will be begun in both prototypes. The international adviser will design the pilot test and describe the potential benefits and issues so that they may be evaluated. A national adviser will assist in this pilot test. The evaluation will be performed in 2003 by the PIOs and the national adviser.
5. The priority and specific outputs from the adviser are:
 - a) Prototype 1: Report covering the above scope and including; report and training on options identified, described and those tested. Evaluation of tested or investigated options, including quality control issues. Report on work shops assessments. Recommendations for better survey and mapping methods.
 - b) Prototype 2: Report covering the following; documentation and training on options tested and the procedures described for each option. Evaluation of tested or investigated options, including quality control issues. Report on evaluation work shops. Recommendations for improved product and

operational processes. Recommendations on staffing issues associated with the tested options and other input resources.

- c) Cadastral Options. An annex listing all cadastral survey options and their advantages and disadvantages is to be completed, with input from the survey control adviser. This will be used for evaluating impacts on survey control (by the Survey Control adviser) and on survey documentation, especially cadastral mapping and survey plan documentation (land parcel mapping adviser).
 - d) GIS: The pilot GIS is a second priority behind the above options analysis and reporting. A large part of the support for this will be provided by the national adviser.
 - e) Photomap delays: Since the photomaps due for delivery by NAMRIA are delayed, then the approach will be as follows: a literature search of experiences from other projects such as TLTP and LLTP (both World Bank funded projects in the Region) will be used to document the processes and advantages / disadvantages for CIM production and survey plan completion, and the nature of expected application in LAMP II. Secondly, the TA team should assist on testing these approaches with photomaps in urban and rural when they become available. This should not affect this TOR but could cause a delay in starting input of TA on CIM in activity 27, due to start 1 January 2003.
6. Work with stake holders to develop strategies, organisational linkages and relationships that support Prototype activities.

End

TERMS OF REFERENCE

NATIONAL SURVEY AND MAPPING ADVISER

Second Part of Long Term Assignment (2001/2002)

The PA-LAMP foreshadows a potential 15-20 year program to improve land administration in the Philippines. It is a strategic GOP initiative which aims to support an efficient land market and alleviate the present low level of confidence in the system of formal land registration and the lack of tenure security.

The **Goal** of AusAID assistance, through support of the TA program, is *to assist the GOP to improve the effectiveness, transparency and efficiency of land administration to achieve the resultant flow of economic and social benefits in the Philippines.*

The **Purpose** of the TA program is *to assist the GOP to establish structures and operating procedures for a long term program to reform the land administration system in the Philippines.*

This terms of reference is in respect to the second assignment of the national S&M adviser. The Survey and Mapping adviser to the LAMP Project will work primarily at Prototype 1 (Leyte) and only as required on specific assignment at PIO2 (Quezon City).

The adviser will report to the TA team leader and work as a team with the other TA advisers, in particular the international land parcel mapping adviser, the survey control and systematic registration adviser. The adviser will work closely with Project counterparts.

The approach at all times will provide the Project with best practice, a safe working situation and be Gender sensitive. The adviser will cooperate with the members of the Quality Assurance Panel whose job it is to verify that TA outputs are of a suitable standard and completeness. To this end, the adviser shall maintain an up to date work plan and have regular review meetings with counterparts on progress, issues and changes to the plan.

A monthly report will be submitted to the team leader.

Survey and Mapping Work in Prototype 1

The overall task in prototype 1 is to assist in the development, training, testing and documenting of procedures and methods for mapping land parcels prior to land titling, surveying and mapping of land parcels during systematic land titling and at the time of land registration in order to support the overall first time issuing of land titles. The records must be in sound condition so that they may be kept up to date in the future as transactions occur and as sub-divisions occur.

A number of survey methods are planned to be used including ground surveys, photomaps and satellite imagery. The various survey plans and maps being produced will be reviewed and improved and training provided. The process of parcel mapping must be smoothly integrated with the other titling activities so that the maps are directly used to

control mistakes in duplicating surveys and patent and title issuing. Access to CENRO information is important for identifying earlier surveys and LRA for earlier title registration.

The mapping should be on the standard national coordinate system (PRS 92). Quality assurance must be built into the processes.

Training and workshops will be a feature to obtain consensus on new approaches and for technical skills upgrade. Any additional equipment to improve the work outputs are to be reported. It is planned that both judicial and administrative titling (free patents) will be implemented in target test Barangays.

Further, assistance is to be provided to the OSS and ROD so that the CIM and other land records are integrated into normal work processes so that they are used to avoid errors in issuing fake or overlapping titles. Assistance is to be given on presenting results and recommendations to the LAG and PMO.

Further, assistance will be provided to ensure that the land lot surveys are performed to suitable levels of accuracy and completeness and well documented. This is to include instructions on standard recording of occupations; i.e. boundary monuments, both artificial and natural.

Assistance will be provided in contracting the private sector surveyors and on methods to test and accept the work of the private sector.

Advice should be provided on better filing and keeping of the valuable survey records.

Together with the other TA advisers develop better ways to streamline the overall process of survey, adjudication and office processing, leading to land title registration.

Work together with the systematic land registration adviser to design and document more efficient processes for free patent issuing and registration.

Survey and Mapping Work in Prototype 2

The overall task in prototype 2 is to assist in the development, documenting and training on methodologies and processes to create Cadastral Index Maps (CIM) from existing map data in offices of participating agencies, using survey information and orthophotos to control the mapping process. Evaluate and report on the quality and completeness of existing survey data held by various agencies. Include a method to ensure that any land parcel sub-divisions / consolidations are captured onto the CIM. The CIM are to be fundamental to the identification of fake, duplicate and missing titles in the Quezon City pilot area and the processes should be integrated with other prototype processes. The integration of the CIM into the OSS and the ROD is a key task in order for the quality of the records to be sustained into the future. The approach will involve community groups in all stages of the work in addition to the PIO2 agencies.

The national survey and mapping adviser will be responsible for completing the following work no later than 30 December 2002 (reference is the PDD and the work to be completed is described as Deliverables 21 and 22 in the AusAid – AMC contract):

1. The top priority specific outputs from the adviser are shown here:
 - a) Prototype 1: Assist the prototype to implement the free patent titling test with new streamlined procedures. Advise on the new procedures, assist on training, assist on supervision and evaluation to catch the lessons and improve the processes of administrative titling. In addition, advise the prototype in the preparation the CIM for the free patent titling in rural areas and the judicial titling test in residential areas. Assist in the training of the deputy land inspectors and others. Assist in the selection of contractors as requested by the prototype manager.
 - b) Assist the international parcel mapping and survey control advisers in their evaluations of various alternate methods for surveying in support of accelerated titling. In particular, give advice and written analysis on the operational and conceptual advantages and disadvantages of the various alternate approaches. Participate in workshops to catch lessons.
 - c) Prototype 2: Assist the international parcel mapping and survey control advisers in their evaluations of various alternate methods for mapping surveying in support of better records management. In particular, give advice on the operational and conceptual advantages and disadvantages of the various alternate approaches. Participate in workshops to catch lessons.
2. Support the continued judicial titling in rural areas as required and its evaluation.
3. Continue to improve the documented procedures and operational manuals for survey and mapping to support the Titling pilots. Prepare relevant training programmes and assist in staff training and training evaluation.
4. Provide assistance to operationalise the OSS at Leyte.
5. Work with stakeholders to develop strategies, organisational linkages and relationships that support Prototype activities.
6. Provide input to the consensus building workshops of the policy studies.

End

TERMS OF REFERENCE

NATIONAL LAND TENURE STATISTICS ADVISER

The National Land Tenure Statistics adviser to the LAMP Project will work primarily at PMO (Quezon City) with occasional visits to the provinces.

The adviser will report to the TA team leader and work as a team with the other TA advisers, in particular, will directly oversight the work of the national land data adviser. The adviser will work closely with Project counterparts.

The approach at all times will provide the Project with best practice, a safe working situation and be Gender sensitive. The adviser will cooperate with the members of the Quality Assurance Panel whose job it is to verify that TA outputs are of a suitable standard and completeness. To this end, the adviser shall maintain an up to date work plan and have regular review meetings with counterparts on progress, issues and changes to the plan. A brief monthly report will be submitted to the team leader.

The qualifications are, experience in developing and documenting and operating GIS applications in land systems, and also, producing reports for management.

The national adviser will lead a team of two persons to compile broad level national land tenure data, essential other census/economic/physical data and produce summary and regional views of the data as an aid for selecting candidate provinces for a future LAMP project. Data quality will be a major issue so in-built checks will be essential. An early decision must be made on the level of aggregation to be used (eg municipal/city or province/city etc) and on the types of data to be gathered. This will be done in consultation with the Project staff and requires the documentation of a user needs analysis so that the system will be well targeted on our needs. Data that is not of primary concern for our analysis will not be collected.

The main tasks are referred to in the work plan as deliverables 20 and 31 include:

Land Tenure System

Deliverable 20

1. Design the land tenure system based on the needs of the LAMP for a system to support decision making about target locations for future titling. Document the needs analysis, the data model, the data entry and checking processes, and reporting.
2. The system is to be based on a standard textual database with some GIS functionality, and to include province and municipal polygons for display and analysis. The Project will provide the software tools.

3. Develop the system on a PC provided by the project and do system checks for performance against the design. Demonstrate to the PMO and make changes as required.
4. Document data collection requirements.
5. Test the prototype system with data from the municipalities of Leyte Province. The TA land tenure data adviser and PMO and PIO1 staff will assist to collect the data. Produce test outputs to verify the full system and documentation. Modify the system and documentation as required.
6. Develop specifications of the data collection phase for the LAMP contractor to perform.
7. Design quality control techniques for the data entry.
8. Provide training on data collection and entry to the contracted staff responsible for the national data capture.
9. Train staff of the Project to manage the system.
10. Provide analysis tools and standard reports and maps.
11. Make a summary report of the system and working guides.

Deliverable 31

12. After the data entry is completed and checked, produce analysis results of the national land tenure situation after consultation with the PMO on the required output.
13. Write a report on the results.
14. Present the results to a workshop organised by the TA and PMO.

GIS System

In addition, the national adviser will work together with the international land parcel mapping adviser to develop, test and evaluate a pilot GIS for use in the LAMP prototypes at Leyte and Quezon City. The purpose is to further improve the quality of the mapping information for use in the land titling and land records management activities.

Initially the system will be designed and a pilot begun in each prototype. This will include training and it will see the output by PIO staff of CIM. A brief report on the system objectives, characteristics and advantages / disadvantages will be made as part of the TA's main reports on deliverables 21 and 22.

During the first half of 2003 the main testing, training and evaluation will occur. Workshops will be used to convey the findings to a wider audience of the potential benefits of GIS in a future LAM Programme. A report on the evaluation will be produced and will form a part of the TA's main reports on Deliverables 25 and 27.

The Project will provide the GIS software and PC equipment, as well as a scanner and plotter.

Priority

This GIS task will be undertaken in parallel with the land tenure study but the land tenure study will be given the higher priority. It is planned that during the data collection phase of the land tenure study that the GIS work will proceed.

End