

BASICS OF DRAFTING FOR CADASTRAL MAPPING

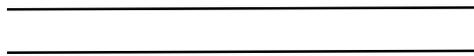
Chapter 3

2015 Cadastral Mapping Manual

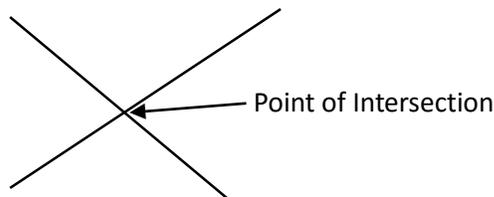
Basic Definitions

Drafting - in connection with cadastral mapping, is the art of representing records on a plane surface such as paper, linen or mylar with aid of instruments.

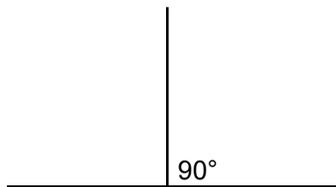
Parallel Lines - are any lines that are the same distance apart throughout their length, as shown below.



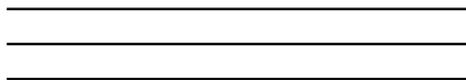
Intersecting Lines - are any lines that cross each other, as shown below. The point at which they cross is called the point of intersection.



Perpendicular Lines - are lines that are at right angles (90°) with each other, as shown below.



Horizontal Lines - as used in drafting, are straight lines that are parallel to the top and bottom of the drawing, as shown below.

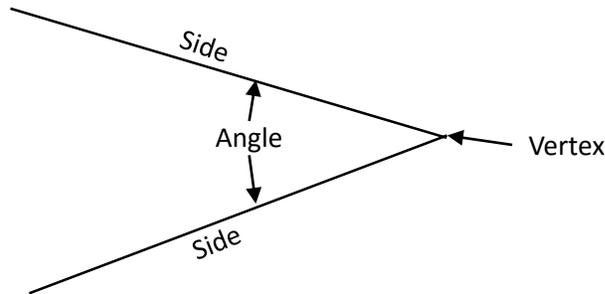


Vertical Lines - as used in drafting, are straight lines that are parallel to the sides of the drawing, as shown below.

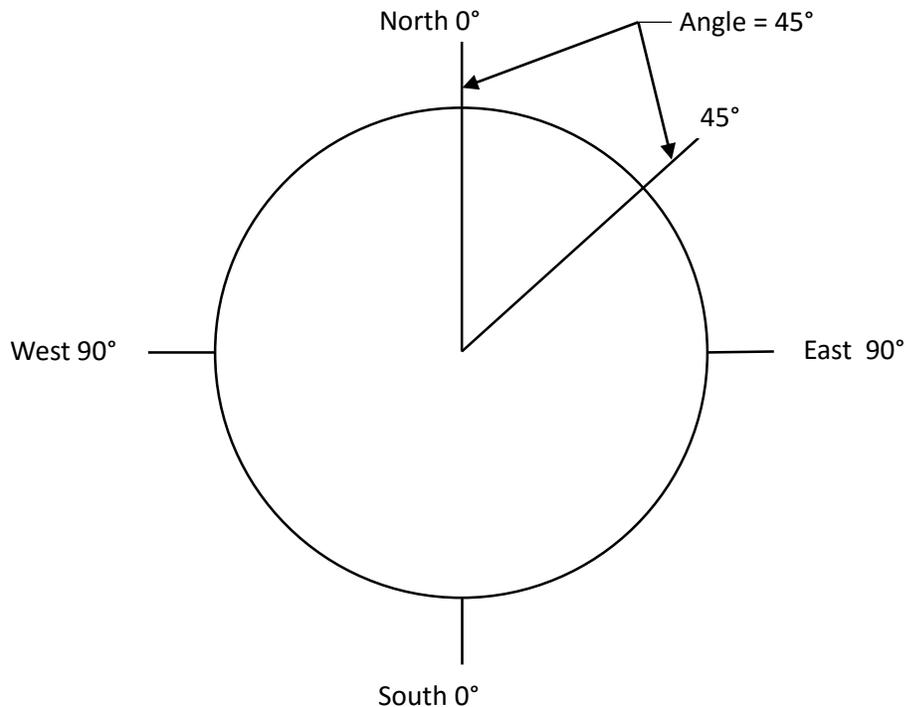


On a particular drawing, all horizontal lines are parallel to each other; all vertical lines are parallel to each other and every horizontal line is perpendicular to every vertical line. Lines that are neither horizontal nor vertical are referred to as oblique or inclined lines.

Angles - An angle is the opening between straight lines that meet or intersect. The lines are called the sides of the angle and the point where sides meet is called the vertex of the angle, as shown below.



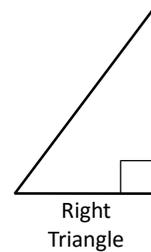
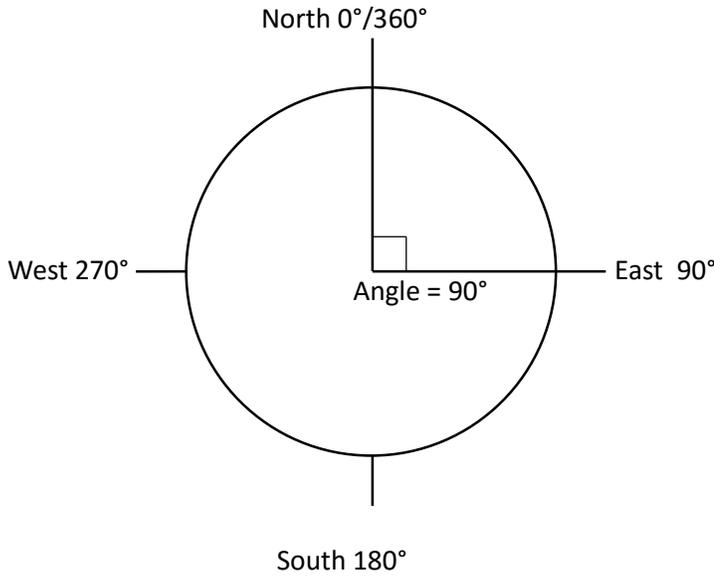
Measurements of Angles - Angles are measured in relation to a circle containing 360° ($^\circ$ = degrees). Degrees are broken down into minutes, there are 60 minutes (') in one degree. Minutes are further broken down into seconds, 60 seconds (") equals one minute. Any given angle may therefore be measured by drawing a circle with a vertex of the angle as the center of the circle and finding the number of degrees in the circle lying between the sides of the angle, as shown below.



Degrees, minutes and seconds and their use in cadastral mapping are further discussed in greater detail in the elements of surveying and mapping chapters of this manual.

Types of Triangles – There are four general types of triangles, below is a brief description of each type.

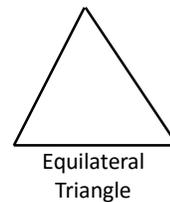
Right Triangle - Two sides of a triangle are perpendicular to each other, the angle is a right angle. A right angle is always 1/4 of a circle (360°) and is always equal to 90°, as shown below.



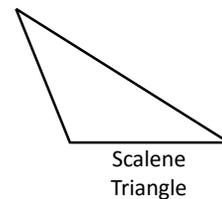
Isosceles Triangle – Two sides of the triangle have the same length.



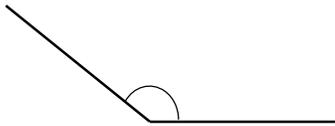
Equilateral Triangle – Three sides of the triangle have the same length and all three angles are equal.



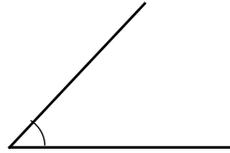
Scalene Triangle – The three sides of the triangle all have different lengths.



Oblique Angles - any angle that is not a right angle is an oblique angle. An oblique angle that is less than a right angle is an acute angle. An oblique angle greater than a right angle is an obtuse angle, as shown below.

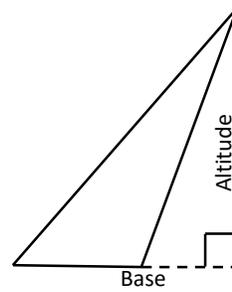
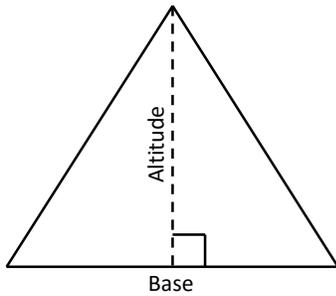


Obtuse Angle

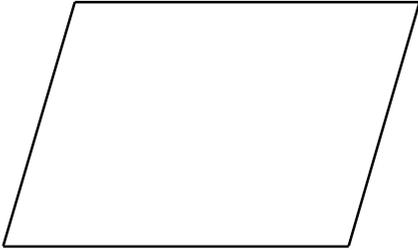


Acute Angle

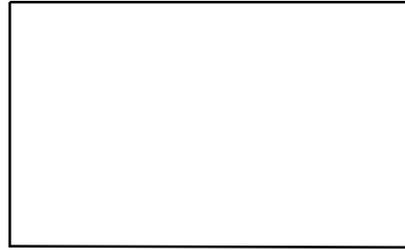
Altitude of Triangle - is represented by a line that is perpendicular to the base and is drawn from the vertex to the base or a prolongation of the base as shown below.



Parallelograms - have four sides and two pairs of parallel sides and the parallel sides have the same length. If the sides of one pair are perpendicular to the other pair, it is a rectangle. Both are shown below.

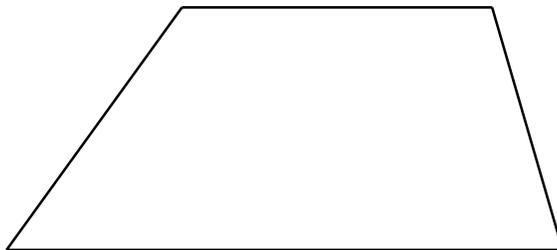


Parallelogram



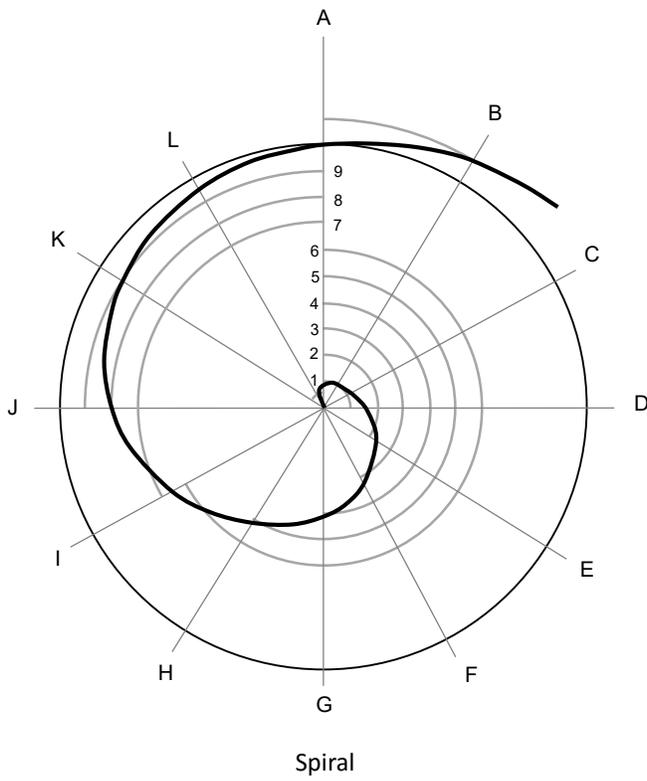
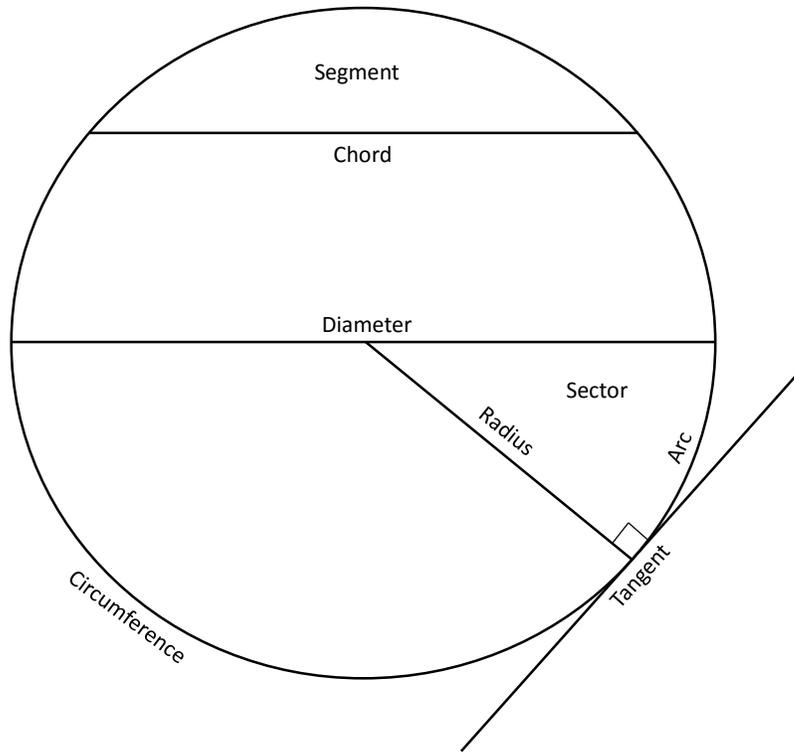
Rectangle

Trapezoid - has four sides and only two sides are parallel, as shown below.

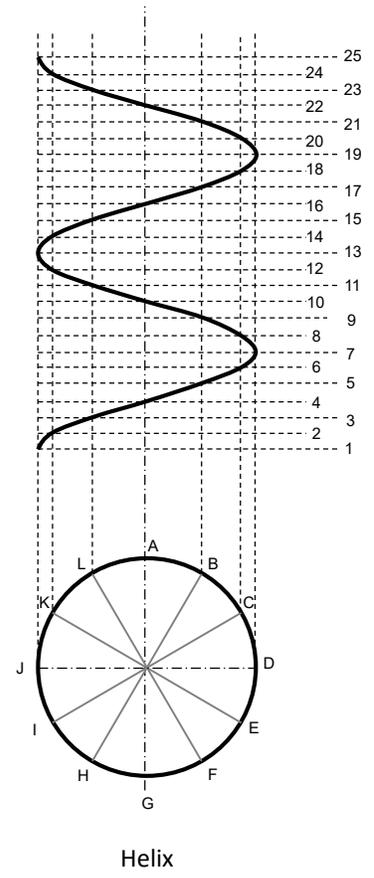


Trapezoid

Elements of a Circle - below are shown the principal terms used in connection with circles.



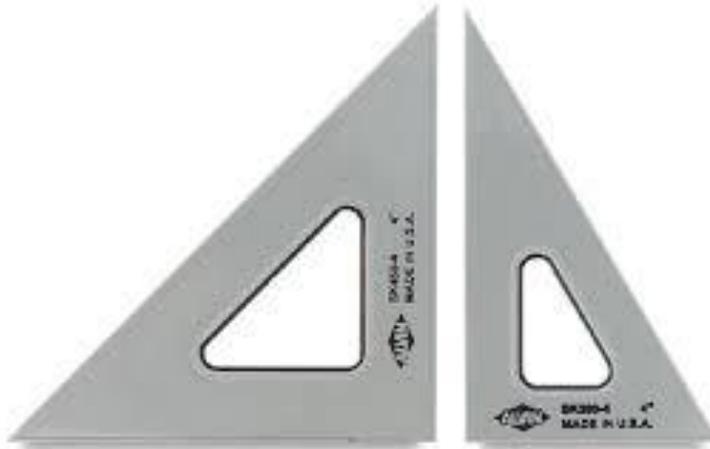
Spiral



Helix

Drafting Equipment

Drafting Triangles - are of 2 shapes, one is a 45° triangle and the other is a 30°- 60° triangle, as shown below.

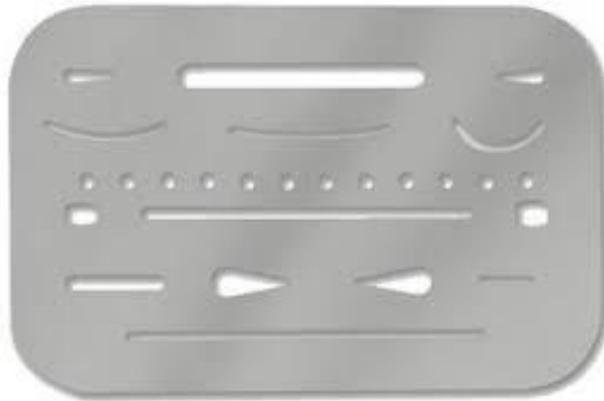


Electric Eraser - is used for a variety of erasing applications whether penciled, inked, or typed. A sample of an electric eraser is shown below.



In the State of Utah, some cadastral mapping is done on film base material that has a matte surface on one side. Electric erasers should NOT be used on this type of surface because they remove too much of the matte surface when erasing, hand erasing pencil lines is the preferred. Erasing ink is easy because ink stays on the surface of the film and can be removed with a dampened eraser.

Erasing Shield - is used to protect the lines around those being erased.



Engineers Scale - is a tool for measuring distances and transferring measurements at a fixed ratio of length and is divided into decimalized fractions of an inch. The cross-section is like an equilateral triangle, which enables the scale to have six edges indexed for measurement. The scale is graduated in units of 1 inch divided into 10, 20, 30, 40, 50, and 60 parts. In using the scale for cadastral mapping, each unit may represent 10', 20', 30', etc., depending on the scale of the drawing. Each part within the inch equals 1' or 10' depending on the scale of the drawing.



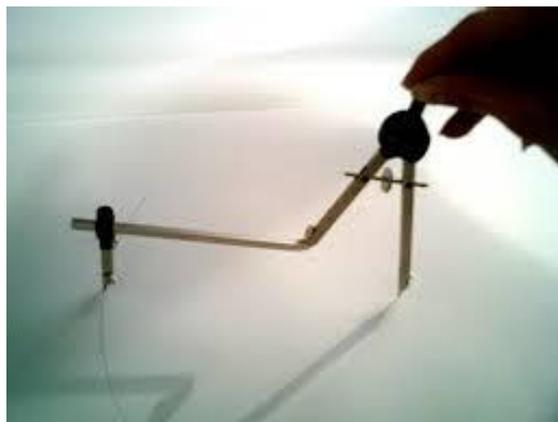
Compass - a drawing instrument used to construct circles or arcs. A combination compass provides a lead attachment, ink attachment and an extension piece to increase the radial capacity of the compass.



Drawing Circles and Arcs with a Compass - after the compass has been adjusted to the desired radius, place the needle point at the center of the required circle. Turn the compass, using the needle point as a pivot, describing the desired circle or arc as shown below.



When it is necessary to draw circles or arcs larger than the compass will permit, insert the extension and use as shown below.



Small Bow Compass - when it is necessary to draw a circle or arc of a small radius, it is advisable to use a small bow compass. It is similar to the large compass except it is smaller in size and has no provision for an extension piece as shown below.



Dividers - are instruments similar to the compass but have needle points in each leg. They are used for stepping off spaces or transferring distances on drawings. A compass can be used as dividers by substituting a needle in place of the pencil or pen. A sample of dividers is shown below.



Adjustable Curve – is used for drawing arcs of different radii, it can be quickly adjusted to the desired radius as shown below.



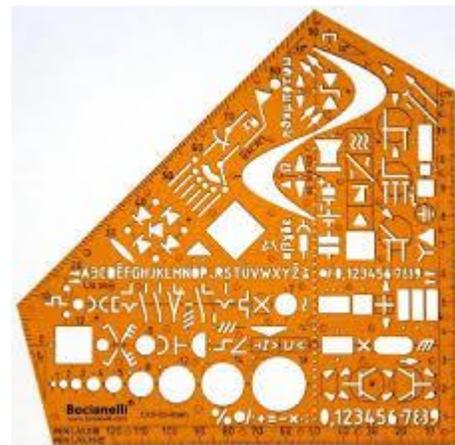
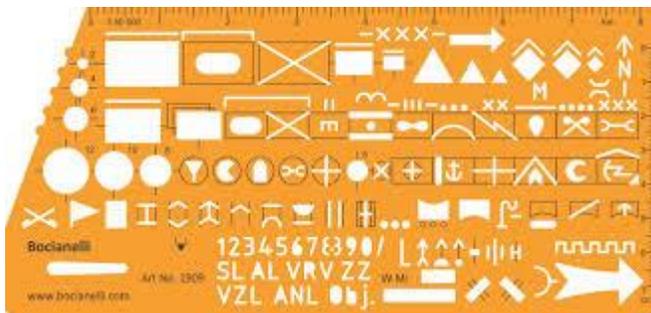
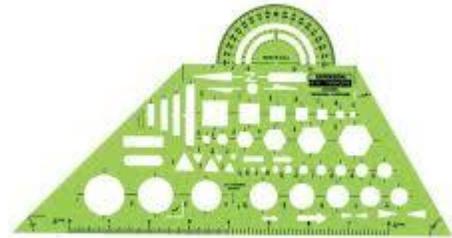
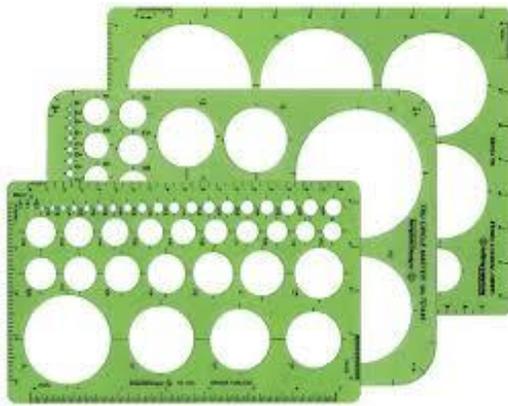
Flexible Curve - gives the mapper unlimited curves and holds any shape after adjusting.



Railroad Curves - can be used when it is required to draw a circular arc whose radius is greater than can be obtained with a compass and extension. They usually come in sets showing the degree of curve and length of radius in inches at a scale of 100 feet to the inch, as shown below.



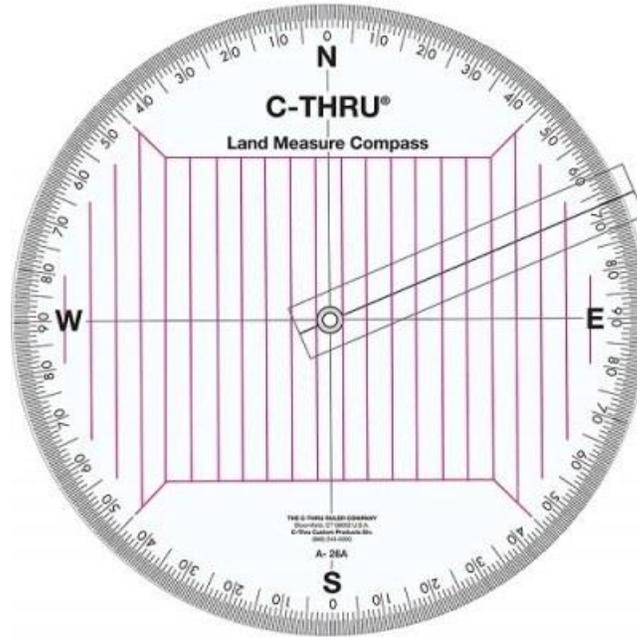
Templates - can be of great assistance to the mapper and come in a great variety of shapes and sizes, a few samples are shown below.



Protractor - is an instrument for measuring or laying out of angles. Protractors come in full circles (360°) or half circles (180°) and are divided into degrees and half-degrees. Every tenth degree is numbered, and the numbers run in both directions, as shown below.



Land Measure Compass – a specific type of protractor for measuring or laying out of angles or based on compass direction usually referred to as bearings. The Land Measure Compass is laid out in a full circle and is broken into four 90° directional quadrants with the measurements divided into degrees and half-degrees. It has a movable arm for assistance measuring existing angles.



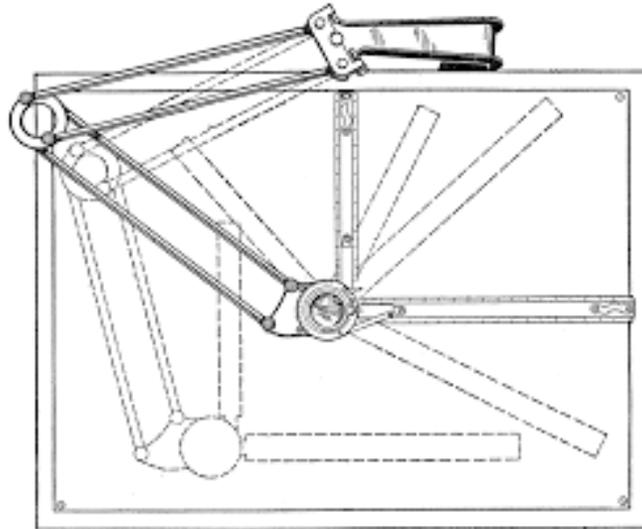
Irregular Curve - also known as a french curve. The various parts of its edges are curves with different radii and it is used for drawing lines with irregular curvatures. A sample of an irregular curve is shown below.



Drafting Machines

Drafting Machines have taken the place of the T square, triangles, scales, and the protractor. The two typical types of drafting machines are shown below.

Elbow Drafting Machines – have taken the place of the T square, triangles, scales, and the protractor. A drafting machines and its parts are shown on the following page.



The arms contain steel bands working on pulleys that provide a parallel motion to the scales. The scales are removable so they can be changed to different scales.

Below is an enlargement of a typical head.



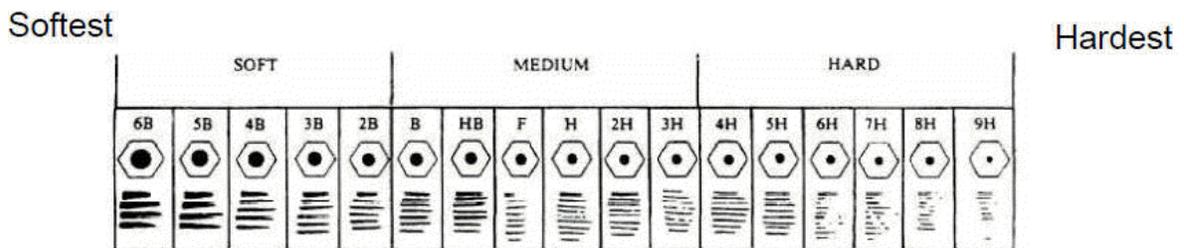
Track Drafting Machines - became very popular with cadastral mappers because it serves all the functions of a traditional drafting machine with additional advantages. The track drafting machine uses less space because the rails do not exceed the table surface as the arms do on a traditional elbow drafting machines but still covers 93% of the table surface. They glide easily to any position on the board and the vertical rail assures constant right angle stability. Some units are equipped with a base line indicator that permits the drawing of oblique lines at any angle and a return to the original baseline.



Drafting Pencil – Drafting Pencils are similar to your standard mechanical pencils but they have a longer sleeve tip where the lead comes out. The longer sleeve on a drafting pencil allows it to glide better along a ruler or template. They are also available in many different lead sizes, including 0.3 mm and 0.9 mm, as well as your usual 0.7 mm and 0.5 mm.



Drafting Lead – these are made of graphite, mixed with varying quantities of clay to produce different degrees of hardness and shade of darkness: 9B (very soft), 8B, 7B, 6B, 5B, 4B, 3B, 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H, 7H, 8H, 9H (very hard). There are also special leads made for work on mylar that vary in hardness. The softer the pencil lead is, the darker it shows up. The HB lead is the same as a standard #2 pencil lead.



Ink Pens - ink lines are made from a variety of pens, the most common being the reservoir pens. The width of lines created by these pens is determined by the number of the point used, the smaller the number the narrower the line and increasing in width as the number increases, as shown below. These pens are ideal for accurate line placement along a straight edge, curve or triangle, and free-hand drawing and lettering.



Ultrasonic Cleaners - can be used to clean inking equipment in seconds without taking apart pens, nor is ink removal necessary. The ultrasonic cleaner can also be used to clean disassemble pen parts if desired.



Lettering

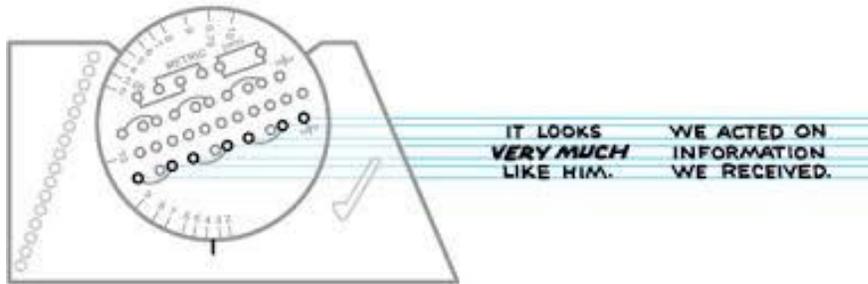
Vertical Single-Stroke Lettering - Single-stroke lettering does not mean that the entire letter is formed with a single stroke, but means a line is made with one stroke. The directions of the strokes are indicated by the small arrows by the letters and the order in which the strokes are made are shown in the examples below.



Inclined Single-Stroke Lettering -



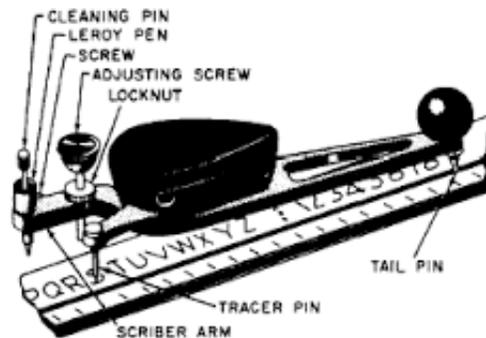
Letter Guides - there are various devices that can be used for drawing for lettering. One of these is known as the Ames Lettering Instrument as shown below. It consists of a disc inserted in a frame which can be rotated for different sized spaces.



A common practice among cadastral mappers is to use a lettering guide to create a series of different sized lines on a separate piece of paper and positioning it under the original drawing and use these lines as a guide for lettering. This lined paper can be moved to any desired position and eliminates the need for lettering guide lines directly on the original drawing.

Precautions in Lettering - Besides being formed properly, the letters on a drawing should always be in good alignment. Horizontal guide lines should always be used and the letters should have the heights indicated by the guide lines. The width of numerals, except 1, should be 5/6 of the height.

Lettering Devices - One of the cadastral mapper's most useful tools is the lettering set, with which perfect lettering can be made easily and rapidly. The Leroy Lettering Instrument is perhaps the most successful lettering device in use, as shown below.



You need only three basic items. This is how to use them.

1. LEROY Template - Choose the template with the size and style of lettering you want. (There are many styles and sizes of alphabets, as well as graphical symbols. Also, templates can be made specially for you to your own design.) Lay it along your straightedge.
2. LEROY Pen or Pencil
LEROY Pen - Choose the type of pen (Reservoir or Standard) with the width that best suits the job you are doing. Set the pen in the socket in the upper arm of the scriber.
LEROY Pencil - For pencil lettering work, you can use either the LEROY 0.5 mm Pencil or the LEROY Lead Clutch that holds any regular draftsmen's lead. Both work with all LEROY scribers.
3. LEROY Scriber - Set the tail pin of the scriber in the straight guide groove of the template. With the tracer pin of the scriber simply trace the engraved letters in the template. The pen reproduces the letter or symbol in full view, above the template.

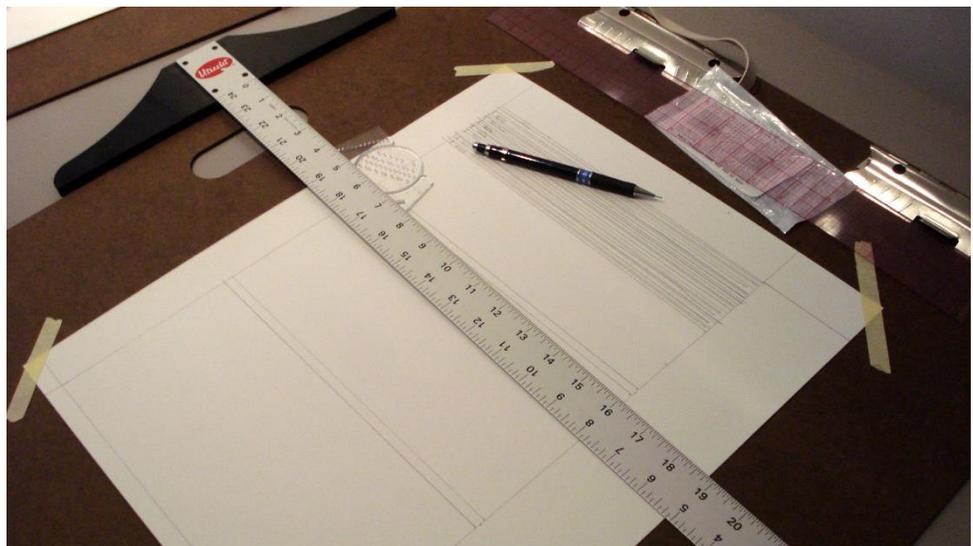
Standard Lettering Set



Electronic Lettering Devices - are available that produce a variety of lettering styles, symbols and designs used in cadastral mapping. These devices provide fast, quality ink lettering directly on the original drawing, as shown below.



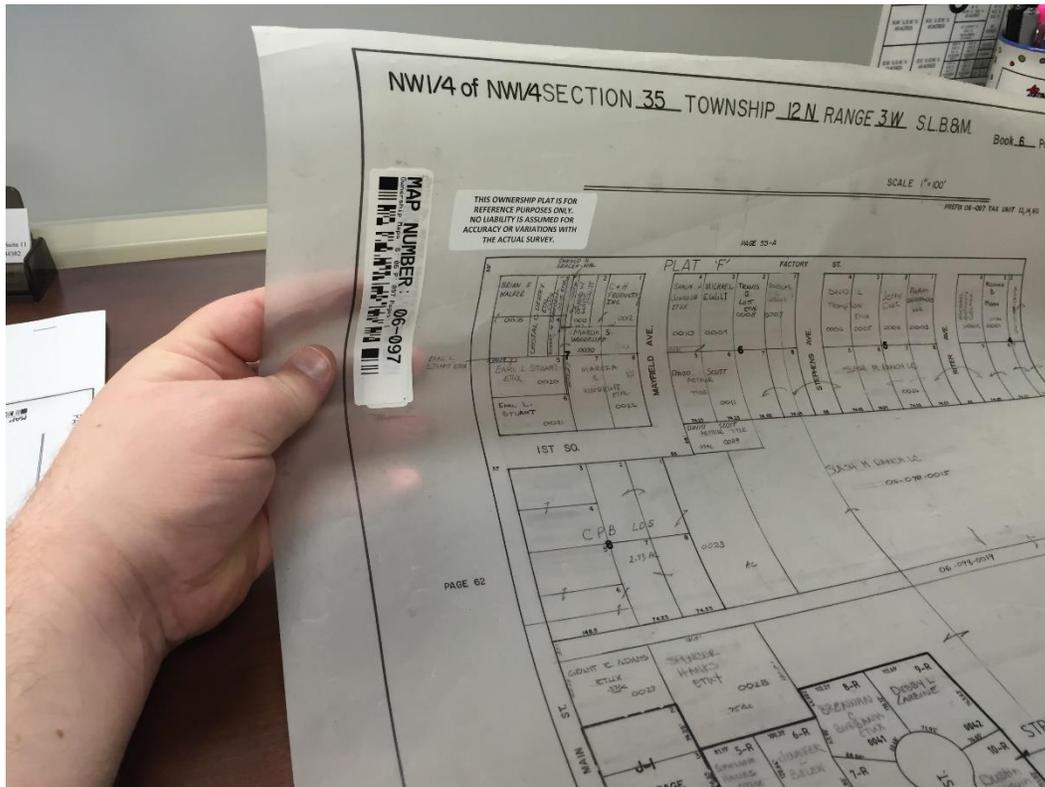
T Square Ruler - a technical drawing instrument used by draftsmen primarily as a guide for drawing horizontal lines on a drafting table. It can be used with a lettering instrument, drafting triangle, or other drafting tools to keep the tools and lines “square” or perpendicular to the sides. Its name comes from its resemblance to the letter T.



Drafting Media - Most non-digital cadastral mapping in the State of Utah is done on a stable base, reproducible polyester film.

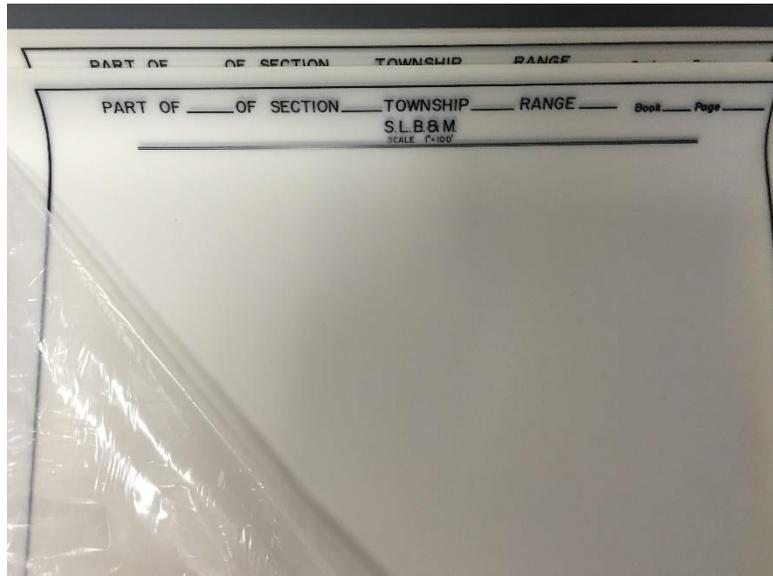
The advantages of film are:

- Copies of maps can be reproduced on standard copying equipment.
- Map information can be changed without physically damaging the master maps.
- Maps will not tear or change in scale.
- Maps can be microfilmed for reproduction, security and storage.



This type of Media is produced by bonding a drawing surface to polyester film, this surface is commonly called a "matte" surface. This matte surface is receptive to pen and pencil work and is able to withstand revisions with little surface degradation if proper film erasers are used. For best results plastic leads, vinyl erasers and specially formulated inks are recommended for drafting film.

This type of drafting film is available with a matte surface on one side or both sides, and comes in thickness from 2mil (.002) to 7 mil (.007). It is available with a non-reproducible grid if desired.



The most common type of drafting film used for cadastral mapping is a one sided matte surface film, 3 mil thickness, white or blue tint.

In the past the drafting film type of media was extremely popular and a broad range special leads, inks and erasers were available.

As digital CAD and GIS software gains popularity some of these drafting supplies mentioned in this chapter have become difficult to obtain. However most of the drafting supplies can still be purchased from an online store.