

**SELECTED LIST OF TECHNIQUES AND MEDIA USED TO
REPRODUCE ARCHITECTURAL DRAWINGS
LOIS OLCOTT PRICE**

1. Inked drawings, with and without water color on various drawing papers, early nineteenth through twentieth centuries. Plans, elevations, perspectives, cross-sections. Some with marks of drafting instruments and transfer/copying processes.
2. Inked and graphite drawings on tracing paper, some with wet and dry color media. Mid-nineteenth century through twentieth.
3. Inked and graphite drawings on tracing cloth, some with wet and dry color media. Mid-nineteenth century through twentieth.
4. Inked and graphite drawings on plastic supports with any other media, etc.

5. Variety of photo-reproductive processes including:

Iron based:

- blue prints
- Pellet prints (blue line)
- blue lines (from blueprints or Vandyke negatives)
- Vandykes (brown negatives and brown line positives)
- ferro gallic prints (brown line)

Silver based: (all black and white)

- salted paper and albumen prints
- silver gelatin contact prints
- photostats
- CB prints on tracing cloth
- fixed line silver halide on vellum and/or Mylar
- wash-off silver halide on vellum and/or Mylar
- auto positive

Dye based:

- hectograph (not photo-reproduction, but often confused)
- diazo prints (range of dates from 1930 to present)
- sepia diazo prints
- aniline prints (blue-black or purple line on greenish ground)

Carbon based:

- direct carbon processes (Artique, chromate, permanent carbon black)
- powdered carbon processes (Anthrakotype, powder process, tacky gelatin, Negrographic)
- gel-lithos (black line)
- lithographs and photo-lithography
- electro static print on vellum and/or Mylar

Most of the common preservation problems represented in a selection like this, but if you have any odd balls for preservation, support or media, we can look at them.

THE FABRICATION OF ARCHITECTURAL DRAWINGS

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I. Drawing Paper

A. Support

1. Drawing Paper
 - a. Writing papers used for drawing in 18th and early 19th century, particularly by carpenter builders.
 - b. Whatman drawing/watercolor papers predominated among professional architects from 1800 to 1870's for all finish drawings. Whatman and other drawing papers were handmade with a cold press surface and substantial gelatin sizing designed for watercolor work. These papers continued to be used for the finest presentation and competition drawings through 1940's.
 - c. Machine-made drawing papers available before 1870 were generally lower quality and seldom used for finish drawings. In the 1870's, egg shell textured paper became popular for finish drawings. Machine-made drawing papers increasingly common by 1900 for finish drawings.
2. Cartridge, German and roll papers
 - a. Cartridge, in 18th century, referred to a strong, rough surfaced paper to wrap gun powder. By early 19th century, referred to a lesser quality drawing paper for developmental sketches and working drawings where durability was important. Probably machine made by 1840. Available in white and buff colors.
 - b. German drawing paper was also a lesser quality machine-made drawing paper available by the roll by 1840.
 - c. In 1890's, machine-made roll papers with varying brand names replaced the generic cartridge and German papers as lesser quality drawing papers. Became the general purpose paper for most architects. Available in white, grey and buff colors.
3. Detail and Manila paper
 - a. Lowest quality papers produced specifically for working drawings of construction details that were often full scale. Available by roll as a cheap paper in 1840's, but not referred to a detail paper until 1870's. Could not be dampened and stretched, so wet media seldom used. Detail papers available in white, buff, pink, green, etc., to reduce eye strain.
 - b. Manila paper was light brown and contained jute for durability. Thinner grades used for large drawings while thicker used for patterns and templates.

4. Cross Section and Profile papers
 - a. Cross section papers composed of a grid of printed squares and used by architects and engineers. Profile papers composed of a printed grid of rectangles and used by civil engineers and landscape architects.
 - b. Thomas Jefferson first to use cross section papers – imported from France where it was used in drafting tapestries. Not used widely by architects until late 19th century.
- B. Drawing Processes and Media Used on Drawing Paper
1. Drawing laid out to scale using instruments (primarily compasses, T square and set squares), graphite, and occult lines.
 2. Lines inked-in with ruling pen
 - a. Iron gall ink – commonly used by carpenter builders in eighteenth and early nineteenth centuries, although English architects were using India ink by this time. Notations continued to be made in iron gall ink well after lines were routinely done in India ink.
 - b. India Ink – imported from China in sticks that were ground on a slate and mixed with water. Europeans made imitations marked with Chinese characters but generally poorer quality. Ink composed of lamp black mixed with glue.
 - c. Bottled Ink – became available after 1840, but waterproof inks now called India ink did not appear until 1880. These were composed of lamp black, shellac and borax or ammonia. Additives of pigments and dyes, ox-gall, sugar, etc. sometimes introduced.
 - d. Colored Inks – Ink sticks that could be ground were available in the early 19th century. Bottled colored inks incorporating dyes were available by 1880 and frequently used for detail and working drawings.
 - e. Japan Ink – black, glossy ink popular for poche'. Composed of fully oxidized iron gall ink in heavily gummed suspension. Available by late 1850's.
 3. Ink washes were applied to create shades and shadows – through 1860, ink washes applied to establish overall tone and composition of rendering, then, as an added option, local color was applied with watercolor. After 1860, color was applied more directly, but monochrome tradition, as a rendering option, continued into 20th century. Ink washes often toned with watercolor pigments to warm or cool tone.
 - a. Shadows cast assuming that light enters at 45° angle from upper left. Toned with dilute ink.
 - b. Ink tints could be applied to provide overall contrast or tone to design elements

- c. Shades were applied in various ink dilutions to produce graduated effects of light and indicate rounded elements like columns.
4. Watercolor - applied as flat tints and graduated washes over ink washes. After 1860, color was applied more directly and in a more painterly style for presentation drawings. In working and detail drawings, the color was applied in flat washes in tones that represented specific materials such as brick, wood, stone, etc. Beaux Arts education (1890-1930) emphasized sophisticated ink and watercolor rendering.
5. Pen and Ink – rendering style popular in the 1880's, that relied on steel nib pens used freehand over drawings laid out in pencil. Used primarily for presentation drawings and those created for publication since half tone reproduction was not readily available.
6. Dry Media – after 1900, increasing numbers of working, detail and finish drawings executed in pencil, charcoal, colored pencil, crayon, pastel and other dry media. Watercolor washes often applied over pencil drawing. Much faster than ink and watercolor, and diazo prints (introduced 1927) could reproduce pencil lines easily. Dry media favored by International style. Friable media routinely fixed. Tracing papers designed for drawing were popular support for dry media.
7. Felt tip pens – Introduced in late 1940's and quickly adopted by architects. Filled with solvent or water based inks with a dye colorant.

II. Tracing Papers, Cloths and Synthetic Supports

- A. Tracing paper - used primarily for tracing until 1860 when it began to be used for design sketches. By the 1880's, it was also used for finish, working and detail drawings, a practice that has continued to the present. After 1880, became very important as translucent support for producing photo-reproductions.
 1. Prepared tracing paper – created by impregnation with oil or resin, known as oiled paper, vegetable parchment, or vellum. Vellum currently made with a more stable acrylic impregnate. In 18th century, prepared by architects or stationary suppliers. Specialized manufacture began in early 19th century. Synthetic resins (acrylic) replaced oil in 1960's. To improve photocopy properties, some manufacturers have returned to oil.
 2. Natural tracing paper – created by heavy beating of pulp and calendaring of finished sheet. Specialized manufacture began in 1870's, but in early 19th century, banknote and transfer printing papers were used.

3. Parchment paper – created by immersion of paper sheet in acid followed by neutralization. Use for architectural drawings began late 1870's.
- B. Tracing cloth – used from 1850, common after 1870 and use continued until 1980's when it was replaced by Mylar. Also known as linens. Made from plain weave cotton heavily sized with starch and then calendared. Waterproof cloths were coated with pyroxalin (cellulose nitrate). Although cloths for drawing were made, primary use was for inked tracings used for photo-reproductions. Blue dye added to increase printing quality.
- C. Synthetic supports – Cellulose acetate films introduced in the 1940's. Coated polyester films (Mylar) introduced in 1950's. Coatings adapted for pen or pencil.
- D. Media – materials and techniques used on translucent supports similar to those used on paper with the following variations:
 1. Watercolor often applied on the back resulting in soft shading and minimal disruption of ruled ink lines when viewed from front.
 2. When watercolor or colored inks were used to color area, organic colors and ink dyes were frequent choices since they were more transparent to light during photo-reproduction printing.
 3. Dry media, particularly graphite, was often fixed with light spray of water, which activated starch size.
 4. Special quick drying solvent based inks developed for use on Mylar.
 5. Stick-ons or sticky backs applied to drawings and prints. Usually contain standard information like title blocks electro statically printed on polyester.

III. Hand Made Copies

- A. Pricking – Original drawing laid on top of another sheet of paper, and key lines marked by pricking through the original with a needle. T Square used to connect prick marks on new sheet. Technique common in 18th and first half of 19th century.
- B. Transfer
 1. Use of carbon or graphite paper placed below original and then original traced with agate stylus.
 2. Original drawing in graphite placed face down and rubbed to transfer media to new sheet. To avoid image reversal, original on translucent support was

traced on back of same sheet, turned face up and rubbed to transfer traced image.

C. Tracing

1. Original drawing traced onto tracing cloth or tracing paper support, often directly in ink.
2. Pantograph used to trace original and, optionally, produce a reduced or enlarged copy.

IV. **Computer Generated Graphics**

A. CADD systems developed in 1960's, but not common until 1990's.

B. Supports – vellum, polyester, paper of varying quality

C. Media

1. Early pen plotters were slow and inks often unstable – light and water sensitive
2. Electrostatic plotters used through early 1990's – very stable as long as not stored in contact with polyester or PVC plastic
3. Ink jet – mid 1990's to present – increasingly stable inks available. See www.wilhelm.com for current information

HISTORIC ARCHITECTURAL REPRODUCTION PROCESSES

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- I. Before photo-reproductions, drawings copied by tracing, pricking, pantograph, ticking strips, etc. The only multiple copy options were:
 - A. Hectographs could reproduce multiple copies of drawings in an aniline ink providing an aniline ink was used for the original. In use from 1880 to 1920, ink could be any color, but most commonly was purple or bright blue.
 - B. Albumen or salted paper prints made as contact prints from original or from a glass plate negative which usually reduced the size from the original.
- II. Processes with a final image composed of an iron, silver, aniline or diazo compound. These were produced on any support directly from and the same size as the original.
 - A. Blueprints, formed by iron compounds, produced from 1880 through the 1950's. Characterized by white lines on a blue ground. Using a negative intermediate (usually a Vandyke), the process could also yield blue lines on a white ground. Blue lines tend to be slightly diffuse and embedded in paper fibers.
 - B. Pellet print, formed by iron compounds similar to blueprint, produced from early 1880's to 1920's. Created a direct positive image characterized by a dense blue line on top of the support fibers.
 - C. Vandykes, composed of a silver image, produced from the 1890's into the 1950's. Characterized by white lines on a dark brown ground. Because the Vandyke was often used as a negative intermediate to create a positive blueprint, the support is often thin and translucent. Printing from a Vandyke negative, the process could also yield a brown line on a white ground which was sometimes rendered over with watercolor or other media. Brown lines have a slightly bronzed, metallic appearance in raking light.
 - D. Ferrogallic prints, formed by iron compounds, were introduced in the 1880's and used until well past 1930. Created a direct positive image characterized by light brown to black lines on a light brown or white ground which was sometimes rendered over in watercolor or other media.
 - E. Aniline prints, formed by the reaction of aniline fumes with light sensitive dichromate salts, were used from the 1880's through the 1920's, primarily by

engineers and contractors. Created a direct positive image characterized by a blue, blue black or purple image on on paper with a yellow green tone. Commonly called green prints.

- F. Diazo prints, formed by azo dyes, were introduced in the late 1920's and are the most common prints today. Characterized by lines that may be purple, brown, blue or black on a "dirty" white ground. Printed on paper or vellum of varying quality. Back usually lighter than discolored front.
- G. Sepias on mylar or vellum used as reproducibles. Dye in sepia prints tends to bleed pink into adjacent sheets. In 1960's and 1970's architects often used sepias rendered with felt tip pens as presentation drawings
- H. Photostats, formed by a silver halide process, were introduced in 1909 for the reproduction of manuscripts and small drawings. After 1920, larger prints could be produced. Characterized by white lines on a dark gray metallic ground, or, after 1953 when a positive process was introduced, by dark gray lines on a white ground. Used into 1990's and often combined with other media such as felt tip pens. Mirroring is common. Note that photostat of a blueprint will produce a positive image.
- I. C.B. prints are a silver halide process introduced in the 1920's specifically for the purpose of reproducing ink drawings on tracing cloth. Characterized by dense black line resembling ink but lacking character of a ruled line. Any part of the image could be erased during processing. Functioned as first "reproducible."
- J. Silver Gelatin Contact prints are a silver halide process introduced in the 1890's and used primarily for copying opaque original drawings. Variations of the process were available through the 1940's. Prints were made on opaque or translucent supports sensitized to produce either high contrast or half-tone images. Translucent prints functioned as reproducibles. Image is characterized by cool blue black to warm greenish black tone and may exhibit mirroring.
- K. Autopositives, a silver halide process, were introduced in 1947. By using a pre-exposed paper support re-exposed under a tracing using a special light, a direct positive was produced. Autopositives are characterized by grey-black line on an often dirty ground.
- L. Silver halide prints on vellum, acetate or mylar, developed in the 1950's, may be a fixed line or wash-off process. The "wash-off" process allows easy erasure and alteration of the image after processing. Fixed line prints used

in 1980's and 1990's on polyester (Cronar, silver slicks) Prints are characterized by black lines on a white or clear ground. Mylars function as reproducibles.

- M. Camera-copying is not a process but a service provided by commercial photo-labs and blueprinters. It depends on a variety of camera and contact printing processes utilizing silver halides in a gelatin emulsion on any support. Processes are typically too complex or light sensitive for use in average drafting room.
- III. Processes with a final image formed by ink or carbon particles. These are produced on any support directly from, and the same size as, the original.
- A. Lithography was used from the decade before the Civil War throughout the nineteenth century and early twentieth century. Photolithography became common in the 1870's and is usually indistinguishable from lithography.
 - B. Direct carbon process, used in England from mid-1880's to 1910's, results in a final image composed of pigment particles, usually lamp black, embedded in a layer of gelatin. Prepared papers may have been exported. Replaced by true-to-scale process. Similar to halftone carbon process, but no transfer of image to secondary support during processing. Characterized by a dense black line without the character of a ruled ink line.
 - C. Powdered Carbon process, used in England and possibly U.S. from mid-1880's to 1910's, results in a final image composed of pigment particles, usually lamp black, on top of a thin gelatin layer. Replaced by true-to-scale process. Characterized by dense black line without the character of a ruled ink line.
 - D. True-to-scale prints, also known as lithoprints and gel lithos, were introduced in 1904 and disappeared from use in the 1950's. Image is composed of lithographic-like ink line.
 - E. Electrostatic prints were introduced in 1948 and have become one of the most commonly used copying processes today. Large format copiers were introduced in the 1970's. Image composed of fine carbon particles thermally fused to vellum, paper or mylar support.

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