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Preserving Architectural Heritage: The Transition of Diazo Prints to Digital Archives

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Preserving Architectural Heritage: The Transition of Diazo Prints to Digital Archives

Abstract
Architectural drawings are seldom held onto for more than fifty years and even fewer are digitized for use in architectural classes. A set of architectural drawings from 1970 that were kept in a series of offices over a fifty-year period required extensive paper conservation before they could be digitized. A team that consisted of individuals from three different departments on campus worked together to overcome the unique challenges presented by these drawings. This set of drawings was humidified, flattened, and repaired using paper conservation methods that could be reversed at any time in the future. They were then digitized using a unique set up that was designed for oversized materials without the need to "stitch" the drawings together after the fact. Finally, these drawings are now available to be used for any number of architecture classes without the need of using the paper copies.

Keywords
Conservation, digital file, elevations, paper, photography, plans, preservation, repair, sections.

Author Bios

Mark Coulbourne is the Head of Preservation, at the University of Maryland, College Park. Mark has a Masters in Library and Information Science from the University of Maryland, College Park and a Bachelor of Science from Towson University. Mark has authored a number of articles that are centered on practical applications in paper conservation.

Bryan L.W. Draper entered the field of preservation at the University of Delaware Library, 1990. He received bench training at the Etherington Conservation Center in North Carolina. Draper developed his conservation skills by treating rare books, maps, photographs, documents on paper and parchment. Since 2007 Draper has been the conservator for Special Collections at the University of Maryland Libraries' Preservation Department. In an academic library with limited resources, he has focused on practical & efficient approaches to conservation & preservation. His other interests include history of papermaking, toolmaking, & the challenges of removing pressure-sensitive tape.

Alexandra Trim is the Digitization Services Coordinator at the University of Maryland, College Park. Alexandra manages the Hornbake Digitization Center and oversees all in-house projects and digitization requests. Alexandra has a Masters in Library and Information Science and a Bachelors in History from the University of South Carolina. Her interests include conducting outreach for digital collections and researching digital accessibility.

Cindy Frank is the Head of the Art and Architecture branch libraries at the University of Maryland, and a licensed architect. She started her career at Maryland as the assistant curator of slides at the School of Architecture, Planning and Preservation. She advanced to become Co-Director of the Elizabeth D. Alley Visual Resources Collection as part of a unique job-sharing position, and later Director. In 2013, she (and the image collection) joined the University Libraries as architecture subject librarian and image collection director. In 2022, she was named to the position she has now.

Kirsten Elliott is the Preservation Graduate Assistant at the University of Maryland and will graduate from UMD's MLIS program in May 2025. She was introduced to the field of book preservation at the University of Virginia's Preservation Department and found a passion for the work of physical preservation.

Charlotte Conant is an Archives Technician with the National Archives and Records Administration at College Park. She has a Masters in Library and Information Science and a Masters in Medieval History from University of Maryland, College Park. Her History Master's thesis focused on the medieval Scottish ballad of Tam Lin. Charlotte's Bachelor of Fine Arts in Creative Writing is from George Mason University, Fairfax. Prior to working at National Archives, Charlotte worked as a Digitization Technician for University of Maryland's Hornbake Digitization Center.

From hand-drawn designs to photomechanical reproductions, architectural drawings are "information systems, and that information can be–was and still is– often conveyed not by original drawings **but by copies**, laboriously produced before the introduction of the blueprint in 1878 and thereafter by various different photo productive processes…"

–James F. O'Gorman in the Forward of Price's *Line, Shade and Shadow*[1]

Introduction

The Architecture Library at the University of Maryland maintained a set of architectural drawings within its Special Collections room that are from the construction of the Architecture School. Over the years, these drawings have served as a valuable resource for professors, providing information regarding the building's dimensions, the location of heating and cooling equipment, and functioning as a teaching tool for "Structures" classes. Additionally, they have been utilized as a foundational element for redesigning the school in design studio projects. Historically, these drawings have been transferred from professor to professor, with the library serving as their latest repository. However, the condition of the drawings has significantly deteriorated; the paper and lines have discolored, edges are torn, and one sheet is split in half. To ensure continued utilization of these drawings for instructional purposes, intervention is required. Consequently, the Architecture Librarian sought assistance from the Libraries' Preservation Department staff and the Digitization Team. The subsequent strategy for preserving the longevity of these plans is delineated herein.

Importance of the School of Architecture drawings as a Teaching Tool

The University of Maryland Architecture Program was established in 1968, initially conducting classes in four temporary buildings situated approximately where one of the current dormitories is now located. Planning for a permanent school building commenced in 1969 with the appointment of architects Fisher, Nes, and Campbell. They collaborated with the client, comprising members of the Architecture faculty and University Administration, to design the current facility. The final proposal included studio spaces, faculty offices, seminar classrooms, an auditorium, and a gallery. This proposal was encapsulated in a set of thirty-nine sheets of 35 by 44-inch paper, chemically treated for a specific photo-reproductive process. Each sheet conveyed distinct information, including plans for room layouts, sectional views to indicate ceiling heights and roof lines, elevations for window placement, and plumbing and electrical plans. Collectively, these drawings constituted the working drawings or set of instructions for constructing the building.

Construction commenced in 1970 and concluded in 1972. The architect, client, contractor, and subcontractors, such as plumbers, masons, and carpenters, utilized the drawings to comprehend the building's construction process. Onsite changes were documented through annotations on the drawings, forming part of the official construction record. The building was dedicated in 1973, and the drawings were retained as a reference for the building's layout. Notably, during the early 1970s, it was anticipated that few women would study architecture, resulting in men's restrooms being twice the size of women's restrooms.

Over the years, the architecture design faculty and the Structures professor referred to the drawings for design projects, verifying dimensions of structural supports, and demonstrating to students how

[1] Lois Olcott Price, *Line, Shade, and Shadow: The Fabrication and Preservation of Architectural Drawings* (New Castle, DE: Oak Knoll Press, 2010), xii.

drawings convey building instructions. In the architecture studio courses, students would be assigned the challenge of redesigning the Architecture School to, for example, accommodate a growing student population. Students would ask to see the drawings. They needed measurements and they needed to understand where structural elements were located. Viewing the plans, sections, and elevations of an actual building they stand in, helps convey the purpose of learning how to make those types of drawings in the studio class. However, every time a student or professor touched the diazo paper, they were impacting it with oils from their hands, and there was a risk of tears. It takes two hands to turn a sheet of paper this large. The Structures professor wanted students to have access to the drawings to understand brick and concrete construction methods. The constant referral to the drawings by multiple people took its toll; and there was no preservation enclosure or designated storage location for the drawings, so they were not protected in any way. One sheet sustained a tear halfway across the long dimension at some point in its history and had been subsequently mended with pressure-sensitive tape. Initially, the drawings were shared amongst various faculty offices but eventually were stored in the Architecture School Wood Shop until the 1990s. The Shop environment of power tools, sawdust, and sharp implements was unsuitable for large drawings on paper in a light-sensitive medium. In the early 2000s, the Architecture Program Director relocated them from the Shop to his office and subsequently entrusted them to the Structures professor. In 2019, she transferred them to the Architecture Librarian for safekeeping in the Special Collections Room. The Librarian requested collaboration with the library's Digitization Staff to digitize the drawings, recognizing that continued use, atmospheric conditions, and time were causing deterioration of this unique set of drawings. They recommended preservation measures prior to digitization. At this juncture, the diazo paper, now 50 years old, exhibited ripped and frayed edges and staining. The Preservation Department Director consented to assess and conserve the drawings.

Condition of the drawings and the need for conservation

To formulate a suitable conservation treatment proposal, it is imperative to first ascertain the photo-reproduction technique employed in the creation of the drawings, alongside conducting a comprehensive condition and damage assessment of each sheet. Various resources are available to facilitate process identification and inform the preservation of architectural drawings (refer to bibliography). The drawings for the School of Architecture at the University of Maryland are identified as diazotype photo-reproductions.

Note: The conservation of these architectural plans was conducted by a team of paper conservators. Due to the nature of architectural plans please consult a paper conservator before beginning any treatments.[2]

The term "diazotype" is derived from the Greek word for "two" (**di**), the French word for "nitrogen" (**azo**te), and the Greek word for "to copy/reproduce" (**type**)[3]. The diazotype process is predicated on the chemistry of aniline, an amine with the chemical formula $C_6H_5NH_2$, first extracted from coal tar in the 19th century. The discovery of aniline catalyzed the development of a new branch of organic chemistry; wherein synthetic aniline dyes were initially utilized within the textile and fashion industry. A commercial process employing a diazo dye for the reproduction of architectural drawings was

[2] American Institute for Conservation, "Find a Conservator," https://www.culturalheritage.org/about-conservation/find-a-conservator.

[3] Eva Glück, Eva-Maria Barkhofen, and Irene Brückle, *Papier – Linie – Licht: Konservierung von Architekturzeichnungen und Lichtpausen aus dem Hans-Scharoun-Archiv = Paper – Line – Light: The Preservation of Architectural Drawings and Photoreproductions from the Hans Scharoun Archive* (Berlin: Akademie der Künste, 2012), 107.

introduced in 1923 by Kalle & Co. of Germany[4]. Due to its rapid execution, capability to reproduce fine detail, and "dry" nature, the diazotype process supplanted the blueprint (cyanotype or ferro-prussiate print) by the 1950s.[5]

The diazotype is characterized by:

- Line coloration varies, encompassing shades of brown, blue, and purple
- The recto exhibits noticeable discoloration in comparison to the verso; only the recto is treated with the diazo solution. Over time, residual chemicals undergo oxidation, resulting in yellowish-tan discoloration, a process intensified by light exposure.[6]
- The paper surface is calendered, maintaining a smooth and matte finish due to the dry processing method.
- The ground often presents with a flecked or "dirty" appearance.[7]

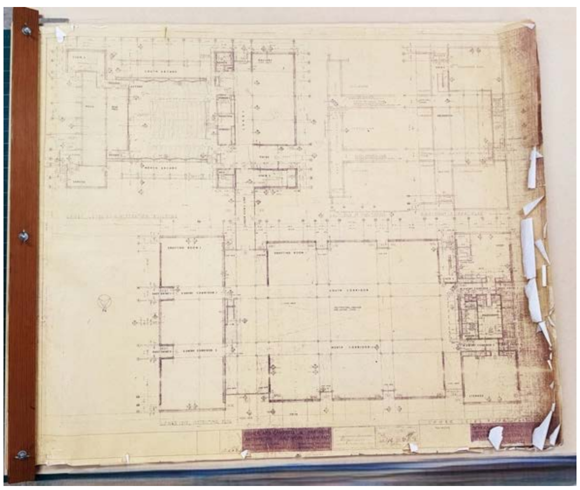

Figure 1: Drawings with Wood and Screws

Upon arrival at the Conservation Department, the drawings were secured between two strips of lacquered pine, measuring 1" x 3", affixed with three metal bolts and wingnuts through three evenly spaced holes, which corresponded to holes punched through the drawings (Figure 1). Due to the configuration of the drawings rolled around the wooden supports, the wingnuts, positioned on the recto or image side, resulted in tears and abrasions to the drawings (Figure 2). Additionally, the outermost drawings sustained significant damage, including a substantial area of loss (Figure 2a).

Prior to the removal of the binding from the drawing set, the sheets were meticulously collated to preserve their existing sequence, and an item number was inscribed in pencil on the lower left corner of the verso of each sheet. An assessment inventory was systematically compiled in a spreadsheet to document damage and other issues requiring attention in the conservation treatment. Initially, the set comprised thirty-nine drawings; however, Sheet A-1 and one of the E drawings are now missing.

The wooden binding strips were subsequently detached, allowing for a thorough evaluation of each sheet's condition, existing damage, and necessary treatment. Variations in discoloration, attributable to the oxidation of the sensitized recto in relation to its exposure to atmospheric conditions and light, are observable. In Figure 2b, the area shielded by the binding, demarcated in blue, remains notably white,

[4] Marketed as "Ozalid Paper" – diazo spelt backwords with the addition of an "I"; the Ozalid process was also used by musicians to reproduce their music scores - Lois Olcott Price, *Line, shade, and shadow: the fabrication and preservation of architectural drawings* (New Castle, DE: Oak Knoll Press, 2010).
[5] Lois Olcott Price, *Line, Shade, and Shadow: The Fabrication and Preservation of Architectural Drawings* (New Castle, DE: Oak Knoll Press, 2010), 198.
[6] Ibid., 201.
[7] Eléonore Kissel and Erin Vigneau, *Architectural Photoreproductions: A Manual for Identification and Care* (New Castle, DE: Oak Knoll Press, 2009), 37–43.

whereas the area outlined in red has undergone discoloration to a yellow-tan hue. The drawings measure 34-3/4" by 43-1/4" in total.

Figure 2: Drawings with edge damage: tears, losses and dog-ears.

Figure 2a: The last sheet, U-1, showing tears, dog-eared folds and losses.

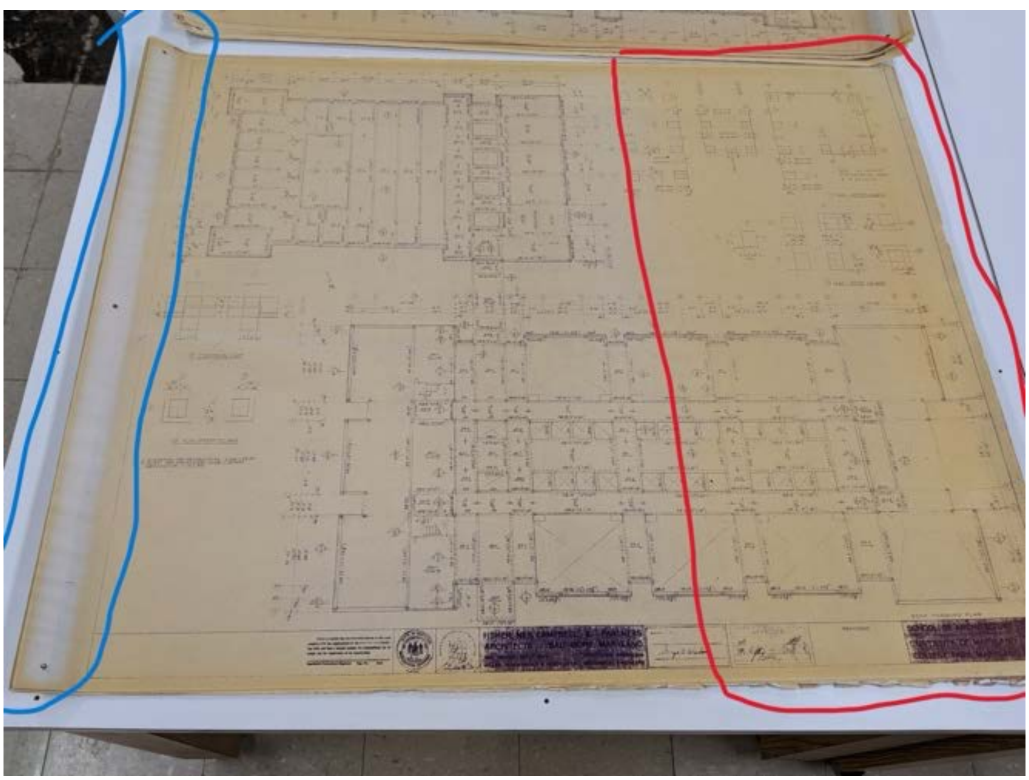

Figure 2b: Variations in discoloration of image due to different exposure to the atmosphere.

Most sheets exhibited varying degrees of edge damage. Through the execution of several extensive projects aimed at preparing materials for digitization, the Preservation Department has established a conservative mending policy for such initiatives. This policy dictates that only tears meeting specific criteria are addressed:

- those that interfere with text or image areas,
- those that structurally compromise the paper or support, or
- those that pose a risk of further damage during handling.

These projects encompass the preparation for digitization, including three extremely brittle newspapers and the initial three volumes of the University of Maryland campus newspaper. The primary objective was to stabilize each project to facilitate the creation of digital surrogates; subsequently, the originals were housed in polyester film folders and stored flat in archival boxes, with anticipated usage and handling expected to be minimal. Each project presented unique challenges, such as reassembling fragmented leaves in a puzzle-like manner and removing substantial quantities of severely deteriorated pressure-sensitive tape. These challenges were prioritized over numerous insignificant edge tears, the mending of which would have significantly increased the overall time and labor involved in each project. In accordance with this protocol, the hundreds of minor edge tears, measuring 5 mm or less, in the diazotypes will not be mended. Seven sheets exhibited such edge damage and required no mending.

Furthermore, each occurrence of pressure-sensitive (PS) tape was meticulously documented. Two distinct types of PS tape were identified: one with an acrylic adhesive and plastic carrier, and another "masking" type with a rubber-based adhesive and crepe paper carrier. Sheet A-6, which illustrates the overall façades of the School of Architecture, sustained the most damage and contained most PS tape repairs (Figure 3a & 3b). Consequently, Sheet A-6 was treated separately from the remaining sheets. In contrast, only two sheets (A-2 and E-4) had minor repairs made with acrylic tape, which were efficiently removed using a heat gun to detach the carrier, followed by the removal of residual adhesive with a crepe square or eraser.

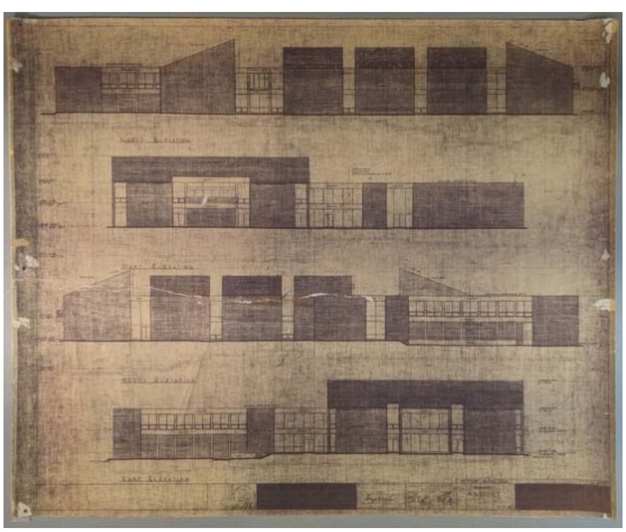

Figure 3a: A-6 recto Before 1

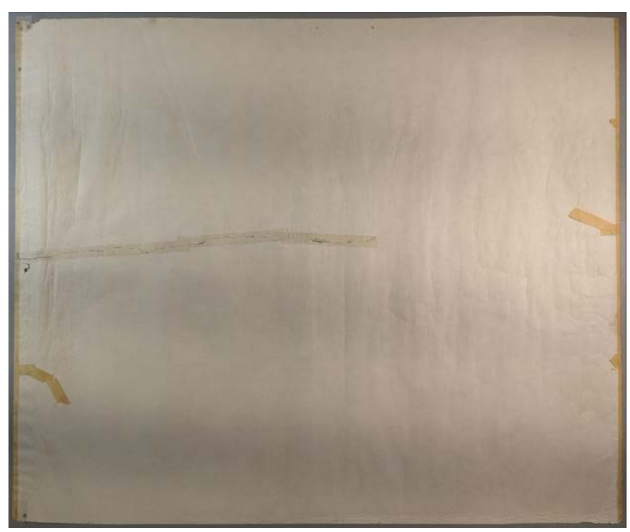

Figure 3b: A-6 verso Before 1

Sheet A-6 exhibited the most extensive damage, was slightly smaller than the other sheets, and its exceptionally dark image may suggest distinct processing. The sheet was characterized by pronounced creases, areas of abrasion, and missing image sections. The left and right edges had been reinforced with masking tape, applied to one side and folded over to the other. Masking tape which is a rubber-based adhesive tape is inherently unstable, prone to oxidation, and discoloration. Degradation products can migrate into paper fibers, causing staining and imparting translucency to the paper. Continued degradation may result in the paper becoming stiff and illegible. The masking tape along the edges of Sheet A-6 remained tacky in certain areas, while in others, the adhesive had lost its tack and detached easily. Sheet A-6 was torn approximately 75% along the middle length of the sheet, with this substantial tear repaired using acrylic tape on both the recto and verso, albeit with poorly aligned edges. Given that Sheet A-6 depicted the building's façade, it was likely handled frequently, possibly pinned or taped to a wall for reference, and/or may have been a late-generation print copy.

Prior to commencing the conservation treatment, the department convened with the Architecture Librarian to establish a treatment plan, which included:

- Light surface cleaning.
- Humidification and drying under blotter and weight to flatten each sheet.
- Mending with Filmoplast R Heat Set Tissue.[8]
- Tears and minor losses located on the outer edges of the drawings, which did not affect image quality or stability, would remain unmended.
- Due to extensive damage, the treatment of Sheet A-6 would encompass the removal of pressure-sensitive tape, aqueous treatment, and lining with Japanese tissue and wheat starch paste.
- Each drawing would be enclosed in a 3-mil polyester folder, thermally sealed along the long dimension.
- Five or six sheets would be placed in a 20-pt. map folder.
- A large flat storage box would be fabricated in-house from blue corrugated board.[9]

Once all details were agreed upon, the Architecture Librarian approved the proposal, allowing the work to proceed.

Conservation

Due to the complexity of treatment Sheet A-6 required, it was treated separately from the other thirty-six drawings. The treatment of the remaining thirty-six drawings was largely conducted and managed by the Preservation Department's Graduate Assistant. The leaves were first surface cleaned using wedges of vulcanized rubber dry-cleaning sponges to remove any accumulated dirt or dust.[10]

A worktable, 4 x 6 foot, was lined with 30 pt. blotter paper that was fixed in place with tape; this provided an absorbent work surface for drying after humidification. The table could accommodate two drawings at once and allow for a streamlined workflow. Using a "nano-mister", the tattered edges and any dog-ears were humidified and dried under squares of weighted Hollytex and blotter. This process

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[8] The Conservator tested inconspicuous areas of a drawing to verify the application of heat caused no further damage to the paper substrate or the diazo-image.
[9] Ideally foldered documents would be stored in flat files. However, the Architecture Library's Special Collections room is small and has no flat files.
[10] Northeast Document Conservation Center, *Surface Cleaning of Paper* (Andover, MA: Northeast Document Conservation Center, 2019).

was repeated as needed. Mending followed using Filmoplast R Heat Set Tissue,[11] silicon release paper, and a tacking iron. Tears with beveled edges were first tacked with wheat starch paste then reinforced with Filmoplast. Losses in the paper were mended on the verso with torn-to-shape tissue, while a smaller patch was applied to the recto. This staggering of mends prevents any "hard edges" caused by mending patches aligned with one another.

Then the entire sheet was humidified with a nano mister, fully covered with blotter paper and weighted under pressing boards to dry. Due to the drawings having been rolled for many years, resulting in severe curling, the misting and weighting cycles had to be repeated several times. When completed, the drawing was temporarily foldered and the next drawing was treated.

Treatment of Sheet A-6

We began with the masking tape which covered both short edges of the drawings. The Conservator and Graduate Assistant were able to work simultaneously, using both our heat gun (Figure 4) and a slide warmer (Figure 5). For areas where the masking tape remained tacky and adhered to the drawing, the controlled use of heat softened the adhesive layer, allowing for the crepe-paper carrier to be gently removed without disturbing the top layer of the drawing. The heat gun provides a targeted flow of hot air to a specific spot. The slide warmer is placed below the drawing with a sheet of blotter paper between and its consistent levels of radiant heat allows for a wider area of work. Over the course of work, areas not being treated were masked with blotter paper to protect and support the drawing.

Figure 4: Softening tape with heat gun.

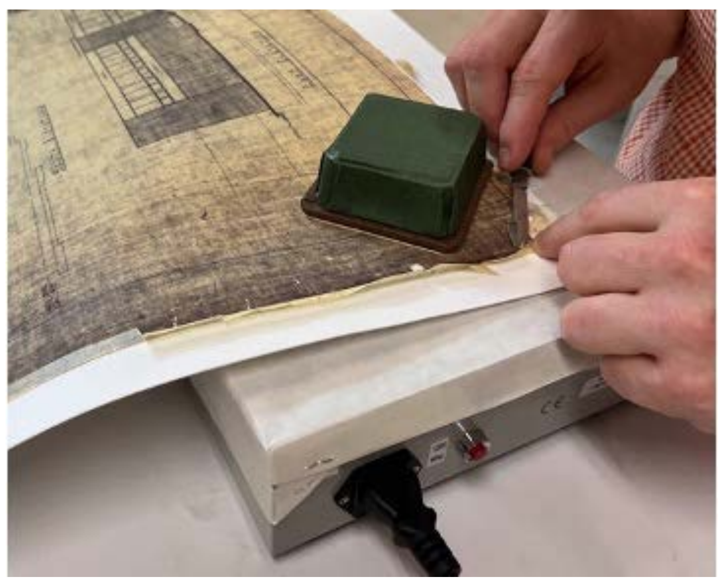

Figure 5: Softening tape with slide warmer.

Upon removal of all crepe paper carriers, the adhesive residues were evaluated. The deteriorated masking tape left behind a minimally tacky adhesive residue on the paper's surface, indicated by purple arrows, and an oil-like residue penetrating the paper fibers, marked by red arrows (Figure 6). Given the propensity for these penetrating residues to continue degrading, it is advisable to remove them, typically using organic solvents. Tests conducted by the Conservator with our limited solvent range yielded no

[11] The Conservator tested inconspicuous areas of a drawing to verify the application of heat caused no further damage to the paper substrate or the diazo-image.

significant change. As these residues exert minimal visual impact on the image layer, they have been left for potential future treatment.

Figure 6: Surface residues

Surface residues identified were removed using rubber cement erasers and white vinyl block erasers. On the recto/image side of the drawing, erasers were applied with minimal pressure to avoid abrading the image. All remnants of the rubber-based adhesive residues were eliminated before addressing the acrylic pressure-sensitive tape.

Due to most of the acrylic tape being applied to the tear traversing the middle of the drawing, the heat gun was predominantly utilized to soften the adhesive and remove the plastic carrier layer. Unlike the masking tape, the acrylic adhesive exhibited no deterioration and remained fully adhered to the drawing. A slight degree of adhesive creep was observed along the edges of the plastic carrier, attracting dust and dirt. As the acrylic adhesive retained its tackiness, sections of the carrier were removed, followed by the adhesive residue using a crepe eraser. Working in small areas mitigated the risk of unintended adhesion to exposed adhesive residue.

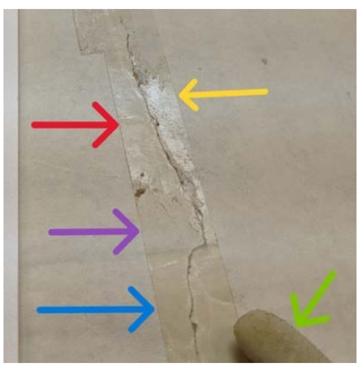

Figure 7: Adhesive removal with crepe eraser.

Figure 7 illustrates the process of adhesive removal using a crepe eraser, denoted by the lime green arrow. The blue arrow indicates the intact plastic tape carrier. The red arrow signifies the residual adhesive post-carrier removal. The yellow arrow marks the commencement of crepe eraser use, while the purple arrow indicates complete adhesive removal from the paper surface. Employing a careful and gentle erasing motion, the adhesive is extracted from the paper surface onto the crepe eraser, forming globs that can be detached from the eraser and discarded. The dark lines along the adhesive edges result from accumulated dust and dirt over time. The paper support must be securely held, and caution exercised when erasing along a paper tear to prevent further damage. The tactile sensation confirms complete adhesive residue removal, allowing treatment to proceed on the subsequent tape section.

Upon the removal of all tape and adhesive, Sheet A-6 was subjected to examination under general lighting and subsequently by raking light (Figure 8). This assessment revealed the extent of cockling and wrinkles present within the sheet. It was determined that the center tear exhibited dog-eared edges and minor loss of image.

Figure 8: Drawing A6 Under Raking Light

The drawing image underwent testing to confirm that its media was insoluble in water, thereby permitting aqueous washing. In the absence of a sink or photo trays of sufficient size for the project, Sheet A-6 was capillary washed using a "slant-board" technique[12], employing TEK-Wipe[13]. The slanted surface comprised two glass plates lined with polyester film to ensure uniformity, a sheet of TEK-Wipe with its top edge immersed in a water reservoir and extending beyond the lower end of the platform, the drawing itself, and an additional layer of TEK-Wipe atop the drawing to mitigate evaporation. The drawing was thoroughly misted using a pump mister and the misting device (Figure 10). Figure 11 illustrates the initial rinse water, discolored by soluble deterioration products present in Sheet A-6. The washing process continued until the wastewater was clear (see Figure 9, which depicts Paraprint OL60 in place of TEK-Wipe).[14]

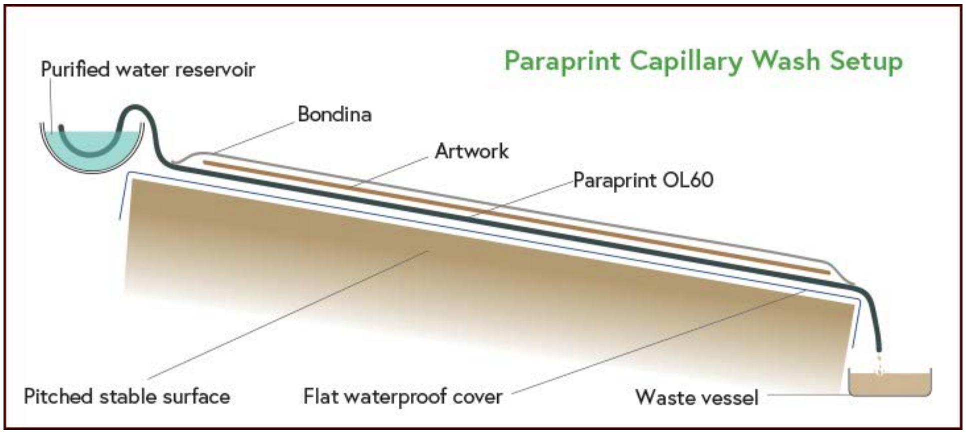

Figure 9: Inclined Washing Process

Figure 10: Washing with Nano Misting Device.

Figure 11: Discoloration removed during washing.

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[12] Hilde Schalkx et al., "Aqueous Treatment of Water-Sensitive Paper Objects: Capillary Unit, Blotter Wash, or Paraprint Wash?" *Journal of Paper Conservation* 12 (2011): 11–20.
[13] Kaslyne O'Connor, "Tip: TEK-Wiping Out the Competition: The Ideal Reusable Absorbent Material," *The Book and Paper Group Annual* 35 (2016): 155–62.
[14] Preservation Equipment Ltd, *How to Wash Artwork with Paraprint OL60*, video, accessed March 13, 2025, https://www.preservationequipment.com/Blog/Blog-Posts/How-to-wash-artwork-with-Paraprint-OL60-VIDEO.

With washing completed, the drawing, face down on Hollytex, was lined with a lightweight kizukishi (kozo) Japanese tissue and wheat starch paste (Figure 12). The large size of the drawing was a challenge. The drawing sandwiched between sheets of Hollytex was then transferred to wool felts for drying (Figure 13).

Figure 12: Lining the drawing

Figure 13: Drawing after lining

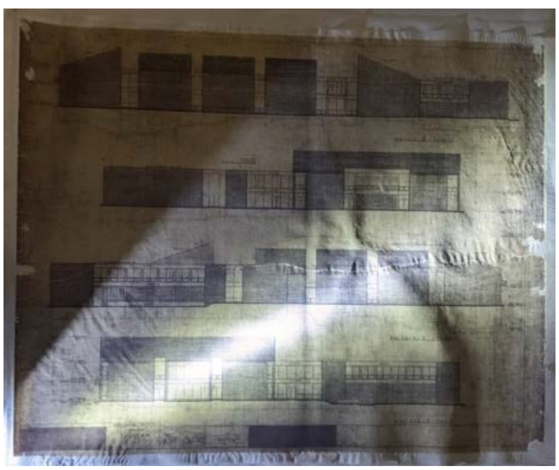

Figure 14: Wrinkles revealed in raking light.

Unfortunately, after drying, the drawing retained many of its original ripples and undulations (Figure 14). We believe a heavy weight Japanese paper may be required as well as drying on a suction table to ensure planarity. As disappointing as this lining is, the drawing was flattened enough to be successfully digitized, and the original is quite stable in its polyester film folder. Should facilities become available here at UMD Libraries, we may revisit this treatment.

Long Term Storage

Finally, a box was fabricated from archival blue corrugated board, 20-pt tan board, and book cloth. The opening flap is held in place with rare-earth magnets embedded in the top of the box as well as the flap (Figures 15-17).

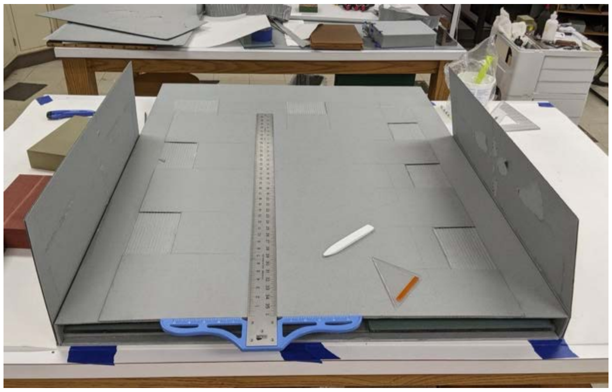

Figure 15: Box construction

Figure 16: Box construction continued

Figure 17: Librarian Frank with completed plans.

Digitization of Architectural Drawings

When the Hornbake Digitization Center (HDC) initiates a new digitization project the primary focus is to establish and meet deliverables for partners while adhering to digitization best practices. HDC was tasked with a project involving the digitization of architectural drawings for preservation and educational purposes. The Architecture Librarian aimed to create digital surrogates for use by professors in the School of Architecture, thereby facilitating student access and reducing physical material handling. To achieve this, HDC ensured compliance with digitization best practices, targeting a resolution of at least 300 dpi (dots per inch) for TIFF files.[15] Following consultation with the Head of the Art and Architecture Libraries, it was decided to capture images at 600 dpi due to the drawings' condition and intended use.

Plan 1: Zeutschel

The initial plan involved utilizing the Zeutschel Planetary Scanner for capturing the architectural drawings. HDC's Zeutschel OS12000 is employed for oversized materials; however, the architectural drawings, measuring 35" x 44", exceeded the scan bed's capacity, necessitating capture in four separate scans. Subsequent image stitching using Adobe Photoshop was required to create seamless images, demanding significant time and handling by technicians. Despite the relatively modest number of 37 architectural drawings, the necessity to divide each drawing into four scans compounded the workload. The real challenge arose during image stitching, as the architectural drawings, originating from the late 1960s, have faded over time and contain large empty sections. These factors complicate the identification of common points for seamless image stitching, extending project timelines. Given these constraints, this was the optimal approach available without outsourcing to an external vendor.

Plan 2: Camera

During a meeting with the Architecture Librarian and the Preservation team to discuss the preservation workflow and HDC's requirements for digitization, a secondary capture option was proposed. The Preservation department possesses a setup for photographing oversized materials pre- and post-treatment.[16] This setup includes a white board, magnets for material stabilization, a Canon EOS R10 camera, two large GVM 560AS LED light panels, two large light reflectors, and a floor-seated softbox. The camera, a digital single-lens non-reflex mirrorless model, boasts a resolution of 24.2 megapixels and a CMOS sensor. An 18-150mm (F3.5-6.3) lens was employed for image captures. The Preservation team offered HDC access to their setup. While several factors required consideration, HDC technicians could test the setup to ensure compliance with digitization best practices (based on FADGI guidelines), enabling the digitization team to capture the drawings using this method.

- The placement of the drawing on the white board.
- That the magnets were uniform and small enough to go unnoticed, were strong enough to hold the drawings in place, and that they would not obstruct any of the text or image.
- Ensure having the magnets pictured in the image wouldn't be a concern for the Architecture Librarian.
- Camera Specifications.
- Evaluate the lighting in the space and ensure we would be able to capture a good quality image.[17]

All these variables meant HDC would have to do an initial test to ensure the space and set up would work for us and the Architecture Librarian.

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[15] Federal Agencies Digital Guidelines Initiative, *Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Images: 3rd Edition* (2023).
[16] Mark Coulbourne and Bryan L. Draper, "Preservation Post: Photodocumenting or Digitizing Oversize Paper Objects on a Budget," *Mid-Atlantic Archivist* 53, no. 1 (2024): 12–13.
[17] Federal Agencies Digital Guidelines Initiative, *Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Images: 3rd Edition* (2023).

Camera Test 1

For the initial test, the HDC selected several architectural drawings for capture. The process began by placing one of the drawings directly on the white board. The Architecture Librarian approved the use of magnets, provided they did not obstruct any content. The office lighting was turned off, and the digitization team utilized two LED lighting panels and lighting reflectors to optimize light angle and focus for superior image capture. Following the setup of lighting and camera calibration, the team proceeded with the shooting process.

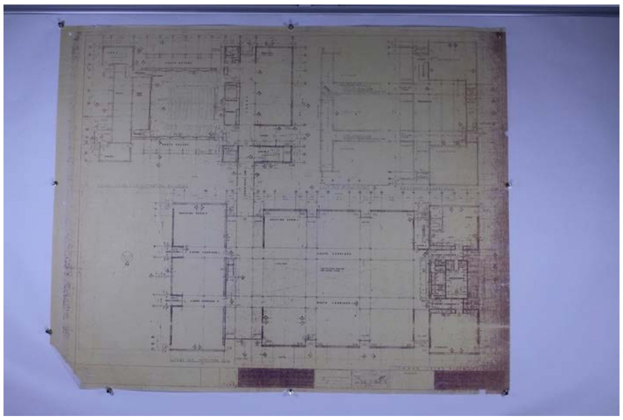

Figure 18: Photo from Camera Test 1 with blue tinge.

The HDC team conducted the initial shots, making necessary lighting adjustments, and subsequently concluded the test. As the camera was the property of the Preservation department, they managed the download of the files and shared the images with HDC. HDC requested the raw image files, as they represent the original, unaltered master copies. Reviewing the raw files enabled HDC to assess the original images and implement any required edits. Upon reviewing the images from the initial camera test, it became evident that the photos exhibited a blue tinge (Figure 18).

During the image review, it was noted that the digitization team had omitted a grayscale reference in the photographs. Additionally, it was determined that covering the white board with a black backdrop would enhance contrast and mitigate the blue tinge in the photos. Although HDC could address these issues in post-production, conducting a second shoot was deemed preferable. The digitization team exported the raw image files to TIFF format and distributed them to the group for review, along with HDC's recommendations for proceeding. After reviewing the materials, the group concurred that a second test was the optimal course of action.

Camera Test 2

Figure 19: Camera digitization set up

For the second test shoot, the HDC incorporated a black backdrop, maintained the lighting configuration from the initial shoot, and ensured the inclusion of a Tiffen grayscale. The digitization team positioned the grayscale a few inches from the architectural drawing on the white board. Subsequently, the camera was meticulously calibrated, and the color balance was verified. With all preparations complete, the team proceeded with the shoot (Figure 19).

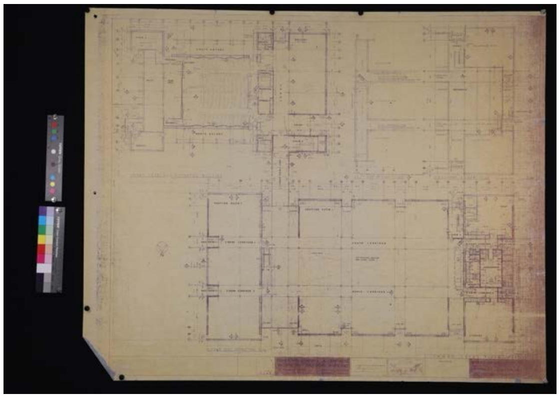

Figure 20: Photo from Camera Test 2.

The digitization team captured the same set of drawings from the initial test to facilitate a robust comparison. This time, the images were devoid of any blue tinge, with colors rendered true and accurate, and lighting appropriately adjusted. The raw files were successfully converted into TIFFs suitable for classroom and research applications. HDC utilized Adobe Lightroom to verify color accuracy and Adobe Bridge for converting raw files to TIFF format, subsequently delivering the image files to the group for review. Following a review of the images from the second test, the group concurred that the test was successful, allowing the digitization process to proceed utilizing the Preservation department's setup (Figure 20).

Scanning process

Figure 21: Technicians take photos of all 37 drawings.

Each architectural plan required three technicians to position it onto the white board. A primary challenge during the digitization process involved adjusting the lighting to achieve optimal image capture. Many architectural drawings exhibited either faded areas or heavily saturated ink, complicating the attainment of proper light balance. Technicians adjusted both the lighting and the positioning of the drawings prior to each shot. The HDC team then reviewed the capture on the camera's screen to ensure lighting accuracy. In the event of any discrepancies, technicians adjusted the lighting and captured another image, resulting in multiple photographs of each drawing. The availability of duplicates enabled technicians to compare images and ascertain the most accurate representation of each drawing (Figure 21).

The capture of all thirty-seven architectural drawings required three hours and the collaboration of seven individuals. Upon completion, the Preservation team shared the raw image files with the HDC for post-processing. Each photograph, including duplicates, was meticulously cropped, straightened, renamed in accordance with HDC's file naming schema, and converted to TIFF and JPEG formats. Additionally, Adobe Lightroom was employed to verify the accuracy and fidelity of color in each image.

Following post-production, HDC technicians commenced the quality check (QC) process for each image, inclusive of duplicates.[18] It is standard practice within HDC for a technician to conduct QC on all scans prior to project completion. During QC, technicians scrutinize images for blurriness or lack of focus, the presence of dust or debris, correct rotation and alignment, completeness of captured drawings, and color accuracy. In this instance, images underwent multiple rounds of QC. The initial QC round eliminated captures that were excessively blurry, dark, washed out, or exhibited inaccurate color. The subsequent QC round involved comparing duplicates to ascertain which captures most closely

[18] Federal Agencies Digital Guidelines Initiative, *Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Images: 3rd Edition* (2023).

represented the physical drawings and identifying any drawings necessitating recapture. Detailed notes were recorded for each potential recapture, facilitating technicians in easily identifying issues and rectifying them during reshoot.

A list of drawings flagged for recapture was communicated to Preservation for retrieval. With assistance from the Preservation team, HDC technicians reestablished the camera and lighting setup and commenced the reshoot. All drawings flagged for recapture presented inherent challenges, with variations in writing complicating optimal lighting. Despite the possibility of not achieving improved captures, adjustments and careful focus on lighting were pursued.

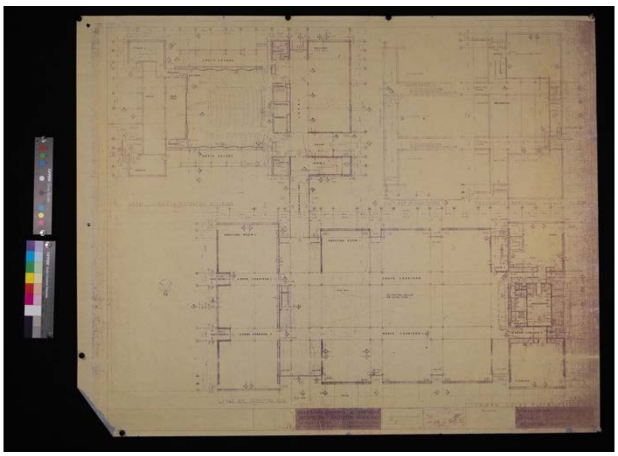

Figure 22: Final version of the digitized drawings.

Recapture of the six flagged drawings was completed in under an hour. Subsequently, HDC initiated post-production and QC anew. Technicians converted the raw image files to TIFF format and performed post-processing on the images. Upon completion, images underwent QC and were compared to initial captures. A determination was made between originals and recaptures to identify superior images. Files and notes were then shared with the group for final review. Upon consensus, the digitization process was concluded. Refer to Figure 22 for the final version of the architectural drawings.

Conclusion

The methods detailed in this publication encompassed the conservation, digitization, and potential applications for a set of architectural drawings. While the time and effort expended on this project may appear substantial for a single set of drawings, the authors have determined that this approach yields optimal results for digitization and long-term storage. While the conservation methods employed were not unique, the size and the condition of the drawings presented several challenges which resulted in creative solutions to conserving these originals. The challenges presented by the size and fragility of the papers provided an opportunity to design and test a new method for digitizing oversized materials in the future. This supplies the department with a larger toolkit for any future endeavors that involve specialized oversized papers. This new method will reduce the amount of time that the digitization center would spend on stitching images together in post-production. Now, the digital files are housed on a server and are in the process of being made available to the campus community through local permissions on the JSTOR platform. Here, they can be accessed by professors and students at any time; this suits faculty and especially students who tend to work at all hours of the night and day. Viewers can zoom in to the digitized file, take as much time as they need to study various aspects of the drawings, all without damaging the original paper documents. With the drawings now conserved and digitized, the necessity for physical usage has significantly diminished, rendering them accessible to all interested parties for reference or future endeavors.

Bibliography

Coulbourne, Mark, and Bryan L. Draper. "Preservation Post: Photodocumenting or Digitizing Oversize Paper Objects on a Budget." *Mid-Atlantic Archivist* 53, no. 1 (2024): 12–13.

Federal Agencies Digital Guidelines Initiative. *Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Images*. 3rd ed. 2023. https://www.digitizationguidelines.gov/guidelines/FADGITechnicalGuidelinesforDigitizingCulturalHeritageMaterials_ThirdEdition_05092023.pdf.

Glück, Eva, Eva-Maria Barkhofen, and Irene Brückle. *Papier – Linie – Licht: Konservierung von Architekturzeichnungen und Lichtpausen aus dem Hans-Scharoun-Archiv = Paper – Line – Light: The Preservation of Architectural Drawings and Photoreproductions from the Hans Scharoun Archive*. Berlin: Akademie der Künste, 2012.

Kissel, Eléonore, and Erin Vigneau. *Architectural Photoreproductions: A Manual for Identification and Care*. New Castle, DE: Oak Knoll Press, 2009.

Northeast Document Conservation Center. *Surface Cleaning of Paper*. 2019. https://www.nedcc.org/free-resources/preservation-leaflets/7.-conservation-procedures/7.2-surface-cleaning-of-paper.

O'Connor, Kaslyne. "Tip: TEK-Wiping Out the Competition: The Ideal Reusable Absorbent Material." *The Book and Paper Group Annual* 35 (2016): 155–62.

Preservation Equipment Ltd. *How to Wash Artwork with Paraprint OL60*. Video, accessed March 13, 2025. https://www.preservationequipment.com/Blog/Blog-Posts/How-to-wash-artwork-with-Paraprint-OL60-VIDEO.

Price, Lois Olcott. *Line, Shade, and Shadow: The Fabrication and Preservation of Architectural Drawings*. New Castle, DE: Oak Knoll Press, 2010.

Schalkx, Hilde, et al. "Aqueous Treatment of Water-Sensitive Paper Objects: Capillary Unit, Blotter Wash, or Paraprint Wash?" *Journal of Paper Conservation* 12 (2011): 11–20.