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Disaster Preparedness: An Imperative for Good Governance

Chapter Two
Source Document Microfilming

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http://www.pria.us

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Introduction and Scope

"... because of the conditions of modern war against which none of us can guess the future, it is my hope that it is possible to build up an American public opinion in favor of what might be called the only form of insurance that will stand the test of time. I am referring to duplication of records by modern processes like microfilm so that if in any part of the country original archives are destroyed a record of them will exist in some other place."

--Franklin D. Roosevelt, February 13, 1942

While this quote is referring to a technology that is becoming a lost art, it is a technology that is tested and trusted. When produced with care and with consistency, and when stored appropriately, the creation of microfilm backups will provide for the permanent preservation of the public record.

Most state archives continue to recommend or even require microfilm as the media of choice for archival or permanent storage. The target audience for this chapter includes government agencies and private sector organizations creating or using microfilm from source documents (e.g., paper, books, Mylar). This chapter is intended to serve as a very brief “How To” for source document microfilming.

Part 1 – Microfilm Cameras

Source document microfilming can best be defined as capturing microfilm images of the original paper document. Generally, planetary (also known as "flatbed") or rotary microfilm cameras are utilized. The images below show examples of both:

Figure 1

Figure 2

Figure 3

Figure 4

With a planetary camera (Figures 1 and 2), the document is placed on top of a flat bed, and the microphotograph is taken. Early planetary cameras generated 35mm microfilm only. With 16mm adapter kits, the versatility was expanded. Examples of early planetary cameras included the Eastman Kodak MRD, MRD-1, and MRG-1. Bell and Howell, Canon, and Minolta soon joined with physically smaller 16mm cameras that were primarily used for documents that were not bound. The image quality produced by planetary cameras is typically very good and these cameras are still in use today.

Rotary cameras (Figures 3 and 4) were manufactured primarily for capturing business documents on 16 mm microfilm. The high throughput speed on these cameras was particularly beneficial as it resulted in a lower per-page cost than that of the planetary cameras. Their function with land records was primarily for index cards and other letter and legal-size documents. Because of the movement of the document and the microfilm at the same time, the image quality on the rotary cameras is typically a step below that of the planetary cameras.

Part 2 – Technical Characteristics of Microfilm

Resolution

Simply stated, film resolution is the clarity and sharpness of the image. Key factors in determining resolution include the optical quality of the lens and the distance of the lens from the source document. The resolution of the microfilm output is a critical component affecting the readability and printability of documents. It is also important when the decision is made to digitally scan the microfilm images.

Each roll of source document microfilm should contain resolution charts at the beginning and the end of each roll to serve as the confirmation mechanism for resolution. American National Standards Institute (ANSI) resolution charts are available from many public sources, some of which are listed in Part 3 of this publication. Figure 5, below, is an example of the type of target that is used to measure the resolution from a conventional microfilm camera.

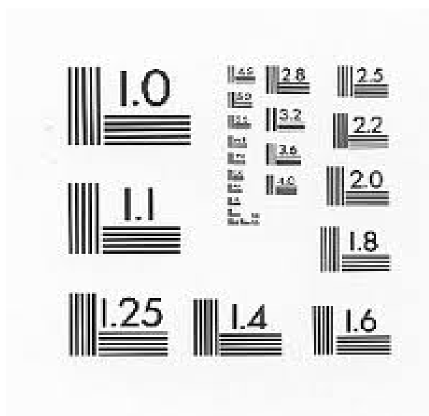

Figure 5

Resolution is typically measured in "line pairs per millimeter (mm)" and there are a number of factors that affect the measurement of resolution. In addition to those mentioned above, the stability of the floor the camera rests on, the mass of the camera itself, and the manufacturing quality of the components also influence a camera's resolution capability.

For rotary camera output, acceptable resolution is typically under 100 line pairs per mm, often in the 72-86 range at a 24X reduction. The technical challenge for resolution in rotary microfilm output is the synchronization of the movement of the paper document through the transport system with the movement of the microfilm in the camera head.

For planetary camera output, the resolution goal should exceed 100 line pairs per mm. Results of 108-134 line pairs per mm should be routine. While planetary cameras typically produce resolution readings that are higher than rotary cameras, there are exceptions. Unfortunately, these exceptions can produce bad images mixed with good images. For example, if the page of a book moves at the precise time of exposure, the image will likely be at least partially blurred. Another example would be technical problems with the platen in the camera head that can affect the "flatness" of the microfilm at the precise moment that the exposure is made. The resulting image will likely be completely or partially blurred.

When microfilming bound books, the adjustability of the focus on a planetary camera can be critical in achieving an acceptable resolution in the microfilm output. Also important is balancing each side of the bound book. Blocks or some other leveling device should be used to make sure the entire surface being microfilmed is as even as possible. An alternative to balancing the book with blocks is using a book cradle to maintain a flat and balanced surface area. This is particularly critical when a bound book is greater than one inch in thickness. Figures 6 and 7 show examples of book cradles:

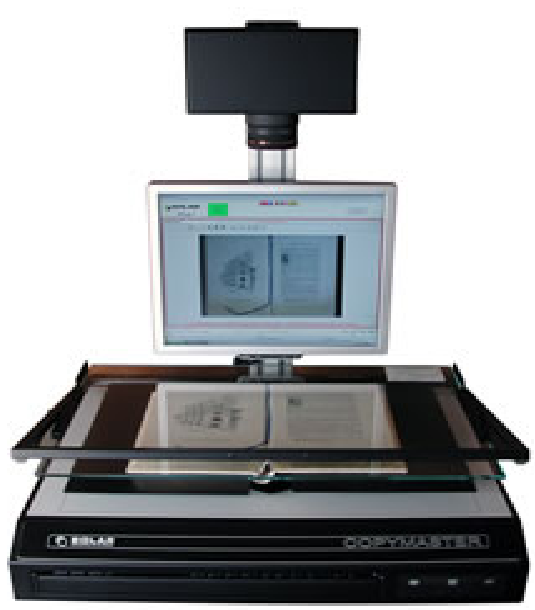

Figure 6

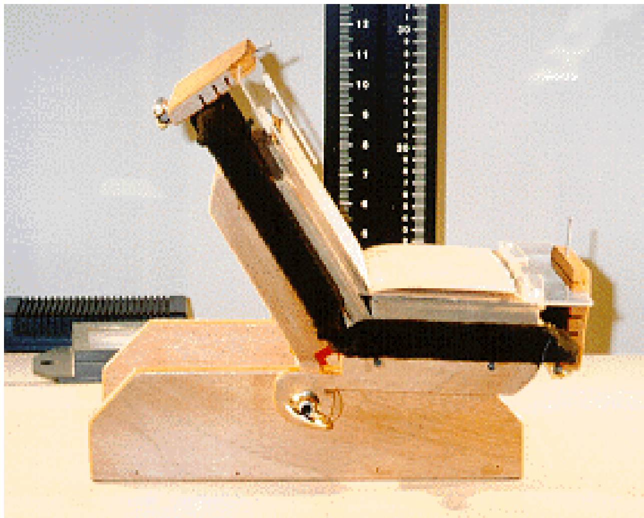

Figure 7

Lighting

With both planetary and rotary microfilm equipment, lighting is very important to create an image of uniform and consistent appearance. Lighting is not only important within a single roll of microfilm, but also over the dozens, hundreds, and thousands of rolls created over an extended period of time.

In combination with the processing of the microfilm, described below, the amount of light used in microfilming documents creates a value known as the density of the microfilm. In order to effectively view, print from, or make duplicates of microfilm, maintaining consistent density in microfilm output is critical.

Typical density of source document microfilm ranges from 0.80 to 1.20, as measured with a densitometer (a device that measures the amount of light that passes through various points in an image). With source documents that have faint writing or an otherwise poor contrast between the print and the paper's background, density should be on the low end of the range. With source documents that have good contrast between the print and the paper's background (e.g., good typing or handwriting on a white or cream-colored paper), the density should be on the high end of the range. A method for maintaining quality control of the density is to film blank white sheets of paper as density targets and to film both density and resolution targets at both the beginning and the end of each roll. Density and resolution readings should be similar at both ends. Any substantial fluctuation between these two readings may indicate lamp brightness instability, processing chemicals that may need replenishment, or a light leak in the film canister or magazine.

On larger planetary cameras, there are typically four flood lamps that are used for illumination. On smaller desktop planetary cameras, there are typically two fluorescent tube lamps for illumination. With the larger planetary cameras, the positioning and balancing of the four flood lamps is critical to obtaining an even and balanced density across the area that the documents occupy on the flatbed. Of great value in the balancing of these lamps is a light meter, which measures candle power. Taking readings and adjusting lamps can be a laborious task, but is well worth the effort. Lamps that are out of balance may produce unacceptable microfilm output.

On rotary cameras, the light banks inside the camera usually contain two rows of small incandescent bulbs, or two fluorescent bulbs. One row illuminates the front side of the document, while the second row illuminates the back side of the document. Over a period of time, the intensity of the illumination from the bulbs will decline and produce microfilm that may have a lower density output. Also, as the bulbs get dirty or dusty, less light will reach the document and streaks of lighter density may begin to appear on the microfilm. When this happens, it is time to clean or replace the bulbs. A bulb that completely burns out will usually produce some kind of error message on a rotary camera.

In combination with the light bulb illumination, the glass guides used in rotary cameras can also affect the quality of the image. Typically, the documents being microfilmed pass between two glass guides, with the microphotograph being taken as the document is moving between the two pieces of high quality glass. If there is a paper dust buildup on the glass guides from a large number of documents being fed into the camera, the resulting images will become progressively lighter in density. Because the lamp area is typically a high temperature area, tape residue can come off and stick to the glass guides, preventing part of the document from being captured on microfilm. Carefully removing and cleaning the glass guides before starting the microfilming process and again for each roll thereafter is a good practice.

Processing

Processing microfilm typically involves a combination of chemicals (developer and fixer), processing time/transport speed, and temperature. In order to maintain the highest film quality possible over the longest period of time, it is considered critical to maintain consistent processing parameters. Adjustments to improve contrast or alter background density should be made by changing camera settings to meet processing parameters, not by changing processing parameters. If a service company is used to process microfilm, it is likely that a critical component of the company's success is maintaining a consistent set of processing parameters. Whether using pre-measured chemicals or manually mixing them, the concentration of both the developer and the fixer is very important. The temperature of the developer is also critical. The warmer the temperature, the more active the developer becomes resulting in microfilm with a higher (darker) density value. If the processing equipment has a variable transport speed, it is important not to speed it up or slow it down once the combination of parameters is established through an extensive set of testing and calibrations. The processed microfilm is a result of the "agreement" between the amount of light used to illuminate the document and the various processing parameters.

The contrast between the clear areas of processed microfilm and the background density of microfilmed documents is important. The density of the clear area is considered the D-min value, while the background density of the microfilmed documents is the D-max value. The D-min value should be less than 0.10, when measured using a transmission-type densitometer. The recommended D-max range is 0.80 – 1.20 as mentioned above.

An additional processing step that is increasingly required by state archivists is a chemical treatment called “polysulfide toning.” This occurs during the processing procedure and it substantially increases the film’s resistance to oxidation (also known as “redox,” “red spot,” or “measles”). When airborne oxidants react with the film’s image and form silver halide, red to orange spots appear that can degrade image quality and affect the preservation qualities of the film.

Film Inspection

Processed film should be visually inspected using a light table, manual rewinds, an eye loupe, and an established set of inspection procedures that insure the physical integrity of the film is preserved and the authenticity of the documents is maintained. This inspection provides a necessary opportunity to monitor the quality of microfilm output. When inspecting the original camera microfilm, it is important to wear film inspection gloves to prevent skin oils from leaving residue and fingerprints behind. Camera negative film should not be inspected with a microfilm reader as it will scratch the emulsion potentially affecting character legibility, reproducibility, and leaving the silver halide vulnerable to oxidation.

Documents or rolls should be immediately re-microfilmed if the quality does not meet the standards that are in place. Microfilm is typically created as the permanent archival media and quality should not be unnecessarily sacrificed. By choosing to re-microfilm a poor roll when it is discovered, the need to locate the records for re-microfilming down the road can be avoided.

When created, processed, and stored correctly, polyester-based silver microfilm is a very stable preservation medium with a useful Life Expectancy Rating of 500 years.

Microfilm Duplicates

The processed microfilm from the camera (silver halide) is typically stored as the archival media. If a duplicate of the camera film is required for office use, the duplicate is usually created directly following the processing and inspection, and before the storage. The most common type of microfilm duplicate is known as a diazo duplicate. Diazo duplicates are less expensive to make than silver duplicates and they are more durable for repeated use.

The diazo process involves a light sensitive polyester microfilm that is exposed by a very bright light source and then developed in a combination of heat and ammonia. To avoid the challenges of storing and venting ammonia, many organizations will utilize an outside service company for the diazo duplication process.

Other duplicating processes include silver duplication and vesicular duplication. Silver duplication involves a film processing step similar to that used with the original camera microfilm. Vesicular is a fairly uncommon method of duplication that uses light and heat, but no other chemicals, for development.

Part 3 – Standards

Following accepted standards for microfilm resolution, processing, density, and film inspection will provide consistent quality of microfilm over a period of years. When standards are not followed, the probability of problems increases. Scanning, duplicating or printing from microfilm of varying quality provides many challenges, some of which are insurmountable. When microfilm cannot be used as the trusted archival medium, a difficult recovery from a disaster will be the likely result.

The American National Standards Institute (ANSI), the Association of Image and Information Management (AIIM), and the International Organization for Standardization (ISO) standards are an excellent resource for maintaining the quality of your microfilm.

The following are some of the basic standards applicable to a microfilming program:

- ANSI/AIIM MS23-1998 (ISO 6199:2005) – Microfilm of Documents, Operational Procedures/Inspection and Quality Control of First-Generation Silver-Gelatin
- ANSI/AIIM MS42-1989 (ISO 12031:2000) – Information and Image Management - Recommended Practice for the Expungement, Deletion, Correction, or Amendment of Records on Microforms
- ANSI/AIIM MS48-1999 – Recommended practices for filming public records on silver halide microfilm
- ISO 11962:2002 – Micrographics - Image mark (blip) used with 16 mm and 35 mm roll microfilm
- ISO 18902:2001 – Imaging materials - Processed photographic films, plates and papers - Filing enclosures and storage containers
- ISO 18911:2000 – Imaging materials - Processed safety photographic films - Storage practices
- ISO 18917:1999 – Photography - Determination of residual thiosulfate and other related chemicals in processed photographic materials - Methods using iodine-amylose, methylene blue and silver sulfide

These and other important microfilm standards can be purchased from:

- American National Standards Institute: www.ansi.org
- International Organization for Standardization: www.iso.org

Conclusion

The microfilming of source documents is becoming a lost art. However, capturing source documents on microfilm continues to be a trusted technology for the permanent preservation of public record. Following the guidelines in this chapter for the creation of high quality source document microfilm will provide a high assurance that the public's records are being protected and preserved.

The practical application of good resolution, lighting, processing, and inspection will assure high quality source document microfilm output. Following accepted standards will provide consistency in quality and will assist in the effective recovery from a disaster.

"Time and accident are committing daily havoc on the originals (of valuable historic and state papers) deposited in our public offices. The late war has undone the work of centuries in this business. The lost cannot be recovered; but let us save what remains; not by vaults and locks which fence them in from the public eye and use in consigning them to the waste of time, but by such multiplication of copies as shall place them beyond the reach of accident."

--Thomas Jefferson, February 18, 1791