FABRICATION OF ARCHITECTURAL DRAWINGS

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Why, one might ask, does fabrication matter? Why is it important to identify the paper, media and technique the architect used? What can it tell us? Isn't the image enough??

Clearly, if you are a conservator you need to understand these issues to treat the material safely and effectively, but how can this information help an architectural historian, curator or archivist? This fabrication information may tell the architectural historian or curator a great deal about the architect, his or her training and practice and where a particular drawing falls in the context of the design process. In addition, by understanding how fabrication changed over time, a significant amount of information about the development of the profession and the role of drawings can be gleaned. The archivist may also find that a knowledge of fabrication helps make sense of a disordered collection and the work flow it represents. In addition, some materials and processes are unstable or require special storage considerations. Preservation of the collection requires accurate identification of these materials.

So, my goal this morning is to take a systematic look at supports, media and drafting techniques and begin to explore some of the inferences that can be drawn from this.

Early American architectural drawings and their European antecedents were fabricated using traditional drafting materials – ink, graphite and watercolor on a gelatin sized writing paper. Between 1800 and the mid-twentieth century, revolutionary changes in materials and copying techniques took place. In an effort to understand and document these changes, a thorough survey of trade catalogs, architectural and drafting manuals and representative drawings and prints was undertaken. The study revealed the development of businesses dedicated to developing specialized papers and tools for drafters in many different industries. It also shed light on why architects and engineers chose various papers and media for specific drafting needs and how these choices changed over time. As the study progressed, it also became clear that some of these changes, particularly in copying processes, had a profound effect on the architectural profession. This paper summarizes the results of the study and suggests some implications regarding the historical interpretation and preservation of architectural drawings and prints.

When dealing with the fabrication of architectural records, they can be divided into two major categories: original drawings or tracings and copies made using photo-reproductive techniques.

ORIGINAL DRAWINGS AND HAND MADE COPIES

Support

Architectural drawings have traditionally been executed on good quality drawing paper. Beautifully formed, cream colored, hand-made rag wove papers sized with gelatin and made by the Whatman paper mills in England were the first choice of American architects from the early nineteenth century until well after the Civil War. Similar papers from a few other English and American mills are also occasionally found. Many architects who continued to do traditional finished drawings in watercolor used Whatman or Whatman type papers for this purpose until well after 1930. Poorer quality machine-made papers that could be used for architectural drawings became available shortly after 1800, but most architects eschewed their use for finished drawings, preferring the superior strength, durability and working qualities of hand made papers. In addition, the consistent use of high quality artists' materials marked architects as part of the fine arts community, differentiating them from house carpenters and builders and enhancing their professional status at a time when the profession was still fighting for recognition.

After 1870, machine-made papers were used more frequently as a support for finished drawings. These papers were designed and sold as fine drawing papers, often with a particular surface finish such as eggshell or vellum. Architects, however, still turned to handmade papers for more demanding wash drawings, particularly during the Beaux-Arts period (1890-1930) when architectural schools and competitions emphasized the artistic appearance of architectural drawings.

Machine made paper, often referred to as cartridge or German drawing paper, was available by the roll in the United States by 1840. Cartridge was an inferior grade of drawing paper that was usually cream to buff in tone. It was used by architects for sketches and studies of architectural projects as well as for working drawings to be used on the site. Detail paper, which was readily available by 1870, was usually quite strong, often included hemp or other baste fibers, and was usually light buff to brown in color. Detail paper was used by craftsmen such as carpenters, stone masons, and other sub-contractors for their design work, which was often full scale and required the large sheets available from a roll paper. Their drawings were often referred to as shop drawings. Paper for detail and working drawings as well as fine drawing papers could be purchased pre-mounted on muslin to increase their durability and manuals indicate that some office routinely mounted their drawings.

Illustration board, manufactured with a variety of facing papers, became a popular support in the twentieth century although its ancestry extends to the eighteenth century when Bristol board, a laminated paper structure, was introduced.

As concern with the artistic appearance of architectural drawings changed and blueprinting grew in importance, architects turned increasingly to alternate paper supports for all their drawings. The most popular was tracing paper.

Tracing paper has been used for centuries. Traditionally, it has been a thin paper, although any paper could be used, impregnated with an oil or resin to render it translucent. It was available from stationers and artist's suppliers by the early decades of the nineteenth century when French tracing paper, according to the trade catalogs, was considered superior. Many manuals contained instructions on how to make your own. Architects also appear to have used thin, smooth surfaced, heavily pressed papers, such as banknote papers, for tracing and drawing purposes. Tracing papers allowed drawings on other supports to be copied, and was also invaluable during the design process since it could be used to redraw and overlay different design options.

After 1860, as architecture became a business as well as a fine art, increasing numbers of architects expediently chose to execute sketches and even finished drawings on tracing paper using pencils and ink with very little wash. Beginning in the 1880's with the advent of blueprinting, the use of tracing paper and tracing cloth for working drawings became quite common since this paper furnished a translucent support that produced excellent prints. Reflecting the use of tracing papers as an original drawing support as well as a tracing and reprographic medium, papers designed specifically for drawing in various media became available in the early twentieth century. Papermakers adjusted the surface quality using surface sizes and and textures imparted during the drying process. The use of tracing paper for almost all drawing functions has continued to the present day.

Tracing papers used by architects can be produced by three different processes: impregnation (oiled, vellum, vegetable tracing or prepared tracing papers), beating (natural tracing papers), and acid gelatinization (vegetable parchment papers or pergamet). The cellulose that forms paper is a transparent material. The opaque appearance of paper is created by the refraction of light from the cellulose fibers and the voids between them. The role of any transparentizing process is therefore to fill the voids and compact the fibers to reduce light refraction allowing more light to pass through the sheet.

The oldest process is impregnation, which fills the voids between the paper fibers with an oil or resin that has optical properties similar to cellulose. The materials most frequently chosen for this purpose were the natural resins such as Canada balsam or oil of turpentine; the drying vegetable oils such as boiled linseed, poppy or walnut; the mineral oils; or, since 1950, synthetic resins. As the market for tracing papers increased during the nineteenth century, manufacturers sought to find impregnants that did not darken and embrittle the paper or transfer to adjacent sheets, but they were unsuccessful until the introduction of acrylic resins after 1950 in papers commonly known as vellums.

Overbeating or hydrating the cellulose fibers in the beater before the sheet is formed produces natural tracing papers. These heavily beaten fibers collapse and fill the voids that would exist in an average sheet of paper, making the sheet translucent. They may also be calendared to further compact the sheet and sized to impart the desired degree of absorbency. The earliest American reference to an unprepared tracing paper for drafting is in a trade catalog of 1879.

In general, oiled papers are more transparent than natural papers and the fibers are much less apparent in transmitted light. In addition, any damaged to oiled papers, such as creases, break the oil film within the sheet and create an opaque area that may appear white if the sheet is discolored.

Subjecting the formed sheet to brief immersion in sulfuric acid followed by a neutralizing bath produces parchment paper. The acid gelatinizes the surface layer of cellulose, which then fills the voids between the remaining fibers rendering the sheet translucent. The resulting sheet is quite strong and resembles parchment in appearance. The earliest American reference to parchment paper as a drawing support is in an 1879 trade catalog, although the technique had been used since 1860 to produce papers for packaging foods.

The use of **tracing cloth**, also known as linens, began in the 1850's, but did not become widespread until the 1870's. Tracing cloth is strong, durable and translucent, which made it an ideal support for working drawings. Using tracing cloth, final inked working drawings suitable for blueprinting were traced from the originals. Because of these properties, tracing cloth became the support of choice on which many firms and institutions maintained their permanent or record set of drawings. The medium of choice was usually ink, although tracing cloths designed for pencil were introduced in the early decades of the twentieth century. While early tracing cloth was made from linen, manufacturers soon changed to long fiber Egyptian cotton. The plain woven cloth was coated with a heavy layer of starch to which various resins, such as nitrocellulose (pyroxylin) might also be added, and then heavily calendared to compact the fabric and impart a smooth, glossy surface. A blue dye or pigment was often added to improve the clarity of photo reproductions made from the cloth. Because of its expense, the use of tracing cloth began to decline in the 1930's and it had disappeared by 1970, replaced by polyester film.

Translucent **synthetic supports** were introduced in the 1940's as architects experimented with coated acetate and cellulose nitrate films. The use of synthetic films did not become widespread until the 1950's with the introduction of coated polyester drafting films commonly known as Mylars. Polyester films are coated with a matte lacquer, which may contain a filler, and a gel "sub" designed to provide the tooth necessary for drawing with a hard pencil. Special pens and inks were developed for use on Mylar.

<u>Media</u>

The traditional finished architectural drawing of the nineteenth century, executed in ink and watercolor, incorporates many of the media and processes involved in making any drawing, although drafters developed many variations peculiar to their craft. Drafters drew from the fine arts, particularly the developing watercolor style, and adapted materials and techniques to their needs while maintaining a drafting style that would appear "up-to-date." The same is true of the working, detail and dry media drawings that dominated most practices by the twentieth century.

Traditional architectural drawings, other than conceptual sketches, begin with the laborious process of laying them out to scale using drawing instruments and pencils. Applying the rules of geometry and perspective, each building must be carefully described, as appropriate, in plan, elevation, cross-section and perspective. Drawing instruments leave behind important evidence of how the drawing was made in the form of pricks left by compasses, dividers and protracting needles and of occult lines incised as guides or as part of a transfer process. Although most architects erased all or part of their pencil guide lines after a drawing was inked, faint evidence of these lines often remains. Aside form the increased complexity of modern buildings, the process of laying out a drawing changed little from the eighteenth century to the introduction of computer assisted drafting.
Full layouts for drawings that would be rendered in wash or water color also included **Shadows.** The drafter followed precise rules in casting shadows to scale showing the exact projection of each molding, column or entablature.

Once a drawing was laid-out, it was inked in using a ruling pen and a black or dilute black ink. From the eighteenth century through the twentieth century, this black ink was known as India, China or Japan ink. It came in a solid stick that was wet ground on a slate slab and diluted with water to produce black ink of the desired consistency. The ink stick was composed of lampblack, a very fine carbon pigment, with a gelatin binder. Architects frequently combined this ink with other materials such as iron gall ink, indigo or Prussian blue, bone black or sugar to increase its density, blackness or gloss particularly when executing the poche' of a plan. Prepared bottled inks were available by 1840, and probably earlier. These proprietary formulas commonly included a carbon black pigment, a binder such as gum arabic, ox gall or a similar material to improve the flow and, variably, an iron gall component for permanence. About 1880, a waterproof formulation incorporating shellac was introduced to produce what is now called India ink. The ink stick was still recommended for finished drawings, but bottled ink was commonly used for working drawings and tracings.

After the lines were inked, an architect had the option of applying washes of dilute ink or watercolor. These washes were used to indicate shadows and projections on elevations and sections, suggest materials and generally make the drawing more attractive to a client. On plans, the thickness of walls was described, in scale, by poche', the practice of filling in the walls with dense black ink or watercolor. Architects generally applied the same principles and materials as watercolorists to their wash drawings. They dampened and stretched a good quality drawing paper so it would dry taut and take watercolor washes without cockling. They generally chose a fairly limited palette from a wide variety of available watercolor pigments and learned to mix and apply graduated washes. While early nineteenth century drawings are unadorned or barely suggest the environment around the building, later drawings often include elaborate land or cityscapes.

Drawings with relatively simple watercolor work were standard practice until after the Civil War when **pen and ink drawings** became prevalent. Drafters would establish the outlines of the building in pencil using standard drafting techniques and then render freehand within that framework on either the original sheet or a tracing paper overlay. Using existing photo mechanical printing processes, these black and white linear designs allowed easy publication in emerging professional journals such as *The American Architect and Builders News* and the *Inland Architect*.

The ascendancy of the beaux arts tradition in the education of architects late in the century lead to the use of sophisticated water color work in student and competition drawings. In the later nineteenth century architects moved toward more **direct watercolor** renderings without underlying ink washes resulting in a more painterly appearance that better suited the prevailing aesthetic. Renderings continued to use **ink washes**, but often in new and different ways. One favorite technique involved rendering the building in ink or monochrome watercolor, then developing the surroundings in full color resulting in a dramatic silhouette effect. Drafters employed the airbrush, introduced about 1900, for this effect and other applications requiring and even tonal gradation.

Most architects, in their daily practice, continued to use pencil, pen and ink and the occasional simple wash in their daily work. The use of watercolor waned by World War II with the dominance of the International Style and the increasing pace of architectural practice.

Architects working in the International Style and even those who continued to design in traditional styles turned to the use of dry media for both finished and working drawings and tracing paper became the support of choice. Pencil, carbon pencil, lithographic pencil, and charcoal, were used together and separately. Colored pencil, crayons and pastels provided color. They were sometimes applied to the back of a tracing paper drawing so they would show through on the front in a soft tint that did not obscure the lines. These drawings were frequently fixed with a resin or shellac sprayed on with an atomizer or an airbrush. When inks were used, they were frequently applied freehand as well as ruled. When felt tip markers and their descendants became available in the 1940's, architects adopted them almost immediately.

Working and detail drawings were generally executed in ink on tracing cloth or paper so they could be reproduced by blueprinting or another available method. Colored washes were sometimes added, on either the front or back, to indicate material or clarify reading the drawing. While many architects continued to use traditional watercolor pigments for these simple washes, others, after approximately 1880, turned to colored inks made from coal-tar dyes such as the aniline colors. These convenient, bottled, waterproof inks, were formulated for ruled lines or washes. One company even made a NO-RINKLE ink especially for use on tracing cloth. Architects also turned to colored pencils, crayons, and markers for use on working and detail drawings.

After 1930, many firms turned increasingly to pencil for their more ephemeral work because the new diazo process, unlike previous processes, could reproduce the average pencil line clearly. By the 1960's, the average working drawing was executed in pencil on Mylar or heavy tracing paper, often known as vellum, and reproduced by the diazo process to provide working copies.

PHOTO-REPRODUCTIONS

One of the great limiting factors in architecture and in the production of architectural drawings has been the need to produce accurate copies in a cheap and timely way. Traditionally, copies were produced by hand, one at a time, using one of several methods. To transfer an image to drawing paper, drafters commonly pricked through the original image to a second sheet with a needle and then connected the prick marks. Alternately, they traced the original onto a new support using and a carbon or graphite transfer paper or a pantograph, which could also enlarge and reduce. As translucent supports became more available, tracing onto paper or cloth became the technique of choice. All these methods were time consuming, labor intensive and expensive.

Hectographs, introduced in the 1870's, provided one other option although the application was limited. The original drawing was executed with a pencil or ink that contained water-soluble aniline dyes, usually purple or bright blue. The completed drawing was pressed against a damp gelatin pad known as a graph, which adsorbed the aniline dyes. After the original was removed, pressing additional sheets of blank paper against the image on the graph until the ink was exhausted could produce up to 50 prints. The process was most commonly used for copying correspondence or specifications, but by 1900, drafting supply companies were marketing colored inks and pencils to produce drawings appropriate for copying by hectograph.

The only other alternative was the use of photography. The original drawing was photographed and printed from the glass plate negative as a salted paper or albumen print. The size, however, was limited by the size of the glass plate negative, never larger than 20 x 24 and usually smaller. Alternatively, the original could be contact printed to produce a full size paper negative, which could then be used to produce a positive. These methods were time consuming and expensive; they were used sparingly by only a few architects.

The introduction of the blueprinting process in the late 1870's, however, changed everything. It was quickly followed by a myriad of other processes, only a half dozen of which received widespread commercial application. They all depended on the light sensitivity of certain iron, silver, chromate or diazo salts. When these salts are exposed to light, the iron, silver, chromate or diazo part of the compound changes chemically in a manner that allows it to react with other substances, either directly or indirectly, to form a visible image. The image may be positive or negative depending on the process and whether the original translucent drawing or print used to make the copy is a positive or negative image.

For purposes of identification, the photo-reproductive processes can be divided into four major categories based on the nature of the final image - an iron, silver, diazo or carbon compound. These images may be blue, brown, black, brown-black, sepia, purple, or magenta. In the first three categories, the image is either embedded in the paper fibers or in an emulsion layer of gelatin or resin on the surface of the paper or synthetic support. In carbon based processes the image sits on top of the paper fibers.

Supports

In the early years of photo-reproductive printing, architects sensitized their own supports, using whatever good quality papers were available. By the end of the 1880's, special papers and tracing cloths for printing were being produced and marketed. They were available plain or pre-sensitized, though by 1900, most architects used pre-sensitized paper or sent their drawings to a blueprint firm to be copied. These papers and tracing cloths were similar to those used for original drawings, but were generally made to stricter standards of purity to avoid any iron, bleach or other chemical residues that might interfere with the photographic process. As technology developed, manufacturers found new manufacturing processes that allowed them to use poorer quality, less expensive paper supports, including wood pulp papers. When synthetic supports were introduced, they also were coated with light sensitive compounds and used for photo-reproductions.

Iron Based Processes

The best known and by far the most common process used for photo-reproduction was the blueprint. Information about the process was first published in the United States in 1871, and its use for the reproduction of architectural drawings was described in 1878. It was fast, easy, inexpensive and produced a print the same size as the original directly from the original. Architects adopted the process quickly and used it until the diazo process displaced it in the 1950's.

The **blueprint** process is similar to that used for all other prints in this category. Only the type and number of development baths vary. To produce a blueprint, the sensitized paper, with the translucent original on top of it, was placed in a glass front printing frame. The frame was then placed in the sun, often by sliding it out a window on a specially constructed frame. Depending on the sensitivity of the paper and the amount of sunlight, exposure took from seconds up to a few minutes. After the printing paper was adequately exposed, which was determined by observing the darkening of the margins, it was removed from the frame and thoroughly washed in a water bath. This removed the unexposed iron salts that had been under the lines of the original, leaving an image of white lines on a blue ground. The paper was then hung to dry.

By 1900, machines that could make blueprints as well as other types of prints using an arc lamp, rather than the sun, had been introduced. These machines developed rapidly and by 1920, machines that could expose, wash, and dry blueprints in one continuous operation were in common use by commercial blueprinters. They continued to get bigger and faster as the century progressed. These machines were faster, but they abbreviated the washing process and dried the wet prints using heated rollers, practices that may have affected the durability of the prints.

Formed by light sensitive iron salts, the blueprint process is characterized by white lines on a distinctive blue background that can range from deep to moderate in intensity. Prints characterized by a blue line on a white ground can also be produced with this process if a negative image, such as a Vandyke print is used to make the print. The **Pellet process**, which produces a blue line on a white ground from a positive original is very similar in chemistry and appearance to the blueprint. Pellet prints are much rarer because they were more expensive and difficult to produce.

The **Vandyke** process, introduced shortly after 1890, was commonly used to produce an intermediate negative print. A deposit of photolytic silver formed the image, which consisted of white lines on a dark brown background. The silver was liberated by light sensitive iron salts in the sensitizing layer that were washed away during development. This negative image, which was opaque to actinic light, was put back in the printing frame and used to produce a positive image on blueprint paper (blue lines on a white ground) or, less frequently, on Vandyke paper (brown lines on a white ground). The lines in these images often have a slightly metallic bronze appearance.

The **ferro gallic** is the least known and recognized of these commonly used processes. It was introduced in the 1880's, but gained popularity more slowly than blueprints because of its greater cost and complexity. Its great advantage was its image, a positive print of light brown to brown-black lines on a white or nearly white ground, which was printed directly from the original. Light sensitive iron salts developed in a bath with tannic or gallic acid produced an image that chemically and visually resembles iron gall ink. These prints and positive brown line prints produced by the Vandyke process were often used as outlines or guides for further development in ink, watercolor or dry media. Some architects used them as studies for alternate designs and even for final presentation drawings.

Silver Based Processes

Photostats, introduced in 1909, reproduced manuscripts and small drawings as a negative image of white lines on a black or gray background. The negative image could be rephotographed to produce a positive. After 1920, the process was adapted to make larger prints, and in 1953, Kodak introduced a Photostat process that produced a direct positive image. Because the Photostat is not a contact printing process, the final image is usually a different size, often smaller, than the original. The sensitized Photostat paper was used in a special camera, where it functioned and was developed like a piece of standard photographic film. The process produces a silver image in a gelatin emulsion that exhibits the same characteristics as other silver halide photographic prints, including mirroring in the dark areas. Because of the manner in which Photostat cameras were used, prints were frequently poorly processed and washed.

C. B. prints were introduced in the early 1920's and used through the 1950's. Both tracing cloth and tracing paper were used as supports. The sensitized support was exposed under a Vandyke negative, and produced a black silver halide image that could be erased to make changes. The ground was cleared of any emulsion during processing. These prints were frequently used as reproducibles, prints that serve as surrogates for the original drawing in the production of additional prints by other processes. During the 1950’s, Mylar became a popular support and these prints evolved to become the wash-off and fixed-line silver halide prints common today. Wash-off prints are easily erased to facilitate changes while fixed-line prints are hardened to prevent erasures. Both allow additional drafting on the support. Because of their complexity, professional blueprinters usually make these prints.

Contact silver prints were produced by various processes throughout the period by either direct or reflected light exposure. Some processes were simple, utilizing sensitized paper that could be handled in dim light while others required a full service photographic lab. They all exhibit a black image that often has a metallic sheen.

Dye Based Processes

William Willis first patented the **aniline process** in England in 1864. There is limited documentary evidence about this process, but it appears to have been used from the 1880's through the 1920's by engineers and sub-contractors. The process produces a positive print from the original with a blue-black or purple image on a characteristic yellow to yellow-green ground. The paper was sensitized with chromate salts to which a vanadium compound was sometimes added, and exposed under the original. The exposed sheet was developed by exposure to aniline fumes in a closed box followed by a slightly acidic water bath. These prints are often brittle and light sensitive.

The **diazo** process, also referred to as the dyeline process, was introduced in the closing years of the nineteenth century, but the process was not successfully developed or marketed in the United States until the late 1920's. The diazo process produces a positive print directly from the original, but unlike the processes discussed previously, it does not have a single characteristic color. It relies on two classes of compounds, the diazos and the phenols, to produce an image in the form of an azo dye. The choice of two specific compounds within these families determines the final color of the print. Early diazo prints have a red purple image on a "dirty" white background. Later prints, including those produced today, are generally magenta, blue, black or brown, but other colors are possible. While the backgrounds of most current diazo prints are clearer than the early prints, they are not a clean white, which provides the primary clue for identifying them.

Aside from the fact that diazo prints produce a positive image directly from the original quickly, easily and inexpensively, they have one other major advantage. They do not require baths or wet processing; they are developed by fuming them with ammonia, or, less commonly, by rolling the surface of the exposed print with a developing agent in a semi-wet process. Not only does dry processing simplify production of the print, it means that the paper does not expand and contract and the scale remains true. Since diazo prints are not washed, however, all the processing chemicals remain on the surface of the print where they oxidize and discolor. Anti-oxidants are added to reduce discoloration, but these frequently react with any adjacent silver-based images. Most diazo prints are also light sensitive.

Brown diazo prints**,** commonly known as sepias, are usually made on a clear or translucent support and used as reproducibles, prints that serve as surrogates for the original drawing in the production of additional prints. The brown image blocks light better than other diazo dyes so these images produce the best prints. To enhance this function, the papers often were oiled to increase translucency. This oil causes stains on adjacent sheets as does the imaging dye which migrates as a pink stain.

Carbon Based Processes

Carbon prints are more common in British collections. There were several production methods, but all resulted in an image of carbon particles embedded in a gelatin layer

Lithography and **photolithography** were used to reproduce architectural drawings from the 1860's well into the twentieth century. The practice became common in the late nineteenth century when large projects involving publicity, complex financial arrangements and multiple real estate agents increased the demand for drawings to publicize and market the project. Images were drawn then transferred photographically to the printing surface where they were developed and printed as lithographs.

True-to-scale prints, also known as lithoprints, were introduced in 1904 and widely used after 1910. Their use continued, with decreasing popularity, until the 1950's. The process produced a positive image in ink that was true to scale. Sensitized blueprint paper was exposed under the original drawing. The exposed but undeveloped blueprint was then laid on a damp gelatin pad known as a graph. The unexposed iron salts in the lines of the blueprint reacted with the gelatin, hardening it, and making it receptive to lithographic ink. The pad could be re-inked and would yielded up to 25 prints. Both well-sized paper and tracing cloth were used as supports. Rendered images on paper can easily be mistaken for drawings.

Electrostatic prints, also commonly known as Xeroxes, were introduced in 1948, and have become one of the most common processes used today. They can be found on almost any kind of support. The image consists of finely divided carbon particles fused to the support with a heat-activated resin. Large format copiers used for architectural drawings were introduced in the 1970's. Copies on a paper support are as stable as the paper, but media on a Mylar support is less firmly bonded and can be pulled off by adjacent sheets of Mylar.

CONCLUSION

As the above summary of information makes abundantly clear, architectural records are complex materials that used a bewildering variety of materials. We are only beginning to understand and appreciate this complexity which effects not only the accurate description of the records, but also their preservation and our understanding of the architectural profession.

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