EGYPT DEED REGISTRATION SYSTEM PROPERTY INDEX MAPS – TECHNICAL SPECIFICATIONS AND GUIDELINES

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DATA PAGE

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Acronyms

CAD	Computer Aided Design
ESA	Egyptian Survey Authority
ESRI	Environmental Systems Research Institute – a GIS software vendor
GIS	Geographic Information Systems
GPS	Global Positioning System
IRO	Improved Registry Office
QA	Quality Assurance
QC	Quality Control
PID	Property Identification number
PIM	Property Index Map
REPD	Real Estate Publicity Department
RMSE	Root Mean Standard Error
RO	Registry Office

Executive Summary

The primary use of the Property Index Map (PIM) is to identify and locate registered and registrable properties, and these specifications are designed to create a map to serve this purpose. (It should be noted that the PIM does not identify and locate property boundaries, which requires a different standard of specification). The property index map will have the generic character of a map. The map will correctly represent real world property objects both geometrically and geographically to some measurable degree. These specifications quantify the “degree” and the level effort or methodology of “measurement”, and apply to both analogue and digital versions of property index maps.

Although in hardcopy format the PIM would be plotted at 1:1,000, it is more appropriate to consider the PIM as a 1:2,500 scale map in terms of positional accuracy. As the primary use of the PIM is for the spatial representation of area features, the absolute accuracy for well-defined features depicted on the PIM is established as: +/- 1.44 meters RMSE (equivalent to +/- 2.50 meters at 95% confidence level). The relative accuracy between well-defined points on the PIM is established as: 1:200.

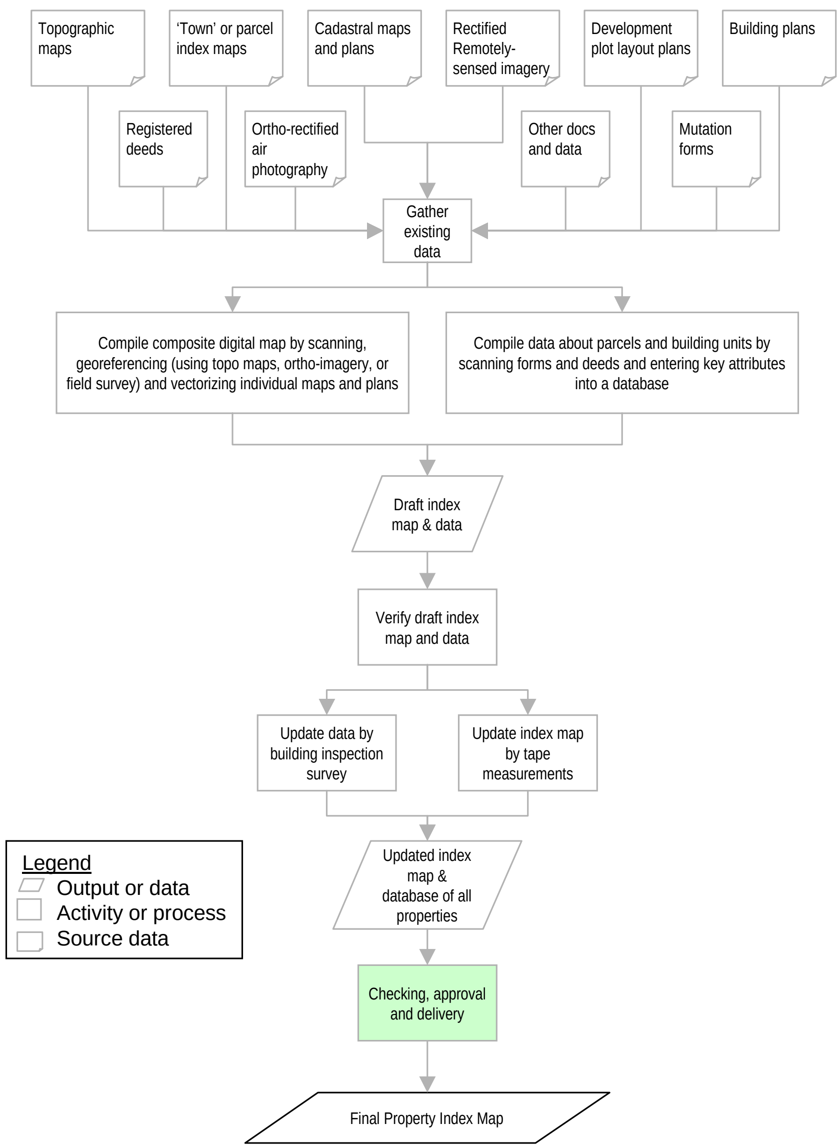
The PIM shows one feature class – properties – comprised of two features types – land parcels and permanent buildings. All other elements of the map are secondary and supporting. Lines only exist to define properties; points exist as hooks for attribute data (property identification number) or text annotation (street names). The PIM only contains the feature objects of parcels and buildings. These are represented by area features (polygons) constructed by vectors (lines) between points (coordinate pairs). The detail or resolution to which a feature is represented is directly related to scale and accuracy, and so parcel or building line features that are less than 2.5 meters in length are not represented.

The PIM is created first by compiling all suitable existing datasets into a common framework and then completing unsurveyed areas by acquiring new data. The objective is to produce a map that shows all registered parcels, registered building (units), proposed plots (parcels with planning approval), and other plots that may exist on the ground and may be capable of registration.

The source materials (existing datasets) for producing the PIM include: cadastral “as-built” maps produced by ESA; plot layout plans prepared by property developers and approved by the planning authority; large scale topographic maps produced by ESA; large

scale orthophoto maps produced by ESA or conforming to ESA standards; very high resolution remotely sensed satellite imagery (sub-meter resolution and geo-rectified).

All maps, plans and images must be of scale 1:2,500 or larger and of sufficient resolution to clearly depict features that are directly or indirectly related to property definitions (i.e. building footprints and parcel boundary lines). The process is summarized in the figure below:



Property identification numbers will be assigned by ESA, who are responsible (Law 142/1964) for this. An example PID would be 01-01-23-45-002/8, which would correspond to: Cairo Governorate (01); Cairo (01); section number 23 (Mokattam, for example); block 45 (numbered from east most block in section, counter clockwise); parcel 2 (in the range 001-999, numbered from east most parcel in block then counter clockwise); building unit or apartment 8 (numbered from lowest floor right most from main door, counter clockwise, then up to highest floor, in the range 1-n).

Standard survey methodologies for map compilation and production will be applied. In many areas most of the field survey effort will involve geo-referencing existing geodata. Larger areas of new data may require capturing and traditional land survey can be used. The following methods and techniques are applicable and compliant with the PIM accuracy standards, if correctly executed and controlled: graphic survey / chain and offset; plane table; theodolite and tape; total station; and GPS. Specifications and guidelines for these standard survey methodologies are not part of these specifications.

Surveys for geo-referencing must be done to a higher order of accuracy (than the PIM), and if GPS is used, particular attention must be paid to transforming GPS coordinates to local coordinates. Transformation and geo-referencing parameters and error residuals (which must not exceed +/- 1.44m) must be reported.

Best practice guidelines cover matters such as preparatory work, survey control, agency coordination, fieldwork, computations and quality control. PIM data content and file formats are provided in annex A.

TECHNICAL SPECIFICATIONS AND GUIDELINES FOR THE PRODUCTION OF PROPERTY INDEX MAPPING

1. INTRODUCTION

This manual documents specifications and guidelines for the production of Property Index Maps (PIM) that are used to identify land and buildings in an improved deeds registration system (Sigueal El-Shakhsi) for urban properties in Egypt. The specifications for the PIM are based on a user needs assessment where the primary users are the customers and administrators of the registration system. The guidelines provide procedural instructions on how to build a PIM that matches the specification and is fit for use in the improved deeds registration system.

1.1 Background

Two registration systems operate in Egypt: deeds registration (Sigueal El-Shakhsi), sometimes referred to as the personal deed registration system, and title registration (Sigueal El-Ainee), sometimes referred to as the “German” system. The current deeds registration law (114/1946) dates from 1946 and operates mainly in urban areas; the title registration law (142/1964) dates from 1964 and currently operates mainly in rural areas. Government policy is to replace the deeds system with the titles system in all areas.

In law, the general principle is that real property should be described unambiguously in documentary form, such as a conveyance deed of document of title, in order for the property to be granted, sold, or however otherwise dealt with, in a formal legal procedure. There are many ways of doing this: in words by referring to adjoining owners and boundary lengths, or by reference to a plan, are two common methods.

In Egypt, the description of registered property is specified in each respective registration law. With respect to the deeds registration law the requirements for describing the property are given in Article 22.3, which states (in translation):

> “Necessary and important information defining the real estate, especially its location, area and boundaries…[If] the land is intended for building…the section, street, alley, and number if any, are mentioned.”

Although this Article applies to the title registration law, it's application also extends to land registered in the deeds system. Boundaries are described by measurements and areas are determined accurately. Measurements and calculation are made by Egyptian Survey Authority (ESA) surveyors and recorded in a document called a 'mutation form'. Although the form is similar to a survey diagram used in other countries, it lacks sufficient data for reliable boundary relocation: the calculation of plan area and recording of parcel changes (in size and ownership) are the forms main functions. There is, therefore, a culture of accurate survey measurement, within real property institutions (registry and cadaster) and probably across society as a whole. An improved deeds registration system needs to be cognizant of this.

Improving deeds registration systems usually involves making it parcel-based rather than grantor-grantee based. This is a key reform proposed and being implemented for *Sigueal El-Shakhsi*. Article 5 of law 114/1946 stated that "each [registration] office shall prepare an index for all documents registered at its place", without specifying what form this index must take (although Article 15 of the Executive Regulations specifies a name index). Indexing all deeds by parcel is an improvement that the registration system can accommodate without a change in the law.

1.2 Context

Recording (indexing) deeds by parcel, or property, requires a location-based indexing system. Just as describing property in general, this location-based method must be unambiguous and unique. There are various ways of doing this, but the most common, and effective, is by using a parcel or property index map.

A property index map provides two things: (a) the means to reliably assign a unique identification number to each property in a geographically-based location; and (b) to visually represent the location of the property in relation to the general neighborhood and in relation to surrounding properties. Taken together, the property identification number (PID) and the property index map (PIM) describe the property unambiguously and therefore sufficiently well to enable the property to be legally transacted and registered.

Many registration systems around the whole operate on the basis that the property index map (also called a registry index map or general map) defines and describes the object of registration, and other means are used to define the exact extent and boundaries of the object. Other means includes accurate cadastral survey plans and maps, and the "general boundaries rule" that leaves boundaries unspecified until such time as they are required to be more clearly identified. Other registration systems, most notably those based on the Australian Torrens system, use an accurate cadastral survey diagram to define and identify the property object and also to define and identify the property boundaries.

In summary, the framework for specifying a content, format and production standard for property index maps can be stated as:

(A) Property index maps provide for:

1. Knowing that properties exist
2. The identification of properties
3. The location of properties

(B) Property index maps **do not** provide:

1. An accurate figure for the size or area of properties
2. The accurate lengths and directions of property boundaries

The content, standard and specification of a property index map are, therefore, dictated by its intended use. At this early stage, it is important to focus on priority needs, and to categorize uses and users into two general groups – primary and secondary.

Table 1 – Primary and secondary use and users of property index map

	Use	***Users***
Primary	Property identification (location and relative position)	Registry office and customers for registration services
Secondary	Integration and provision of land information	Government agencies concerned with planning, land tax, service delivery etc.

The primary users are the public and the Improved Registry Office (IRO). The role of the Egyptian Survey Authority (ESA) is as provider of property index maps and data; they are only a primary user in the context of being a customer for registration services (information about ownership when expropriating land on behalf of the State, for example).

1.2.1 Primary Use

The property index map provides a spatial representation of part of the real world; the part specifically related to separately held (owned or occupied) properties. This representation is achieved by geometrical arrangements of points, lines and polygons. The object of registration (land parcel or building) is defined by a series of interconnecting lines that form a closed polygon.

The most important quality of this spatial representation is the definition of the object itself – the fact that it exists, and in a particular absolute location (registration area, district, section and block) and relative location (next to adjacent properties). These attributes of existence and location are the primary uses of the index map: “does the property exist, and where is it?” The quality of spatial accuracy (the polygon area and lengths of polygon sides) is of less importance.

In addition to the qualities of existence and location, a property index map must be complete; in other words, all registered properties must be indicated. Completeness refers to both coverage and currency, and any changes or mutations to registered properties must be reflected immediately. The temporal quality of the index map must be classed as ‘continually kept up to date’.

1.2.2 Secondary Use

With respect to secondary uses, the property index map provides a valuable spatial data framework for broader land-related information. The integration and exchange of spatial data is achieved through both the map and attributes of the map, specifically the Property Identification number (PID). In this respect, the quality of spatial accuracy (size and geometry) becomes relatively more important.

A balance is therefore required between the more abstract primary uses of “does the property exist, and where is it?” and the more concrete requirements of “what shape and size is the property?” As a general rule, land information held by other agencies is spatially referenced according to the needs and resources of the agency concerned. For example, utility and commercial distribution companies often use street addressing for location-based services. Agencies responsible for land and environmental management typically use base mapping – topographic maps if available; high resolution remotely sensed imagery when suitable maps are unavailable.

Satisfying the general needs of most secondary users, and balancing these against the specific primary need of property registration (registry organization and services delivered to registry customers) requires, therefore, that the spatial precision of property index maps should be approximately consistent with general-purpose base mapping (the most common form of spatial representation). In an urban context this would be up to 1:2,500 map scale.

1.2.3 Other Uses

It is common practice throughout the world for agencies to request data based on their perceived needs rather than real needs. This is more so where the data is provided at less than the cost of production. In instances where users are required to pay the full economic cost for data, there may be a reassessment of the cost/benefit equation, and less comprehensive and less accuracy data is often then found to be adequate for satisfying business needs. A good example is utility companies who can demand accurate cadastral maps for managing distribution networks; a need satisfied in many other countries by base topographic mapping without reference to the cadaster.

The primary function of accurate cadastral survey data, in plan, map or numerical form, is to provide evidence of the location of boundary marks and lines, to aid the re-establishment of such points and lines if they are moved or lost or for the resolution of a dispute. Such accuracy is not necessarily a requirement for registering the property (unless otherwise explicitly specified in legislation) as demonstrated by the land law and registration systems that operate in many common law jurisdictions with non-numerical property descriptions, such as India. Accurate measurement is, however, highly desirable in places lacking substantial physical linear boundary demarcations (such as walls, hedgerows, ditches, fences) and where marks (such as stones or iron rods) are easily lost or moved. Although the accurate survey to provide evidence for the location and relocation of boundary marks is also used for describing the parcel (e.g. Australia) this need not be the case, and different methodologies can be used for describing properties and defining boundaries. Many jurisdictions utilize mapping techniques such as photogrammetry[1] to compile less accurate property index maps especially when registering for the first time properties that already exist; they may also employ more accurate cadastral surveys for defining, demarcating and documenting new parcels created by subdivision. Two survey methodologies and standards can coexist: one for property identification and first registration of existing properties, and another for subdivision and providing better evidence of ill-defined boundary lines.

National agencies may be responsible for mapping or for both mapping and (cadastral) surveying. In many jurisdictions different organizations may be responsible for the cadastre (boundary surveying) and the registry, whereas in many others, these functions are combined in one agency. More often than not, jurisdictions in developing countries that have separate cadastre and registry agencies are less successful (in terms of numbers and

[1] A technique for producing maps for a series of vertical aerial photographs

percentage of registered properties and vibrancy of the land market) than those countries that have combined agencies[2]. One reason for this is that the cadaster agency has different needs and requirements for cadastral surveys maps than the registry. The cadastre agency stresses the importance of comprehensive and accurate boundary data for the resolution of boundary disputes; the registry stresses the completeness and accuracy of title information and sufficient data to identify the property. These differences can be amplified where land registers are being created for the first time by the titling or systematic adjudication of existing properties. The cadaster agency may insist that all properties, even if well defined on the ground, are surveyed to the same high standards of accuracy that apply to new and ill-defined properties. By applying the same high standards of accuracy of subdivision surveys to large volumes of existing well defined properties results in the need for significantly more resources to achieve first registration than would otherwise be the case if less exacting methods and standards were used. For this reason, many jurisdictions have opted to adopt different standards of survey and property identification for different purposes – one standard for mass formalization and first registration, and another (higher) standard for subdivision and boundary dispute resolution. In such cases, a property index map identifies all registered properties and cadastral maps and plans provide supplementary boundary data for subdivided properties and where needed. If a user has a need for accurate numerical boundary data, reference should be made to cadastral maps, plans, and mutation forms etc., and not to property index maps, which serve a different function, which is to identify and locate the property object.

This specification and guidelines manual of procedures cover the production of property index maps to support first registration; it does not cover the maintenance of the maps for ongoing transactions involving mutation (subdivision and consolidation of properties). The strategy for the initial production of the index map emphasises the use of all existing spatial data sources or varying resolutions (accurate cadastral maps, general-purpose topographic maps, developer plot layout plans, remotely sensed satellite imagery, etc.) in order to compile the map quickly and completely at reasonable cost. Thereafter, maintenance and updating of the index map will be based mostly on accurate cadastral surveying methods, which are required for property mutation and the preparation of mutation forms and cadastral information forms. This strategy provides for achieving quick results in terms of identifying all properties in a registration area.

[2] Which is why the World Bank, in Land Policies for Growth and Poverty Reduction, recommend that borrowing countries integrated their cadastre and registry functions.

1.3 Definitions

The following definitions will be used throughout this document:

Accuracy:	The degree of correctness with which the measurement of coordinates for a point or a distance determined from a map agree with the coordinates for the same point or distance for the same line determined by ground survey or other independent means or source(s) accepted as accurate or true.
Aerial Survey:	A survey of an area made by taking a series of overlapping vertical photographs from an aircraft. Maps are then drawn from the photographs by a process called 'photogrammetry'.
Block	A contiguous group of parcels bounded by a well-defined geographical feature(s), such as a road.
Boundary:	Either the physical objects marking the limits of a property or an imaginary line or surface marking the division between two legal estates. Also used to describe the division between features with different administrative, legal, land-use, topographic, etc., characteristics.

Building footprint: The part of the earth's surface covered by a building construction.

Cadastral Information Form (CIF):	The form that describes a property for a legal transaction. The form is prepared by ESA and transcribed by the local registration office in the preparation of a deed.
Cadastral map:	Either a map that shows parcel objects or parcel boundary information. A cadastral map showing just property objects is equivalent to an index map; a cadastral map showing boundary information, such as direction and distances, is equivalent to a cadastral plan, but showing many parcels.
Cadastral plan:	A plan showing accurate parcel boundary data, usually boundary marks and directions and distances between marks. The plan will usually show a single parcel, and for clarity will be plotted at a scale of between 1:100 and 1:500. It is used for documenting evidence about the location of boundaries, which may be needed to r-establish them if lost or disturbed.

Cadastral survey:	A land survey carried out to record the location of boundaries, usually by numerical means, and for the purpose of documenting evidence for the re-establishment of corner marks or for the resolution of disputes.
Deed:	A legal document laying out the agreements and conditions in the transfer of land between two parties.
Digitize:	The process of converting a hard copy or analog map into a digital map by tracing the lines on the map with a cursor, puck, or using software. These methods are sometimes is referred to as board digitizing, 'heads-up' digitizing or line following.
Easement	A right enjoyed by one landowner over that of another, for instance a right of access or for the passage of water or electricity.
Encroachment	Unauthorized movement of the boundaries of land onto and over adjoining land belonging to another.
Geodata	Geographic or map data, either digital or analogue
Legal Cadaster	A generic term for a land parcel-based real property registration system.
Mutation Form	The document generated by the EPO or EDO when a parcel is mutated (created by subdivision or consolidation). It contains information regarding the spatial characteristics of real property objects as well as ownership information that is updated each time there is a transaction.
Map Scale	The relationship between distance on the map and distance on the ground, usually represented as a fraction or ratio (1/1,000 or 1:1,000).
Property Identifiers	A system for unique identification of all properties in a jurisdiction, linking the property, as shown on a map or plan, with files containing ownership information, and providing an index for the organization of registration records.
Plan	A scale drawing usually showing a specific object, such as a parcel

	of land or a building, as opposed to a map which shows many more objects and a greater geographical extent.
Property	An object belonging to or possessed by an individual (see real property)
Property Index Map	A map that shows, identifies and locates, in two-dimensional form, all parcels of land and buildings that are held in separate ownership. The map is an index to other information that more fully describes the extent of the property and the nature of the ownership rights. The map does not delineate property boundaries and, therefore, does not require accurate surveying to produce.
Real property	Land and any things attached to the land including buildings and natural objects such as trees
RMSE	Root Mean Standard Error is the error value representing the discrepancy between the captured position of feature point and its true position
Sigueal el-Ainee	Registry of real property (all rights, responsibilities and interests are registered against real property objects).
Sigueal el-Shakhsi	Personal registry (meaning registration of property objects by reference to persons or date of registration).
Subdivision	The division of a land parcel into two or more parts, usually according to development regulations.
Traversing	A process of controlling the scale and orientation of large surveys by measuring angles and distances between known fixed and intermediary points.

2. TECHNICAL SPECIFICATIONS

2.1 Preliminary

The primary use of the property index map is to identify and locate registered (and registrable) properties, and these specifications are designed to create a map to serve this purpose. The specifications will be appropriate for this purpose and not for the purpose of identifying and locating property boundaries, which require a different standard of specification.

The property index map will, however, have the generic character of a map. The map will correctly represent real world property objects both geometrically and geographically to some measurable degree. These specifications quantify the “degree” and the level effort or methodology of “measurement”.

These specifications and standards apply to both analogue and digital versions of property index maps.

2.2 Datum and Coordinate System

A map requires the definition of a geodetic datum and coordinate system (projection). Ideally this datum should be ‘geocentric’, that is earth centered, and related to the International standard Terrestrial Reference Frame (ITRF). The current global standard (ITRF2000) is essentially the same datum as used by the Global Positioning System (WGS84). However, work is not yet complete in Egypt in adopting a new geocentric datum compatible with GPS, and as such the property index map should adopt the current official geodetic datum and the coordinate system used by base topographic mapping.

The property index map shall use the following datum and projection:

a. Datum: Egypt 1907
b. Ellipsoid: Helmert 1906
c. Projection: Transverse Mercator
d. Unit: international meter

The property index map does not require a vertical reference frame (e.g. heights above datum).

2.3 Map Parameters

2.3.1 Scale

Mostly digital use of the PIM is envisaged, so the definition of scale is less significant, but important nevertheless because it provides an indication of accuracy. Much of the source material for index map compilation (see Sections 4 and 5 below) is collected/plotted at a scale of 1:1,000, and on this basis a similar scale could be envisaged. Given that: (a) accuracy will deteriorate in the conversion and compilation process, (b) some source material will be of a smaller scale (less accurate), and (c) the primary use of the PIM is to identify property objects, the scale of 1:1,000 is not wholly appropriate. In the longer term a more accurate map at a scale of 1:1,000 could be compiled as more accurate cadastral survey data is acquired and added, but in the short term the map will only be as accurate as its lowest common denominator, which is approximately equivalent to 1:2,500 scale mapping. However, upgrading the PIM is not a recommended strategy – it is better and less confusing to keep the PIM and cadastral maps, although the same scale, as separate products for different uses. Therefore, a global scale of 1:2,500 will be adopted to reflect use accuracy needs of the PIM, a nominal scale of 1:1,000 will be applied in operational use and maintenance of the PIM.

2.3.2 Cartographic elements

(See section 2.9 below)

2.4 Positional Accuracy

Accuracy is the ability to produce a result close to the true value. Precision is the ability to produce a consistent result when repeating a measurement. Map specifications are, therefore, directly concerned with positional accuracy as well as with content accuracy.

Intended use and scale of map dictate positional accuracy. Although visually the map shows interconnecting lines, the features that these lines represent are property objects, and it is these objects, and not the lines, that are the subject matter of the property index map.

2.4.1 Absolute Accuracy

Accuracy in terms of absolute position means the true position of an object on the surface of the earth with respect to a global reference system such as latitude and longitude. For the PIM the global reference system is the map coordinate grid defined by the datum and coordinate system (2.2).

Although the PIM has a working scale of 1:1,000, its global (absolute) scale is approximately equivalent to 1:2,500, which reflects the accuracy of its compilation and source material. Moreover, as the primary use of the PIM is for the spatial representation of area features it follows that absolute accuracy is a secondary characteristic (because accurate position is provided by cadastral maps). On this basis, the absolute accuracy for features depicted on the PIM is established as:

+/- 2.5 meters (95% confidence level)

2.4.2 Relative Accuracy

Comparing the vector (distance and direction) between two points on the PIM and the same two points on the ground gives a measure of relative accuracy. Because this measure can be made more precisely, relative accuracy is typically expressed more precisely. Again this accuracy is governed by the intended use and operational scale of the map, and a measure of relative accuracy between features depicted on the PIM may established as distance, but is more usually quoted as a ratio that is related to the relative distance measured. The relative accuracy of the PIM is established as:

1:200 (within each block of parcels)

2.5 Attribute Accuracy

The content of the PIM is stated in annex A. The PIM shows one feature class – properties – comprised of two features types – land parcels and permanent buildings. All other elements of the map are secondary and supporting. Lines only exist to define properties; points exist as hooks for attribute data (property identification number) or text annotation (street names).

Every property that is registered (i.e. a legal document or deed exists in the registration system) must be depicted on the PIM (although the PIM will also show properties that are not registered). There is a strict one to one relation with respect to property records in the registry and registered properties shown on the PIM. However, there can be more than one deed for each property (multiple transactions) and more property objects in the PIM than in the registration system (not all properties registered).

All registered properties must have a PID attached to the PIM feature that represents that property in the registration database. Property features that are not registered may or may not have a PID. The PID must conform to format as specified in section 3 of these specifications.

2.6 Feature Types

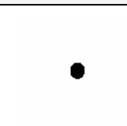
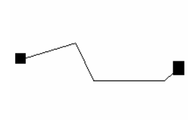
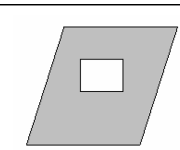
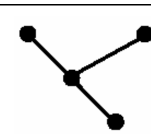
The PIM contains the following feature objects:

- Parcels
- Buildings

Registration blocks, sections, cities and Governorates are not represented by individual objects; however, they can be displayed and constructed if required by using components of the PID.

2.7 Data Structure

The PIM comprises property objects that are represented by area features (polygons) that are constructed by vectors (lines) between points (coordinate pairs). These graphic or geometric data elements of points, lines and polygons are defined as follows:

Element	***Definition***	***Entity***	***Graphic***
Points	X, Y Coordinate pair	Attribute tags Annotation tags	
Lines	Two coordinate pairs and connecting vector(s) between point nodes	Polygon boundary	
Polygon	Four or more vectors	Closed polygon	
Nodes	X, Y Coordinate pair	Polygon apex	

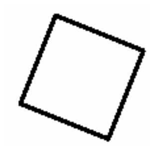
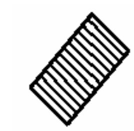
The data is structured as follows:

Geometry: Lines are “snapped” or connected to points or nodes (there are no gaps or overlaps) and polygons are comprised of a closed loop of connected lines.

Topology: Polygons do not overlap; building polygons are wholly within (or wholly or partly coincident with) parcel polygons (unless there is an exception).

2.8 Feature Representation

The PIM must distinguish, both as an attribute and visually, between the two key classes of source data for parcels and buildings. These classes, and their representation, are:

Feature class	***Parcel representation***	***Building representation***
Cadastral data • Field survey		
Other data • Plot layout plans • Topographic maps • Satellite imagery • Etc		

2.9 Cartographic Representation

The PIM is designed primarily to be a digital representation and product; however, there will also be a need in many instances for a hardcopy version of the map. For practical reasons this will require the map to be divided up into sheets of a manageable size.

Each hardcopy map sheet must conform to the following:

Item	***Description***
Sheet size	Metric A1 (841mm x 594mm)
Frame (map) size	750mm x 500mm (corresponding with cadastral map)
Borders	(as per cadastral maps)
Scale	1:1,000
Grid	100 meter interval; grid crosses
Text	Arial font sizes 9 to 22

2.10 Feature Resolution

The detail or resolution to which a feature is represented in either hardcopy or digital form is directly related to scale and accuracy. Parcel or building line features that are less than 1.5 meters in length should not be plotted.

3. PROPERTY IDENTIFICATION NUMBER

A key component in any legal cadaster or real property registration system is the use of a property identifier – a number or code – that links the spatial elements (maps and plans) with the textual elements (deeds, registers and records). The parcel or property identifier should be the primary legal descriptor for the parcel and all registered documents, and its constitution and use are of key importance in registration practice.

The property identification scheme in the improved deeds registration system is built on two principles, which are that it should:

a. Match as closely as possible the ideal qualities and attributes for a property identification system[3]; in particular the PID should be as short and user friendly as possible.
b. Aligned to the future expansion of the title registration system and conforming closely to the legislative requirements of this Sigueal El-Ainee law.

Therefore the following property identification schema will be used in the improved deeds registration:

Governorate	-	Governorate
|		
City	-	A geographical area corresponding to a, city, or parts of a large city.
|		
Section	-	Possibly corresponding to existing administrative divisions within a city
|		
Block	-	New definition of contiguous groups of parcels, typically bounded by roads
|		
Parcel	-	Land parcel, which may also be a building footprint
|		
Unit	-	Units or apartments within a multi-occupancy building

The PID is composed of two main parts – the parcel number, which includes prefixes for larger administrative areas, and the internal components or parts of parcels. For clarity and ease of use, the components of the parcel number are separated by dash ("–") characters, and the internal parts of parcels, such as building units, apartments or leases, are treated as a suffix separated from the parcel number by a forward slash ("/") character. The whole number – parcel plus part – identifies units or leases, and a PID without the suffix identifies the parcel. The PID does not distinguish separately the floor number or other address attributes, as these are held in the registry databases a separate attributes. The principle is

[3] Outlined in section 6.7 of the Guidelines

that the number should be as short as possible and refers only to objects that are registered (a floor in a building isn't registered separately).

An example PID would be:

01-01-23-45-002/8

This would correspond to:

01	-	Cairo Governorate
01	-	Cairo
23	-	Section number 23 corresponding to Mokattam, for example
45	-	Block 45 (in the range 01-99, numbered from east most block in section, counter clockwise
002	-	Parcel 2 (in the range 001-999), numbered from east most parcel in block then counter clockwise
8	-	Building unit or apartment 8, numbered from lowest floor right most (from main door), counter clockwise, then up to highest floor, in the range 1-n.

ESA have the responsibility (according to Law 142/1964) to allocate property identifiers, and this responsibility will extend to the improved parcel-based deeds registration system.

4. PRODUCTION AND/OR ACQUISITION DATASETS

The PIM is created first by compiling all suitable existing datasets into a common framework and then completing unsurveyed areas by acquiring new data. The objective is to produce a map that shows all:

1. Registered (and registrable) parcels
2. Registered building (units)
3. Proposed plots (parcels with planning approval)
4. Other plots, informal or otherwise, than exist on the ground and may be capable of registration.

Ongoing maintenance is then achieved by adding new survey data acquired when properties are mutated (subdivided or consolidated), granted by the State, or first registered where there is no prior survey.

The source materials (existing datasets) for producing the PIM include:

1. Cadastral "as-built" maps produced by ESA
2. Plot layout plans prepared by property developers and approved by the planning authority
3. Large scale topographic maps produced by ESA
4. Large scale orthophoto maps produced by ESA or conforming to ESA standards
5. Very high resolution remotely sensed satellite imagery (e.g. Ikonos or Quickbird), sub-meter resolution, geo-rectified.

All maps, plans and images must be of scale 1:2,500 or larger and of sufficient resolution to clearly depict features that are directly or indirectly related to property definitions (i.e. building footprints and parcel boundary lines.)

5. PRODUCTION AND/OR ACQUISITION METHODS

This section specifies acceptable methods that can be used to produce and/or acquire some of the aforementioned geographic datasets used in producing the PIM. Guidelines for the overall compilation of the PIM and for the following production/acquisition methods are specified in section 6.

5.1 Cadastral “As-Built” Maps

Cadastral maps at 1:1,000 scale maps are produced by ESA, according to ESA’s internal cadastral surveying standards, which show all properties, mostly parcels, that have been built (boundary walls constructed) or marked out (boundary marks placed and found by ESA’s surveyors).

Figure 1. Extract from a cadastral “as built” map

The specifications and standards for this map and the cadastral surveying methods used are documented elsewhere by ESA.

5.2 Plot Layout Plans

These plans, also usually at the scale of 1:1,000, are prepared by property development companies for the planning, construction and sale of parcels, buildings and building units. The plans will be submitted for approval to the planning authority and, if approved, a listing of all the plots in the scheme, with areas of plots, will be published in the official gazette. As the officially approved subdivision layout, the plot must be demarcated according to the plan and the published area. The sales contract (transfer deed) must also conform to the approved plot size.

Figure 2. Extract from a plot layout plan

The specifications and standards for this map and the surveying methods used to demarcate the plots are not known.

5.3 Large Scale Topographic Maps

Topographic maps, sometimes called “base” maps, are a general-purpose representation of the natural and artificial landscape, showing such things as topography, rivers, roads and buildings, for instance. In order to show urban properties (parcels and buildings) with sufficient clarity the maps must be large scale; that is, of scale 1:2,500 and larger. A 1:5,000 scale topographic map is usually unsuitable for identifying parcels (as illustrated in figure 3 below). Although the current standard scale for urban topographic maps in Egypt is 1:1,000 there are no maps at this scale for Greater Cairo.

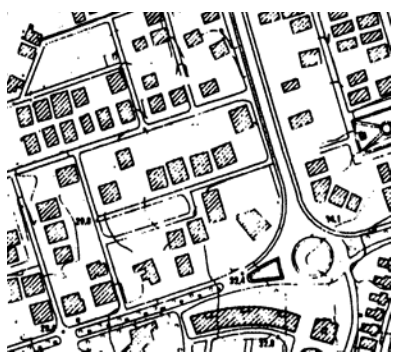


Figure 3. Extract from a 1:5,000 topographic map
(Unsuitable for parcel identification)

5.4 Orthophoto Maps[4]

Standards for the production of orthophoto maps are not documented here. An example of a suitable standard is the United States Geological Survey Standards for Digital Orthophotos DOQ1296 (http://rockyweb.cr.usgs.gov/nmpstds/doqstds.html).

5.5 VHR Satellite Imagery

Currently there are two sources of suitable very high-resolution remotely sensed satellite imagery with a ground resolution of less than one meter that is suitable for urban mapping applications.

1. GeoEye's Ikonos (Precision Plus) image product (1.0m ground resolution)
2. Satellite Imaging's Quickbird image products (0.6m ground resolution)

Both are capable of locating features at an absolute accuracy of +/-2.5 meters, which makes them suitable for use in compiling the PIM. They are also available in ortho-rectified format but with more limited geographic coverage and a reduced absolute accuracy of about +/-6.0 meters. Acquiring uncorrected images will mean that, as a minimum, the images must be geo-referenced. In area of homogeneous terrain, geo-referencing of each 10km by 10km image requires 18 ground control points distributed throughout the image, supplemented by an additional 18 check points. In areas with large terrain relief, more ground control points are needed: in some cases, the use of available higher accuracy base mapping (1:1,000-scale cadastral maps, for example) is preferable. Standards for geo-referencing the PIM components are given in section 5.7.

5.6 Ground Survey

Following the compilation of all existing geographic datasets the need for and quantity of primary data collection will become clearer. Additional parcels and buildings must be added to the compiled draft PIM. The following methods shall be applied:

5.6.1 Land survey

In large expansive areas where new data must be collected, traditional land survey can be used. The following methods and techniques are applicable and compliant with the PIM accuracy standard, if correctly executed and controlled:

[4] An orthophoto or orthophotograph is an aerial photograph that has been geometrically corrected ("ortho-rectified") such that the scale of the photograph is uniform, meaning that the photo can be considered equivalent to a map. Unlike an aerial photograph, an orthophoto can be used to measure true distances, because it is an accurate representation of the earth's surface, having been adjusted for topographic relief, lens distortion, and camera tilt.

1. Graphic survey / chain and offset
2. Plane table
3. Theodolite and tape
4. Total Station

Graphic survey must use a calibrated chain and perpendicular offsets shall be established with the aid of an optical square. All distances must be made horizontally or corrected for slope and shall be consistent with the PIM standard of accuracy, which is +/- 2.5m (95% confidence). The use of graphical, optical or digital alidades is permitted when using a plane table. If a theodolite is used, it shall be an optical instrument capable of reading directly to 6” of arc. Theodolites and total stations must be checked and if necessary calibrated.

Procedures and specifications for standard land surveying techniques can be found in any basic surveying textbook.

5.6.2 Global Positioning System (GPS) survey

GPS surveying methodologies can utilize either kinematic or post-processed rapid static or static techniques; in all cases, differential processing of baselines to a known reference station is required. This reference station must be a second or higher order geodetic control point and within 15 kilometers of the survey point (for dual frequency receivers; 10km for single frequency receivers).

The GPS survey receivers, methodology, and processing technique employed, shall achieve an absolute positional accuracy of better than +/-1.44 meters (95% confidence).

A suitable reference document for GPS surveying techniques is Standards and Guidelines for Cadastral Surveys Using Global Positioning System Methods published by the United States Bureau of Land Management, which can be found at: www.blm.gov.

5.6.3 Aerial survey

Maps produced from aerial photography are a well-proven method for capturing urban geographic data including property boundary walls and fences. The map can either be an orthophoto or a line map produced by photogrammetry. Generally, the benefits outweigh the (relatively large) costs of aerial survey and photogrammetric mapping where the area to be mapped is large (typically greater than fifty square kilometers), difficult to survey by other methods, and there are multiple uses for the photography and maps. The mass formalization and registration of properties in Greater Cairo, for example, would be the ideal case for photogrammetric property index mapping.

Specifications for air photography must list the flying requirements, camera calibration and testing, film quality, etc., and are beyond the scope of the PIM specifications.

5.6.4 Control Survey

ESA places significant importance on connecting all surveys, especially surveys related to property rights, to a common geodetic framework. As such, ESA now requires that all property surveys be connected to the horizontal control framework as currently defined.

This National horizontal geodetic control framework comprises a hierarchal network of points classified according to relative positional accuracy:

- Order A – 30 High Accuracy Reference Network (HARN) – 1:10,000,000
- Order B – 112 Points established through GPS – 1:1,000,000
- Third Order – 1: 50,000
- Fourth Order – 1:15,000

ESA maintains a geodetic survey department (Department for Geodesy, Triangulation and Control, which comes under the Mapping Affairs Central Department) who are responsible for establishing and calculating coordinate values for Order A, Order B and Third Order network control stations. ESA surveyors, in the course of their usual work, create 4^{th} Order points.

Additional 3^{rd} or 4^{th} Order points may be required for PIM production work, such as geo-referencing plans and for controlling field measurements. As the responsible agency for National geodetic control, ESA will establish any additional 3^{rd} order control points needed. This work will be conducted in accordance with current ESA standards and specifications.

5.7 Geo-referencing

To geo-reference something means to locate it on the surface of the earth, usually with respect to geographic or grid coordinates. For the production of the PIM this typically means the positioning of existing plans so that they fit with all other plans in correct geographic space.

The following geo-referencing methods are suitable for PIM production:

1. Plane survey connected to control points

2. Plane survey connected to feature points with known coordinates
3. GPS measurements

The purpose is to determine X and Y (but not Z) coordinates for at least four, preferably six, points on a plan that are both well defined (resolution) on the plan and the ground. To achieve the PIM global absolute positional accuracy requirements, surveys of points used for geo-referencing purposes should be done to a higher level of accuracy than the PIM. Given that the PIM is accurate to +/-2.5m, geo-referencing must achieve: +/-1.44m or better.

Procedures and survey data processing techniques for each of the above three methodologies (for example, the use of transformation parameters in GPS processing) must be adopted that will achieve this geo-referencing standard of accuracy.

5.8 Coordinate transformations

When performing geo-referencing or transforming a data set from one coordinate system to another, the transformation type should be consistent with the type of geographic data. For a vector data set, transformation type should not alter the scale, i.e. only origin shift and rotation should be used. For a raster data set, a 'rubber sheeting' method is permissible although not preferable.

The type of coordinate transformation, the input and output coordinates, and the residuals at each point, must be reported. If the residuals are greater than 2.5 meters at any point, the process must be repeated, with different control points if necessary.

5.9 Cadastral Surveys

The property index map is not a cadastral map. A cadastral map depicts parcel boundary corners and lines, often including distance and directions, whereas a property index map depicts property objects. These standards and guidelines for property index maps do not, therefore, include specifications for cadastral surveys, boundary demarcation, calculation or property areas, and cadastral maps, which are all the responsibilities of ESA.

6. BEST PRACTICE GUIDELINES FOR PROPERTY INDEX MAPPING

6.1 Data Acquisition Process

Procedures for the acquisition of geographic data that is suitable for the production of property index maps begins with compiling lists of data sources. Although these sources may vary from area to area, they can be expected to include the following:

1. Egyptian Survey Authority (ESA)
2. Provincial and district offices of ESA
3. Property Development Companies
4. District or local government
5. Military Survey Department
6. Other agencies, individuals and private companies

Data will be both geographic and textual. Geodata will be maps, plans and diagrams. Text data will be acquired mainly from deeds and mutation forms. In assembling data, the material should be as close as possible to the original source. That is, if it is possible to capture information directly off the original map or document, this is preferable that capturing it off a copy. When creating digital images of maps and plans by scanning, it will usually be necessary to perform the scanning work at the location where the maps and plans are kept. It is unlikely that an official agency, such as ESA, would allow original material to leave the premises. If scanning cannot be done on site, then a good film or paper copy can be made from the original. Photocopies of documents, such as mutation forms, are less problematical because the image will not be used for data extraction and only for viewing.

The data acquisition process is detailed in figure 4 below and described in the following sections.

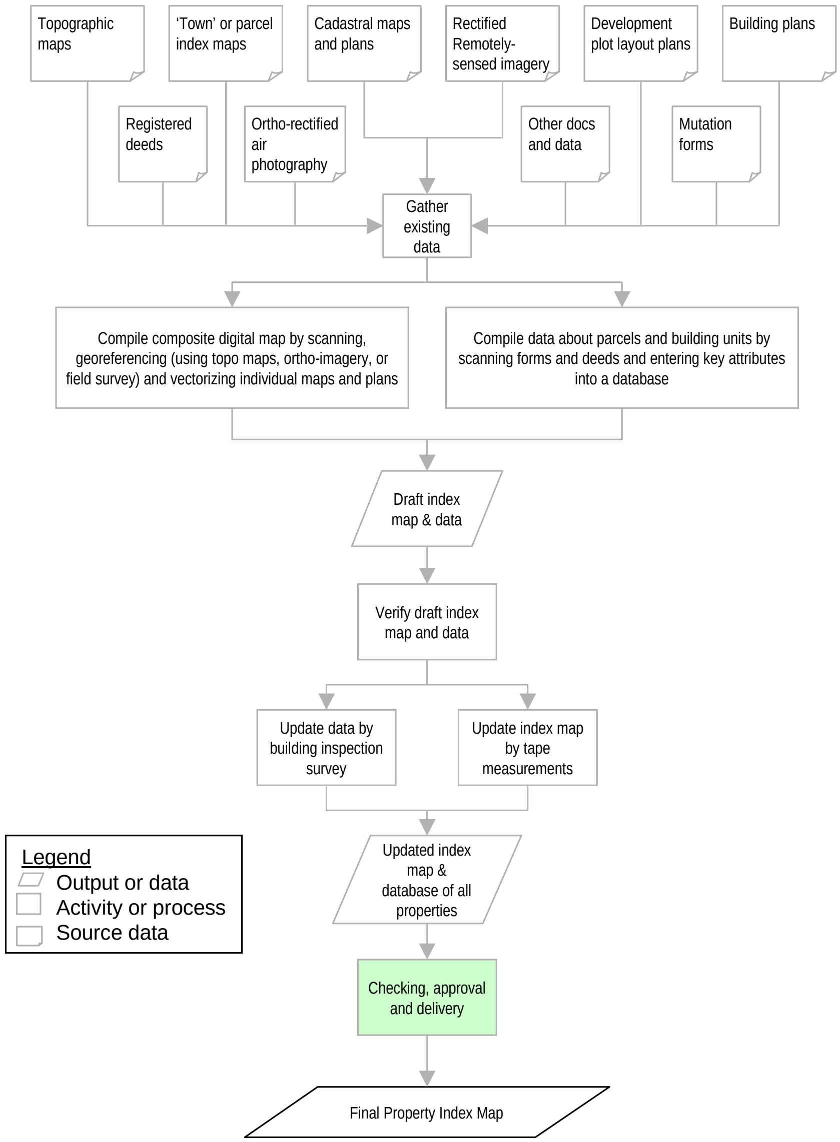


Figure 4. Property Index mapping process

6.2 Data Conversion

In most urban areas, the bulk of the work required to produce property index mapping is concerned with the conversion and compilation of existing geographic data.

The PIM is stored and used in a digital geographic information system (GIS) environment, which means spatial entities (points, lines and polygons) are suitably coded and topologically structured. The required format for spatial data loading into the PIM is specified as, or equivalent to:

1. SHAPE file[5]
2. MIF file[6]
3. SDTS TVP file[7]

6.2.1 Converting vector digital geodata

Existing geographic data may exist in any one of a large number of file formats. Typically, a great deal of digital map and cadastral plan data is held in AutoDesk AutoCAD DWG file format. This will require the export of CAD data into other software, such as ArcView or MapInfo, where GIS data structures (closed polygons) can be formed, before being re-exported into one of the above transfer file formats.

Prior to exporting data from its native file format, all unneeded features and entities, such as road lines and text annotation for example, must be deleted. The features that remain must only be:

a. Tag points for PID location
b. Lines for parcel polygons
c. Lines for building polygons

In addition, all vector line data must be “clean” (see section 6.8 below).

6.2.2 Converting raster digital geodata

Scanned raster images must be “digitized” to create vector point and line data. This digitizing can be done semi-automatically, using line tracing software, or manually, by “heads up digitizing” where the operator creates lines by using the mouse cursor. Again, it is important to ensure the vector data is “clean” and this can be done either during or after digitizing.

6.2.3 Converting hardcopy map geodata

Paper or film maps can be digitized either by: (a) scanning to create a raster image file and then using line following software or “heads up” on screen methods; or (b) table

[5] A proprietary format used in ESRI ArcView software and widely implemented as an exchange format in other software.

[6] MapInfo Interchange Format, also widely used.

[7] Spatial Data Transfer System, Topological vector Profile, a format developed by the U.S. Geological Survey but not widely used

digitizing. Both methods are acceptable. Scanning resolution must be sufficient for the vectorization process: 300 dpi and output file format is TIFF with CITT4 compression is specified as a minimum. Georeferencing should be conformance with section 5.7 of these specifications.

6.2.4 Converting digital text data

The critical issue here is that existing data must be reformatted to match the required specifications. For instance, numbers may need to be converted from text fields into numeric fields.

6.2.5 Converting hardcopy documents

Existing paper documents must be: (a) scanned and stored as raster image files; or, (b) scanned, stored as raster image files, and (some) data extracted. Scanning resolution and format shall be in conformance with this specification. Data extraction can be made using either optical character recognition software, or input manually. If input manually, it is best, in terms of quality control, to use ‘drop down’ lists of frequently used data entries.

6.3 Preparatory Work

6.3.1 Coordination

A delimitation of the area to be mapped is required, and one or both of the core agencies responsible for real property registration, which are the Real Estate Publicity Department, Ministry of Justice, and the Egyptian Survey Authority, will provide this. The delimitation should ideally be map-based, highlighting the boundaries of a contiguous area on a suitable scale of topographic map.

Within the mapping area there may be one (preferable), or more, district offices of REPD and ESA. A person should be assigned to coordinate all the preparatory work, making contact with district offices, and ascertaining the scope and number of maps, plans and documents that cover the area. Contact must be made early in the project and before the start of any fieldwork with:

- Egyptian Survey Authority head office – for initial assessment, survey control points, base maps and digital data
- Real Estate Publicity Department Registry Office (RO) – for initial assessment and quantifying level of effort

- Egyptian Survey Authority district office (EDO) – for initial assessment, and qualifying level of effort
- Local Government – to keep them informed and to ascertain administrative boundaries
- Property development companies – to ascertain the quantity and availability of plot layout plans

Additionally, it may be useful, depending on particular circumstances, to also visit and discuss the proposed work with:

- Physical Planning – for any particular issues or proposed new developments, etc.

6.3.2 Survey Control

The need for additional survey control will be discussed with ESA head office, which will provide information about the extent and number of control points that exist in the project area. Depending on the coverage of existing cadastral maps, there may be a need for more control points for geo-referencing and field completion purposes. In particular, if GPS use is envisaged, suitable control points with GPS coordinates must exist such that no point within the project area is further than 15km from a GPS control point.

The construction and surveying of control points is the responsibility of ESA. The need for any new control points must be ascertained early in the planning phase in order to give ESA sufficient time to plan, conduct and compute the work in accordance with existing ESA standards and guidelines. ESA will also be responsible for field checking and verifying existing control points.

In some areas, agencies other than ESA, such as the New Urban Communities Agency, may have established a control network and monuments. Before adopting and using these control networks they should be checked by sample re-observation and evaluated, and if available, to assess the results of the original survey computation and adjustment.

The density of a Third Order network, which might be needed to survey in areas where there is very little existing data, should be sufficient to allow adequate connection by local control traverses. Control station monuments for the Third Order network should be set at approximately 5km apart.

6.3.3 Control Monuments

Monuments for Third Order network control stations will be constructed by ESA and in accordance with current ESA specifications. The construction of monuments for local traverse survey stations is not required; these stations must be marked but not permanently monumented. Traverse stations must be marked in-situ (on site) by:

- A nail or rivet with a head diameter of at least 12mm driven flush into a concrete curb or pathway.
- A drill hole not less than 10mm in diameter and 30mm deep in concrete or rock
- A chiseled mark of a distinctive nature, such as an X inside a circle, cut into a permanent structure, such as an existing concrete slab. If the structure is made of steel a punch mark can be used.
- A 12mm diameter steel reinforcing rod, at least 300mm in length, set into a concrete surround that is at least 150mm square and 150mm deep and flush with ground level

6.4 Fieldwork

6.4.1 Control surveys

These will be conducted by ESA and in conformance with current ESA standards and guidelines.

6.4.2 Traverse surveys

In areas where there is little existing geographic data, substantial ground survey work may be required if other data capture methods, such as photogrammetry or GPS, are unsuitable or too costly. Ground surveys in older densely populated areas, for example, will need to be tied to local control established by traverse surveys, which are in turn tied to Third Order control.

Traverse surveys must commence and end, or connect, with a minimum of two Third or higher Order control points. The maximum distance between traverse points should be no more than 200 meters. Wherever possible traverse legs should be of similar length; i.e. do not mix long and very short legs, as illustrated in figure 5.

√ - Do keep traverse legs equidistant

X - Don't mix long and short legs

The accuracy required for traverses is 1:3,000, where the computed misclosure of a traverse that starts and ends on two different known points should not exceed 1.44 meters. Observations of distance and direction at each traverse point should be commensurate with this closure accuracy.

6.4.3 GPS surveys

All GPS surveys for property index mapping will be undertaken and processed using differential techniques; i.e. with a base station receiver located at a known control point. The maximum permitted distance between the roving receiver and the base station receiver is 15km for dual frequency receivers and 10km for single frequency receivers; however, for operational reasons, it is best to keep baselines to a maximum length of 10km and 7.5km, respectively.

Observation technique and processing parameters should be consistent with achieving the survey objective. If the survey is for establishing control, the preferable method is static or rapid static survey; for detail measurements, kinematic techniques are recommended (preferably in real time, so that errors can be monitored). For all GPS survey techniques, there must be a minimum of 5 satellites in view above 10 degrees (from the horizon). If single frequency receivers are being used, all baseline lengths (control or detail survey) must be significantly less, and a maximum separation of 5km between receivers is recommended.

Processing of GPS baselines will be done using proprietary software (supplied with the GPS receivers). The output results will be coordinates with respect to the WGS84 system, and these will need to be transformed (re-projected) into the local (map) coordinate system. Transformation parameters must be obtained from ESA; the parameters supplied with proprietary GPS software must not be used. If suitably accurate transformation parameters are not available, then it will be necessary to derive some by field observation and computation. At least 4, preferably 6, existing geodetic control points located around the periphery of the project area must be used to compute local transformation parameters.

General guidelines for the use of GPS techniques in detail surveying for map production can be found on the Internet at:

Vermont Center for Geographic Information
http://www.vcgi.org/techres/standards/partiii_section_l.pdf

British Columbia Integrated Land Management Bureau
http://ilmbwww.gov.bc.ca/bmgs/gsr/gsr_standards.htm

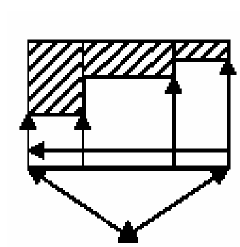
6.4.4 Detail surveys

"Detail" means the features that are depicted on property index maps; namely buildings and walls/fences that define properties. Measurements are taken in the field to position these features in their correct absolute and relative locations in accordance with the accuracy standards defined for the map. The PIM accuracy standards are:

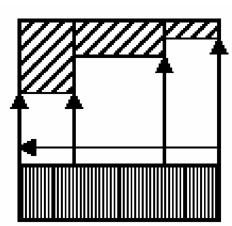
Absolute	***Relative***
+/- 2.5 meters (95%)	1:200

For details surveys, the relative accuracy ratio of 1:200 is the more significant parameter. To satisfy this requirement, short distance must be measured much more accurately than longer distances. However, the PIM also has an absolute accuracy and resolution components (smallest feature element represented, which is 1.4m). As a practical guide, distance can be measured to the nearest decimeter (0.1m) and directions to the nearest 20" (twenty seconds).

Depending on the survey methodology applied, measurement can be made from control points or from known points. 'Known' points are either: (a) surveyed from control points; or, (b) already positioned on the map. The figure below illustrates how these techniques are applied, and the principle is that parcel and building corners do not need to be measured directly in relation to traverse control points.



Detail by reference to base line



Detail by reference to other detail

Field measurements can be recorded either digitally or manually. In both cases, they benefit from using a field sketch. This sketch can be an existing or draft map that is being updated or field completed.

Field books and sketches must be legible and well kept. Books and sketches should bear the name of the area, the surveyor and the date. Obliteration of entries must never be made; if an error has occurred, the original figure is cancelled by scribing a diagonal line through the figure and writing the correct value alongside.

6.5 Field Survey Procedures

After compilation of all existing data, a reconnaissance of the project area, evaluation of existing control, choice of survey method(s) to be employed, and training of field surveyors, the following procedures should apply:

6.5.1 Public information

During the preparations and site reconnaissance, contact must be made with local government to inform them of the impending arrival of survey field staff. Also, one or two days prior to commencement of work, information leaflets should be distributed to all properties where it is required to access the compound in order to measure the building footprint. These leaflets, which explain the purpose of the survey, will be part of a broader public information campaign. All field staff must be issued with an identification card and also carry an official letter from ESA authorizing them to access properties and to take measurements. Coordination with ESA may also be required during this public information phase.

6.5.2 Geo-referencing

It may be possible to compile and geo-reference all existing geodata without any fieldwork by using existing maps or geo-rectified satellite imagery. However, fieldwork may also be required to determine coordinates for coincident points on a plan and on the ground. Acceptable survey methods for georeferencing are by GPS or traversing (see section 5.7).

6.5.3 Field Completion

Field teams should be mobilized with the required equipment and a copy of the draft PIM (produced by compiling and geo-referencing all existing data). A systematic program should be followed, moving from property to property in each block, and from block to block, visually verifying the data shown on the draft PIM and taking measurements to add new data. It is expected that the majority of this new data will be building footprints.

At the same time, the same field survey teams will also collect data characteristics of buildings as follows:

- Number of floors
- Number of units and/or apartments
- Street address including building number
- Use of building (and status of construction)

Note: it is **not** a requirement of property index map production to: (a) demarcate, re-demarcate or in any way determine parcel boundary corners or lines; and, (b) to document or adjudicate or make any enquiries whatsoever about ownership rights.

6.5.4 Detail survey

(See 6.2.4 above)

During field verification, particular attention should be directed towards areas where buildings have not yet been constructed but development plans exist and show approved plots. These areas may or may not have infrastructure such as roads and some parcels may be laid out. Checkpoints surveyed in strategic locations in these areas should identify any discrepancies between as planned and as set out development. These discrepancies should be flagged and reported to the client.

6.5.5 Quality Control and Data Verification

An independent survey team should be responsible for quality control checks. These checks should be carried out in conformance with the published Quality Assurance / Quality Control specifications and guidelines, and will include checking of absolute and relative positional accuracy, attribute accuracy, amongst other things.

6.6 Computations

Calculations and computation will be made either in software or manually depending on the measurement technique or the facilities available. GPS baselines will always be computed by specialist software; traverses and coordinates can be computed and adjusted in software, or using calculators or tables.

All measurement reductions and computations must be independently checked. This can be done by any one of a variety of means: for example, by redundant measurement and comparison of results, or recalculation by another person.

6.7 Property Identification Numbering

Real property and parcel identification can be achieved in a number of ways. The desired qualities of a robust and appropriate identification system have been summarized as[8]: simple, unique, accurate, flexible, economic, and accessible. A further elaboration[9] of these qualities would add: ease of use and easy to understand and remember; convenient both for users and computers; permanent (i.e. doesn't change with the sale of the property); capable of change when property is subdivided or consolidated; accurate and unlikely to be written down in error. The quality of uniqueness is probably the most important in the legal context, which is why the procedures for identification – and the maps and plans needed to support identification – are usually embedded in the registration law or regulations.

6.7.1 Background

The systems for identifying real property units in Egypt today were summarized in an earlier discussion paper[10]. Briefly, the title registration system (Sigueal El-Ainee) defines a hierarchal parcel identifier in the Executive Regulations to law 142/1964 depending upon whether the land is agricultural or urban. The urban hierarchy is: – city (or part of city) – section – block – parcel. A variation of this format applies for agricultural lands: - Governorate ID – district – village – Hod – parcel, where the Hod corresponds to urban blocks, and the district to sections. Despite the distinction between agricultural and urban lands, and the use of numbers and not letters (using letters keeps the PID shorter and easier to remember) this ID schema conforms to most of the cardinal principles of parcel identification and similar examples can be found in many other countries.

6.7.2 Property Identification Number Format

For ease of use and clarity, the components of the PID are separated by dash ("–") characters, except for internal divisions of parcels, such as building units, apartments or leases, which are suffixes separated from the parcel number by a forward slash ("/") character. Ideally, alphanumeric characters would be used, which keeps the PID short and memorable, but to conform to existing (legal) requirements and practice, only numbers are used. However, this should not prevent the future use of letters by changing the Executive Regulations.

An example PID is provided in section 3 of the technical specifications.

[8] EFS Report: 2005-07-17 Taylor Briefing Paper- Real Property Identifier Systems - Edited RDMSC Aug 17 (p.1)

[9] Dale and McLaughlin, 1999. Land Administration (p.59)

[10] *Ibid.*

The number format is specified in both the Executive Regulations of Law 146/1964 and by current practice. This means that numbers must be padded by leading zeros where necessary so that they comply with a fixed length format. The parcel number suffix, that identifies units and leases, can be of variable length.

An undivided parcel will omit the slash and division number; a lease of a parcel will be indicated in a similar way (e.g. 01-01-23-45-002/L1 for lease 1 of the whole or part of parcel 2 in block 45 etc.)

Some important rules that should be followed in defining and using a unique property identification number using this form and format:

1. The boundaries of registration areas and sections could be based on existing city administrative boundaries but they should not be fixed to them. In other words, if the city administration varies the boundaries, they would not be a corresponding change in the registration area or section boundary. The principle is that the registration agency is the only authority empowered to amend registration area, section or block boundaries, and change parcel identification numbers. Another guiding principle is that mutations of the parcel will result in the parcel ID number being retired and new number assigned. This ensures uniqueness and maintains links to parent parcels and old records.
2. The assignment of parcel ID numbers may be the responsibility of the surveying and mapping agency or the registration agency. If it is the former, a strict mutation procedure must be followed, because the ID number is the legal identification of the property and supporting records and documents.
3. Roads or geographic features usually delineate blocks. However, a block is not necessarily the smallest group of contiguous parcels surrounded by roads. A block can comprise many internal roads or “blocks” as the word is more commonly used. Arbitrary divisional lines can also delineate blocks if no suitable geographic features exist.

Note: The designated agency responsible for assigning property identification numbers is ESA. In the unlikely event that ESA cannot assign PIDs in order to complete the PIM (where the work is being done by a contractor) it is possible to assign a temporary PID and to amend this later automatically using software.

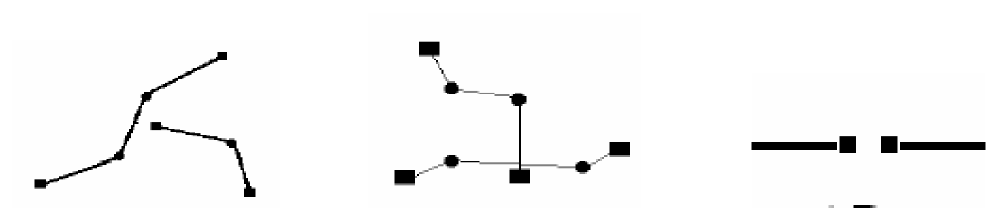
6.8 PIM Quality Evaluation

The quality assurance and quality control measures that are required to produce a PIM that meets specifications and fitness for purpose are given in a separate specifications and guidelines document. Briefly, after data compilation, georeferencing, fieldwork, verification, and editing have been completed, a final evaluation should check the following:

1. Geometric integrity (no line duplication overlaps, overshoots, undershoots, gaps, or artifacts, as illustrated in figure 6, below)
2. Topological integrity (polygons are closed, defined as area objects, no gaps, no overlaps, no slivers)
3. Parcels are not split by buildings, and buildings are not split by parcels (buildings must be completely within or wholly or partially coincident with parcels unless the property is a “villa” that spans two parcels)
4. All parcels have internal PID points and text; all blocks have internal identification number; all sections have internal identification number; all cities have internal identification number; all governorates have internal identification number.
5. All lines are associated with polygons
6. All polygons are labeled
7. A visual comparison between the PIM and very high resolution satellite imagery
8. Absolute and relative positional accuracy checks

A report that documents all the quality controls put in place during property index map production and the results of the quality evaluation prior to delivery must be produced. All checks must be reported, including checks where the data failed to pass.

A separate metadata file in a format specified in the QA / QC specifications and guidelines must also be produced.



Undershoot Overshoot Gap

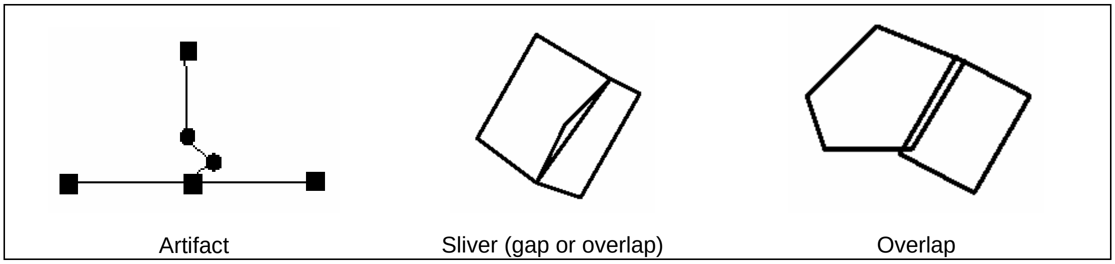


Figure 6. Examples of lack of data integrity

ANNEX A – PROPERTY INDEX MAP SPECIFICATIONS

A1 Property Index Map Data Content

Entity	***Typology***	***Description***
Points	Attribute text	Property identification number
		Street name
Lines	Parcel boundary	Straight line between boundary corner points
	Building line	Straight line between building corners
	Servitude line	Straight line between servitude corners
Polygons	Parcel	Closed loop of linked lines
	Building	Closed loop of linked lines within or wholly or partly coincident with parcel polygon
	Servitude	Closed loop of linked lines within or wholly or partly coincident with parcel and/or building polygon

A2 Property Index Map Spatial Data Tables

Table name	***Comments***
POINT_PID	X, Y coordinate; fixed format text field; date created; source
POINT_STREET	X, Y coordinate; fixed format text field; date created; source
LINE_PARCEL	2x coordinate pairs; feature type(s); date; source
LINE_BUILD	2x coordinate pairs; feature type(s); date; source
LINE_SERV	2x coordinate pairs; feature type(s); date; source
AREA_PARCEL	PID #; # sides; area; feature type; date; source
AREA_BUILD	PID #; # sides; area; feature type; date; source
AREA_SERV	PID #; # sides; area; feature type; date; source

Where: PID # is the property identification number; # sides is the number of straight line segments that make up the polygon; feature type the area feature that the polygon represents (parcel, building, etc); date is the date of acquisition; source is where 1=ESA cadastral layer, 2=plot layouts, 3=image data (very high remote sensed or aerial photography), 4=field measurements.

A3 Feature Topology

Feature	***Relationship***
Property identification no.	Wholly within parcel polygon

Feature	***Relationship***
Street name	Wholly outside parcel polygons
Parcel number	Wholly within parcel polygon
Servitude number	Wholly within servitude polygon
Parcel boundary	Line snapped to other line at node; not crossing line
Building	Line snapped to other line at node; not crossing line
Servitude	Line snapped to other line at node; not crossing line
Parcel	Polygon, not overlapping other parcels, wholly within block
Building	Polygon, not overlapping other building, wholly within or wholly or partly coincident with parcel
Servitude	Polygon, wholly within or wholly or partly coincident with parcel

A4 Attribute Data - Parcel

Attribute name	***Format***	***Details***
PID (aggregated)	TEXT	Assigned by ESA
PID (disaggregated)	NUM	Separate fields for each component of the PID
Plot number	NUM	From map or plan
Stated area	NUM	From an existing map or plan
Source reference	TEXT	Map or plan number; field survey
Source date	DATE	From map or plan
Parcel type	TEXT	Private or public
Parcel use	TEXT	Residential, commercial, industrial, administrative
Parcel status	TEXT	Demarcated or undemarcated

A5 Attribute Data - Building

Attribute name	***Format***	***Details***
PID (aggregated)	TEXT	Assigned by ESA
PID (disaggregated)	NUM	Separate fields for each component of the PID
Plot number	NUM	From map or plan
Building number	NUM	From map, plan or field
Street address	TEXT	
Source reference	TEXT	Map or plan number; field survey
Source date	DATE	From map or plan
Building type	TEXT	Private or public

Attribute name	***Format***	***Details***
Building use	TEXT	Residential, commercial, industrial, administrative; mixed
Building status	TEXT	Occupied; unoccupied; partially occupied
Number of floors	NUM	
Number of units	NUM	Estimated number of separate units or apartments

A6 Attribute Data – Maps, plans and documents

Attribute name	***Format***	***Details***
PID (aggregated)	TEXT	Assigned by ESA
PID (disaggregated)	NUM	Separate fields for each component of the PID
Type	TEXT	Map, plan, mutation form, deed, other
Number	TEXT	Document reference number
Property	TEXT	Property reference stated on document
Source	TEXT	ESA, REPD, other
Date	DATE	Document date
Hyperlink	LINK	Link to scanned raster image of document

A7 Image File Formats

Table B1	***File Format***	***Type***	***Resolution***
Documents	TIFF	CCIT4 bitmap	200 dpi
Color maps	TIFF	Indexed Colors	300 dpi
Plans	TIFF	Grayscale	200 dpi
Satellite images	TIFF	RGB True Colors	300 dpi

A8 Metadata File Format

Category	***Element***	***Definition***	***Occurrences***	***Field***
Dataset	Title	The name of the dataset	1	Text (50)
Custodian	Owner	Organisation responsible	1	Text (50)
Description	Abstract	Brief description	1	Text (150)
	Key words	For searching	N	Text (50)
	Geographic	Common name of the area that	N	Text (100)

Category	***Element***	***Definition***	***Occurrences***	***Field***
	extent name	the data set covers		
	Geographic region	Common name of the region where the extent is located	N	Text (50)
	Geographic extent	Latitude and longitude (decimal degrees) of E, S, W, N extents	4	Number
	Format	Description of what format data is stored	1	Text (25)
Data currency	Begin date	First data added	1	Date
	End date	Last data added	1	Date
Data quality	Lineage	A brief history of the source and processing steps	1	Text (200)
	Positional accuracy	A brief assessment of the data set as a whole and the checks carried out	1	Text (200)
	Attribute accuracy	A brief assessment of the reliability and completeness of associated data and the checks carried out	1	Text (200)
	Logical consistency	A brief assessment of the geometric and topology data rules	1	Text (200)
	Completeness	A brief assessment of the extent and coverage of data	1	Text (200)
Contact	Information	Organisation, person, address, telephone, etc	1	Text (200)