OUT OF THE ARCHIVES

Why scan what you can shoot?

STORY

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PHOTOGRAPHS

Collection of the Center

Opposite: Lehigh and New England Railroad 2-8-0 no. 307 and 2-10-0 no. 401 at Summit, Pennsylvania, on March 10, 1946. The eastbound train is "doubling the hill;" this is the first cut consisting of 23 cars. Instead of using a traditional scanner to digitize this 5x7-inch negative, the Center photograhed the negative with a Nikon D800 digitial camera and 60mm macro lens. Photograph by Donald W. Furler, Furler-02-054-01

THE CENTER'S MISSION IS TO both preserve and present significant images of railroading. Saving collections of great photography is critically important to us, but of equal importance is ensuring that those images are easily accessible. In these early decades of the 21st century, ease of accessibility for images generally requires digitization. While the Center is enjoying a period of unprecedented growth, we still have limited resources and we need to use them wisely. Digitizing large photography collections takes a long time. We sought process improvements that would allow us to work faster without sacrificing quality. In this expanded edition of our regular "Out of the Archives" column, we share our results.

Slides

Scanning slides and negatives at high resolution is a time intensive process. At three minutes per scan, digitizing a collection of 50,000 slides would take one person 2,500 hours, or fifteen months of full-time work—not counting handling time or meta-data. Many collections of railroad slides number in the tens of thousands, so we wanted to find a faster way to digitize them. Even a low-resolution method would be useful, as it would allow us—and any other interested researchers—to quickly view a collection's contents and select the best images for high resolution scanning. That alone would have been a worthwhile improvement, but we ultimately found a much faster digitization technique that matches or even exceeds the quality of dedicated slide scanners.

With the ever-higher resolving capabilities of digital cameras, we decided to try using a digital, single-lens-reflex (DSLR) camera equipped with a close-up, "macro" lens to photograph slides. Having previously discussed the merits of this approach with some other photographer friends as well as finding some websites that described this technique, I was anxious to try it and evaluate the results.

To add a degree of automation to the process, I employed a regular slide projector to speed up the handling of the slides. This required making two simple modifications. I removed the lens from the projector, and I inserted a diffuser element in front of the bulb assembly. My diffuser is simply a piece of glossy photo paper, cut to fit and held in place with tape (see p. 36). This provides even lighting essential to a high-quality digitization. I aimed the camera straight into the projector and positioned the camera such that the slide filled the frame.

We selected a Canon Rebel SL1 camera with a Canon 100mm, f/2.8 macro lens. This camera has a "cropped," 18-megapixel sensor. While it delivers high quality images, there are better cameras on the market. Why not use one of them, particularly a camera with a full frame sensor? Given the lens's focal length, doing so would require positioning the camera closer to the slide than the projector allows. We performed some comparison tests on a light table, evaluating the Rebel and a Nikon D800 with a full-frame, 36-megapixel sensor. The full-frame camera does indeed resolve more detail, but in general, what we saw it resolving was more film grain. Slides are only so big, and even with fine grained film and sharp lenses, they only contain so much information.

The camera is connected to a computer with a USB cable. Canon provides a free utility called "EOS Utility" that can be used to control the camera via the computer. Nikon has a similar utility, "Camera Control Pro," although it currently costs $180. You can operate the camera entirely from the computer without having to touch (and risk bumping) the camera. A single mouse click fires the shutter, and the camera can be configured to write the image files directly to an external hard drive, eliminating the need to transfer files from a memory card. The software provides a feature for custom file names, and we configure these to match our unique identifier or "call number" for each slide.

For slides, we typically use a shutter speed of 1/500th of a second. The projector's cooling fan causes some vibrations, and a high shutter speed of 1/500th ensures that we still get sharp images. To account for variations in the flatness of each slide, we stop down the lens to around f/5.6. This generally requires a sensitivity setting of ISO 400, which is still low enough to provide noise-free images on today's digital cameras.

We shoot both JPEG and RAW files simultaneously. The JPEGs instantly provide reference images that are perfectly suitable for electronic viewing, while the RAWs can be optimized for print publication. Slide film tends to be very high in contrast, but the RAW files capture enough information that we can usually pull quite a bit of detail from the highlights as well as the shadows.

Compared to files from our Minolta DiMage 5400 scanner, the camera appears to produce images with similar resolution and sharpness. While the scanner has slightly better dynamic range than the camera's

JPEG files, the additional information contained in the camera's RAW files matches or even slightly exceeds the dynamic range of the scanner. Why scan what you can shoot?

Negatives

Like slides, scanning negatives at high resolutions also takes multiple minutes per image. Further, their handling typically takes considerably longer. Slides are individually mounted and of uniform size, making for relatively efficient handling. Negatives are not mounted and many photographers used negative film of several different sizes, sometimes cutting roll film into strips with widely varying numbers of images. All of these factors increase the handling time required when digitizing negatives.

Since negatives are not mounted, there is no automated handling option available like the slide projector. The Center has recently taken on several collections that contain thousands of black-and-white negatives of many different formats. The constant need to change scanner settings for different-sized film made a slow process take even longer. Surely we could devise a way to use a digital camera instead.

We ultimately decided to use a mounted camera pointed straight down at a light table. The light table provides a flat, evenly lit surface that can accommodate negatives of any size. Negatives that lay flat can simply be placed on the table and photographed. For negatives with mild warping or bending, we use L-shaped brackets to flatten the corners. For negatives with more severe warping and bending, we still use the film holders that came with our scanners.

The remainder of the setup is the same as what we use for slides. A USB cable connects the camera to the computer, which provides full control of the camera. Files are written directly to an external hard drive, and the filenames are configured to match the unique identifier or "call number" of each negative.

Bulb assembly from slide projector with glossy photo paper taped in place at lower left as diffuser element
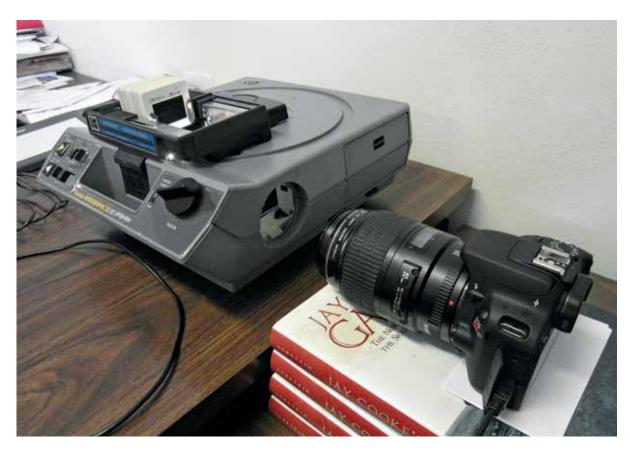

We were concerned that external light might compromise the image quality, but this generally is not a problem. In one case, a fluorescent light located directly above a digitization workstation caused reflections on the negatives, but we easily solved this by fashioning a simple shield out of cardboard.

We have constructed two workstations. One uses a camera mounted on a Manfrotto column that can be raised and lowered with a crank. We use this setup for collections with wide varieties of film sizes, as the crank allows for quick repositioning of the camera. For the other workstation, we use a camera clamp on a vertically-mounted board. The clamp still allows the camera to be repositioned for different film sizes, but since that takes longer, we generally use this setup for collections of more uniformly-sized negatives. In both cases, we use a simple bubble level to ensure that the camera and the light table are level.

The exposure settings we use for negatives are significantly different than what we use for slides. Because there are no vibrations like the ones from the slide projector's cooling fan, we can use much lower shutter speeds. We tend to keep the camera at a sensivity setting of ISO 100 or 200. Since the negatives are generally larger and not as flat as slides, we tend to use smaller aperture settings to provide for greater depth-of-field, typically f/11 or even f/16. The shutter speeds can vary widely as negative films tend to have a wider range of densities. We typically use aperture priority mode on the camera, allowing its processing to choose the shutter speed. This can range from 1/15th of a second to two or even four seconds for very dense film. We make sure not to bump the camera or the light table during these longer exposures. The camera stays in "live view" mode, with its mirror up, so there is no chance of vibrations from the mirror blurring the image.

Using a Nikon D800 digital camera with a Nikon 60mm, f/2.8 macro lens, we have been favorably impressed with the resulting image quality. Compared to our Epson V700 scanner, the digitizations obtained with the camera appear every bit as sharp, with similar levels of dynamic range. Unlike slide film, most negative films have relatively low contrast, so if anything, contrast needs to be increased in digital post-processing.
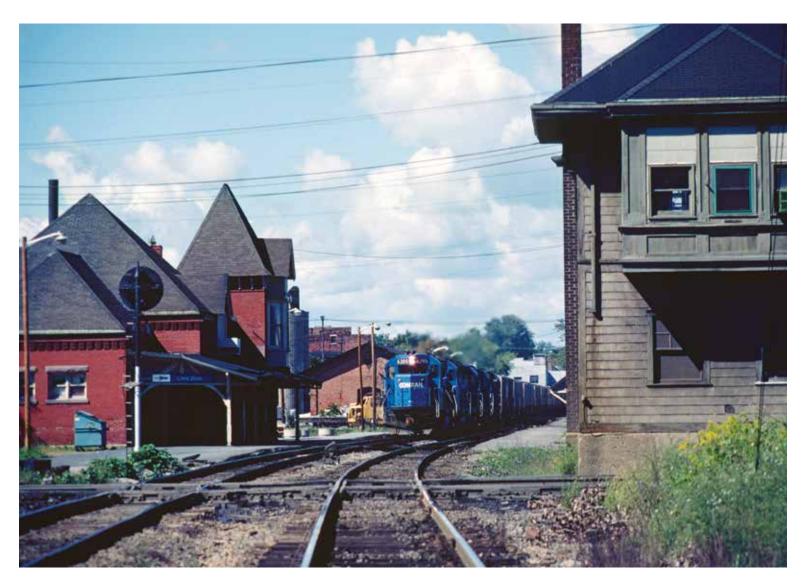
The varying film sizes play a greater role. For 35mm and 120 roll film, the camera has no problems matching or even exceeding the scanner's capabilities. For larger film formats, though, such as 4x5-, 5x7-, and 8x10-inches, the camera's resolution limit can sometimes become apparent. However, it is worth noting that these limits are only visible in very big enlargements. We compared 16x24-inch prints made using both methods, and the quality is indistinguishable. If we ever need larger prints from large format negatives, we can scan them. Otherwise, the digital photographs are sufficient for all uses, including most gallery prints. Why scan what you can shoot?

Left: Digitization workstation for slides. Canon Rebel SL1 camera with 100mm macro lens aimed into slide projector with lens removed. A USB cable connects the camera to a computer.

Below: Digitization workstation for negatives. Nikon D800 with 60mm macro lens mounted to a vertical board with a Manfrotto clamp. Negatives lay on the light table on the desk; L-brackets flatten the corners. The cardboard shield blocks reflections from an overhead light. A USB cable connects the camera to a computer, which fully controls the camera and writes the image files directly to an external hard drive.

In summary

Photographing slides and negatives with modern
DSLR cameras and high-quality, macro lenses can
provide digital image files of similar quality to what
can be obtained with traditional scanners. In general,
the camera files are of a quality suitable for all uses
in both electronic and print publication. In the rare
cases where a scan might still provide better quality,
careful numbering of both the original photographic
media and the digital camera files make it easy to find
the original for scanning.

The time savings are significant. High resolution
scans typically take two to five minutes per image.
High resolution digital photographs take fractions
of seconds. There is still handling time involved.
Mounted slides allow for efficiency, while unmounted
negatives of varying sizes require more handling time.
There is also the matter of digitizing the caption
information, or metadata, that accompanies each
image. This remains a manual process that is essential
to the usefulness of digitized photographs. After taking
into account the time still required for handling and
recording metadata, we estimate that using cameras
instead of scanners to digitize photographs speeds the
process by a factor of three or greater.

Above: Full image as digitized with a Canon Rebel SL1

Far left: Detail of locomotive, sized as it would appear in a 16x24-inch enlargement, from the Canon SL1

Left: Detail of locomotive, sized as it would appear in a 16x24-inch enlargement, from the Nikon D800

4x5 NEGATIVE COMPARISON
Lehigh and Hudson River Railroad 2-8-0 steam locomotive no. 95 on westbound freight train no. 31 with 37 cars at Craigville, New York, on April 28, 1940. Photograph by Donald W. Furler, Furler-03-068-02

Above: Full, 4x5-inch negative as scanned with Epson V700

Right: Detail of locomotive, sized as it would appear in a 16x20-inch enlargement, from the Epson V700

Above: Full, 4x5-inch negative as digitized with Nikon D800

Left: Detail of locomotive, sized as it would appear in a 16x20-inch enlargement, from the Nikon D800

About this column and our collection

"Out of the Archives" brings to light the world of professional archiving, providing a regular forum to share selections from the Center's collections and tips for maintaining your own photographs. Whether you are a photographer, collector, or avid fan, it is important to organize and preserve the materials you create or collect. Please get in touch with Jordan Radke, **jordan@railphoto-art.org**, if there are any topics you would like us to cover in the future.

The Center's Railroad Heritage Visual Archive includes some 200,000 photographs. The team in Madison, Wisconsin, consists of Jordan Radke, archives manager, graduate archival interns Hailey Paige, Erin Rose, and Emily Shultz, intern Aviva Gellman, and volunteer John Kelly. We also partner with Lake Forest College, working with Anne Thomason, archivist, along with graduate archival intern Colleen O'Keefe, to process and maintain Center materials housed in the college's Archives & Special Collections in the Donnelley and Lee Library. Scott Lothes, Center president and executive director, and the Collections & Acquisitions Committee of the board of directors provide oversight.

In keeping with the Center's mission of preserving and presenting significant images of railroading, with the Railroad Heritage Visual Archive we seek to securely house collections and make their contents accessible for others to view and use. We adhere to established archival principles to ensure safety and accuracy. Our work as archivists includes:

Preservation. One of the Center's main objectives is properly preserving our collections. This includes appropriately caring for and handling our materials by using archival-safe supplies, and providing a controlled environment where our collections are housed.

Processing. Processing materials is a long, tedious, and detailed endeavor. Organizing a collection appropriately sets up the rest of the processing work that includes any digitization and metadata entry. This work is essential to the long-term care and future accessibility of a collection.

Arrangement and Description. To maintain quick and easy retrieval of our materials, we organize every collection down to its individual items, if possible, given the time and resources available to us.

Accessibility. Finally, the Center will make sure that users have access to our processed collections. We create detailed finding aids to describe each collection and its contents and share images electronically through our websites and many social media outlets.

Railroad Heritage Visual Archive updates

In our Madison office, Jordan Radke, our archives manager, recently finished processing the seventh batch of photographs from J. Parker Lamb and uploaded selections to our website. We have received the eighth and final batch of Lamb's black-and-white negatives, which we will upload once the processing work is complete. Graduate archival intern Emily Shultz is processing a newly acquired collection; we are excited to share more about it in coming issues. Volunteer John Kelly has begun inventorying our Glenn A. Oestreich Collection.

We are pleased to announce the arrival of two new interns for the summer of 2017, Hailey Paige and Erin Rose. Paige is a graduate student in the Historical Administration Program at Eastern Illinois University. She will assist with the Center's traveling exhibitions while also working on collections. Rose is a new graduate of the Library and Information Studies program at the University of Wisconsin-Madison, and she will take over processing work for the Donald W. Furler Collection.

At Lake Forest College, graduate archival intern Colleen O'Keefe has finished metadata entry and scanning work for the Wallace W. Abbey Collection. She is continuing to process photographs in the Ted Rose Collection and the Sam Breck Collection.

You can view highlights and browse selections from many of our collections online at our website, **www.railphoto-art.org**. We post updates weekly to our social media accounts on Facebook, Twitter, Instagram, and Flickr.

One of the last Illinois Central Gulf Railroad (ICG) trains to operate westward from Meridian, Mississippi, prepares to leave the siding at Meehan, Mississippi. This train has just met the last eastbound train for Meridian in April 1986. It would return to Jackson, Mississippi, on the next day, pulling down the curtain on this part of ICG. Photograph by J. Parker Lamb. Lamb-02-120-07

Norfolk Southern empty coal train with Norfolk and Western equipment waits at Norton, Virginia, in March 1985. Photograph by J. Parker Lamb. Lamb-02-125-06