Standard on Manual Cadastral Maps and Parcel Identifiers

Approved August 2004

International Association of Assessing Officers

The assessment standards set forth herein represent a consensus in the assessing profession and have been adopted by the Executive Board of the International Association of Assessing Officers. The objective of these standards is to provide a systematic means by which concerned assessing officers can improve and standardize the operation of their offices. The standards presented here are advisory in nature and the use of, or compliance with, such standards is purely voluntary. If any portion of these standards is found to be in conflict with the *Uniform Standards of Professional Appraisal Practice* (*USPAP*) or state laws, *USPAP* and state laws shall govern.

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Standard on Manual Cadastral Maps and Parcel Identifiers

1. Scope

This standard provides recommendations on the development and maintenance of cadastral maps and parcel identifiers, using primarily manual methods. It describes the components of a basic mapping system and addresses map content, design, preparation, materials, security and maintenance. It also discusses requirements for an effective parcel identification system as a common index to all property records.

2. Introduction

The principal responsibility of the assessor is to locate, inventory, and appraise all property within the jurisdiction. A complete set of maps is necessary to perform this function. Maps help determine the location of property, indicate the size and shape of each parcel and reveal geographic relationships that affect property value. Maps and map data are important not only for assessors, but also for other governmental agencies, the public at large, and the land information community (such as realtors, title companies, and surveyors). In addition, the assessor must track current ownership of all parcels, so that the proper party can receive assessment notices and tax bills.

To make maximum use of data on land parcels, in a manual or digital mapping environment, it is necessary for jurisdictions to develop a multipurpose cadastre. A multipurpose cadastre furnishes a framework to record, store, and provide comprehensive land information at the parcel level, and makes it possible to share parcel data among all users of the data. See *Standard on Digital Cadastral Maps and Parcel Identifiers* (IAAO 2003a) for further guidance on mapping standards.

A cadastral mapping system should contain the following components.

- geodetic control network
- current, accurate, base map layer (ideally, photogrammetrically derived tied to the geodetic control)
- cadastral overlays delineating all real property parcels
- a unique parcel identifier assigned to each parcel
- a series of parcel data files containing parcel identifiers, ownership and assessment data
- additional overlays of interest to the assessor such as municipal boundaries, zoning, and flood plains

In creating or revising a cadastral mapping system, the assessor should make every effort to cooperate with other public and private sector entities, and thus create a true multipurpose cadastre. Such a system meets the needs of other offices in the jurisdiction, and of outside agencies and entities, and allows efficient sharing of maps and data. However, should efforts at cooperation fail, it may become necessary for the assessor to develop a single-purpose mapping system. In any case, the assessor must retain the ultimate authority to inventory, create, and define parcels and parcel identifiers.

3. Elements of a Manual Mapping System

A mapping system for assessment purposes includes the maps, accompanying records, and resources to support mapping. It should contain the elements described in the following paragraphs.

3.1 Geodetic Network

A geodetic control network consists of monumented points whose locations on the surface of the earth are defined with certainty. The points may be described in terms of latitude and longitude, but are more commonly used when projected to state plane coordinates. Spacing of control points should be related to land value, need for accurate mapping, and desire to avoid re-mapping when more accurate information becomes available. Today, professional land surveyors using global positioning systems (GPS) usually locate such points.

In the future, improvements in surveyors' GPS equipment and techniques may reduce the need for dense on-the-ground control networks. A few control points with continuously operating reference stations (CORS)—especially those that broadcast their signals—might serve this end. Assessors should support efforts to create such stations, and to mandate their use when preparing plats, surveys, and descriptions.

3.2 Base Maps

Base maps locate the major physical features of the landscape such as roads, water features, elevation contours, fence lines, and building footprints. In some jurisdictions, they contain the fundamental information from which the cadastral maps are prepared. Base maps should be tied to the geodetic network. Base maps can be in the form of line maps (generated manually or by computer) or photographic maps. Regardless of the form, base maps are usually created from aerial photographs. Aerial photographs provide an efficient and economical means for preparing the base maps, using photogrammetry (see section 7.1).

3.3 Cadastral Maps

The cadastral maps should be viewed as overlays to the base maps. There should be cadastral maps for the entire assessing jurisdiction, showing the size and position of each parcel in relation to other properties, bodies of water, roads, and other major geographic features. The maps should be produced at an appropriate scale (see section 5.2) and display all boundary lines, dimensions, or areas; identifying parcel numbers; and other pertinent legal and descriptive information (see section 4.1). The maps provide a physical framework upon which non-physical parcel information can be displayed, such as assessing comparisons, land appraisals and market or other statistical data.

3.4 Additional Map Overlays

A full multipurpose cadastre will have a variety of overlays. Map overlays that can be of great value to the assessor include municipal and taxing district boundary, appraisal neighborhood, soil type, zoning, flood insurance rate areas; and utility and transit lines. Some of these layers may be obtained from other offices or entities.

3.5 Parcel Identifiers

A unique identification number should be assigned to each parcel or code that links the parcel with files containing data such as ownership, value, use, and zoning. Parcel identifiers provide a common index for all property records. They provide a means of referencing legal descriptions in a uniform and more manageable way. Parcel identifiers make possible an efficient property record system for office and field use.

3.6 Index Map

An index map should show the location and boundaries of the individual cadastral map sheets in relation to the major features within the jurisdiction, such as roads, railroads, streets, rivers, lakes and political boundaries (see Appendix, figure 1).

3.7 Subdivision Index

The subdivision index should list all recorded subdivision plats. The index should contain a map reference for each subdivision with named subdivisions in alphabetical order and numbered subdivisions in numerical order.

3.8 Map Work Records

There should be documentation of all records used in preparing the maps and in describing the locations of property corners and monuments shown on the maps. Indexes should be available to facilitate future access to those records. The map work records should be keyed to the parcel identifiers and indexed in map sheet order.

3.9 Ownership Information

The current owner, owners, and/or parties of interest should be identified for each parcel. In addition, the basis of ownership (recorded deed, contract, court decree, etc.) should be documented. It is desirable to maintain records of past ownership history. Deeds and other ownership documents should be processed as soon as possible, but always within two weeks of recording (National Research Council [NRC] 1983, 56).

3.10 Imagery

Aerial photography has long been an essential tool for assessment purposes. Digital imagery is increasingly supplementing or replacing aerial photography. Imagery becomes more valuable when distortions have been removed to match the geodetic control, base map, and cadastral layer. These images are called orthophotos or ortho images. Jurisdictions should acquire new imagery of urban areas at least every five years, and of rural areas at least every ten years. Jurisdictions experiencing rapid or slow growth may need to adjust this timetable. Aerial imagery (and photogrammetric work done to create base maps) should meet published specifications for scale, overlap, tilt, time of day, and other requirements (URISA 1999; U.S. Geological Survey 1986, FGDC 1996, 1998a, 1998b).

3.11 Facilities and Equipment

Cadastral mappers and deed processors should have a minimum of 100 square feet (10 square meters) or workspace per person. Adequate equipment should also

be supplied for the production and storage of maps. See *Standard on Facilities, Computers, Equipment, and Supplies* (IAAO 2003b).

3.12 Program Management

Responsibility for mapping program management should be clearly assigned. Management personnel should be well trained in performing any or all of the following duties.

- producing new cadastral and associated map layers
- maintaining existing layers and ownership records
- controlling quality of production and maintenance
- contracting for mapping services and aerial imagery
- sharing and selling maps and data
- meeting with the land information community and the public on parcel descriptions in problem areas
- purchasing equipment, hardware and software
- creating and maintaining procedure manuals
- training personnel
- budgeting

Managers must first ensure that their map products meet appraisal needs, and then coordinate their efforts with other agencies and entities. They should also be aware of national standards for cadastral and other map data.

3.13 Staff and Training

An effective cadastral mapping and deed-processing program requires approximately one staff person per 10,000 parcels. This number may be modified due to any of the following reasons.

- degree of automation achieved in deed processing and mapping work flows
- economies of scale in larger jurisdictions
- need to create or recreate maps, or to transition to digital maps
- volume of deed processing work
- ratio of deeds which simply require changing owner names to deeds and plats which require creating new parcels
- need to respond to public requests for map and ownership information
- reliance on contracted mapping services
- need to create overlays for non-assessment purposes

All mapping personnel should receive training in procedures that are appropriate to the jurisdiction. At a minimum, mapping and deed processing staff should understand the engineering basis of highway and railroad right-of-ways, the surveying basis of boundary creation and description throughout the history of the jurisdiction, and appropriate legal principles of boundary and title law. Once these basic competencies are achieved, staff should be trained in the appropriate techniques of mapping with the available tools.

3.14 Production and Maintenance

Standard procedures for the production and maintenance of cadastral maps should be developed to ensure that all maps are completed and maintained in a uniform manner (also see section 7.4). A procedural manual should be developed, including such items as compilation and drafting accuracy, control, boundaries, text sizes, symbols, scale, technical specifications, and maintenance procedures. The manual must be continually maintained to reflect procedural changes and include any supporting data standards.

4. Map Content

4.1 Basic Information

Cadastral maps should contain the following:

- Boundaries of all parcels
- Parcel dimensions or areas
- Block and lot numbers and, if scale permits, names and boundaries of subdivisions and plats
- Boundaries of political subdivisions, for example, county, town and municipality
- Boundaries of geographic subdivisions, for example, section, township, and range; government lot boundaries and numbers; land districts, land lots, and numbers
- Location and names of streets, highways, alleys, railroads, rivers, lakes, etc.
- Parcel identifiers
- Other basic map information including a map number, date map was prepared, scale, revision

block, legend, map key, north arrow, and key to adjoining maps

4.2 Supplemental Information

Supplemental parcel information should be recorded on overlays or a computerized database. This allows access to as much or as little data as required without changing the original maps. It also facilitates use of the map data by other users.

Commonly collected supplemental information includes the following:

- Right-of-way and easement boundaries
- Names and addresses of parcel owners
- Assessed values
- Locations of improvements
- Street numbers
- Monumentation network coordinate listing
- Zoning information
- Special districts (for example, voting)
- Sewer and water lines
- Waterways and county drains
- Topological and topographical information
- Soil types
- Sales data
- Deed and survey reference information

5. Essentials of Design

Cadastral maps should conform to the following standards.

5.1 Map Sheet Size

A uniform size for map sheets facilitates handling and storage of maps. The final map size will depend on the scale and coverage of the maps; however, intended use of the maps, supply, storage and mode of reproduction must also be considered. The use of readily available precut material is desirable. The following are commonly used map sizes: 11” x 17”, 20” x 30” 24” x 36”, 30” x 30”, 30” x 36” and 36” x 36”.

5.2 Map Scales

A map scale that covers the largest possible area while showing necessary detail should be selected. Parcel size and the complexity of parcel descriptions in the area to be covered by a single map are the major determining factors in choosing map scales. In general, larger-scale maps should be used for urban and suburban areas and smaller-scale maps for rural areas. Map scales should be expressed as ratios, allowing for easy conversion from the imperial system to the metric system (for example 1:1,000 can be read as “one unit on the map equals 1,000 units on the ground”). The following are commonly used mapping scales:

- Urban areas: 1:1200 (1” = 100’)
- Suburban areas: 1:2400 (1” = 200’)
- Rural areas: 1:4800 (1” = 400’) and 1:9600 (1” = 800’)

5.3 Map Material

All photographic enlargements and final detailed maps, whether generated manually or by computer, should be on stable base film of at least 0.004” thickness. Double-matte finish is preferred for maps. Overlays should have a single-matte finish. Among the advantages of film over paper are:

- Map and photograph reproduction using standard diazo process is easier and more economical.
- Map information can be changed without physically damaging the master maps.
- The dimensional stability of maps and photographs is increased.
- The durability and permanence of the maps and photographs are greatly increased.

5.4 Symbols

Standard symbols should be employed on the maps. Examples of standard mapping symbols and cartographic specifications are shown in the Appendix.

5.5 Line Work

Throughout the finished maps, the line widths should be standardized and drawn in non-etching ink produced specifically for use on films. Line weights should be specified by technical pen sizes, for example, 00, 0, 1 and 2, or the metric equivalents, .30, .35, .50 and .60.

5.6 Lettering

All lettering on finished cadastral maps should be produced mechanically and specified by the template size or character height, line weight and orientation.

5.7 Map Layouts

Throughout the finished maps the layout should be standardized, containing a title block, revision block, legend, map key, north arrow and keys to adjoining maps. A title block identifies the map, the date it was prepared and the scale. A revision block is used to record any revisions made to the maps and the date of revision.

6. Preparation for a Mapping Program

Preparation is essential before undertaking a mapping program. The jurisdiction should evaluate the mapping needs of the assessor and other agencies that will be using the final product; determine the type of finished product and the accuracy required; evaluate existing and needed personnel, facilities, data processing, and technical administrative support; investigate and determine the funding available; and, establish preliminary schedules and completion dates.

6.1 Program Management

Mapping may be carried out in a variety of ways, depending on the scope and magnitude of the mapping project. Regardless of how the mapping function is performed, responsibility for its management should be specifically assigned and a project plan developed as to serve as the organization's blueprint for both the process of mapping and for the content and format of the final product.

Managers can expect to deal with contracts for photography, equipment and production; daily map production; personnel training; budgeting; quality control; and external standards. A critical element of a successful project is the skill level of the cadastral compiler. Whether the ownership parcel compilation is done in house or through a contractor, those doing the actual work should be CMS certified, or at least have taken IAAO Courses 600 and 601 or their equivalent. A surveying background alone isn't sufficient without experience in land tenure/ownership determination as opposed to merely boundary delineation.

6.2 Contracting for Mapping Services

When a mapping program or a major updating and remapping program is undertaken, consideration should be given to whether the project will be conducted in-house or contracted to an appropriate vendor. Many assessors' offices do not have the experienced personnel necessary to produce and maintain cadastral maps, and few have the specialized equipment and expertise needed to produce orthophoto base maps. In some states or provinces the property tax supervisory agency provides maps for the assessor. Occasionally mapping is the responsibility of another governmental agency, such as the engineering or public works department. In many cases, however, the jurisdiction must contract with a professional mapping firm for the production of maps. The jurisdiction or assessor should become familiar with accepted contracting procedures. See *Standard on Contracting for Assessment Purposes* (IAAO 2002).

6.2.1 Technical Specifications

The jurisdiction must prepare a set of technical specifications that clearly defines the aerial photography or mapping services to be performed. The specifications should address the technical aspects of the project and specify the quality and quantity of the products to be delivered.

The technical specifications should include such items as the following.

- geographic areas to be mapped
- preliminary activities to be performed (for example, the establishment of horizontal and vertical control)
- types of maps to be produced
- data to be displayed on the maps (for example, dimensions, political boundaries, geographic features, street names, and other labels)
- sources of data
- scale, size and layout of the maps
- labeling
- deed records
- all other technical and accuracy requirements

In developing technical specifications, any state- or province-mandated aerial photography and mapping standards must be used. In the absence of such standards, research should be carried out to determine which published mapping specifications best fulfill the needs of the individual jurisdiction (see section 7.1).

6.2.2 Evaluating Mapping Firms

A high level of technical expertise is required to evaluate mapping professionals and contract proposals. If the expertise is not readily available, consultants should be retained to assist in the effort. See *Standard on Contracting for Assessment Services* (IAAO 2002).

6.2.3 Requests for Proposals and Contractor Selection

When contracting for the development of mapping services, it is recommended that the jurisdiction develop a request for proposals (RFP) that embodies the technical specifications set forth in 6.2.1. See *Standard on Contracting for Assessment Services* (IAAO 2002).

7. Parcel Map Compilation Process

7.1 Base Map Preparation

Cadastral maps should be prepared using base maps (for example, planimetric maps, topographic maps, or orthophoto maps) that have been produced photogrammetrically from aerial photography. At a minimum, rectified aerial photographs should be used as the base for cadastral maps. Aerial photographs must be current, taken with a calibrated precision mapping camera, and must meet prescribed specifications for scale, overlap, tilt, time of day, and other requirements.

Aerial photographs and base maps should be prepared in accordance with established industry and governmental standards, such as those adopted by the American Society for Photogrammetry and Remote Sensing; the Surveys and Mapping Branch of the Canadian Department of Energy, Mines, and Resources; the U.S. Geological Survey; or the British Air Survey Association. Aerial Photography/base mapping specifications prescribed by the U.S. Geological Survey are contained in *Large-Scale Mapping Guidelines, USGS Open-File Report 86-005* (1986).

7.2 Ownership Parcel Map Compilation

The compilation and plotting of the parcels shall be accomplished through the use of any existing source maps and the descriptions as contained in the vesting instruments or assessment records in conjunction with the delineation of the parcel's boundaries and limits, as distinguishable from the physical and cultural features of a photographic basemap.

In the event a parcel ownership boundary cannot be delineated or determined through the use of existing source maps, assessment record descriptions, recorded surveys of plats, or vesting instrument description, the following priorities of calls shall be utilized:

a. Natural boundaries.

b. Man-made boundaries.

c. Contiguous owners.

d. Distance.

e. Course (bearing or direction).

f. Area

7.2.1 Deed Research

Delineation of parcel boundaries on the cadastral maps can often be accomplished by using property descriptions taken from the current assessment rolls. Where such descriptions are inadequate and not plottable, the deed or deeds applicable to the parcels in question should be researched in the registry of land titles office to delineate the parcels. If descriptions are unavailable, field checks and discussions with owners to establish agreed upon boundaries are appropriate.

7.2.2 Other Sources of Data

The following data can be useful in preparing cadastral maps.

- Filed or recorded plans or plats of subdivisions
- Road and railroad rights-of-way
- Land surveys
- Field research
- Existing maps
- Other recorded data (for example, annexations, street or alley closings or openings, taxing district boundaries and descriptions)

Any agency that has recorded information related to political subdivision boundaries can also be a useful source.

7.3 Map Maintenance

Maps represent a substantial capital investment and qualified personnel should perform map maintenance on a daily basis to ensure the integrity of the maps.

Map maintenance involves recording description changes, making map corrections, and notifying map users of the changes on a regular basis. It is also necessary to make an annual back-up copy of any maps. Maintenance also includes the constant correction and improvement of the maps from new and more accurate survey data. There should also be a plan for re-mapping areas at as large a scale as necessary, to more clearly depict new subdivisions and areas of rapid development and growth.

7.4 Map Security

As insurance against loss or damage, and as assurance of an adequate historical record of ownership, at least one reproducible set of maps, or microfilmed copy plus

any related computerized map data should be stored in a fireproof environment at a location different from the place where the originals are stored or used. A copy should be made for these purposes at least once a year, or as often as ownership parcels are used for a certified assessment roll or tax roll.

8. Digital Mapping and Interactive Graphics

See *Standard on Digital Cadastral Maps and Parcel Identifiers* (IAAO 2003a).

9. Parcel Identification Systems

A parcel identification system provides a method for referencing land parcels, or data associated with parcels, using a number or code instead of a complete legal description. The correlation of maps and individual property records requires that all parcel files be indexed using a uniform parcel identifier.

Each parcel should have assigned to it a unique identification number or code. The parcel identification system should be legally defined and recognized as the official reference to all documents or data for each parcel. It is desirable for all jurisdictions in a state or province to use the same primary system of parcel identification. Various secondary identifiers may also be used to index parcel data because agencies have different needs; there may be a requirement to reference historical records; or, to reference other data holdings. However, all of the secondary identifiers should be cross-indexed as much as possible to the legally recognized, unique parcels identifier, allowing multiple uses of the data. These secondary 'identifiers' may be maintained regularly along with the primary PIN, or merely a one-time reference to provide historical continuity to associated records or files. Computers make possible easy cross-referencing of these identifier systems to the parcel files.

9.1 Kinds of Parcel Identifiers

There are three basic forms of parcel identifiers in common use.

- Location
- Name-related
- Alphanumeric

For manual mapping systems, the primary identifier for assessment purposes should be a location identifier. Name-related and alphanumeric identifiers are frequently used as secondary identifiers and should be cross-indexed to the location identifier.

9.1.1 Location Identifiers

A location identifier is one in which the parcel number provides the location of the parcel. Examples include map-based identifier systems, geographic coordinate identifier systems or identifiers related to the U.S. Rectangular Survey System. See National Research Council, *Need for a Multipurpose Cadastre* (National Academy Press 1980).

- Assessors' Map Based Systems. A map-based system is relatively simple and easily used. Under this system, the assessment map itself is incorporated into the parcel identifier. The parcel identifier consists of a map, block (or group), and parcel number such as 32-02-16, where 32 represents the map on which the parcel is found, 02 indicates the block on the map and 16 identifies the parcel in that block. Rural maps usually do not use the block designation. In some jurisdictions maps are bound in books. In such instances parcel identifiers may consist of map book, page, and parcel numbers. Maps based identifiers do, to some extent, reference a geographic area and are convenient in the field. Problems may arise in this system where extensive development is occurring, requiring re-mapping and the assignment of new parcel identifiers. However, in stable areas, this system may be satisfactory.
- Geographic Coordinate Systems. The geographic coordinate system is a method of locating a point on the earth's surface based on its distance from each of two intersecting grid lines known as x and y axes. A coordinate parcel number is composed of the x and y coordinates. Parcel identifiers using this system are composed of the coordinates for a single point, usually the approximate center of the parcel. Since the parcel number generally refers to the center of the parcel it describes, the geographic location of the parcel can be determined from the parcel number alone. This system tends to be complex, and an understanding of coordinate systems is needed to fully utilize it. Once understood, however, the system is relatively simple to use and maintain. It also meets the criteria of uniqueness and permanence. This system lends itself to automated systems since computers can be programmed to prepare maps and assign parcel identifiers based on coordinates.
- Rectangular Survey System. This system of parcel numbering is based on the U.S. Public Land Survey System. Parcel identifiers based on the rectangular survey system are developed using the township, range, section, quarter-section and

quarter-quarter-section numbers, along with individual parcel identifiers that are assigned to each tract. This kind of identifier readily provides the geographic location of each parcel, is relatively easy to understand and maintain, and meets the criteria of uniqueness and permanence.

9.1.2 Name-related Identifiers

A name-related identifier uses the names of individuals claiming an interest to a parcel as the parcel identifier. A common example of this is the use of name codes in the grantor-grantee index.

9.1.3 Alphanumeric Identifiers

An alphanumeric code is often an arbitrary number associated with the parcel. An example is the sequential numbering system in a tract index.

9.2 Desirable Characteristics

It is desirable for parcel identifiers to incorporate the following attributes.

- uniqueness,(most important attribute)
- permanence
- simplicity
- ease of maintenance
- flexibility
- reference to geographic location

9.2.1 Uniqueness

Uniqueness refers to a one-to-one relationship between a parcel and its identifier. An identifier should be assigned to one and only one parcel.

9.2.2 Permanence

Parcel identifiers should be permanent and change only if the boundaries of the parcel change, and a new parcel is created. In areas where there is extensive subdivision, requiring re-mapping, it may become necessary to assign new parcel identifiers, even though some parcel boundaries have not changed. Whenever a new parcel is created, it should be assigned a new parcel identifier. Changing parcel boundaries are generally handled through the use of suffix systems or through retiring number systems. A retiring number system is recommended.

9.2.3 Simplicity

Parcel identifiers should be easily understood and uncomplicated to reduce the number of errors in its use.

9.2.4 Ease of Maintenance

The parcel identification system should be easy to maintain and should efficiently accommodate changes, such as subdivision or consolidation of parcels.

9.2.5 Flexibility

The parcel identification system should be reasonably flexible. It should be capable of serving a variety of uses and be convenient for both field and office operations. In the office, access to property records and files should be facilitated through the use of parcel identifiers. To accomplish this, parcel identifiers must be accessible in a logical, sequential order. For field use, parcel identifiers may need to be arranged in geographical order to facilitate systematic valuation procedures.

When computer-assisted mass appraisal systems (CAMA) are used, it is also important that parcel identifiers be suitable for both computerized and manual operations. To meet data processing requirements, parcel identifiers must be capable of being sorted into a logical sequential order.

9.2.6 Reference to Geographic Location

A parcel identification system that is based on geographic location makes it possible to describe and locate a parcel using only the parcel identifier. Such a system simplifies the handling of property records.

9.3 Assigning Parcel Identifiers

Parcel identifiers should be assigned to all parcels, whether taxable or exempt, during the initial phase of a cadastral mapping program. These parcel numbers should be considered provisional until the mapping program has been completed and all maps formally approved. Subsequent assignment of parcel identifiers should be done on an ongoing basis, by a single agency, as new parcels are created.

Appendix

FIGURE 1. Example of an Index Map

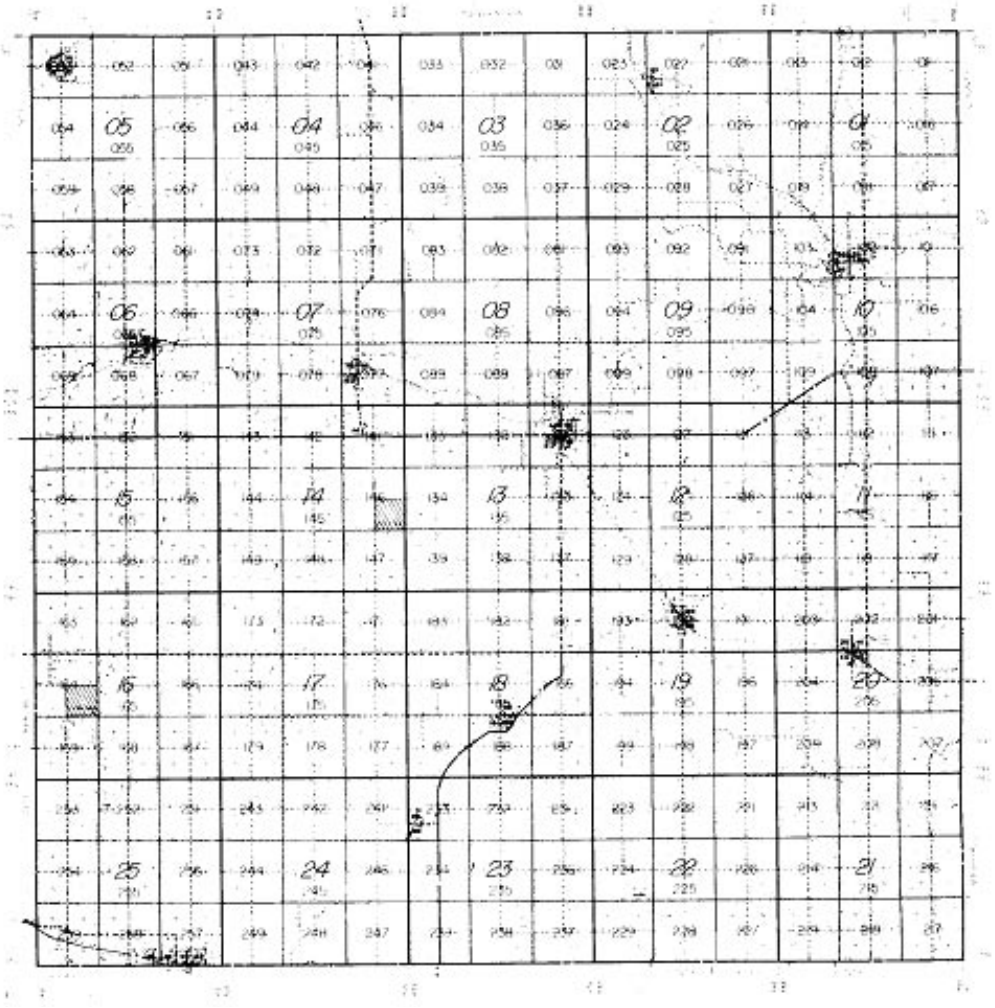
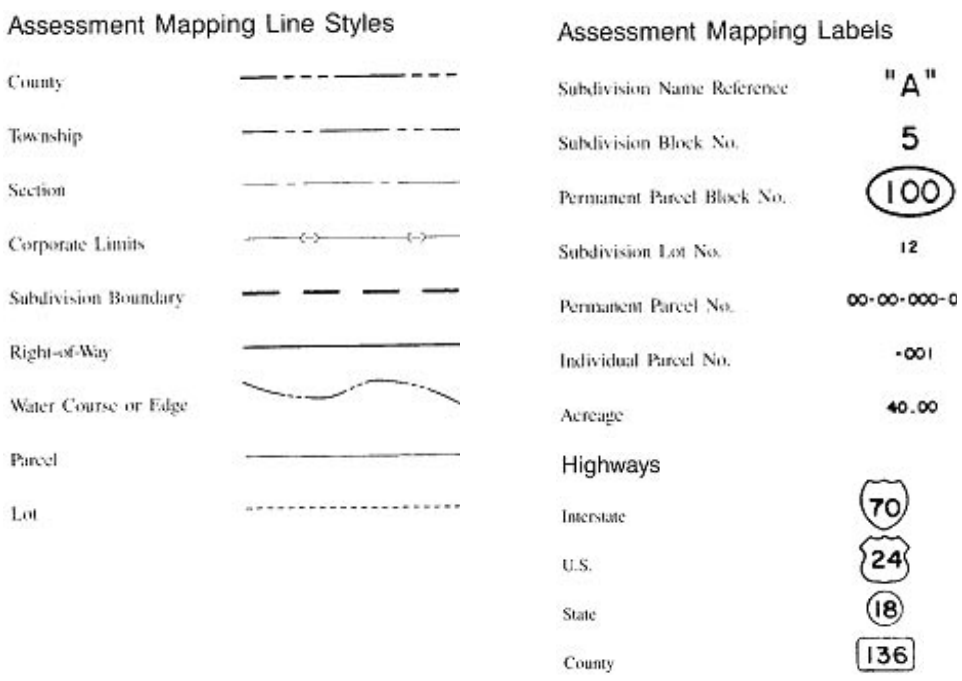


FIGURE 2. Examples of Standard Mapping Symbols



12.6 PEN WEIGHT AND TEMPLATE GAUGE FOR 1"=200', 1"=100' MAPS

SUBJECT	LEROY/EQUIVALENT PEN WEIGHT/TEMPLATE	EXAMPLE
1. Road and Street Names	1 Pen / 120 L Template	TOPEKA AVE
2. Alleys	0 Pen / 80 L Template	ALLEY
3. Parcel Number	1 Pen / 140 L Template	4
4. Original Lot Number	0 Pen / 120 L Template Slant	22
5. Creeks, Streams, Etc.	0 Pen / 120 L Template Slant	RYE CREEK
6. Rivers, Lakes, Etc.	1 Pen / 175 L Template Slant	KANSAS RIVER LAKE PERRY
7. Deed Dimensions	0 Pen / 100 L Template	100'
8. Scaled Dimensions	0 Pen / 100 L Template	105' (s)
9. Road Dimensions	0 Pen / 80 L Template	60' R/W
10. Deed Acreage	0 Pen / 100 L Template	40 Ac. (d)
11. Calculated Acreage	0 Pen / 100 L Template	44 Ac. (c)
12. Church, Cemetery, School Names Etc.	0 Pen / 80 L Template	SHAWNEE COUNTY COURTHOUSE
13. Ownership Block Number	2 Pen / 240 L Template	"04"
14. Original Block Number	2 Pen / 200 L Template	(3)
15. Transmission Lines	0 Pen / 80 L Template	K.P.&L. 100' R/W EASEMENT
16. See Note	0 Pen / 120 L Template	SEE 1"=100' MAP 011-11-40
17. Easement Line	0 Pen	
18. Corner Dimension	0 Pen / 80 L Template	90°
19. Adjoining Map Number	0 Pen / 120 L Template	011-12-10
20. Conflict	0 Pen / 120 L Template	CONFLICT
21. Map Numbers	2 Pen / 200 L Template	011-12-14
22. State Line	4 Pen	NEBRASKA / KANSAS
23. County Line	4 Pen	SHAWNEE / OSAGE

12.6 CONTINUED 1"=200', 1"=100' MAPS

SUBJECT	LEROY/EQUIVALENT PEN WEIGHT/TEMPLATE	EXAMPLE
24. Township and Range Lines	4 Pen	
25. Section Lines	3 Pen	
26. Quarter Section Lines	1 Pen	
27. Corporate Limit Lines		TOPEKA CITY LIMITS
28. Railroad R/W	1 Pen	A.T. & S.F. R.R. 100' R/W
29. Highway R/W	1 Pen	50' R/W
30. Property Boundary Lines	1 Pen	P/L P/L
31. Original Lot Lines	0 Pen	
32. Water	0 Pen	
33. Land Hooks	0 Pen	
34. Transmission Lines	0 Pen	
35. State Name	2 Pen/ 200 L Template	KANSAS
36. County Name	2 Pen/ 200 L Template	SHAWNEE COUNTY
37. Township and Range Number	1 Pen/ 140 L Template	T-22 S R-2W / T-23 S R-3W
38. Section Number	1 Pen/ 140 L Template	2 1 / 11 12
39. Corporation Name	1 Pen/ 140 L Template	TOPEKA CITY LIMITS
40. Railroad Name	0 Pen/ 120 L Template Slant	BURLINGTON N. R.R.
41. Interstate Highway	0 Pen/ 140 L Template	70
42. U.S. Highway	0 Pen/ 140 L Template	24
43. State Highway	0 Pen/ 140 L Template	18
44. County Highway	0 Pen/ 140 L Template	136
45. S/D Limits	1 Pen	
45-A S/D Limit Number	0 Pen/ 80 L Template	2
46. Vacated Street	0 Pen	
47. Leasehold Imp. Boundary Lines	0 Pen	13.01 L. I.
48. Leasehold Improvement	1 Pen/ 140 L Template	
49. Mineral Rights	1 Pen/ 140 L Template	12 320 Ac. M. R.

12.7 PEN WEIGHT AND TEMPLATE GAUGE FOR 1" = 400' MAPS

SUBJECT	LEROY/EQUIVALENT PEN WEIGHT/TEMPLATE	EXAMPLE
1. State Line	4 Pen	
2. County Line	4 Pen	
3. Township and Range Lines	4 Pen	
4. Section Lines	3 Pen	
5. Corporation Lines	3 Pen	
6. Railroad R/W	0 Pen	A.T. & S.F. R.R.
7. Highway R/W	1 Pen	60' R/W
8. Property Boundary Lines	1 Pen	
9. Original Lot Lines	0 Pen	P/L P/L
10. Water Line	0 Pen	
11. Land Hooks	0 Pen	
12. S/D Limits	1 Pen	
12-A S/D Limit Number	0 Pen/ 80L Template	2
13. Transmission Lines	0 Pen	
14. State Name	2 Pen/ 200L Template	KANSAS
15. County Name	2 Pen/ 200L Template	SHAWNEE COUNTY
16. Township and Range Number	1 Pen/ 140L Template	T-14S R-2E / T-15S R-2E
17. Section Number	1 Pen/ 140L Template	6 5 / 7 8
18. Corporation Name	1 Pen/ 140L Template	TOPEKA CITY LIMITS
19. Railroad Name	0 Pen/ 80L Template Slant	BURLINGTON NORTHERN R.R.
20. Interstate Highway	0 Pen/ 140L Template	70
21. U.S. Highway	0 Pen/ 140L Template	40
22. State Highway	0 Pen/ 140L Template	6
23. County Highway	0 Pen/ 140L Template	127

12.7 CONTINUED 1"= 400' MAPS

SUBJECT	LEROY/EQUIVALENT PEN WEIGHT/ TEMPLATE	EXAMPLE
24. Road and Street Names	1 Pen/ 120 L Template	COUNTY ROAD
25. Alleys	0 Pen/ 80 L Template	ALLEY
26. Parcel Number	1 Pen/ 140 L Template	2
27. Original Lot Number	0 Pen/ 120 L Template Slant	20 | 21 | 22
28. Creeks, Streams Names	0 Pen/ 120 L Template Slant	DRAGOON CREEK
29. Rivers, Lakes Names	1 Pen/ 175 L Template Slant	CLINTON LAKE
30. Water Acreage	0 Pen/ 80 L Template Slant	35 AC. (c)
31. Deed Dimensions	0 Pen/ 80 L Template	175'
32. Scaled Dimensions	0 Pen/ 80 L Template	180' (s)
33. Deed Acreage	0 Pen/ 120 L Template	120 Ac. (d)
34. Calculated Acrege	0 Pen/ 120 L Template	127 Ac. (c)
35. Church, Cemetery, School, Etc.	0 Pen/ 80 L Template	SHILOH CEMETERY
36. Transmission Lines	0 Pen/ 80 L Template	K.P.&L. 100' R/W EASEMENT
37. Adjacent Map Reference	0 Pen/ 120 L Template	012
38. Easement Line	0 Pen	
39. Map Number	2 Pen/ 200 L Template	012-04-10
40. Conflict	0 Pen/ 120 L Template	CONFLICT
41. Road Dimensions	0 Pen/ 80 L Template	60' R/W
42. Vacated Street	0 Pen	
43. Leasehold Imp. Boundary Lines	0 Pen	13.01 L. I.
44. Leasehold Improvement	1 Pen/ 140 L Template	
45. Mineral Rights	1 Pen/ 140 L Template	12 320 Ac. M.R.

Glossary

This glossary defines mapping terms used in this standard and its appendices and other commonly used mapping expressions. Many of these definitions were compiled from the textbook, *Definitions of Surveying and Associated Terms* (1978), and are used with permission of the publisher (American Society of Civil Engineers).

abandonment. An action involving relinquishment of rights in real property, by an owner, for the sole purpose of permanently terminating his ownership. The act of abandonment must be voluntary and intentional

abstract of title. A compilation of abstracts of deeds and other pertinent data, which affect the title to a piece of real property, all bound together in chronological order. It is a form of title evidence made for the purpose of title examination.

access rights. The right of ingress to and egress from a property which abuts upon an existing street or highway. It is an easement in the street, which is appurtenant to abutting property, and is a private, not public, right.

accretion. The process by which new soil is accumulated. The imperceptible addition of land to the shore of the ocean or bay, or to the banks of a river.

adverse possession. The actual, exclusive, open, notorious, and continuous possession and occupation of real property under an event claim of right or title.

assessment map. (See *cadastral map*.)

assumed plane coordinates. A local plane coordinate system set up at the convenience of the user. (See also *coordinates*.)

avulsion. The sudden and perceptible tearing away or separation of land by violent action of water. The land so removed remains property of the original owner.

bearing. Direction of a line measured from north or south to east or west, not exceeding 900 . Examples: N 300 W or S 870 E.

cadastral map. A map showing the boundaries of subdivisions of land, usually with the bearing and lengths thereof and the areas of the individual tracts, for the purposes of describing and recording ownership. A cadastral map may also show culture, drainage, and other features relating to the value and use of the land.

chain. A land surveyor's measure, 66 feet or 100 links

chain of title. A chronological list of documents which comprise the recorded history of title of a specific piece of real estate.

compilation. (1) Cartography: The production of a new or revised map or chart, or portion thereof, from existing maps, aerial photographs, surveys, new data and other sources (see delineation). (2) Photogrammetry: The production of a map or chart, or portion thereof, from aerial photographs and geodetic control data, by means of photogrammetric instruments, also called stereocompilation.

contour map. A topographic map that portrays relief by means of contour lines.

coordinates. Linear or angular quantities that designate the position of a point in a given reference frame or system. Also used as a general term to designate the particular kind of reference frame or system, such as plane rectangular coordinates or spherical coordinates. (See also *assumed plane coordinates, geodetic coordinates, geographic coordinates, plane rectangular coordinates,* and *state plane coordinate systems*.)

culture. Features of the terrain that has been constructed by man.

delineation. The visual selection and distinguishing of map worthy features on various possible source materials by outlining the features on the source material, or on a map manuscript (as when operating a steroplotting instrument); also, a preliminary step in compilation.

diazo process. A means of reproduction using a coating of a diazo compound that is decomposed by exposure to light.

dimensional stability. Ability to maintain size; resistance to dimensional changes in moisture content and temperature.

double matte finish. (See *matte finish*.)

easement. An interest in land created by grant or agreement, which confers a right upon owners to some profit, benefit, dominion, or lawful use of or over the estate or another; it is distinct from ownership of land.

geocode. A code (usually numerical) used to locate or identify a point, such as the center of a parcel.

geodetic coordinates. The quantities of geodetic latitude and longitude that defines the position of a point on the surface of the earth with respect to the reference spheroid. (See also *coordinates*.)

geographic coordinates. A system of spherical coordinates for defining the positions of points on the earth. The declinations and polar bearings in this system are the geographic latitudes and longitudes respectively. (See also *coordinates*.)

government lots. Lots established, measured, and computed by the U.S. Government's survey of the pubic lands. The term is often used synonymously with "frac-

tional lots" or "lots" (¼ sections irregularly shaped and more, or less than 40 acres). Some government lots are regular in shape and are 40 acres in area.

government surveys (U.S. Rectangular Land Survey). In 1785, the U.S. Congress authorized the first land survey of the United States. It specified that surveyed townships were to be 6 miles square. The townships are surveyed from an east-west base line and from north-south principal meridians. Townships are laid off from these base lines and meridians.

horizontal control. Control stations whose grid coordinates have been computed on plane surveys; known points can be converted to coordinate values.

index map. (1) A map of smaller scale on which are depicted the locations (with accompanying designations) of specific data, such as larger-scale topographic quadrangles or geodetic control. (2) Photography: A map showing the location and numbers of flight strips and photographs.

latitude (geodetic use). The angular distance north or south of the equator. The horizontal element of the geodetic coordinate system.

link. A one-hundredth of a surveyor's chain, a linear measure of 66 hundredths of a foot or 7.92 inches.

longitude (geodetic use). The angular distance east or west of the prime meridian, never exceeding 1800. The vertical element of the geodetic coordinate system.

lot. A plot of land, generally a subdivision of a city, town, or village block, or some other distinct tract, represented and identified by a recorded plat.

map. A representation (usually on a flat medium) of all or a portion of the earth or other celestial body, showing relative size and position of features to some given scale or projection. A map may emphasize, generalize or omit the representation of certain features to satisfy specific requirements.

map scale (fractional). A fractional scale is the ratio that any small distance on the map bears to the corresponding distance on the earth. It may be written in the form of a fraction (1/100,000) or as a proportion (1:10,000). Fractional scales are representative in any linear units.

manuscript map. The original drawing of a map as compiled or constructed from various data, such as ground surveys or photographs (See *compilation*)

matte print. Print made on photographic paper with a dull finish; more suitable for pencil or ink annotations than a glossy print but less suitable for interpretation than a semimatte print.

matte finish. A coating or texture on the surface of polyester film. Commonly used with cadastral maps because of dimensional stability, ink adherence, erasing quality, translucence, and strength.

meridian. A north-south line from which longitudes or departures, and azimuths are reckoned.

metes and bounds. Measurement of angles and distances; a description of a parcel of land accomplished by beginning at a know reference point, proceeding to a point on the perimeter of the property being described, and then tracing the boundaries until one returns to the first point on the perimeter, usually a corner. The angles are described by reference to points of the compass, and the distances are described in feet or chains; curves are treated as arcs on a circle.

monument. A permanent physical structure marking the location of a survey point or boundary line. Common types of monuments are inscribed metal tablets set in concrete post, solid rock or parts of buildings; distinctive tone posts; and metal rods driven in the ground.

national map accuracy standards (NMAS). For horizontal accuracy, maps at publication scales larger that 1:20,000, 90% of all well-defined features, with the exception of those unavoidably displaced by exaggerated symbolization, with be located within 1/30 inch (85 mm) of their geographic positions as referred to the map projection; for maps at publication scales of 1:20,000 or smaller, 1/50 inch (50 mm). For vertical accuracy, 90% of all contours and elevations interpolated from contours will be accurate within one-half of the basic contour interval. Discrepancies in the accuracy of contours and elevations beyond this tolerance may be decreased by assuming a horizontal displacement within 1/50 inch.

original plat. Used to distinguish the first plat from the subsequent addition. Original Town or Original Townsite are employed in the same manner.

orthophotograph. A photograph having the properties of an orthographic projection. It is derived from a conventional perspective photograph by simple or differential rectification so that image displacements caused by camera tilt and relief of terrain are removed.

overlay. Mapping: A record on a transparent medium to be superimposed on another record; for example, maps showing original land grants (or patents) prepared as tracing cloth overlays so that they can be correlated with maps showing the present ownership. Also, any of the several overlays that may be prepared in compiling a manuscript map; usually described by name, for example, lettering overlay.

parcel. A contiguous area of land described in a single description or as one of a number of lots on a plat; separately owned, either publicly or privately, and capable of being separately conveyed and assessed.

photodelineation. The delineation of features on a photograph.

photogrammetry. The art, science and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring and interpreting images and patterns of electromagnetic radiant energy and other phenomena.

plane rectangular coordinates. Called plane coordinates. A system of coordinates in a horizontal plane used to describe the positions of points with respect to an arbitrary origin by means of two distances perpendicular to each other. (See also *coordinates*.)

planimeter. A mechanical device used for measuring the area of a parcel on a map.

planimetric map. A map that presents only the horizontal positions for the features represented; distinguished from a topographic map by the omission of relief in measurable form.

plat. A diagram drawn to scale showing all essential data pertaining to the boundaries and subdivisions of a tract of land, as determined by survey or protraction.

public land survey system (PLSS). A rectangular survey system established in the United States by the Land Ordinance of 1785. The basic survey unit is the six-square-mile township. Townships are located by baselines and meridians parallel to latitude and longitude lines; they are defined by range lines running parallel (north-south) to meridians and township lines running parallel (east-west) to baselines.

rectification. The process of projecting the image of a tilted aerial photograph onto a horizontal reference plane to eliminate the image displacement caused by tile of the aerial camera at the time of exposure.

single matte finish. (See *matte print*.)

state plane coordinate systems. A series of grid coordinate systems prepared y the U.S. Coast and Geodetic Survey for the entire United States, with a separate system for each state. Each state system consists of one or more zones. The grid coordinates for each zone are based on, and mathematically adjusted to, a map projection. (See also *coordinates*.)

topographic map. A map that presents the horizontal and vertical positions of the features represented; diminished from the planimetric map by the addition of relief in measurable form.

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